MEMOIRS
OF THE
AMERICAN ENTOMOLOGICAL SOCIETY
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BARRY C. POULTON AND KENNETH W. STEWART

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Paul M. Marsh
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Issued April 15, 1991

Printed on Acid Free Paper in the United States of America

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The Stoneflies of the Ozark and Ouachita Mountains (Plecoptera)

BY

BARRY C. POULTON[1] AND KENNETH W. STEWART

Dept. of Biological Sciences
University of North Texas
Denton, TX 76203

ABSTRACT— Collections of stoneflies (Plecoptera) were made at 603 stream sites from November 1983 - May 1988 in the Ozark- Ouachita Mountain region, in relation to physiographic and vegetational characteristics. Examination of approximately 9,000 vials from these collections, supplemented with material from major museums and other collectors, revealed 88 stonefly species in eight families and 24 genera. Keys and illustrations are provided for all regional species, including descriptions for three new species: *Leuctra paleo, Acroneuria ozarkensis*, and *Perlesta fusca*. Allotypes are designated for *Alloperla ouachita* and *Zealeuctra wachita*, and 12 new nymphal descriptions are provided. A summary table of species presence/absence in relation to 15 natural subregions, six stream order designations, four flow permanence types, and three vegetation types is provided to enhance predictive inferences as to which stonefly species are expected in certain streams. Pearson's measure of association (R) showed there was a significant association between species present and each of the tested variables. Cluster analysis of 126 watersheds elucidated regional divisions based on stonefly species present. A four cluster solution appeared the most biologically meaningful based on knowledge of collection habitats, and had low similarity to 15 natural subregional divisions based on geologic or vegetational characters. The Ozark-Ouachita stonefly fauna most closely resembles that of the Appalachian Mountains and northeastern states, with 49 species common to both regions. Past glacial events, and more specific parameters related to ecological and life cycle requirements such as stream thermal regime and flow permanence, appeared to be the best determinants of species distributions within the region.

INTRODUCTION

There are currently 575 species of stoneflies (Plecoptera) known in North America, representing 99 genera and nine families (Stewart and Stark 1988). They are important components of stream food webs and serve as biological indicators of water quality (Hynes 1972; Resh and Unzicker 1975; Duchrow 1977, 1984; Harper and Stewart 1984; Jones et al. 1981). They contribute substantially to the forage base of many freshwater fishes (White 1975; Healy 1984; Robison and Buchanan 1988), and birds such as nighthawks (Hitchcock 1974). Nymphs of larger species have long been used as bait for bass and trout fishing, and nymphs and adults have been imitated as artificially tied flies by fisherman for over four and a half centuries (McCafferty 1981). Despite their ecological importance in stream ecosystems, the biology of stoneflies is poorly known, and systematic knowledge of the immature stages lags behind the needs of aquatic ecologists for species level identification (Merritt and Cummins 1984; Stewart and Stark 1988). There are particularly large gaps our in knowledge of distributional patterns and species affinities with physiographic, vegetational or other biotic or physical characteristics, and the morphology and biology of immature stages. Except for regional papers by Jewett (1959, Pacific Northwest),

[1]Current Address:
National Fisheries Contaminant Research Center, U. S. Fish & Wildlife Service, Route 2, 4200 New Haven Rd., Columbia, MO 65201

Ricker (1964, Canada), Stewart et al. (1974, southwestern United States), and Baumann et al. (1977, Rocky Mountains), most stonefly distributional studies in North America have been for political entities (states or provinces). There have been few attempts to systematically sample regions or quantify distributions of species with the goal of achieving predictive inference of their relationships with physiographic provinces, vegetation, types of streams or other biotic or physical characteristics. Recent changes in Plecoptera systematics and new species discoveries have emphasized the need to update knowledge of Plecoptera distributions in most areas of North America.

There have been no comprehensive studies of the stonefly fauna of the Ozark and Ouachita mountain region of eastern North America. Species records and in some cases keys, are available for some states near the region, including Oklahoma (Stark and Stewart 1973b), Texas (Szczytko and Stewart 1977), Lousiana (Stewart et al. 1976), Kansas (Stewart and Huggins 1977), and Illinois (Frison 1929, 1935, 1942). Additional records of Ozark - Ouachita species are available in taxonomic papers (Ross and Ricker 1971; Stark and Stewart 1973a; Stark and Ray 1983; Ernst et al. 1986), from ecological studies of particular stream systems such as the Little Missouri River, Arkansas (Feminella and Stewart 1986), Illinois River, Arkansas (Brown and Ricker 1982), Battle Branch, Oklahoma (Ernst and Stewart 1985b), biotic index studies on Missouri streams (Jones et al. 1981), and other regional studies (Hitchcock 1974). Earlier papers do not include recent taxonomic changes or updated geographical knowledge. Many government publications have little zoogeographic or taxonomic value, since stoneflies are often listed at generic and family levels.

Illies' (1966) catalog attributed 33 and 25 stonefly species to Arkansas and Missouri, respectively. Stewart and Stark (1988) reported 60, 42, and 34 species from Arkansas, Oklahoma, and Missouri, respectively. Frison (1942) listed 27 species from the Illinois Ozarks; the total species list was 67, of which 20 were known from all four states. The families Chloroperlidae (six species), Nemouridae (five species), and Pteronarcyidae (one species), have been poorly represented in the region, and there were no records of Peltoperlidae.

There has been little documentation of stonefly occurrence from the Arkansas River Valley, Gulf Coastal Plain including the Monroe uplift in central Arkansas, Crowleys Ridge in eastern Arkansas and Missouri, and foothill or "border" areas near the Mississippi and Missouri River systems. This intensive regional study, which relies on natural boundaries rather than political divisions and provides quantificaton of species affinities, will be useful to stream ecologists in defining regional Plecoptera fauna and gaining predictive inference as to which species might be expected in the various streams.

Because nymphs are the most frequently encountered life stage during aquatic sampling, there is a particular need for current species level nymphal keys. This is important for stream water quality monitoring, where species identification is nessesary for accurate asessment of community change (Hilsenhoff 1982, 1987).

The major objectives of this study are to provide: 1) a current stonefly species list, 2) keys to nymphs and adults, 3) zoogeographic comparisons between regional and continental distributions, 4) distributional affinities of species with stream order, stream temperature and flow permanence, dominant vegetation types, and physiographic subregions, and 5) new information on the biology, life cycles and nymphal stages of regional species based on the diverse types of habitats in the region.

Description of the Study Area

The Ozark-Ouachita Mountain region encompasses approximately 375,000 km^2 , and includes portions of five states (Fig. 1). Stroud and Hanson (1981), Rafferty (1980, 1982), Pflieger (1975), and Robison and Buchanan (1988) have variously subdivided the region based on general topographic features, vegetation, geology, land use, and other ecological factors. A synthesis of these subdivisions was used in this study, and included the following (Fig. 2): 1) Ouachita Mountains, 2) Boston Mountains, 3) Springfield Plain, 4) White River Hills, 5) Central Plateau, 6) Osage-Gasconade Hills, 7) Curtois Hills, 8) St. Francois Mountains, 9) Missouri River Border, 10) Mississippi River Uplands, 11) Illinois Ozarks, 12) Crowley's Ridge, 13) Mississippi River Alluvial Plain, 14) Gulf Coastal Plain, and 15) Arkansas River Valley. Mean annual precipitation varies from 91.4 to 127 cm per year, most occurring in spring and fall (Rafferty 1985). Mean monthly temperatures range annually from lows of 6.6°C in January to highs of 33.3 °C in August (Rafferty 1980).

Major vegetation types noted during this study included 1) upland Pine including Loblolly and Shortleaf (*Pinus* spp.), 2) upland Hardwoods including Oak (*Quercus* sp.) and Hickory (*Carya* sp.), and 3) bottomland Hardwoods including Black Gum (*Nyssa* sp.), Cypress (*Taxodium* sp.), and River Birch (*Betula* sp.). The most common aquatic plant in riffle areas of regional streams was Water Willow (*Justicia* sp.). This plant provided emergence habitat for many stoneflies during spring and summer, and the roots provided habitat and organic material during winter when nymphs were actively growing. The presence of Watercress (*Nasturtium* sp.) at some localities helped suggest the presence of underground springs.

The Ozark-Ouachita mountains were formed during periods of slow uplift near the beginning of the Pleistocene Glaciation (Udvardy 1969). Erosion by streams have formed deep hollows and steep cliffs, resulting in relatively uniform knobs and peaks in comparison to other mountain regions of North America. Elevation ranges from 182-244 m (msl) in lowland areas along the Mississippi River, to 427-855 m (msl) in mountainous areas (Thom and Iffrig 1985). Limestone, the primary sedimentary rock type, underlies over 80% of the region, but exposed areas of sandstone, dolomite, shale, chert, granite, and rhyolite also occur in the region (Rafferty 1985). Fragments of chert and dolomitic limestone predominate among stream substrates. When loosely packed, these may permit significant interstitial flow without surface flow (Clifford 1966). An exchange between surface water and groundwater often results in "losing" streams, where surface flow may partially disappear underground (Thom and Iffrig 1985) and reappear elsewhere as springs. Other features which occur in the region include caves, springs, sinkholes, and natural bridges.

A majority of small regional streams (orders 1-3) consisted of intermittent pools or a completely dry stream bed during parts of the summer months. Some 4th-5th order streams in the Ouachita Mountains, which flow through valleys between elongate east-west hills, were slow, murky and became intermittent during summer. Intermittent streams and those that dry up completely during certain seasons have stonefly species with dessicant-resistant, diapausing eggs (Snellen and Stewart 1979a). Some permanent streams result from undergound springs, which substantially altered the stream temperature regime (Fig. 3). Areas in the Springfield Plain, Central Plateau, and Curtois Hills contain some of the largest springs in the United States (Vinyard and Feder 1974). Big Spring (mean cms=12.3) and Greer Spring (mean cms=9.5) are the two largest in the region (USGS 1974), and their sources have been traced with dye from "losing" streams up to 88 km away (David Foster, pers. comm.).

Most streams in the Mississippi Alluvial Plain have been heavily channelized and suffer from organic pollution due to agricultural enrichment (Duchrow 1977, Robison and Buchanan 1988). Non-point source pollution, often from agriculture, is evident in regional subdivisions with low relief such has the Springfield Plains, Missouri River Border, and Central Plateau (Duchrow 1984). These areas probably act as dispersal barriers for some less vagile and tolerant stonefly species.

Materials and Methods

Stoneflies were collected monthly from November 1983 to June 1988. Trips were planned to coincide with occurrence of pre-emergent nymphs (for rearing) and adult emergence. Detailed county maps from the Departments of Transportation of Arkansas, Missouri, and Oklahoma were used to subdivide the region into watersheds based on 4th and 5th order streams (Fig. 4, Table 1). Natural "breaks" in conditions such as gradient and regulation were used in a method similar to that of Matthews and Robison (1988). Collection sites were selected along accessable transects traversing a full array of stream orders within each major watershed. Unique habitats such as waterfalls, springs, and cave streams, "typical" streams representing each physiographic subregion, and those which contained high stonefly diversity were repeatedly sampled. Collections were made from a total of 603 stream sites, providing substantial coverage of the region (Fig. 1). Stoneflies were present in 523 of these sites, and repeat collections were made from 191 of them. Collections from some sites near Springfield, Missouri and Fayetteville, Arkansas were made by other researchers, and these specimens were available from collectors or through various museums.

During collection periods, the following variables were recorded for each location sampled: 1) approximate stream width, depth, and current velocity, 2) dominant surrounding vegetation, 3) stream substrate type, 4) surrounding topography, 5) indication of organic enrichment, and 6) flow permanence. In this study, water temperature was combined with the flow permanence variable. Water temperature was measured with a total immersion °C thermometer, and flow permanence was noted during summer and fall seasons. Because life cycle requirements can be related to flow permanence and degree of stream hydration (Snellen and Stewart 1979a), a distinction was made between intermittent (standing pools without surface flow) and dry (completely dry stream bed) streams during sampling and analysis.

Methods of collecting stoneflies included: 1) disturbance of stream substrates directly upstream from a rectangular-framed kick net, 2) sweeping/beating riparian vegetation with a sweep net, 3) searching emergent leaves, snags, bridges, fenceposts, stones, and spider-

Fig. 1. The Ozark-Ouachita Mountain region, showing major rivers and their tributaries. Closed circles represent collection sites made during the current study, and open circles represent records from other collections. The dashed line depicts the southern limit of the Kansian glacial lobe.

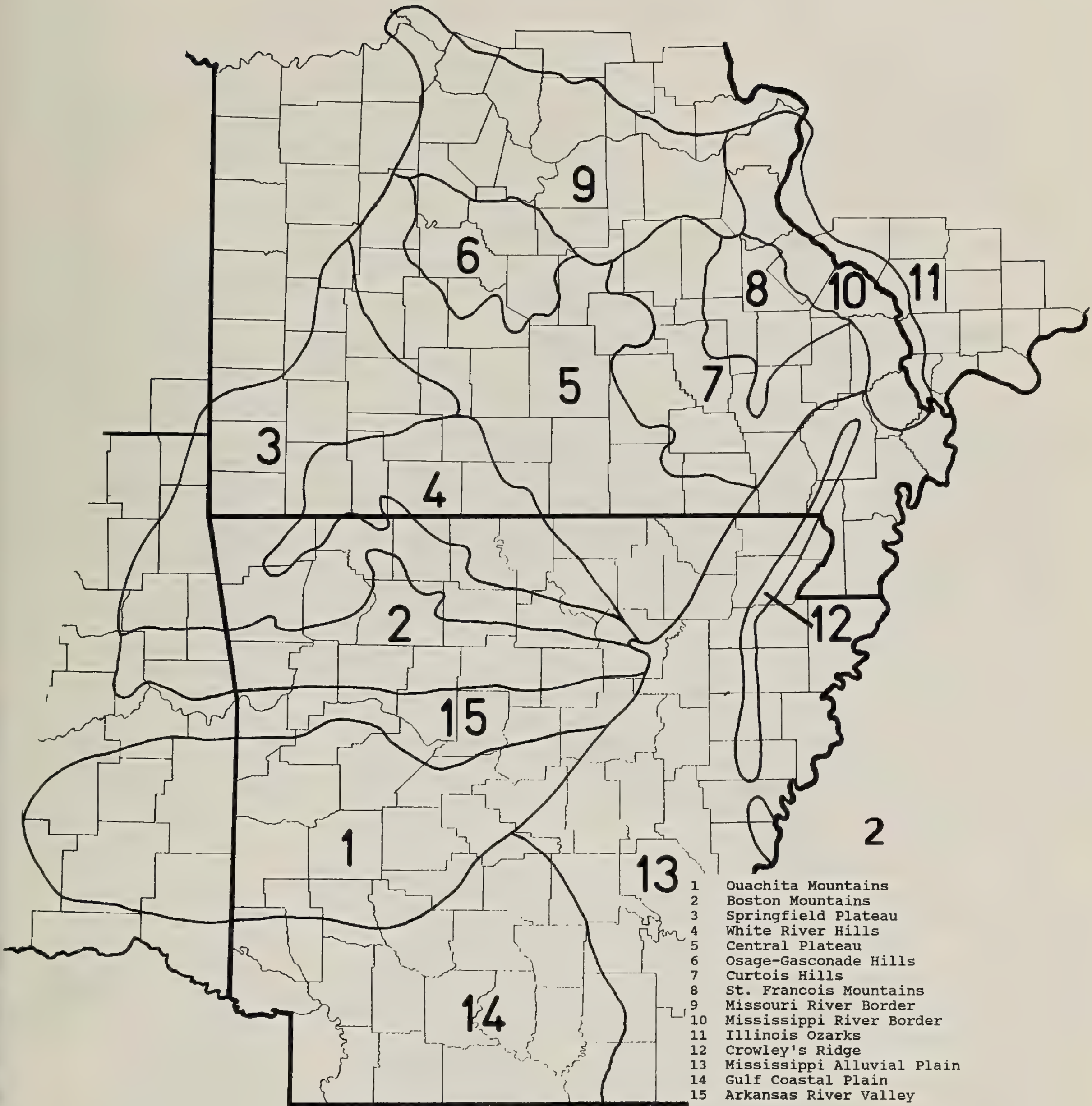

Fig. 2. Natural subregions within the Ozark- Ouachita Mountains.

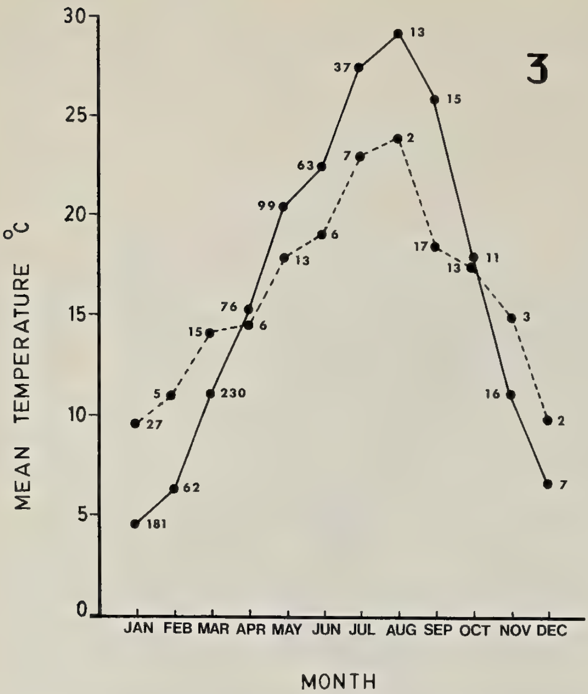

Fig. 3. Plot of mean monthly water temperatures in Ozark-Ouachita Mountain streams from Nov. 1983-May 1988. Streams with significant flow from underground springs are represented by the dashed line, and those without permanent spring flow are represented by the solid line. Integers next to data points indicate the total number of streams sampled each month.

Table 1. List of the 126 Ozark-Ouachita watershed divisions shown in Figure 4.

1. Upper Fourche la Fave
2. Piney Creek
3. Big Creek
4. Flint Creek
5. Lower Poteau River
6. Bodcau Creek
7. Maumelle River
8. Richland and Bear Creeks
9. Big Piney Creek
10. Magazine Mountain
11. Cypress Creek
12. Cornie Creek
13. Upper Ouachita River -II
14. Cossatot River
15. Caney Creek
16. Upper Moro Creek
17. Upper Little Missouri River
18. South Fourche la Fave
19. Little Petit Jean Creek
20. Frog Bayou
21. South Cadron Creek
22. Fourche Creek
23. Sylamore Creek
24. Mississippi River (lowland)
25. War Eagle Creek
26. Crooked Creek
27. Point Remove Creek
28. White River (Beaver, Table Rock, Taneycomo Reservoirs)
29. Terre Rouge Creek
30. Smackover Creek
31. Rolling Fork Creek
32. White River (Bull shoals Reservoir)
33. Middle Fourche la Fave
34. North Cadron Creek
35. Illinois Bayou
36. Upper Illinois River
37. Upper Petit Jean Creek
38. North Fork White River
39. Lower Little Missouri River
40. Cypress Bayou and Bayou des Arc
41. South Fork Spring River
42. Middle Fork Little Red River
43. South Fork Little Red River
44. Mulberry River
45. Lee Creek
46. Upper Saline River
47. Eleven Point River
48. Saline River
49. Caddo River
50. Middle Saline River
51. Lower Moro Creek
52. Strawberry River
53. Spring River
54. Lower Little Red River
55. Buffalo River
56. Upper Ouachita River. - I
57. Middle Ouachita River - I
58. Middle Ouachita River - II
59. Red River and Sulphur River
60. Little River
61. Antoine River
62. Lower Ouachita River
63. Lower Saline River
64. Tulip Creek
65. Kings River
66. Sugar Creek
67. Lower Black River
68. Lower Current River
69. Lower White River -II
70. Crowley's Ridge
71. Upper White River
72. Lower White River - I
73. Upper Poteau River
74. Mountain Fork River
75. Lower Arkansas River
76. Brushy Creek
77. Kiamachi River
78. Upper Little River.
79. Glover River
80. Fourche Maline Creek
81. Lower Illinois River
82. Canadian River
83. Spavinaw Creek
84. Lower Neosho River
85. Upper Black River
86. Castor River and White-water River
87. Lower Osage River
88. Missouri River
89. Mississippi River (upland)
90. Arkansas River
91. Big Creek
92. Flat Creek
93. Little Piney Creek
94. Cache River
95. Bryant Creek
96. Bull Creek & Swan Creek
97. Finley Creek
98. Little Black River
99. Curtois Creek and Huzzah Creek
100. Jack's Fork River
101. Moreau River
102. Elk River
103. Shoal Creek
104. St. Francis River
105. Kaskaskia River and Big Muddy River
106. Lower Ohio River
107. Lower Gasconade River
108. Bourbouse River
109. Lower Meramec River
110. Big River
111. Maries River
112. Lamine River and Petit Saline River
113. Upper Osage River
114. Lower Sac River
115. Pomme de Terre River
116. Niangua River
117. Osage Fork Gasconade River
118. Upper Sac River
119. Spring River
120. James River
121. Beaver Creek
122. Upper Gasconade River
123. Big Piney River
124. Upper Current River
125. Upper Meramec River
126. Saline River

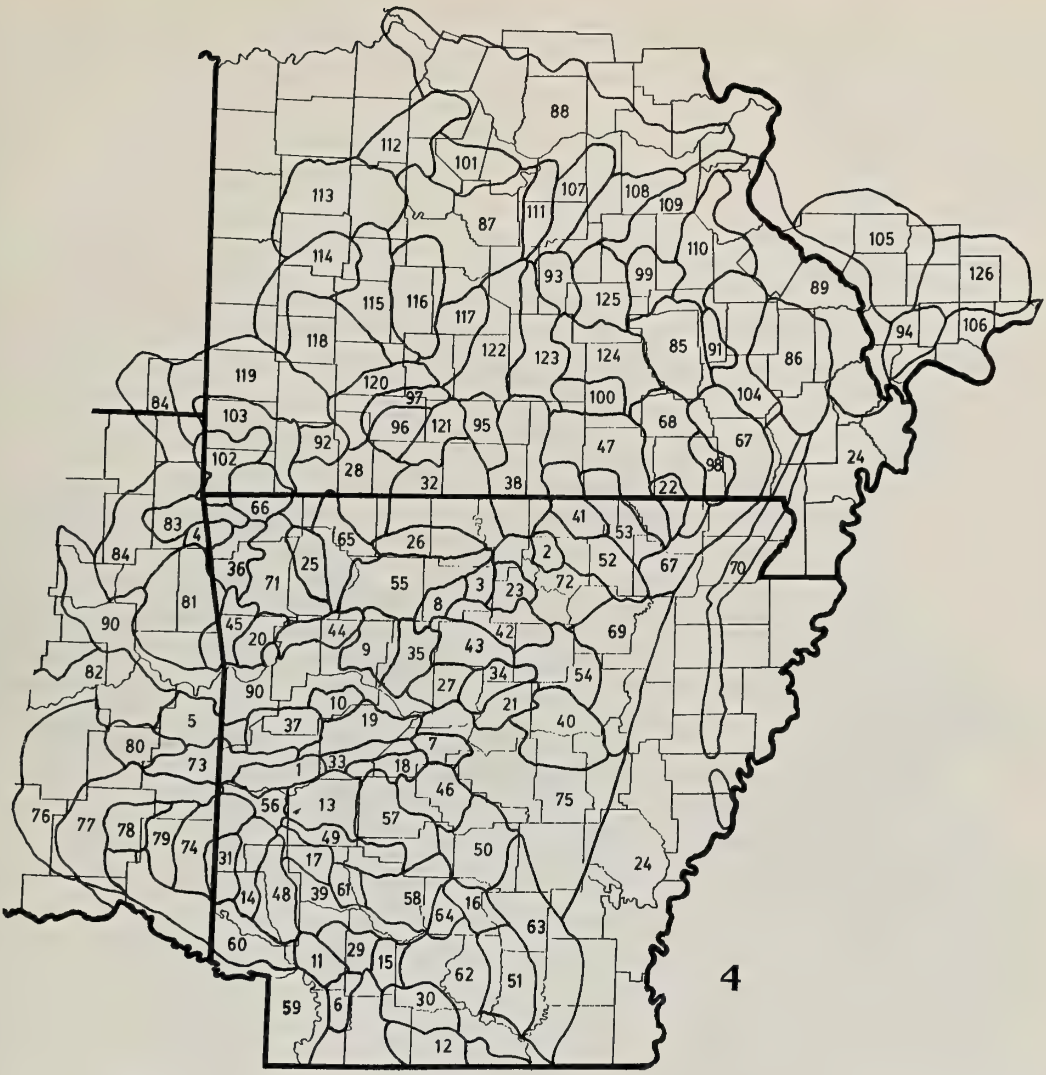

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Fig. 4. Natural watershed divisions within the Ozark- Ouachita Mountains. Watersheds are listed in Table 1.

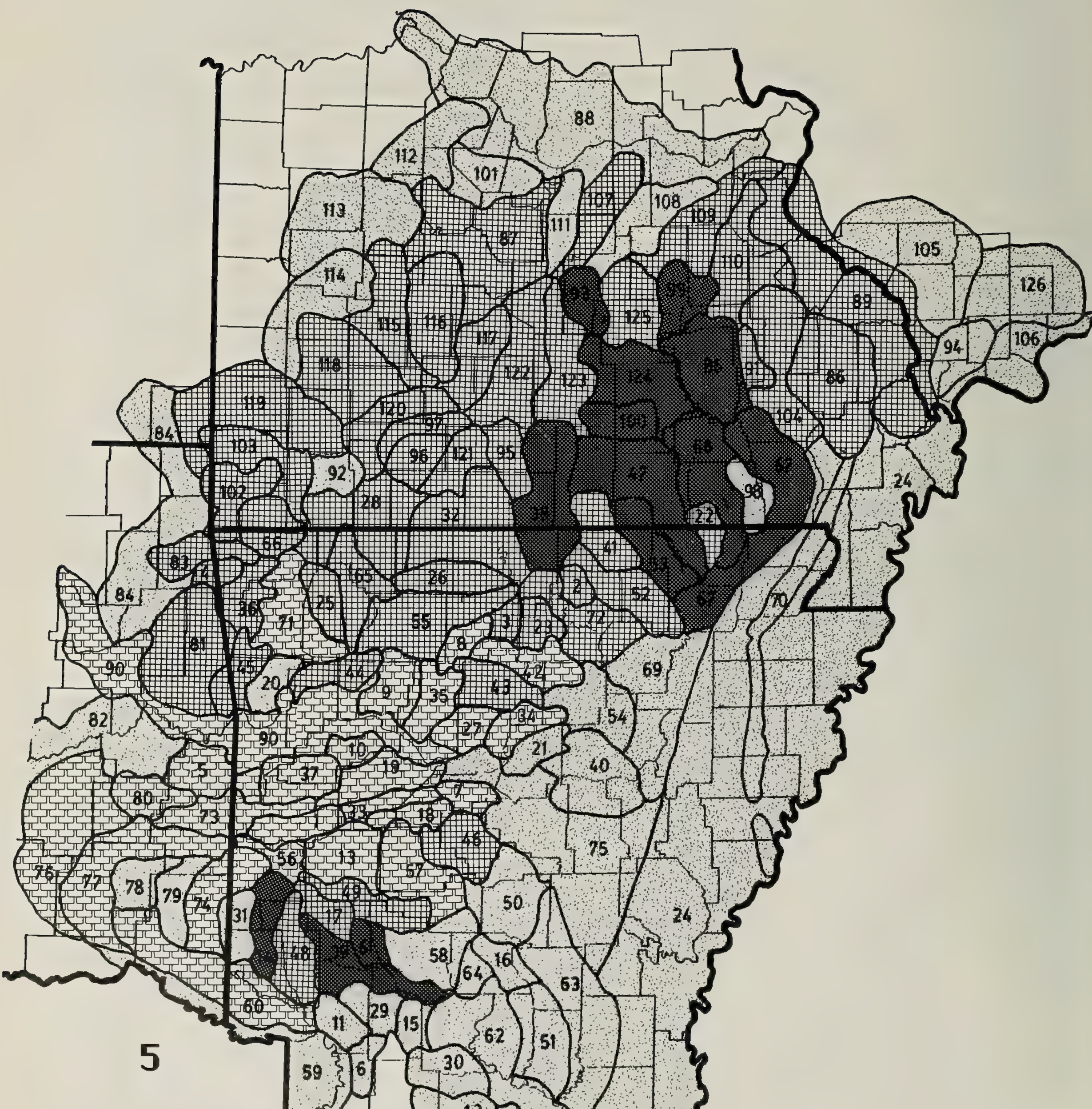


Fig. 5 Watershed clusters in the Ozark-Ouachita Mountains. Each cluster represents faunistically similar watersheds based on stonefly species present. Watersheds are listed in Table 1.

webs for exuviae and adults, and 4) light trapping with a Bioquip Universal Light-trap and eight-watt fluorescent blacklight, or a Ray-o-Vac Sportsman lantern with black bulbs set up on a white cloth sheet at dusk. An aspirator constructed of 3 cm dia. plastic tubing, neoprene stoppers, 1.0 cm Tygon tubing, and Nitex was used to facilitate collection of adults and exuviae.

All specimens were initially preserved with 75% ethanol or 70% isopropanol in six dram screw-capped vials and labeled with site numbers and date. They were then sorted, identified, labeled, and transferred into fresh 80% ethanol or isopropanol within one to three weeks.

Nymphs were reared in the field or transported live to the laboratory in small portable styrofoam "six-pack" drink coolers containing stream water (Szczytko and Stewart 1979). Each of the six cylindrical compartments was eight cm dia. x 11 cm depth, and nymphs were enclosed in them with tight fitting styrofoam cups. During warm months, water was changed daily or as needed during transport, and these smaller coolers were transported with ice inside larger ice chests. Nymphs were then transferred into rearing cages housed in laboratory living streams (Frigid Units, Inc.) set to simulate seasonal stream temperature changes (Stewart and Stark 1988). Rearing cages consisted of tall cylindrical baskets made of metal screen or plastic mesh set into the water column of the artificial stream and weighted with gravel, or styrofoam cups with side windows cut out and replaced with screening and floated in the water column with styrofoam sheets. Rearing enabled correlation of unknown nymphs with adults, and provided nymphal study material necessary for constructing keys.

Males were prepared for study by the following techniques: 1) aedeagi of *Perlesta*, *Acroneuria*, *Isoperla*, *Paragnetina*, and some *Taeniopteryx* were extruded in the field by gently rolling and squeezing the middle abdominal seqments between thumb and forefinger, then holding the specimen by its terminal segments with a forceps while immersing it in alcohol until death, and fixing the extruded aedeagus (Stark 1990a), 2) aedeagi of unextruded, preserved adults in these same taxa were prepared by boiling the terminal abdominal segments in hot 10% KOH for two to eight minutes or until soft tissue was cleared or loosened from the segments. Eversion of some preserved *Isoperla* aedeagi was achieved by using methods outlined by Szczytko and Stewart (1979), and those of *Neoperla* and *Acroneuria* were studied utilizing methods outlined by Stark and Gaufin (1976) and Stark and Baumann (1978). The aedeagi of some *Acroneuria* were also extruded from KOH - cleared specimens by pulling them inside-out with a fine forceps, but male aedeagi of *Perlesta* had to be field-extruded to be of taxonomic value.

Nymphal mouthparts and chorionic sculpturing of "in uteri" eggs, were examined using a Jeol JSM T300 Scanning Electron Microscope. Adult and nymphal identification, general mouthpart characters, and some egg characters were determined using an Olympus JM Stereomicroscope with an Olympus LSG lighting attachment. Specimens were prepared for drawing by pinning in the appropriate orientation or holding with No. 1 insect pins molded to pieces of lead. Line drawings were completed on poster board with Staedler technical pens (0.018, 0.025, 0.030, 0.045) and color patterns were drawn and shaded on stipple board with pencil. Key characters were drawn with the aid of a Wild M- 5 stereomicroscope with drawing attachment. Approximately 9000 vials of stoneflies were examined during this study, and over half of them are deposited at the UNT Aquatic Insect Museum. Voucher specimens have also been deposited at the following museums: UWSP, BYU, SAU, MC, ASU, UM, INHS, and the USNM (for key to abbreviations, see end of this section).

Stonefly presence/absence was recorded on a species checklist for each of the 126 watersheds, and used in a computerized cluster analysis (Norusis 1985). This analysis generated a dendrogram and 2-15 clusters of faunistically similar watersheds. The most biologically meaningful solution (number of clusters) was chosen based on cluster distance and gaps in the dendrogam that represented the most natural differences in stonefly requirements based on stream characteristics in the clustered regions. This solution was used to provide general comparisons with subregional groupings (Stroud and Hanson 1981; Rafferty 1985), and other regional faunistic studies (Matthews and Robison 1988). It was assumed that a grid of streams where stoneflies were collected represented a reasonable sample of all streams present, and yielded a realistic frequency of occurrence for each species. Since variables in this study (permanence, subregion, presence/absence, vegetation type) were discrete, a crosstabulation procedure (Norusis 1985) provided the most appropriate descriptive relationships between species presence and stream characteristics or geographic areas. This analysis generated numerical cell frequencies for each combination of variables, and Chi Square and Pearsons associations (R) between species present and subregion, stream order, vegetation, and stream type based on temperature and flow permanance. Procedure Log- Linear (Norusis 1985) was used to analyze the natural log of these cell frequencies to generate a model. However, since statistical significance cannot be substituted for biological significance when presence/absence data are used, statistical results from this procedure was not emphasized in this study.

Other stoneflies were obtained from major museums and collectors. Specimens were examined from the Wilbur E. Enns Museum at the University of Missouri (UM), the Illinois Natural History Survey Museum, at the University of Illinois (INHS), and the National Museum of Natural History (USNM).

Individuals and their university, or institutional affiliations,that provided loans of or access to specimens included: Dr. O. S. Flint, Jr., (USNM); Dr. S. W. Szczytko (SWS), University of Wisconsin, Stevens Point (UWSP); Dr. B. P. Stark (BPS), Mississippi College (MC); Dr. R. W. Baumann (RWB), Brigham Young University (BYU); Dr. H. W. Robison (HWR), Southern Arkansas University (SAU); Dr. G. L. Harp, Arkansas State University (ASU); Dr. A. V. Brown (AVB), University of Arkansas (UA); L. Trial, Missouri Dept of Conservation (LT); and R. McDaniel, Arkansas Dept. of Pollution Control and Ecology (RM). Other individuals who provided specimens included: J. W. Feminella (JWF), O. & M. Hite (Hite), E. J. Bacon (EJB), and B. J. Armitage (BJA). Our collections are abbreviated as (BCP) and (UNT).

Results

Eight families, 24 genera, and 88 species of Plecoptera are currently known from the Ozark-Ouachita Mountain region (the 25 regional endemic species are in bold face type):

OZARK-OUACHITA PLECOPTERA SPECIES LIST

Euholognatha
Family Capniidae
Subfamily Capniinae
Allocapnia forbesi Frison
Allocapnia granulata (Claassen)
Allocapnia jeanae Ross
Allocapnia malverna Ross
Allocapnia mohri Ross and Ricker
Allocapnia mystica Frison
Allocapnia oribata Poulton and Stewart
Allocapnia ozarkana Ross
Allocapnia peltoides Ross and Ricker
Allocapnia pygmaea (Burmeister)
Allocapnia rickeri Frison
Allocapnia sandersoni Ricker
Allocapnia smithi Ross and Ricker
Allocapnia vivipara (Claassen)
Allocapnia warreni Ross and Yamamoto
Nemocapnia carolina Banks
Paracapnia angulata Hanson
Family Leuctridae
Subfamily Leuctrinae
Leuctra paleo Poulton and Stewart
Leuctra rickeri James
Leuctra tenuis (Pictet)
Zealeuctra cherokee Stark and Stewart
Zealeuctra claasseni (Frison)
Zealeuctra fraxina Ricker and Ross
Zealeuctra narfi Ricker and Ross
Zealeuctra warreni Ricker and Ross
Zealeuctra wachita Ricker and Ross
Family Taeniopterygidae
Subfamily Brachypterinae
***Strophopteryx* arkansae** Ricker and Ross
Strophopteryx cucullata Frison
Strophopteryx fasciata (Burmeister)
Subfamily Taeniopteryginae
Taeniopteryx burksi Ricker and Ross
Taeniopteryx lita Frison
Taeniopteryx lonicera Ricker and Ross
Taeniopteryx maura (Pictet)
Taeniopteryx metequi Ricker and Ross
Taeniopteryx parvula Banks
Family Nemouridae
Subfamily Amphinemurinae
Amphinemura delosa (Ricker)
Amphinemura nigritta (Provancher)
Subfamily Nemourinae
Prostoia completa (Walker)
Prostoia similis (Hagen)
Shipsa rotunda (Claassen)
Systellognatha
Family Chloroperlidae
Subfamily Chloroperlinae
Tribe Alloperlini
Alloperla caddo Poulton and Stewart
Alloperla caudata Frison
Alloperla hamata Surdick
Alloperla leonarda Ricker
Alloperla ouachita Stark and Stewart
Tribe Chloroperlini
Haploperla brevis (Banks)
Family Perlidae
Subfamily Acroneuriinae
Tribe Acroneuriini
Acroneuria abnormis (Newman)
Acroneuria evoluta Klapalek
Acroneuria filicis Frison
Acroneuria internata (Walker)
Acroneuria mela Frison
Acroneuria ozarkensis Poulton and Stewart
Acroneuria perplexa Frison
Attaneuria ruralis (Hagen)
Perlesta baumanni Stark
Perlesta browni Stark
Perlesta cinctipes (Banks)
Perlesta decipiens (Walsh)
Perlesta fusca Poulton and Stewart
Perlesta shubuta Stark
Perlinella drymo (Newman)
Perlinella ephyre (Newman)
Subfamily Perlinae
Tribe Neoperlini
Neoperla carlsoni Stark and Baumann
Neoperla catharae Stark and Baumann
Neoperla choctaw Stark and Baumann
Neoperla falayah Stark and Lentz
Neoperla harpi Ernst and Stewart
Neoperla osage Stark and Lentz
Neoperla robisoni Poulton and Stewart
Tribe Perlini
Agnetina capitata (Pictet)

Agnetina flavescens (Walsh)
Paragnetina kansensis (Banks)
Paragnetina media (Walker)
Family Perlodidae
Subfamily Isoperlinae
Clioperla clio (Newman)
Isoperla bilineata (Say)
Isoperla burksi Frison
Isoperla coushatta Szczytko and Stewart
Isoperla decepta Frison
Isoperla dicala Frison
Isoperla mohri Frison
Isoperla namata Frison
Isoperla ouachita Stark and Stewart
Isoperla signata (Banks)
Isoperla szczytkoi Poulton and Stewart
Subfamily Perlodinae
Helopicus nalatus (Frison)
Hydroperla crosbyi (Needham and Claassen)
Hydroperla fugitans (Needham and Claassen)
Family Pteronarcyidae
Subfamily Pteronarcyinae
Pteronarcys pictetii Hagen

Some rare species historically reported from areas surrounding the region, or those that could not be confirmed due to the unavailability of specimens, such as *Amphinemura varshava* (Ricker), *Isoperla longiseta* Banks, and *Isoperla montana* (Banks) are not included in this list. *Perlesta placida* (Hagen) and *Neoperla clymene* (Newman) are also omitted, but are noted in the Perlidae species accounts because of the large numbers of museum specimens that remain so labeled.

A cross-tabulation of the frequency of occurrence for each species within the 15 subregions, six stream order categories, four flow permanence/temperature types, and three vegetational types contained a total of 3301 entries. A measure of association (Pearson's R) was calculated with species present as the dependent variable, and gave the following significance ($P<0.05$) for each independent variable: 1) subregion ($R=0.028$), $p = 0.049$, 2) stream order ($R=0.219$), $p < 0.001$, 3) stream permanence ($R=0.214$), $p < 0.001$, and 4) vegetation ($R=0.056$), $p = 0.01$, indicating that there was a significant association between the species present, and each of the tested variables. A Log-linear model including all variables and the properly selected interaction terms generated an overall significance at the $\alpha= 0.05$ level of $P < 0.01$. Because of the high percentage (range 53.7 to 85.5% for the four variables) of cells with an expected frequency of < 5, testing of individual cell frequencies with this method, and therefore individual associations, is invalid at this time. However, the cross- tabulation of presence/absence data provided useful descriptive information.

The summary table (Table 2) including number of records, and the species expected within subregions under certain stream conditions is intended to provide general predictive information of species presence for the region. When a species appeared to be associated with particular subregions, thermal regimes, flow permanence types, or vegetation types, parenthetical numbers were given in Table 2 to show the percentage of the total species records corresponding with that character. For example, of the total number of records for *Paragnetina media*, 80 % were from subregions 5 (Central Plateau) and 7 (Curtois Hills), 100 % were from stream orders 1-5 with no apparent preference for stream size, 90 % were from permanent streams containing spring inputs (type D), and 100 % were from localities containing either upland hardwoods (type 2) or pine (type 1) as the predominant vegetation type. Subregion (1-15, Fig. 2, Table 1) best predicted the presence of endemic species, and those that were found under conditions characteristic of a particular subregion. For example, permanent springs were most common in subregions 3 (Springfield Plateau), 5 (Central Plateau), and 7 (Curtois Hills) due to their geology. These subregions contained many species under flow permanence type D in Table 2 (permanent streams containing spring flow). Stream order (1-6+) and vegetation type (1-3) are related to stream size and the forms of food available during nutrient cycling. Small streams (orders 1-3) were found with upland vegetation and more often became intermittent than did larger streams (orders 4-6). Therefore, these variables best predicted the presence of species common in intermittent habitats and larger streams that contained lowland vegetation. In this study, the flow permanence variable was combined with thermal regime because of its close relationship to the presence of permanent, underground springs. Flow permanence type was the best predictor of stonefly presence and provided the most valuable inferences of life cycle requirements.

Stonefly emergence occurred throughout the year, with the highest diversity during winter and spring, and lowest diversity during September and October (Table 4). Streams with high stonefly diversity could have adults emerging during every week of the year. Since many regional species are known to emerge synchronously (Ernst & Stewart 1985b), black bars in Table 4 probably reflect periods of adult presence rather than emergence. Since basic ecological requirements may be similar in other regions, Tables 2 and 4 may provide useful data for biologists throughout eastern North America.

The Ouachita Mountain subregion was the most diverse, with 56 stonefly species known, including 19 of

Table 2. Ozark-Ouachita Plecoptera table, including total number of collection records for each species (N), and their presence in different subregions, stream orders, flow permanence types, and vegetation types. Numbers and letters under each variable represent 100% of N for that species, unless otherwise indicated in parentheses.

Species	N	Subregion	Stream Order	Flow Permanence	Vegetation	Clusters 1	2	3	4
Acroneuria abnormis	3	10,11	6+	C	3	U		X	
Acroneuria evoluta	140	1-11	1-6+	C,D(87)	1,2(98)	U	C	C	C
Acroneuria filicis	15	1-8,11,13-15	2-5	C,D(93)	1,2,3	U	C	C	U
Acroneuria internata	17	1-3,5-7,9	3-6+	C,D	1,2(94)	X	X	U	U
Acroneuria mela	10	2,6,13-15	3-6+	C	3(80)	C	U	X	U
Acroneuria ozarkensis	2	2,9	5,6+	C	2,3			U	
Acroneuria perplexa	44	1-3,5,7(82)	3-5(86)	C,D(96)	1,2(91)	C	C	C	C
Agnetina capitata	13	3-7	1-4	D(85)	1,2	X		U	C
Agnetina flavescens	56	1-9,15	1-5	C,D	1,2(98)	X	C	C	C
Allocapnia forbesi	3	11	2-4	B,C	2	X			
Allocapnia granulata	116	1-11,13-15	1-6+	C(74)	1,2(94)	C	C	C	C
Allocapnia jeanae	9	1-4,10,15	1-3	A,B(89)	1(78)	X	U	U	
Allocapnia malverna	35	14(97)	1,2(77)	A,B(94)	1(91)	C	X		X
Allocapnia mohri	102	1-5,15(89)	1-5	A,B,C(96)	1,2(96)	U	C	C	C
Allocapnia mystica	53	1,3-5,7-12	1-5	A,B,C,D	1,2(92)	U	C	C	C
Allocapnia oribata	2	2	4	C	1		U	U	
Allocapnia ozarkana	2	14,15	1-3	B	1	X	U		
Allocapnia peltoides	10	1	1-4	A,B(90)	1,2,3		U	X	
Allocapnia pygmaea	6	6,7,11	2-4	C,D	1,2(83)			U	U
Allocapnia rickeri	145	1-11,13-15	1-5	B,C(89)	1,2(97)	U	C	C	C
Allocapnia sandersoni	9	3,4,5	2-4	B,C(89)	2(67)		U	U	
Allocapnia smithi	1	11	3	C	2	X			
Allocapnia vivipara	53	3,9-11(91)	1-3(93)	A,B,C	2,3(98)	C		C	X
Allocapnia warreni	1	3	3	C	2			U	
Alloperla caddo	4	1	1-3	A,B,C	1		U	X	
Alloperla caudata	33	1-10,15	1-5	B,C,D	1,2(91)	U	C	C	C
Alloperla hamata	2	2,4	2,3	B,C,D	1			U	
Alloperla leonarda	1	4	3	D	1			U	
Alloperla ouachita	2	1	2	C	1			U	
Amphinemura delosa	97	1-12,14,15	1-3(92)	A,B,C,D	1,2(97)	C	C	C	C
Amphinemura nigritta	3	9,13	1-3	A,B,C	1,2	U			
Attaneuria ruralis	4	10,11,13	6+	C	3	U		U	U
Clioperla clio	258	1-11,13-15	1-5	A,B,C,D	1,2,3	C	C	C	C
Haploperla brevis	88	1-15	1-5	A,B,C,D	1,2(95)	U	C	C	C
Helopicus nalatus	32	1-3,5,8(84)	2-5	C(97)	1,2	X	C	C	C
Hydroperla crosbyi	96	1,3,5,9,15(84)	1-5	A,B,C,D	1,2(97)	C	C	C	C
Hydroperla fugitans	2	10	6+	C	3			U	
Isoperla bilineata	9	9-11	6+(78)	C	2,3	U		X	
Isoperla burksi	18	1,2,11,15(81)	3,4(94)	C(95)	1,2	X	C	U	
Isoperla coushatta	19	12,14(84)	1-5	A,B,C	1,2(84)	C		X	
Isoperla decepta	23	6,9-11	1-4	B,C(96)	2(96)	C		C	
Isoperla dicala	13	5,7(93)	1-5	D	1,2			U	C
Isoperla mohri	77	1,5,9,12,14,15(76)	1-3(91)	A,B,C	1,2(91)	C	C	C	U
Isoperla namata	121	1-8(96)	1-5	C,D(84)	1,2(98)	X	C	C	C
Isoperla ouachita	167	1-10,13-15	1-5	A,B,C(96)	1,2(97)	X	C	C	C
Isoperla signata	17	3,7(82)	2-5	C,D	1,2			C	C
Isoperla szczytkoi	1	1	1	A	1		U		
Leuctra paleo	2	14	2	C	1	U			
Leuctra rickeri	3	11	2-3	C	2	U			
Leuctra tenuis	34	1-8	1-4	C,D(94)	1,2			C	C
Nemocapnia carolina	1	1	2	C	1			U	
Neoperla carlsoni	7	1,2,6,14,15	3-5	C,D	1,2,3	X	U	U	
Neoperla catharae	20	1,3,5,7,8,14	2-5	C(95)	1,2	U		C	C
Neoperla choctaw	15	1-3,5,9,14,15	2-5	C(87)	1,2,3	U	U	U	
Neoperla falayah	64	1-10,14	3-5(89)	C,D(98)	1,2,3	C	C	C	C
Neoperla harpi	42	1-10,14,15	2-5	C,D(93)	1,2(98)	C	C	C	C
Neoperla osage	42	1-10	1-5	C,D(98)	1,2(98)	C	C	C	C
Neoperla robisoni	24	1-9,14	4-6+	C,D	1,2,3	C	C	U	U
Paracapnia angulata	18	1,3,4,7	1-4	C,D	1,2			C	C
Paragnetina kansensis	9	5,7,13-15	5,6+(89)	C,D	1,2,3			U	U
Paragnetina media	20	5,7(80)	1-5	D(90)	1,2			U	C
Perlesta baumanni	4	1	1-4	A,B	1,2		U	X	
Perlesta browni	18	1-5,8,9,14,15	4,5(78)	B,C	1,2(94)	C	C	C	C

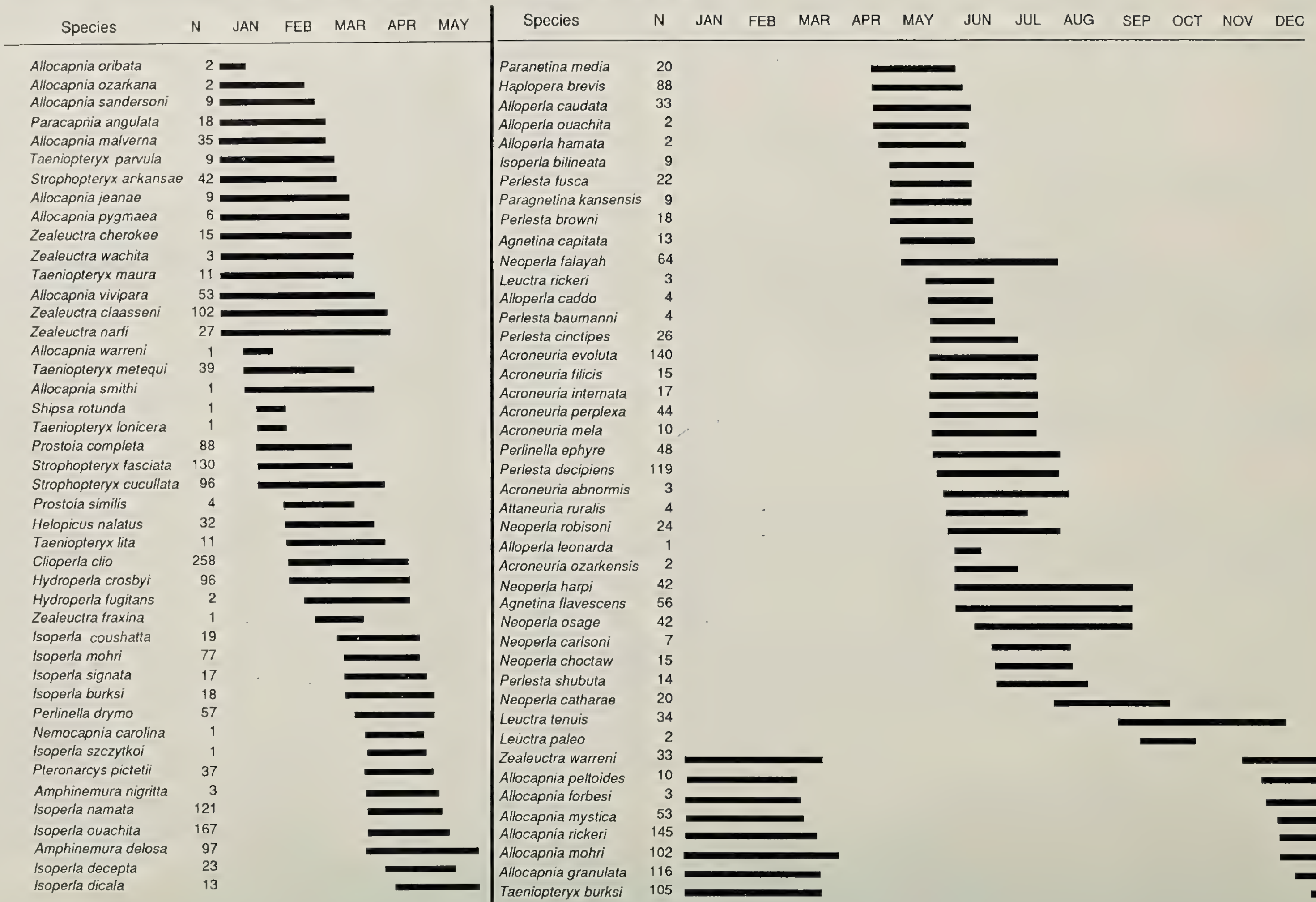
Perlesta cinctipes	26	1,3,5,9,15(93)	1-4	A,B,C	1,2,3	C	C	C	C
Perlesta decipiens	119	1-15	1-6	A,B,C,D	1,2(94)	C	C	C	C
Perlesta fusca	22	1,2,15(83)	1-3(95)	A,B(86)	1,2(95)	U	C	U	U
Perlesta shubuta	14	3,5,7,10	2-5	C,D	1,293)			U	C
Perlinella drymo	57	1-15	1-6+	A,B,C,D	1,2(95)	C	C	C	C
Perlinella ephyre	48	1-8(94)	2-5(94)	C,D(94)	1,2,3	C	C	C	C
Prostoia completa	88	1-8(90)	1-5	C,D(99)	1,2(99)	X	C	C	C
Prostoia similis	4	7	2,3	C	1U				
Pteronarcys pictetii	37	5,7(74)	4-6+(79)	C,D	1,2,3	U		U	C
Shipsa rotunda	1	14	3	C	3	U			
Strophopteryx arkansae	42	1,2,8(86)	1-4	B,C(98)	1(83)		C	U	C
Strophopteryx cucullata	96	1,2,15(82)	1-4	A,B,C	1,2(98)	X	C	C	U
Strophopteryx fasciata	130	1-11,5	1-6+	C,D(95)	1,2(98)	U	C	C	C
Taeniopteryx burksi	105	1-11,14,15	1-6+	C,D(87)	1,2,3	U	C	C	C
Taeniopteryx lita	11	1,5,10,11,13,15	4-6+(82)	C(91)	1,2,3	U	U	U	U
Taeniopteryx lonicera	1	14	3	C	3	U			
Taeniopteryx maura	11	1,14(91)	2-4	B,C	1(91)	C	U	U	U
Taeniopteryx metequi	39	1-5,7,10,15(89)	1-5	C(80)	1,2(97)	X	C	C	C
Taeniopteryx parvula	9	1,8,9,13-15	2-6+	C(89)	1,2,3	U	U	U	C
Zealeuctra cherokee	15	1(93)	1,2(87)	A,B	1(93)		C	U	
Zealeuctra claasseni	102	1-11,13-15	1-4	A,B,C,D	1,2(97)	U	C	C	C
Zealeuctra fraxina	1	11	3	C	2	U			
Zealeuctra narfi	27	1-3,5,15(85)	1-3	A,B(86)	1,2(92)	X	C	C	C
Zealeuctra wachita	3	1	1,2	A,B,C	1		U		
Zealeuctra warreni	33	1-5,7,14	1-4	A,B,C,D	1,2	U	C	C	U

SUBREGIONS: Refer to Fig. 2.
ORDER: Stream orders 1-6+
PERMANENCE: A = Dry stream bed for part of year
B = Intermittent, pools with no flowing water for part of year
C = Permanently flowing the entire year
D = Permanently flowing with significant underground spring source
VEGETATION: 1 = Upland Pine
2 = Upland Hardwood
3 = Bottomland Hardwood
CLUSTERS (Fig. 5): C = Common
U = Uncommon
X = Present but not typical of this cluster, found in 1-2 relict habitats near borders of adjacent clusters

Table 3. (1-15) Plecoptera species diversity within 15 subregions of the Ozark-Ouachita Mountains, and (A-D) number and percentage of species common with other regions in North America.

Subregion/N.A. Region (Fig. 2)		Number of Endemics (Total = 25)	Number of species (Total = 88)/% similarity
1	Ouachita Mountains	19	56
2	Boston Mountains	14	44
3	Springfield Plateau	14	43
4	White River Hills	12	40
5	Central Plateau	11	50
6	Osage-Gasconade Hills	6	35
7	Curtois Hills	9	47
8	St. Francois Mountains	8	37
9	Missouri River Border	9	37
10	Mississippi River Border	5	33
11	Illinois Ozarks	0	26
12	Crowley's Ridge	1	8
13	Mississippi Alluvial Plain	3	17
14	Gulf Coastal Plain	10	39
15	Arkansas River Valley	12	40
A	Northern U.S. and Canada (Michigan, Minnesota, Wisconsin, Central and Eastern Provinces		36 (41%)
B	Southern U.S. (Texas, Louisiana, southeastern States)		25(28%)
C	Eastern U.S. (Appalachian Mountains, Northeatern States)		49(56%)
D	Western U.S. and Canada (Rocky Mountains, western provinces)		7(8%)

Table 4. Ozark-Ouachita Plecoptera emergence chart, and total number of collection records for each species (N).



Species	N
Allocapnia oribata	2
Allocapnia ozarkana	2
Allocapnia sandersoni	9
Paracapnia angulata	18
Allocapnia malverna	35
Taeniopteryx parvula	9
Strophopteryx arkansae	42
Allocapnia jeanae	9
Allocapnia pygmaea	6
Zealeuctra cherokee	15
Zealeuctra wachita	3
Taeniopteryx maura	11
Allocapnia vivipara	53
Zealeuctra claasseni	102
Zealeuctra narfi	27
Allocapnia warreni	1
Taeniopteryx metequi	39
Allocapnia smithi	1
Shipsa rotunda	1
Taeniopteryx lonicera	1
Prostoia completa	88
Strophopteryx fasciata	130
Strophopteryx cucullata	96
Prostoia similis	4
Helopicus nalatus	32
Taeniopteryx lita	11
Clioperla clio	258
Hydroperla crosbyi	96
Hydroperla fugitans	2
Zealeuctra fraxina	1
Isoperla coushatta	19
Isoperla mohri	77
Isoperla signata	17
Isoperla burksi	18
Perlinella drymo	57
Nemocapnia carolina	1
Isoperla szczytkoi	1
Pteronarcys pictetii	37
Amphinemura nigritta	3
Isoperla namata	121
Isoperla ouachita	167
Amphinemura delosa	97
Isoperla decepta	23
Isoperla dicala	13
Paranetina media	20
Haplopera brevis	88
Alloperla caudata	33
Alloperla ouachita	2
Alloperla hamata	2
Isoperla bilineata	9
Perlesta fusca	22
Paragnetina kansensis	9
Perlesta browni	18
Agnetina capitata	13
Neoperla falayah	64
Leuctra rickeri	3
Alloperla caddo	4
Perlesta baumanni	4
Perlesta cinctipes	26
Acroneuria evoluta	140
Acroneuria filicis	15
Acroneuria internata	17
Acroneuria perplexa	44
Acroneuria mela	10
Perlinella ephyre	48
Perlesta decipiens	119
Acroneuria abnormis	3
Attaneuria ruralis	4
Neoperla robisoni	24
Alloperla leonarda	1
Acroneuria ozarkensis	2
Neoperla harpi	42
Agnetina flavescens	56
Neoperla osage	42
Neoperla carlsoni	7
Neoperla choctaw	15
Perlesta shubuta	14
Neoperla catharae	20
Leuctra tenuis	34
Leuctra paleo	2
Zealeuctra warreni	33
Allocapnia peltoides	10
Allocapnia forbesi	3
Allocapnia mystica	53
Allocapnia rickeri	145
Allocapnia mohri	102
Allocapnia granulata	116
Taeniopteryx burksi	105

the regional endemics, six of which were found in no other subregion (Table 3). The Appalachian Mountains and northeastern states contain the greatest degree of similarity to the region (56 %), and known distribution ranges for only seven species extend into the Rocky Mountains of western North America.

Included in the keys and accounts below are three newly discovered species, and new characters and illustrations within groups that were previously poorly known. The species accounts contain descriptions for the three new species, allotype descriptions and designations for *Alloperla ouachita* and *Zealeuctra wachita*, and 12 new nymph descriptions. Keys reflect current knowledge based on nymphal rearing. Color patterns of some species are variable, and collections of large numbers are helpful in their verification. Of the characters used in key couplets (Figs. 6-464), the first character listed in each couplet is considered the most reliable for specimens collected within the region.

Species accounts below consist of a brief synonymy including only name changes and their references. Collection data and plotted distributions are given in two different ways: 1) specific localities and actual numbers of specimens reared or field collected (M=male, F=female) are listed for less common species, and their distributions are plotted on regional maps (Figs. 465-469), and 2) watershed numbers (Table 1) are listed for common species.

Key to the Families of Ozark-Ouachita Plecoptera

Males and Females

1. Paraglossae and glossae of about equal length (Fig. 26) 2
   Paraglossae longer than glossae (Fig. 25) 6
2. Gill remnants on sides of thorax and abdominal segments 1-2 (Fig. 21) . . . . . **Pteronarcyidae**
   Gill remnants absent from abdominal segments 1-2, but sometimes present elsewhere (Fig. 17, 18) 3
3. Second tarsal segment subequal to first (Fig. 34) . . . . . **Taeniopterygidae**
   Second tarsal segment shorter than first (Fig 32, 33) 4
4. Cerci multisegmented (Figs. 69-81); vein 2A of forewing unforked . . . . . **Capniidae**
   Cerci of one segment, often globular (Figs. 107-111, 138-143); vein 2A in forewing forked (Figs. 6, 10, 14) 5
5. Wings folded flat at rest; forewing with vein in costal space beyond cord (Fig. 6) . . . . . **Nemouridae**
   Wings rolled at rest, covering sides and back of abdomen; forewing without vein in costal space beyond cord (Fig. 14) . . . . . **Leuctridae**
6. Gill remnants on side of thorax (Fig. 17); cubito-anal crossvein in forewing set at anal cell or away from it by a distance less than its length (not reliable in some *Isoperla*, *Clioperla*, and *Perlesta*) (Figs. 8, 12) . . . . . **Perlidae**
   Gill remnants absent from thorax; cubito-anal crossvein removed from anal cell by a distance equal to or greater than its length (Figs. 9, 10) 7
7. Vein 2A of forewing forked beyond anal cell (Fig. 10); body yellow or green in life, (pale in alcohol), wings clear . . . . . **Chloroperlidae**
   Vein 2A of forewing leaves anal cell as 2 separate veins (Fig. 9); body color in life variable, most species with amber to dark wings . . . . . **Perlodidae**

Nymphs

1. Paraglossae and glossae of about equal length (Fig. 26) 2
   Paraglossae longer than glossae (Fig. 25) 6
2. Branched gills on both thorax and abdominal segments 1-2 (Fig. 462) . . . . . **Pteronarcyidae**
   No branched gills on abdominal segments 1-2, but sometimes present elsewhere (Figs. 16, 19, 27) 3
3. Second tarsal segment subequal to first (Fig. 34) . . . . . **Taeniopterygidae**
   Second tarsal segment shorter than first (Figs. 32, 33) 4
4. Wing pads strongly divergent from median body axis (Figs. 177-184); body short, hind legs when extended, reach tip of abdomen . . . . . **Nemouridae**
   Wing pads nearly parallel to median body axis (Fig. 43); body elongate, hind legs when extended do not reach tip of abdomen 5
5. Setae absent, or sparse, on posterior margin of abdominal terga; distance between tips of front wing pads greater than distance between tips of hind wing pads (Fig. 42); membranous pleural fold reaches from first abdominal segment to, at most, the 7th segment (Figs. 36, 37) . . . . . **Leuctridae**
   Setae present on posterior margin of abdominal terga; distance between tips of front wing pads about equal to distance between tips of hind wing pads (Figs. 43, 48); membranous pleural fold reaches to abdominal segment 9 (Fig. 35) . . . . . **Capniidae**
6. Highly branched gills on sides of thorax (Fig. 16) . . . . . **Perlidae**
   Branched gills absent from thorax 7
7. Length of cerci 3/4 or less than abdominal length; pigment contrast weak or absent (Figs. 205-208) . . . . . **Chloroperlidae**
   Length of cerci as long or longer than abdomen; pigment contrast present . . . . . **Perlodidae**

Family Capniidae

This is the best represented family of "winter stoneflies" in the region, with 17 species. The small, black adults were common on bridges, and often were found crawling on snow and ice. Males of all but one species of *Allocapnia* Claassen are brachypterous, but both sexes of the genus were observed gliding for short distances. Unlike Nemouridae and Leuctridae, the adult cerci have several segments, and 2A of the forewing is unforked. Nymphs differ from those of Leuctridae in two ways: 1) the distance between the tips of the front wingpads is subequal to that of the hind wingpads (Fig. 43), and 2) the abdominal pleural fold reaches segment 9 (Fig. 35). Searching bridges, emergent leaves, and debris is effective for collecting adults. The herbivorous nymphs skeletonized pieces of conditioned leaf material added to rearing chambers. Adult *Allocapnia* were apparently attracted to vertical surfaces, and congregated on concrete bridge pillars during warm afternoons. When numerous, males appeared to defend territories, by sparring with antennae. The less active females were found in more secretive places such as crevices and under bridge railings. Ross and Ricker (1971) provided keys to *Allocapnia* adults of eastern North America. The key below includes the recently described *Allocapnia oribata* Poulton and Stewart (1987), and females of some species not previously separated. Except for male nymphs of *Allocapnia vivipara* (Claassen), which lack wing pads, and the relatively large size of *Allocapnia sandersoni* Ricker nymphs, the immature stages of regional *Allocapnia* are currently inseparable.

Key to Genera and Species of Capniidae

Males and Females

1. Males 2
   Females 18
2. Wings brachypterous or reduced to small vestiges . . . . ***Allocapnia*** Claassen 4
   Wings long, reaching tip of abdomen or beyond 3
3. A1 of forewing sharply bent beyond anal cell (Fig. 15); epiproct straight, apex blunt (Fig. 55); cerci with fewer than 11 segments . . . . ***Nemocapnia carolina*** Banks
   A1 of forewing not sharply bent beyond anal cell; outer margin of epiproct curved, apex sharply pointed (Figs. 51, 52); cerci with 12 or more segments . . . . ***Paracapnia angulata*** Hanson
4. Wings reduced to small vestiges (Fig. 46) . . . . ***A. vivipara*** (Claassen)
   Wings extend to middle abdominal segments 5
5. Raised sclerotized process present on tergum 7 and tergum 8 (Figs. 61, 69) 6
   Raised process present on tergum 8 only (Figs. 56-59,73- 75); tergum 7 with, at most, a small hump (Figs. 71, 72) 8
6. Apical section of epiproct upper limb as long or longer than basal section; tergum 7 process a low, unnotched shelf . . . . ***A. smithi*** Ross and Ricker
   Apical section of epiproct upper limb much shorter than basal section (Fig. 69) 7
7. Tergum 7 process with a small median notch (Fig. 87) . . . . ***A. ozarkana*** Ross
   Tergum 7 process cone-shaped, without notch . . . . ***A. forbesi*** Frison
8. Tergum 8 process notched or indented (Figs. 83, 84, 88, 90, 93-95) 9
   Tergum 8 process entire (Figs. 82, 85, 89, 92) 16
9. Apical section of epiproct upper limb shorter than basal section (Figs. 73, 74, 80) 10
   Apical section of epiproct upper limb as long or longer than basal section (Figs. 75-78, 81) 12
10. Tergum 8 process divided into 2 widely separated knobs (Figs. 57, 88) . . . . ***A. rickeri*** Frison
    Tergum 8 process with narrower notch (Figs. 94, 95) 11
11. Apical section of epiproct upper limb globular, widened apically (Fig. 73) . . . . ***A. sandersoni*** Ricker
    Apical section of epiproct upper limb elongate, slender apically (Fig. 80) . . . . ***A. jeanae*** Ross
12. Tergum 8 process without setose knobs along posterior margin (Figs. 59, 60), or if knobs present, upper limb of epiproct thin, blade-like (Fig. 81) 13
    Tergum 8 process with setose knobs present (Figs. 62, 68, 72, 78); upper limb of epiproct swollen apically 15
13. Upper limb of epiproct thin, blade-like (Fig. 81) . . . . ***A. warreni*** Ross and Yamamoto
    Upper limb of epiproct swollen apically (Figs. 75, 77) 14
14. Apex of epiproct upper limb pointed in dorsal aspect (Fig. 59); notch of tergum 8 process large (Fig. 83) . . . ***A. pygmaea*** (Burmeister)
    Apex of epiproct upper limb rounded in dorsal aspect (Fig. 60); notch of tergum 8 process small (Fig. 84) . . . . ***A. mystica*** Frison
15. Apex of epiproct upper limb rounded; anterior corners of tergum 8 process angulate (Fig. 72) . . . . ***A. peltoides*** Ross and Ricker
    Apex of epiproct upper limb moderately pointed; anterior corners of tergum 8 process rounded (Fig. 78) . . . . ***A. granulata*** (Claassen)
16. Upper limb of epiproct thin, blade-like (Fig. 70) . . . . ***A. mohri*** Ross and Ricker
    Upper limb of epiproct swollen apically (Figs. 71, 76) 17
17. Tergum 8 process wide, and cone-shaped in posterior aspect (Figs. 58, 92) . . . . ***A. oribata*** Poulton and Stewart
    Tergum 8 process narrow, and rounded or flat in posterior aspect (Figs. 63, 85) . . . . ***A. malverna*** Ross

18. A1 of forewing sharply bent beyond anal cell (Fig. 15); cerci with fewer than 11 segments............ ***Nemocapnia carolina*** Banks
A1 of forewing straight or slightly sinuate; cerci with more than 12 segments.. **19**
19. Anal lobe of hind wing noticably smaller than rest of wing (Fig. 11); anterior margin of sternum 8 without lateral extensions of pleural membranes (Fig. 53).. ***Paracapnia angulata*** Hanson
Anal lobe of hind wing subequal to rest of wing (Fig. 13); anterior margin of sternum 8 with lateral notches, sometimes extending to posterior margin and separating sterna from pleura (Figs. 96-106) .... ***Allocapnia*** Claassen **20**
20. Sternum 7 and 8 fused (Figs. 96, 97, 103, 105) (some overlap between sterna may occur)................................... **21**
Sternum 7 and 8 separated by membrane (Figs. 98, 99, 102, 104, 106)... **25**
21. Tergum 8 with little or no membranous areas; posterior margin of sternum 8 straight, with a rounded flap positioned anterior to it (Fig. 97)... ***A. vivipara*** (Claassen)
Tergum 8 with wide membranous area; posterior margin of sternum 8 at least slightly rounded (Fig. 105), or if straight, rounded flap absent (Fig. 100), or overlapping posterior margin (Fig. 103)... **22**
22. Posterior margin of sternum 8 with a wide flap having rounded corners, indented in lateral aspect (Fig. 105), or flexed under margin of sternum 7.. ***A. pygmaea*** (Burmeister)
Posterior margin of sternum 8 with, at most, a narrow flap (Fig. 96), and not indented (Figs. 100, 103)......................... **23**
23. Sternum 8 flap evenly rounded (Fig. 103); large species, extended body length greater than 7mm............ ***A. sandersoni*** Ricker
Sternum 8 flap truncate (Figs. 96, 100); smaller species, extended body length 7mm or less................................ **24**
24. Sternum 8 flap extended, not continuous with posterior margin (Fig. 96); connection between sternum 7 and 8 narrow (Fig. 96)...... .... ***A. jeanae*** Ross
Sternum 8 flap not extended, nearly continuous with posterior margin (Fig. 100); connection between sternum 7 and 8 wide (Fig. 100) .... ***A. rickeri*** Frison
25. Sternum 8 flap saggitate, and surrounded by membranous areas (Figs. 101, 106).. **26**
Sternum 8 flap not saggitate, posterior margin entire and/or without adjacent membranous areas (Figs. 99, 102, 104)........... **27**
26. Anterior margin of sternum 8 with an evenly rounded, concave indentation; saggitate flap usually wider than long (Fig. 106) .... ***A. granulata*** (Claassen)
Anterior margin of sternum 8 without concave indentation, or not evenly rounded (Fig. 101); saggitate flap about as wide as long (Fig. 101).. ***A. peltoides*** Ross and Ricker
27. Sternum 8 flap extends beyond its posterior margin (see Ross & Ricker 1971)... **28**
Posterior margin of sternum 8 either sinuate (Figs. 99, 102, 104) or flap does not extend beyond posterior margin (Fig. 98)....... **29**
28. Sternum 8 flap truncate; tergum 8 with wide membranous area... ***A. smithi*** Ross and Ricker
Sternum 8 flap rounded; tergum 8 with membranous area narrow or absent.. ***A. forbesi*** Frison
29. Sternum 8 with 2 circular areas lateral to median flap (Fig. 98)... ***A. ozarkana*** Ross
Sternum 8 without circular areas; posterior margin of sternum 8 sinuate (Figs. 99, 102, 104)................................... **30**
30. Posterior margin of sternum 8 indented (Fig. 104)... ***A. malverna*** Ross
Posterior margin of sternum 8 not indented (Figs. 99, 102)... **31**
31. Posterior margin of sternum 8 continuous and sinuate, without contrasting pigment (Fig. 102)............ ***A. mohri*** Ross and Ricker
Posterior margin of sternum 8 discontinuous, and slightly broken along lateral margins of median hump; pigmentation adjacent to medium hump pale (Fig. 99)... ***A. mystica*** Frison

Nymphs

1. Cercal segments with many fine hairs forming a fringe (Fig. 49) .... ***Nemocapnia carolina*** Banks
Cercal segments with hairs restricted to whorls, not forming a fringe (Fig. 50)... **2**
2. Abdominal terga and their posterior margins with numerous hairs (Fig. 39); front and hind wing pads similar in shape, outer margin of hind wing pads not divergent (Fig. 48).. ***Paracapnia angulata*** Hanson
Abdominal terga and their posterior margins with at most short bristles (Fig. 38); hind wing pads wider at tip than front wing pads, and with outer margin divergent (Fig. 43)... ***Allocapnia*** Claassen

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Allocapnia forbesi Frison

Allocapnia forbesi Frison (1929).

Type locality.—Illinois, Pope County, Dixon Springs. *Regional distribution.*— IL: Alexander Co., New Columbia; Pope Co., Dixon Springs, Golconda, Herod; Union Co., Cobden.

Discussion.— This species was reported by Frison (1929) in the southern Illinois Ozarks. It is distinguished from other *Allocapnia* by the cone-shaped process on the male tergum 7. Frison (1935) reported a variant of this species with a similar process on tergum 6. No recent collections are available from the region. The Illinois Ozarks probably represents the western edge of its range, where it was collected in intermittent habitats from early December through early March (Ross and Ricker 1971).

Allocapnia granulata (Claassen)

Figs. 13, 38, 43, 68, 78, 90, 106

Capnella granulata Claassen (1924).
Allocapnia granulata: Frison (1929, 1935).

Type locality.— New York, Johnstown.
Regional distribution.— Watersheds 1-5, 9, 13, 14,

17, 19, 22, 24-29, 31-33, 36-42, 46-49, 52, 53, 56, 57, 60, 61, 65, 67, 71-77, 79-82, 86-92, 95-97, 100-104, 106-123, 125 (Table 1).

Dicussion.— Males of this species are distinguished by the wedge-shaped process and setose knobs of tergum 8 (Fig. 68). In addition to Illinois localities (Frison 1929), it was reported from Oklahoma (Ross and Yamamoto 1967). It is the only *Allocapnia* distributed as far west as the Arbuckle and Wichita Mountains of southern Oklahoma (Ross and Ricker 1971), and north central Texas (Szczytko and Stewart 1977). It is widespread in the region, and as stated by Ross and Ricker (1971), is common in large rivers (74% from permanent streams, Table 2) with slower gradients. It was often collected up to 1 km from moving water, from bridges over lowland streams with large pools. In small, organically enriched creeks in the Missouri River border subregion, it often co-occurrs with *A. vivipara*. These occurrences suggest a wide tolerance to a variety of conditions. Its low frequency in small, high elevation creeks in mountainous areas suggest an inability to compete with other species common in these habitats. Emergence occurs from December to early March.

Allocapnia jeanae Ross

Figs. 67, 80, 95, 96

Allocapnia jeanae Ross (1964).

Type locality.— Arkansas, Washington County, White River,Winslow.

Regional distribution.—Watersheds 7, 9, 10, 21, 23, 25, 28, 34, 36, 65, 81 (Table 1).

Discussion.— Males of this species have a relatively long epiproct upper limb (Fig. 80), and females resemble those of *A. rickeri* and *A. sandersoni*, except for the truncate flap extending from sternum 8 (Fig. 100). In addition to records from northwestern Arkansas (Ross and Ricker 1971), Stewart et al. (1974) reported it from Oklahoma, and our collections include one southwestern Missouri locality and several records from the Ouachita Mountains. Although it was not collected in abundance, it is endemic to the region, occurring in intermittent first and second order streams, or those that dry up during summer months (Table 2). Adults were collected from January through mid March.

Allocapnia malverna Ross

Figs. 63, 76, 85, 104

Allocapnia malverna Ross (1964).

Type locality.— Arkansas, Hot Springs County, Malvern.

Regional distribution.— Watersheds 6, 11, 12, 14-16, 29, 30, 39, 50, 51, 57-59, 62-64, 69 (Table 1).

Discussion.— This species resembles *A. mohri*, but the male epiproct upper limb is broader (Fig. 76), and the female has an indentation on sternum 8 (Fig. 104). Since the original description (Ross 1964), records from Oklahoma (Stark and Stewart 1973a), Texas, (Szczytko and Stewart 1977), and Louisiana (Stewart et al. 1976) have been reported. Our collections include one record from the lower White River Valley, but 97% were from the Gulf Coastal Plain, primarily in cleaner first and second order intermittent streams (Table 2) with sand or gravel substrates. Emergence occurs in January & February.

Allocapnia mohri Ross and Ricker

Figs. 56, 70, 82, 102

Allocapnia mohri Ross and Ricker (1964).

Type locality.— Oklahoma, Leflore County, Summitt.

Regional distribution.—Watersheds 1, 2, 5, 7-9, 13, 18, 20, 21, 23, 25-28, 32-37, 40-45, 48, 49, 52-57, 59, 60, 65, 68, 69, 71-82, 84, 87-90, 96, 98, 99, 107, 108, 114, 116, 118, 120, 122, 123 (Table 1).

Discussion.— Males of this species can be separated from *A. malverna* by the thin, blade-like tip of the epiproct upper limb (Fig. 70). Females are not reliably separated from those of *A. malverna* and *A. mystica*, but sternum 8 of *A. mohri* is usually sinuate and uniformly pigmented (Fig. 102). Based on distributions given by Ross and Ricker (1971), and our own records, it is the most common and widespread *Allocapnia* endemic to the region. It occurs in mountainous subregions, and is common in intermittent streams. Emergence begins in December, and gravid females were collected as late as early April.

Allocapnia mystica Frison

Figs. 60, 75, 84, 99

Allocapnia mystica Frison (1929).

Type locality.— Illinois, Salt Fork River, Oakwood.

Regional distribution.— Watersheds 2, 32, 38, 41, 46, 47, 52, 53, 57, 67, 68, 70, 72, 85, 86, 91, 95, 96, 105-108, 113, 114, 118, 120-122, 125, 126 (Table 1).

Discussion.— Males are distinguished by the short, spatulate epiproct upper limb, and the narrow notch of the tergum 8 process (Figs. 75, 84). Females are not reliably separated from those of *A. mohri*, but the posterior margin of sternum 8 is not uniformly pigmented as is typical for *A. mohri* (Fig. 99). This species occurs in

Arkansas and Missouri (Ross and Ricker 1971), and it was most common in the Central Plateau, White River, and Illinois Ozark subregions. It is the only *Allocapnia* known from Crowley's Ridge, however males of these populations differed slightly in having a shorter tip of the epiproct upper limb. Its distribution is "hourglass" shaped, with the Illinois Ozarks connecting regional populations and those in the Appalachian Mountains. It was common at hilly, upland sites, and emergence occurs from December to early March.

Allocapnia oribata Poulton and Stewart
Figs. 58, 71, 92

Allocapnia oribata Poulton and Stewart (1987).

Type locality.— Arkansas, Searcy County, Middle Fork Little Red River, Shirley.

Regional distribution.— AR: Searcy Co., M. Fk. L. Red R., Hwy 65 @ Shirley, 6-I-85, 3M, BCP; Van Buren Co.,Archey Cr., Hwy 254, 12.1 km NE Rupert, 6-I-85, 1M, BCP.

Discussion.— This regional endemic species is distinguished from other *Allocapnia* by the wide unnotched elevated process of male tergum 8. The female is unknown but male characteristics suggest it is a member of the *Allocapnia recta* (Claassen) group (Ross and Ricker 1971). This species is known only from two, 4th order permanent streams (Poulton and Stewart 1987). Emergence occurs in early January.

Allocapnia ozarkana Ross
Figs. 61, 69, 86, 87, 98

Allocapnia ozarkana Ross (1964).

Type locality.— Arkansas, Madison County, Cannon Creek.

Regional distribution.— AR: Johnson Co., Big Minnow Cr., Hwy 123, 5.5 km W Hagarville, 7-I-85, 1M, BCP; Dallas Co., Trib. Moro Cr., Hwy 48, 3 mi E Tulip., 4-II-84, 2M, 9F, BCP; six plotted localities in northern Arkansas (Ross and Ricker 1971).

Discussion.— This regional endemic species is separated from other *Allocapnia* by the notched process on male tergum 7 (Fig. 61). It has not been collected in large numbers, and is apparently rare (Ross and Ricker 1971). A relict population was discovered from the northern Gulf Coastal Plain during this study (Trib. of Moro Cr., listed above), but other collections were from intermittent streams in the Boston Mountains and the White River drainage. Emergence occurs in January and February.

Allocapnia peltoides Ross and Ricker
Figs. 62, 72, 93, 101

Allocapnia peltoides Ross and Ricker (1964).

Type locality.— Oklahoma, Leflore County, Polk Creek, Poteau.

Regional distribution.— AR: Polk Co., Rock Cr. Hwy 271, 4.4 km SW Mena, 26-XI-83, 1M, 6F, 20 n, BCP; Scott Co., Big Cedar Cr., Hwy 28, 9-I-85, 1M, BCP; Mill Cr. (Ross and Ricker 1971); Sebastian Co., creek 11 km SW Hartford, 17-II-85, 1M, 2F, BCP. OK: Haskell Co., 8.8 km S Lewisville, 10-II-61, 1M, H. H. Ross & J. A. Ross; Leflore Co., Hwy 270, Page, 4-II-79, 16M, 8F, BPS; Pushmataha Co., Hardy Cr., 19.8 km S Clayton, 1M, BPS.

Discussion.— This regional endemic species is similar to *A. granulata* in the wedge-shaped process on male tergum 8 (Figs. 62, 72), and a sagitate flap on female sternum 8 (Fig. 101). The upper limb of the epiproct is rounded at the tip rather than pointed as in *A. granulata.* The rarity of *A. peltoides* was noted by Stark and Stewart (1973a) who listed one locality from Oklahoma. Additional localities listed above confirm its restriction to the Ouachita subregion. All known localities are small to medium-sized intermittent streams in upland pine. Emergence occurs from late November through February, which is earlier than for other winter species.

Allocapnia pygmaea (Burmeister)
Figs. 59, 77, 83, 105

Semblis pygmaea Burmeister (1839).
Allocapnia pygmaea: Ross and Ricker (1971).

Type locality.— Canada, Ontario.

Regional distribution.— MO: Miller Co., Bagnell, 25-III-61, 2M, H.H. Ross and L.J. Stannard; Blue Spring Cr.,Hwy 54, 2 km S Bagnell, 16-III-86, 1M, BCP; Reynolds Co., Trib. Logan Cr., Hwy Y @ Ellington, 29-I-87, 1 M, BCP; Shannon Co., Round Spring, date & collector unknown; Sinking Cr., Hwy 19, 11 km S Timber, 29-I-87, 1M, BCP. Five additional Missouri records given by county (Ross et al. 1967): Franklin Co., Maries Co., Phelps Co., Reynolds Co., Washington Co.

Discussion.— This species is similar to *A. mystica*, but the notch of the male tergum 8 is wider, and the upper limb of the epiproct is pointed (Figs. 59, 77, 83). Ross et al. (1967) noted modal variation in the epiproct, with Ozark populations posessing shorter epiproct tips than eastern populations. Missouri populations are disjunct from the northern and eastern portions of its range. Ross et al. (1967) noted *A. pygmaea* as a subboreal species, found only in streams which remain cool throughout the year, and Pugsley and Hynes (1986) found this species to exhibit hyporheic nymphal diapause during summer months. Collections during this study support these works, but it was never collected in large numbers. It is restricted to permanent habitats, and those that recieve flow from underground springs. It is considered a rare and endangered species in Missouri (Wilson 1984), and was collected from late January to mid-March.

Allocapnia rickeri Frison

Figs. 57, 74, 88, 100

Allocapnia rickeri Frison (1942).

Type locality.— Illinois, Pope County, Grand Pierre River, Golconda.

Regional distribution.— Watersheds 1-4, 7-9, 13, 14, 17, 20-23, 25-28, 31, 32, 34-38, 41-46, 48-50, 52-57, 61, 64-69, 71-74, 80, 81, 83-89, 91-94, 96, 97, 99-107, 109-111, 115-125 (Table 1).

Discussion.— Males of this species can be distinguished by the wide, U-shaped notch of tergum 8, which appears as two separate knobs (Fig. 57). It is one of the most common regional species, first reported by Frison (1942) from Illinois, and Ross (1964) and Stewart et al. (1974) from Arkansas, Missouri and Oklahoma. The Ozark-Ouachita region is probably the southwestern limit of its range, where it was found in a variety of stream sizes and in every subregion except Crowley's Ridge. It is common in mountainous areas, and adults occur from December through March.

Allocapnia sandersoni Ricker

Figs. 35, 65, 73, 94, 103

Allocapnia sandersoni Ricker (1952).

Type Locality.— Arkansas, Washington County, Clear Creek, Fayetteville.

Regional distribution.— Watersheds 32, 36, 41, 42, 71, 72,90, 96, 122 (Table 1).

Discussion.— This species is similar to *A. rickeri*, but the notch of male tergum 8 is smaller. It is the largest regional *Allocapnia*, and adults and mature nymphs are 10 mm or more in length. This regional endemic was reported in Arkansas (Ricker 1952), Missouri (Ross and Ricker 1971) and Oklahoma (Stark and Stewart 1973a). It is most common in 2nd order streams with upland hardwoods in the White River and Springfield Plateau subregions. Adults are present in January and February.

Allocapnia smithi Ross and Ricker

Allocapnia smithi Ross and Ricker (1971)

Type locality.— Kentucky, Butler County, 5.5 km W of South Hill.

Regional distribution.— IL: Pope Co., Lusk Cr., 11 km SE Eddyville, 5-III-58, 3M, H.H. Ross and L.J. Stannard.

Discussion.— This species was collected from a single locality in southern Illinois (Ross and Ricker 1971). Males are distinguished from other *Allocapnia* by the presence of a short, shelf-like tergum 7 process (Ross and Ricker 1971). It is common in Kentucky and northern Alabama, and the Illinois locality listed above probably represents the northwestern limit of its range. No additional specimens were recorded from the region, where it emerges from small, spring-fed streams from mid-December to late March (Ross and Ricker 1971).

Allocapnia vivipara (Claassen)

Figs. 46, 64, 79, 89, 97

Capnella vivipara Claassen (1924).
Allocapnia vivipara: Frison (1929, 1935).

Type locality.— Illinois, Lake Forest.

Regional distribution.— Watersheds 67, 86, 88, 89, 94, 101, 105-108, 110-114, 118, 119, 126 (Table 1).

Discussion.— Males of this species were the only specimens collected during this study with wings reduced to small vestiges (Fig. 46). The epiproct upper limb is similar to *A. rickeri* and *A. sandersoni*, and the female resembles *A. rickeri* except tergum 8 has little or no membranous area. Frison (1942) reported it from Illinois and Missouri, and Stark and Stewart (1973a) and Stewart and Huggins (1977) reported it from Oklahoma and Kansas, respectively. Our record from Lawrence Co., Arkansas (Little Cypress Creek, Hwy 25) is the first for this state, and extends the known range further south in the Mississippi Valley. This lowland species was most commonly found in Mississippi-Missouri River border subregions and the Illinois Ozarks (Table 2), often from streams with organic enrichment. Adults are present from January through March.

Allocapnia warreni Ross and Yamamoto

Figs. 66, 81

Allocapnia warreni Ross and Yamamoto (1966).

Type locality.— Arkansas, Washington County, Clear Creek.

Regional distribution.— AR: Washington Co., Clear Cr., 29-I-year unknown, 1M, H.H. Ross.

Discussion.— The male tergum 8 process of this species resembles that of *A. granulata* (Fig. 66), but the epiproct upper limb is narrower and resembles *A. mohri* (Fig. 81). Repeated collections from the type locality failed to yield any specimens, and the female remains unknown. It is considered a sister species of *A. granulata* (Ross and Ricker 1971). The type locality has undergone extensive deterioration due to agricultural pollution and siltation, which may have eliminated the population.

Nemocapnia carolina Banks

Figs. 15, 49, 54, 55

Nemocapnia carolina Banks (1938).

Type locality.— North Carolina, Morgantown.

Regional distribution.— AR: Saline Co., Salt Cr., Benton, 15-IV-39, 1M, H.H. & J.A. Ross.

Discussion.— This species is similar to *Paracapnia angulata*, but the forewing has a sinuate A1 (Fig. 15), and the cerci have fewer than 11 segments. The bluntly pointed epiproct has no lower limb as in *Allocapnia*, and nymphal cerci have a fringe of fine hairs (Figs. 49, 55). The specimen collected in 1939 listed above was examined from a loan of INHS material, and confirmed to be this species. This is the only known record west of the Mississippi River, and four additional collections from this second order permanent stream have not produced additional specimens. Hitchcock (1974) noted a spring emergence for this species, suggesting the presence of adults later than other regional Capniidae.

Paracapnia angulata Hanson

Figs. 11, 39, 48, 50-53

Paracapnia angulata Hanson (1961).

Type locality.— Massachusetts, Pelham.

Regional distribution.— Watersheds 4, 17, 25, 28, 36, 38, 49, 56, 68, 83, 85, 87, 96, 104, 120, 124, 125 (Table 1).

Discussion.— The lower limb of the epiproct found in all other *Allocapnia* is absent in this species (Fig. 52), and the wings are of normal length. Frison (1942) reported it from Illinois as *Capnia opis* (Newman), and Hanson (1946) recognized *Paracapnia* as a separate genus. Specimens examined at the INHS collected from Arkansas and Missouri after 1946 were labeled *Paracapnia opis* (Newman). Later, Hanson (1961) recognized *P. angulata* as a separate species, and Ernst and Stewart (1985b) recently reported it from Oklahoma. Our records from the Ouachita Mountains probably represent the southwestern limit of its distribution. Its presence is an indicator of permanently flowing streams, and was collected from mountainous subregions where springs are common (Table 2). Adults frequent emergent leafpacks and stream side vegetation in January and Febuary.

Family Leuctridae

This family of small, thin, black stoneflies has nine regional species, many of which are part of the "winter stonefly" fauna. Unlike Capniidae, all regional species have full-length wings, which are often rolled around the sides of the abdomen. Nymphs have a greater distance between the tips of the front wingpads than of the hind wingpads. Adults were collected by searching bridges or riparian vegetation. Nymphs are herbivore-detrivores, occupying leaf packs and debris along stream margins and habitats with slower currents. Ricker and Ross (1969) and Hitchcock (1974) provided descriptions and keys to *Zealeuctra* Ricker and *Leuctra* Stevens, respectively, but four of nine regional species were not known at that time. Female specimens of *Z. fraxina* were not available for illustration, and is omitted from the key. Pre-emergent nymphs can be identified with the key below, if adult structures can be seen through the cuticle.

Key to Genera and Species of Leuctridae

Males and Females

1. Male tergum 9 deeply cleft (Figs. 107-111); female sternum 8 with a pair of accessory sclerites, sometimes hidden under subgenital plate (Figs. 130-134) .... ***Zealeuctra*** Ricker **2**
   Male tergum 9 entire (Figs. 123-125); female sternum 8 without accessory sclerites (Figs. 135-137) .... ***Leuctra*** Stevens **8**
2. Males **3**
   Females **13**
3. Epiproct with 2 prominent spines (Fig. 119) or an accessory cusp behind largest spine (Fig. 118) **4**
   Epiproct with one spine and, at most, ventral serrations (Figs. 112, 114, 116, 121) **5**
4. Epiproct with 2 prominent spines, the smaller one ventral (Fig. 119) .... ***Z. warreni*** Ricker and Ross
   Epiproct with small accessory cusp behind the primary spine (Fig. 118) .... ***Z. fraxina*** Ricker and Ross
5. Origin of terminal epiproct spine anterior to bulbous posterior portion (Fig. 112); tergum 9 cleft narrowed anteriorly, "V"-shaped, and with sclerotized margin narrow (Fig. 107) .... ***Z. claasseni*** (Frison)
   Hind portion of epiproct not bulbous, generally following curvature of spine (Figs. 114, 116, 121); tergum 9 cleft not narrowed anteriorly, "U"-shaped, with sclerotized margin wide (Figs. 108, 110, 111) **6**

6. A pair of knobs present on anterior margin of the tergum 9 cleft, or if these absent, terminal posterior lobes of cleft single, pointing inward (Fig. 111); cerci truncate in lateral aspect, without dorsal swelling (Fig. 122) .... ***Z. wachita*** Ricker and Ross
Knobs on anterior margin of tergum 9 cleft absent (serrations may be present); terminal posterior lobes of cleft split into 2 closely set lobes on each side (Figs. 108, 110); cerci with dorsal swelling (Figs. 115, 117) **7**
7. Terminal posterior lobes of tergum 9 cleft about 2X size of adjacent, inner lobes (Fig. 108); terminal indentation of cerci strongly concave in lateral aspect (Fig. 117) .... ***Z. narfi*** Ricker and Ross
Terminal posterior lobes of tergum 9 cleft 3-4X size of adjacent inner lobes, and barely separated (Fig. 110); terminal indentation of cerci weakly concave in lateral aspect .... ***Z. cherokee*** Stark and Stewart
8. Males **9**
Females **11**
9. Tergum 7 with truncate process extending caudad over tergum 8 (Figs. 124, 128) .... ***L. tenuis*** (Pictet)
Tergum 7 with no process (Fig. 123), or with, at most, asmall sinuate band of sclerotization, appearing knob-like (Fig. 125) **10**
10. Paraprocts as long or longer than specilla (Figs. 126, 127); specilla with long subterminal spines (Fig. 127) .... ***L. paleo*** Poulton and Stewart, n.sp.
Paraprocts about 1/2 as long as specilla (Fig. 129); specilla with, at most, short subterminal knobs (Fig. 125) .... ***L. rickeri*** James
11. Subgenital plate notched laterally (Fig. 135) .... ***L. tenuis*** (Pictet)
Subgenital plate entire laterally, or with, at most shallow indentations (Figs. 136, 137) **12**
12. Small lobe present in terminal notch of subgenital plate (Fig. 136) .... ***L. rickeri*** James
Small lobe absent from terminal notch of subgenital plate (Fig. 137) .... ***L. paleo*** Poulton and Stewart, n.sp.
13. Median lobe of sternum 7 absent; sclerites of sternum 8 directed laterad (Fig. 134) .... ***Z. warreni*** Ricker and Ross
Median lobe present on sternum 7, but often covered by sternum (Figs. 130-133); sclerites of sternum 8 oval or triangular with rounded margins **14**
14. Posterior margin of sternum 7 straight, with terminal lobe located behind the margin or separated from it by membranous areas (Figs. 131, 132) **15**
Posterior margin of sternum 7 with notch containing the terminal lobe (Figs. 130, 133) **16**
15. Terminal lobe evenly rounded, about as long as wide and membranous (Fig. 131) .... ***Z. claasseni*** (Frison)
Terminal lobe truncate, about twice as wide as long (Fig. 132) .... ***Z. narfi*** Ricker and Ross
16. Notch of sternum 7 deep, containing elongate terminal lobe with adjacent membranous areas (Fig. 133); sclerites of ster num 8 about same size as terminal lobe and somewhat triangular .... ***Z. cherokee*** Stark and Stewart
Notch of sternum 7 shallow, (sometimes appearing deep due to lack of pigmentation surrounding lobe base)(Fig. 130); sclerites of sternum 8 smaller than terminal lobe, and oval .... ***Z. wachita*** Ricker and Ross

Nymphs

1. Membranous pleural fold present on abdominal sterna 1-4 (Fig. 37); abdominal terga with numerous hairs .... ***Leuctra*** Stevens
Membranous pleural fold present on abdominal sterna 1-6 (Fig. 36); abdominal terga with very few hairs, or naked .... ***Zealeuctra*** Ricker

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Leuctra paleo Poulton & Stewart, new species

Figs. 14, 123, 126, 127, 137

Type locality.— Arkansas, Columbia County, Tributary of Smackover Creek, Hwy 98, 8.8 km E McNeil.

Types.—Holotype M, Allotype F, 2 paratype M, and 4 paratype F, (all reared), 2-X-84, BCP. Holotype and allotype in USNM, paratypes in UNT Insect Museum. Additional paratypes*:* AR: Dallas Co., Browns Cr., Hwy 8, 10 km W Princeton, 3-X-84, reared 2M, 2F, field 2M, 3F, BCP. Paratypes deposited in BCP collection.

MALE: (Figs. 123, 126, 127). Forewing length 7mm, body length 6mm. Color and wing venation simliar to other *Leuctra*. Terga 7 & 8 entire, without projections or lobes. Specilla widest at base, narrowing posteriorly, with long subterminal spine pointing laterally (Fig. 127). Paraprocts as long or longer than specilla (Figs. 123, 126). Vescicle similar to other *Leuctra*.

FEMALE: (Fig. 137). Forewing length 8mm, body length 7mm. Color and wing venation similar to other *Leuctra*. Sternum 8 with shallow notch, apices of lobes evenly and broadly rounded, and darkened.

Etymology.— This species is named for the ancient Paleo Indians who were the first human inhabitants of Arkansas.

Discussion.— Since the description of *Leuctra szczytkoi* Stark and Stewart (1981), no species of *Leuctra* have been described west of the Mississippi River. *Leuctra szczytkoi* and *Leuctra rickeri*, are different in the lengths of the paraprocts, and the specilium spines. All male terga are entire and bear no lobes or projections. This species was collected from clear, sandy substrate, permanent streams in the Gulf Coastal Plain, and emergence occurs in October.

Leuctra rickeri James

Figs. 125, 129, 136

Leuctra rickeri James (1976).

Type locality.— Kentucky, Frenchburg.

Regional distribution.— IL: Pope Co., Gibbons Cr., Herod, 24-V-40, 3 M, 3 F, 7 n, C.O. Mohr. & B.D. Burks;

Lusk Cr., Eddyville, 24-V-40, 2 M, 2 F, C.O. Mohr & B.D. Burks; Union Co., trib. Devils Kitchen Lake, Panthers Den, 28.6 km SE Carbondale, 13-V-76, 4 M, 8 F, W. Brigham & J. Unzicker.

Discussion.— Males of this species lack the posterior tergum 7 process found in *L. tenuis*, and the long paraprocts and specilium spine of *L. paleo*. James (1976) placed this species in the *L. ferruginea* Walker group. Figures 125, 129, and 136 drawn from the Union Co., Illinois specimens above, differ slightly from those of James (1976), in the notch of the female subgenital plate. Since James (1976) recorded southern Illinois specimens as *Leuctra rickeri*, including those previously labeled as *L. ferruginea* at the INHS, these specimens are tentatively placed with *L. rickeri*, pending a revision of this complex. Within the region, it is limited to the Illinois Ozarks, where it emerges in May.

Leuctra tenuis (Pictet)
Figs. 37, 124, 128, 135

Nemoura tenuis Pictet (1841).
Leuctra tenuis: Claassen (1940).

Type locality.— Pennsylvania, Philadelphia.

Regional distribution.—Watersheds 3, 4, 17, 22, 23, 25, 28, 38, 45, 47, 49, 52, 53, 65, 66, 68, 83, 85, 87, 93, 95, 96, 99, 100, 109, 118, 119 (Table 1).

Discussion.— This species is distinguished by the truncate male tergum 7 process, which extends posteriorly over tergum 8 (Fig. 124, 128). Among regional populations, this structure exhibits variability in length and width. This is the most abundant *Leuctra* in the region. It was collected at Greer Spring, Missouri, by Harden and Mickel (1952), and recently from Oklahoma, by Ernst and Stewart (1985b). The Ozark-Ouachita region probably represents the southwestern limit of its range. It is nearly restricted to permanent streams (Table 2), and is especially common in spring streams. Small nymphs appeared in May collections, and were collected from a few limestone streams that became intermittent in late summer. This suggests it may have the ability to emerge earlier or occupy standing pools prior to fall emergence. This species emerges during early and mid summer in Wisconsin, and the upper peninsula of Michigan (BCP, unpublished). Emergence in the Ozark-Ouachita region begins in late August and continues through mid November.

Zealeuctra cherokee Stark and Stewart
Figs. 110, 114, 115, 133

Zealeuctra cherokee Stark and Stewart (1973b).

Type locality.— Oklahoma, Sequoyah County, 4.4 km W Vian.

Regional distribution.— Watersheds 1, 5, 7, 10, 17-19, 33, 37, 56, 71, 73, 78, 81, 90 (Table 1).

Discussion.— This species can be distinguished from other *Zealeuctra* by the wide, horseshoe-shaped cleft of the male tergum 9, which has posterior lobes barely separated from the smaller, inner lobes (Fig. 110). Based on our records, it is restricted to the Ouachita Mountains and Arkansas River Valley. It was collected in first and second order intermittent or dry streams (Table 2), suggesting requirements similar to other *Zealeuctra*. Emergence occurs in January and February.

Zealeuctra claasseni (Frison)
Figs. 36, 42, 107, 112, 113, 131

Leuctra claasseni Frison (1929).
Leuctra (Zealeuctra) claasseni: Ricker (1952).
Zealeuctra claasseni: Ricker & Ross (1969).

Type locality.— Illinois, Pope County, Bushy Fork, Herod.

Regional distribution.— Watersheds 1-5, 7-10, 13, 14, 19-23, 26-28, 31-38, 40-43, 45-48, 52-57, 60, 61, 65, 67-69, 71-74, 76-87, 89, 90, 92, 93, 95-99, 102-105, 107-111, 119-126 (Table 1).

Discussion.— This species is distinguished from other *Zealeuctra* by the bulbous basal portion of the male epiproct, and the rounded fleshy lobe of female sternum 8 (Figs. 112, 131). It has been reported from several localities (Frison 1929, 1935, 1942; Illies 1966; Hitchcock 1974; Stewart et al. 1974), and was the most commonly encountered species of Leuctridae in the region. It is the only regional *Zealeuctra* to be collected as far west as northern Texas (Szczytko and Stewart 1977). Snellen and Stewart (1979a) reported that this species had life cycle flexibility, with extended periods of egg diapause in dry years, and very fast nymphal growth. Only 14% of our collection localities were permanently flowing streams (Table 2), suggesting that an egg diapause was probable. Emergence occurs from January to early April.

Zealeuctra fraxina Ricker and Ross
Fig. 118

Zealeuctra fraxina Ricker and Ross (1969).

Type locality.— Kentucky, Breckenridge County, Hardinsburg.

Regional distribution.— IL: Pope Co., Gibbons Cr., Herod, 6-III-28, 1M, T.H. Frison, H.H. Ross.

Discussion.— Males of this species are distinguished by the subterminal point of the epiproct, located above the main spine (Fig. 118). It is mentioned here because of its close resemblance to *Z. warreni*. The southern

Illinois locality probably represents the western limit of its distribution. Considered rare, its habitat requirements are poorly known, and no recent collection records have been reported from the region. It is known to emerge in early March.

Zealeuctra narfi Ricker & Ross
Figs. 108, 116, 117, 132

Zealeuctra narfi Ricker & Ross (1969).

Type locality.— Wisconsin, Sauk County, Otter Creek.

Regional distribution.— Watersheds 1, 8, 9, 16, 19, 21, 23, 34, 35, 42, 52, 54, 55, 58, 67, 69, 75, 81, 89, 116 (Table 1).

Discussion.— Males of this species differ from *Z. cherokee* in the relative width of the cleft of tergum 9, and the two pairs of posterior lobes (Fig. 108). Ricker and Ross (1969) and Stark and Stewart (1973a) provided many records for Arkansas, Missouri, and Oklahoma. Regional localities probably represent the southern limit of its range, and it occurred most frequently in the Ouachita, Arkansas River Valley, and Boston Mountain subregions. Most collections were from intermittent or dry streams, suggesting an egg diapause like that of *Z. claasseni* in Texas (Snellen and Stewart 1979a). Emergence begins in January and continues to early April.

Zealeuctra warreni Ricker and Ross
Figs. 109, 119, 120, 134

Zealeuctra warreni Ricker and Ross (1969).

Type locality.— Arkansas, Sharp County, Sugar Creek, Hardy.

Regional distribution.— Watersheds 1, 4, 5, 8, 9, 10, 13, 17, 18, 19, 22, 23, 25, 28, 31, 35, 36, 42-45, 49, 52, 55-57, 60, 65, 66, 71, 73, 74, 76, 77, 79-81, 83, 90, 91, 96, 102, 118, 122 (Table 1).

Discussion.— Males are distinguished from other *Zealeuctra* by the 2-spined epiproct (Fig. 119), and females lack a median lobe on sternum 8 (Fig. 134). It most closely resembles *Z. fraxina*. Ricker and Ross (1969) reported it from Arkansas and Oklahoma, and records above include the first known from Missouri. This regional endemic was most commonly collected from mountainous subregions (Table 2). This species is one of the first winter stoneflies to begin emerging in November. Ernst and Stewart (1985b) found females to exhibit greatly extended emergence, from November to mid- March. Our records support this, with males found through early January, and collections through mid-March being dominated by females.

Zealeuctra wachita Ricker and Ross
Figs. 111, 121, 122, 130

Zealeuctra wachita Ricker and Ross (1969).

Type locality.— Arkansas, Polk County, Ouachita River.

Types.—Allotype M, AR: Polk Co., Ouachita R., 5.5 km W Acorn, 23-III-84, BCP. Allotype in USNM.

Regional distribution.— AR: Polk Co., Ouachita R., 5.5 km W Acorn, 23-III-84, 1M, 4F, 16-II-85, 1M, BCP; Scott Co., trib. Johnson Cr., Hwy 71, 8.8 km W Y-City, 9-I-85, 1M, 1F, BCP.

The male is described here for the first time:

MALE: (Figs. 111, 121, 122). Forewing length 6mm, body length 7 mm. Cleft of tergum 9 narrowed anteriorly, with heavily sclerotized inner margin, hind corners each with a single rounded lobe directed inward, and anterior edge with 2 bluntly pointed knobs (Fig. 111). Epiproct with a single long, acutely pointed spine, with a small anterior decline (Fig. 121). Cercal tips heavily sclerotized, the small subterminal hump with dorsal shelf; ventral margin setose (Fig. 122). Vescicle and probe similar to *Z. cherokee*.

Discussion.— Males of this species have a pair of small knobs on the inside margin of the median notch (Fig. 111). The female is difficult to distinguish from *Z. cherokee*, and separation in the key is based on coloration near the lobes of sternum 8. Males and females were correlated from the type locality, and additional specimens were collected from a nearby watershed. Both sites became intermittent during summer months. Emergence occurs during February and March.

Family Taeniopterygidae

This family contains nine regional species of "winter stoneflies". They are larger in size than the Capniidae and Leuctridae, and are usually dark in color. Adults and nymphs are easily separated from other stoneflies because the first and second tarsal segments are subequal in length (Fig. 34). Mature nymphs have divergent wing pads, and were commonly collected from leaf packs and organic debris, or gravel containing high amounts of interstitial organic matter. The submerged, net-like root system remaining from beds of water willow at the margins of riffles provided habitat for *Strophopteryx* Frison nymphs during winter. Adult taeniopterids were commonly collected from bridges and vegetation. Ovipositing females were observed flying over riffles during mid-day when temperatures reached at least 13°C. Nymphs skeletonized pieces of leaf material fed to them during rearing, which supported their classification as herbivore-detritivores. Nymph and adult keys are available for *Taeniopteryx* Pictet (Ricker and Ross 1968;

Harper and Hynes 1971; Fullington and Stewart 1980), and the key below reflects regional variation in this genus. Adult descriptions are available for regional *Strophopteryx* (Ricker and Ross 1975), but the key below is the first for both nymphs and adults of this genus.

Key to Genera and Species of Taeniopterygidae

Males and Females

1. Gill scar present, appearing as membranous hole in coxae (Fig. 18) . . . . ***Taeniopteryx*** Pictet **2**
   No gill scar present on coxae (Fig. 20) . . . . ***Strophopteryx*** Frison **7**
2. Male vescicle present on sternum 9 (Fig. 152); female subgenital plate notch without marginal sclerotized band (Figs. 162, 163) 3
   Male vescicle absent; female subgenital plate notch bordered by sclerotized band (Figs. 164-167). 4
3. Male with femoral spur, its length equal to at least half of femur width (Fig. 172). . . . . ***T. maura*** (Pictet)
   Male without spur on femur, but small raised knob or swelling may be present (Fig. 171). . . . . ***T. burksi*** Ricker and Ross
4. Distal portion of male sub-anal lobes broadly rounded (Figs. 154, 155); female subgenital plate notch with wide, U-shaped or sub-rectangular band of sclerotization (Figs. 166, 167) 5
   Distal portion of male sub-anal lobes narrow, curved outward, or club shaped at tip (Figs. 156, 157); female subgenital plate notch with narrow U or V-shaped band of sclerotization (Figs. 164, 165) 6
5. Male cerci long, narrow, curved inward at tip (Fig. 154); sclerotization of female subgenital plate U-shaped, evenly rounded anteriorly (Fig. 166). . . . . ***T. lonicera*** Ricker and Ross
   Male cerci short, broad, and slightly curved inward at tip (Fig. 155); sclerotization of female subgenital plate sub-rectangular, not evenly rounded anteriorly (Fig. 167). . . . . ***T. lita*** Frison
6. Tip of male sub-anal lobes globular, club-shaped (Fig. 157); notch of female subgenital plate U-shaped, with median flap wide, truncate (Fig. 165). . . . . ***T. metequi*** Ricker and Ross
   Male sub-anal lobes narrow, hooked outward apically (Fig. 156); notch of female subgenital plate V-shaped, with median flap narrow, truncate (Fig. 164). . . . . ***T. parvula*** Banks
7. Male sternum 9 elongate and upturned between cerci (Fig. 159); posterior margin of male tergum 9 with a pair of globular setose bulbs extending caudally (Fig. 158); flap of female sternum 9 truncate at tip (Fig. 170). . . . . ***S. fasciata*** (Burmeister)
   Male sternum 9 not upturned between cerci; posterior margin of male tergum 9 without globular setose bulbs (Figs. 160, 161); female sternum 9 evenly rounded (Figs. 168, 169). **8**
8. Male epiproct tip broad (Fig. 160); basicercal process of male bearing a sharp caudally directed spine (Fig. 160); female abdomen pink or reddish in life, sternum 9 broadly rounded (Fig. 169). . . . . ***S. cucullata*** Frison
   Male epiproct tip narrow (Fig. 161); basicercal process of male rounded (Fig. 161); rest of female abdomen pigmented darker than sternum 9; tip of sternum 9 narrowly tapered (Fig. 168). . . . . ***S. arkansae*** Ricker and Ross

Nymphs

1. A single, finger-like gill on each coxa (Fig. 19) . . . . ***Taeniopteryx*** Pictet **2**
   No coxal gills present . . . . ***Strophopteryx*** Frison **9**
2. Mid-dorsal stripe absent or incomplete (Fig. 178). 3
   Mid-dorsal stripe continuous (Figs 177, 179, 180). 4
3. Mid-dorsal stripe most distinct on abdomen; thorax and pronotum concolorous or with pale markings (Fig. 178); area adjacent to eyes as dark as rest of head (Fig. 181). . . . . ***T. lita*** Frison (in part)
   Mid-dorsal stripe broken throughout its length, weak or entirely absent on abdomen (Fig. 178); area adjacent to eyes paler than rest of head (Fig. 178). . . . . ***T. parvula*** Banks
4. Pigmentation darkest along border of mid-dorsal stripe, either throughout its length (Fig. 177), or on thorax only (Fig. 179). 5
   Pigmentation along border of mid-dorsal stripe as dark as rest of nymph (Figs. 180, 181). 7
5. Pale area between eyes wider than pronotal portion of mid-dorsal stripe; muscle scars evident (Fig. 179); broad pale ring around each eye (Fig. 179). . . . . ***T. metequi*** Ricker and Ross (in part)
   Pale area between eyes and pronotal portion of mid-dorsal stripe of same width (Fig. 177); usually no muscle scars visible (Fig. 177); pale ring around eyes narrow or absent. 6
6. Developing femoral spur in mature male nymphs visible under exoskeleton (Fig. 175). . . . . ***T. maura*** (Pictet)
   No femoral spur visible under exoskeleton, at most a raised swelling occurs (Fig. 176). . . . . ***T. burksi*** Ricker and Ross
7. Head protion of mid-dorsal stripe wider than pronotal portion, with muscle scars visible (Fig. 179); broad pale ring around each eye (Fig. 179). . . . . ***T. metequi*** Ricker and Ross (in part)
   Head portion of mid-dorsal stripe of same width or narrower than pronotal portion (Figs. 180, 181); pale ring around eyes narrow or absent **8**
8. Pale rectangular area between eyes extends laterally beyond ocelli (Fig. 180). . . . . ***T. lonicera*** Ricker and Ross
   Pale rectangular area between eyes limited to area between lateral ocelli (Fig. 181). . . . . ***T. lita*** Frison (in part)

9. Abdominal terga banded, anterior margin dark (Fig. 183); wing pads with contrasting blotches, appearing mottled. . . . . **S. fasciata** (Burmeister)
Abdominal terga not banded (Fig. 182); wing pads with, at most, faint darker areas (Fig. 182). **10**
10. Pale ring surrounding eyes (Fig. 184); spots on abdominal segments large, nymphs pale yellow-orange to sandy brown in life . . . . . . **S. arkansae** Ricker and Ross
Area surrounding eyes as dark as rest of head (Fig. 182); spots on abdominal segments small, appearing as specks (Fig. 182); nymphs olive green to brown or black in life. . . . . **S. cucullata** Frison

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Strophopteryx arkansae Ricker and Ross
Figs. 161, 168, 184

Strophopteryx arkansae Ricker and Ross (1975).

Type locality.— Arkansas, Polk County, Two Mile Creek,Hatfield.

Regional distribution.— Watersheds 1, 5, 7, 9, 13, 14, 18, 27, 34, 35, 37, 42-44, 49, 55-57, 61, 71-74, 77, 80, 85, 91, 98, 104 (Table 1).

The first nymphal description is provided here:

NYMPH: (Fig. 184). General color pale yellow, sandy brown, or reddish-orange. Head with pale area around each eye, and rectangular pale areas posterior to lateral ocelli and anterior to median ocellus. Paired spots on abdominal terga and pleura large, abdominal banding or striping absent, blotches on thorax absent. Femora and tibiae with prominent setal fringe along outer margin.

Discussion.— This species differs from *S. cucullata* because it lacks the pointed male basicercal process found in *S. cucullata*, and has a narrower epiproct (Fig. 161). The female sternum 9 is narrower than that of *S. cucullata* (Fig. 168). *S. arkansae* is endemic to the region and it was first described from Arkansas and Missouri populations (Ricker and Ross 1975). Watersheds listed above include the first Oklahoma records. It is most common in the Ouachita and Boston Mountain subregions, and occurs in both permanent and intermittent streams. However, no specimens were collected from habitats that dry up in summer months. Emergence begins in January, somewhat earlier than for other *Strophopteryx* species.

Strophopteryx cucullata Frison
Figs. 20, 160, 169, 173, 174, 182

Strophopteryx cucullata Frison (1934).
Strophopteryx ostra Ricker and Ross (1975), **new synonymy.**

Type locality.— Oklahoma, Latimer County, Boy Scout Camp.

Regional distribution.— Watersheds 1, 2, 5, 7-10, 13, 16, 18, 19, 21, 27, 32-37, 40, 42-46, 52, 54-57, 60, 67, 69-71, 73-75, 77, 78, 80, 82, 90, 104, 116 (Table 1).

The first nymphal description is given here:

NYMPH: (Fig. 182). General color olive-green, brown, or black. Head with narrow pale areas in ocellar triangle and medially; area encircling eyes pigmented. Paired spots on abdominal terga and pleura small, often indistinct. Abdominal banding absent, blotches on thorax absent, small faint rugosities present along anterior edge of wing pads. Femur and tibia with setal fringe along dorsal margin.

Discussion.— The status of this species has been uncertain since Ricker and Ross (1975). Specimens collected by Stark and Stewart (1973b), and identified as *S. cucullata* (including the first described male), were considered as *S. ostra* by Ricker and Ross (1975). Twelve females (nine reared) and eight males (five reared) collected from the Leflore County, Oklahoma locality of Stark and Stewart (1973b) agree with descriptions of *S. cucullata* females (Frison 1934; Ricker and Ross 1975) and Stark and Stewart's (1973b) description of plesiotype *S. cucullata* males. Two females from this series, and females collected from other localities during this study, showed variability in the flap of sternum 9 and sclerotized band of sternum 8 (Figs. 173, 174). Many of these matched *S. ostra* females (Ricker and Ross 1975). Males from regional collections, including this series, fit Ricker and Ross's (1975) description of *S. ostra*. Therefore, we consider *S. ostra* to be a synonym of *S. cucullata*, the latter name having priority.

Males of this species have a sharply pointed spine on the basicercal process (Fig. 160), and female sternum 9 is usually broader than that of *S. arkansae* (Figs. 169, 174). This species was previously reported from northeastern Texas (under *S. ostra*), but Szczytko and Stewart (1977) were unable to locate Texas populations. Based on its apparent requirement for streams with substantial gradients, its presence in Texas is questionable and we consider this species to be endemic to the region. It is common in intermittent streams, and was the only *Strophopteryx* collected from streams that dry up during summer months. This suggests the possibility of a heterodynamic life cycle (Stewart and Stark 1988). It is most common in the Arkansas River Valley, Boston, and Ouachita Mountain subregions, where it emerges from early February to early April.

Strophopteryx fasciata (Burmeister)
Figs. 158, 159, 170, 183

Semblis fasciata Burmeister (1839).
Taeniopteryx (*Strophopteryx*) *fasciata*: Frison (1942).
Brachyptera fasciata: Harden and Mickel (1952).
Strophopteryx fasciata: Illies (1966).

Type locality.— Pennsylvania.

Regional distribution.— Watersheds 1-5, 8, 9, 13, 14, 20, 22, 23, 25-29, 32-34, 36-38, 42-49, 52, 53, 55, 57, 65-68, 71, 72, 74, 76, 77, 80, 81, 83-92, 94-100, 102-104, 106-111, 115-125 (Table 1).

Discussion.— The narrowed tip of male sternum 9 and the trucate, tapered shape of female sternum 9 (Figs. 158, 159, 170) separate this species from other *Strophopteryx*. Nymphs are mottled with blotches on the wingpads, and they have transverse bands on abdominal terga (Fig. 183). It was reported from several regional localities (Frison 1935; Illies 1966; Stark and Stewart 1973a). It is the most widespread species in the genus, and is the only regional *Strophopteryx* common to both north central states, and the Appalachian Mountains. It occupies all subregions except the Gulf Coastal Plain, Mississippi Alluvial Plain, and Crowleys Ridge. Our collections indicate it is probably restricted to permanently flowing streams in mountainous regions. It emerges later than *S. arkansae*, from early February to mid-March.

Taeniopteryx burksi Ricker and Ross
Figs. 18, 19, 34, 150-152, 162, 176, 177

Taeniopteryx burksi Ricker and Ross (1968).

Type locality.— Illinois, Urbana.

Regional distribution.— Watersheds 2-5, 7-9, 13, 14, 17-28, 31-38, 40-45, 47-50, 52-56, 60, 65, 67, 71-74, 76, 77, 79, 80, 82, 83, 85-97, 99-111, 114-126 (Table 1).

Discussion.— Males of this species are distinguished from *T. maura* by the absence of a large spur on the femora, although small knobs and swellings may be present (Fig. 171). It is often confused with *T. nivalis* Fitch (Ricker and Ross 1968), but *T. nivalis* lacks the brown sclerotized band across the male aedeagus (Fig. 150). Nymphs have a mid-dorsal stripe bordered by dark brown or black (Fig. 177). Museum specimens examined from the University of Missouri included collections by Jones et al. (1981), who reported *T. nivalis* from Missouri, but these specimens were *T. burksi*. Stark and Stewart (1973a) and Fullington and Stewart (1980) provided the most recent regional records. This is the most common regional species of *Taeniopteryx*, and was collected in medium to large permanent or intermittent streams in nearly every subregion. Females were observed depositing egg masses on bridges, and flying during warm temperatures. Nymphs inhabit organic debris and leaf packs, and adults emerge from late December to early March.

Taeniopteryx lita Frison
Figs. 155, 167, 181

Taeniopteryx lita Frison (1942).

Type locality.— Illinois, Elizabethtown.

Regional distribution.— AR: Franklin Co., 17-II-62, 1M, L.O. Warren; Polk Co., Mill Cr., 17-II-62, L.O. Warren; Prairie Co., Cache R., Brasfield, 16-IV-39, 1M, H.H. Ross & J.A. Ross; Yell Co: Petit Jean R., Conway Co. line, 9-III-63, 2M, O & M Hite. IL: Hardin Co., Elizabethtown, 7-III-28, 3M, T.H. Frison; Pope Co., Golconda, 17-III-32, 1F, H.H. Ross; Randolph Co., Kaskaskia R., Evansville, 3-II-34, 1M, T.H. Frison & C.J. Mohr. OK: Pushmataha Co., Big Cedar Cr., Hwy 271, 1 km E Finley, 17-II-85, 1F, BCP.

Discussion.— Males of this species can be separated from *T. lonicera* by the short, broad cerci (Fig. 155), and females have a wide, subrectangular sclerotized patch similar to *T. lonicera* (Fig. 167). The nymph has a middorsal stripe that is sometimes discontinuous. It was reported from southern Illinois by Frison (1942), and other localities listed above were provided by Ricker and Ross (1968). Only one female was collected during this study, representing the first Oklahoma record. Regional records probably represent the western edge of its range, but it is not commonly collected. Localities listed above are large, slow moving streams surrounded by bottomland hardwoods (Table 2). Adult collections from mid-February through early April suggest a later emergence than for *T. burksi*.

Taeniopteryx lonicera Ricker and Ross
Figs. 154, 166, 180

Taeniopteryx lonicera Ricker and Ross (1968).

Type locality.— Alabama, Laurel Fork, Blountsville.

Regional distribution.— AR: Clark Co., L' Eau Frais Cr., Hwy 128, 2.2 km S Joan, 5-II-84, reared 3M, 9F, 2n, same data, 15-II-85, 1M, BCP.

Discussion.— This species is similar to *T. lita*, but the male cerci are more elongate and inwardly curved (Fig. 154), and the sclerotization on female sternum 8 is more evenly U-shaped (Fig. 166). Nymphs are not reliably separable from *T. lita*. Stewart et al. (1974) and Stark et al. (1986) reported *T. lonicera* from Louisiana and Texas, respectively. The single regional locality also contained a small, relict population of *Shipsa rotunda*, and is a slow moving, lowland stream with permanent flow. Nymphal collections were made from roots and organic debris, and adults emerged in February.

Taeniopteryx maura (Pictet)

Figs. 153, 163, 175

Nemoura maura Pictet (1841).
Taeniopteryx maura: Frison (1942).

Type locality.— Pennsylvania.

Regional distribution.— Watersheds 11, 12, 15-17, 27, 46,49, 61, 77 (Table 1).

Discussion.— This species resembles *T. burksi*, but males have a pointed femoral spur with a length at least 1/2 the width of the femur (Fig. 172). A rounded knob has been found on some specimens of *T. burksi*, but in general the ranges of these two species overlap very little within the region. Nymphs cannot be separated from *T. burksi* except if mature, when the femoral spur is visible through the cuticle (Fig. 175). Stewart et al. (1988) reported that drumming signals from regional specimens were distinctly different from *T. burksi*. Stark and Stewart (1973a) provided the most recent records from Oklahoma. It is a lowland, Gulf Coastal Plain species, but it was also found in a few large river systems in the southern Ouachita subregion where *T. burksi* is common. It was collected from intermittent streams, but was absent from localities that dry up during the summer months. Emergence occurs from January to mid-March.

Taeniopteryx metequi Ricker and Ross

Figs. 157, 165, 179

Taeniopteryx metequi Ricker and Ross (1968).

Type locality.— Illinois, Hays Creek, Glendale.

Regional distribution.— Watersheds 1, 7, 13, 14, 23, 25, 27, 29, 35-38, 40, 42, 46, 53, 54, 56, 61, 64, 65, 71-73, 77, 80, 86, 89-91, 103, 106, 109, 118, 124 (Table 1).

Discussion.— This species has globular, club-shaped sub-anal lobes in males (Fig. 157, often resembling *T. parvula* when the inner margin of these lobes are dark), and a U- shaped sclerotized band with a wide truncate flap on female sternum 8 (Fig. 165). Males have long legs, and relatively short wings which reach to the tip of the abdomen. Nymphs have a wide, rectangular pale patch on the rear margin of the head (Fig. 180). The most recent records were provided by Ricker and Ross (1968) and Stark and Stewart (1973a), and the region probably represents the southwestern limit of its distribution. It was absent from the Missouri River border and some eastern subregions. This species prefered permanent streams with upland vegetation, and was collected from intermittent streams more frequently than other *Taeniopteryx*. Emergence begins in mid-January and adults were present through mid-March.

Taeniopteryx parvula Banks

Figs. 156, 164, 178

Taeniopteryx parvula Banks (1918).

Type locality.— Virginia, Peach Grove Hill.

Regional distribution.— AR: Montgomery Co: Ouachita River, 2.2 km S Oden, 15-II-85, 1M, BCP; Saline Co., Saline R., Hwy 5, E Owensville, 3-I-85, 2M, 2F, 2 n, BCP; Sevier Co., Cossatot R., 8.8 km W Lockesburg, 6-I-78, 6 n, J. W. McGraw. MO: Miller Co., Maries R., 3 n, location, date, & collector unknown; Madison Co., Castor R., Hwy V, 4.4 km SE Corwall, 6-I-86, 2 n, BCP; Osage Co., Gasconade R., Hwy 89, 6.6 km E Rich Fountain, 26-I-87, R 2M, 3F, 5 n, BCP.

Discussion.— The hook shaped sub-anal lobes of the male (Fig. 156), and the "V" shaped sclerotized notch of the female (Fig. 164), separate this species from *T. metequi*, which it most closely resembles. Most of the nymphs collected from the region did not have a distinct middorsal stripe. Frison (1935, 1942) reported this species from southern Illinois as *T. lita*. Ricker and Ross (1968) reported several Missouri and Arkansas records, and additional localities were added from our collections of 4th order or larger permanently flowing streams (Table 1). The only known large population was in the lower Gasconade River, Missouri, where it was collected in leaf packs and organic debris along the stream margin. Adults were collected in January and Febuary.

Family Nemouridae

Nemourids are small, dark stoneflies that emerge during late winter and spring. Five species occur in the region, and only two were commonly collected. Adults have an extra cross vein in the forewing costal space beyond the cord (Fig. 6). The wings often have blotches or unpigmented "windows" (Baumann 1975). Nymphs have divergent wing pads as in Taeniopterygidae. Adults were commonly collected by sweeping vegetation and searching bridges or streamside debris. Nymphs are abundant in leaf packs and organic debris (Ernst and Stewart 1986), and are considered herbivore- detritivores. Hitchcock (1974) provided the most recent keys to eastern species in this family. *Amphinemura nigritta* is presently considered a complex of several species that are not separated in the key below.

Key to Genera and Species of Nemouridae

Males and Females

1. Remnants of cervical gills present (Fig. 28) .... ***Amphinemura*** Ris . **2**
   Cervical gill remnants absent **3**
2. Male sub-anal lobe not recurved at apex with at most, hairs pointing rearward (Fig 144, 145); female subgenital plate with median notch and smaller lateral notches (Fig. 139) .... ***A. delosa*** (Ricker)
   Male sub-anal lobe recurved at apex forming an elbow-like protrusion pointing rearward (Fig. 146, 147); female subgenital plate with median notch, but lateral indentations appear, at most, as small crevices (Fig. 138) .... ***A. nigritta*** (Provancher)
3. Male tergum 10 produced into 2 inwardly curved lobes covering cerci (Fig. 143); female subgenital plate rounded, without notch or indentation (Fig. 140) .... ***Shipsa rotunda*** (Claassen)
   Male tergum 10 without curved lobes; female subgenital plate notched or indented (Figs. 141, 142) .... ***Prostoia*** Ricker **4**
4. Basal process of male epiproct twisted, and nearly 1/2 as long as the epiproct (Fig. 149); female subgenital plate indented, with pointed lateral corners, at most slightly rounded (Fig. 142) .... ***P. similis*** (Hagen)
   Basal process of male epiproct short, less than 1/5 as long as the epiproct (Fig. 148); female subgenital plate indented, with lateral corners rounded or truncate (Fig. 141) .... ***P. completa*** (Walker)

Nymphs

1. Highly branched cervical gills present (Fig. 31); prominent fringe of short, stout hairs around pronotum (Fig. 31)... ***Amphinemura*** Ris
   Gills and prominent pronotal fringe absent (Fig. 29, 30).......... **2**
2. Distal end of tibia with a row of stout, short spines (Fig. 32); width of pronotum usually subequal to distance between eyes (Fig. 30) .... ***Prostoia*** Ricker
   Tibia with, at most, a few small spines at distal end, and appearing banded (Fig. 33); width of pronotum usually less than distance between eyes (Fig. 29).......... ***Shipsa rotunda*** (Claassen)

Amphinemura delosa (Ricker)

Figs. 28, 31, 139, 144, 145

Nemoura (Amphinemura) delosa Ricker (1952).
Amphinemura delosa: Illies (1966).

Type locality.— Indiana, McCormicks Creek, Spencer.

Regional distribution.— Watersheds 1-5, 7-10, 13, 14, 16-23, 25-28, 31-41, 43-50, 51-58, 60, 61, 65-96, 98, 100-103, 105-111, 114, 116- 126 (Table 1).

Discussion.— This is the most common nemourid from the region. Unlike *A. nigritta*, the male sub-anal lobes are not recurved rearward at the tip, and they have, at most, a few black hairs (Figs. 144, 145). Illies (1966) listed this species in all states encompassing the region, and regional records are probably at the western limit of its range. It is most common in mountainous subregions, including Crowley's Ridge, but is apparently absent from the Mississippi Alluvial Plain. Ernst and Stewart (1986) reported it as a common inhabitant of leaf packs. Emergence occurs in April and May. Based on our collections, some females live up to 6 weeks after emergence and retain their eggs throughout this time.

Amphinemura nigritta (Provancher)

Figs. 138, 146, 147

Nemoura nigritta Provancher (1876).
Nemoura (Amphinemra) nigritta: Ricker (1952).
Amphinemura nigritta: Illies (1966).

Type locality.— Canada, Quebec.

Regional distribution.— AR: Miller Co., May Br., Hwy 160, 2.2 km E Brightstar, 6-IV-84, reared 10 M, 18 F, BCP; Dallas Co., Populi Cr., Hwy 273, 4.4 km SE Forrest Bonner, 17-IV-85, reared 3 M, 1 F, BCP. MO: Callaway Co., Middle R., Hwy H, E of Fulton, 30-IV-72, 1 M, D.A. Boehne.

Discussion.— This species is similar to *A. delosa*, and can be distinguished by the tip of the male sub-anal lobes, which are recurved posteriorly (Figs. 146, 147). Nymphs are not separable from *A. delosa* at this time. Ricker (1952) reported it from Illinois, along with *A. varshava* (Ricker), but these specimens were not available to confirm their presence in southern Illinois. The male sub-anal lobes differed between Gulf Coastal Plain specimens and those from central Missouri, suggesting there may be more than one member of this complex in areas surrounding the region. It was found in small, temporary habitats in the Gulf Coastal Plain, but was not collected in mountainous areas where *A. delosa* was common. Regional collections in April suggest it has an emergence period similar to Texas populations (Szczytko and Stewart 1977).

Prostoia completa (Walker)

Figs. 6, 30, 32, 141, 148

Nemoura completa Walker (1852).
Nemoura (Prostoia) completa: Ricker (1952).
Prostoia completa: Illies (1966).

Type locality.— Canada, Nova Scotia.

Regional distribution.— Watersheds 2-4, 8, 9, 13, 17, 20, 22, 23, 25-28, 32, 35, 36, 38, 41-46, 49, 52, 53, 55-57, 65-68, 71, 72, 81, 83, 85-87, 89, 91-93, 95-100, 102, 104, 107, 109-111, 115-118, 120-125 (Table 1).

Discussion.— This species is distinguished by the widened male epiproct, and the short basal process (Fig. 148). It has been reported from several regional localities (Ricker 1952; Stark and Stewart 1973a; Stark et al. 1986), and its univoltine fast life cycle was recently reported by Ernst & Stewart (1985a) in Oklahoma. It is common in mountainous subregions, in permanently flowing streams (Table 2). The emergence period of February to March is earlier than for *Amphinemura* species.

Prostoia similis (Hagen)

Figs. 142, 149

Taeniopteryx similis Hagen (1861).
Nemoura (Prostoia) similis: Ricker (1952).
Prostoia similis: Illies (1966).

Type locality.— Washington, District of Columbia.

Regional distribution.— MO: Reynolds Co., W. Fk. Black R., Greeley, 23-II-88, reared 1M, 2F, L. Trial; W. Fk. Black R. at jct. mouth of Smalls Cr., 23-II-88, reared 8M, 7F, 5 n, also 2-III-88, reared 1M, 1F, L. Trial.

Discussion.— Males are distinguished from *P. completa* by the long, coiled basal process of the epiproct (Fig. 149). It was recently discovered from the pristine upper Black River system in Missouri. These localities are the first records west of the central Mississippi Valley, and are isolated from other populations in eastern North America. It probably requires permanently flowing streams, and the emergence period is similar to *P. completa*.

Shipsa rotunda (Claassen)

Figs. 29, 33, 140, 143

Nemoura rotunda Claassen (1923).
Nemoura (Shipsa) rotunda: Ricker (1952).
Shipsa rotunda: Illies (1966).

Type locality.— Maine, Waldeboro.

Regional distribution.— AR: Clark Co., L' Eau Frais Cr., Hwy 128, 2.2 km SE Joan, 5-II-84, reared 1M, BCP.

Discussion.— This species is separated from other nemourids by apical abdominal lobes which are curved inward to cover the cerci (Fig. 143). One specimen was collected from a 3rd order stream in the northern edge of the Gulf Coastal Plain, which also contained a relict population of *Taeniopteryx lonicera*. Both *S. rotunda* and *T. lonicera* occupy similar ranges east of the Mississippi River. Emergence of *S. rotunda* is in April and May in more northern latitudes (Ricker 1964).

Family Chloroperlidae

The six regional species of Chloroperlidae emerge in spring and early summer, and have clear, colorless wings. Adults of *Haploperla* are yellow in life, and *Alloperla* are bright green, but both become pale in preservative. The pale nymphs have short cerci, which are equal to 3/4 length of the abdomen. The adults can be collected by sweeping riparian vegetation, and with blacklights. Nymphs were often collected from finer gravel in the slower portions of riffle areas. Ernst and Stewart (1986) found *H. brevis* was a generalist in an Oklahoma stream, but Stewart and Stark (1988) reported most chloroperlid nymphs as predacious engulfers. Records and descriptions of new spepcies have recently become available (Stark et al. 1983; Poulton and Stewart 1987). The key below is the first to include both males, females, and nymphs of regional *Alloperla*. The nymph of *Alloperla leonarda* remains unknown.

Key to Genera and Species of Chloroperlidae

Males and Females

1. Hind wing without anal lobe (Fig. 7); body yellow in life; female subgenital plate rounded (Fig. 201); male epiproct triangular (Fig. 196) . . . . **Haploperla brevis** (Banks)
   Hind wing with anal lobe; body green in life; female subgenital plate variable, male epiproct slender, not triangular (Figs. 185-194) . . . . ***Alloperla*** Banks 2
2. Male epiproct with lateral spines and/or serrations (Figs. 186, 188, 194); female subgenital plate pointed (*A. caudata*, Fig. 197, often slightly pointed) (Figs. 199, 200, 202) 3
   Male epiproct smooth or bearing fine silky hairs (Figs. 189-192); female subgenital plate rounded or with slight knob (Figs. 197, 198) 5
3. Male epiproct tip truncate, with lateral serrations and small spines (Fig. 186), and flat in lateral aspect (Fig. 185); female subgenital plate with broad point extending from widened ridge (Fig. 199) . . . . ***A. hamata*** Surdick
   Male epiproct tip with lateral spines, but serrations absent (Figs. 188, 194), wide in lateral aspect (Figs. 187, 193); female subgenital plate without widened ridge, but may have broad point (Figs. 200, 202). 4

4. Male epiproct oval in dorsal aspect, with lateral spines apically (Fig. 188); female subgenital plate with broad point (Fig. 202) .... ***A. ouachita*** Stark and Stewart
Male epiproct narrower in dorsal aspect, apex "T"-shaped (Fig. 194); female subgenital plate narrowly pointed (Fig. 200).......... .... ***A. leonarda*** Ricker
5. Male epiproct elevated at apex, appearing boot-shaped (Fig. 189); female subgenital plate rounded (Fig. 198) .... ***A. caddo*** Poulton and Stewart
Male epiproct oval, covered with fine silky hairs (Figs. 191, 192); female subgenital plate blunt, gradually pointed (Fig. 197)....... .... ***A. caudata*** Frison

Nymphs

1. Inside margin of mature wing pads nearly parallel (Fig. 205); setae around entire margin of pronotum (Fig. 205).......... ***Haploperla brevis*** (Banks)
Inside margin of mature wing pads divergent (Fig. 208); setae mostly restricted to corners of pronotum (Fig. 208) .. ***Alloperla*** Banks **2**
2. Rear corners of head slightly angulate (Fig. 208) .... ***A. hamata*** Surdick
Rear corners of head evenly rounded (Figs. 206, 207) **3**
3. Setal fringe on femora and tibia short, sparse (Fig 204) .... ***A. caddo*** Poulton and Stewart
Setal fringe on femora and tibia dense, equal to femur width (Fig. 203) **4**
4. Labrum paler than posterior margin of head (Fig. 206) .... ***A. caudata*** Frison
Pigmentation of labrum about same as posterior margin of head (Fig. 207) .... ***A. ouachita*** Stark and Stewart

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Alloperla caddo Poulton and Stewart

Figs. 189, 190, 198, 204

Alloperla caddo Poulton and Stewart (1987).

Type locality.— Arkansas, Garland County, Middle Fork SalineRiver, Iron Springs Recreation Area.

Regional distribution.— AR: Garland Co., M. Fk. Saline R., Hwy 7, Iron Spgs. Rec. Area, 6-VI-84, 8 M, 5 F, BCP; Perry Co., Dry Fk. Cr., Hwy 7, 14.3 km S Hollis, 6-VI-84, 4 M, 1 F, BCP; Bear Cr., Hwy 7, 4.4 km SE Hollis, 12-V-85, 4 M, 1 n, 1 ex, BCP; Scott Co., Big Cedar Cr., Hwy 28, 6.6 km E Cedar Creek, 14-V-85, 1 F, BCP.

Discussion.— This species is distinguished from other regional *Alloperla* by the saddle-shaped epiproct in males (Figs. 189, 190), and the rounded female subgenital plate (Fig. 198). Nymphs have a sparse setal fringe on the outer edge of the femur (Fig. 204). It is endemic to the Ouachita subregion and considered rare (Poulton and Stewart 1987). Adults were collected from small, intermittent streams in May and June.

Alloperla caudata Frison

Figs. 10, 191, 192, 197, 203, 206

Alloperla caudata Frison (1934).

Type locality.— Oklahoma, Adair County.

Regional distribution.— Watersheds 3, 4, 8, 22, 23, 28, 32, 35, 45, 46, 49, 53, 57, 65, 66, 71, 81, 83, 86, 91, 95, 96, 102, 107, 116-118, 121-123, 125 (Table 1).

Discussion.— This species was the only common *Alloperla* collected from the region. The male epiproct is oval and smooth, and lacks lateral spines or serrations (Fig. 192). It has been reported from several regional localities (Frison 1934; Illies 1966; Stark et al. 1983; Ernst and Stewart 1985b). The region probably represents the southwestern limit of its range. It was absent from streams that dry up during late summer (Table 2), and preferred mountanous subregions. No records are know from the Mississippi Alluvial and Gulf Coastal Plains, or Crowley's Ridge. Emergence begins in late April and continues through mid June.

Alloperla hamata Surdick

Figs. 185, 186, 199, 208

Alloperla hamata Surdick (1981).

Type locality.— Alabama.

Regional distribution.— AR: Johnson Co., Washita Cr., Hwy 103 S. Oark, 19-IV-85, reared 1M, 1F, field 17M, 1F, 4 n, 4 ex, BCP; Montgomery Co., L. Missouri R., 20-IV-80, 1M, E.J Bacon, J.W. Feminella. MO: Christian Co., Bull Cr., 10-V-72, 29M, B.K. Newman.

The first nymphal description is provided here:

NYMPH: (Fig. 208). General color pale yellow to light brown. Contrasting colors generally lacking, except on head. Labrum, posterior margin of head, and area encircling eyes darker than ocellar triangle. Posterior corners of head slightly angulate, eyes set slightly anteriorly (Fig. 208). Pronotum oval, slightly wider than long. Pronotal setae longest at corners. Femora and tibia with numerous long setae subequal to femur width along outer edge.

Disussion.— Males of this species have a wide, flattened epiproct with lateral serrations (Fig. 186). Nymphs are distinguished from other regional *Alloperla* by the slightly angulate posterior corners of the head (Fig. 208). Regional populations are isolated from those in Alabama, and the epiproct exhibits geographical variation (Stark et al. 1983). The cool, rock-rubble streams it inhabits may represent glacial relict habitats. Nymphs collected from Washita Creek were found in patches of fine gravel in slower currents behind large boulders. Emergence occurs in April and May.

Alloperla leonarda Ricker

Figs. 193, 194, 200

Alloperla leonarda Ricker (1952).

Type locality.— Minnesota, Pine County, Big Sand Creek.

Regional distribution.— MO: Christian Co., Bull Cr., Hwy W, S of Ozark, 10-V-72, 13M, B.K. Newman.

Discussion.— This species has lateral spines on the male epiproct (Fig. 194), and a narrow, pointed female subgenital plate (Fig. 200). It was only collected at one regional locality (Stark et al. 1983), a permanently flowing, spring-fed stream similar to those of more northern latutudes where it is more common. Our collections from this locality have not provided additional specimens, but many *A. caudata* were collected. The nymph of this species is unknown, and adults emerge in May and early June.

Alloperla ouachita Stark and Stewart

Figs. 187, 188, 202, 207

Alloperla ouachita Stark et al. (1983).

Type locality.— Arkansas, Montgomery County, LittleMissouri River.

Types.— Allotype F, AR: Hot Spring Co., Big Hill Cr., Hwy 7, 18-IV-85, BCP. Allotype in USNM.

Regional distribution.— AR: Hot springs Co., Big HillCr., Hwy 7, 18-IV-85, 5M, 14F, 2n, BCP; Montgomery Co., L. Missouri R., Albert Pike Campground, 20-VI-80, 17M, E.J. Bacon and J.W. Feminella.

The first female and nymph descriptions are given below:

FEMALE: (Fig. 202). Forewing length 8 mm, body length 7 mm. General color white in alcohol, abdominal stripes absent. Subgenital plate with broad point, covering 1/2 of sternum 9.

NYMPH: (Fig. 207). General color pale yellow to light brown. Contrasting coloration generally lacking, except on head. Head slightly elongate; labrum, posterior margin of head, and ocellar triangle darker than ecdysial suture and area encircling eyes (Fig. 207). Posterior corners of head evenly rounded. Pronotum oval, slightly wider than long. Pronotal setae longest at corners, femora and tibiae with setal fringe along outer edge; setal length subequal to femur width.

Discussion.— One additional locality (Hot Spring Co. given above) was discovered for this rare species, which is endemic to the Ouachita Mountain subregion. Males have an oval, bulbous epiproct with a pair of lateroapical spines (Fig. 188). Nymphs were found in leaf packs and patches of fine gravel, in small, clear, rapid, rocky streams. Adults emerge from mid-April to early June.

Haploperla brevis (Banks)

Figs. 195, 196, 201, 205

Chloroperla brevis Banks (1895).
Hastaperla brevis: Frison (1942).
Haploperla brevis: Zwick (1977).

Type locality.— Canada, Sherbrook.

Regional distribution.— Watersheds 1-5, 7-10, 13, 14, 16-23, 25-28, 31, 33-49, 52-58, 60, 61, 64-74, 76-87, 89-105, 107-111, 114-125 (Table 1).

Discussion.— This was the most commonly collected chloroperlid, and can be distinguished by its bright yellow color and no fold in the hind wing (Fig. 7). Wing pads of mature nymphs have nearly parallel inner margins (Fig. 205). Illies (1966) noted the presence of this species in all states encompassing the region. Ernst and Stewart (1986) reported nymphs to be generalists in an Oklahoma stream, occupying fine gravel with high FPOM. Although most common in mountainous areas, it was collected from every subregion, and is the only chloroperlid known from Crowley's Ridge. Adults are present from mid-April through early June.

Family Perlidae

There are 28 perlid species in the region, and most emerge in late spring and summer. The adults have remnants of gills on the thorax, and the cubito-anal crossvien of the forewing is set at the anal cell, or removed from it by a distance less than its length (Figs. 12, 14). Nymphs have thoracic gills, contrasting pigmentation, and are carnivorous engulfers (Stewart and Stark 1988). Ernst and Stewart (1986) found *Agnetina* and *Acroneuria* to be associated with CPOM (leaf packs), due to the presence of their food source, but substrates containing interstitial organic matter are also good nymphal habitats, especially in larger streams. Adults were collected shortly after emergence in water willow and other streamside vegetation, but because they emerge during warmer seasons when insects are more active, they quickly flew into the riparian canopy, and therefore adult collections of perlids were often limited to those taken from blacklights.

Several observations of adult behavior are noteworthy. Ernst and Stewart (1985b) found many perlids exhibited synchronous emergence in the region, and lived longer as adults than species of other families. Many species were collected as long as 6-8 weeks after disappearance of nymphs from stream collections. Blacklight trapping was selective for females, with about a 20:1 ratio (females to males) observed. Blacklight collections have revealed that larger numbers of adults can be collected when open areas were chosen for placement of the light. This allowed a larger unobstructed field from which adults could be attracted. Collections at the same stream on successive nights with similar weather conditions confirmed this, and placement of a blacklight at some localities yielded a 25 liter bucket of adult perlids in less than 15 minutes.

Adults were collected in numbers from locations several miles from the nearest stream on windy evenings. This suggests that dispersal flights, possibly aided by wind, are common in *Acroneuria* and *Neoperla*. Species from these genera were collected with a blacklight set up at very small streams that had dried up previously, and were 11-22 km from the larger streams of their presumed origin. Such collections included females with extruded egg masses on their abdomens. *Acroneuria evoluta* nymphs were collected from small, first order streams that dried up by early June, and no additional specimens were present in following years. These observations may suggest reasons why some perlid species are not found in given streams during successive years: 1) adults may spend daylight hours in the vegetation canopy a considerable distance from the stream, 2) they may undergo dispersal flights, often miles from the stream from which they emerged, 3) they may lay eggs that undergo diapause, or 4) chance dispersal to unsuitable streams results in nymphal development only during wet years, causing these streams to be inconsistent in nymphal production.

The emergence of members of this family during the warmest months of the year caused special problems in field transport and rearing of nymphs. Most species were collected as pre-emergent nymphs, and successful rearing required frequent changing of water in the styrofoam chambers. *Acroneuria* nymphs were often absent during the two months prior to emergence in many streams, and most species were collected in January and February and transported to the laboratory where they could be individually fed and reared in an artificial stream for 4-8 weeks. These rearing difficulties and the numerous congeners in *Acroneuria*, *Neoperla*, and *Perlesta* have hampered the species delineation of nymphs of regional fauna, and in the Perlidae in general. The regional aspect and lack of descriptive detail have made other keys to northeastern *Acroneuria* nymphs (Hitchcock 1974; Unzicker and McCaskill 1982) of limited use for Ozark-Ouachita nymphs.

The key below represents the first attempt to separate nymphs of any regional *Neoperla* and *Perlesta* fauna to the species level, and incorporates the latest systematic changes in these groups (Ernst et al. 1986; Stark and Lentz 1988; Stark 1990a, 1990b). Stewart and Stark (1988) pointed out that the assumed variability of color patterns in stonefly nymphs is often due to inadequate comparisons of reared series of regional congeners. We generally found distinct patterns among perlid congeners of the Ozark- Ouachita fauna, but differences were often subtle. Comparisons of Ozark and Wisconsin populations of *Agnetina capitata*, *Agnetina flavescens*, and *Paragnetina media* showed that genitalia matched well, but Wisconsin specimens were typically darker in their color patterns. Key illustrations depict only characters of Ozark-Ouachita populations. Pre-emergent nymphs or adults of *Neoperla* can be dissected to reveal the aedeagal tube or spermatheca aiding in their identification. However, the aedeagus of adult *Perlesta* and *Acroneuria* males should be extruded in the field. The nymphs of *Acroneuria ozarkensis* and *Neoperla carlsoni* are unknown.

Key to Genera and Species of Perlidae

Males and Females

1. Two ocelli .... *Neoperla* Needham **13**
   Three ocelli (some *Perlinella* have median ocellus reduced, Figs. 359, 360) **2**
2. Males **3**
   Females **8**
3. Genital hooks arising from tergum 10 (Figs. 285-290) **4**
   Genital hooks arising from paraprocts (Figs. 245-251, 312-315, 365-366) **5**
4. Genital hooks long, extending forward to tergum 8 (Figs. 289, 290) .... ***Agnetina*** Klapalek **19**
   Genital hooks short, extending to tergum 9 (Figs. 287, 288) .... ***Paragnetina*** Klapalek **20**
5. Hammer absent from sternum 9 (Fig. 45) .... ***Perlesta*** Banks **21**
   Hammer present on sternum 9 (Fig. 44) **6**

6. Hind corners of head angulate, eyes set far forward (Figs. 359, 360); small species, forewing shorter than 15mm ***Perlinella*** Banks **26**
Hind corners of head not angulate (Fig. 281); large species, forewing longer than 15mm **7**
7. Spinule patches present on tergum 9 and 10 (Figs. 246-251) . . . . ***Acroneuria*** Pictet **27**
Spinule patches absent from tergum 9 and 10, a few spinules present on tergum 10 (Fig. 245). . . . . ***Attaneuria ruralis*** (Hagen)
8. Hind corners of head angulate, eyes set far forward (Figs. 359, 360); sternum 8 with V-shaped sclerotization and rectangular notch (Figs. 361, 362) . . . . ***Perlinella*** Banks **26**
Hind corners of head evenly rounded, eyes set normally (Fig. 281); sternum 8 without V-shaped sclerotization **9**
9. Small species, forewing less than 13 mm; subgenital plate notched, overlapping 1/3 of sternum 9 (Figs. 334-336, 338, 339), or margin sinuate (Fig. 337) . . . . ***Perlesta*** Banks **21**
Larger species, forewing more than 13 mm; subgenital plate variable (Figs. 264-275, 291-294) **10**
10. Subgenital plate with submarginal tubercle (Fig. 275) . . . . ***Attaneuria ruralis*** (Hagen)
Subgenital plate without a submarginal tubercle (Figs. 264-274, 291-294) **11**
11. Anterior portion of head almost uniformly brown, lacking pigment contrast (some species have darker, sinuate"W" pattern or light posterior margin, Fig. 281); subgenital plate variable (Figs. 264-274) . . . . ***Acroneuria*** Pictet **27**
Anterior portion of head with contrasting pigment (Figs. 303, 304, 310, 311); if head mostly dark, subgenital plate is a small, U-shaped projection (Figs. 291, 292). **12**
12. Subgenital plate broadly rounded, covering 1/2 of sternum 9, rarely with a slight notch (Figs. 293, 294) . . . . . . ***Agnetina*** Klapalek **19**
Subgenital plate with a U-shaped notch, usually covering 1/2 or less of segment 9 (Figs. 291, 292) . . . . ***Paragnetina*** Klapalek **20**
13. Male aedeagal tube with external spines (Figs. 217, 218, 220); female spermatheca short (Fig. 233- 235); anterior margin of female sternum 8 entire (Figs. 225, 228, 229) **14**
Male aedeagal tube without external spines (Figs. 216, 219, 221); female spermatheca long, partially coiled (Figs. 230-232, 236); female sternum 8 with rectangular, triangular, or sub-circular indentation along anterior margin (Figs. 223, 224, 226, 227). **16**
14. Male genital hooks straight (Fig. 214); female spermatheca curved, narrowing toward tip (Fig. 235); egg smooth. . . . . ***N. catharae*** Stark and Baumann
Male genital hooks slightly recurved (Figs. 213, 215); female spermatheca triangular (Fig. 233), or not narrowed at tip (Fig. 234); egg covered with punctations. **15**
15. Male femora banded distally near articulation (Fig. 238); female spermatheca curved, and striate (Fig. 234); egg collar absent . . . . ***N. choctaw*** Stark and Baumann
Male femora broadly banded, pigmentation covers entire dorsal surface (Fig. 237); female spermatheca triangular, striations indistinct or absent (Fig. 233); egg collar present . . . . ***N. carlsoni*** Stark and Baumann
16. Male genital hooks short and straight (Fig. 209); male aedeagal tube short, with ventral bulb subequal to 2 1/2 X total tube length (Fig. 219); female spermatheca coiled one revolution or less in-situ and tip of spermatheca not narrowed or tapered (Fig. 231) . . . . ***N. osage*** Stark and Lentz
Male genital hooks longer and at least slightly recurved (Figs. 210-212); total length of aedeagal tube greater than 3X width of ventral bulb (Figs. 216, 221, 222); female spermatheca either narrowed at tip (Fig. 236), or coiled more than one revolution in-situ (Fig. 232) **17**
17. Tip of male aedeagus (visible through tube wall) with rows of dense, small spines (Fig. 222); female spermatheca coiled more than one revolution in-situ, its tip not narrowed (Fig. 232). . . . . ***N. falayah*** Stark and Lentz
Tip of male aedeagus with medium to large sized spines, not in dense rows (Figs. 216, 221); female spermatheca coiled one revolution or less in-situ, tapered and slightly recurved at tip (Figs. 230, 236). **18**
18. Male genital hooks only slightly recurved (Fig. 210); male aedeagal tube ca. 4-5x length of ventral bulb (Fig. 221); dense brown setae on female spermatheca with serrations along edge (Fig. 230); anterior indentation of female sternum 8 subcircular (Fig. 224); egg without striations. . . . . ***N. harpi*** Ernst and Stewart
Male genital hooks strongly recurved (Fig. 212); aedeagal tube long, ca. 6-7X ventral bulb (Fig. 216); dense brown setae of female spermatheca without serrations along outer edge (Fig. 236); anterior indentation of female sternum 8 a triangular notch (Fig. 226); egg with striations. . . . . ***N. robisoni*** Poulton and Stewart
19. Tip of male genital hooks long, appearing oval in lateral aspect (Fig. 290); ocellar triangle dark, pigmented lobes extending from anterior corners (Fig. 304); female sternum 9 with poorly defined lateral rectangular patches (Fig. 294) . . . . ***A. capitata*** (Pictet)
Tip of male genital hooks short, appearing triangular or bluntly pointed in lateral aspect (Fig. 289); head with ocellar triangle dark, pigment at anterior corners extends laterally toward eyes (Fig. 303); rectangular patches of female sternum 9 with contrasting dark pigment posteriorly (Fig. 293). . . . . ***A. flavescens*** (Walsh)
20. Male genital hooks rounded and globular in dorsal aspect (Fig. 287); posterior margin of tergum 5 overlapping part of tergum 6 (Fig. 287); female subgenital plate a small U-shaped notch not overlapping more than 1/4 of tergum 9 (Fig. 291); ocellar triangle and adjacent areas of head dark (Fig. 310). . . . . ***P. media*** (Walker)
Male genital hooks pointed in dorsal aspect (Fig. 288); posterior margin of tergum 5 similar to other terga (Fig. 288); female subgenital plate with small notch overlapping at least 1/2 of tergum 9 (Fig. 292); ocellar triangle pigmented with inverted "V", rest of head pale (Fig. 311). . . . . ***P. kansensis*** (Banks)
21. Male paraprocts nearly as broad as wide basally, and curved outward (Fig. 318); costal margin of wings entirely black (Fig. 320); head nearly completely dark, (Fig. 352); female subgenital plate sinuate (Fig. 337) . . . . ***P. baumanni*** Stark
Male paraprocts not as above (Figs. 312-317); costal margin of wings amber, at least posteriorly (Fig. 319); head with pale areas near eyes or elsewhere (Figs. 346-351) and/or female subgenital plate with distinct notch (Figs. 334-336, 338, 339). **22**
22. Tip of male paraprocts narrowly pointed (Figs. 314, 317); spur located far from pointed apex, appearing saggitate (Figs. 329, 332); pigmentation present along posterior margin of head, contrasting pale areas adjacent to eyes (Figs. 347, 351). **23**
Male paraprocts broad (Figs. 312, 315, 316), spur located close to rounded apex (Figs. 328, 330, 331); pigmentation along posterior margin of head indistinct or absent (Figs. 348-350), or if present, area between lateral ocelli and eyes also dark (Fig. 346). . . . **24**

23. Male paraprocts spine-like, appearing stalked, never curved outward (Fig. 317); dark pigment on femora extends to tibial articulation (Fig. 344); pronotal stripe absent or weak (Fig. 351). . . . . ***P. browni*** Stark
Male paraprocts long, evenly curved outward (Fig. 314); dark pigment on femora separated by pale areas at tibial articulation (Fig. 342); pronotal stripe usually present (Fig. 347). . . . . ***P. cinctipes*** (Banks)

24. Male paraprocts nearly as broad as long basally, appearing triangular (Fig. 315); forewing black, posterior portion of costal margin yellow (Fig. 321); head nearly completely pigmented (Fig. 346); dark pigment on femora present only on dorsal margin (Fig. 341); dark pigment present on some abdominal sterna (Fig. 324). . . . . ***P. fusca*** Poulton and Stewart
Male paraprocts narrow, and may be curved outward (Figs. 312, 313, 316); wings amber, costal margin pale or nearly so (Fig. 319); head pigmentation limited to ocellar quadrangle (sometimes anterior margin, Figs. 348-350); dark pigment absent from sterna, but may be present on terga and pleura (Figs. 322, 325). **25**

25. Male paraprocts with wide band of dark pigment along outer margin (Figs. 312, 313); male aedeagus with raised shelf-like swelling (Fig. 322); female subgenital plate notch deep (Fig. 336); pronotal stripe absent (Figs. 348, 349). . . . . ***P. decipiens*** (Walsh)
Male paraprocts with, at most, a narrow band of dark pimentation along outer margin, or none (Fig. 316); male aedeagus without a raised swelling (Fig. 325); teneral adult head with inverted "V" connecting ocelli; pronotal stripe present (Fig. 350); female subgenital plate notch shallow (Fig. 335) . . . . ***P. shubuta*** Stark

26. Pronotum with 2 completely separated pale stripes (Fig. 360); male paraprocts wide (Fig. 366) . . . . ***P. drymo*** (Newman)
Pronotum with pale stripes connected to other pale areas (Fig. 359); male paraprocts narrower (Fig. 365). . . . . . ***P. ephyre*** (Newman)

27. Male aedeagus with 1 or 2 apical spinule patches separated from other spinule patches by membranous areas (Figs. 252-259); male genital hooks curved inward along their entire length (Figs. 247, 249-251); abdomen light brown to yellow, lacking contrasting pigment (Figs. 264-271) **28**
Male aedeagus without apical spinule patches (Figs. 262, 263), or if present, are connected to other spinule patches (Figs. 260, 261); male genital hooks straight, or at most, hooked at tip (Fig. 248), or if curved as above, abdomen dark brown with contrasting pale areas on sterna (Fig. 274) **31**

28. Dorsal aspect of male aedeagus with 1 rectangular apical spinule patch (Fig. 258); female subgenital plate usually evenly rounded, covering 1/3 or less of sternum 9 (Figs. 264, 265). . . . . ***A. perplexa*** Frison (in part)
Dorsal aspect of male aedeagus with 2 oval apical spinule patches (Fig. 256), or a single "V" - shaped patch (Figs. 252, 254); female subgenital plate covers more than 1/3 of sternum 9 (Figs. 266, 271). **29**

29. Male genital hooks blunt, not sharply pointed, but may be hooked at tip (Fig. 247); basal spinule patch of male aedeagus without elongate longitudinal band ventrally (Fig. 255); subgenital plate as wide at base as apex, and usually rounded (Figs. 270, 271). . . . . ***A. evoluta*** Klapalek (in part)
Male genital hooks sharply pointed (Fig. 250, 251); basal spinule patch of male aedeagus with longitudinal band ventrally (Figs. 253, 257); female subgenital plate wider at base than at apex (Figs. 266-269). **30**

30. Male genital hooks thick, stout (Fig. 250); dorsal aspect of male aedeagus with 2 oval apical spinule patches (Fig. 256); base of female subgenital plate narrow, 1/3 total width of sternum 8 (Figs. 268-269). . . . . ***A. mela*** Frison
Male genital hooks thin, narrow (Fig. 251); dorsal aspect of male aedeagus with 1 lobed apical spinule patch (Fig. 252); base of female subgenital plate wide, 1/2 total width of sternum 8 (Figs. 266, 267). . . . . ***A. filicis*** Frison

31. Apical spinule patches on male aedeagus absent (Figs. 262, 263); male genital hooks straight, at most slightly hooked at tip (Fig. 248); female subgenital plate bearing 2 flap-like lobes (Figs. 272, 273) . . . . ***A. internata*** (Walker)
Apical spinule patches present, either separated by membranous areas (Figs. 254, 258), or continuous with basal spinule patch (Figs. 260, 261); male genital hooks straight or curved; female subgenital plate without 2 flap-like lobes. **32**

32. Male genital hooks curved (Fig. 246); apical spinule patch encircles entire male aedeagus (Figs. 260, 261); subgenital plate evenly rounded (Fig. 274); head brown, with yellow contrast along posterior margin (Fig. 281). . . . . ***A. ozarkensis*** Poulton and Stewart
Male genital hooks straight, at most slightly hooked at tip (Fig. 249); apical spinule patches not encircling entire aedeagus, but separated by membranous areas (Figs. 254, 258); female subgenital plate variable (Fig. 265,271); head more or less uniformly brown . . **33**

33. Ventral aspect of male aedeagus lacking longitudinal spinule patch (Fig. 255); apical spinule patch not rectangular (Fig. 254); female subgenital plate covering at least 1/2 of sternum 9 (Figs. 270, 271). . . . . ***A. evoluta*** Klapalek (in part)
Ventral aspect of male aedeagus with longitudinal spinule patch present, widened apically (Fig. 259); apical spinule patch rectangular (Fig. 258); female subgenital plate covering less than 1/2 of segment 9 (Figs. 264, 265) . . . . ***A. perplexa*** Frison (in part)

Nymphs

1. Two ocelli (some *Perlinella* have median ocellus greatly reduced) (Figs. 239-244) . . . . ***Neoperla*** Needham **7**
Three ocelli. **2**

2. Occiput with closely set, regularly spaced row of spinules extending from postocular fringe, more or less completely across head (Fig. 22) **3**
Spinule row either surrounding eyes (Fig. 24), or sinuate and irregularily spaced (Fig. 23), or absent. **4**

3. Posterior spinule fringe of sternum 7 complete (Fig. 41); basal cercal segments without fringe of long setae along inner margin . . . . ***Agnetina*** Klapalek **12**
Posterior spinule fringe of sternum 7 incomplete (Fig.40); basal cercal segments with long setae along inner margin . . . . ***Paragnetina*** Klapalek **13**

4. Spinule row on occiput of head sinuate, irregularly spaced; pronotum with fringe of numerous long bristles (Figs. 23, 280) . . . . ***Attaneuria ruralis*** (Hagen)
Occiput with, at most, a few spinules with large spaces between them, not arranged in a row (Fig. 24); pronotum with short bristles or pegs, or at most, a few long bristles (Fig. 24). **5**

5. Eyes set far forward (Figs. 363, 364); postocular fringe of spinules around eyes lacking or absent (Figs. 363, 364)................ .... ***Perlinella*** Banks **15**
Eyes set further rearward (Figs. 353-358, 276-283); postocular fringe of spinules present (Figs. 276-283)..................... **6**
6. Abdominal terga banded (sometimes unicolorous in *A. mela* and *A. abnormis* (Figs. 295-298), dark intercalary setae lacking .... ***Acroneuria*** Pictet **16**
Abdominal terga not banded, with dark intercalary setae usually numerous (Fig. 47) .... ***Perlesta*** Banks **23**
7. Head with brown band extending from ocelli to anterior margin of eyes, leaving a closed pale window (Fig. 241) .... ***N. harpi*** Ernst and Stewart
Head without brown band between ocelli and eyes (Fig. 240), or if present, not reaching eye margins (Figs. 239, 242-244)........ **8**
8. Brown pigment of pronotum extends posteriorly along pronotal suture, often meeting posterior margin of pronotal ring (Fig. 244) .... ***N. robisoni*** Poulton and Stewart
Brown pigment encircles pronotum more or less evenly (Figs. 239-240, 242-243).. **9**
9. Brown pigment band across head wide, extending posteriorly to eyes (Fig. 242)........................ ***N. osage*** Stark and Lentz
Brown pigment band across head narrower, about 1/3 width of its anterior margin, or less (Fig. 239), but somtimes extending posteriorly to eyes (Figs. 240, 243)...**10**
10. Brown pigment band across head narrow, posterior margin sinuate; anterolateral margin of head lacking dark pigment (Fig. 239) .... ***N. falayah*** Stark and Lentz
Brown pigment band across head wider, posterior margin, at most, slightly sinuate; anterolateral margin of head with some dark pigment (Figs. 240, 243).. **11**
11. Margin of anterolateral corners of head dark (Fig. 240); mature nymphs found in late June and July ***N. choctaw*** Stark and Baumann
Margin of anterolateral corners of head unpigmented (Fig. 243); mature nymphs found in late July and August.................. .... ***N. catharae*** Stark and Baumann
12. Yellow mask anterior to median ocellus sinuate, nearly closed (Fig. 305); dark bands on abdominal terga at or nearest the anterior margin (Fig. 300)... ***A. flavescens*** (Walsh)
Yellow head mask anterior to median ocellus open, not sinuate (Fig. 306); dark bands on abdominal terga at or nearest the posterior margin (Fig. 299).. ***A. capitata*** (Pictet)
13. Diagonal pale bands absent from head, at most small pale spots posterior to occipital ridge (Fig. 308) .... ***P. media*** (Walker), dark phase
Pale diagonal bands present (may not be continuous), converging from eyes to posterior margin of head (Figs. 307, 309)........ **14**
14. Pale bands extending diagonally from eyes, often broken along occipital ridge (Fig. 309); pale area adjacent to lateral ocelli small, broken into 2 patches near each ocelli (Fig. 309); dark pigment touches eyes laterally, and sometimes posteriorly . . . ***P. kansensis*** (Banks)
Pale bands extending diagonally from eyes broken by dark pigment, both at occipital ridge and posterior margin of head (Fig. 307); pale area adjacent to lateral ocelli large, not divided into 2 separate patches (Fig. 307); dark pigment does not touch lateral or posterior margin of eye.. ***P. media*** (Walker), light phase
15. Contrasting pigmentation present, head with "W" anterior to median ocellus (Fig. 363)..................... ***P. drymo*** (Newman)
Entire nymph pale, lacking contrasting pigmentation (Fig. 364) .... ***P. ephyre*** (Newman)
16. Pale window anterior to median ocellus open, continuous, sometimes forming a "W" (Fig. 276-279)........................ **17**
Pale window anterior to median ocellus closed, forming 3 separated patches (Fig. 282-283)............................... **21**
17. Pale window anterior to median ocellus wide, not forming a "W" (Figs. 276, 277)................ ***A. evoluta*** Klapalek, light phase
Pale window anterior to median ocellus forming a "W" (Figs. 278, 279) **18**
18. Some abdominal terga completely dark, with pale areas small or absent........................ ***A. abnormis*** (Newman) (in part)
Abdominal terga banded (Figs. 295, 297, 298), sometimes with dark pigment reaching posterior margin (Fig. 296).............. **19**
19. Banding on abdominal terga includes dark blotches reaching posterior margin, leaving 3 separate pale areas (Fig. 296)............ .... ***A. filicis*** Frison
Banding on anterior margin of abdominal segments only (Figs. 297, 298)... **20**
20. Pale area adjacent to lateral ocelli usually larger than ocelli, and closed or nearly so (Fig. 279); banding on abdominal segments widest dorsally (Fig. 297) .... ***A. perplexa*** Frison
Pale area adjacent to lateral ocelli usually smaller than ocelli, and connected to other pale areas (Fig. 278); banding on abdominal segments widest laterally (Fig. 298).. ***A. evoluta*** Klapalek, dark phase
21. Abdominal terga with dark band along anterior margin (Figs. 297, 298); dark posterior margin of head diffuse, not reaching laterally to eyes (Fig. 282) .... ***A. internata*** (Walker)
Banding on abdomonal terga broken, not touching anterior margin, or absent (Fig. 295); posterior margin of head with dark band reaching laterally to eyes (Fig. 283), or absent.. **22**
22. Abdominal terga light brown, with dark brown band widened laterally (Fig. 295) .... ***A. mela*** Frison
Abdominal terga lacking pigment contrast, sometimes with a few small pale patches.............. ***A. abnormis*** (Newman) (in part)
23. Head mask consisting of brown freckles (Fig. 355).. ***P. shubuta*** Stark
Head mask consisting of dark pigmentation, freckles not contributing to dark appearance of mask (Figs. 353, 354, 356-358)..... **24**
24. Head mask darker than rest of brown areas on head (Figs. 356-358).. **25**
Head mask not darker than rest of brown areas on head, brown pigmentation more or less uniform (Figs. 353, 354)............ **28**
25. Pale "W" anterior to head mask present, usually complete (Fig. 356) **26**
Pale "W" anterior to head mask broken into separate pale areas (Fig. 358), or area anterior to mask entirely pale, or nearly so (Fig. 357) **27**
26. Pronotal ring as dark as head mask (Fig. 356); pale "W" anterior to mask continuous........................ ***P. cinctipes*** (Banks)
Pronotal ring paler than head mask, often reticulate (Fig. 358); brown band anterior to mask weak, pale "W" between them barely visible .... ***P. decipiens*** (Walsh) (in part)

27. Brown band anterior to head mask with irregular posterior margin (Fig. 357), or this band absent; brown patches between lateral ocelli and eyes absent (Fig. 357). . . . . ***P. browni*** Stark
Brown band anterior to head mask fused to mask, leaving 3 pale areas (Fig. 358); brown patches between lateral ocelli and eyes weak . . . . ***P. decipiens*** (Walsh) (in part)
28. Pale "W" anterior to head mask complete (Fig. 353); posterior margin of head with irregular dark blotches. . . . . ***P. fusca*** Poulton and Stewart
Pale "W" anterior to head mask incomplete, leaving separate pale areas (Fig. 354); posterior margin of head may be dark, but without irregular blotches. . . . .***P. baumanni*** Stark

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Acroneuria abnormis (Newman)

Perla abnormis Newman (1838)
Acroneuria abnormis: Ricker (1938).

Type locality.— New York, Trenton Falls.

Regional distribution.— IL: Hardin Co., Elizabethtown, 28-30-V-28, 3M, T.H. Frison; Jackson Co., Grand Tower, 2-VI-13, 1F, T.H Frison; Massac Co., Metropolis, 1,4-VI-28, 3M, 1F, T.H. Frison.

Discussion.— Males of this species have broad, triangular hooks, similar to *A. ruralis* (Fig. 245). The female subgenital plate is barely produced over sternum 9 (Stark and Gaufin 1976), and nymphs have dark, nearly concolorous abdominal terga. It has been reported in southern Illinois (Frison 1935; Stark and Gaufin 1976), but no specimens were collected during this study. Due to the difficulty in collecting large rivers, its existence in the Mississippi, Missouri, Ohio, and Arkansas Rivers was not documented. Emergence occurs in May and early June.

Acroneuria evoluta Klapalek

Figs. 16, 17, 24, 44, 247, 254, 255, 270, 271, 276-278, 298

Acroneuria evoluta Klapalek (1909).

Type locality.— Louisiana, New Orleans.

Regional distribution.— Watersheds 1-5, 8, 13, 17, 20, 22, 23, 25, 26, 28, 31, 32, 35, 36, 38, 42-50, 52, 53, 55-57, 65, 66, 68, 69, 71, 72, 74, 80, 81, 83, 85-89, 91-99, 102-104, 106-110, 113-126 (Table 1).

Discussion.— This was the most common *Acroneuria* collected in small to medium sized streams in the region. Nymphs were more frequently collected than those of large river species. The female subgenital plate covers about 1/2 of sternum 9 (Fig. 270), and the male aedeagus has a longitudinal spinule band (Figs. 254, 255). Frison (1942), and Stark and Gaufin (1976) first reported it from the region. Ernst and Stewart (1986) reported this species was univoltine in Oklahoma, and nymphs were common in CPOM. Nymphs were collected from streams that were dry during summer, although repeat collections at some localities did not produce additional specimens, suggesting that their existence in a particular stream may depend on dispersal flights and rainfall. Emergence occurs in May, and adults are present until mid- July.

Acroneuria filicis Frison

Figs. 251-253, 266, 267, 296

Acroneuria filicis Frison (1942).

Type locality.— Kentucky, Pineville.

Regional distribution.— Watersheds 1, 28, 31, 34, 42, 44, 45, 47, 67, 71, 91 (Table 1).

Discussion.— This species is widespread in the region, but was seldom collected in large numbers. Males have narrow, sharply pointed genital hooks (Fig. 251), and the nymph has dark blotches along the posterior margin of each abdominal tergum in addition to dark bands on the anterior edge (Fig. 296). Females exhibit variation in subgenital plate shape (Fig. 267), and are often collected in smaller numbers from the same localities as *A. perplexa*. The region probably represents the western limit of its range, where it occupies large, slow gradient permanent streams. Emergence begins in late May and adults are present up to mid July.

Acroneuria internata (Walker)

Figs. 248, 262, 263, 272, 273, 282

Perla internata Walker (1852).
Acroneuria internata: Claassen (1940).

Type locality.— North America.

Regional distribution.— Watersheds 14, 41, 42, 45, 47, 53, 55, 67, 68, 88, 93, 99, 107, 116, 119 (Table 1).

Discussion.— The straight male hooks (Fig. 248) and the bilobed, flap-like female subgenital plate (Figs. 272, 273) distinguish this species from other *Acroneuria*. The nymphal head pattern has a closed "W", appearing as three separate pale patches near the median ocellus (Fig. 282). It was reported from the region by Illies (1966), and Stark and Gaufin (1976). Our localities probably represent the southwestern limit of its range. It was most common in larger, permanent streams in the Boston Mountain and Central Plateau subregions, nearly 1/2 of which receive inputs from large springs. Nymphs have been reared successfully by feeding them midge larvae (Diptera: Chironomidae) for 4-6 weeks. Emergence occurs from late May through June.

Acroneuria mela Frison
Figs. 250, 256, 257, 268, 269, 283, 295

Acroneuria mela Frison (1942).

Type locality.— Indiana, White River, Petersburg.

Regional distribution.— Watersheds 39, 45, 50, 53, 60, 67, 90, 122 (Table 1).

Discussion.— This species is probably more common than records indicate, because of its presence in large rivers which are difficult to sample. Males have stout genital hooks (Fig. 250), with two oval spinule patches positioned apically on the aedeagus (Figs. 256, 257). Nymphs have dark bands on abdominal terga that may or may not reach the anterior or posterior margins (Fig. 295). Frison (1942), Stark and Stewart (1973a), and Stark and Gaufin (1976) provided regional records, noting its occurrence in large rivers. Its distribution in North America follows the upper Ohio and central Mississippi River valleys, and includes much of the Gulf Coastal Plain. It occurs in lowland streams having bottomland hardwoods in the riparian zone. Adults have been collected during late May and June.

Acroneuria ozarkensis Poulton and Stewart, new species
Figs. 246, 260, 261, 274, 281, 284.

Type Locality.— Arkansas, Searcy County, Buffalo River, Hwy 65, 4.4 km N Silver Hill.

Types.— Holotype M, Allotype F, 8 paratype M, 26 paratype F, 16-VI-85, H.W. Robison. Holotype and allotype deposited in USNM, 1 paratype M and 3 paratype F deposited in UNT Insect Museum, other paratypes depos. in BCP collection. Additional paratypes: MO: Osage Co., Gasconade R., Hwy 89 access, 6.6 km E Rich Fountain, 7-VII-86, BCP.

Regional distribution.— Known only from these two localities.

MALE: (Figs. 246, 260, 261). Macropterous. Length of forewing 22-23 mm, length of body 18-20 mm. Paraprocts relatively broad, similar to *A. evoluta*, curved inward and acute at apex (Fig. 246). Tergum 10 spinule patches separated mesally, tergum 9 spinule patches barely separated and sparse (Fig. 246). Apical lobe of aedeagus encircled with fine, reddish-brown spinules and connected to basal spinule patch (Figs. 260, 261). Basal lobe of aedeagus with a few short, fine hairs dorsally. Abdominal sterna pale, rest of abdomen dark (Fig. 274). Head with posterior margin pale (Fig. 281).

FEMALE: (Figs. 274, 281). Macropterous. Length of forewing 26-28 mm, length of body 22-25 mm. Subgenital plate oval- shaped, evenly rounded, covering 1/2 of sternum 9. Dark brown pigmentation of abdominal terga and pleura extending to edge of subgenital plate (Fig. 274). Head and body coloration similar to male (Fig. 274).

NYMPH: Unknown.

EGG: (Figs. 284a-d). Outline pear-shaped, cross section circular. Collar knob-like. Chorion reticulate in posterior 3/4, anterior 1/4 smooth. Micropyles arranged circumlinearly in posterior third.

Etymology.— This species name is based on the Ozark Mountains where the type series was collected.

Discussion.— This species is similar to *A. flinti* Stark and Gaufin (1976), and may be a member of the *A. flinti* group due to its dark coloration and deep reticulations of the egg (Stark and Gaufin 1976). The females resemble *A. evoluta*, but have contrasting pigmentation on the adult head and abdomen (Figs. 274, 281). Emergence appears similar to other *Acroneuria*, probably beginning in May. Adults of A. *perplexa* and *A. internata* were also collected at the type locality.

Acroneuria perplexa Frison
Figs. 249, 258, 259, 264, 265, 279, 297

Acroneuria perplexa Frison (1937).

Type locality.— Indiana, White River, Petersburg.

Regional distribution.— Watersheds 1, 7, 9, 13, 14, 17-20, 25-27, 31, 36, 37, 39, 41-46, 48, 50, 52-56, 61, 62, 71-74, 77-79, 93, 98, 99, 102-104, 106-110, 115, 117, 122, 123 (Table 1).

Discussion.— This was the most common regional species of *Acroneuria* in larger streams. The male aedeagus has a more or less rectangular apical spinule patch (Figs. 258, 259), and the female subgenital plate is variable (Figs. 264, 265). Nymphs have a continuous pale "W" anterior to the median ocellus (Fig. 279). Stark and Gaufin (1976) reported it from several localities within the region, and our collections indicate that it is widespread in all subregions except the Mississippi Alluvial Plain and Crowleys Ridge. It was found in larger, permanent streams and emerged in May. Adults are present through mid-July.

Attaneuria ruralis (Hagen)
Figs. 23, 245, 275, 280

Perla (Acroneuria) ruralis Hagen (1861).
Acroneuria ruralis: Claassen (1940).
Attaneuria ruralis: Illies (1966).

Type locality.— Missouri, St. Louis.

Regional distribution.—AR: Greene Co., Paragould, 14-VI-58, 1M, collector unknown; Lawrence Co., Black R., Hwy 63, Black Rock, 22-V-57, 1 F, H.H. Ross & H.J. Stannard. IL: Hardin Co., Elizabethtown, 22-VI-27, 1F, T.H. Frison; Jackson Co., Fountain Bluff, 1-VI-13, 1M, T.H. Frison.

Discussion.— This rare species was reported from large rivers in Arkansas, Missouri, Illinois, and Kansas (Stewart and Huggins 1977). Males have broad, triangular hooks, but the spinules on tergum 10 are not arranged in a patch as in *Acroneuria* (Fig. 245). The female has a submarginal tubercle on sternum 8 (Fig. 275). No additional specimens were collected during this study. This species is widespread but is seldom collected in large numbers. Nymphs can be collected by pulling debris from the river bottom or disturbing rocks of riprap upstream from a net. Emergence occurs from mid-May to early July.

Perlesta baumanni Stark

Figs. 318, 320, 327, 333, 337, 340, 352, 354

Perlesta baumanni Stark (1990a).

Type locality.— Arkansas, Scott County, Mill Creek, Y-City.

Regional distribution.— AR: Garland Co., Mid Fk. Saline R., Hwy 7, Iron Spgs Rec Area, 6-VI-84, 1M, 1F, BCP; Logan Co., Chiggar Cr., Hwy 109, Driggs, 13-V-85, 2M, 3 n, BCP; Perry Co: Dry Run Cr., Hwy 7, 13.2 km S Hollis, 11-V-85, reared 3M, 1 n, BCP; Scott Co., Mill Cr., Y-City, 30-IV-72, 3M, 9F, RWB; Big Cedar Cr., Hwy 28, 6.6 km E Big Cedar, 14-V-85, 2M, BCP. OK: Latimer Co., Turkey Cr., Hwy 270, 13-V-72, 3M, 3F, BPS; Leflore Co., Cedar Cr., Hwy 59, 30-IV-72, 1M, 4F, RWB.

Discussion.— This is the only *Perlesta* having wings with a black costal margin (Fig. 320). Stark (1990a) noted the uniformly brown nymphal coloration, and the pale "W" is weak and usually not continuous (Fig. 354). The female sternum 8 is sinuate (Fig. 337), rather than notched as in other *Perlesta*. Four localities in addition to those listed by Stark (1990a) are given above. This species is endemic to the Ouachita subregion and occupies intermittent or dry streams. Emergence begins in late April and continues through early June.

Perlesta browni Stark

Figs. 317, 326, 332, 334, 344, 351, 357

Perlesta browni Stark (1990a).

Type locality.— Oklahoma, Latimer County, Rock Creek, 15.4 km north of Red Oak.

Regional distribution.— Watersheds 1, 14, 16, 18, 31, 33, 34, 37, 47, 55, 56, 61, 73, 74, 90, 101, 104 (Table 1).

The first nymphal description is provided here:

NYMPH: (Fig. 357). General color yellow to pale or light brown. Head mask brown, anterior dark band absent or very weak (Fig. 357), pale "W" absent. Posterior margin of head without brown patches, occiput with setal row. Brown pigment between lateral ocelli and edge of eyes absent. Pronotal disk light brown with scattered yellow areas. Abdomen with numerous intercalary setae each set in brown socket, giving freckled appearance (Fig. 47).

Discussion.— Males of this species have straight, narrowly pointed paraprocts (Fig. 317). The weak brown band anterior to the head mask, although occasionally absent, is separated from the mask, leaving no pale "W" (Fig. 357). This species is endemic to the region, and was most common in larger streams in the Ouachita subregion (Table 2). Emerge occurs from late April through June.

Perlesta cinctipes (Banks)

Figs. 314, 323, 329, 338, 342, 347, 356

Perlesta cinctipes Banks (1905).

Type locality.— Kansas, Pottawatomie County, Onaga.

Regional distribution.— Watersheds 10, 11, 14, 18, 19, 34, 37, 46, 52, 53, 56, 88, 90, 101, 107, 110, 113-115 (Table 1).

Discussion.— This species is separated from other regional *Perlesta* by the banded femora (Fig. 342). The male has evenly curved, long, narrow paraprocts bordered by dark pigmentation (Fig. 314). The spine on the anteroapical margin of the paraprocts is far from the tip (Fig. 329) as in *P. browni*. Adults usually have a pronotal stripe, and nymphs have a continuous pale "W" anterior to the head mask (Fig. 356). In addition to our regional collections, it has been reported from Oklahoma, Kansas, and northern Missouri (Stark 1990a). It was most frequently collected from streams with slower gradients in the Central Plateau, Springfield Plain, Ouachita, and Missouri River border subregions. Based on our collections, this species may be able to withstand moderate levels of organic enrichment. It emerges from mid-May through June.

Perlesta decipiens (Walsh)

Figs. 312, 313, 319, 322, 328, 336, 345, 349

Perlesta decipiens Walsh (1863).

Type locality.— Illinois, Rock Island.

Regional distribution.— Watersheds 2-5, 7, 9, 13-15, 17-23, 25-28, 32, 34, 35, 37-41, 49-55, 58-62, 65, 66, 68, 70, 71, 73-79, 81, 82, 85-91, 93-101, 103-105, 107, 109-111, 113-126 (Table 1).

Discussion.— This was the most common, widespread species of *Perlesta* in the region. Males have bluntly pointed paraprocts that are pigmented on the outer margin (Figs. 312, 313). The entire costal margin of the forewing is yellow (Fig. 319), and the caecum of the extruded male aedeagus is large (Fig. 322). Nymphs of some regional populations have a broken pale band anterior to the head mask, leaving 3 separate pale areas. Nymphs usually have brown pigment between lateral ocelli and inner margin of the eyes (Fig. 358). Snellen and Stewart (1979b) reported the life history of this species, then considered a variant of *P. placida* (Stark 1990a), and found it to survive well in intermittent streams. Emergence begins in mid-May, and adults are present through mid July.

Perlesta fusca Poulton and Stewart, new species

Figs. 47, 315, 321, 324, 330, 339, 341, 346, 353

Type Locality: Arkansas, Newton County, Yardelle Creek,Hwy 123, 4.4 km south of Western Grove.

Types.—Holotype M, Allotype F, 12 paratype M and 7 paratype F, 4-VI-84, BCP. Holotype and allotye deposited in USNM, paratypes deposited in BCP collection.

Regional distribution.— Watersheds 1, 8, 9, 10, 18, 33, 34, 37, 44, 45, 53, 55, 65, 74, 87, 88, 90, 92, 123 (Table 1).

MALE: (Figs. 315, 324, 330). Forewing length 8-9mm, body length 9-11mm. General color brown, some abdominal sterna pale (Fig. 324). Costal margin of wings dark brown to black anteriorly, yellow posteriorly (Fig. 321). Head with ocellar quadrangle dark, lighter brown areas extending to posterior margin of head and laterally to eyes; rest of head yellow (Fig. 346). Brown blotch present on thoracic sterna. Pronotum brown, femora with dorsodistal brown patch reaching tibial articulation (Fig. 341). Paraprocts brown, short and triangular (Fig. 315), and somewhat blunt (Fig. 330), with an anteapical spine (Fig. 330). Sparse sensilla basiconica patch on tergum 10. Penis tube and sac long, caecum weak, lateral sclerites long and slender, patch covers dorsal surface of sac (Fig. 324).

FEMALE: (Figs. 339, 341, 346). Forewing length 10-12mm, body length 12-14mm. Subgenital plate lobes with rounded corners separated by a V-shaped notch (Fig. 339). Forewing, abdomen, and head coloration similar to male.

NYMPH: (Figs. 47, 353). General color brown, lacking contrast except for scattered pale areas. Head mask brown, accessory band 5, anterior to pale "W" uniformly brown (Fig. 353). Posterior margin of head with brown patches. Pronotal disk brown with scattered pale areas. Abdomen with sparse intercalary setae each set in brown socket, giving slight freckled appearance (Fig. 47). Occipital setal row approaches ecdysial suture.

EGG: Outline oval, cross-section circular. Chorion reticulate, collar absent.

Etymology.— The name is derived from the latin word "fuscus", meaning dark or dusky, and refers to the coloration of this species.

Discussion.— This species is similar to *P. baumanni* because of the dark coloration and broad male paraprocts. It is endemic to the region and was most common in the Arkansas River Valley, Ouachita, and Boston Mountain subregions (Table 1). It was also collected from a few small, Gulf- Coastal Plain streams. Adults were collected by sweeping vegetation at streams that were reduced to standing pools by late spring months. Emergence occurs from late April to early June.

Perlesta placida (Hagen)

Perla placida Hagen (1861).
Chloroperla virginica: Banks (1898).
Perlesta placida: Stark (1990a).

Type locality.— Washington, District of Columbia.

Regional distribution.— Unknown from the region.

Discussion.— The genus *Perlesta* has been recently revised (Stark 1990a). Specimens previously identified as *P. placida*, including those examined from museums during this study, contained numerous species. Stark (1990a) noted the distribution of *P. placida* as extending into Louisiana and Mississippi. Regional collections did not contain *P. placida*, but it is mentioned here because of the possibility of its occurrence in the region.

Perlesta shubuta Stark

Figs. 316, 325, 331, 335, 343, 348, 350, 355

Perlesta shubuta Stark (1990a).

Type locality.— Mississippi, Simpson County, Mill Creek.

Regional distribution.— Watersheds 26, 47, 52, 68, 85, 89, 91, 93, 99, 100, 124, 125 (Table 1).

Discussion.— Nymphs of this species are distinguished from other *Perlesta* by the speckled head mask, which contains no dark pigmentation (Fig. 355). Adults are similar to *P. decipiens*, but both species were reared and nymphs can easily be separated. Stark (1990a) described this species from Mississippi. Based on differences between this description and our material, and the fact that eggs from regional populations were not available, our specimens are tentatively placed under *P. shubuta*, and may represent another undescribed species. Speckled nymphs were reared from larger, permanent streams, and is apparently the only regional *Perlesta* restricted to these conditions. Emergence occurs later than other *Perlesta* species, probably during June and July.

Perlinella drymo (Newman)

Figs. 360, 361, 363, 366

Isogenus drymo Newman (1839).
Perlinella drymo: Claasen (1940).

Type locality.— Georgia.

Regional distribution.— Watersheds 4, 14, 21, 24, 27, 34, 37, 38, 41, 45, 47, 48, 50, 52, 53, 60, 62, 64-70, 72, 76, 80, 81, 83, 85, 87-91, 93, 94, 96, 101, 102, 104, 106-109, 111, 115-117, 119, 120, 125 (Table 1).

Discussion.— This is the largest regional *Perlinella*, and is separated from *P. ephyre* by pronotum coloration, and stout male paraprocts (Figs. 360, 366). Nymphs are brown and usually have a "W" anterior to ocelli (Fig. 363). Previous records include Illinois and Arkansas (Illies 1966), Oklahoma (Stark and Stewart 1973a; Ernst and Stewart 1985b), and Missouri (Kondratieff et al. 1988). The nymphs were rarely collected in large numbers, and appeared to prefer portions of riffles with slower gradients, often occurring in organic debris at stream margins. *P. drymo* is one of three species of Perlidae found on Crowley's Ridge, where it occurs in large numbers at some localities. It was found in all subregions except the Mississippi Alluvial Plain, in both permanent and temporary streams. Emergence is the earliest of regional perlids, and occurs from mid-March to early May.

Perlinella ephyre (Newman)

Figs. 359, 362, 364, 365

Chloroperla ephyre Newman (1839).
Atoperla ephyre: Claassen (1940).
Perlinella ephyre: Zwick (1971).

Type locality.— Georgia.

Regional distribution.— Watersheds 2-4, 14, 17, 23, 25, 26, 32, 36, 38, 39, 42, 45, 47-49, 52, 53, 55, 65-68, 71, 72, 85, 87, 91, 93, 95, 99, 100, 103, 104, 107, 109, 115-117, 119, 120, 124, 125 (Table 1).

Discussion.— Males are distinguished from *P. drymo* by the narrow paraprocts and the single mesal pronotal stripe (Figs. 359, 365). Nymphs lack dark pigmentation, suggesting a hyporheic existance (Stanford and Gaufin 1974). Nymphs have two well-developed ocelli (Fig. 363), and are rare when compared to the abundance of adults collected from light traps. Illies (1966) noted this species from Arkansas, Ernst and Stewart (1985b) from Oklahoma, and Kondratieff et al. (1988) from Missouri. The region probably represents the western limit of its range, where it was commonly collected from mountainous subregions and the Gulf Coastal Plain (Table 2). Nymphs occur in fine gravel in slow, deep portions of riffles, and were often observed emerging on water willow. Emergence begins in May and adults are present through July.

Neoperla carlsoni Stark and Baumann

Figs. 215, 220, 225, 233, 237

Neoperla carlsoni Stark and Baumann (1978).

Type locality.— Florida, Gadsden County, Rocky Comfort Creek, Quincy.

Regional distribution.— AR: Crawford Co., Clear Cr., Hwy 282, 23-VII-84, 1F, HWR; Logan Co., Petit Jean R., 3.3 km W Magazine, 2-VII-84, 6M, 3F, BCP; Petit Jean R. Hwy 23, 2.2 km S. Booneville, 11-VII-81, 2M, 8F, HWR; Scott Co., Mill Cr., Y-City, 29-VI-80, 13M, 28F, HWR; Sebastian Co., Vache Grasse Cr., Hwy 22 1.1 km E Central City, 21-VI-84, 5M, 1F, HWR; Sevier Co., Saline R, Hwy 24, E Lockesburg, 26-VII-82, 2M, 2F, HWR & Koym. MO: Dallas Co., Niangua R., Moon Valley Access, 5.5 km E Windyville, 6-VII-86, 1F, BCP.

Discussion.— This species is separated from other regional *Neoperla* by the short, triangular spermatheca of females (Fig. 233), and differences in femoral pigmentation of males (Fig. 237). It is a member of the "*choctaw*" complex (Stark and Baumann 1978; Ernst et al. 1986). The nymph is unknown. Oklahoma specimens reported by Stark and Baumann (1978) were confirmed as *N. harpi* Ernst and Stewart (Ernst et al. 1986). This species is found west to Texas, and Missouri probably represents the northwestern limit of its range. Eggs of regional populations exhibit variation from paratypes collected in South Carolina (Ernst et al. 1986). It is present in slow moving, murky streams, some with intermittent flow. The emergence period is similar to that of *N. choctaw*, from late June through July.

Neoperla catharae Stark and Baumann

Figs. 214, 217, 228, 235, 243

Neoperla catharae Stark and Baumann (1978).

Type locality.— Arkansas, Randolph County, Jane's Creek.

Regional distribution.— Watersheds 4, 17, 36, 45, 46, 48, 49, 53, 61, 63, 66, 68, 85, 91, 95, 102, 110, 115, 122, 125 (Table 1).

The first nymphal description is provided here:

NYMPH: (Fig. 243). General color pale yellow with dark brown pigmentation. Transverse band between antennal bases wide, narrowing mesally, posterior margin sinuate. Ocellar pigmentation extends posterolaterally to hind margin of head. Pronotal ring brown, lateral and posterior margins pale.

Discussion.— This is the most common *Neoperla* in the "choctaw" complex. Males have straight genital hooks (Fig. 214), and the female spermatheca is curved, narrowing apically (Fig. 235). Nymphs were usually of smaller size than most other regional *Neoperla*. In addition to previously reported regional localities (Stark and Baumann 1978; Ernst et al. 1986), our collections include the first from Missouri. Regional populations are disjunct from more eastern populations in Ohio. Most regional records were from the Ouachita, Central Plateau, and Curtois Hills subregions, where it was collected in permanent streams (Table 2). Emergence begins later than other summer emerging species, and adults are present until early October.

Neoperla choctaw Stark and Baumann
Figs. 213, 218, 229, 234, 238, 240

Neoperla choctaw Stark and Baumann (1978).

Type locality.— Oklahoma, Latimer County, Red Oak Creek, Denman.

Regional distribution.— Watersheds 19, 29, 34, 37, 48, 52, 69, 80, 88, 90, 108 (Table 1).

The first description of the nymph is provided below:

NYMPH: (Fig. 240). General color pale yellow with dark brown pigmentation. Transverse band between antennal bases medium wide, posterior margin sinuate, pigmentation extends to anterolateral corners of head, and labrum margin. Brown patch from ocelli to posterior margin of head. Pronotum with brown ring, yellow on margin of posterolateral corners. Femora with silky, brown hairs and short, stout spinules. Femora and tibia with outer fringe of long, white hairs.

Discussion.— This is one of three regional "choctaw" group species, which are all characterized by spines on the outer surface of the male aedeagal tube (Figs. 217, 218, 220), very short female spermatheca (Figs. 233-235), and no anterior indentation on female sternum 8 (Figs. 225, 228, 229). Femur pigmentation is used to separate males of this species from *N. carlsoni* (Figs. 237, 238), and females are separated by spermathecal or egg characters. Records listed above include the first reports in Missouri. This species was previously reported from Arkansas and Oklahoma (Stark and Baumann 1978; Ernst et al. 1986). West Virginia populations are apparently disjunct from those in the region. Regionally, it was most common in the Gulf Coastal Plain, Ouachita, and Missouri River border subregions. Emergence is from late June through July.

Neoperla clymene (Newman)

Chloroperla clymene Newman (1839).
Neoperla clymene: Claassen (1940).

Type locality.— Georgia.

Regional distribution.— Unknown from the region. Localities nearest to the region include: OK: Bryan Co., Blue River (Stark and Baumann 1978), and the Kansas River near Lawrence, KS (BCP, unpublished data).

Discussion.— This species was considered common from the region, based on identifications by B. P. Stark (Ernst et al. 1986). Examination of the type specimen of *N. clymene*, revealed that *N. clymene* and *N. stewarti* as reported in Ernst et al. (1986) were two different species, *N. falayah* & *N. osage*, respectively (Stark and Lentz 1988). The Benton County, Arkansas specimens listed by Stark and Baumann (1978) as *N. freytagi* were confirmed as *N. harpi* (Ernst et al. 1986). Further clarification is provided in Stark (1990b), and at present, *N. freytagi* and *N. clymene* are not known from the region.

Neoperla falayah Stark and Lentz
Figs. 211, 222, 223, 232, 239

Neoperla falayah Stark and Lentz (1988).

Type locality.— Oklahoma, Delaware County, Battle Branch.

Regional distribution.— Watersheds 1, 2, 4, 8, 13, 14, 17, 19, 22, 23, 25, 26, 31, 33, 36, 39, 41, 42, 45, 46, 48, 49, 52, 53, 55, 56, 61, 62, 65-67, 71, 72, 74, 76-78, 83-86, 89, 91, 93, 96, 97, 99, 100, 102-104, 108, 109, 110, 115-117, 120-123, 125 (Table 1).

The first description of the nymph is provided here:

NYMPH: (Fig. 240). General color pale yellow with dark brown pigmentation. Transverse hand between anterior edges of antennal bases narrow, posterior margin sinuate, pigmentation absent from antennal bases, or at most, touching their anterior margin. Dark pigmentation present between ocellar area and occiput. Pronotum with brown ring, lateral and posterior margins yellow. Tibiae and femora with thick, brown hairs and short, stout brown spinules.

Discussion.— This common *Neoperla* is one of 4 regional "*clymene*" group species (Stark and Baumann 1978), which all lack spines on the outside surface of the male aedeagal tube (Figs. 216, 219, 221, 222), and have an anterior indentation on female sternum 8 (Figs. 223, 224, 226, 227). This anterior indentation is V-shaped in *N. falayah*, and the spermatheca is coiled at least 1 1/2 times in-situ (Fig. 232). The apex of the male aedeagus, which is visible through the aedeagal tube, has several rows of small, dense spines, unlike the larger spines of other regional species in the "*clymene*" group (Fig. 222). This species is only known from the Ozark-Ouachita region, and is limited to permanent streams (Table 2). Emergence is the earliest of regional *Neoperla*, with adults present from early May through early July.

Neoperla harpi Ernst and Stewart
Figs. 210, 221, 224, 230, 241

Neoperla harpi Ernst et al. (1986).

Type locality.— Oklahoma, Delaware County, Battle Branch.

Regional distribution.— Watersheds 1, 2, 4, 8, 13, 14, 19, 21, 23, 25, 31, 34, 36, 38, 42-46, 48, 49, 53-57, 61-69, 71, 74, 77-80, 83, 85, 88, 89, 92, 100-102, 104, 108, 110, 116, 120, 124, 125 (Table 1).

The first description of the nymph is provided here:

NYMPH: (Fig. 241). General color pale yellow with brown pigmentation. Transverse band between antennal bases wide laterally, narrowing medially. Brown stripe from ocelli to anterior margin of eyes, closed yellow region anterior to ocelli. Pronotum with brown ring, yellow on lateral and posterolateral margins. Tibiae and femora with thick, brown hairs and short, stout, brown spinules.

Discussion.— This species is distinguished by the medium- length male aedeagal tube (Fig. 221) and the female spermatheca with serrations along the spinule margin (Fig. 230). Nymphs are the most easily recognized of all regional *Neoperla*, with a band of pigmentation extending diagonally from the ocelli (Fig. 241). This species is endemic to the region, and was collected from all subregions except Crowley's Ridge and the Mississippi Alluvial Plain. Like *N. osage*, it occurs most commonly in permanent streams. Emergence begins in mid-June, and adults are present through September.

Neoperla osage Stark and Lentz

Figs. 209, 219, 227, 231, 242

Neoperla osage Stark and Lentz (1988).

Type locality.— Arkansas, Washington County, Devils Den State Park.

Regional distribution.— Watersheds 2-4, 14, 17, 18, 23, 28, 31, 35, 36, 38, 39, 44-46, 48, 49, 52, 55, 56, 61, 81, 83, 85, 87-89, 95, 96, 99, 102, 103, 108, 110, 111, 121-125 (Table 1).

The first description of the nymph is given here:

NYMPH: (Fig. 242). General color pale yellow with red-brown pigmentation. Transverse band between antennal bases wide, posterior margin lighter and near anterior margin of eyes. Ocellar pigmentation extends laterally along occipital ridge, and posteriorly to margin of head. Pronotum with brown ring, lateral and posterior margins pale.

Discussion.— Males have short, straight genital hooks (Fig. 209), and a short, stout aedeagal tube (Fig. 219). The female spermatheca is sclerotized for 3/4 its width, and is truncated apically at the tip (Fig. 231). This species was originally reported as *N. stewarti* (Stark and Lentz 1988), which is presently unknown from the region. *N. osage* is endemic to the region, but was also collected from large rivers of the Gulf Coastal Plain. Emergence extends from late May to late August.

Neoperla robisoni Poulton and Stewart

Figs. 212, 216, 226, 236, 244

Neoperla robisoni Ernst et al. (1986).

Type locality.— Arkansas, Ouachita River - Little Missouri River confluence, Tates Bluff.

Regional distribution.— Watersheds 14, 15, 20, 33, 39, 44, 48, 52, 53, 57, 58, 60-63, 66-68, 71, 91, 93, 99, 107, 119 (Table 1).

The first description of the nymph is provided below:

NYMPH: (Fig. 244). General color pale yellow with dark brown pigmentation. Transverse band between antennal bases of medium width, narrower laterally, posterior margin sinuate. Pigmentation absent from antennal bases, or present, at most on their anterior edge. Ocellar pigmentation extends diagonally to antennae, and posteriorly to hind margin of head. Pronotal ring brown, pigmentation extending posteriorly along pronotal suture. Lateral and posterior pronotal margins pale.

Discussion.— Males of this species have a relatively long aedeagal tube, with ventral bulb equal to 1/5 - 1/7 total tube length (Fig. 216). The female spermatheca has striations with a narrowed, cone-shaped apex (Fig. 236). This species is nearly restricted to large, permanent rivers, and is present in the Gulf Coastal Plain (Table 2). Numerous male specimens from the Gasconade River, Missouri contained eggs in their abdomens. These had an elastic, transparent coating and a milky-white center with a dark spot. These eggs did not resemble those of *Neoperla*, and presumably belong to a parasitoid, representing one of the first reports of such an occurrence in Plecoptera. This species emerges from early June through late July.

Agnetina capitata (Pictet)

Figs. 286, 290, 294, 299, 301, 304, 306

Perla capitata Pictet (1841).
Phasganophora capitata: Illies (1966).
Agnetina capitata: Zwick (1984).

Type locality.— USA.

Regional distribution.— Watersheds 28, 36, 38, 68, 92, 97, 102, 103, 116, 120, 124 (Table 1).

Discussion.— This species differs from *A. flavescens* by the shape of the male genital hooks (Figs. 286, 290), pigmentation on the head and female sterna 8 & 9 (Figs. 294, 304), and the banding on nymphal terga (Fig. 299). Nymphs often lack dark pigment on tergum 10 (Stark 1986). It was listed from Illinois and Kansas by Illies (1966) under the name *Phasganophora capitata*, and Stark (1986) reported one Missouri locality. This species is distributed further north than *A. flavescens*, and regional populations are disjunct from those in northern and eastern North America. About 85% of regional localities had a small yearly water temperature fluctuation (Fig. 3) due to inputs from large springs, making this species an indicator of spring streams. It was most commonly collected in the White River and Springfield Plateau subregions. Emergence begins in May and continues through June.

Agnetina flavescens (Walsh)

Figs. 41, 285, 289, 293, 300, 302, 303, 305

Perla flavescens Walsh (1862).
Agnetina flavescens: Stark (1986).

Type locality.— Illinois, Rock Island.

Regional distribution.— Watersheds 1, 3, 4, 13-15, 17, 25, 28, 36, 42, 45, 48, 55-57, 61, 66, 74, 81, 85, 89, 91-93, 96, 97, 99, 100, 102-104, 108, 111, 115-118, 120, 122-125 (Table 1).

Discussion.— This is the most common species of *Agnetina* in the region. Ernst and Stewart (1986) collected this species in Oklahoma, and reported it as *Phasgonophora capitata*. They found it to have a prolonged emergence during summer. Stark (1986) and Stark et al. (1986) provided distributional records for all states within the region. It was frequently collected in abundance from many subregions, but it was not collected in the Illinois Ozarks. It is confined to permanent streams, and adults were found throughout the summer, which suggested a differential hatching of eggs (Ernst and Stewart 1985b).

Paragnetina kansensis (Banks)

Figs. 288, 292, 309, 311

Perla kansensis Banks (1905).
Togoperla kansensis: Ricker (1945).
Paragnetina kansensis: Ricker (1949).

Type locality.— Kansas.

Regional distribution.— Watersheds 14, 39, 47, 52, 67, 68, 124 (Table 1).

Discussion.— This species is distinguished from *P. media* by the absence of an overlapping lobe on male tergum 5 (Fig. 288), and the female sternum 8 which is produced over 1/2 of sternum 9 (Fig. 292). Nymphs have a diagonal pale band extending from eyes to the posterior margin of the head, which may be interrupted by brown pigment at the occipital ridge (Fig. 309). It is widespread in the region (Illies 1966; Stewart and Huggins 1977; Stark and Szczytko 1981), but it was not collected in abundance. Our records suggest that it is more common than *P. media* in large, warm rivers not fed by springs. Emergence begins in early May and continues through mid-June.

Paragnetina media (Walker)

Figs. 22, 40, 45, 287, 291, 307, 308, 310

Perla media Walker (1852).
Togoperla media: Claassen (1940).
Paragnetina media: Ricker (1964).

Type locality.— Canada, Ontario, Albany River, St. Martins Falls.

Regional distribution.— Watersheds 3, 23, 38, 47, 53, 68, 72, 93, 99, 100, 109, 121, 124 (Table 1).

Discussion.— This species is distinguished from *P. kansensis* by male tergum 5 that overlaps tergum 6 (Fig. 287), and by the small bilobed female subgenital plate (Fig. 291). There are two different nymph phases in the region: 1) light phase, with large pale blotches adjacent to ocelli and occipital ridge (Fig. 307), and 2) dark phase, with a uniformly brown head and small pale patches (Fig. 308). Both have been reared, and eggs had much shorter collars than those shown in Stark and Szczytko (1981). Drumming signals from females of regional populations vary from those of more northern populations (Maketon and Stewart 1988). Regional populations probably represent the southwestern limit of its distribution, and are separated from northern portions of its range where it is more common. Stark and Szczytko (1981) reported one Missouri locality, and museum collections included some records. Our collections from large springs include Blanchard Springs (Sylamore Creek), and Mammoth Springs (Spring River) in Arkansas, and the North Fork White River, Current River, and Jacks Fork River drainages in Missouri (Table 1). About 90% of localities were from permanently flowing streams that contained flow from springs, suggesting it may be an indicator of these conditions. The emergence period is late April through May.

Family Perlodidae

This family has 14 regional species, which emerge in the spring. Adults lack conspicuous gill remnants, and the forewing has a cubito-anal crossvien separated from the anal cell by more than its own length (Fig. 8). The robust nymphs have wingpads generally parallel to the body axis, but in mature nymphs, the inner margins of the hind wingpads are more divergent than those of the front wingpads. Adult *Isoperla* Banks are smaller than *Hydroperla* Frison, *Helopicus* Ricker, and *Clioperla* Needham and Claassen, and their nymphs have well-defined color patterns and are often easier to identify than adults. Exuviae can also be identified with the nymphal key below. Male *Isoperla* can be more easily identified if the fleshy aedeagus is field-extruded at the time of collection (Szczytko and Stewart 1979). Pending a revision of the eastern *Isoperla* species (S. W. Szczytko, pers. comm.), some fine details of the ultrastructure of the aedeagus are not included in the following key. Sweeping vegetation was an effective collecting technique for adults, but large species were cryptic, and were often found under streamside rocks. Emergence of some *Isoperla* is known to coincide with appearance of buds or blossoms of certain plants (Ernst and Stewart 1985b). Nymphs are mostly carnivorous, and often inhabit leaf packs due to the presence of their food items. *Isoperla mohri* is known to be a herbivore-detritivore (Feminella and Stewart 1986), and some species may switch food habits in later instars (Fuller and Stewart 1979), becoming carnivorous during the last month of growth.

Key to Genera and Species of Perlodidae

Males and Females

1. Male tergum 10 deeply cleft (Figs. 371, 372); paraprocts not modified into recurved hooks; gill remnants on submentum. **2**
   Male tergum 10 entire (Fig. 369); paraprocts modified into recurved hooks (Figs. 397-406); submental gill remnants absent. **7**
2. Males **3**
   Females. **5**
3. Epiproct with lateral stylets (Fig. 371). . . . . ***Hydroperla*** Frison **4**
   Epiproct without lateral stylets (Fig. 372). . . . . ***Helopicus nalatus*** (Frison)
4. Epiproct with decurved hook (Fig. 368), broader at tip than at its base. . . . . ***H. crosbyi*** (Needham and Claassen)
   Epiproct without decurved hook (Fig. 377), usually tapered. . . . . ***H. fugitans*** (Needham and Claassen)
5. Female subgenital plate bluntly pointed (Fig. 376); margins of eyes with dark pigment along nearly entire margin (Fig. 383). . . . . ***H. fugitans*** (Needham and Claassen)
   Female subgenital plate rounded (Fig. 375); dark pigment along eye margins absent or restricted to anterior margin (Figs. 381, 382) **6**
6. Female subgenital plate mostly dark, extending beyond middle of sternum 9 (Fig. 374). . . . . ***H. nalatus*** (Frison)
   Female subgenital plate with 2 pale areas, not reaching past middle of sternum 9 (Fig. 375). . . . . ***H. crosbyi*** (Needham and Claassen)
7. Male with a pair of ridges on posterior margin of tergum 10 (Fig. 369); female with subgenital plate barely overlapping sternum 9 (Fig. 373); forewing length usually > 12mm. . . . . ***Clioperla clio*** (Newman)
   Male tergum 10 without ridges; female subgenital plate overlaps at least 1/4 of sternum 9, and forewing length usually < 12 mm (Fig. 407-416). . . . . ***Isoperla*** Banks **8**
8. Dark pigment on head absent, or connecting ocelli only (Figs. 417, 420, 423). **9**
   Dark pigment on head present in ocellar region and elsewhere (teneral adults may be pale)(Figs. 418, 419, 421, 422, 424-426). **11**
9. Dark pigment absent from head, except for minute spots lateral to ocelli (Fig. 423); male aedeagus with patch-like process and a single fleshy, pointed lobe (Fig. 388); female subgenital plate short, barely overlapping sternum 9 (Fig. 412). . . . . ***I. decepta*** Frison
   Dark pigment connecting ocelli (Figs. 417, 420); male aedeagus without patch-like process (Figs. 387, 392); female subgenital plate usually overlapping at least 1/3 of sternum 9 (Figs. 409, 410). **10**
10. Aedeagus with sclerotized, basoventral tooth (Fig. 387); dark pigment of male vescicle extends anteriorly to overlap 2/3 of sternum 8 (Fig. 387); pronotum rugosities surrounded by dark pigment (Fig. 420). . . . . ***I. dicala*** Frison
    Aedeagus without sclerotized teeth (Fig. 392); dark pigment of male vescicle extends anteriorly, covering 1/2 of or less of sternum 8 (Fig. 392); pronotum rugosities without dark pigment (Fig. 417). . . . . ***I. bilineata*** (Say)
11. Male aedeagus with patch-like indentation bearing teeth (Figs. 391, 395); head with dark pigmented lobes extending from posterior edges of lateral ocelli towards center of eyes (Figs. 422, 425); female subgenital plate rounded. **12**
    Male aedeagus without patch-like indentation bearing teeth, but may have a pair of sclerotized basoventral teeth (Figs. 394, 396); head with dark pigmented lobes extending from lateral ocelli towards posterior margin of eye or head (Figs. 418, 424, 426), or this dark pigment absent (Figs. 419, 421); female subgenital plate rounded or pointed. **13**
12. Aedeagal patch with a single row of 6-8 sclerotized teeth in an indented patch (Fig. 395); dark pigment along anterolateral margins of head weak or absent (Fig. 425); abdomen more or less uniformly pale; female subgenital plate evenly rounded (Fig. 407) . . . . ***I. szczytkoi*** Poulton and Stewart
    Aedeagal patch with 2 rows of numerous sclerotized teeth in an indented patch (Fig. 391); anterolateral margins of head with dark pigment (Fig. 422); abdomen mostly dark; female subgenital plate often slightly indented (Fig. 414). . . . . ***I. mohri*** Frison
13. Male aedeagus with oval lobe bearing numerous spinulae (Fig. 397); head lacking dark pigment except oceller triangle and anterior to median ocellus (Fig. 421); female subgenital plate triangular, evenly tapered (Fig. 415) . . . . ***I. burksi*** Frison
    Male aedeagus without oval lobe bearing numerous spinulae (Figs. 402, 403, 405); head with dark pigment adjacent to eyes or antennae (Figs. 418, 419, 424, 426); female subgenital plate rounded, or if pointed, not evenly tapered (Figs. 411, 413). **14**
14. Male aedeagus with pair of fleshy lobes each bearing a sclerotized tooth (Figs. 394, 396); head with dark pigment posterior to eyes, but lacking dark pigment connecting lateral ocelli and posterior margin of head (Figs. 418, 419); female subgenital plate rounded or slightly indented (Figs. 408, 416). **15**
    Male aedeagus without a pair of lobes bearing sclerotized teeth (Fig. 389, 390); dark pigment posterior to eyes absent (Fig. 426), or if present, weaker than that of ocellar triangle (Fig. 424); dark pigment sometimes connecting lateral ocelli and posterior margin of head (Fig. 426); female subgenital plate at least slightly pointed (Figs. 411, 413). **16**

15. Male vesicle about as long as wide (Fig. 394); ocellar triangle and posterior margin of eye usually connected with dark pigment (Fig. 418); ocellar triangle usually not closed (Fig. 418); female subgenital plate rounded (Fig. 416) .... ***I. namata*** Frison
Male vescicle wider than long (Fig. 396); dark pigment of ocellar triangle and posterior margin of eye separated by pale areas (Fig. 419); ocellar triangle with pale spot completely surrounded by dark pigment (Fig. 419); female subgenital plate sometimes slightly notched (Fig. 408).. ***I. signata*** (Banks)
16. Male aedeaus lacking numerous fleshy lobes (Fig. 390, 398); dark pigment nearly absent from anterolateral corners of head (Fig. 426); female subgenital plate usually pointed (Fig. 411)...................................... ***I. coushatta*** Szczytko and Stewart
Male aedeagus with numerous fleshy lobes (Figs. 389, 404); dark pigment present along entire anterolateral margin of head (Fig. 424); female subgenital plate rounded or slightly pointed (Fig. 413)................................ ***I. ouachita*** Stark and Stewart

Nymphs

1. Submental gills present (Fig. 27); pigment stripes on abdominal terga, if present, transverse with dark pigment along anterior margin **2**
Submental gills absent; pigment stripes on abdominal terga, if present, usually longitudinal (Figs. 440, 441, 444, 445-449), or if transverse, dark pigment is along posterior margin (Fig. 442, 443).. **3**
2. Dark pigment along posterior margin of head usually absent; head mask between antennal bases straight (Fig. 378) .... ***Helopicus nalatus*** (Frison)
Dark pigment present along posterior margin of head; head mask between antennal bases sinuate (Figs. 379, 380) .... ***Hydroperla*** Frison **4**
3. Dark pigment on head a rectangular outline (Figs. 385, 386); abdominal terga uniformly brown, sometimes with pale spots .... ***Clioperla clio*** (Newman)
Dark pigment on head not a rectangular outline (Figs. 427-435, 437-439); abdominal terga with pigment contrast (Figs. 440-449) .... ***Isoperla*** Banks.. **5**
4. Dark band across anterior margin of head continuous (Fig. 379); pronotum with narrow pale margin (Fig. 379) .... ***H. crosbyi*** (Needham and Claassen)
Dark band across anterior margin of head broken into 2 spots (Fig. 380); pronotum with irregular, wide pale margin (Fig. 380) .... ***H. fugitans*** (Needham and Claassen)
5. Abdominal terga with transverse bands (Fig. 442, 443).. **6**
Abdominal terga with longitudinal bands, or dark blotches on terga give abdomen a striped appearance (Fig. 440, 441, 444-448).... **7**
6. Lacinia with two elongated teeth and very few accessory spines (Fig. 452); pale area anterior to median ocellus open (Fig. 438) .... ***I. burksi*** Frison
Lacinia with two teeth and a row of several spines (Fig. 451); pale area anterior to median ocellus usually closed (Fig. 434......... .... ***I. signata*** (Banks)
7. Lacinia with 1-2 short, blunt teeth (Fig. 458); abdominal sterna with paired spots (Fig. 436); abdominal terga with blotches near posterior margin (Fig. 446).. ***I. decepta*** Frison
Lacinia with 1-2 prominent teeth (Figs. 450, 452, 453, 454, 459); paired spots absent from abdominal sterna; abdominal terga with longitudinal bands (Figs. 440, 441, 444, 445, 447, 448) **8**
8. Lacinia with 2 teeth, the second usually shorter than the first (in *I. szczytkoi*, second tooth barely visible) (Figs. 450, 454, 456, 457, 459) **9**
Lacinia with 1 tooth (Figs. 453, 455).. **13**
9. Abdominal terga with diagonal bands, pointing inward posteriorly (Fig. 444); lacinia with second tooth short, barely visible (Fig. 456) .... ***I. szczytkoi*** Poulton and Stewart
Abdominal terga with straight bands (Figs. 441, 447, 448); lacinia with second tooth prominent (Figs. 450, 454, 457, 459)....... **10**
10. Dark spots on abdominal terga absent, or limited to 2 laterally (Figs. 441, 449); dark bands on abdominal terga with narrow pale borders (Figs. 441, 449); ocellar triangle dark, closed, and with a small pale spot (Figs. 428, 439) **11**
Dark spots present on abdominal terga (Figs. 447, 448); dark bands on abdominal terga with (Fig. 447) or without (Fig. 448) narrow pale borders, but ocellar triangle open or mostly pale (Figs. 427, 432, 433).. **12**
11. Pale patches near anterolateral corners of head closed (Fig. 439); dark pigment present along pronotal suture (Fig. 439)........... .... ***I. dicala*** Frison
Pale patches near anterolateral corners of head continuous with other pale areas (Fig. 428); dark pigment usually absent along pronotal suture.. ***I. coushatta*** Szczytko and Stewart
12. Dark pigment continuous between lateral ocelli and posterior margin of head (Fig. 427); ocellar triangle pale, closed (Fig. 427); dark bands on abdominal terga without narrow pale borders (Fig. 448) .... ***I. bilineata*** (Say)
Dark pigment between lateral ocelli and posterior margin of head not continuous (Figs. 432, 433); ocellar triangle open, connected to other pale areas (Fig. 432, 433); dark bands on abdominal terga with narrow pale borders (Fig. 447)........... ***I. namata*** Frison
13. Median longitudinal dark bands of abdominal terga narrow (Fig. 440); lacinia broad, triangular, tooth as short as spinules (Fig. 453) .... ***I. ouachita*** Stark and Stewart
Median longitudinal dark bands of abdominal terga wide (Fig. 445); lacinia narrow, tooth longer than spinules (Fig. 455).......... .... ***I. mohri*** Frison

Clioperla clio (Newman)
Figs. 369, 370, 373, 384-386

Isogenus clio Newman (1839).
Isoperla clio: Frison (1935).
Clioperla clio: Szczytko and Stewart (1981).

Type locality.— Georgia.
Regional distribution.— Watersheds 1-126 (Table 1).
Discussion.— Szczytko and Stewart (1981) recently re-evaluated Clioperla Needham and Claassen, and recognized that it was different from *Isoperla*. Male tergum 10 has a pair of posterior ridges and hooks (Fig. 369), and the aedeagal spines are large and dense (Fig. 370). The female subgenital plate is lip-like and barely covers sternum 9 (Fig. 373). Mature nymphs collected from some localities in eastern Missouri have darker head pigmentation (Fig. 386). *Clioperla clio* was the most widespread stonefly species within the region. It was collected in a wide variety of stream types from every watershed, including streams which had no other stoneflies. Adults were secretive and seldomly collected in large numbers. Nymphs occured in a few Missouri streams which recieved mine drainage for many years. Poulton et al. (1989) reported this species had a high tolerance for chromium, and it was collected in streams with intense organic pollution in agricultural areas of the Gulf Coastal Plain and Springfield Plateau. The region is probably the western limit of its range, where it emerges from late March through April.

Isoperla bilineata (Say)
Figs. 392, 400, 409, 417, 427, 448, 459

Sialis bilineata Say (1823).
Isoperla bilineata: Claassen (1940).

Type locality.— Ohio, Ohio River, Cincinnati.
Regional distribution.— Watersheds 88, 89, 106, 107 (Table 1).
Discussion.— This is the type species for *Isoperla* (Szczytko and Stewart 1978) and head coloration is reduced to light brown pigmentation connecting the ocelli (Fig. 417). The male aedeagus is entirely membranous (Fig. 392), and the female subgenital plate is more pointed than *I. dicala* (Fig. 409). It was reported in southern Illinois from the Mississippi and Ohio Rivers, and in large Kansas rivers (Stewart and Huggins 1975), but was not formerly listed from Missouri. Nymphs were taken in large numbers from stomachs of Shovelnose Sturgeon [*Scaphirhynchus platorynchus* (Rafinesque)](Linden Trial, pers. data), and we have collected large numbers with a black-light from the Missouri River. This species may also be present in the Arkansas River (Roland McDaniel, pers. corresp.). Regionally, it is confined to large rivers, and emergence occurs during May and June.

Isoperla burksi Frison
Figs. 393, 397, 415, 421, 438, 443, 452

Isoperla burksi Frison (1942).

Type locality.— Illinois, Pope County, Lusk Creek, Eddyville.
Regional distribution.— Watersheds 1, 8, 9, 19, 25, 35, 42, 43, 45, 57, 89, 90, 104, 106, 126 (Table 1).
Discussion.— The aedeagus of this species has a bulbous lobe with dense spines (Fig. 397). Adults are light in color and are similar to *I. bilineata*. Nymphs of this species and *I. signata* are the only 2 regional *Isoperla* which have transverse bands on abdominal terga (Fig. 443). It was first reported in Illinois (Frison 1942) but was not reported west of the Mississippi River before this study. Stark et al. (1986) reported it in Arkansas based on our collections in progress. It was collected from one Missouri locality and a few Oklahoma localities, and is most common in the Ouachita and Boston Mountain subregions. About 95% of the localities in this study were from permanent streams (Table 2). Emergence occurs from late March through April.

Isoperla coushatta Szczytko and Stewart
Figs. 390, 398, 411, 426, 428, 441, 457

Isoperla coushatta Szczytko and Stewart (1977).

Type locality.— Texas, Anderson County, Saddler Creek.
Regional distribution.— Watersheds 12, 15, 29, 30, 51, 52, 58, 62, 64, 70, 75 (Table 1).
Discussion.— Males of this species lack lobes on the aedeagus (Fig. 390), and the adult head pattern resembles that of *I. ouachita* (Fig. 424). Nymphs have longitudinal bands with narrow pale borders (Fig. 441). This species was originally reported from the Gulf Coastal Plain of Texas (Szczytko and Stewart 1977), and based on our preliminary collections, was reported in Arkansas and Oklahoma (Stark et al. 1986). In this study, it was restricted to Gulf Coastal Plain streams, and Crowley's Ridge. It appeared to prefer clean streams with sand or fine gravel substrates. Emergence occurs from mid-March through April.

Isoperla decepta Frison
Figs. 388, 403, 412, 423, 436, 437, 446, 458

Isoperla decepta Frison (1935).

Type locality.— Illinois, New Columbia.

Regional distribution.— Watersheds 87-89, 94, 101, 106-109, 111, 126 (Table 1).

Discussion.—The male aedeagus has a patch-like indentation with a fleshy lobe bearing a sclerotized tooth-like spine (Fig. 388), and female sternum 8 overlaps less than 1/4 of sternum 9 (Fig 411). The small yellow adults have light grey wings and the head has no dark pigmentation. Nymphs have a pair of spots on each abdominal sterna (Fig. 436). Frison (1935) collected this species in southern Illinois, but it was not previously reported west of the Mississippi River. In this study, it was found commonly in the Missouri and Mississippi River border subregions (Table 2), and apparently is able to tolerate a considerable amount of organic enrichment. Emergence occurs from mid-April to mid-May.

Isoperla dicala Frison

Figs. 387, 406, 410, 420, 439, 449, 450

Isoperla dicala Frison (1942).

Type locality.— Michigan, Free Soil.

Regional distribution.— Watersheds 25, 38, 47, 68, 93, 95, 100, 109, 124 (Table 1).

Discussion.—The adult head pattern of this species is light- colored with brown pigment connecting ocelli (Fig. 420). The aedeagus has a single, ventral tooth basally (Fig. 387), and nymphs are generally dark olive-green or brown with pigment connecting lateral ocelli and the posterior margin of the head (Fig. 439). Stark et al. (1986) noted its ocurrence in Missouri, and a widespread distribution in northern and eastern North America. Regionally, it was entirely restricted to springs and streams which remained cool throughout the summer. Withrow Springs near Huntsville, Arkansas, and the lower Eleven Point River are the southernmost localities within the region. Emergence is later than other regional *Isoperla*, beginning in late April and continuing through early June.

Isoperla mohri Frison

Figs. 391, 399, 414, 422, 429, 445, 455

Isoperla mohri Frison (1935).

Type locality.— Illinois, Little Salt des Flusses, Watson.

Regional distribution.— Watersheds 1, 2, 5-7, 11, 19, 25, 29, 35, 37, 38, 40, 49, 50, 52-54, 56, 57, 59, 60, 62, 67, 70, 72, 73, 75, 76, 78, 80, 82, 86-88, 90, 98, 101, 107-109, 115-120, 126 (Table 1).

Discussion.— Males of this species are distinguished by the 2 rows of numerous, long teeth within a patch-like indentation on the male aedeagus (Fig. 391). Nymphs have a single lacinial tooth (Fig. 455). Frison (1935) reported it from the Illinois Ozarks, Stark and Stewart (1973a) reported it from Oklahoma, and Feminella and Stewart (1986) studied an Arkansas population that shifted food habits from omnivory to carnivory during nymphal growth. Like *I. ouachita*, this species occurs in intermittent streams and those that dry up in summer. Emergence occurs from late March through April.

Isoperla namata Frison

Figs. 394, 405, 416, 418, 432, 433, 447, 454

Isoperla namata Frison (1942).

Type locality.— Missouri, Wayne County, Silva.

Regional distribution.— Watersheds: 2-4, 8, 13, 14, 17, 22, 23, 25, 26, 28, 32, 35, 36, 38, 41-50, 52, 53, 56, 57, 60, 61, 65, 66, 68, 71, 72, 74, 81, 83-87, 90-93, 96-100, 102-104, 107, 109-111, 115-125 (Table 1).

Discussion.— Adults of this species cannot be reliably separated from *I. signata*, but our key reflects subtle characters that distinguish most regional populations. Like *I. bilineata*, nymphs usually do not have continuous dark pigmentation from the ocelli to the posterior margin of the head (Figs. 432, 433). It was reported from Missouri by Frison (1942), and more recently from Oklahoma (Ernst and Stewart 1985b) and Arkansas (Feminella and Stewart 1986). It was absent from lowland subregions (Table 2). A slow- growing, late-emerging population was discovered at Alley Spring, Missouri, which had a yearly water temperature range of 13-16°C, suggesting this species may not require temperature fluctuation for egg incubation and growth. The nymphal head pattern of this population differed from those collected at other localities (Fig. 433). It was collected most frequently from permanent streams and emerges from mid-April through May.

Isoperla ouachita Stark and Stewart

Figs. 389, 404, 413, 424, 430, 440, 453

Isoperla ouachita Stark and Stewart (1973b).

Type locality.— Oklahoma, Latimer County, Pine Creek.

Regional distribution.— Watersheds 1-5, 6-10, 13, 14, 16-23, 25-29, 31-50, 52-57, 60, 61, 64-69, 71-81, 83-87, 89-93, 95-100, 102-104, 107-111, 113, 115-118, 120-125 (Table 1).

Discussion.— The male aedeagus has several lobes, but no sclerotized teeth (Fig. 388). The adult head is dark along most of the anterior margin. Nymphs have broad lacinia, bearing a single tooth and an even row of spines (Fig. 453). This was the most common, widespread

Isoperla in the Ozark- Ouachita Mountains, and is endemic to the region. However, it was not collected in the Illinois Ozarks or Crowley's Ridge. It was abundant in intermittent streams and those that are dry during summer, which suggests an egg diapause in its life history. Emergence occurs from mid- March to the end of May.

Isoperla signata (Banks)
Figs. 396, 402, 408, 419, 434, 442, 451

Perlinella signata Banks (1902).
Isoperla signata: Claassen (1940).
Walshiola signata: Banks (1948).
Isoperla signata: Harden and Mickel (1952).

Type locality.— Michigan.

Regional distribution.— Watersheds 4, 36, 66, 81, 91, 96, 99, 102, 103, 110, 124, 125 (Table 1).

Discussion.— Nymphs of this species are often confused with *Isoperla marlynia* Needham and Claassen. It is not certain whether nymphs pictured by Frison as *Isoperla clio* (1935, 1942) were of *I. marlynia* or *I. signata.* Stark and Stewart (1973a) reported *I. marlynia* from four Oklahoma localities, and Brown and Ricker (1982) reported it from Arkansas, but due to the similarity of this species with *I. signata*, it is probable that these two species were confused. Our large series of nymphs and reared adults from these same localities were *I. signata*, and Ernst and Stewart (1985b) recently reported this species from northeastern Oklahoma. It is more common in cooler, northern climates, and regional localities are disjunct from them. In this study, it was restricted to permanent streams, containing flow from springs. It was most frequently collected in the Springfield and Curtois subregions where springs are common (Table 2). Emergence is from mid-April through mid-May.

Isoperla szczytkoi Poulton and Stewart
Figs. 25, 395, 401, 407, 425, 435, 444, 456

Isoperla szczytkoi Poulton and Stewart (1987).

Type locality.— Arkansas, Logan County, Gutter Rock Creek.

Regional distribution.— AR: Logan Co., Gutter Rock Cr., 4.4 km S Corley, 21-III-84, 4n, BCP, also 20-IV-85, reared 6 M, 3 F, 6n, BCP.

Discussion.— This species has an indented triangular patch bearing 7-8 teeth on the male aedeagus (Fig. 395), and the nymph has diagonal tergal bands (Fig. 444). It was only collected from the upper reaches of Gutter Rock Cr. on Magazine Mountain, the highest elevation in the region (853 m msl). This locality is a hyporheal stream with steep gradient and large rock rubble, but becomes organically enriched further downstream. This species was absent from nearby streams and is probably isolated. Nymphs were reared in April, and emergence probably continues through early May.

Helopicus nalatus (Frison)
Figs. 367, 372, 374, 378, 381

Hydroperla nalata Frison (1942)
Isogenus (Helopicus) nalatus: Ricker (1952)
Helopicus nalatus: Illies (1966)

Type locality.— Michigan, Huron River.

Regional distribution.— Watersheds 3, 4, 8, 17, 22, 32, 35, 36, 55-57, 81, 83, 84, 86, 89, 91, 96, 97, 102-104, 110, 115, 117-119, 122, 123 (Table 1).

Discussion.— This species is distinguished from *H. crosbyi* by the absence of lateral stylets on the male epiproct (Fig. 372), and a female subgenital plate that covers 1/2 or more of sternum 9 (Fig. 374). Nymphs are distinguished by the dark, straight pigment band across the head (Fig. 378). Stark and Stewart (1973a), Feminella and Stewart (1986), and Stark and Ray (1983) reported it from several regional localities. It was misidentified as *Isogenoides varians* (Walsh) during a Missouri study (Jones et al. 1981). These specimens, available through a loan from the University of Missouri collection, were confirmed as *H. nalatus.* The Michigan and Indiana populations are separated from regional distributions. This species was restricted to permanent streams in mountainous subregions, and was rarely collected in large numbers. The nymphs appeared to prefer large boulders and fast currents, and adults were secretive. Emergence was from late February through March.

Hydroperla crosbyi (Needham and Claassen)
Figs. 27, 368, 371, 375, 379, 382

Perla crosbyi Needham and Claassen (1925).
Hydoperla crosbyi: Frison (1935).

Type locality.— Missouri.

Regional distribution.— Watersheds 1, 5, 7-11, 13, 14, 18, 19, 21, 22, 25, 27, 33-37, 39, 42-45, 48, 52, 53, 56, 57, 60, 61, 64, 65, 69, 71, 73, 74, 76, 77, 80, 82, 86, 88-91, 97, 101, 104, 107-109, 111-119, 125 (Table 1).

Discussion.— This common species can be distinguished from *Helopicus nalatus* by the lateral stylets on the male epiproct (Fig. 371), and the rounded female subgenital plate produced over 1/3 - 1/4 of sternum 9 (Fig. 375). The nymph has a sinuate band across the head (Fig. 379). Illies (1966), and Ray and Stark (1981) reported it from all states within the region, where it was more common than *H. nalatus*. Nymphs are known to inhabit leaf packs and organic debris (Stewart and Huggins 1977), and often occupied lowland streams similar to those containing *Clioperla clio*. Oberndorfer and Stewart (1977) reported that *H. crosbyi* was able to survive in intermittent and dry streams in Texas due to their dessicant-resistant diapausing eggs. It was also found in permanent, large rivers with high levels of organic debris. Emergence occurs from late February through early April.

Hydoperla fugitans (Needham and Claassen)

Figs. 376, 377, 380, 383

Perla fugitans Needham and Claassen (1925).
Hydroperla harti: Frison (1935).
Isogenus (*Hydroperla*) fugitans: Ricker (1952).
Hydroperla fugitans: Illies (1966).

Type locality.— Texas, Austin.

Regional distribution.— IL: Randolph Co., Kaskaskia R., Shelbyville, 10-IV-32, T.H. Frison. MO: Scott Co., unknown locality, 31-III-38, 1M, 2F, W. F. Turner.

Discussion.— This species can be distinguished from *H. crosbyi* by the shape of the male epiproct (Fig. 377) and the triangular female subgenital plate (Fig. 376). Nymphs lack the anterior head band which is present in *H. crosbyi* (Fig. 380). Frison (1935) and Ray and Stark (1981) indicated it was a large river species. Although Ricker (1952) listed this species in Arkansas, and others have reported it in surrounding states (Kansas, Stewart and Huggins 1977; Texas, Szczytko and Stewart 1977), it is considered rare. No recent publications have provided locality records, and no specimens were collected during this study. Emergence is reported in March and April.

Family Pteronarcyidae

Jones et al. (1981) reported two pteronarcyid species from Missouri streams. The University of Missouri collection contained nymphs from many localities, but the species identity was unknown. Based on these collections, and reared material from this study, *Pteronarcys pictetii* is the common regional species in this family. It is the largest regional stonefly, and some adults were 5-6 cm in length. Nymphs are brown or black, and have gills on the thorax and abdominal segments 1 & 2 (Fig. 462). No adults were collected in this study, but in Wisconsin streams, they are found in riparian vegetation, and beneath bridges. Nymphs are herbivorous, and can be collected in large streams from snags and organic debris. During this study, high water levels often prevented collections of nymphs. Hitchcock (1974) provided a key to separate eastern species, but nymphs of *P. pictetii* are not reliably separable from those of *P. dorsata* (Say).

Key to Genera and Species of Pteronarcyidae

Males and Females

1. Tip of sternum 9 curved ventrad (Fig. 464); female subgenital plate with square notch (Fig. 461) . . . . ***P. pictetii*** Hagen
   Tip of sternum 9 not curved ventrad (Fig. 463); female subgenital plate unnotched, with 2 small projections (Fig. 460). . . . . ***P. dorsata*** (Say)

Pteronarcys pictetii Hagen

Figs. 21, 26, 461, 462, 464

Pteronarcys pictetii Hagen (1873).

Type locality.— Pennsylvania, Philadelphia.

Regional distribution.— Watersheds 24, 26, 38, 41, 47, 53, 55, 67-69, 85-87, 93, 95-97, 99, 100, 104, 108, 109, 116, 120, 122-125 (Table 1).

Discussion.— Nymphs were collected from several large river systems, and 76 adults were reared from 15 localities. *Pteronarcys dorsata* (Say) is included in the key to provide comparisons (Figs. 460, 463), in case this species is discovered during future studies. Nymphs in their last instar were collected in January from leaf packs and debris, and emerged in the laboratory 1-2 months earlier than their normal emergence period, following daily increases in Living Stream temperatures of about 1-2°C/day. This species was restricted to large rivers, which usually recieved spring water or cold tailwaters below reservoirs. The largest numbers were collected from the upper Current and Jacks Fork Rivers in Missouri. Watersheds listed above include the first Arkansas localities, and probably represent the southwestern limit of its range. Judging from collections of medium-sized nymphs in May, it is presumably one of the few semivoltine species in the region. Emergence was in April, which was one month earlier than for northern populations.

DISCUSSION

Stonefly distributions in eastern North America are not well documented, except for the studies of Ricker (1964), Ross et al. (1967), Ross and Yamamoto (1967), and the recent state lists of Louisiana (Stewart et al. 1976), Mississippi (Stark 1979), Florida (Stark and Gaufin 1979), Alabama (Stark and Harris 1986), Virginia (Kondratieff and Kirchner 1987), North and South Carolina (Unzicker and McCaskill 1982), West Virginia (Tarter and Kirchner 1980), Kentucky (Tarter et al. 1984), and Indiana (Bednarik and McCafferty 1977). There has been no concerted effort to sample the stonefly fauna of entire natural regions such as the Appalachian Mountains or associated ranges in relation to physiographic or biotic characteristics, and specifically no study has been done on the Ozark-Ouachita Mountain region. Fishes (Pflieger 1971; Hocutt and Wiley 1986; Mayden 1985; Robison and Buchanan 1988) and mayflies (Ephemeroptera)(McCafferty and Provonsha 1978) are the only aquatic groups that have recieved attention in the region. Plecoptera distributions can provide clues to past dispersals in eastern North America (Ross and Ricker 1971), and distributional patterns for the 88 known species in the Ozark-Ouachita region can be attributed to their ecological requirements, topography, climate and geological/glacial history.

There is considerable evidence that eastern North America once contained clear streams with a more uniform gradient and cooler temperature regimes than at present (Thornbury 1965). In the Illinois Ozarks, evidence of past boreal habitat belts exist (Udvardy 1969). The Interior Highlands, encompassing the area between the Mississippi River and the Great Plains, which includes the Ozark- Ouachita region, underwent changes in stream characteristics as the "Ozark Dome" was alternatively uplifted and degraded during the Pliocene (Bretz 1965). These changes included increased gradient and erosion, breaching of the water table and subsequent formation of springs (Ross 1963, 1965).

It is generally thought that the Pleistocene glaciations lasted about 1 million years, and included four major glacial advances, separated by warmer interglacial periods of about 10,000 years when glaciers retreated northward (Udvardy 1969). The Kansian extended the furthest south (Fig. 1), and the Wisconsin was the most recent, retreating about 10,000 years ago. Since the glacial front reached only as far south as the Missouri River (Fig. 1), major changes in stream drainages probably did not occur in the Interior Highlands during glacial periods (Pflieger 1971), although climate and subsequent stream temperatures probably differed enough to affect the distribution and dispersal of species at that time (Ross and Ricker 1971). Stonefly species that moved south ahead of glacial advances were left behind after glacial retreats, and now presently occupy "refugia", or isolated habitats with preserved environmental conditions that were more continuous before and during glaciation (Udvardy 1969). This pattern is manifested today by the presence of biogeographic "relicts", or species restricted to these refugia, often resulting in discontinuous distributions.

The distribution patterns of Ozark-Ouachita Plecoptera generally fall into three different categories: 1) endemic species, either products of speciation within the region or sister species to those in the Appalachian Mountains, 2) those with continuous distributions, or those that are widespread with presently open dispersal pathways via the Illinois Ozark corridor (Ricker and Ross 1971), and 3) those with discontinuous distributions, or that are geographically separated from more northern or eastern populations, where they may be more common.

There are a total of 25 endemic species of Plecoptera known from the Ozark-Ouachita region. In comparison, Hocutt and Wiley (1986) reported 27 endemic species of fishes from the Interior Highlands. Robison and Harris (1978) noted the possibility of previous connections between the Caddo, Little Missouri and Ouachita River systems based on the endemic fish species common to their headwaters. Mayden (1985) also provided distributions of endemic headwater fish species as evidence of previous stream drainage connections between the Ouachita and Little Missouri Rivers. Records of endemic stonefly species within the drainages of these systems seem to parallel those of some fishes, particularily *Alloperla ouachita*, which was found only in the headwaters of these drainages (Fig. 469). Although not based on geological evidence, the distributions of *Alloperla caddo* (Fig. 469) and *Zealeuctra wachita* (Fig. 466) similarily suggest that connections may have previously existed between the Ouachita, Saline, and Fourche la Fave watersheds. Another plausable explanation for the distribution of endemics from headwater systems is that of multiple headwater transfer (Pflieger 1971; Matthews and Robison 1988), which is certainly more of a present-day dispersal possibility for stoneflies than for fishes.

Several endemic *Allocapnia*, including *A. mohri* and *A. ozarkana*, are considered sister species to members of the Appalachian fauna (Ricker and Ross 1971). *Allocapnia sandersoni*, *A. peltoides*, and *A. warreni* are endemics that may represent possible products of sympatric speciation, since presumed sister species *A. rickeri* and *A. granulata*, respectively, are also found within the region.

Presently, there are 26 regional species which have continuous distributions due to their abundance throughout the Interior and Northern Highlands, and east of the Mississippi River. *Clioperla clio*, *Hydroperla crosbyi*, *Perlesta decipiens*, *Allocapnia granulata*, *Allocapnia rickeri*, *Haploperla brevis* and *Zealeuctra claasseni* presumably dispersed northward after the last glacial retreat, and presently occupy previously glaciated terrain. Others such as *Allocapnia forbesi* and *Zealeuctra fraxina* reached the Illinois Ozarks but did not cross the Mississippi River. Species such as *Allocapnia mystica* probably dispersed northward during glacial retreat, but required stream habitats with suitable gradients, which caused a distributional bottleneck at the Illinois Ozarks.

Discontinuous distributions due to the presence of small refugia with suitable conditions are perhaps the most noteworthy, and can be ecologically or historically based. Some widespread regional species are separated from eastern or northern populations by "cultural deserts" that act as dispersal barriers where survival is unlikely, such as the Mississippi Alluvial Plain with its low gradient, channelized streams and heavily cultivated topography. Other species are limited to a few isolated refugia that have preserved ecological characteristics allowing their survival in the region, but are more widespread and common in northern or eastern climates, and are unable to disperse because of the limited frequency of these habitats. *Isoperla burksi* and *I. signata* have widespread distributions in the Ouachitas and Ozarks, respectively, but are separated from populations further north and east of the Mississippi River. *Alloperla hamata*, *Neoperla carlsoni*, and *Taeniopteryx lonicera* (Figs. 467-469) are represented by relict populations, and do not occur in previously glaciated areas. These species probably had continuous distributions when a sounthern disperal route between the Appalachians and Ozarks was present before the Mississippi River occuped its present stream channel (Udvardy 1969). Similarly, *Shipsa rotunda*, *Prostoia similis*, and *Nemocapnia carolina*, which do occur in previously glaciated areas are also found in isolated refugia which have similar characteristics to streams in northern and northeastern North America (Figs. 465, 467).

Spring streams with cooler summer water temperatures provide fine examples of refugia that contain restricted populations of stonefly species that are more common in northern latitudes. Some cold water fishes are also known from these systems (Pflieger 1975; Robison and Buchanan 1988). *Isoperla dicala*, *Agnetina capitata*, *Paragnetina media*, *Allocapnia pygmaea*, and *Pteronarcys pictetii* probably dispersed south ahead of glacial advances, then dispersed northward again during glacial retreats, leaving behind populations only in streams with suitable temperature regimes.

The Ozark - Ouachita region is the most arid mountainous region in eastern North America (Rafferty 1985). In addition to a relatively warm climate, the region lacks significant altitude to provide cool temperatures in most streams during summer months (Fig. 3). Interestingly, streams containing significant spring flow maintained warmer winter temperatures and lacked many winter genera common to most regional streams with near - freezing temperatures during winter. Although apparently excellent habitats existed, *Taeniopteryx*, *Strophopteryx*, and *Allocapnia* (except for the previously mentioned *A. pygmaea*) species were rare or absent from spring streams. In this respect, regional streams with greater yearly temperature fluctuation generally had greater stonefly diversity than spring streams, possibly due to lack of a low end thermal cue required for egg hatching of some winter species. Conversely, temperatures as high as 31°C were recorded during summer months from permanent streams without spring flow, which may be too high to properly cue eggs and young nymphs of species with immediate hatching such as *P. media* (Heiman and Knight 1970), or species with nymphal diapause such as *A. pygmaea* (Pugsley and Hynes 1985). In these respects, the thermal regime of Ozark - Ouachita streams is unique and may be unsuitable for the Peltoperlidae, the only North American stonefly family that does not occur in the region.

From the computerized cluster analysis, four clusters were chosen based on equal cluster distances and gaps in the dendrogram that provided the most biologically meaningful divisions (Fig. 5, Table 2). As mentioned previously, watersheds were clustered based on similarity of their stonefly fauna. Cluster 1 included watersheds located primarily in lowland areas surrounding the interior Ozark- Ouachita subregions, which have low gradient streams with finer substrates, including the Gulf Coastal Plain, Missouri River Border, and Illinois Ozarks. Species typical of streams in this cluster include *Acroneuria abnormis*, *Allocapnia malverna*, *Amphinemura nigritta*, *Isoperla bilineata*, *I. coushatta*, and *I. decepta*. A few scattered watersheds (20, 31, 92, 98) clustered with them because of low numbers of collection records. Cluster 2 included watersheds within the Ouachita, Arkansas River Valley, and parts of the Boston Mountain subregions (Fig. 5). This cluster contains the highest number of regional endemics (Table 3), and consists of geologically similar watersheds (Mayden 1985). Species typical of this cluster include *Alloperla caddo*, *Allocapnia ozarkana*, *A. peltoides*, *Perlesta baumanni*, and *Zealeuctra cherokee*. Cluster 3 included most of the watersheds in the White River, Central Plateau, Osage-Gasconade Hills, Mississippi River Border, and the St. Francois Mountains (Fig. 5). These watersheds generally contain low numbers of endemic species, but include a variety of stream types. Species unique to this cluster include *Acroneuria ozarkensis*, *Alloperla hamata*, *A. leonarda* and *A. ouachita*. Cluster 4 included geologically similar watersheds fed by large springs in south central Missouri and northern Arkansas (Fig. 5). Typical species found under these conditions include *Agnetina capitata*, *Isoperla dicala*, *Leuctra tenuis*, *Paragnetina media*, *Pteronarcys pictetii*, and *Perlesta_shubuta*. Watersheds 14, 39, and 61 clustered with them, presumably due to small headwater springs or their physiographic position as ecotones, and included *Acroneuria internata* and *Paragnetina kansensis*.

Cluster results (Fig. 5) did not match subregional divisions (Fig. 2) that were based on geology, soil type, and vegetation, but were similar to some Arkansas fish faunal regions calculated with defined drainage units and principal components by Mathews and Robison (1988). Their five region solution contained more detailed subdivision of Gulf Coastal Plain streams based on large river fishes (Mathews and Robison 1988). In this study, a seven cluster solution (not shown) separated cluster 1 into the Gulf Coastal and Mississippi Alluvial Plains, but based on stream characteristics, other divisions in this solution did not appear reasonable.

In summary, the combination of mountainous topography, high gradient streams, varying flow permanence and temperature regimes, and warm climate make the Ozark- Ouachita Mountains and its diverse Plecoptera fauna unique among the natural physiographic regions of North America. Faunistically based clusters of watersheds elucidated in this study (Fig. 5) were similar to those based on species of fishes in other studies (Matthews and Robison 1988). Even though some species had strong affinities for a particular subregion (Table 2), the presence/absence of many uncommon species reflected historical (often glacial) distributions and geographic or ecological isolation. This appears to suggest that more specific characteristics were responsible for the presence/absence of many regional stonefly species. A total of 23 species were common in intermittent or dry streams, which probably have heterodynamic life cycle capabilities such as diapausing eggs (Stewart and Stark 1988). In addition, 28 species were restricted to either permanently flowing streams or those with significant spring water that altered the thermal regime. Based on this study, the best predictors of stonefly presence/absence within the region were stream thermal regime and flow permanence due to their apparent relationship to certain stonefly life cycle requirements.

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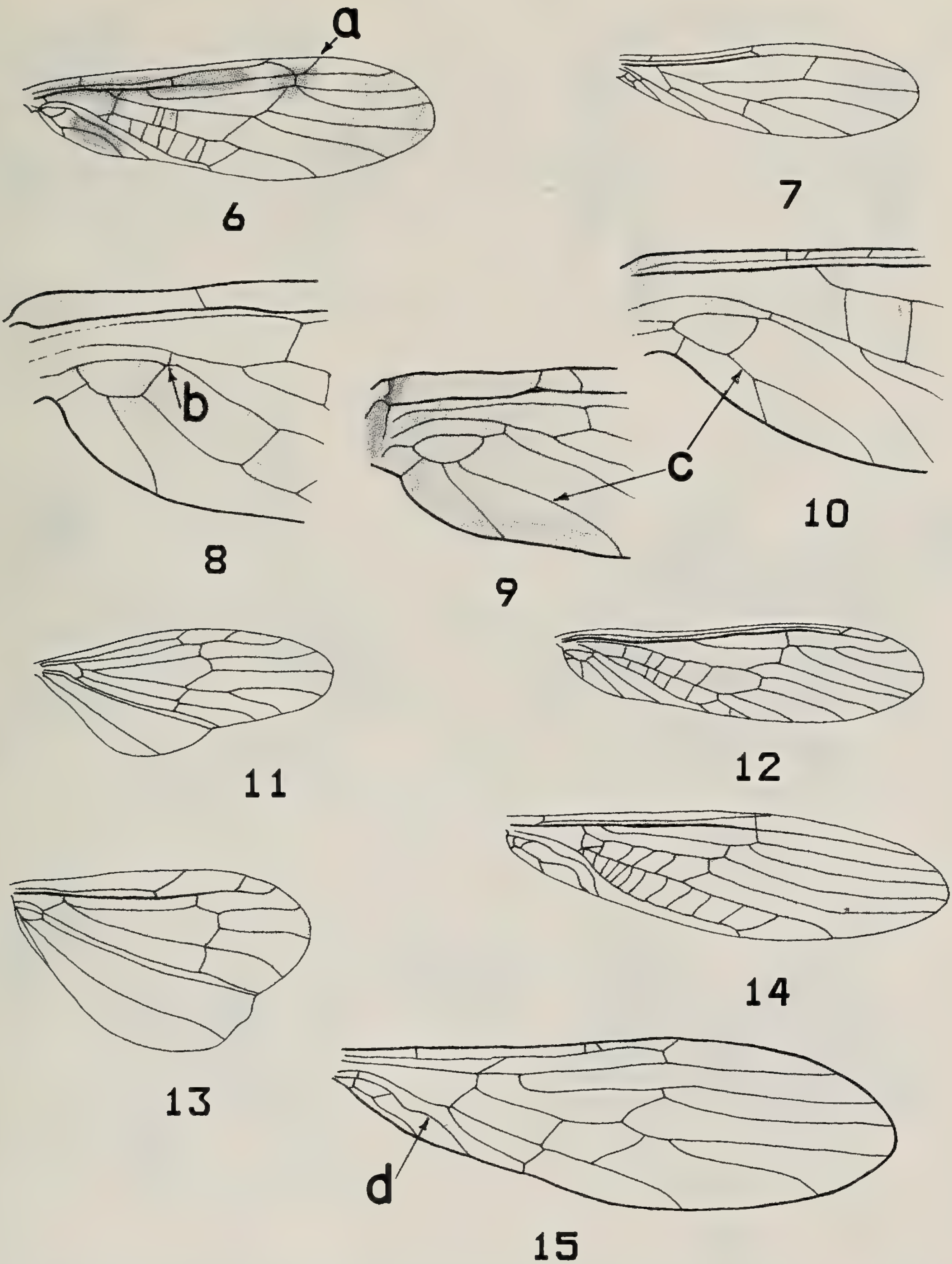

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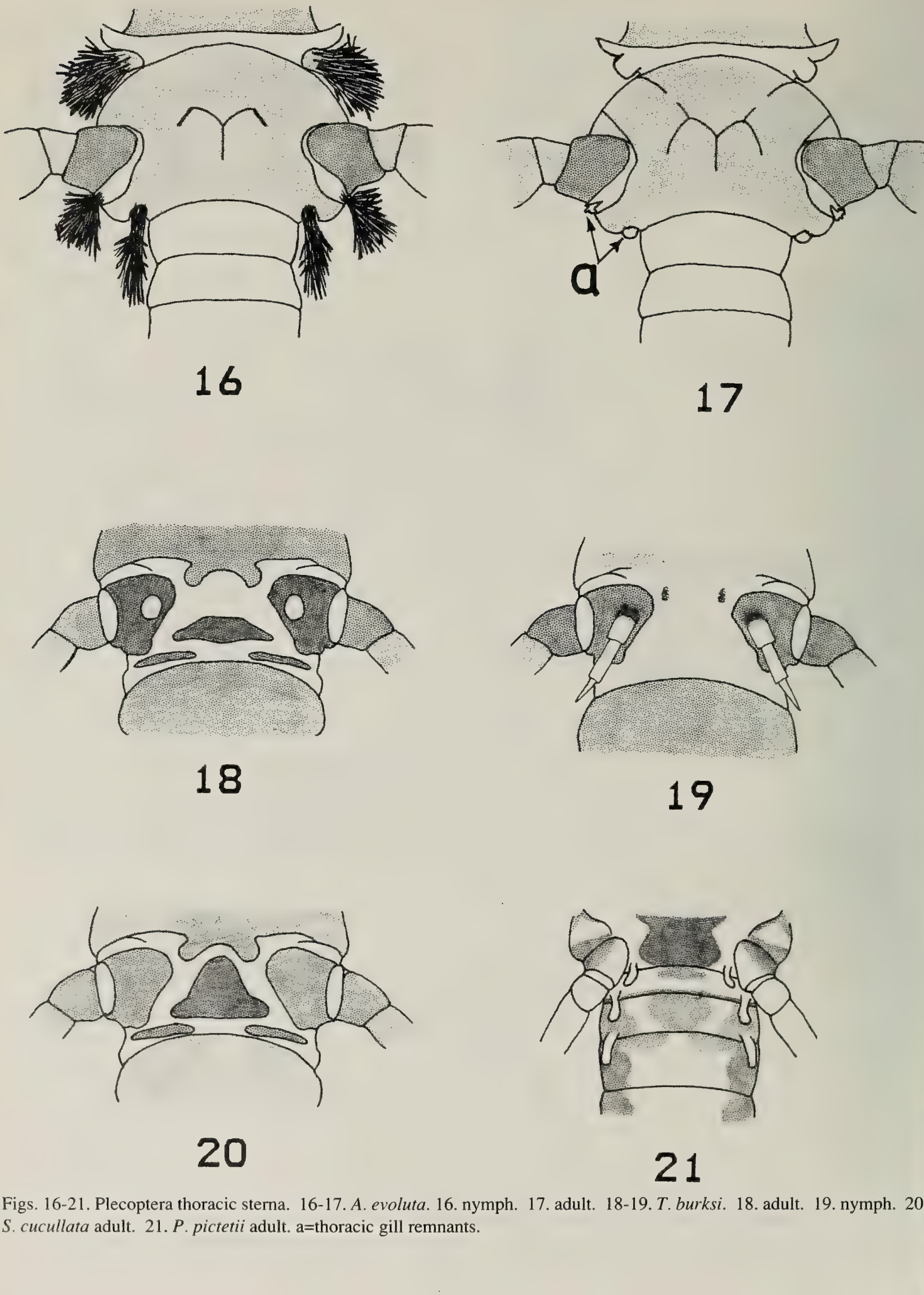

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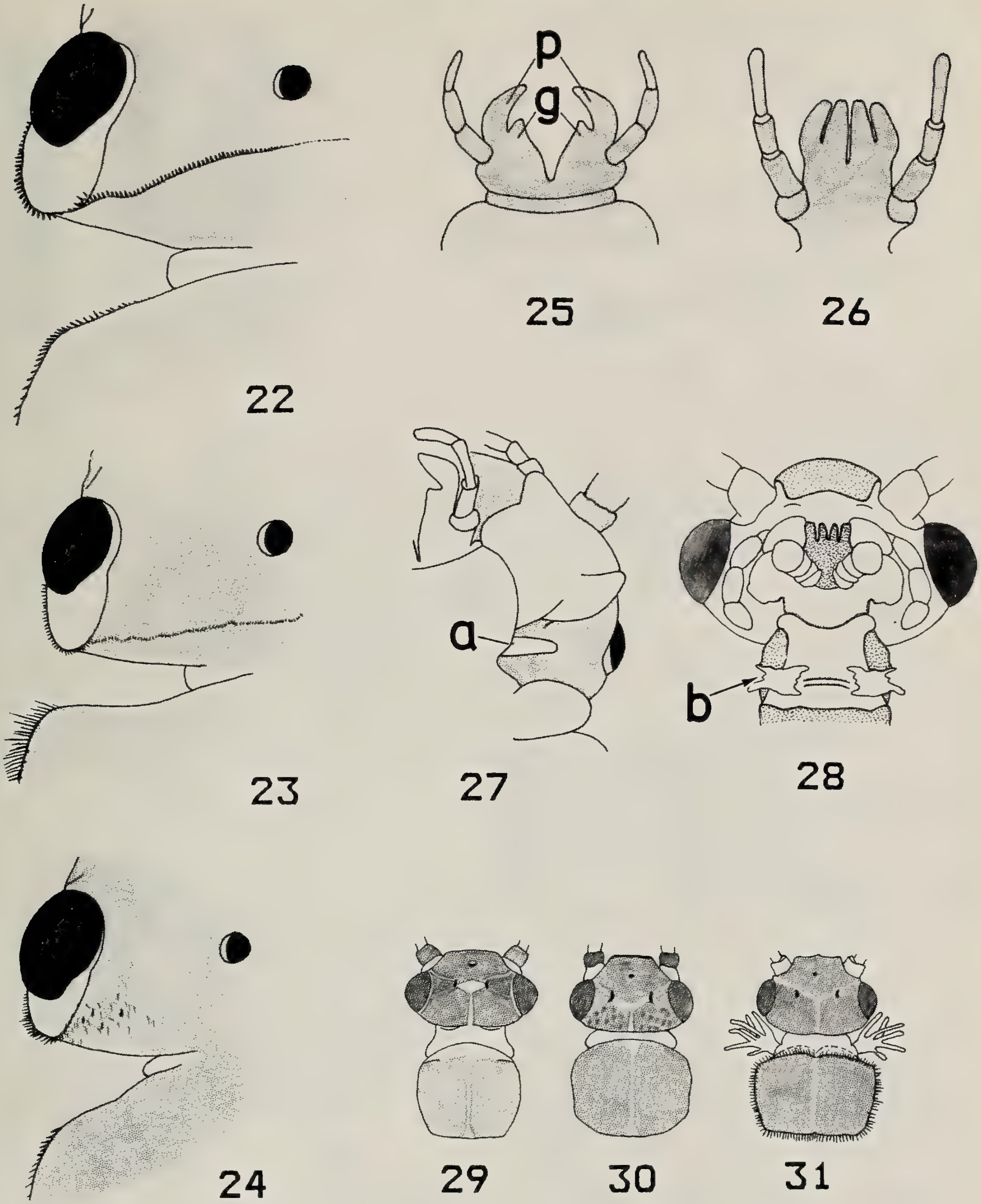

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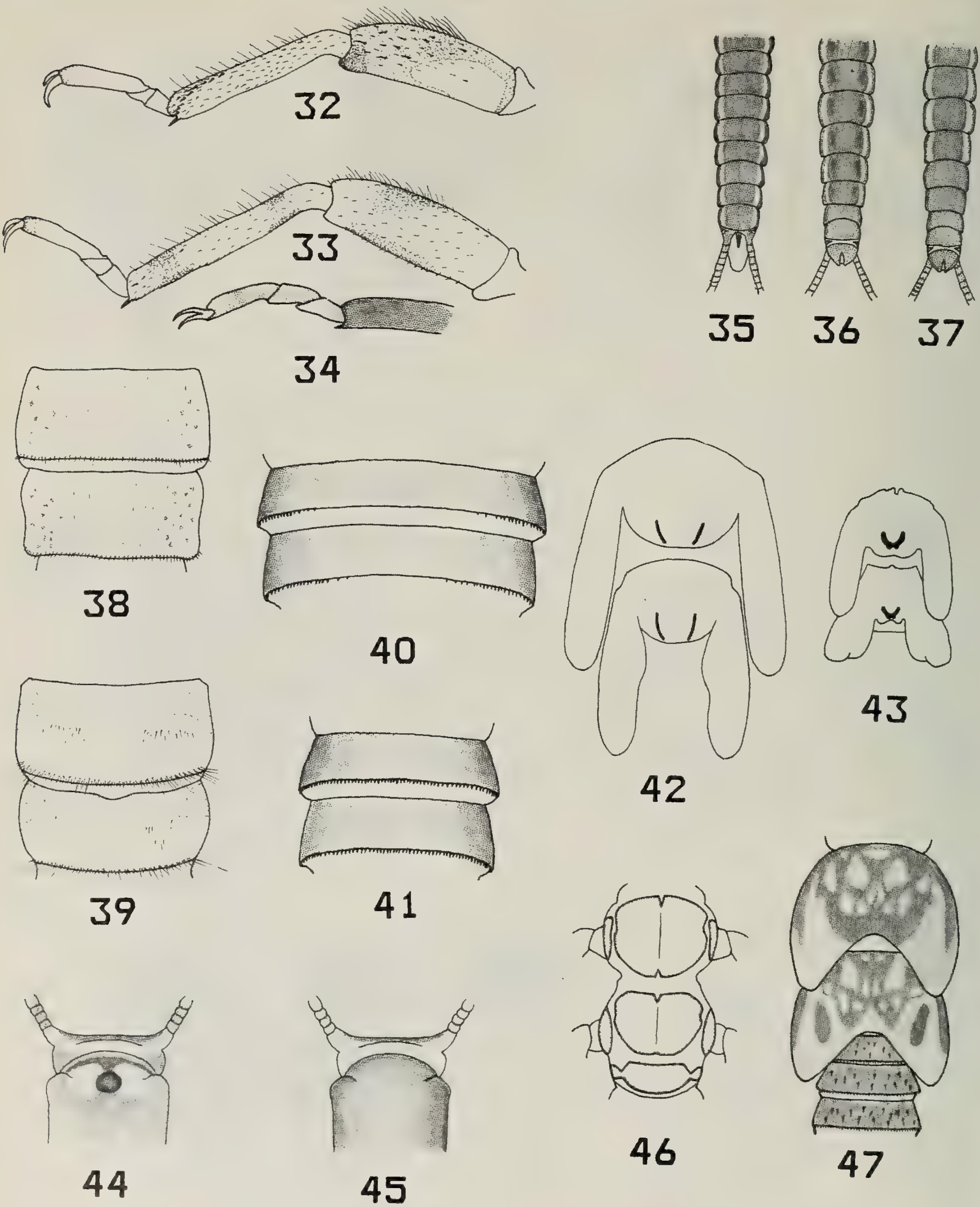

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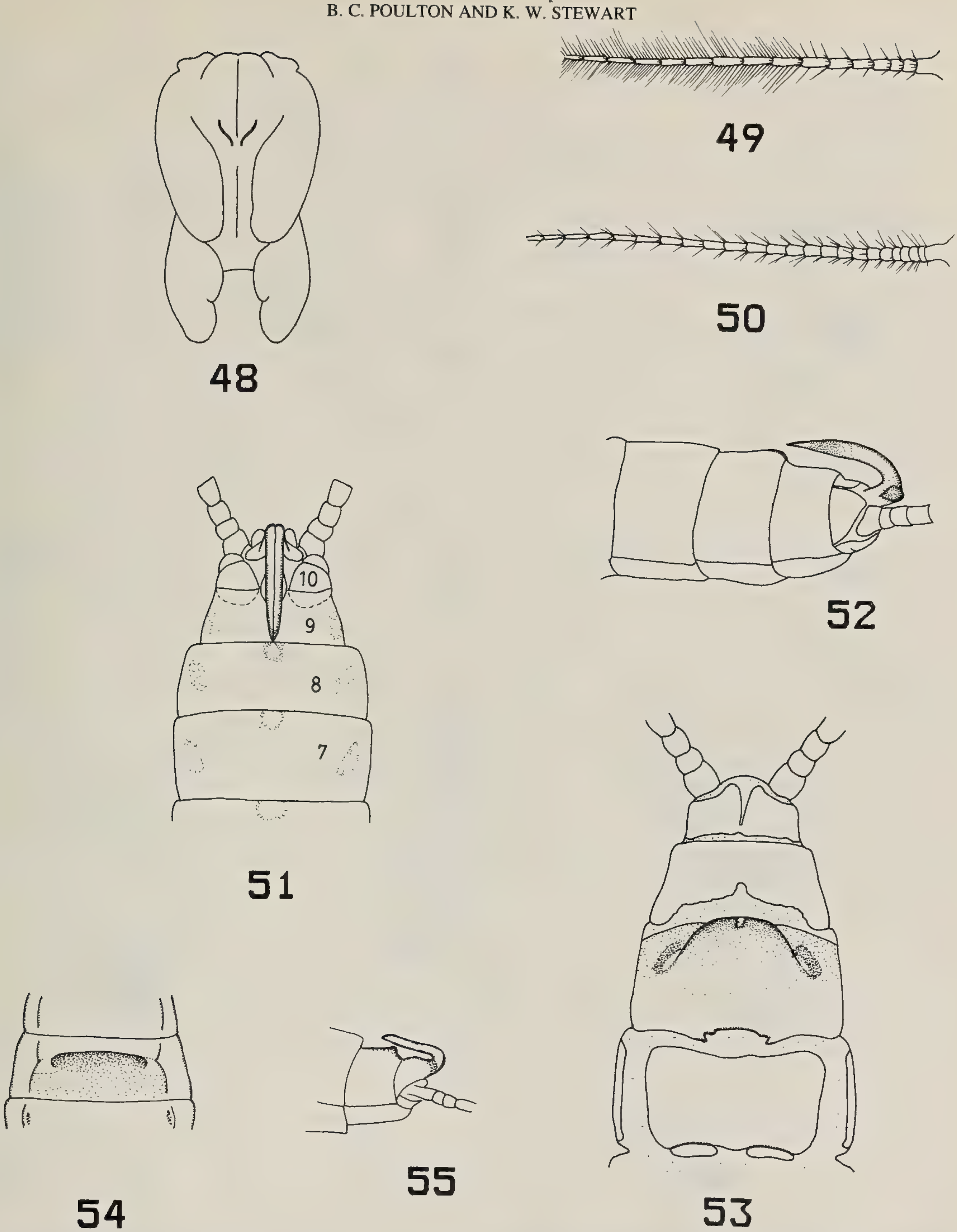

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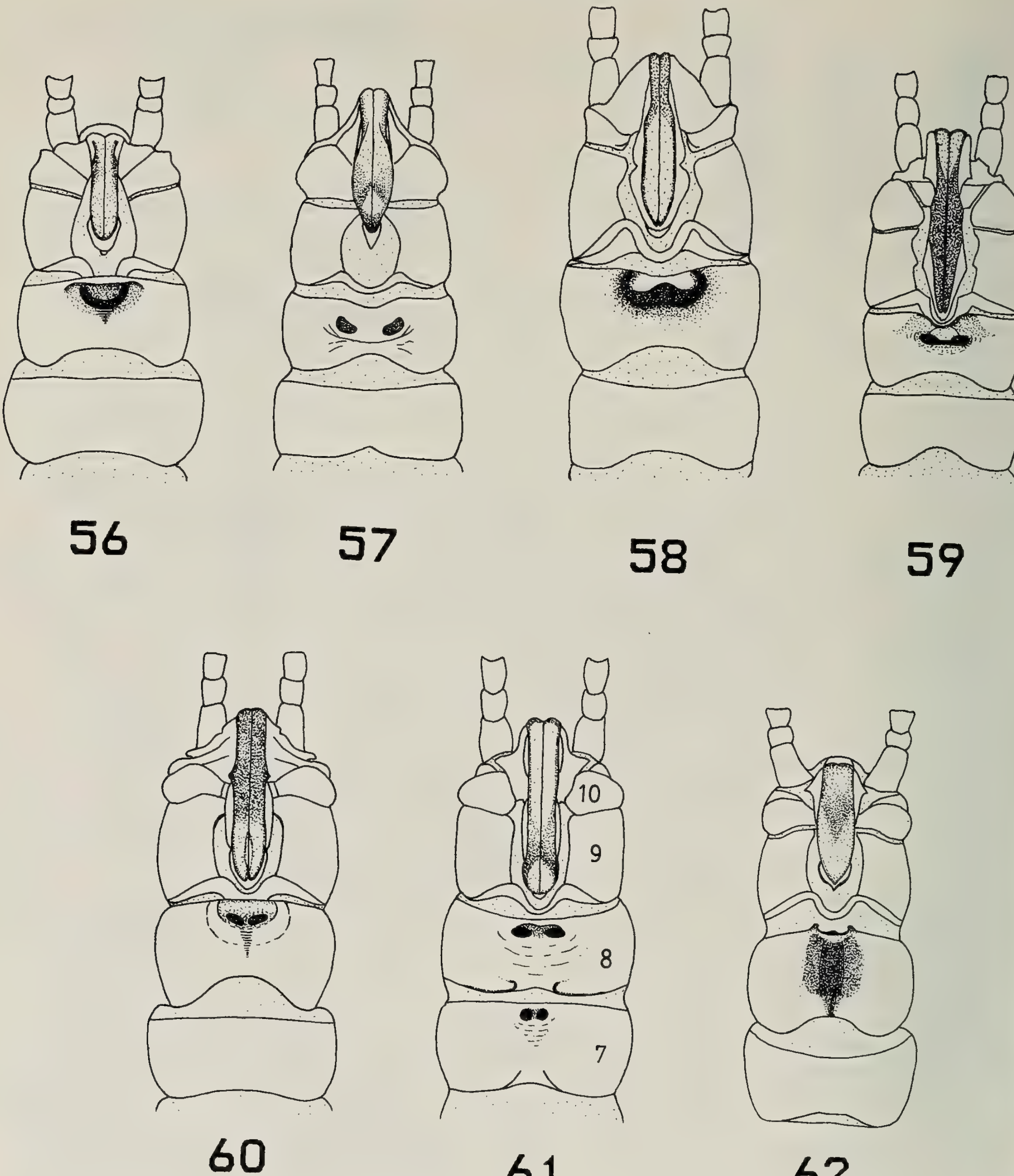

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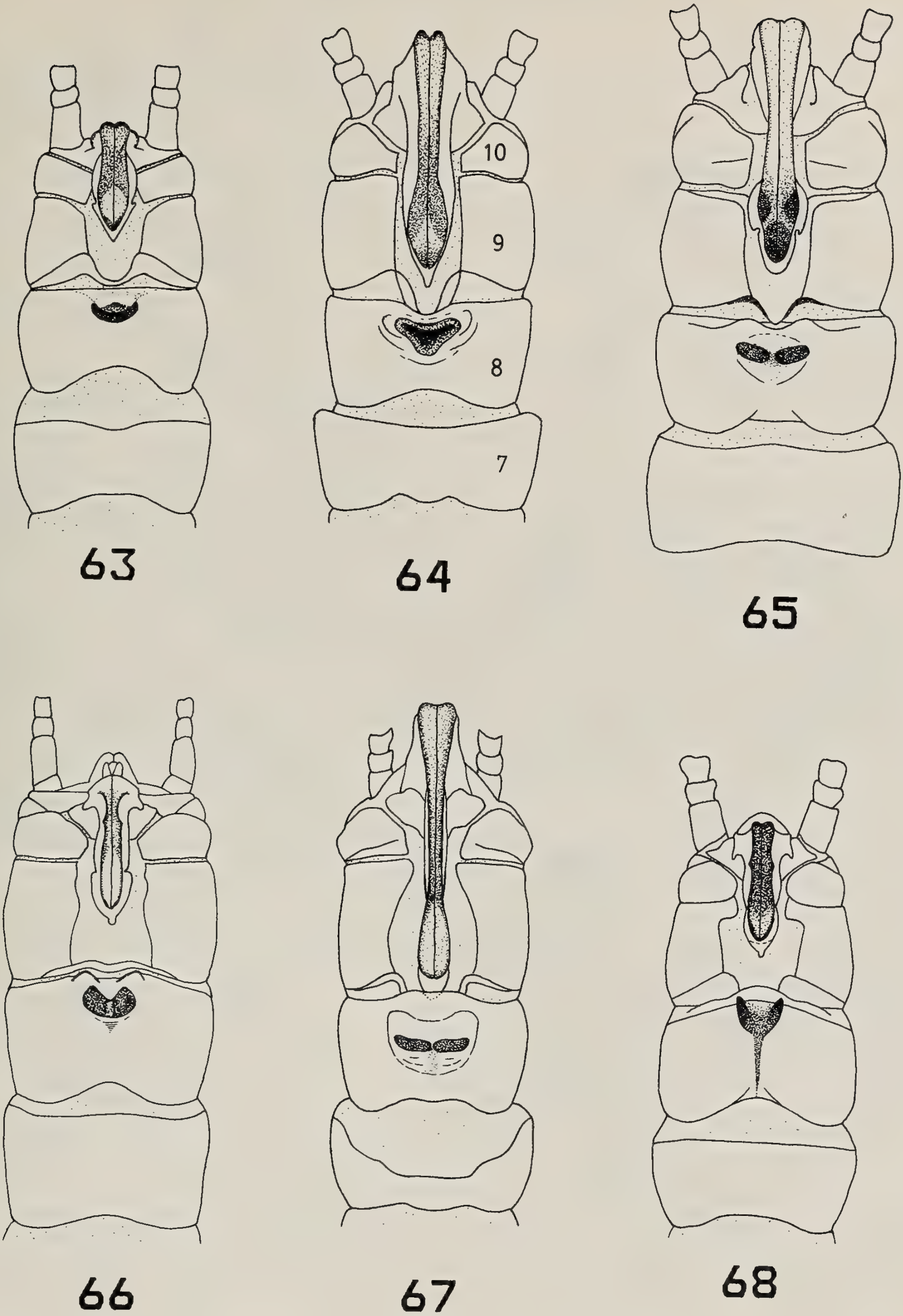

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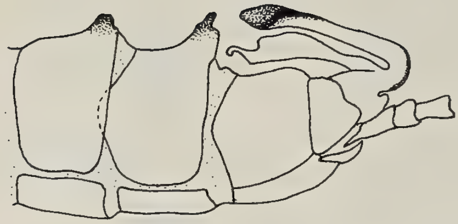

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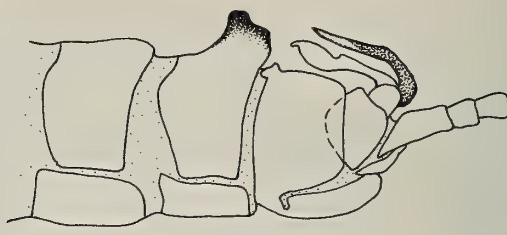

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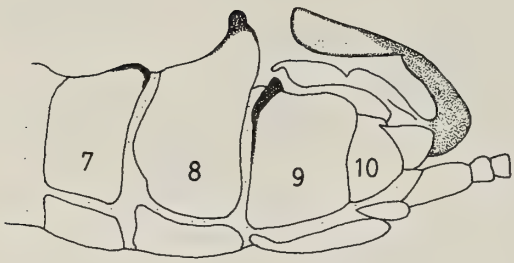

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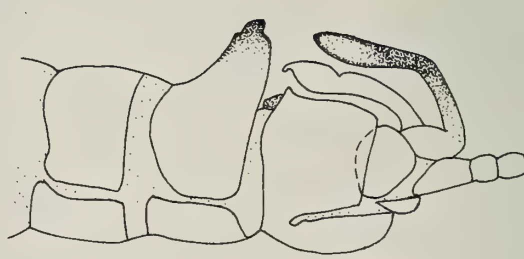

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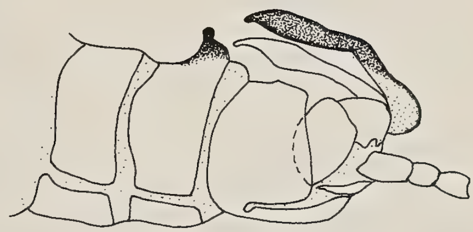

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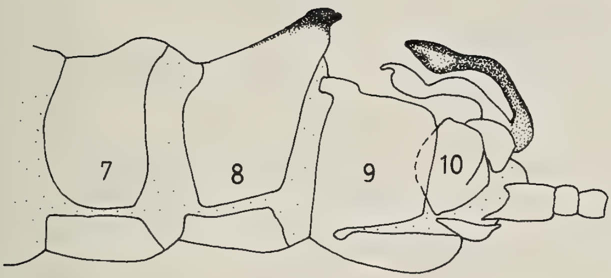

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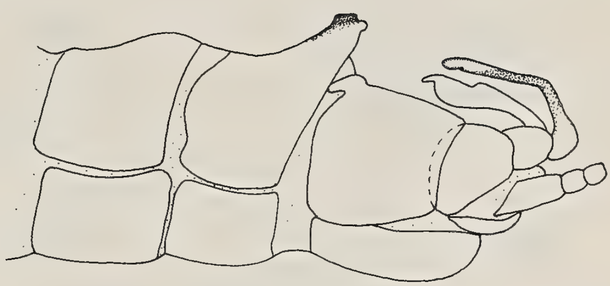

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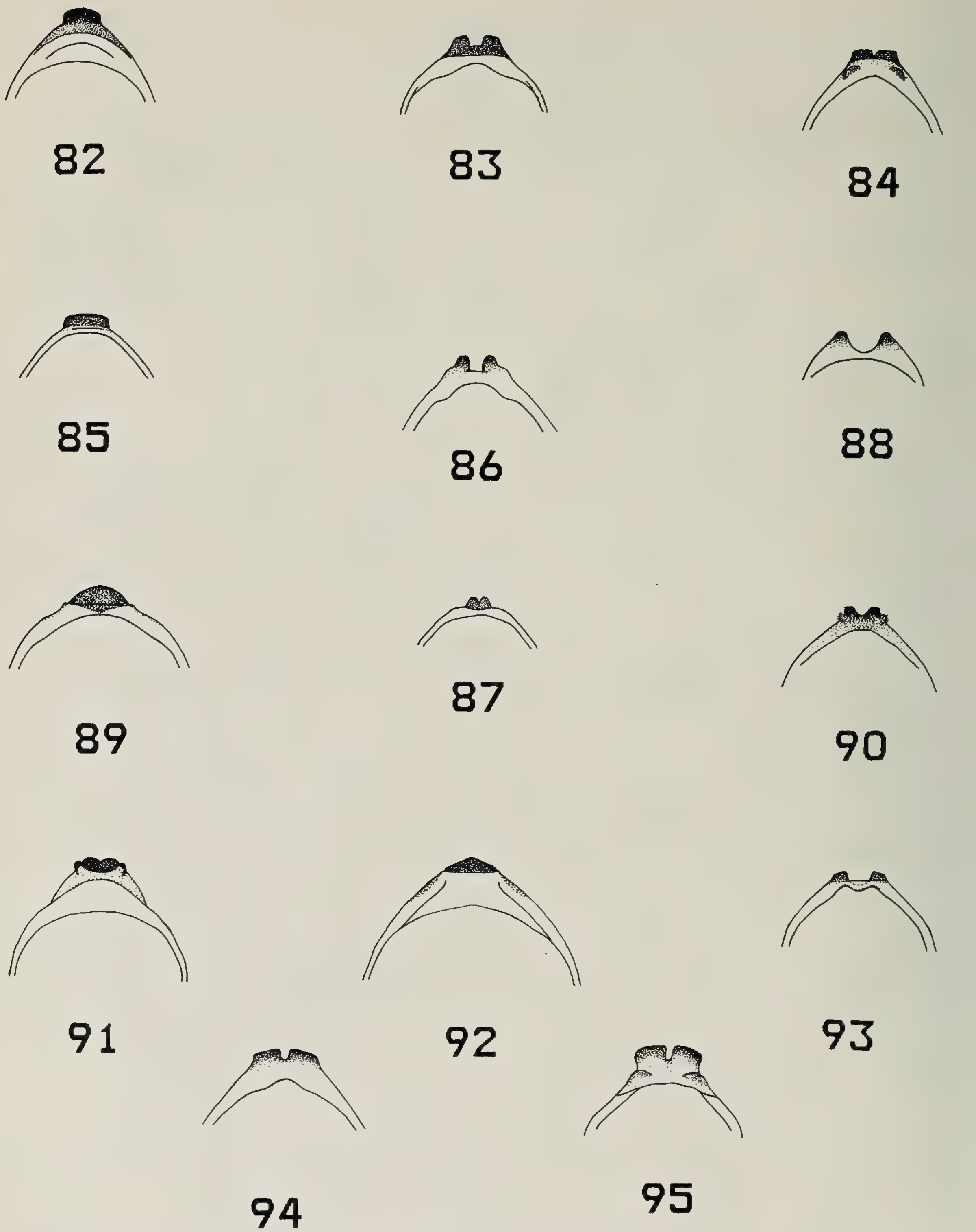

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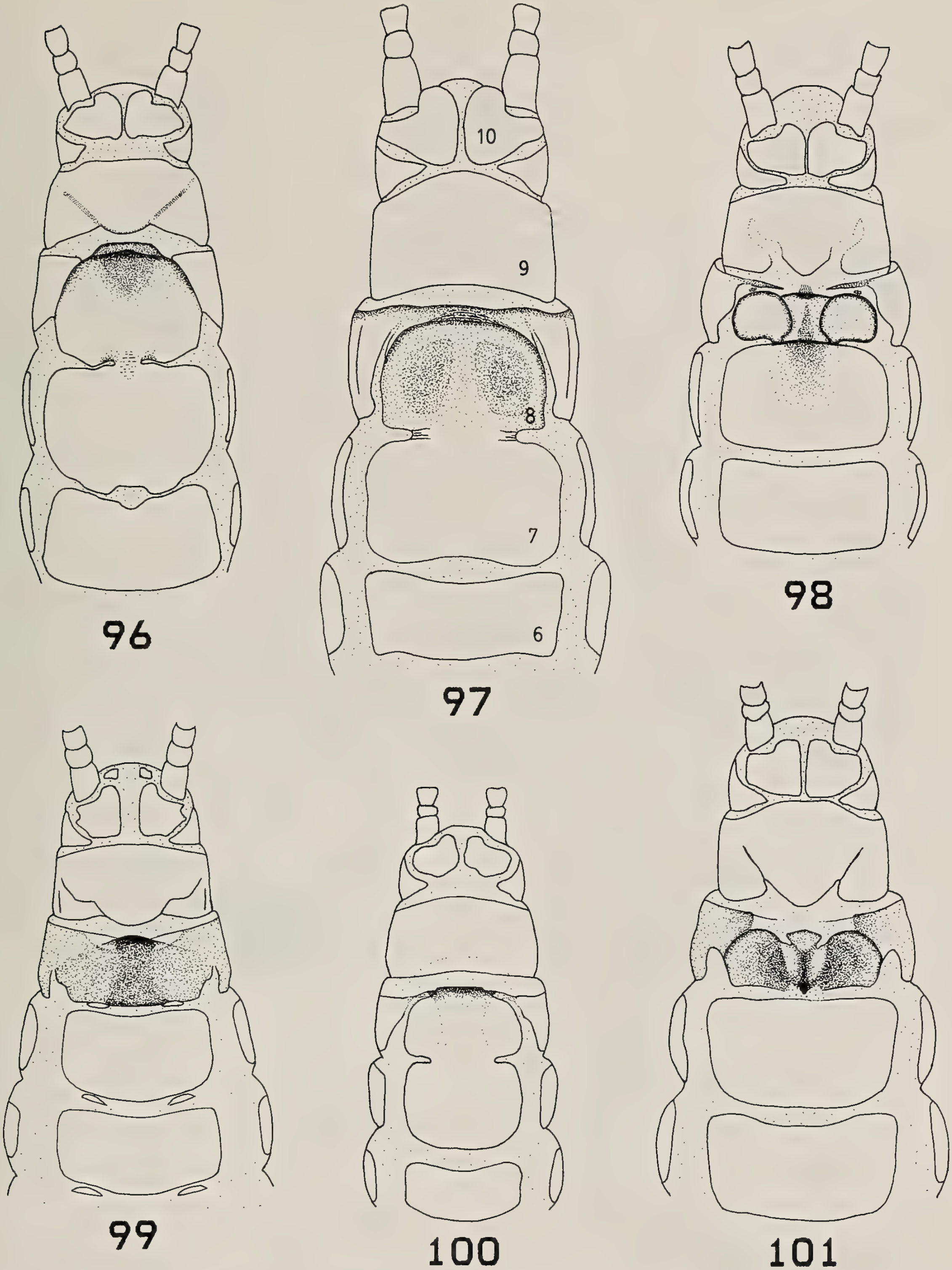

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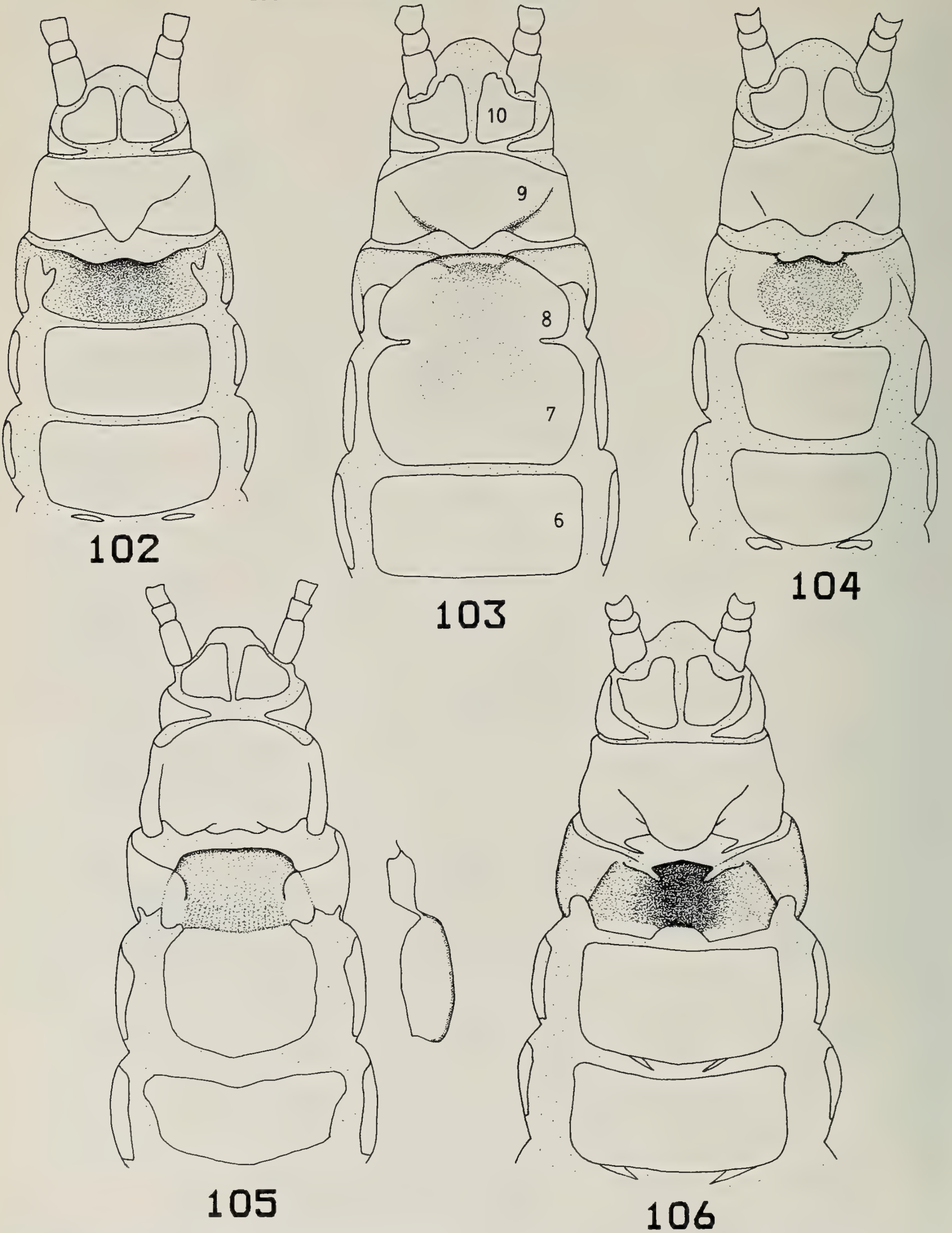

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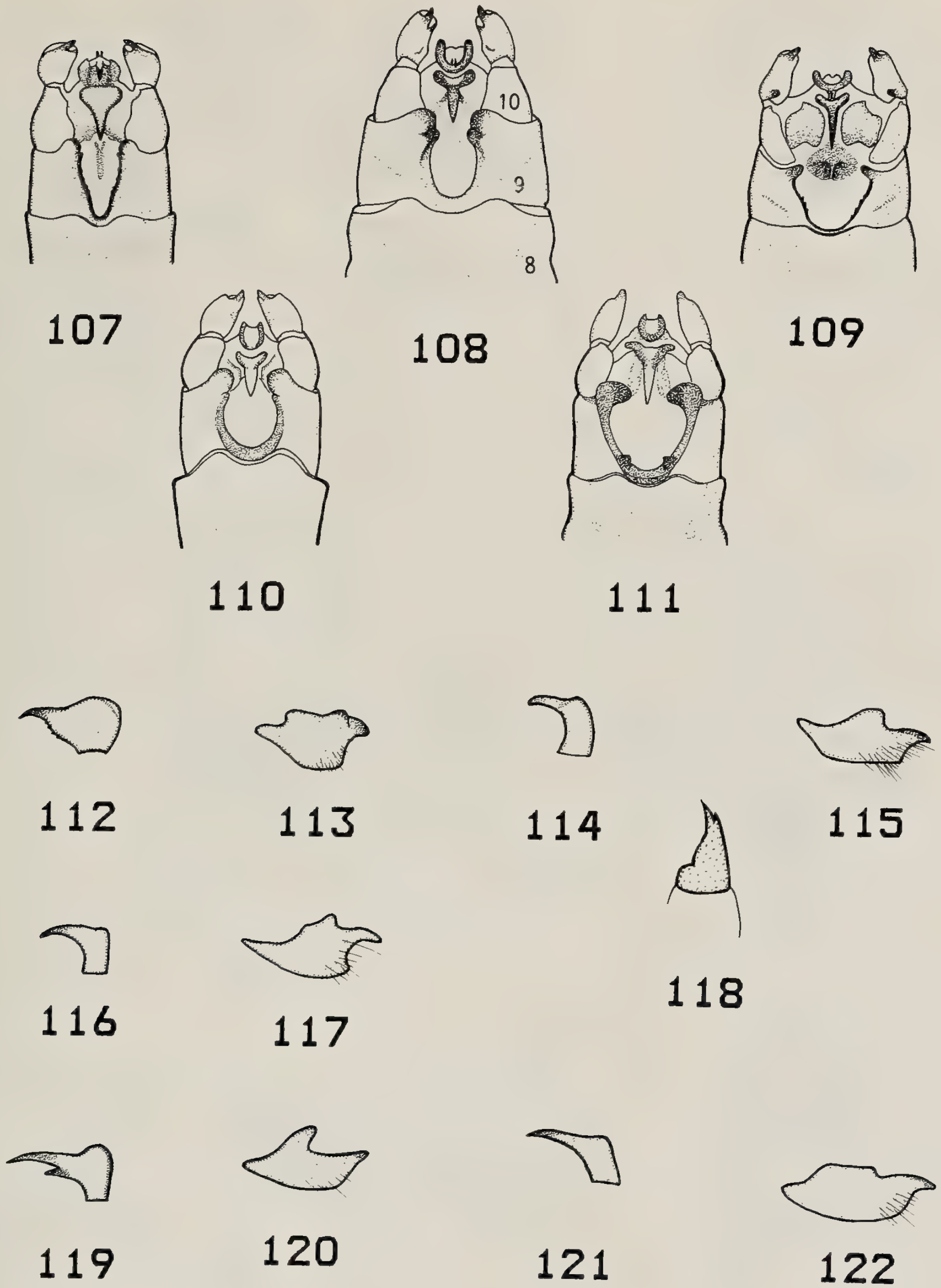

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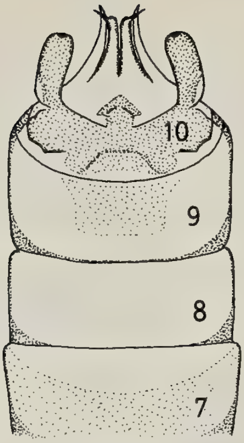

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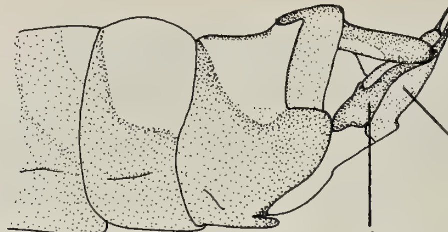

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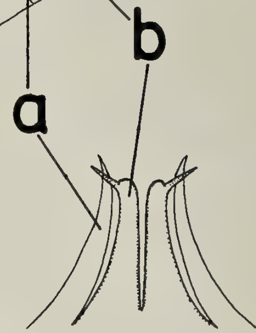

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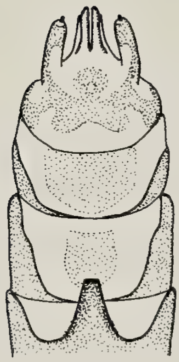

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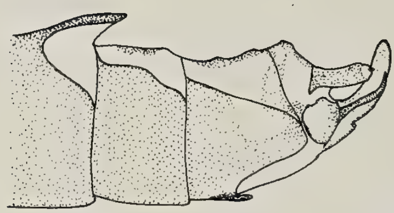

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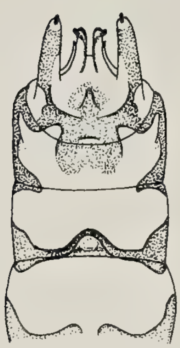

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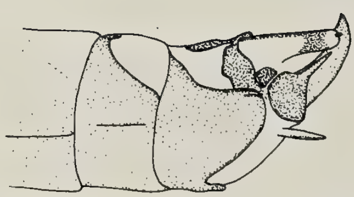

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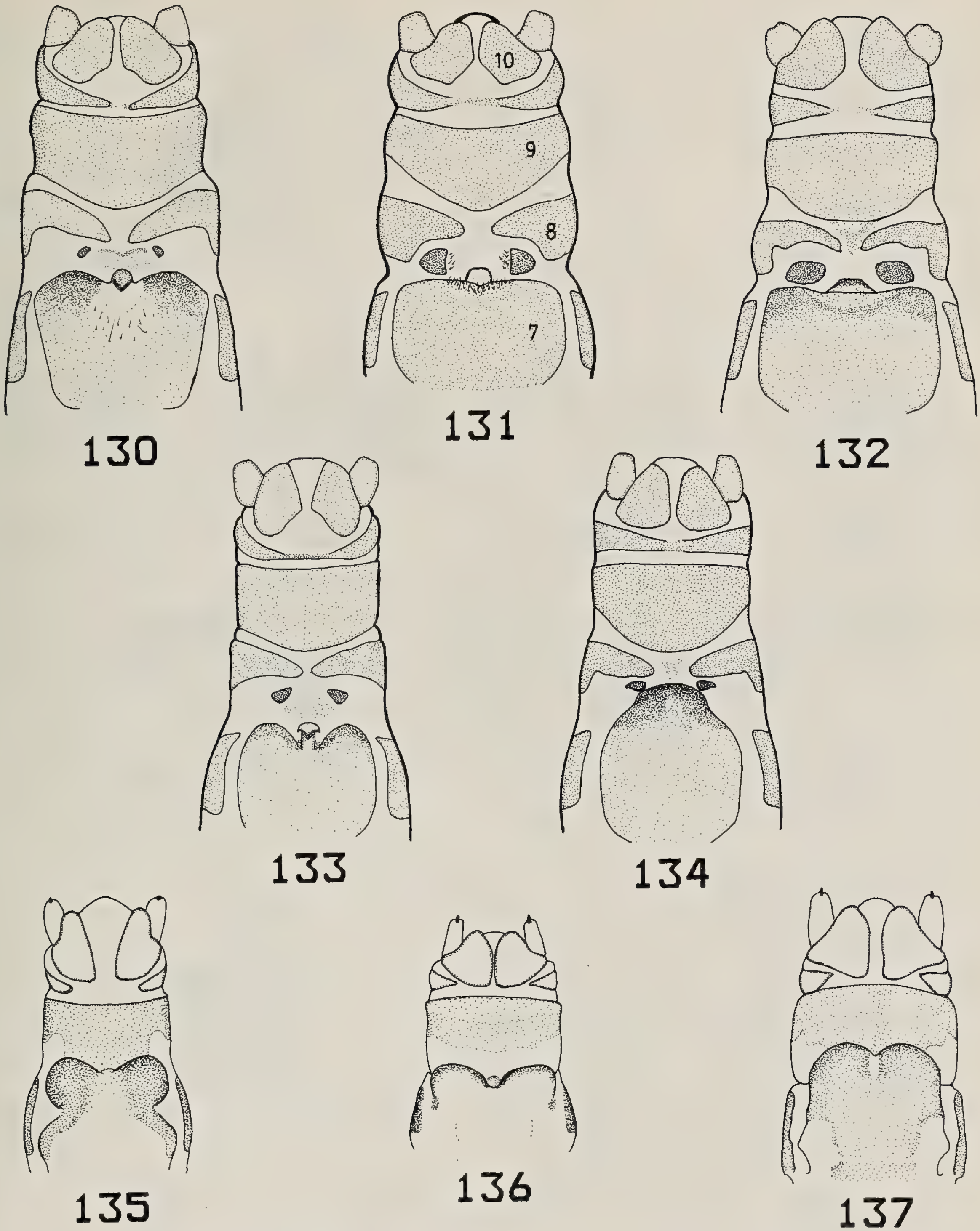

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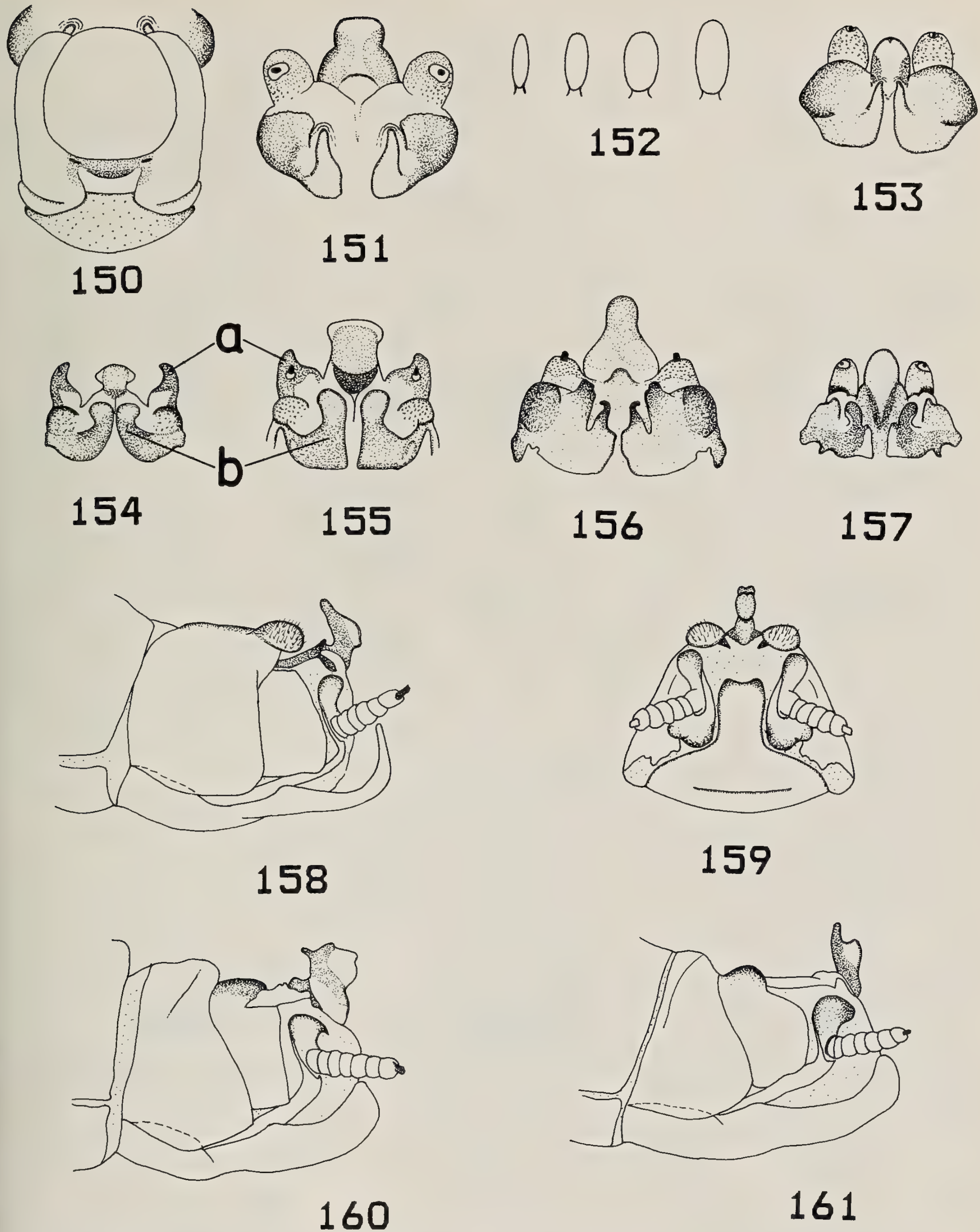

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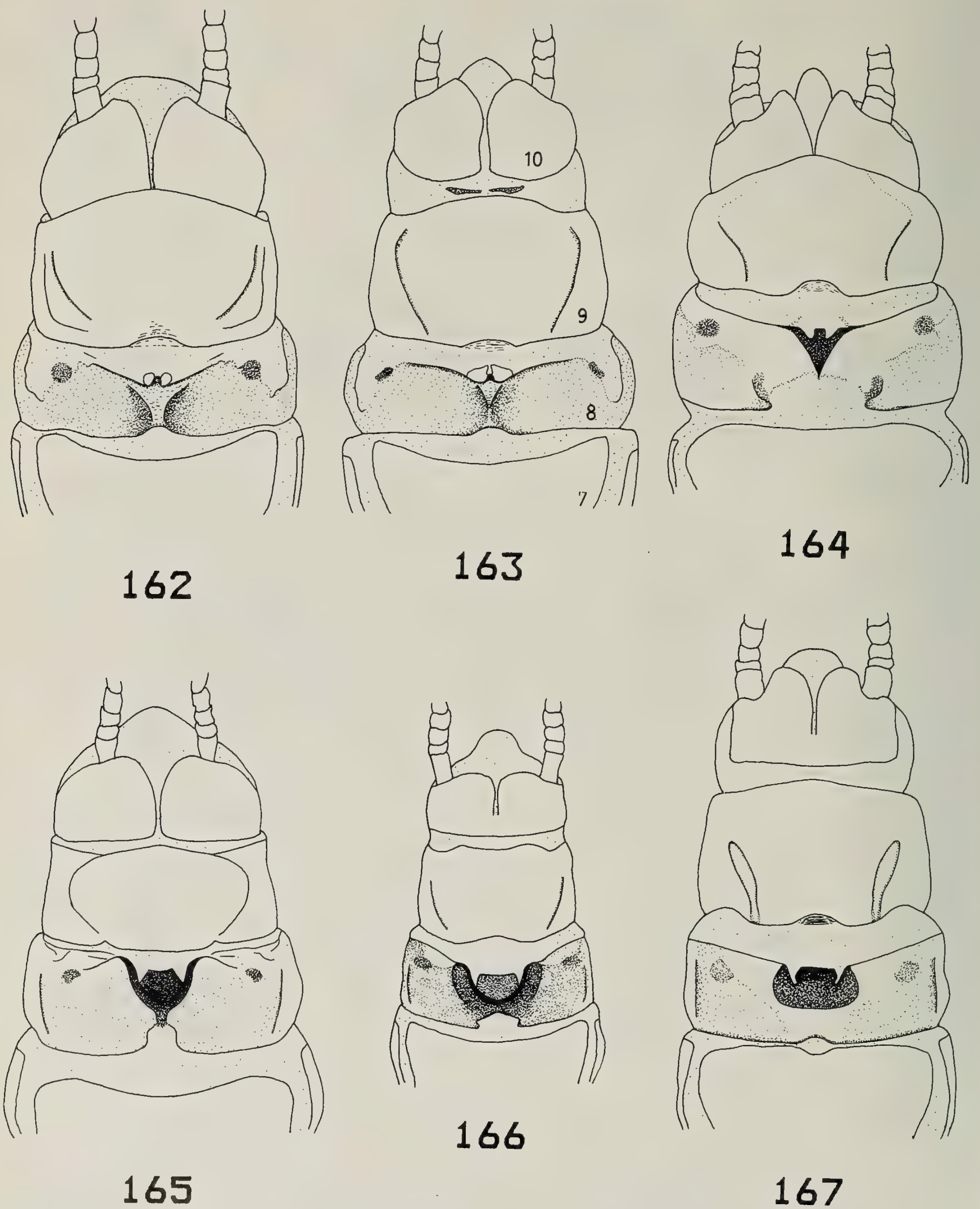

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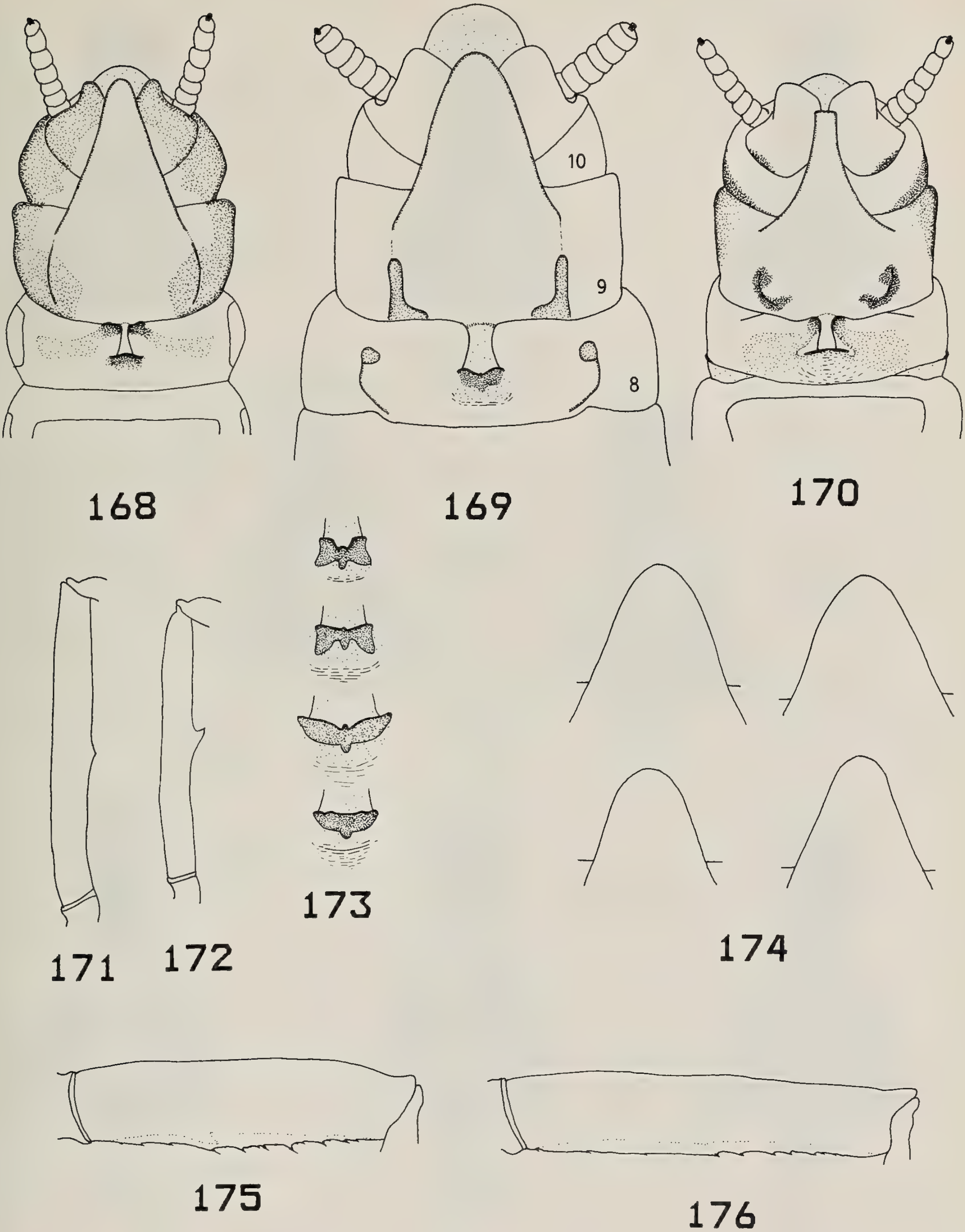

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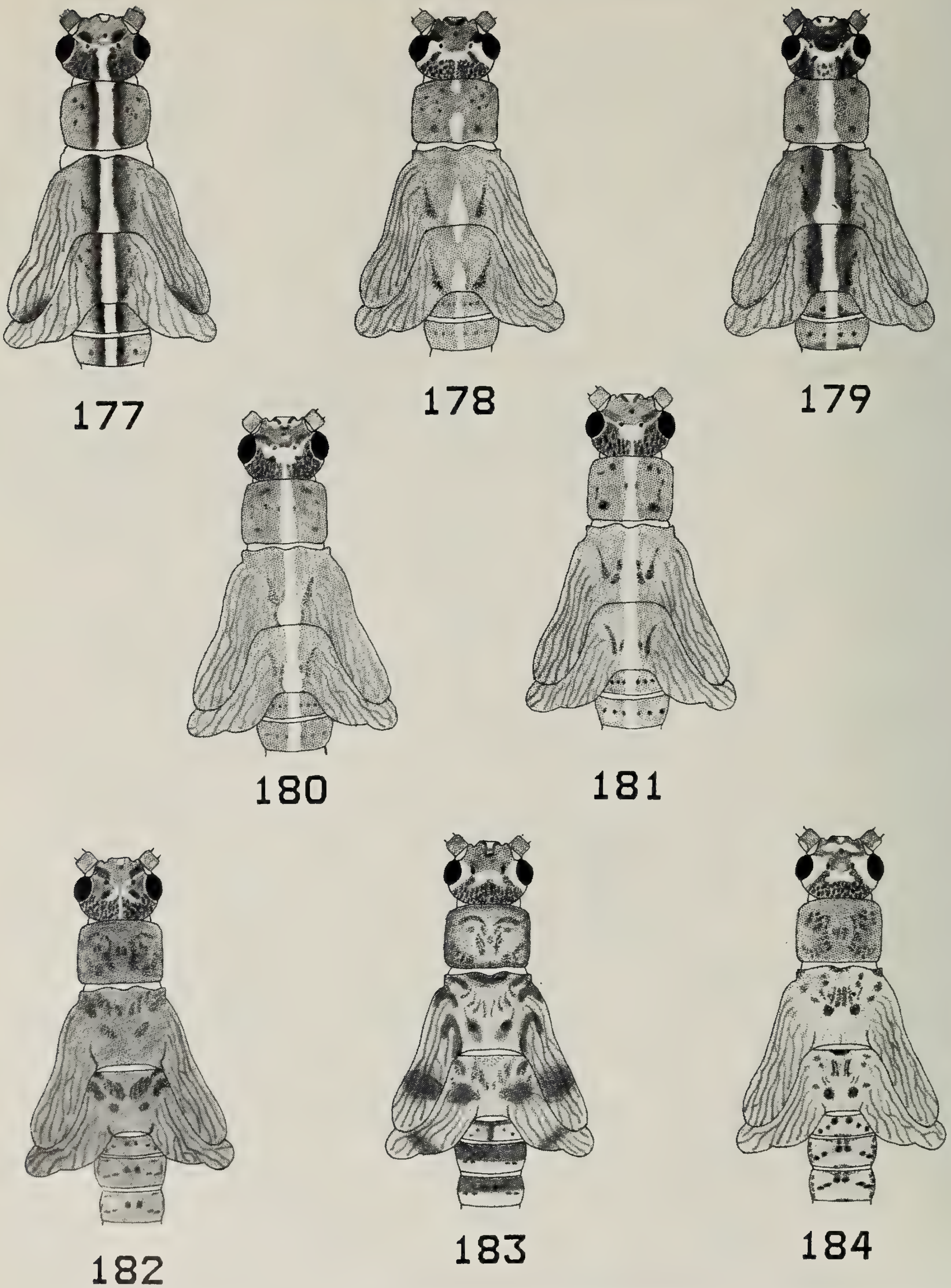

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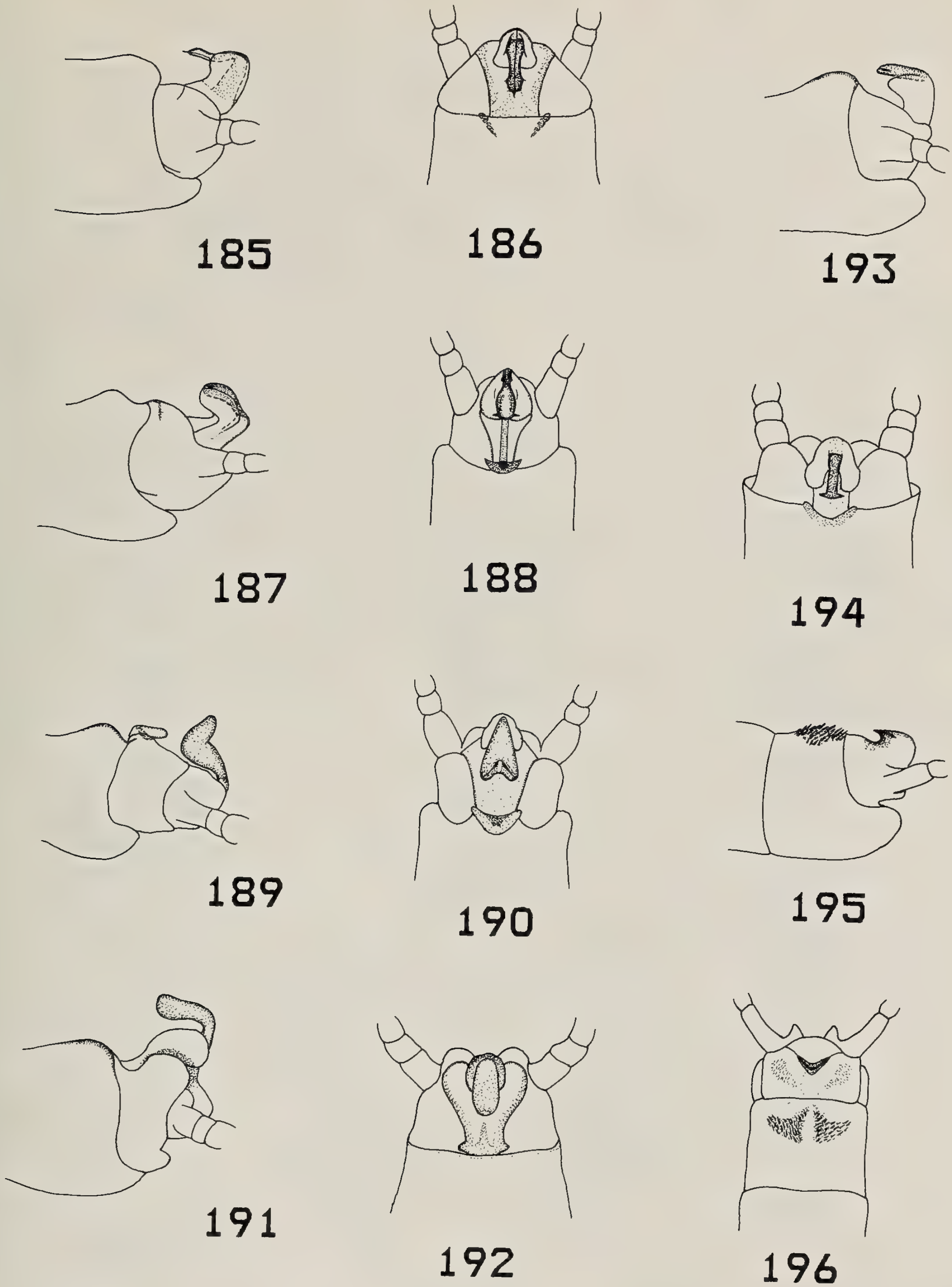

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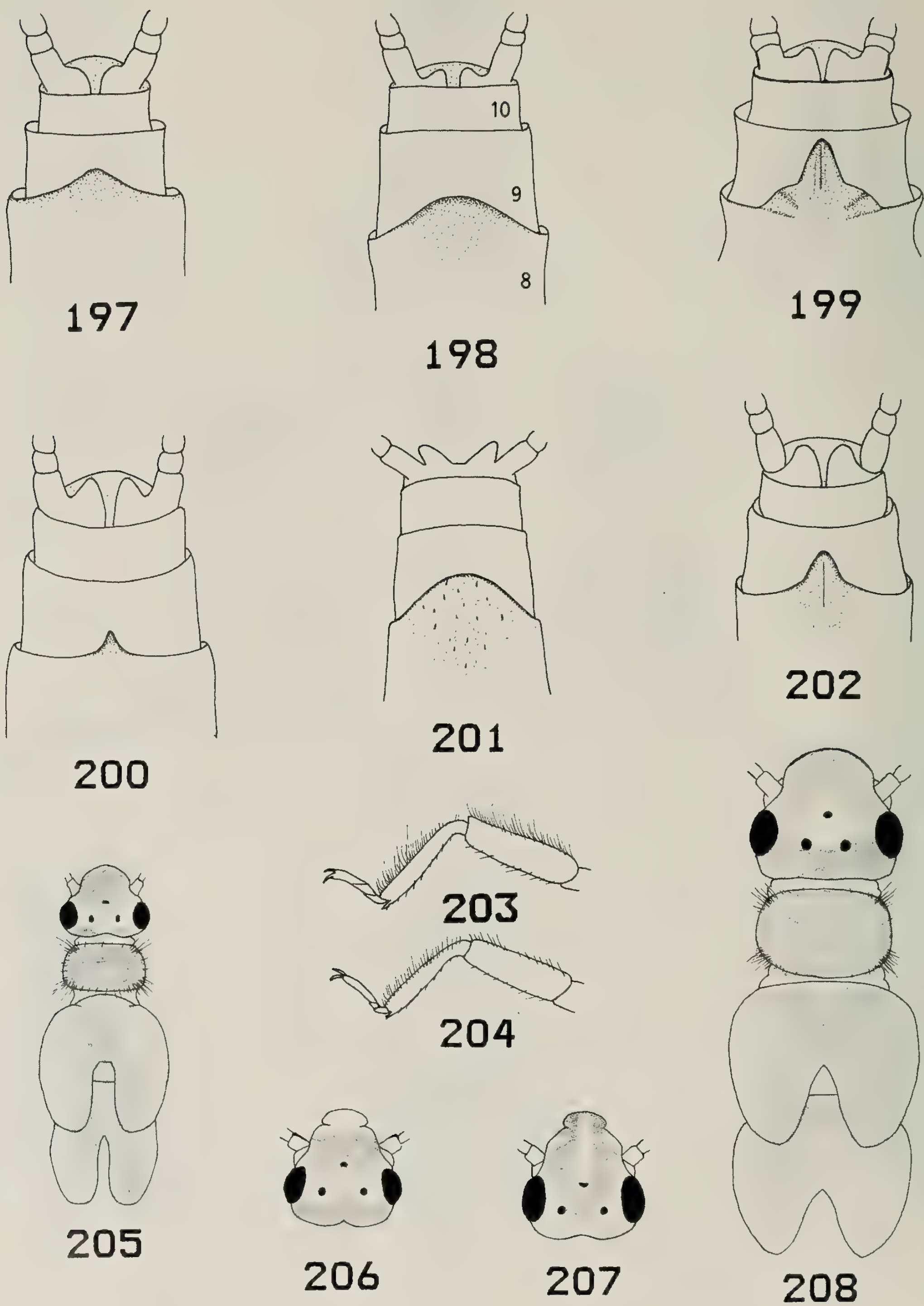

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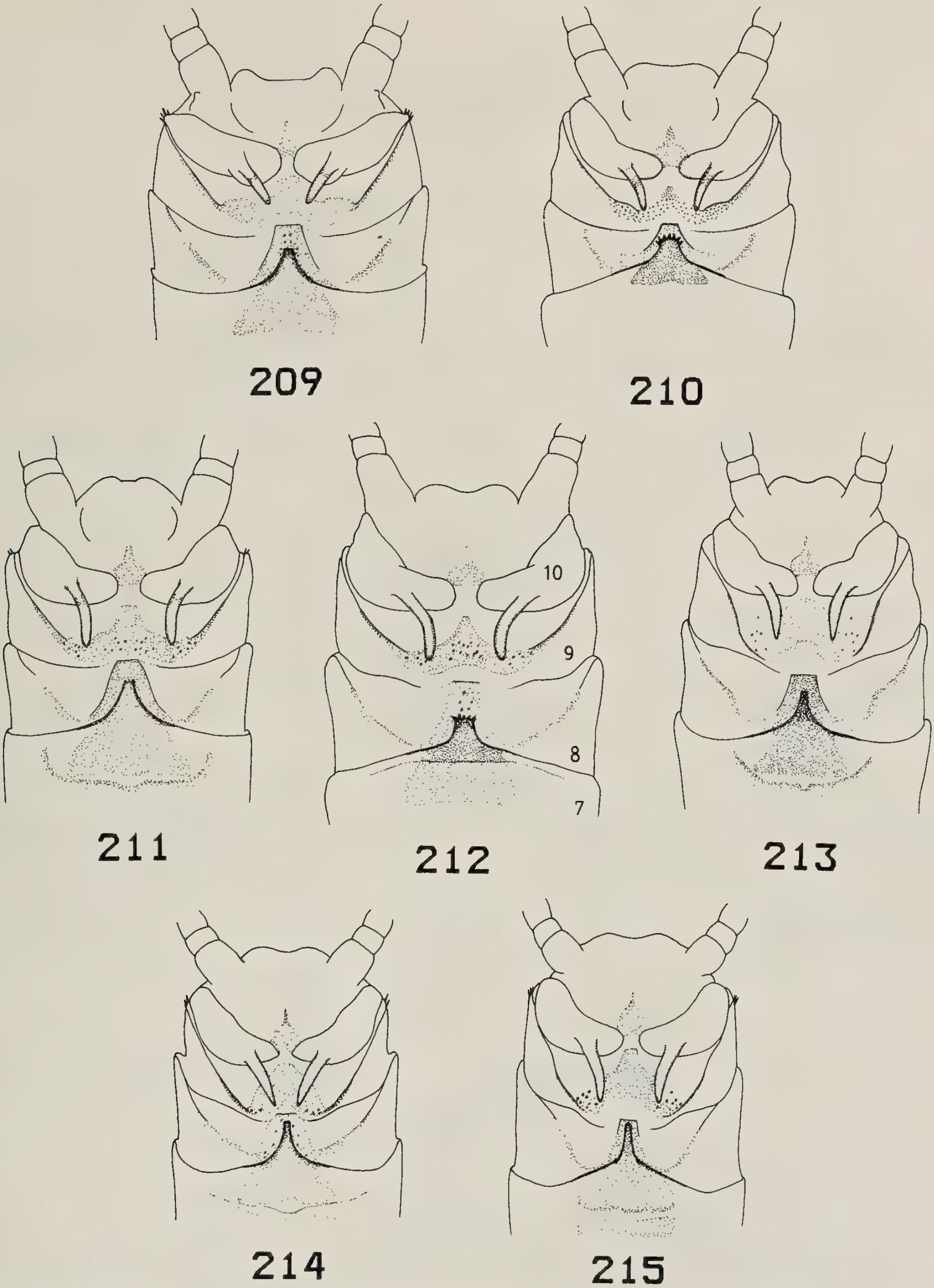

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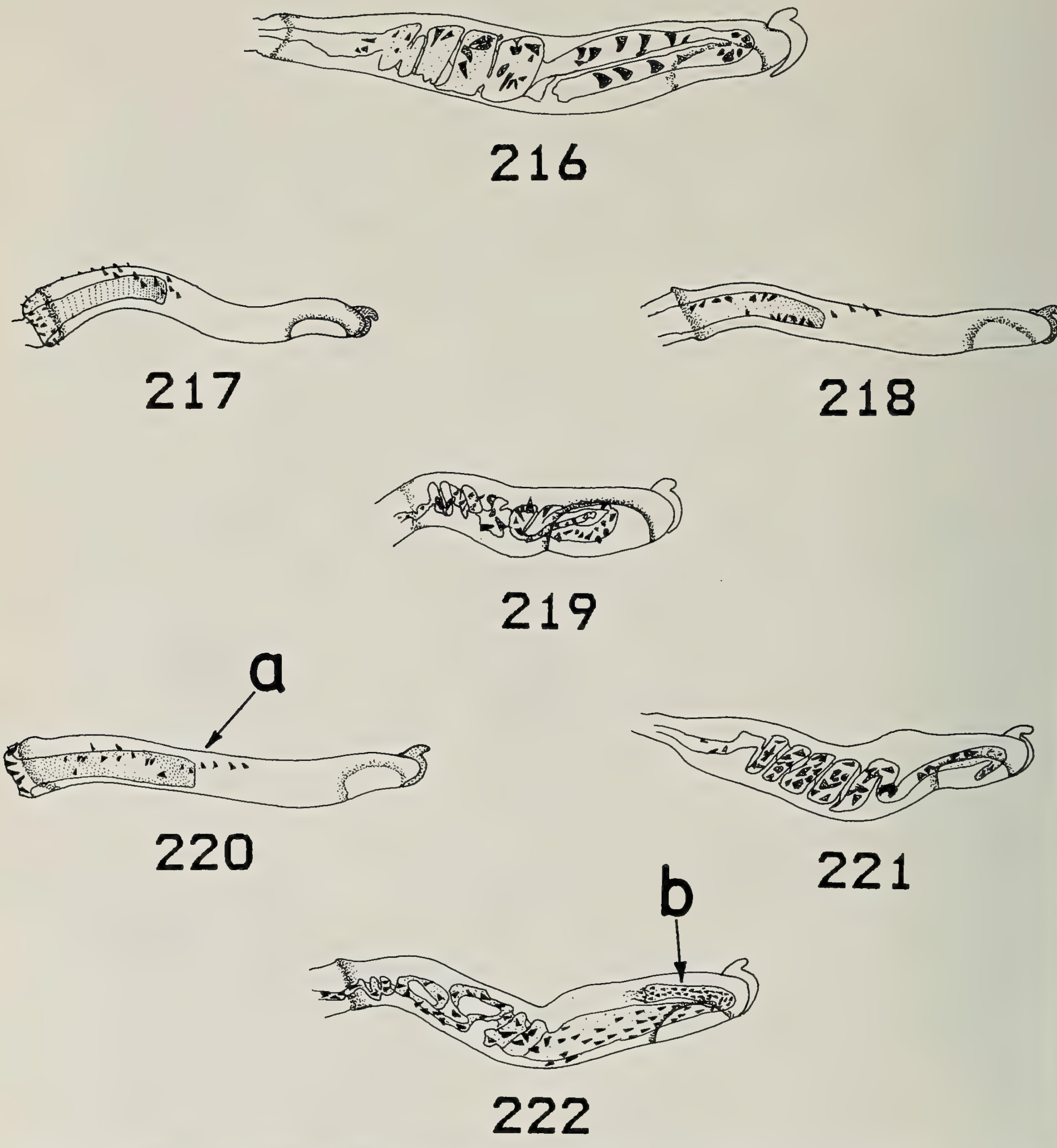

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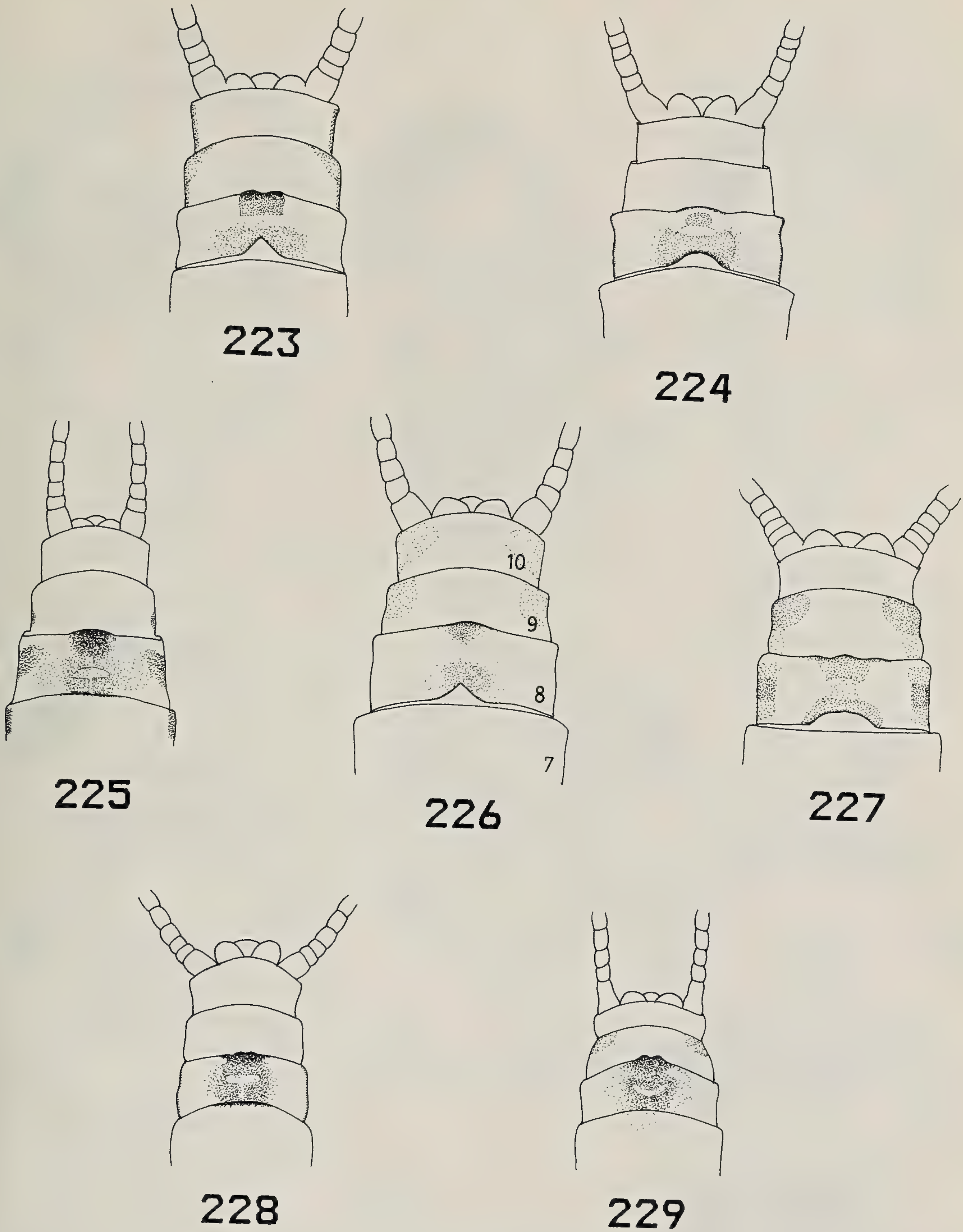

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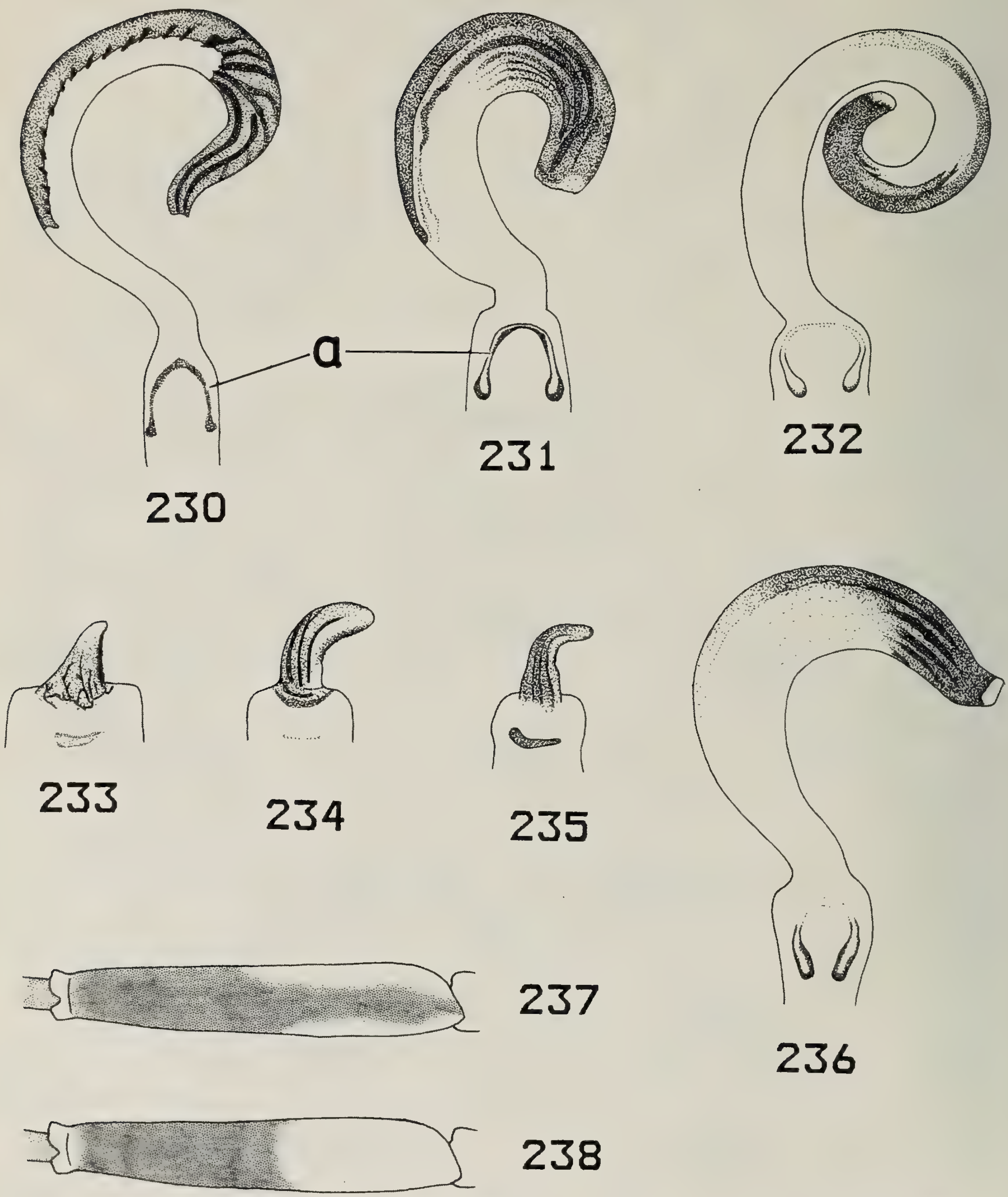

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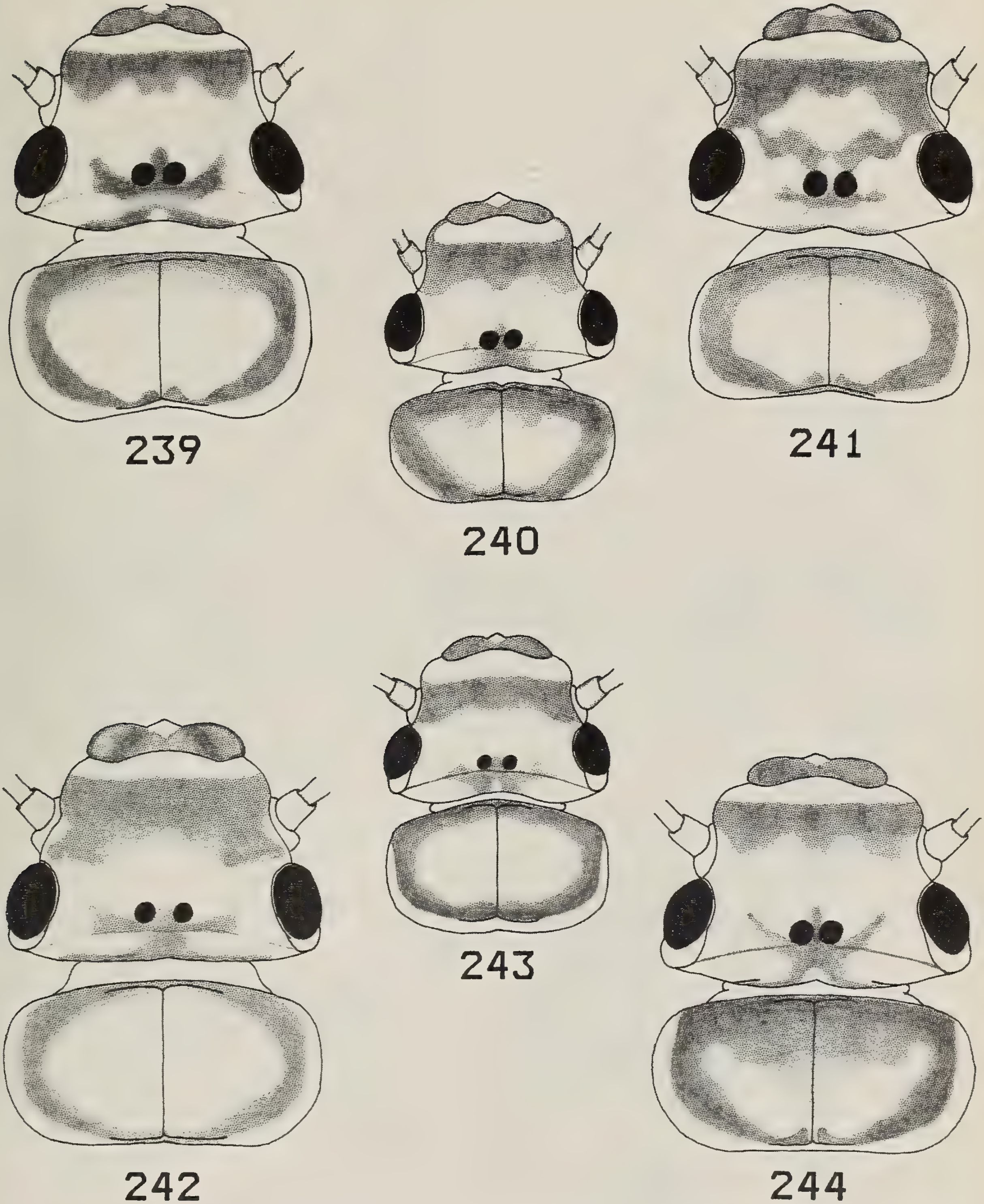

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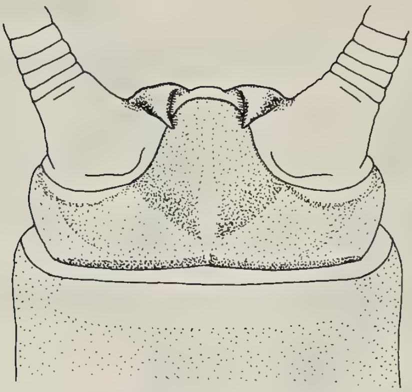

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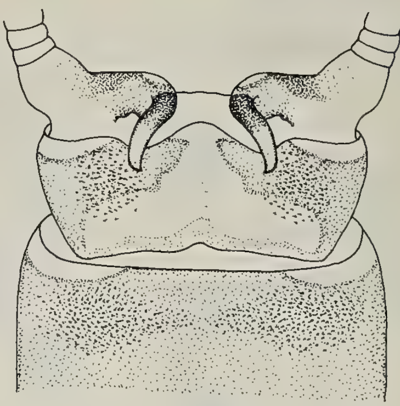

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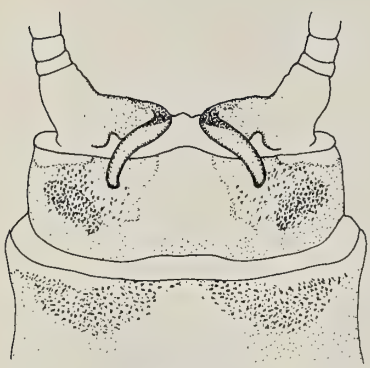

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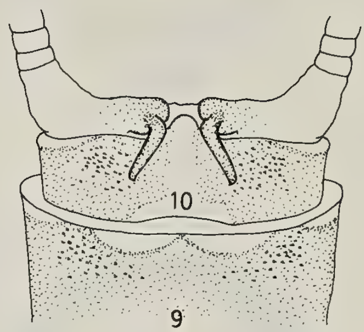

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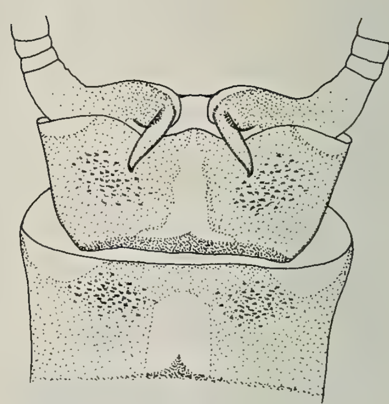

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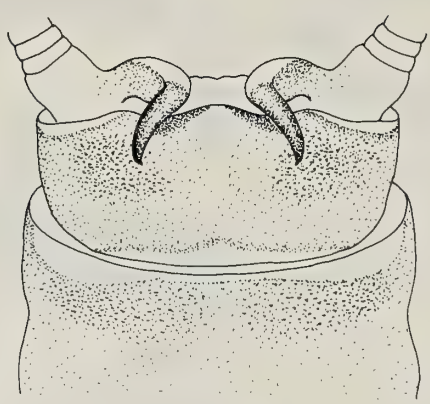

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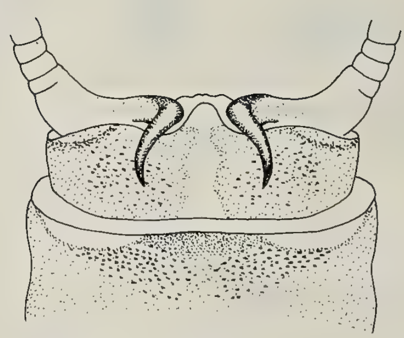

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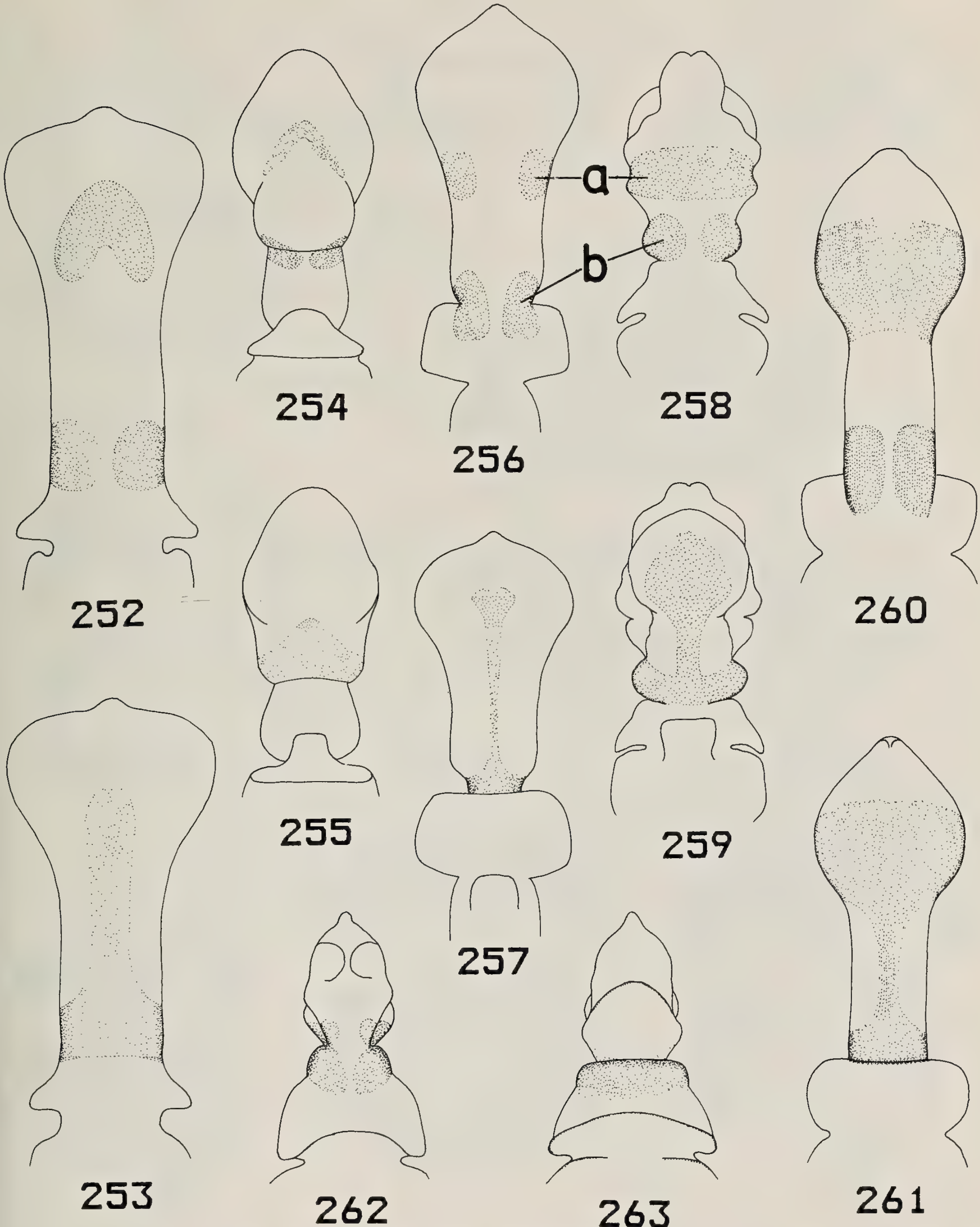
Figs. 245-251. Perlidae male terminal abdominal terga. 245. *Attaneuria ruralis*. 246. *Acroneuria ozarkensis*. 247. *A. evoluta*. 248. *A. internata*. 249. *A. perplexa*. 250. *A. mela*. 251. *A. filicis*.



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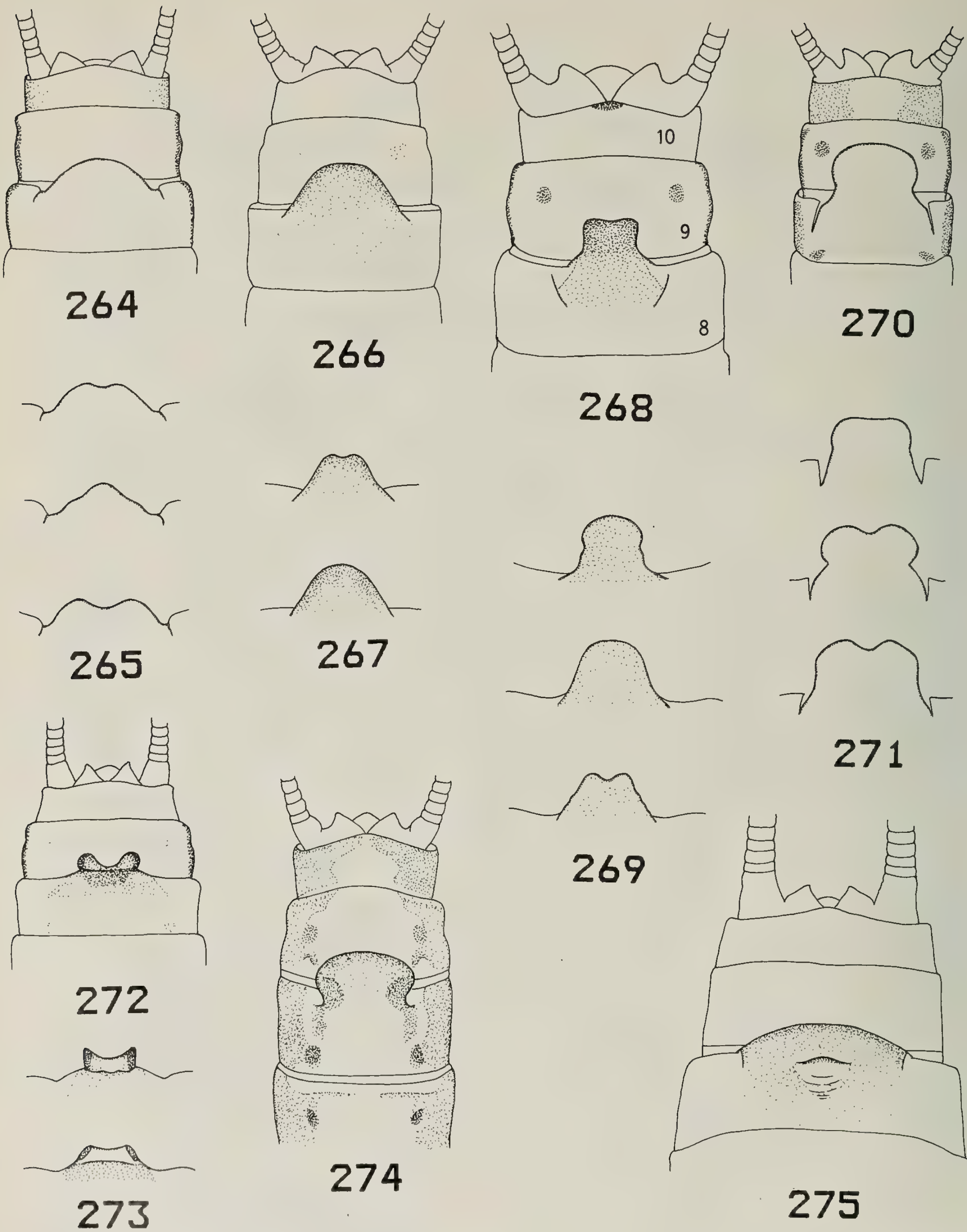

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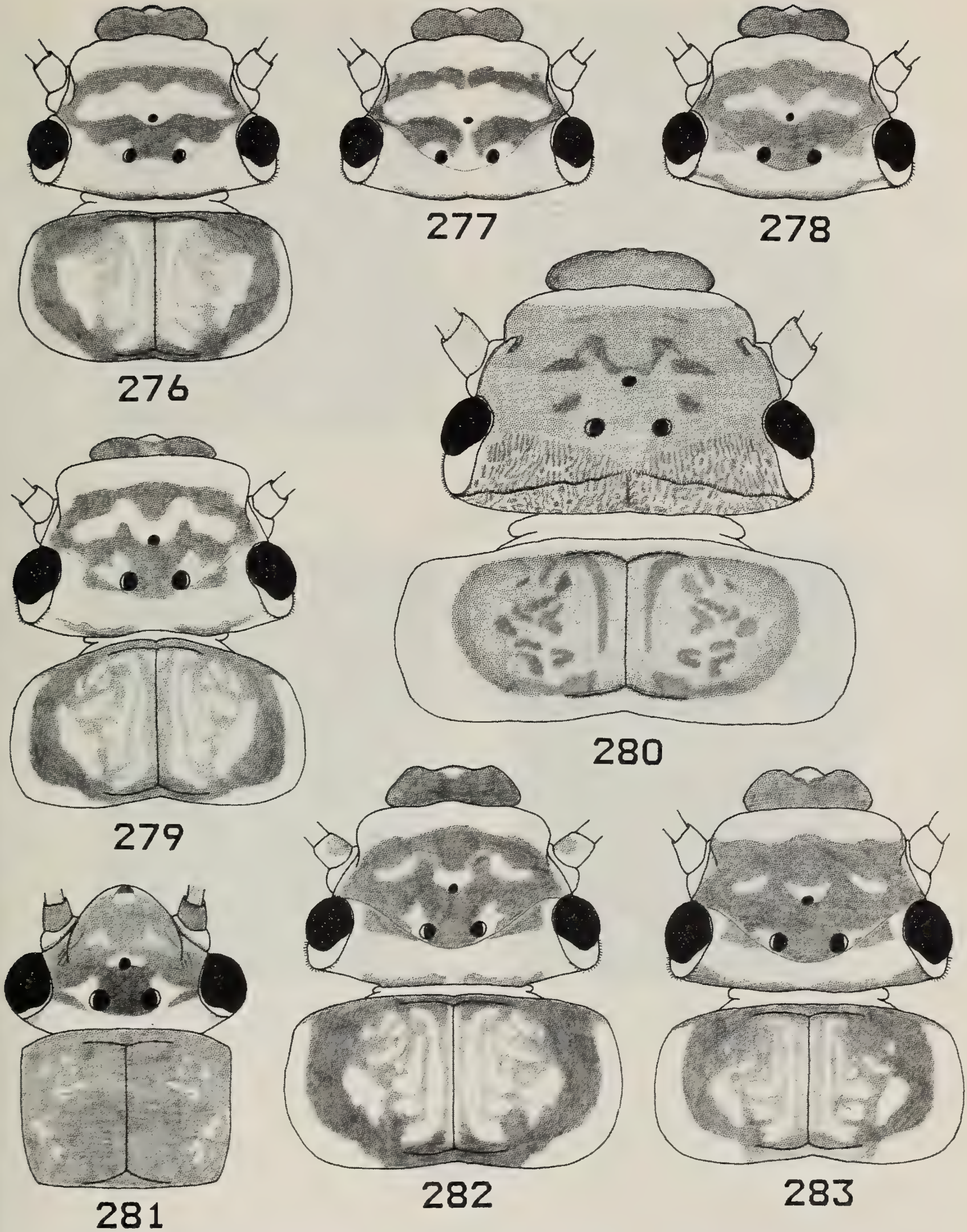

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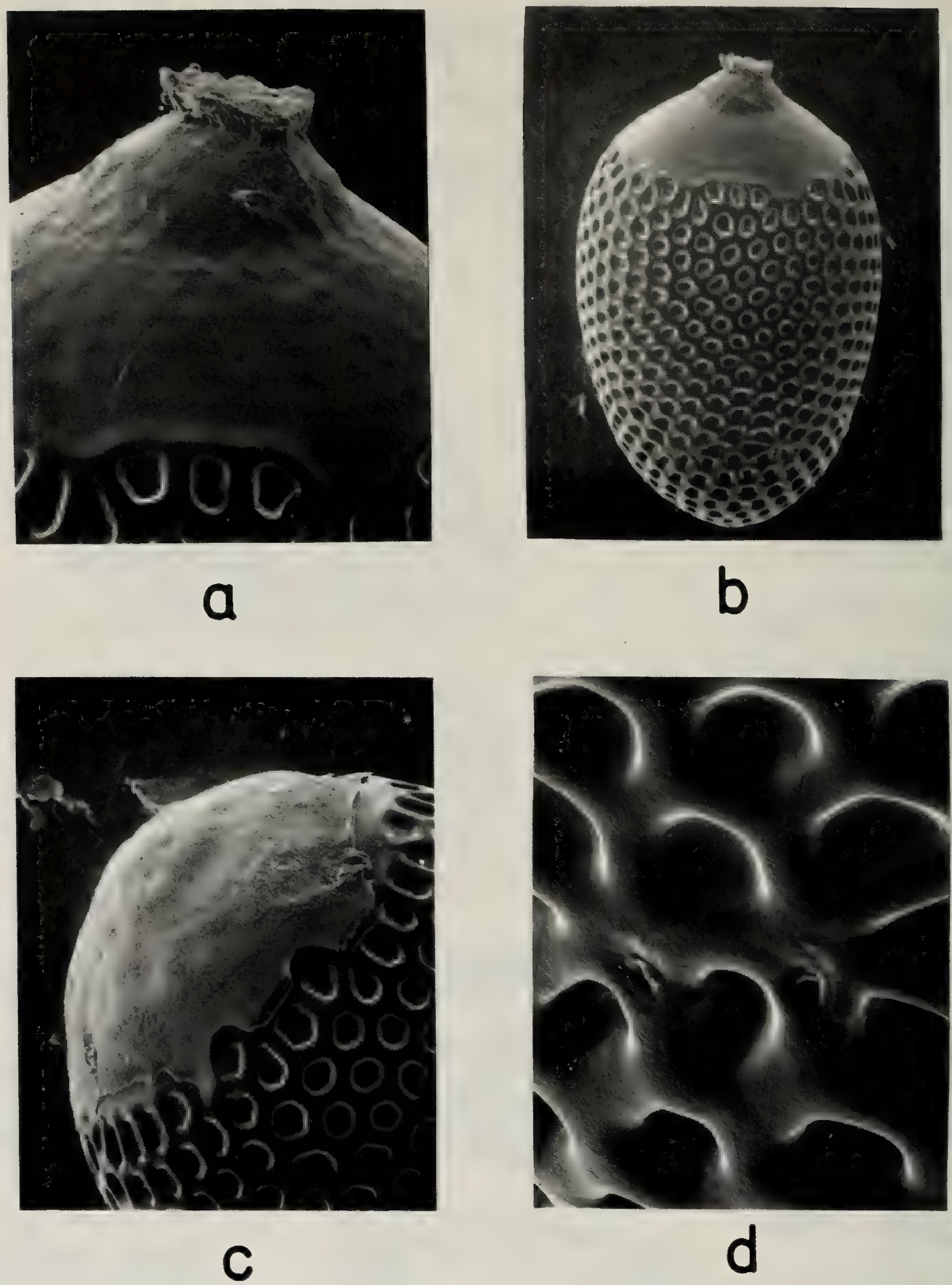

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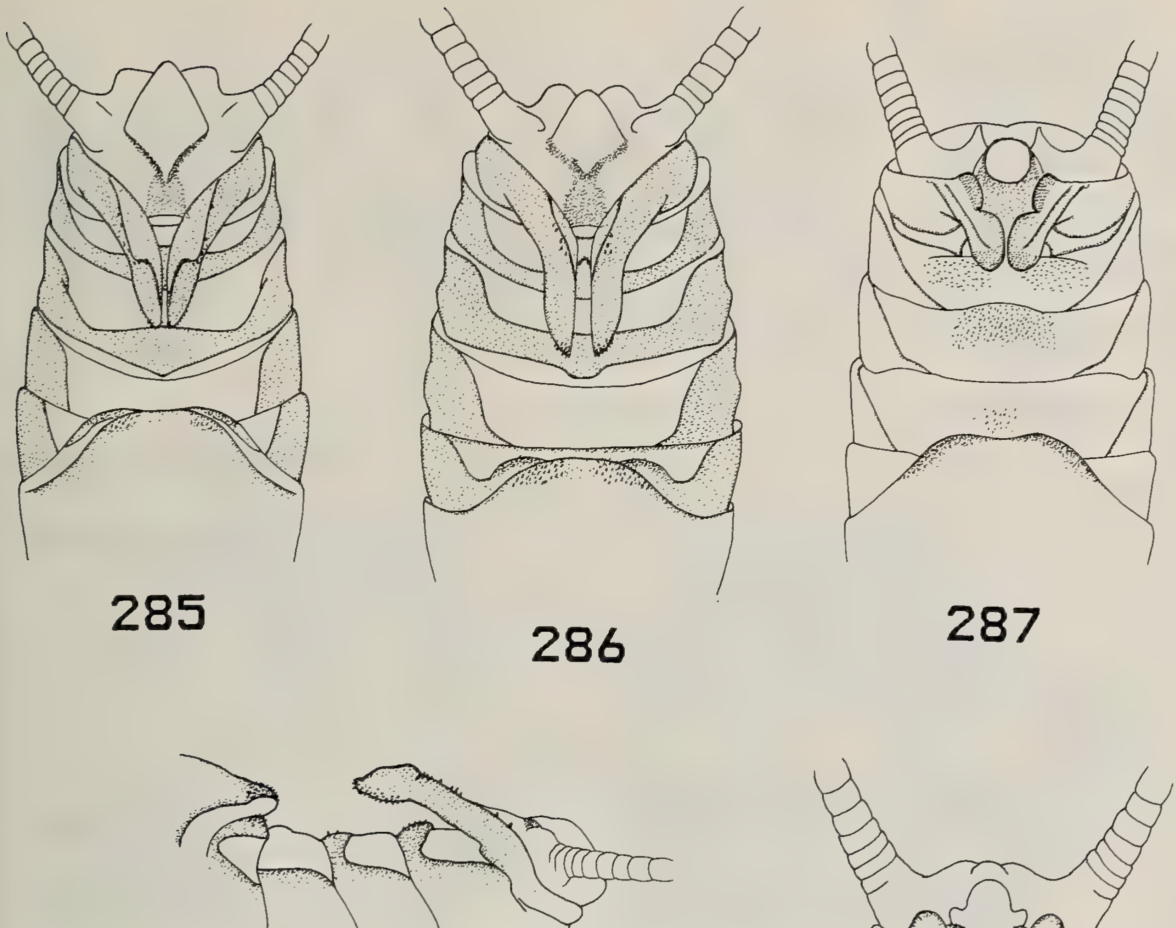
Figs. 284a-d. Egg of *A. ozarkensis*. a. 500X. b. 170X. c. 300X. d. 1300X.



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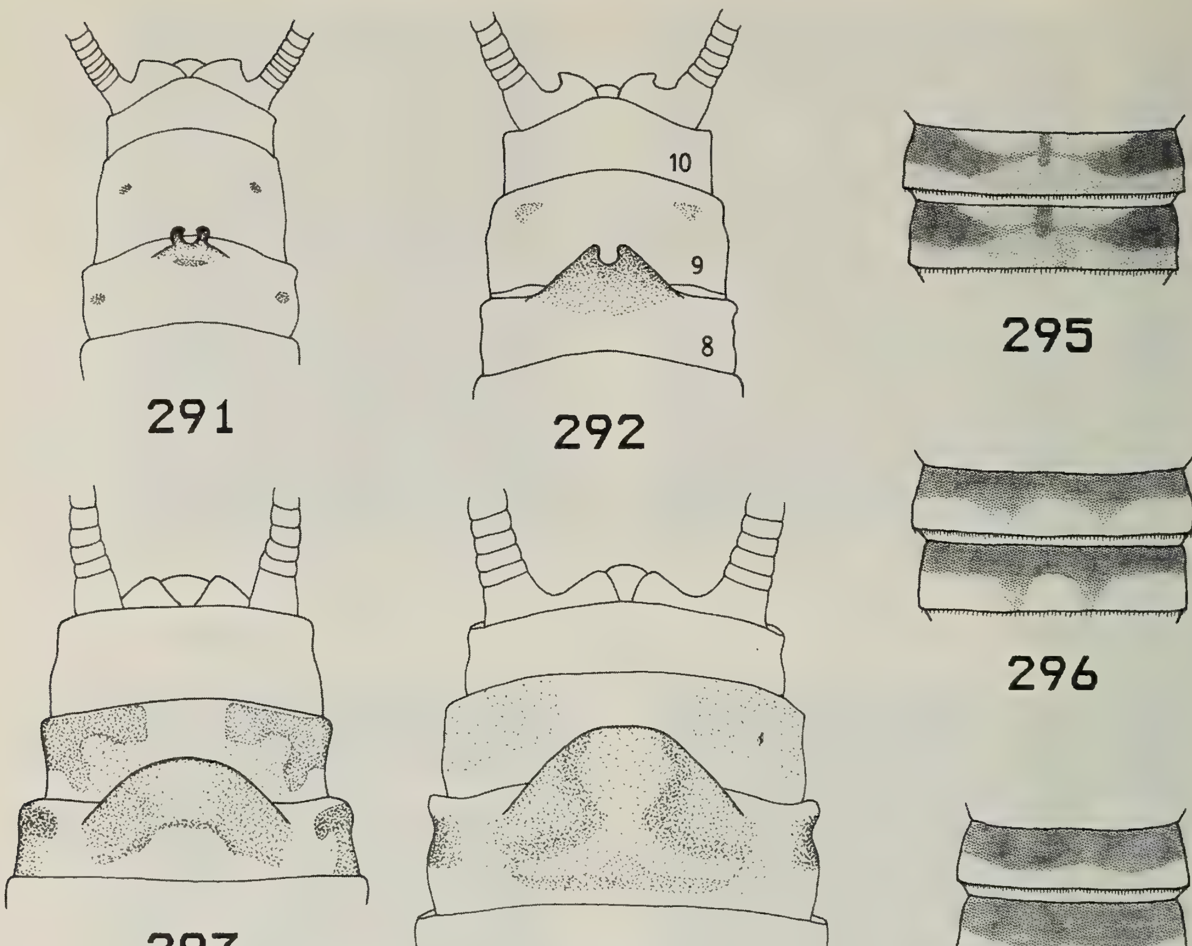
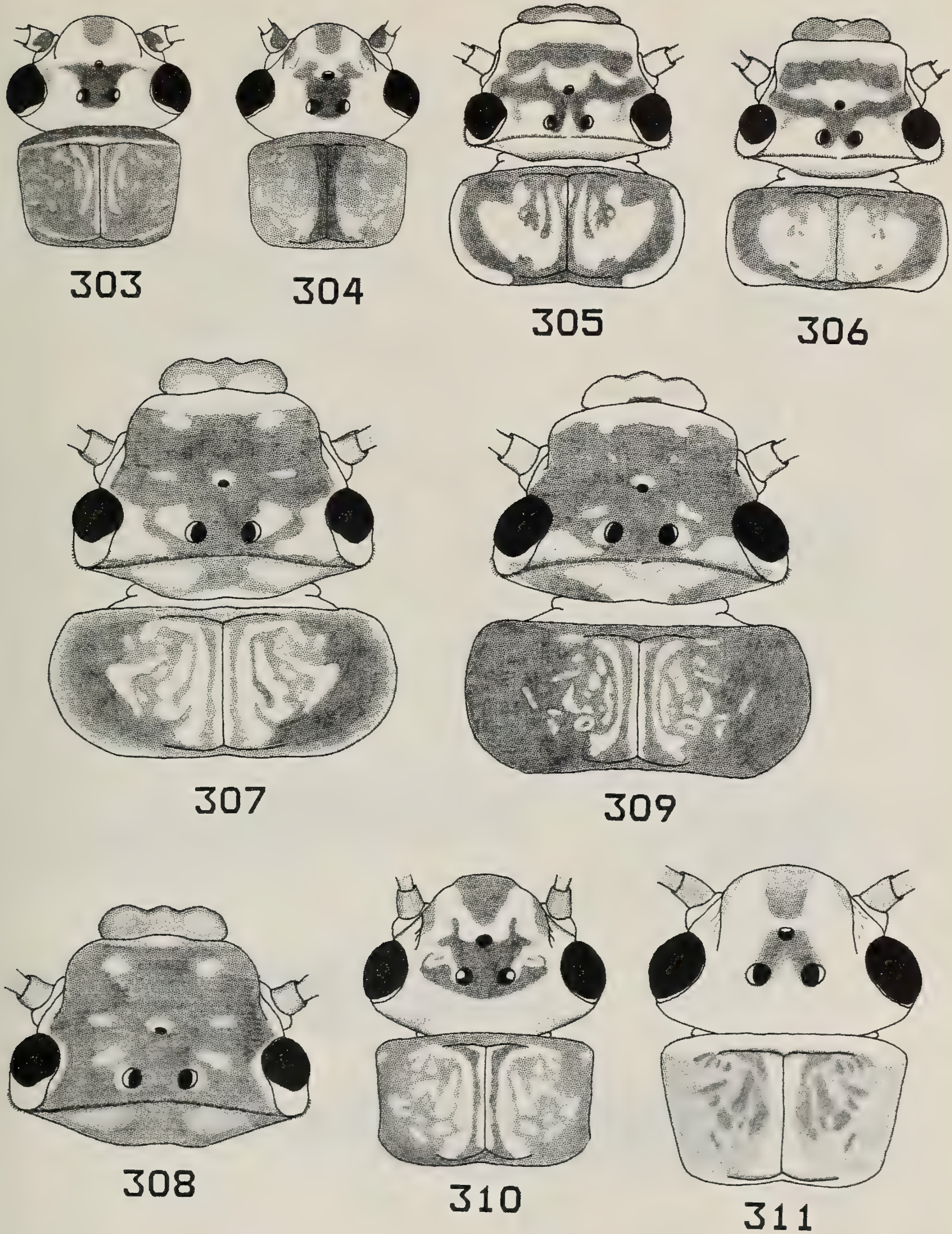
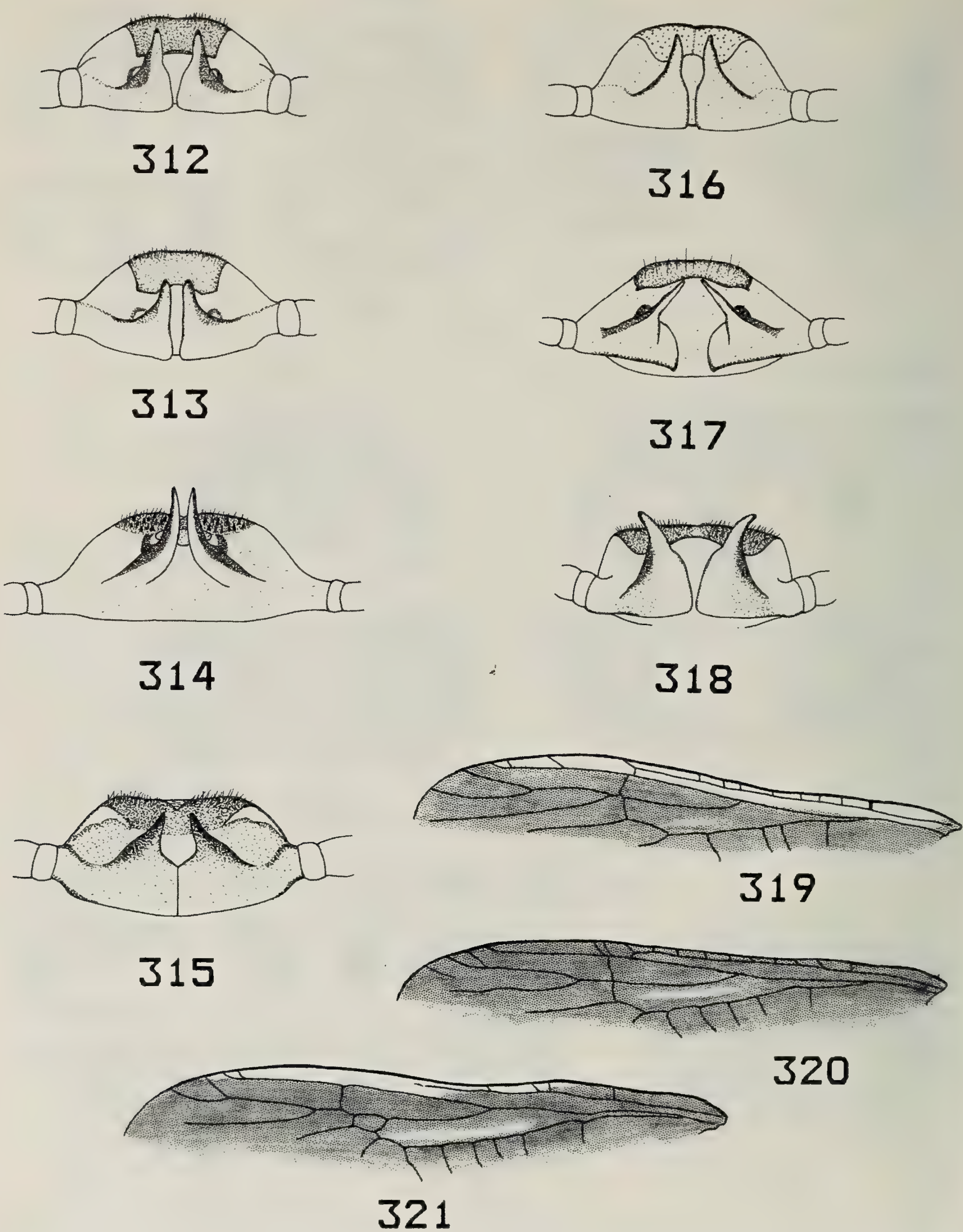


Figs. 291-302. *Acroneuria*, *Agnetina* and *Paragnetina*. 291-294. Female abdominal sterna. 291. *P. media*. 292. *P. kansensis*. 293. *Agnetina* flavescens. 294. *A. capitata*. 295-300. Nymphal abdominal terga. 295. *Acroneuria mela*. 296. *A. filicis*. 297. *A. perplexa*. 298. *A. evoluta*. 299. *Agnetina capitata*. 300. *A. flavescens*. 301-302. Adult femora. 301. *A. capitata*. 302. *A. flavescens*.



Figs. 303-311. Perlidae head and pronotal patterns. 303-304. *Agnetina* adults. 303. *A. flavescens*. 304. *A. capitata*. 305-306. *Agnetina* nymphs. 305. *A. flavescens*. 306. *A. capitata*. 307-308. *P. media* nymph variants. 309. *P. kansensis* nymph. 310-311. *Paragnetina* adult. 310. *P. media*. 311. *P. kansensis*.



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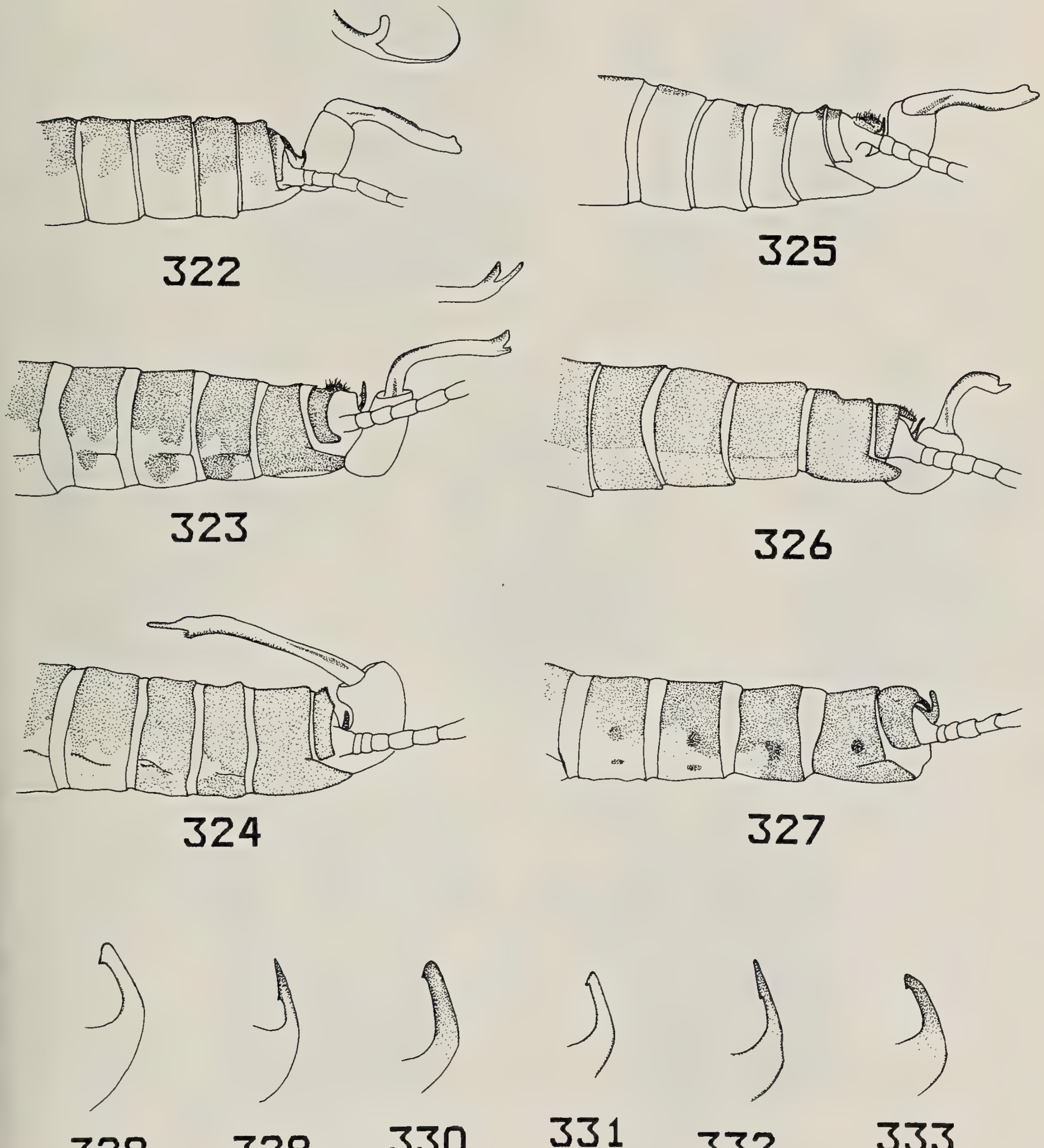
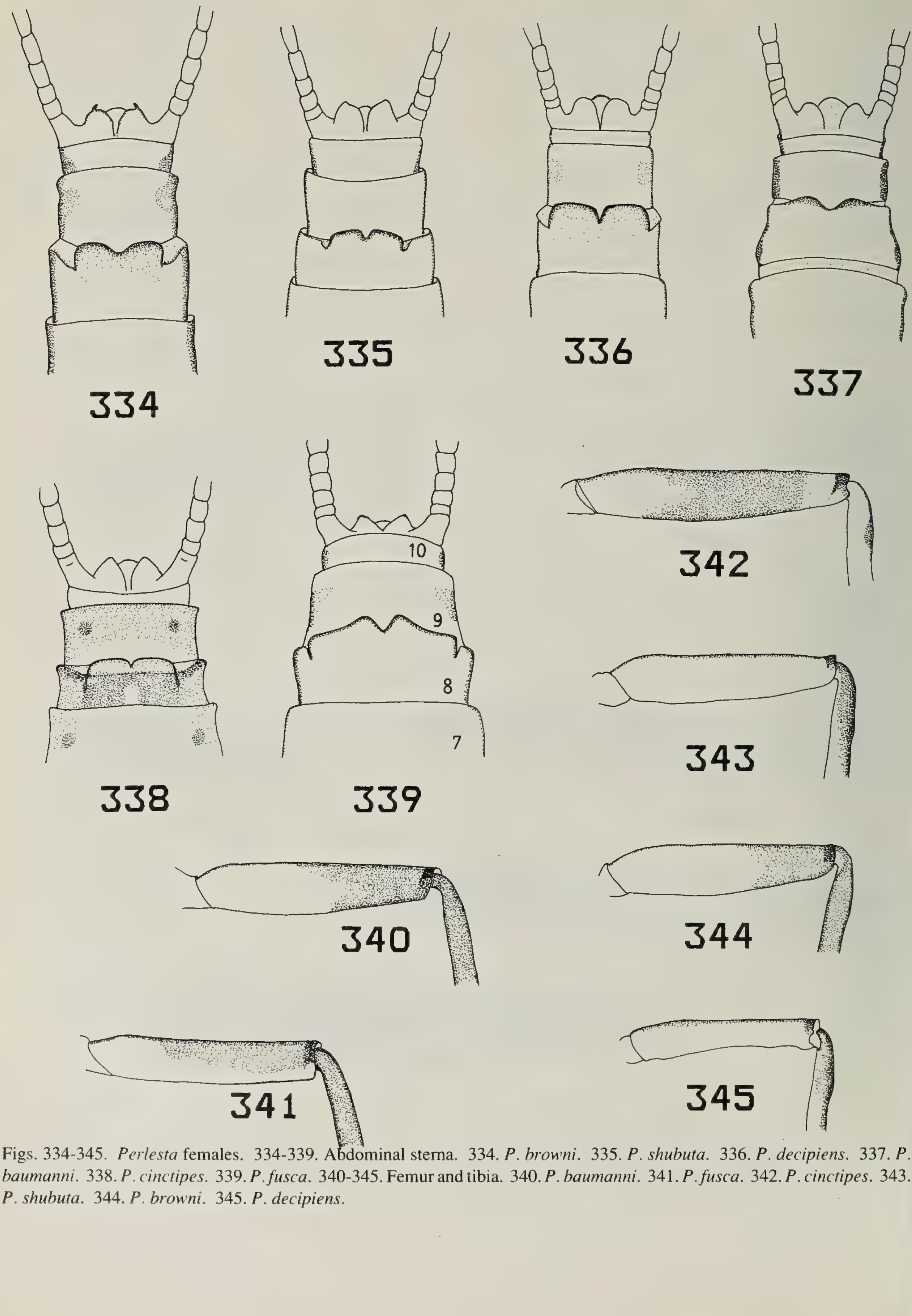
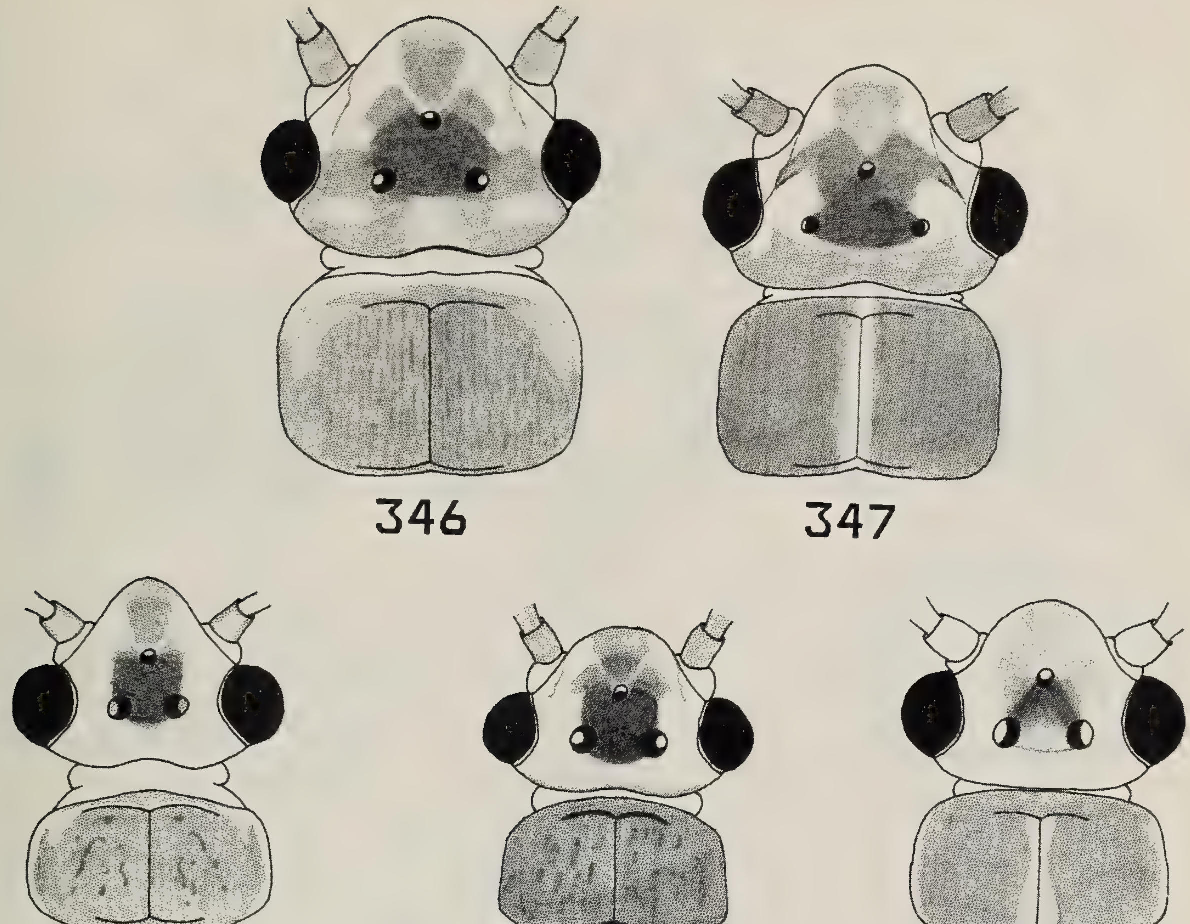


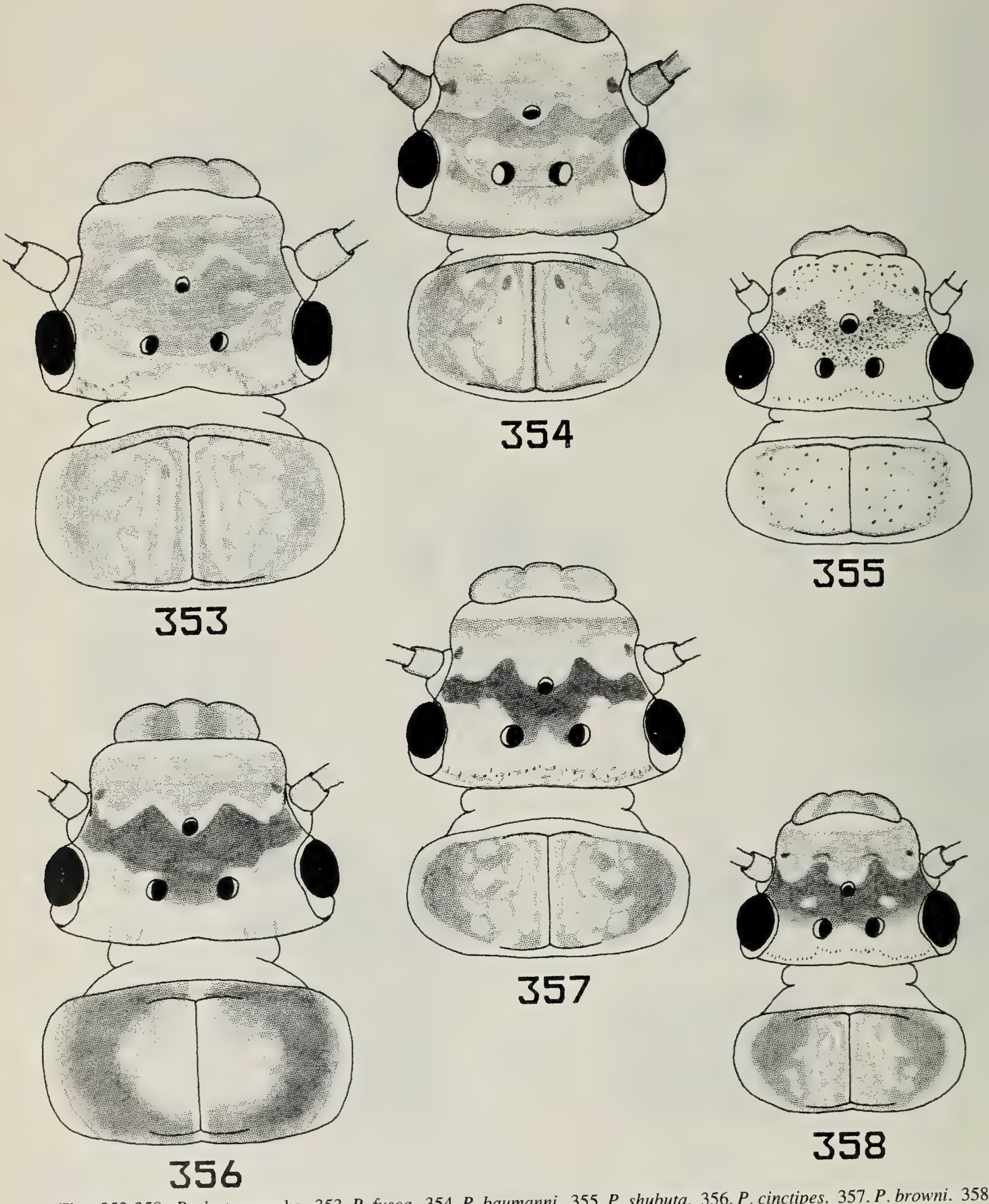
Figs. 322-333. *Perlesta* males. 322-327. Abdomen and everted aedeagus. 322. *P. decipiens*. 323. *P. cinctipes*. 324. *P. fusca*. 325. *P. shubuta*. 326. *P. browni*. 327. *P. baumanni*. 328-333. Lateral aspect of paraproct. 328. *P. decipiens*. 329. *P. cinctipes*. 330. *P. fusca*. 331. *P. shubuta*. 332. *P. browni*. 333. *P. baumanni*.



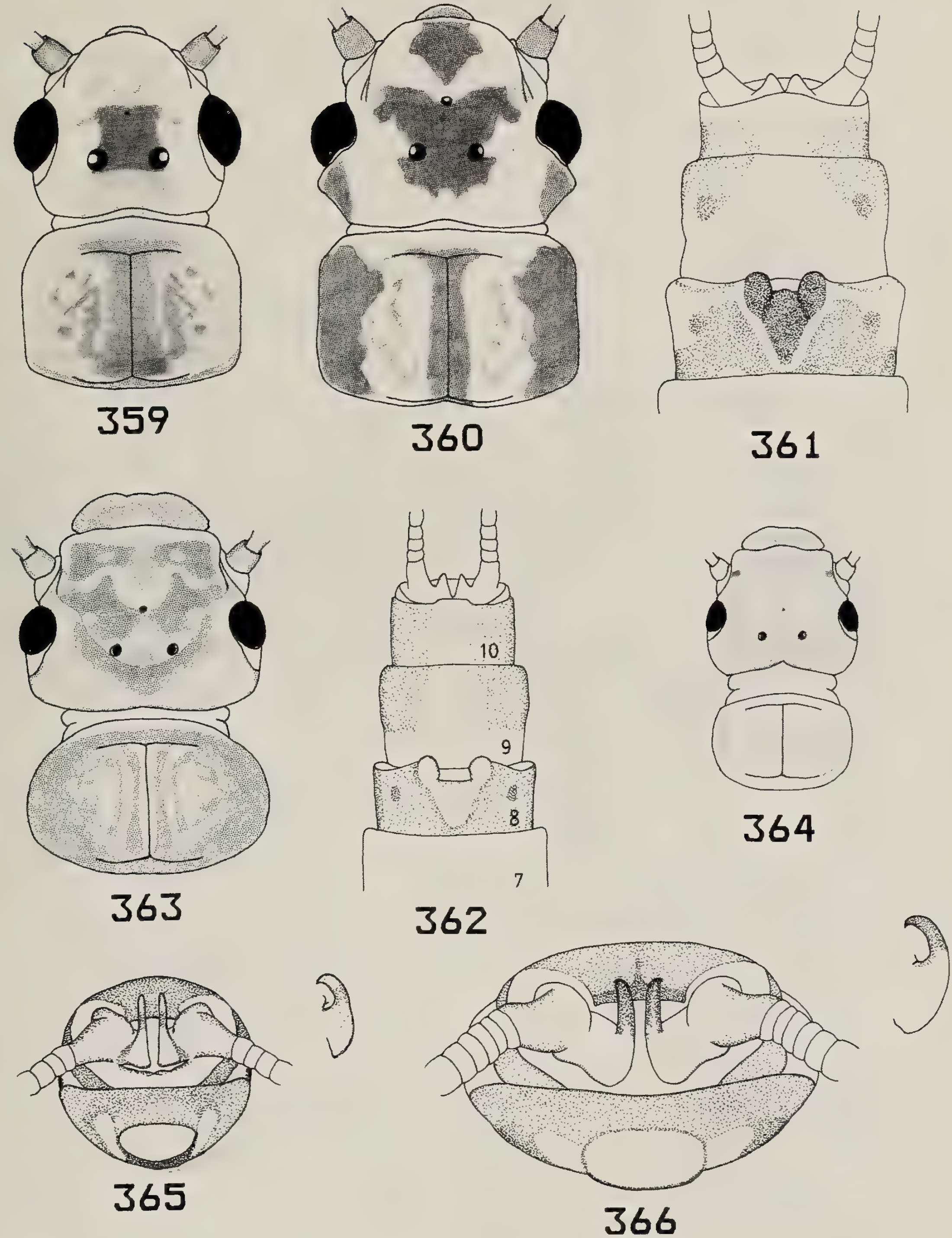
Figs. 334-345. *Perlesta* females. 334-339. Abdominal sterna. 334. *P. browni*. 335. *P. shubuta*. 336. *P. decipiens*. 337. *P. baumanni*. 338. *P. cinctipes*. 339. *P. fusca*. 340-345. Femur and tibia. 340. *P. baumanni*. 341. *P. fusca*. 342. *P. cinctipes*. 343. *P. shubuta*. 344. *P. browni*. 345. *P. decipiens*.



Figs. 346-352. *Perlesta* adults. 346. *P. fusca*. 347. *P. cinctipes*. 348. *P. shubuta*. 349. *P. decipiens*. 350. *P. shubuta* variant. 351. *P. browni*. 352. *P. baumanni*.



Figs. 353-358. *Perlesta* nymphs. 353. *P. fusca*. 354. *P. baumanni*. 355. *P. shubuta*. 356. *P. cinctipes*. 357. *P. browni*. 358. *P. decipiens*.



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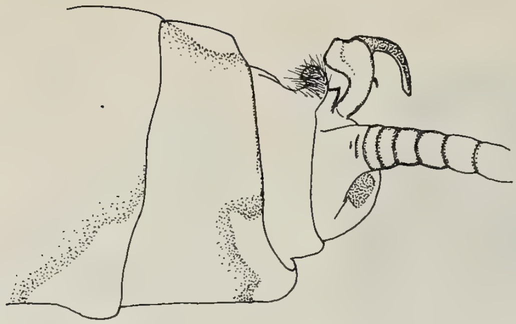

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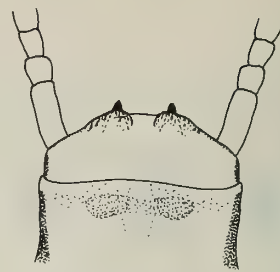

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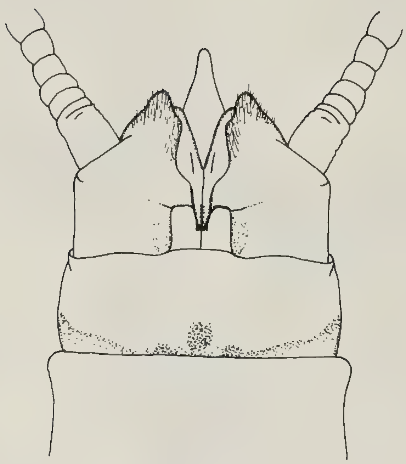

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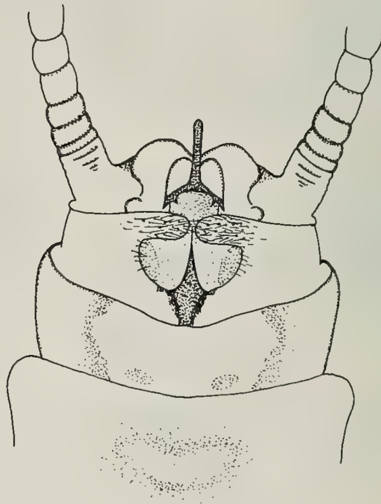

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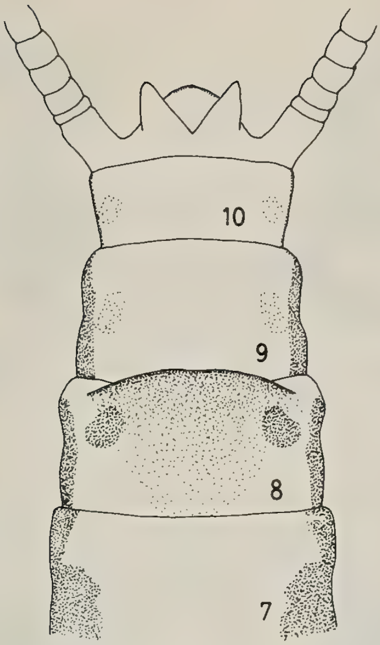
Figs. 367-372. Perlodidae male terminalia. 367-368. Lateral. 367. *Helopicus nalatus*. 368. *Hydroperla crosbyi*. 369-370. *C. clio*. 369. Dorsal. 370. Lateral, with everted aedeagus. 371-372. Dorsal. 371. *H. crosbyi*. 372. *Helopicus nalatus*.



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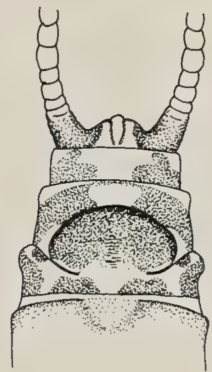

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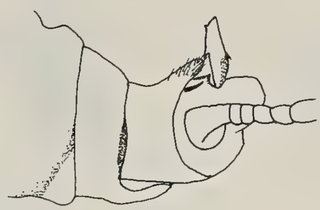

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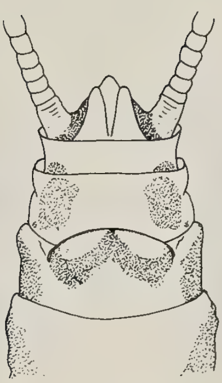

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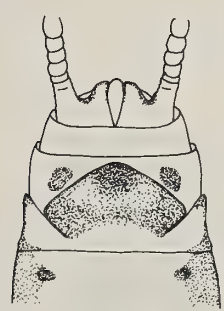

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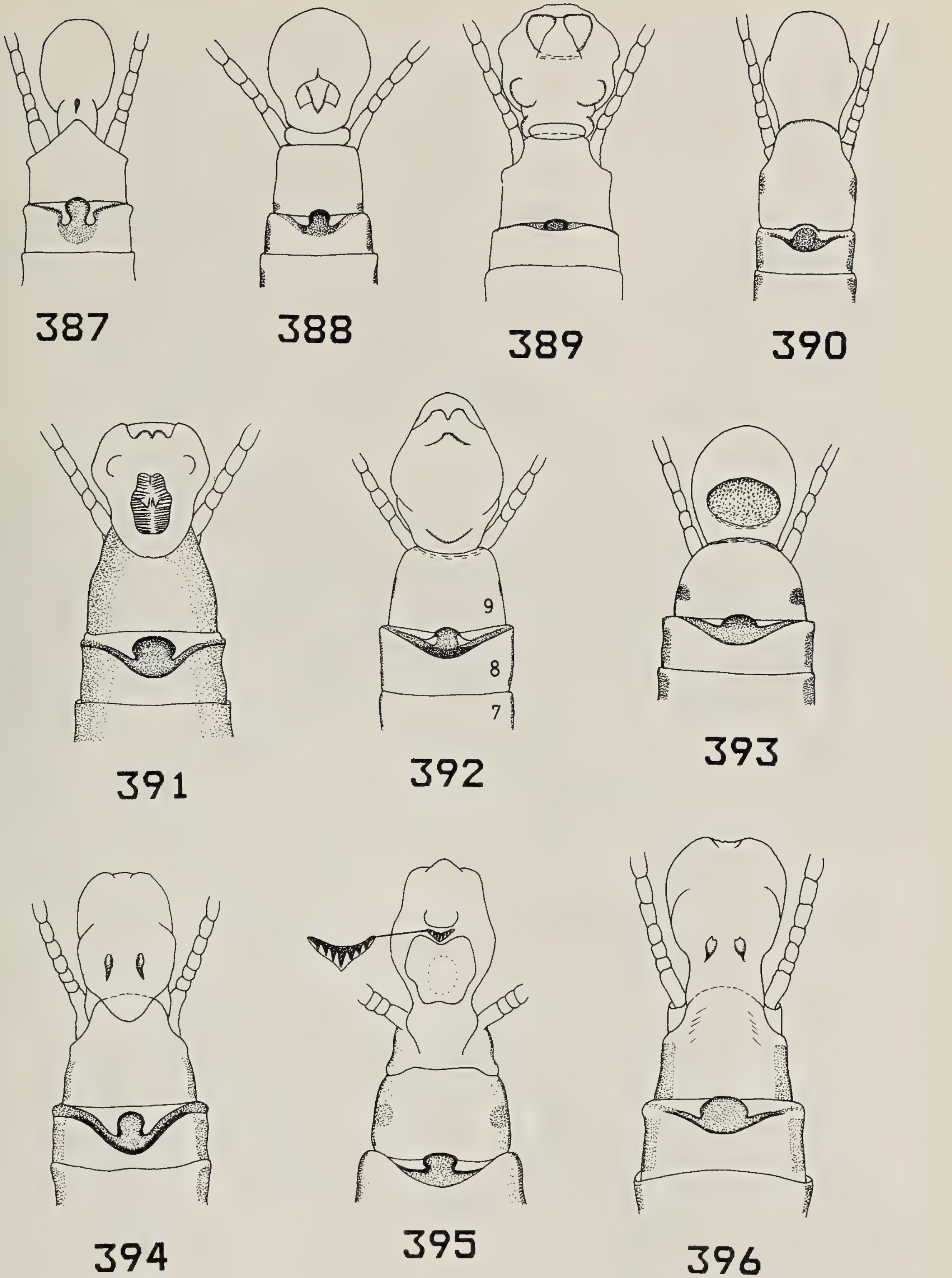
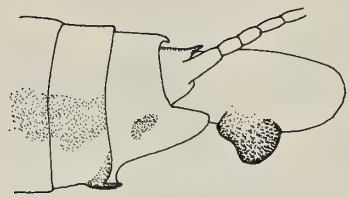


Figs. 387-396. *Isoperla* male abdominal sterna and aedeagus. 387. *I. dicala*. 388. *I. decepta*. 389. *I. ouachita*. 390. *I. coushatta*. 391. *I. mohri*. 392. *I. bilineata*. 393. *I. burksi*. 394. *I. namata*. 395. *I. szczytkoi*. 396. *I. signata*.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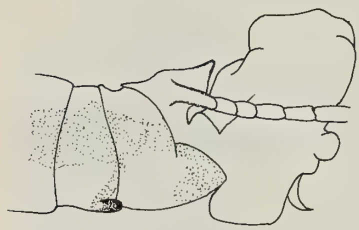
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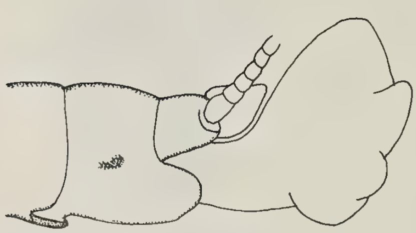
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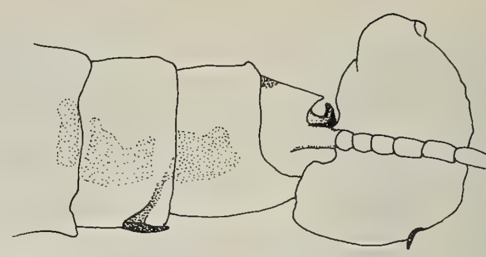
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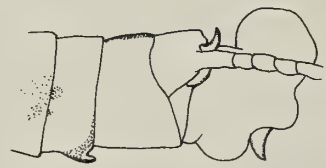
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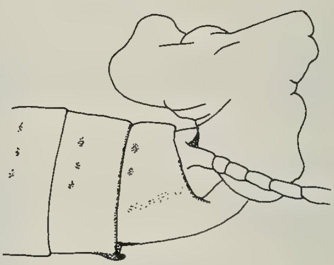
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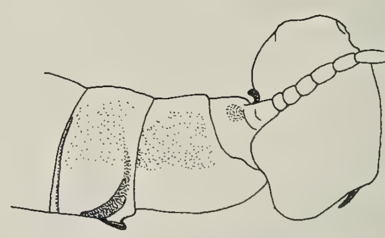
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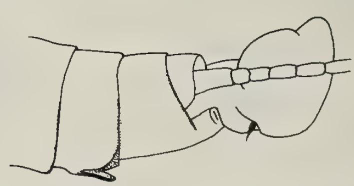
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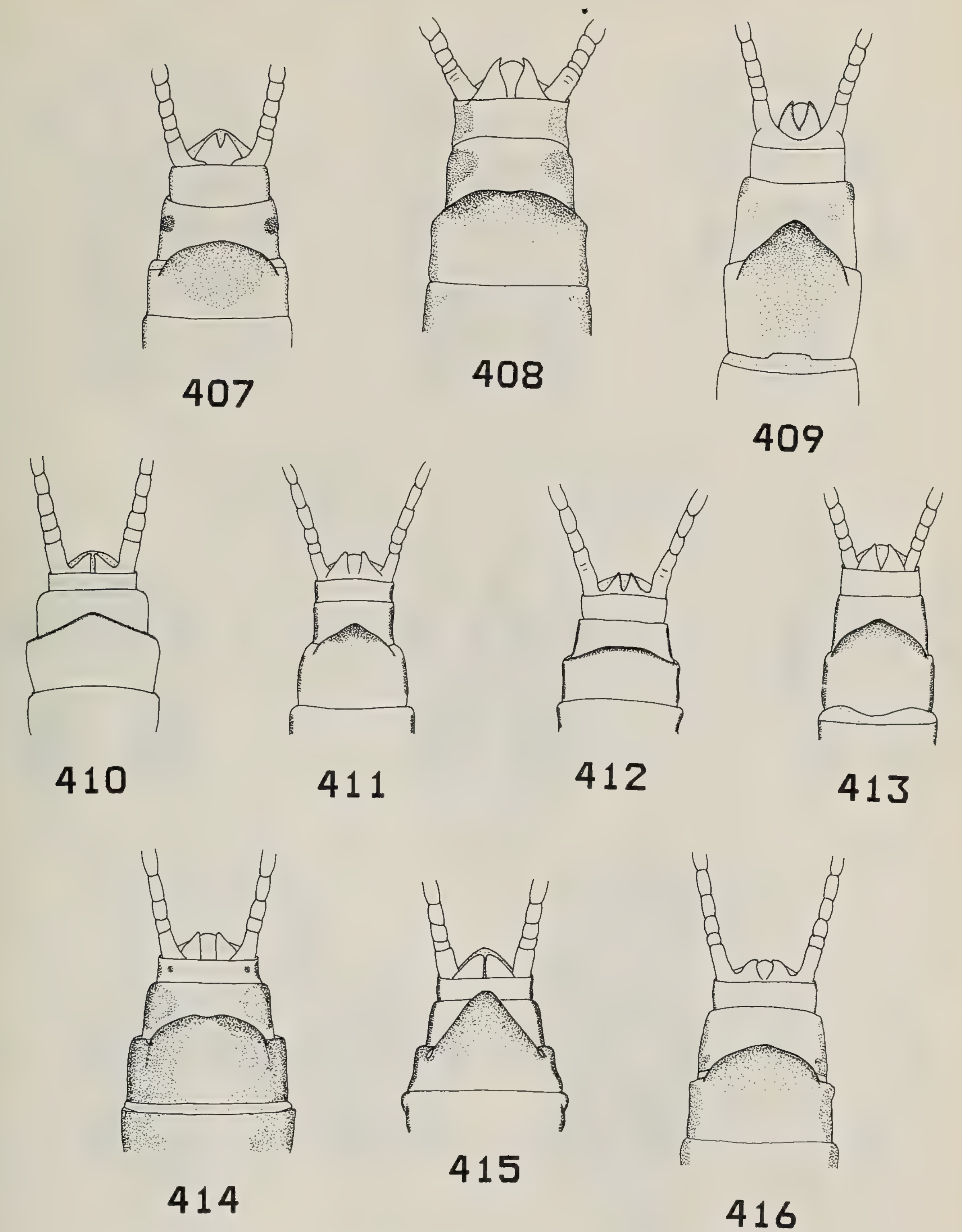

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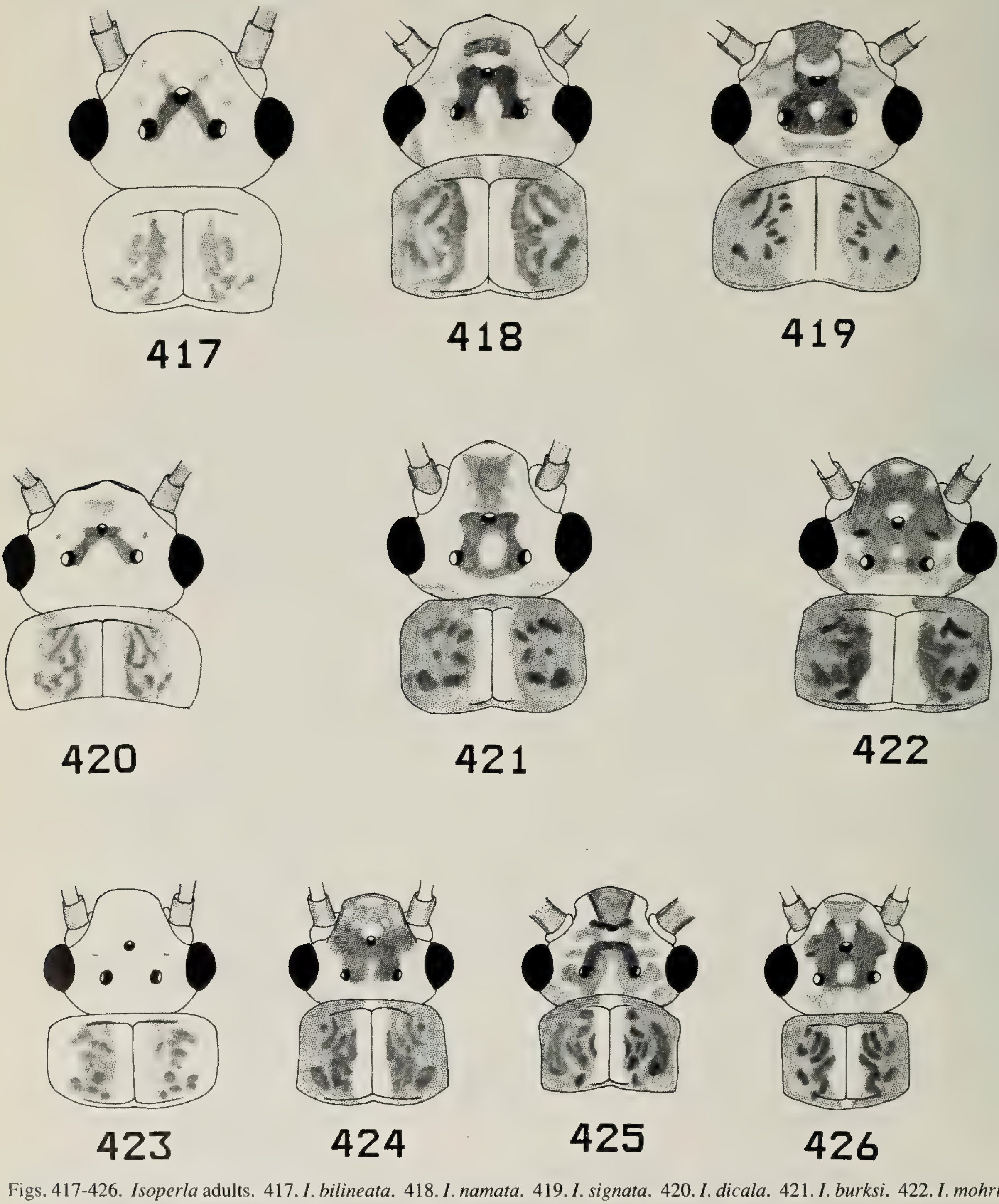
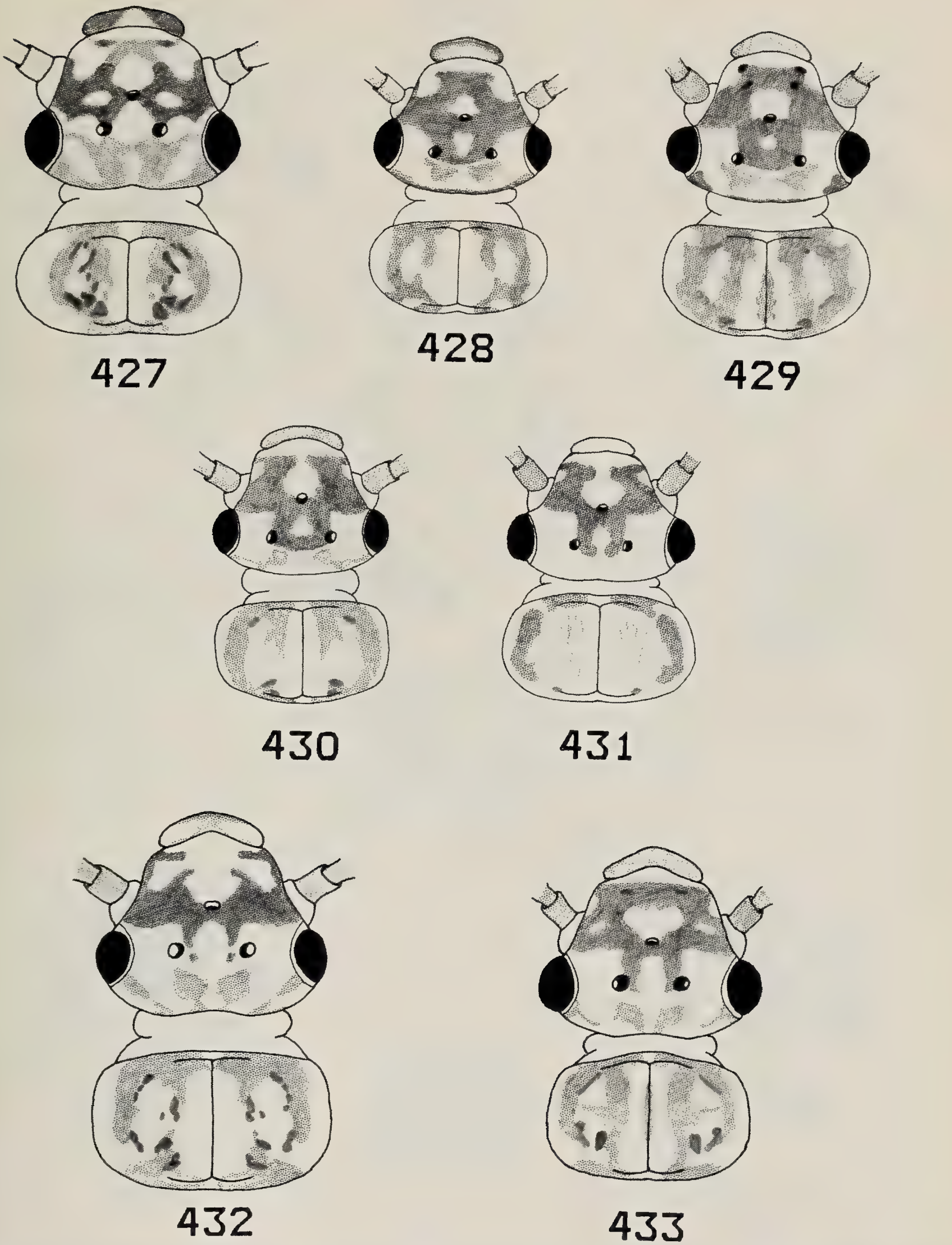
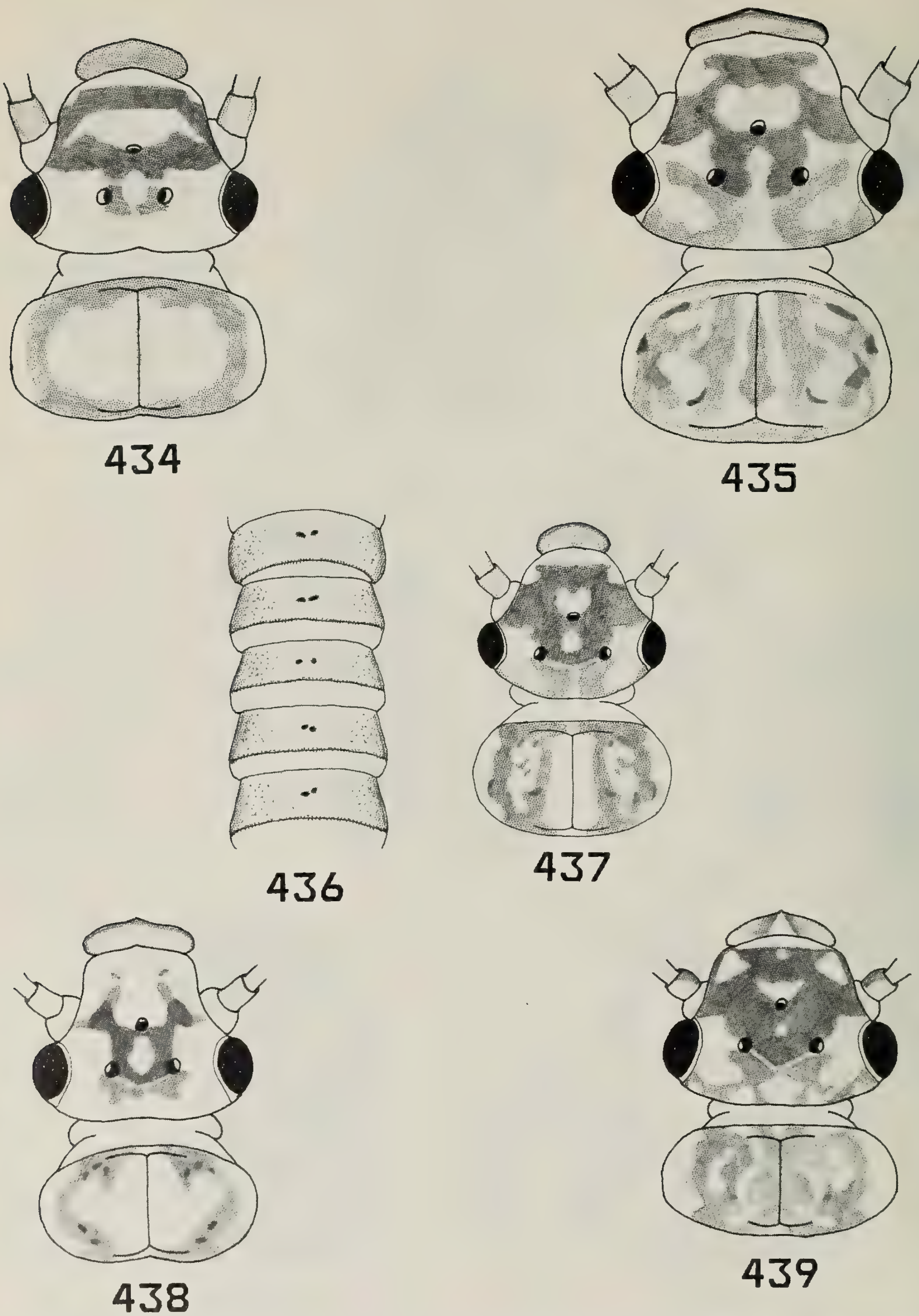


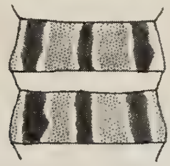
Figs. 417-426. *Isoperla* adults. 417. *I. bilineata*. 418. *I. namata*. 419. *I. signata*. 420. *I. dicala*. 421. *I. burksi*. 422. *I. mohri*. 423. *I. decepta*. 424. *I. ouachita*. 425. *I. szczytkoi*. 426. *I. coushatta*.



Figs. 427-433. *Isoperla* nymphs. 427. *I. bilineata*. 428. *I. coushatta*. 429. *I. mohri*. 430. *I. ouachita*. 431. *I. ouachita*, variant. 432. *I. namata*. 433. *I. namata*, variant.



Figs. 434-439. *Isoperla* nymphs. 434. *I. signata*. 435. *I. szczytkoi*. 436-437. *I. decepta*. 436. sterna. 437. head and pronotum. 438. *I. burksi*. 439. *I. dicala*.



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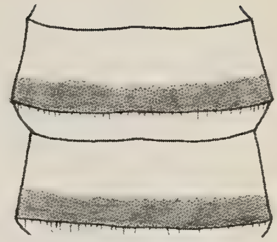

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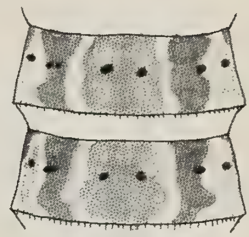

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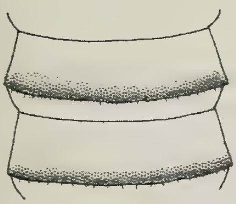

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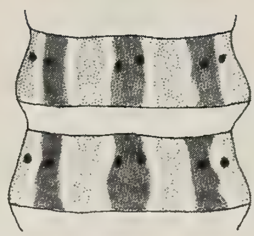

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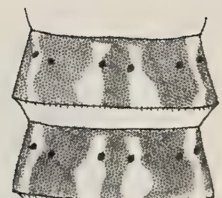

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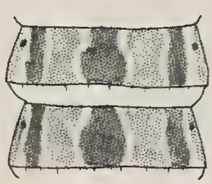

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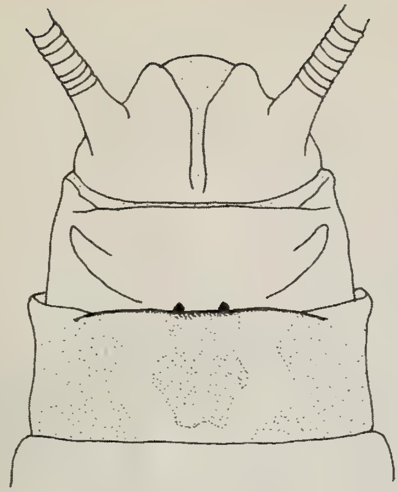
Figs. 440-449. *Isoperla* nymphal abdominal terga. 440. *I. ouachita*. 441. *I. coushatta*. 442. *I. signata*. 443. *I. burksi*. 444. *I. szczytkoi*. 445. *I. mohri*. 446. *I. decepta*. 447. *I. namata*. 448. *I. bilineata*. 449. *I. dicala*.

Figs. 450-459. *Isoperla* nymphal lacinia. 450. I. dicala. 451. *I. signata*. 452. *I. burksi*. 453. *I. ouachita*. 454. *I. namata*. 455. *I. mohri*. 456. *I. szczytkoi*. 457. *I. coushatta*. 458. *I. decepta*. 459. *I. bilineata*.



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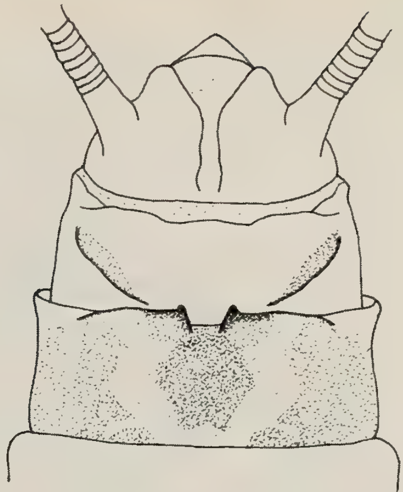

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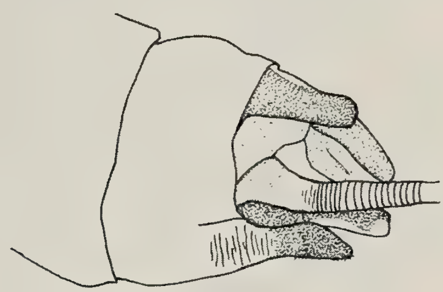

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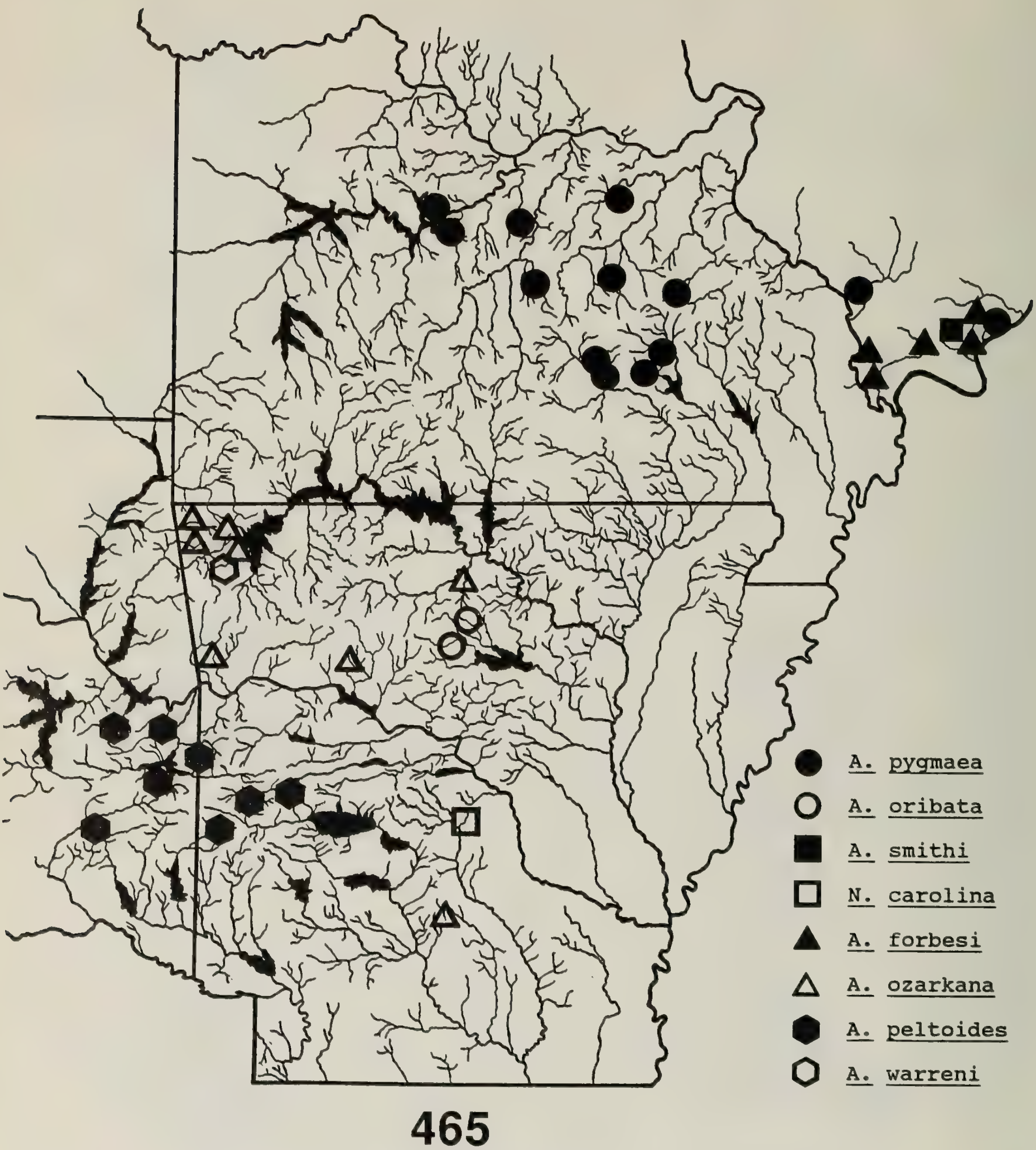

Fig. 465. Distributions of 8 Capniidae species within the Ozark-Ouachita Mountains.

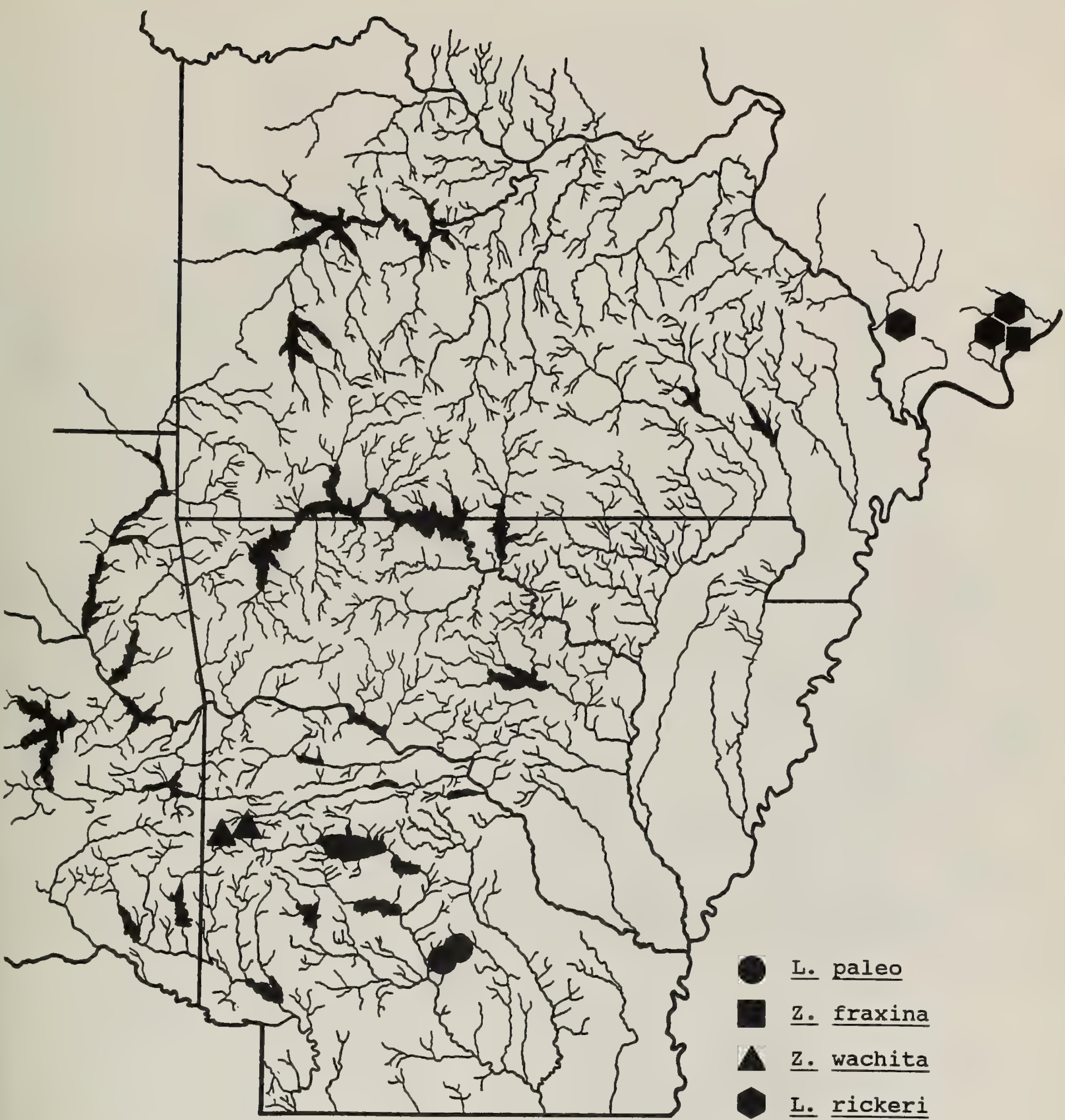

Fig. 466. Distributions of 4 Leuctridae species within the Ozark-Ouachita Mountains.

Fig. 467. Distributions of 3 Taeniopterygidae and 3 Nemouridae species within the Ozark-Ouachita Mountains.

Fig. 468. Distributions of 5 Perlidae species within the Ozark-Ouachita Mountains.

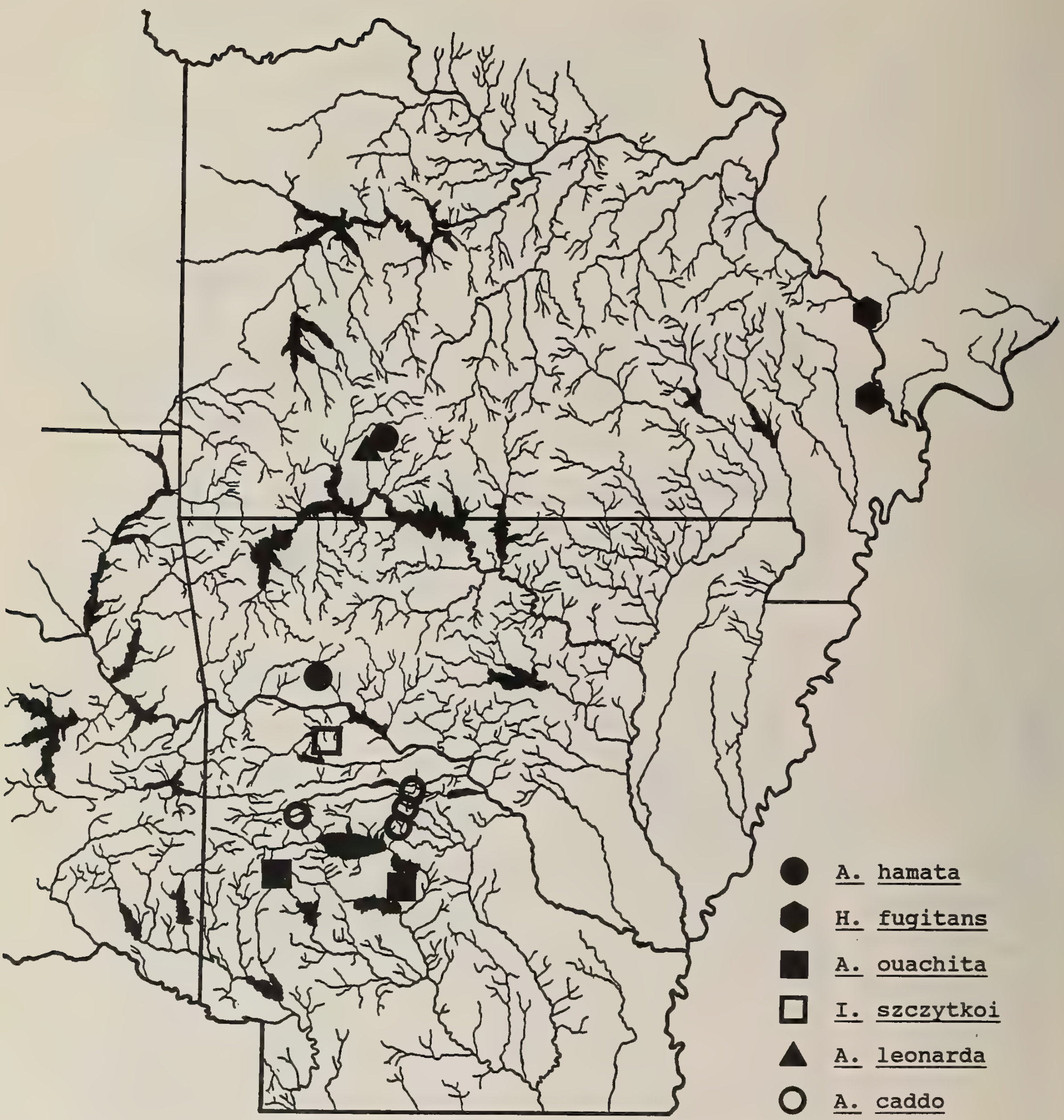

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Fig. 469. Distributions of 4 Chloroperlidae and 2 Perlodidae species within the Ozark-Ouachita Mountains.

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AMERICAN ENTOMOLOGICAL SOCIETY
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A SYNOPSIS OF THE SAWFLIES (HYMENOPTERA: SYMPHYTA) OF AMERICA SOUTH OF THE UNITED STATES: ARGIDAE

DAVID R. SMITH

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Paul M. Marsh
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Issued March 20, 1992

Printed on Acid Free Paper in the United States of America

Typesetting and page composition by

ELYTRON
Swarthmore, Pennsylvania

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MEMOIRS
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AMERICAN ENTOMOLOGICAL SOCIETY
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A Synopsis of the Sawflies (Hymenoptera: Symphyta) of America South of the United States: Argidae

DAVID R. SMITH

Systematic Entomology Laboratory, PSI,
Agricultural Research Service, U. S. Department of Agriculture,
c/o National Museum of Natural History, NHB 168,
Washington, D.C. 20560

Abstract.—The family Argidae is divided into six subfamilies, Zenarginae, Arginae, Atomacerinae, Erigleninae, Dielocerinae, and Sterictiphorinae. These divisions are based primarily on wing venation, mandibles, and preapical tibial spines. All except for the Australian Zenarginae occur in the Neotropical Region. The Argidae are widespread in the neotropics, occuring from Mexico to northern Argentina and Chile. The fauna consists of 5 subfamilies, 32 genera, and 356 species. Keys are provided for identification of all taxa. All references for each taxon and known host plant data are given. One new genus, *Zynzus*, and the following 94 new species are described: *Scobina angusticeps, S. brusa, S. diagonica, S. emora, S. guaca, S. paradorsalis, S. tina, S. zantara; Atomacera comana, A. diasi, A. flava, A. heda, A. lobula, A. mina, A. nama, A. petroa, A. raza, A. serrata, A. tria, A. zonia; Dielocerus ocreatus; Themos malaisei, T. ochreus; Eriglenum tristum; Neurogymnia albitarsis, N. longiserra, N. nigricosta, N. tria; Sericoceros sutus, S. tannuus, S. vumirus, S. zonorus; Acrogymnia acella, A. palama; Acrogymnidea surinamensis, A. udata; Adugoa willinki; Brachyphatnus vescus; Didymia connarusae, D. breva, D. resa, D. teusa; Hemidianeura dasua, H. dominicaensis, H. evansi, H. menkei, H. midea, H. nantina, H. plana, H. quidra; Manaos toulus; Neoptilia nyvsa, N. opulesa, N. palla, N. stata; Ptilia townesi, P. una; Schizocerella kierychi; Sphacophilus barius, S. ceraus, S. defius, S. darus, S. edus, S. evansi, S. holmus, S. iotus, S. janzeni, S. jucunus, S. latus, S. madunus, S. masoni, S. nuntius, S. odontus, S. panitus, S. scutinus, S. tenuous, S. usinus; Tanymeles bequaerti, T. critus, T. fasciatus, T. medeus, T. rasitus, T. rossi, T. suritus, T. tosus, T. wizunus; Trailia silana; Zynzus apicofuscus, Z. dusurus, Z. himus, Z. menkei, Z. retus, Z. townesi, Z. usirus. Scobina ventris* is proposed as a new name for *S. ventralis* (Klug). In addition, 114 new combinations and 76 new synonymies are proposed.

INTRODUCTION

Argidae occur in all tropical, temperate, and subarctic regions of the world. Even though worldwide in distribution, the fauna of the Neotropical Region is the most diverse. Representatives of all subfamilies, except the Australian Zenarginae, occur in the neotropics. In numbers of genera (32) and numbers of species (over 350), the neotropical fauna includes more than twice the number of genera and nearly half the species as the rest of the world regions combined.

Most species, where the biology is known, feed externally on the foliage of the host plants. A few are leaf miners. Similar to some Pergidae, subsocial habits in sawflies reach their highest development in some neotropical Argidae, primarily the Dielocerinae. In these, the female sits over and protects her eggs and young larvae, the larvae feed gregariously, some exhibiting distinctive organized feeding patterns, and the larvae form a mass cocoon protected by a common covering.

This is the third in a series of papers on neotropical

Symphyta. The first (Smith, 1988) reviewed the Xyelidae, Pamphiliidae, Cimbicidae, Diprionidae, Siricidae, Xiphydriidae, Orussidae, and Cephidae. The second (Smith, 1990) treated the Pergidae. The single family remaining, the Tenthredinidae, will complete the Symphyta. Nearctic Argidae, for North America north of Mexico, were revised by Smith (1969b, 1970, 1971b, 1972, 1989).

The format, museum designations, and acknowledgments are given in Smith (1988). Additions are given in acknowledgments at the end of this paper.

Family ARGIDAE

Antenna 3-segmented, the flagellum (3rd segment) single segmented, simple (Fig. 272), furcate in some males (Fig. 273). Head type open. Ventral arms of cervical sclerites (propleuron) narrowly or broadly rounded on meson, approximate or sometimes separated (Figs. 9, 164, 263). Mesosternal suture present (obscure in a few genera); mesoprescutal sutures distinct. Posterior margin of mesoscutellum without posttergite. Cenchri usually large and much closer together than the breadth of one (except Zenarginae). Both apical spines of foretibia, if present, simple (in Zenarginae, outer foretibial spine with short lateral tooth); preapical spines of mid- and hindtibiae present (Fig. 5) or absent. Forewing (Fig. 2) without radial crossvein (2r); basal section of vein 2A+3A atrophied, leaving anal cell petiolate (except Zenarginae, Fig. 1). Hindwing (Fig. 2) with 2 closed cells, Rs and M (except Zenarginae). Metepimeron undivided and fused with lateral margin of first abdominal tergite.

Members of Argidae are immediately recognized by the single segmented flagellum of the antenna.

Few higher classifications have been attempted. Konow (1905a, 1907a) treated the Argidae as a subfamily of the Tenthredinidae, and divided it into two tribes, the Argides and Schizocerides, based on the presence or absence of the intercostal crossvein (Sc) in the forewing, respectively. Rohwer (1918) keyed three subfamilies, the Zenarginae, Arginae, and Sterictiphorinae, the latter two also separated by the presence or absence of an intercostal crossvein. Malaise (1941) keyed the world genera but did not recognize major groupings. Benson (1938) gave the first subfamily classification and presented a key to ten world subfamilies, seven of which occur in the neotropics. In 1963, Benson recognized only three world subfamilies, Zenarginae, Arginae, and Sterictiphorinae, with three tribes in the Arginae and four tribes in the Sterictiphorinae. After study of many thousands of specimens, I believe the family can be separated into six subfamilies, Zenarginae, Arginae, Atomacerinae, Dielocerinae, Erigleninae, and Sterictiphorinae, all of which except Zenarginae are represented in the neotropics. As yet, I see no reason for tribal classifications within the subfamilies.

Relationships

The Arginae is represented in the neotropics by the two genera *Arge* and *Scobina*, the latter unique to this region. *Arge* is primarily a northern genus (though large in the Ethiopian Region) but with a number of species in Mexico and one as far south as Colombia. *Scobina* possibly has its counterpart in Australia in the genus *Antargidium* which includes only a few species. Both share the transorbital carinae which Benson (1963) emphasized as relating these genera, and he put both in his tribe Scobinini. However, *Antargidium* lacks a genal carina and has a pronotal groove (both absent in *Scobina*), and it may actually be closer to *Arge* with which it shares these characters.

The Atomacerinae are found only in the Western Hemisphere from Canada to Argentina, but only two species occur in eastern North America whereas more than 30 are known from southwestern United States to South America. The Dielocerinae and Erigleninae are unique to South America and related counterparts are unknown from anywhere else.

The Sterictiphorinae, although very diverse in the neotropics, are found in all other parts of the world, including the small genera *Trichorachus* and *Styphelarge* from Australia. The largest holarctic genera are *Sterictiphora* and *Aprosthema*. The two Australian genera are included in the tribe Trichorachini by Benson (1963).

Hosts and biology

Curtis (1844) was the first to present biological notes on neotropical Argidae, describing some of the social habits of *Dielocerus*. Other miscellaneous notes since that time are by Lima (1927) on *Dielocerus*, Monte (1941, 1946) on *Dielocerus* and *Digelasinus*, and Martorell (1941) on *Sericoceros* in Puerto Rico. Dias (1975, 1976) gave the most complete biological and behavioral studies of two species, *Dielocerus diasi* Smith and *Themos olfersii* (Klug). Kimsey and Smith (1985) gave some notes on several species reared by the senior author in Panama. The biology of *Schizocerella pilicornis*, a widespread species in the New World and a leafminer or external leaf feeder of *Portulaca*, has been covered in many papers (see references under the species). Much of the host data presented in this paper has not been recorded before. A summary of the recorded host genera is as follows, with the associated sawfly genus in parentheses:

Anacardiaceae	— *Rhus* (*Arge* spp.).
Bombacaceae	— *Ceiba* (*Themos* sp.); *Eriotheca* (*Themos* sp.).
Connaraceae	— *Cnestidium* (*Ptilia* sp.); *Rourea* (*Ptilia* sp., *Didymya* sp., *Trochophora* sp.); *Connarus* (*Didymia* sp.)
Convolvulaceae	— *Ipomoea* (*Atomacera* sp., *Sphacophilus* sp.)
Erythroxyllaceae	— *Erythroxylon* (*Digelasinus* sp.).
Lecythidaceae	— *Lecythis* (*Ptilia* sp. ?).
Leguminosae	— *Acacia* (*Zynzus* sp.); *Cassia* (*Adurgoa* sp.); *Desmanthus* (*Zynzus* sp.); *Hosackia* and *Lotus* (*Aprosthema* sp.); *Hymenaea* (*Sphacophilus* sp.); *Inga* (*Dielocerus* sp., *Hemidianeura* sp., *Manaos* sp.); *Lonchocarpus* (*Sericoceros* sp.); *Machaerium* (*Eriglenum* sp., *Subsymmia* sp.?); *Mimosa* (*Zynzus* sp.); *Prosopis* (*Zynzus* sp.); *Sclerolobium* (*Dielocerus* spp.); *Stylosanthes* (*Sphacophilus* sp.).
Malpighiaceae	— *Banisteriopsis* sp. (*Schizocerella* sp.).
Malvaceae	— *Althaea*, *Malva*, *Malvastrum*, *Sphaeralcea*, *Sida* (*Neoptilia* spp., *Scobina* spp.); *Thespesia* (*Themos* sp.); "Malvaceae" (*Brachyphatnus* sp.).
Polygonaceae	— *Coccoloba* (*Sericoceros* spp.); *Eriogonum* (*Sphacophilus* sp.).
Portulacaceae	— *Portulaca*, *Montia* (*Schizocerella* sp.)
Rosaceae	— *Chrysobalanus* (*Sericoceros* sp.).
Sapotaceae	— *Mahea* (*Pachylota* sp.)
Tiliaceae	— *Luehea* (*Themos* sp.)

Of special interest is the development of subsocial habits, similar to some Pergidae, where the female sits over and protects her eggs and young larvae, the larvae feed gregariously and usually in an organized pattern, and the larvae spin cocoons together protected by a communal covering. This has been recorded in some of the literature, but the most complete studies are by Dias (1975, 1976). This social pattern is most developed in genera of the Dielocerinae. It is alluded to in *Sericoceros* (Erigleninae) by Martorell (1941) who indicates that the female of *S. krugii* stays with the eggs, the larvae feed gregariously, but they do not make a common covering over the cocoon masses. All other groups of Argidae apparently do not show such social development, but information is very scanty.

Structures

Various features used in the grouping of subfamilies and separation of genera are discussed below. Possible generalized versus specialized conditions are indicated if known.

Head. A genal carina occurs only in *Scobina* (Arginae) and *Zenarge* (Zenarginae). Carinae on the head are most developed in *Scobina* (Fig. 10) which have carinae on the clypeal suture, interantennal and supraclypeal areas, lower inner orbits, and laterally from the hindocelli to each eye. In most other genera, only an interantennal carina is present which may be short, sharp (Fig. 339) or rounded or Y-shaped above the antennae and bisect the supraclypeal area below (Fig. 268). The latter is most developed in *Acrogymnia* and *Acrogymnidea*.

Antenna. The flagellum is simple in both sexes in the Arginae, Zenarginae, and Atomacerinae (Figs. 90, 91). In males of the Dielocerinae, Erigleninae, and Sterictiphorinae the flagellum is furcate (Fig. 273). The furcate antennal flagellum is a specialized feature. The antennal flagellum of males usually differs from that of females by the presence of numerous long, erect hairs and the presence of transverse ridges thus making it appear segmented.

Mouthparts. The clypeus is usually truncate to subtruncate, but in *Dielocerus* and *Digelasinus* there is a deep, central, semicircular emargination (Figs. 200, 217). Several other genera have a slight but distinct emargination at the center. The labrum is usually broader than long, rounded or sometimes depressed at its center.

The mandibles may be simple, either the right or left mandible may have a tooth or basal lobe at its base, or the left mandible may have two or three small teeth or crenulations near its center (Figs. 8, 240, 270, 391, 499). In the Zenarginae, each mandible has a large subapical tooth, and in the Atomacerinae and Erigleninae, each mandible has two or three large teeth that are nearly subequal in size (Figs. 134, 161). These are probably more generalized states.

The maxillary palpus is normally 6-segmented and the labial palpus 4-segmented (Fig. 7). The labium is trilobed, though the lobes are sometimes fused and difficult to see. Only the Dielocerinae have a reduction in number of segments, and the extreme is in *Themos* where the maxillary and labial palpi are each 3-segmented and the labium is simple, without lobes (Fig. 241). This reduction is considered specialized. In some genera of Erigleninae and Sterictiphorinae, the third segment of the labial palpus and fourth segment of the maxillary palpus are extremely enlarged, usually much broader and shorter than the other segments (e.g., *Eriglenum*, *Ptilia*, *Didymia*, Figs. 135, 343, 500). In other genera, only the third segment of the labial palpus is enlarged (e.g., *Acrogymnia*, Fig. 271), and in others there is no enlargment (e.g., *Sericoceros*, *Sphacophilus*, Arginae, Figs. 7, 163, 540), all the segments being of uniform width. Such modified segments are considered specialized.

Thorax. Mesosternal-pleural sutures are present in most Argidae but are sometimes faint and difficult to see, especially in the Atomacerinae. A pronotal furrow is present in *Arge*, extending from near the tegula to the anterolateral margin of the pronotum. This is absent in all other Argidae treated here. In most Argidae, the cenchri are large, transverse, and very close together. Only in *Zenarge* are they small and farther apart than the breadth of one. They are somewhat farther apart in some Dielocerinae, but not significantly so. Small cenchri are considered the most specialized by reduction.

The ventral arms of the cervical sclerites (propleuron) are usually narrowly rounded on the meson and meet or are close together (Fig. 9). In *Zenarge* and some Dielocerinae they are broader and more approximate (Fig. 263), and in *Sericoceros* and a few other genera they are separated, joining the prosternum laterally to form a precoxal bridge (Fig. 164). These latter two types are directions of specialization.

Abdomen. The propodeum (first tergum or basal plates) is mostly sclerotized in most Argidae. In some Atomacerinae and Sterictiphorinae, the propodeal plates are reduced in size, thus leaving a large membranous area.

In males of two species of *Hemidianeura*, there are unusual cavities laterally on the eighth tergite (Fig. 396). These are deep, circular, and lined with erect hairs, and there is usually some whitish substance in each. They are reminiscent of the large cavity at the center of eighth tergite of the male of *Neostromboceros congener* (Konow) (Tenthredinidae), for which Malaise (1944) proposed the term "sinus sexualis," but the cavities in these argids are different in that one is found on each side of the eighth tergite.

The female sheaths are of various shapes. They may be slender and simple (Figs. 626-629), broad (Figs. 70, 71), pincer-like (Figs. 11-13), or with various laterally or posteriorly projecting scopae (Figs. 543-555). The female lancets and male genitalia are equally diverse. The male genitalia usually have broadly rounded gonostipes, meeting ventrally on the meson, and the harpe is separate from and articulates with the gonostipes (as in Figs. 39-65). However, those of *Neoptilia* are most unusual in the Argidae in that the harpe is fused with the gonostipes (Figs. 489-493) and a definite parapenis is developed ventrally (Figs. 492, 493). The sheaths, lancets, and male genitalia are commonly used in species separation, but those of many genera conform to a similar pattern.

Legs. The Zenarginae and Arginae (except some Asian genera) have preapical spines on the mid- and hindtibiae. The Zenarginae have two preapical spines on the midtibia and one on the hindtibia, and the Arginae have one on each (Fig. 5). These are lost in all other argids. All argids have two apical spines on each tibia except for the unusual *Pachylota* which has lost all tibial spines (Fig. 231). The apex of the hindtibia is modified in *Brachyphatnus* and *Neoptilia*. There is a collar-like projection, and the apical spines arise at the base of the collar and barely exceed its apex (Fig. 328). In all other genera the apical hindtibial spurs arise at the apex of the tibia.

The tarsal claws are simple in most Argidae. In the Atomacerinae and *Acrogymnidea* (Sterictiphorinae) they are simple but with a large acute basal lobe (Figs. 95, 294). In *Neoptilia*, the claws are bifid having a large inner tooth (Fig. 469). In *Themos*, all the claws are bifid or only the foreclaw is bifid and the mid- and hindclaws are simple with a basal lobe (Figs. 242, 243).

In most genera, the hindcoxae are contiguous, but in *Sericoceros* especially, the hindcoxae are far apart, being separated by a distance equal to the breadth of one.

Forewing. The radial cell may be open (Figs. 532, 533) or closed (Fig. 2) at its apex, but always closed in the Arginae. A small basal anal cell may be present (Fig. 2) or absent (Fig. 318). The costa varies from much narrower than the intercostal area (Figs. 3, 4), to swollen and as broad or broader than the intercostal area (Figs. 532, 533). It is modified, i.e. swollen, only in many genera of the Sterictiphorinae. The intercostal crossvein (Sc) is present in the Zenarginae, Arginae, Atomacerinae, and most Dielocerinae and Erigleninae (Figs. 3, 4, 89, 131, 198), but it is lost in all the Sterictiphorinae (Figs. 495, 532, 533). Veins M and Rs+M meet Sc+R at or near the same point in most Arginae and some Dielocerinae (Figs. 2, 198), but in other groups, including Zenarginae, M has migrated basally so it meets Sc+R far basad to the point where Rs+M meets Sc+R (Figs. 442, 495). This migration is a specialized state. In the Arginae, Zenarginae, and some Dielocerinae, vein 1r is joined at or near the junction of Sc+R and the stigma or joined on Sc+R (Figs. 2-4). In the Atomacerinae, Sterictiphornae, and Erigleninae, vein 1r has migrated so that it joins the stigma near or far apical to the junction of the stigma and Sc+R (Figs. 338, 442, 532, 533). This migration is also specialized.

In *Eriglenum*, *Mallerina*, and *Neurogymnia* a crossvein (Cu_1) is retained at the base of the wing between veins $M+Cu_1$ and 1A (Fig. 131). It is only in the hindwing of *Neurogymnia* but in both wings of the other two genera. This is absent in all other genera.

Hindwing. The radial cell is closed only in the Arginae and Zenarginae (Fig. 2) and open in all other subfamilies (Figs. 89, 131). There are two enclosed cells, Rs and M. Only *Zenarge* lacks cell M. The anal cell may be present (Fig. 2) or absent (Figs. 89), but it is absent only in Atomacerinae and some genera of the Dielocerinae, Erigleninae, and Sterictiphorinae. In the genus *Trochophora*, the jugal area of the hindwing is extremely enlarged (Figs. 663, 664). This is unknown in other sawflies.

Species names

Unless otherwise indicated or obviously based on a geographical name or persons name, all new species group names are arbitrary combinations of letters and are to be treated as nouns in the nominative singular standing in apposition to the generic names.

Keys

Separate keys to subfamilies and genera are given. Since certain more obvious characters are used to separate genera, identification to genus is easier using a separate key, thus saving an extra step. The key to subfamilies is valid on a world basis.

Throughout this paper, sexes are indicated as follows: F = female, M = male. Locality records and dates are given essentially as they appear on specimen labels.

KEY TO SUBFAMILIES OF ARGIDAE

1. Anal cell of forewing complete, crossed by a crossvien (Fig. 1); midtibia with 2 preapical spines; hindwing with one closed cell (Rs), cell M absent; cenchri small, farther apart than the breadth of one (antennal flagellum of male simple) . . . . **Zenarginae**

— Anal cell of forewing petiolate (Fig. 2), base of vein 2A+3A atrophied; midtibia with one or no preapical spine; hindwing with cells Rs and M both present (Fig. 2); cenchri large, transverse, closer together than half the breadth of one **2**

2. Radial cell of hindwing closed, with accessory vein at apex (Fig. 2); antennae inserted above level of middle of eyes (Fig. 10); genal carina present or absent; lateral diagonal furrow present or absent on pronotum; tarsal claws simple; costa of forewing narrow and intercostal crossvein (Sc) present (Figs. 2-4); mid- and hindtibiae each with preapical spine in all New World species (Fig. 5) (antennal flagellum of male simple) . . . . **Arginae**

— Radial cell of hindwing open at apex (Fig. 89); antennae inserted at or below level of middle of eyes (Figs. 92, 157, 496); genal carina absent; pronotal furrow absent; tarsal claws simple, with basal lobe, or bifid; costa of forewing various and intercostal crossvein present or absent; tibiae without preapical spines **3**

3. Antennal flagellum of male simple (Fig. 91); tarsal claws simple with large acute basal lobe (Fig. 95; occurs elsewhere only in *Acrogymnidea* and *Themos*); each mandible 3-toothed (Fig. 93); forewing with intercostal crossvein (Sc) (Fig. 89); outer apical foretibial spine nearly twice length of inner spine . . . . **Atomacerinae**

— Antennal flagellum of male furcate (Fig. 273); tarsal claws various, usually simple (except above genera and *Neoptilia*); mandibles various; intercostal crossvein of forewing present or absent; apical foretibial spines subequal in length **4**

4. Costa narrower than intercostal area and intercostal crossvein present (Fig. 198) (except *Themos*, but mandibles extremely enlarged basally, Fig. 239; tarsal claws bifid or simple with basal lobe, Figs. 242, 243; maxillary and labial palpal segments less than 6 and 4, respectively, and labium without lobes, Fig. 241); palpi reduced, equal to or shorter than eye length, with maxillary palpus 3-6 segmented and labial palpus 3-4 segmented (Figs. 205, 215, 241, 262); mandibles simple or either one with small basal lobe (Figs. 216, 240); clypeus sometimes with semicircular central emargination (Fig. 217); head extremely enlarged and broadened behind eyes (Figs. 229, 230) . . . . **Dielocerinae**

– Costa narrow or swollen, intercostal crossvein absent (faint in *Eriglenum* and *Neurogymnia*); maxillary palpus 6-segmented, labial palpus 4-segmented, commonly longer than eye length, and labium trilobed (Figs. 271, 343, 344, 520); mandibles various; tarsal claws usually simple (with basal lobe in *Acrogymnidea*, bifid in *Neoptilia*); clypeus truncate or subtruncate; head commonly sharply narrowing behind eyes **5**

5. Each mandible with 2 or 3 large teeth (Figs. 134, 161, 191); intercostal crossvein present or absent, if present faint (in *Eriglenum* and *Neurogymnia*); both wings of *Eriglenum* and hindwing of *Neurogymnia* with basal crossvein (Cu_1) between veins $M+Cu_1$ and 1A (Fig. 131); tarsal claws simple; head transverse from above, broader than long, sharply narrowed behind eyes, sometimes (especially *Sericoceros*) much narrower than the enlarged thorax (Figs. 133, 158); cervical sclerites sometimes separated, the ventral arms joining the prosternum laterally to form a precoxal bridge (Fig. 164). . . . . **Erigleninae**

— Left mandible simple or with 2 or 3 small teeth or crenulations near center, right mandible with single tooth near base (Figs. 270, 391, 519); basal crossvein (Cu_1) and intercostal crossvein absent; tarsal claws simple, except *Acrogymnidea* and *Neoptilia*; head from above usually rounded, not notably broader than long, though usually sharply narrowed behind eyes (Figs. 269, 390, 497, 676); ventral arms of cervical sclerites usually narrowly rounded and meeting or nearly meeting on meson . . . . **Sterictiphorinae**

KEY TO GENERA

1. Tibiae without apical and preapical spines (tarsal segments swollen, segments 2-5 each much broader than long, Fig. 231; head from above extremely long and broadened behind eyes, Figs. 229, 230; clypeus with semicircular central emargination, Fig. 226; forewing with intercostal crossvein) . . . . ***Pachylota***

— Tibiae with apical spines; mid- and hindtibiae with or without preapical spines **2**

2. Mid- and hindtibiae each with a preapical spine (Fig. 5). **3**

— Mid- and hindtibiae without preapical spines **4**

3. Head with high, sharp carinae, interantennal carina Y-shaped above and bisecting supraclypeal area below, carina between lateral ocellus and eye, short carina on lower inner orbits, and transverse carina above clypeus (Fig. 10); genal carina present; pronotum without diagonal furrows; female sheath pincer-like (Figs. 11-13) . . . . ***Scobina***

— Head without carinae, sometimes with low or rounded carina only on interantennal area and supraclypeal area appearing carinate at center; genal carina absent; pronotum with diagonal furrow from about area of tegula to anterolateral margin; female sheath broad (Figs. 70, 71). . . . . ***Arge***

4. Tarsal claws modified, simple with large acute basal lobe or bifid with long inner tooth (Figs. 95, 242, 243, 294, 469) **5**

— Tarsal claws simple. **8**

5. Hindwing without anal cell (Fig. 89); forewing with intercostal crossvein (Fig. 89); each mandible with 3 large teeth (Fig. 93); antennal flagellum of male simple (Fig. 91) (tarsal claw simple with acute basal lobe, Fig. 95; radial cell of forewing open, Fig. 89; small, ca. 5-6 mm long, black or red and black). . . . . ***Atomacera***

— Hindwing with anal cell (Fig. 236); forewing without intercostal crossvein (Figs. 236, 466); left mandible simple or with one or two small teeth or crenulations near center and right mandible with one basal tooth (Fig. 240); antennal flagellum of male furcate (Fig. 203). **6**

6. Mandible extremely enlarged and inflated at base (Fig. 239); palpi short, maxillary palpus 3-segmented and labial palpus 3-segmented, labium without lobes (Fig. 241); each tarsal claw with long inner tooth or foreclaw with long inner tooth and mid- and hindclaws simple with basal lobe (Figs. 242, 243) (head from above enlarged and broadened behind eyes; usually large, ca. 10 mm or more long). . . . . ***Themos***

— Mandible not so enlarged at base, narrow and tapering to apex; palpi long, maxillary palpus 6-segmented, labial palpus 4-segmented, labium trilobed (Figs. 296, 472); tarsal claws with long inner tooth or simple with basal lobe, never a combination of both. **7**

7. Tarsal claw simple with large basal lobe (Fig. 294); high Y-shaped interantennal carina present which bisects supraclypeal area below (as in Fig. 268); eyes large and converging below, lower interocular distance much less than eye length (Fig. 268); radial cell of forewing open at apex. . . . . ***Acrogymnidea***

— Tarsal claw bifid, with long inner tooth, without basal lobe (Fig. 469); interantennal area low and rounded, without sharp carina; eyes smaller, not so converging below, lower interocular distance about equal to to greater than eye length (Fig. 468); radial cell of forewing usually closed. . . . . ***Neoptilia***

8. Jugal area of hindwing enormously expanded (Figs. 663, 664). . . . . ***Trochophora***

— Jugal area of hindwing normal (as in Figs. 338, 442, 495, 532, 533). **9**

9. Radial cell of forewing with crossvein near apex, the cell apical to the crossvein closed (Fig. 144) (basal crossvein Cu_1 between $M+Cu_1$ and 1A present in hindwing only, as in Fig. 131; mandibles with 2 or 3 sharp teeth, Fig. 145; palpi as in Fig. 146; sheath broad from above, Fig. 149) . . . . ***Neurogymnia***

— Radial cell of forewing open or closed at its apex, but without a crossvein **10**

10. Radial cell of forewing closed at its apex *and* anal cell of hindwing present (Figs. 131, 338, 442, 495) **11**

— Radial cell of forewing closed at its apex *and* anal cell of hindwing absent, or radial cell of forewing open at its apex and anal cell of hindwing present or absent **20**

11. Basal crossvein Cu_1 between veins $M+Cu_1$ and 1A present in forewing and hindwing (Fig. 131); intercostal crossvein (Sc) present but may be difficult to see **12**

— Basal crossvein Cu_1 absent; intercostal crossvein present or absent **13**

12. Head from above strongly narrowing behind eyes (Fig. 133); 10 mm or less in length (maxillary palpus 6 segmented, longer than eye length, labial palpus 4-segmented, Fig. 135; each mandible 3-toothed, Fig. 134; sheath pincer-like from above, Fig. 138) . . . . ***Eriglenum***

— Head from above broadened behind eyes (as in Figs. 229, 230); ca. 16 mm in length (according to Malaise, 1942, maxillary palpus 4-segmented, labial palpus 3 segmented, shorter than eye length; sheath from above not pincer-like, Fig. 223) . . . . ***Mallerina***

13. Intercostal crossvein (Sc) present in forewing, basal anal cell absent (Figs. 198, 256); large, 12 mm or more long; head from above broadened behind eyes (as in Fig. 201). **14**

— Intercostal crossvein absent and basal anal cell usually present in forewing; usually smaller than 10 mm long and head from above sharply narrowing behind eyes **15**

14. Clypeus with central, semicircular emargination (Fig. 217); forewing with 4 cubital cells (as in Fig. 198); female antenna with small lobe at base of flagellum (Fig. 214). . . . . ***Digelasinus***

— Clypeus truncate (Fig. 257); forewing with 3 cubital cells (Fig. 256); female antennal flagellum without lobe (Fig. 264) . . . . ***Topotrita***

15. Last closed cubital cell of forewing quadrate, about as long on the radius as on the cubitus (Figs. 305, 388, 442); palpal segments of uniform width or 3rd segment of labial palpus and/or 4th segment of maxillary palpus slightly expanded (Figs. 392, 447). **16**

— Last closed cubital cell of forewing elongate, longer on the radius than on the cubitus, except some *Ptilia* (Figs. 338, 377); 3rd or 2nd and 3rd segments of labial palpus and 4th segment of maxillary palpus expanded, much broader than other segments (Figs. 343, 344, 380, 500). **18**

16. Lower interocular distance greater than eye length, eyes small, slightly converging below, interantennal area rounded (Fig. 307); maxillary palpus shorter than eye length, all palpal segments of uniform width (Fig. 309) . . . . ***Adurgoa***

— Lower interocular distance shorter than eye length, eyes large and converging below, interantennal carina present, sharp (Figs. 389, 443); maxillary palpus longer than eye length, palpi without expanded segments or 3rd segment of labial palpus and 4th segment of maxillary palpus expanded (Figs. 392, 447) **17**

17. First antennal segment large, bulbous, much broader than other segments (Fig. 445); apical anterior margin of radial cell of forewing close to anterior margin of wing, with none or a very short accessory vein (Fig. 442); interantennal carina high and sharp (Fig. 443); palpi without expanded segments or sometimes with 3rd segment of labial palpus slightly expanded (Fig. 447) (most species orange with black marks) . . . . ***Manaos***

— First antennal segment normal, not broader than rest of antenna (Fig. 394); apical anterior margin of radial cell of forewing removed from anterior margin of wing, with long accessory vein (Fig. 388); interantennal carina various; palpi usually with 3rd segment of labial palpus and 4th segment of maxillary palpus expanded (Fig. 392) . . . . ***Hemidianeura*** (in part)

18. Lower interocular distance greater than eye length, eyes small and not so converging below (Fig. 378); from above head broadened behind eyes; usually longer than 10 mm; female lancet long and multisegmented (Figs. 385-387) . . . . ***Durgoa***

— Lower interocular distance shorter than or subequal to eye length, eyes large and converging below (Figs. 339, 496); head from above sharply narrowing behind eyes; size various, mostly smaller than 10 mm long; female lancets short, some nearly triangular (Figs. 354-362, 505-509) **19**

19. Interantennal area without a carina, usually smooth and somewhat depressed (Figs. 496, 497); flagellum of female antenna compressed and tapering to acute apex (Fig. 498); sheath in lateral view acute at apex (Figs. 501-504); lancets short and triangular (Figs. 505-509); 2nd and 3rd segments of labial palpus expanded (Fig. 500) (commonly yellowish species, wings partly yellowish) . . . . ***Ptilia***

— Interantennal area with small or large carina (Fig. 339); flagellum of female various, but usually round or oval and rounded at apex (Figs. 340, 341); sheath in lateral view rounded at apex, usually with distinct scopae (Figs. 345-353); lancets more elongate (Figs. 354-362); usually only 3rd segment of labial palpus expanded (Figs. 343, 344) (color various, but commonly red and black) . . . . ***Didymia***

20. Radial cell of forewing closed at its apex *and* anal cell of hindwing absent (Figs. 198, 653, 674) **21**

— Radial cell of forewing open at its apex, anal cell of hindwing present or absent **24**

21. Intercostal crossvein (Sc) of forewing present (that of male sometimes faint) and forewing without basal anal cell (Fig. 198); clypeus with central, semicircular emargination (Fig. 200); eyes small and far apart (Fig. 200); head from above broadened behind eyes (Fig. 201) (lancet long, multisegmented, Figs. 207-209). . . . . ***Dielocerus***

— Intercostal crossvein absent and basal anal cell present in forewing; clypeus usually truncate; eyes small or large and closer together (Figs. 389, 675); head from above usually sharply narrowing behind eyes **22**

22. Last closed cubital cell of forewing much longer on the radius than on the cubitus *and* eyes large and converging below with lower interocular distance shorter than eye length (maxillary palpus longer than eye length, with 3rd segment of labial palpus and 4th segment of maxillary palpus expanded (Fig. 655) . . . . ***Triptenus***

— Last closed cubital cell of forewing as long as or shorter on radius than on cubitus (Figs. 388, 674) or eyes not distinctly converging, with lower interocular distance longer than eye length **23**

23. Eyes large, lower interocular distance shorter than or subequal to eye length (Fig. 389); female antennal flagellum tapering and usually curved (Fig. 394); maxillary palpus longer than eye length and 2nd segment of labial palpus and sometimes 4th segment of maxillary palpus enlarged (Figs. 392, 393) . . . . ***Hemidianeura*** (in part)

— Eyes small, lower interocular usually greater than eye length (Fig. 675); female antennal flagellum more clublike and rounded at apex (Fig. 680); maxillary palpus subequal to or shorter than eye length, palpi with all segments uniformly narrow or sometimes 3rd segment of labial palpus slightly enlarged (Figs. 678, 679) . . . . . . ***Zynzus***

24. Radial cell of forewing open at its apex *and* anal cell of hindwing present (Figs. 267, 323, 532, 533). **25**

— Radial cell of forewing open at its apex *and* anal cell of hindwing absent (Figs. 156, 514, 619) **31**

25. Interantennal carina high, sharp, Y-shaped, bisecting supraclypeal area below (Fig. 268) (eyes large, lower interocular distance less than eye length; maxillary palpus longer than eye length, without enlarged segments, 3rd segment of labial palpus sometimes enlarged, Fig. 271; last closed cubital cell of forewing short, as long on radius as on cubitus, Fig. 267) . . . . ***Acrogymnia***

— Interantennal carina straight or interantennal area rounded **26**

26. Eyes large and converging below, lower interocular distance less than eye length (Fig. 646); last closed cubital cell of forewing longer on radius than on cubitus (Fig. 644) (female antennal flagellum flattened, tapering to acute apex, Fig. 645; maxillary palpus longer than eye length, without enlarged segments, labial palpus with 3rd segment enlarged, Fig. 649; mostly yellow, wings yellowish with apices black) . . . . ***Trailia***

— Lower interocular distance greater than or subequal to eye length (as in Fig. 324); last closed cubital cell of forewing various **27**

27. Forewing without basal anal cell (head from above depressed between eyes, Fig. 318; palpi shorter than eye length, segments uniformly slender; female antennal flagellum clublike, shorter than head width, Fig. 319; malar space broader than diameter of front ocellus; northern Mexico and western U.S.) . . . . ***Aprosthema***

— Forewing with basal anal cell (Fig. 532) **28**

28. Hindtibia produced into a collar at apex, tibial spines arise at base of collar and do not extend beyond its apex (Fig. 328) (eyes small, not distinctly converging, lower interocular distance greater than eye length, Fig. 324; usually without interantennal carina; palpi short, without enlarged segments, Fig. 327 . . . . ***Brachyphatnus***

— Hindtibia without collar at apex, tibial spines arise at apex of tibia (as in Fig. 5) **29**

29. Left mandible simple or with several small crenulations at center, right mandible with basal tooth (Figs. 536, 537); last closed cubital cell of forewing short, as long or a little longer on radius than on cubitus (Figs. 532, 533); hindcoxae contiguous; head not notably narrower than thorax; female lancets usually long and multisegmented (Figs. 570-604) (all palpal segments narrow or sometimes 3rd segment of labial palpus enlarged, Figs. 538-540) . . . . ***Sphacophilus***

— Each mandible with 3 sharp teeth or right mandible with 2 sharp teeth (Figs. 161, 191); last closed cubital cell of forewing markedly longer on radius than on cubitus (Fig. 156); hindcoxae separated; head short and broad from above, usually much narrower than enlarged thorax (Figs. 157, 158); female lancets short and triangular, with 10 or fewer segments (Figs. 170-183, 195) (palpi usually shorter than eye length, without enlarged segments, or with 3rd segment of labial palpus slightly enlarged) **30**

30. Each mandible with 3 sharp teeth (Fig. 161); antennal length 1 1/2X or less head width (Fig. 159); segments of palpi uniformly narrow (Figs. 162, 163) .... ***Sericoceros*** (in part)

— Left mandible with 3 sharp teeth, right mandible with 2 sharp teeth (Fig. 191); antennal length 2X head width (Fig. 193); 3rd segment of labial palpus slightly enlarged (Fig. 192) .... ***Subsymmia***

31. Female antennal flagellum flattened, tapering to acute apex (Fig. 622); interantennal carina sharp, sometimes Y-shaped above and bisecting part of supraclypeal area below (Fig. 620) (eyes large and converging below, lower interocular distance usually less than eye length, Fig. 620; maxillary palpus longer than eye length, segments not enlarged, 3rd segment of labial palpus usually enlarged, Fig. 624; last closed cubital cell of forewing longer on radius than on cubitus, Fig. 619; female sheaths usually slender, without scopae, Figs. 625-629) .... ***Tanymeles***

— Antenna clublike, compressed, oval or rounded in cross section, apex rounded (Figs. 516, 518); interantennal carina short or not developed (palpal segments usually of uniform width, not or only slightly enlarged, Figs. 374, 520) **32**

32. Last closed cubital cell of forewing short, as long or slightly longer on radius than on cubitus (Fig. 514) (female antenna usually much shorter than head width, Figs. 516, 518; interantennal carina short, sometimes rounded; lower interocular distance greater than or subequal to eye length (Fig. 515); female sheath with scopae, Figs. 522-524; usually 6 mm or less in length) .... ***Schizocerella***

— Last closed cubital cell of forewing longer on radius than on cubitus (Fig. 156) (usually 8 mm or more in length) **33**

33. Each mandible with 3 sharp teeth (Fig. 161); eyes small, only slightly converging below, lower interocular distance much longer than eye length (Fig. 157); head from above strongly narrowing behind eyes, and not as broad as enlarged thorax (Fig. 158); malar space as broad or broader than diameter of front ocellus (Fig. 157); hindcoxae separated (female lancets short and triangular, Figs. 170-183; female sheaths short and broad, Fig. 167) .... ***Sericoceros*** (in part)

— Left mandible simple, right mandible with basal tooth (as in Fig. 342); eyes large and converging below, lower interocular distance subequal to eye length; head from above broadened behind eyes, and breadth of head subequal to breadth of thorax; malar space nearly linear; hindcoxae contiguous (sheath rounded at apex in lateral view, very slender from above, Figs. 375, 376) .... ***Duckeana***

Subfamily ZENARGINAE

Zenarginae Rohwer 1918: 434.— Benson 1938: 373.— Benson 1963: 634.

Antennal flagellum of both sexes simple; antenna inserted on head at about midlength of eyes. Genal carina present; each mandible with one large subapical tooth; maxillary palpus 6-segmented, labial palpus 4-segmented. Pronotum with indication of furrow from near tegula to anterolateral margin; ventral arms of cervical sclerites nearly truncated and broadly meeting on meson; cenchri small and much farther apart than the breadth of one. Forewing with anal cell complete and crossed by a crossvein (a) (Fig. 1), basal part of vein 2A+3A not atrophied; costa not swollen, narrower than intercostal area; intercostal crossvein present; distance between M and Rs+M on Sc+R about half length of vein M; 1r connected to stigma near junction of stigma and Sc+R. Hindwing with cell M absent, Rs present, anal cell absent. Two preapical spines on midtibia, one preapical spine on hindtibia; outer foretibial spine with short lateral tooth; tarsal claws simple.

The complete anal cell of the forewing, two preapical spines on the midtibia, absence of cell M in the hindwing, small lateral tooth of the outer foretibial spine, and small cenchri are not found in any other Argidae.

This subfamily is mentioned because of its unique features in the Argidae and because it is the only subfamily not represented in the neotropics. One genus with one species and two subspecies, *Zenarge turneri turneri* Rohwer and *Z. turneri rabus* Moore, are known in Australia. Hosts are *Callitris* and *Cupressus*, both Cupressaceae. No other argids are known to feed on coniferous plants.

Subfamily ARGINAE

Arginae Rohwer 1918: 435.— Benson 1938: 373.— Benson 1963: 634.
Athermantinae Benson 1938: 375.
Athermantini Benson 1938: 373.— Benson 1963: 634.
Sjoestedtini Benson 1938: 375.
Tanyphatnideini Benson 1938: 375.
Argini Benson 1963: 634.
Scobinini Benson 1963: 634.

Antennal flagellum of both sexes simple (Fig. 6); antennae inserted on head above level of middle of eyes (Fig. 10). Head with or without sharp carinae on frontal area, inner orbits, between ocelli and eye; with or without genal carina. Maxillary palpus 6-segmented, labial palpus 3-segmented (Fig. 7); labium trilobed; each mandible simple or one or the other with basal tooth (Fig. 8). Pronotum with or without a lateral diagonal furrow; cenchri large, transverse, much closer together than half the breadth of one. Forewing (Figs. 2, 66) with costa narrower than intercostal area; intercostal crossvein (Sc) present; vein 1r joined at or near the junction of Sc+R and stigma, sometimes on Sc+R; radial cell closed; Rs+M and M usually meet Sc+R at or near the same point. Hindwing (Figs. 2, 66) with radial cell closed; anal cell present. Mid- and hindtibiae each with one preapical spine (Fig. 5) (in New World genera); tibial spines long, greater than width of apices of tibiae; inner foretibial spine nearly twice length of outer spine; foretibial spines simple; tarsal claws simple.

Benson (1963) included three tribes, the Athermantini, Scobinini, and Argini. The latter two are represented in the Western Hemisphere by *Scobina* and *Arge*, respectively. Benson included the neotropical *Scobina* and *Stelidarge* (here considered a synonym of *Scobina*), and the Australian *Antargidium* in the Scobinini. The Athermantini included five or six small southeast Asian and African genera. Two genera occur in the New World and all others are Australian or Asian. A reevaluation of the world fauna is needed to justify tribal groupings.

All Arginae treated here have the male antennal flagellum simple, vein 1r of the forewing joining Sc+R near the junction of Sc+R and the stigma, the radial cell of the hindwing closed, the mid- and hindtibiae with one preapical spine, and simple tarsal claws. Two other characters found in some of the Arginae but not in other argids (except Zenarginae) are the presence of a genal carina and other carinae on the head and a furrow on the pronotum from about the area of the tegula to the anterolateral margin.

Genus SCOBINA Lepeletier and Serville

Scobina Lepeletier and Serville 1828: 574. Type species: *Hylotoma melanocephala* Lepeletier. Monotypic.
Caloptilia Ashmead 1898: 212. Preoccupied by *Caloptilia* Huebner, 1825. Type species: *Caloptilia townsendi* Ashmead. Orig. desig.
Labidarge Konow 1899a: 309-310. Type species: *Labidarge bolivari* Konow. Desig. by Rohwer 1911a.
Stelidarge Konow 1901: 58. **New synonymy.** Type species: *Stelidarge diptycha* Konow. Monotypic.

First and 2nd antennal segments each about as long as broad; 3rd segment usually flattened (Fig. 6). Head with carinae as in Fig. 10, with transverse carina along clypeal margin, supraclypeal carina branching near interantennal area with branches nearly reaching lateral ocelli, carina extending laterally from each lateral ocellus to inner margin of each eye, short inner orbital carina on lower portion of eye; genal carina present. Clypeus subtruncate to slightly emarginate at center; malar space slightly less than to slightly more than diameter of front ocellus; lower interocular distance usually greater than eye length, eyes slightly converging below; labrum broadly rounded to truncate; maxillary palpus 6-segmented, labial palpus 4-segmented, segments of uniform width (Fig. 7), maxillary palpus longer than eye length. Pronotum without diagonal furrow from area near tegula to anterolateral margin. Forewing (Fig. 2) with radial cell closed; basal anal cell present or absent; intercostal crossvein (Sc) present. Hindwing (Fig. 2) with radial cell closed; anal cell present. Mid- and hindtibia each with preapical spine (Fig. 5); apical tibial spines usually longer than width of tibiae at apices; inner foretibial spine about half length of outer one; tarsal claw simple. Female sheath with narrow, usually cylindrical scopae, narrowing apically in lateral view, pincer-like in dorsal view (Figs. 11-13).

Representatives of *Scobina* are recognized by the presence of a preapical spine on the mid- and hindtibiae, presence of carinae on the head, presence of a genal carina, lack of a pronotal groove, closed radial cell of the hindwing, simple antennal flagellum of the male, and the pincer-like female sheath.

Malaise (1937) first characterized *Scobina* and synonymized *Labidarge* and *Caloptilia*. Prior to Malaise, most species were placed in *Hylotoma* by Dalla Torre (1894) or *Labidarge* and *Stelidarge* by Konow (1907a). *Stelidarge* was separated from *Labidarge*, or more recently from *Scobina*, only by the absence of a basal anal cell in the forewing. This is too variable for use as a generic character. The stub of vein 2A+3A is sometimes faint, or even partially present, with the result that some species were described in *Stelidarge* even though they are only variations of the same species in *Scobina*. I could not find other characters to separate the two groups and therefore am treating all species as *Scobina*.

Besides the presence or absence of the basal anal cell in the forewing, another difference in forewing venation is apparent. A number of species have veins M and Rs+M widely separated on Sc+R and vein M meeting Sc+R basal to Sc (Fig. 3). Most species have veins M and Rs+M meeting near the same point on Sc+R and vein M meeting Sc+R apical to Sc (Fig. 2). This difference could also be used for groupings. Those that have the veins widely separated on Sc+R are *dorsalis, fascialis, lurida, melanaria, zantara, dibapha, collaris, brusa*, and *eximia*. In one species, *diagonica*, Sc is diagonal and subparallel with M (Fig. 4), but in all other species Sc is perpendicular to Sc+R.

Konow (1907a) gave a key to species, most of them as *Labidarge*, but a few under *Scobina* and *Stelidarge*, and Forsius (1925a) gave a key to the species of *Stelidarge* known to him. These have been the only references to aid in species identification.

Scobina is one of the most commonly collected groups of sawflies in the neotropics. Little is known of their habits and host plants, but some adults have been captured from various flowers and two species, *S. guatemalensis* and *S. consobrina*, have been associated with *Sida* sp. About 50 species are known, distributed from Mexico to northern Argentina.

Color variation is common, and sexes of most species are very different. The following key is best for females, though males when known and if that sex was described are included. Most variation apparently occurs in males, so keying single males should be done cautiously.

KEY TO SPECIES

1. Head yellow, only ocellar area or narrow transverse band between eyes through ocelli may be black; wings yellow with apex or base and apex black 2

— Head black, or black above and behind eyes and whitish below ocelli to mouthparts; wings uniformly hyaline, uniformly blackish, or bicolored 4

2. Forewing yellow at center, black at base and apex (thorax yellow, abdomen yellow with black apex; femora sometimes black; hindtibia black with white at base; hindbasitarsus white, rest of hindtarsal segments black; lancet similar to *poecila*, Fig. 21; male genitalia as in Fig. 57) . . . . ***consobrina*** (Norton)

— Forewing yellow with only apex black, veins at extreme base may be blackish 3

3. Hindbasitarsus white, at most black at extreme apex; lancet similar to that of *poecila*, Fig. 21; male genitalia as in Fig. 60 (variable in color with hindcoxa black or yellow, hindfemur black to yellow, and mesonotum yellow or with black stripes; mesosternum yellow) . . . . ***guatemalensis*** (Dalla Torre) (in part)

— Hindtarsus all black; lancet as in Fig. 24; male genitalia as in Fig. 59 (amount of black on hindfemur variable; mesosternum usually black) . . . . ***lepida*** (Klug) (in part)

4. Femora, at least hindfemur, black, half or more black, or black on entire inner surface 5

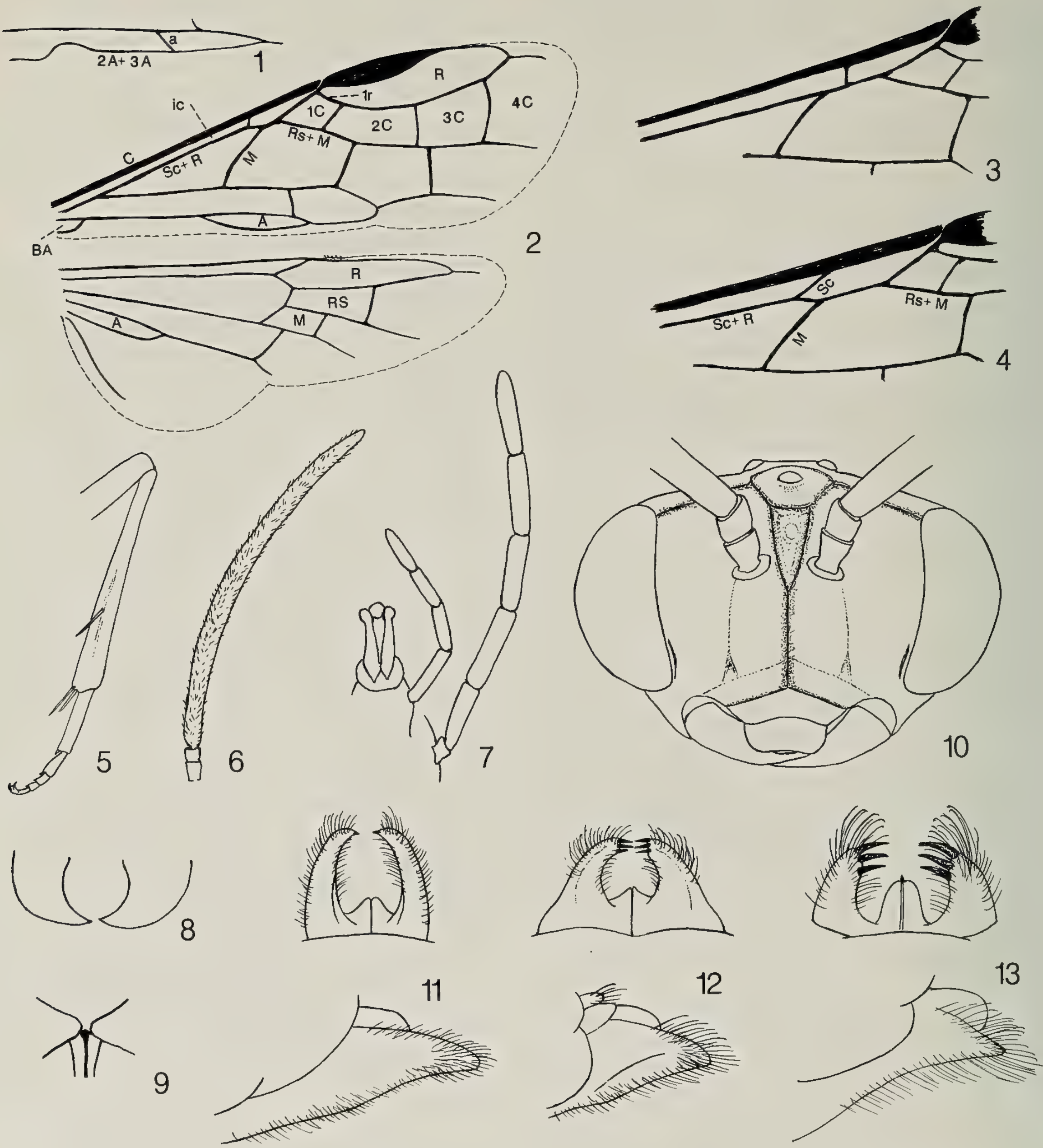
— Femora, at least hindfemur, yellow or orange, at most hindfemur black at base and/or apex, but black less than 1/2 of surface 26

5. Forewing bicolored, yellow with black apex 6

— Forewing uniformly blackish, hyaline, or dark yellowish, or hyaline with apex somewhat more blackish (costa and stigma may be pale) 8

6. Head and legs entirely black; mesonotum except sometimes scutellum and/or lateral lobes black; abdomen black with basal 4-5 segments or only basal 4-5 terga orange at center (lancet as in Fig. 25; male genitalia as in Fig. 49) . . . . ***tina***, new species

— Face below and just above antennae white; tibiae partly white; mesonotum mostly yellow; abdomen mostly or at least basal sterna yellow 7



Figs. 1-13. 1, Anal area of forewing of *Zenarge turneri*. 2-13, *Scobina*. 2, Forewing and hindwing of *S. melanocephala*. 3. Anterior central portion of forewing of *S. fascialis*. 4, Anterior central portion of forewing of *S. diagonica*. 5, Hindtibia and tarsus of *S. melanocephala*. 6, Female antenna of *S. melanocephala*. 7, Palpi of *S. melanocephala*. 8, Mandibles of *S. melanocephala*. 9, Cervical sclerites of *S. melanocephala*. 10, Front view of head of *S. melanocephala*. Dorsal and lateral views of sheaths of 11, *S. bolivari*; 12, *S. carbonaria*; 13, *S. bonplandi*. (ic = intercostal area; BA = basal anal cell; 1C = first cubital cell ($1R_1$); 2C = second cubital cell (1Rs); 3C = third cubital cell (2Rs); 4C = fourth cubital cell (3Rs); R = radial cell ($2R_1$ in forewing; R_1 in hindwing); lateral and dorsal views are shown for most female sheaths.).

7. Hindbasitarsus white, tibiae black with basal 1/3 white; abdominal terga mostly black and abdomen black at apex; thorax yellow with mesosternum black; sheath in dorsal view without stout spines (as in Fig. 11) (lancet similar to that of *poecila*, Fig. 21; male genitalia as in Fig. 60) .... ***guatemalensis*** (Dalla Torre) (in part)

— Hindtarsus black, tibiae white with basal 1/4 of mid- and hindtibiae black; apical 3-4 abdominal segments black, rest yellow; thorax orange with lower 1/2 mesepisternum and spot on each side of mesosternum black; sheath in dorsal view with 3 stout spines (as in Fig. 13) .... ***bipartita*** (Cameron)

8. Entirely black, tibiae and/or base of femora may be whitish **9**

— Some of thorax or abdomen reddish or yellow **13**

9. In forewing, vein M meets Sc+R basal to Sc, distance between Rs+M and M on Sc+R half or more as long as vein M (Fig. 3) (basal anal cell present in forewing; scopae of sheath stout in dorsal view with large inner apical spines, as in Fig. 13) **10**

— In forewing, vein M meets Sc+R apical to Sc, veins Rs+M and M meet Sc+R at nearly the same point (Fig. 2). **12**

10. Mid- and hindlegs black; forewing uniformly blackish (lancet as in Fig. 18, without annular spines; sheath as in Fig. 13; male genitalia as in Fig. 56) .... ***dorsalis*** (Klug)(in part)

— Tibiae white with apical 1/3 or less black; basal 1/3 to 1/2 of femora may be white; forewing hyaline, may be blackish apically **11**

11. Forewing uniformly hyaline with blackish spot below anterior half of stigma; basal 1/3 to 1/2 of mid- and hindfemora whitish; tibiae white with extreme apices black; tarsi black; lancet as in Fig. 27 .... ***brusa***, new species

— Forewing hyaline with apex beyond stigma blackish; femora black; tibiae white with black stripes on inner surfaces; basal two segments of tarsi mostly white; lancet as in Fig. 26 .... ***eximia*** (Kirby)

12. Basal anal cell absent in forewing; scopae of sheath stout in dorsal view (as in Fig. 12) .... ***carbonaria*** (Klug)

— Basal anal cell present in forewing; scopae of sheath slender in dorsal view (as in Fig. 11) (lancet similar to that of *melanocephala*, Fig. 14; male genitalia as in Fig. 53) .... ***styx*** Malaise

13. Hindtibia mostly white or white at base; abdomen black or with basal terga pale and with lateral longitudinal white line or marks **14**

— Hindtibia black; abdomen black or orange, but without lateral white line.................................... **15**

14. In forewing, vein M meets Sc+R apical to Sc, veins M and Rs+M meet Sc+R at nearly the same point (Fig. 2); abdomen with basal terga pale at center and with a lateral white line; length over 6.0 mm; male genitalia as in Fig. 45; lancet as in Fig. 20 .... ***torquata*** (Konow) (in part)

— In forewing, vein M meets Sc+R basal to Sc, distance between veins M and Rs+M on Sc+R half as long as or longer than vein M (Fig. 3); abdomen black; small, 5.5-6.0 long; male genitalia as in Fig. 51; lancet as in Fig. 28 .... ***melanaria*** (Klug)

15. Thorax black (abdomen orange, basal plates sometimes and apical 3 segments black, varying to abdomen nearly all black above with basal sterna orange; lancet similar to that of *notaticollis*, Fig. 23; male genitalia as in Fig. 50). . ... ***inculta*** (Konow)

— Mesothorax partly red or yellowish **16**

16. Abdomen mostly orange with apical segment and sheath black (female with thorax orange with cervical sclerites, center of pronotum, and band separating mesopleuron and mesosternum black; sheath slender in dorsal view, as in Fig. 11; male similar but mesoprescutum and mesonotal lateral lobes, mesosternum, and lower part of mesepisternum black) .... ***nigripes*** (Konow)

— Abdomen black or black above and pale below.................................... **17**

17. Mesopleuron black, if some orange then only upper 1/4 or less.................................... **18**

— Mesopleuron more than 1/4 or entirely orange **19**

18. Scopae of sheath slender in dorsal view, with slender spines on inner margin at apex (Fig. 11); in forewing, vein M meets Sc+R apical to Sc, veins M and Rs+M meet Sc+R at nearly the same point (Fig. 2); female lancet similar to that of *poecila*, Fig. 21; male genitalia as in Fig. 47............................ ***strophosa*** (Konow)(in part)

— Scopae of sheath stout in dorsal view, with 3 stout spines on inner margin near apex (Fig. 13); in forewing, vein M meets Sc+R basal to Sc, distance between veins M and Rs+M on Sc+R half or more length of vein M (Fig. 3); female lancet as in Fig. 18; male genitalia as in Fig. 56 .... ***dorsalis*** (Klug) (in part)

19. Basal anal cell of forewing absent.................................... **20**

— Basal anal cell of forewing present (Fig. 2).................................... **22**

20. Thorax orange with mesosternum and most of mesepisternum black; mesoprescutum and sometimes mesoscutellum black (legs black; male genitalia as in Fig. 58). . . . . ***stigmaticollis*** (Klug)

— Thorax orange but metapleuron, metanotum, and cervical sclerites may be partly black; male with mesoprescutum black. **21**

21 Legs black (lancet similar to that of *melanopyga*, Fig. 19; male genitalia as in Fig. 43) . . . . ***rubricollis*** (Klug)

— Legs black with apical 1/3-1/5 of femora orange, fore- and midcoxae red (metapleuron, metanotum, and cervical sclerites black) . . . . ***geniculata*** (Klug)

22. Pronotum and mesonotum orange **23**

— Usually most of pronotum and/or mesoprescutum black. **24**

23. Forewing with vein M meeting Sc+R basal to Sc, distance between M and Rs+M on Sc+R about as long as M (Fig. 3); lancet with lateral armature (as in Fig. 29); scopae of sheath stout in dorsal view, with 3 stout spines (as in Fig. 13). . . . . ***collaris*** (Klug)

— Forewing with M meeting Sc+R apical to Sc, veins M and Rs+M meeting Sc+R at nearly the same point (Fig. 2); lancet without lateral armature (Fig. 17); scopae of sheath slender in dorsal view (Fig. 11). . . . . ***paradorsalis***, new species

24. Femora white, hindfemur with entire inner surface black (lancet as in Fig. 33; male genitalia as in Fig. 63) . . . . ***emora***, new species (in part)

— Legs or at least hindleg entirely black **25**

25. Most of or middle of pronotum blackish and infuscate blackish spot on anterior 1/2 of mesoprescutum; mesosternum black; Brazil (female unknown) . . . . ***infuscata*** (Klug)

— Color variable, but usually most of pronotum and most of mesoprescutum black, but either one may be mostly reddish; mesosternum orange; northeastern Argentina to Venezuela (lancet similar to that of *poecila*, Fig. 21; male genitalia as in Fig. 47; abdominal sterna may be whitish) . . . . ***strophosa*** (Konow) (in part)

26. Wings bicolored, contrasting yellow and black **27**

— Wings uniformly pale or dark, costa and stigma may be pale **33**

27. Wings black at base and apex, yellow at center **28**

— Wings yellow with black only at apex **29**

28. Hindbasitarsus white, rest of hindtarsal segments black; hindtibia white with black apex in female or mostly black with only base white in male; in forewing, vein M meets Sc+R basal to Sc, distance between M and Rs+M on Sc+R half or more as long as vein M (Fig. 3); lancet as in Fig. 30; male genitalia as in Fig. 48 (mesonotal lateral lobes with black marks; face white; carina on face high, sharp, and protruding, eyes large). . . . . ***fascialis*** (Norton)

— Hindtarsus and hindtibia black; in forewing, vein M meets Sc+R apical to Sc, veins M and Rs+M meet Sc+R at nearly the same point (Fig. 2); lancet as in Fig. 21; male genitalia as in Fig. 40 (carina on face distinct but not as protruding as above; face black varying to brownish and white; mesonotum orange or with black marks on prescutum and/or lateral lobes). . . . . ***poecila*** (Klug)

29. Inner apical surface of scopae with very stout spines (Fig. 13); lancet with lateral armature or well sclerotized and round at apex (Figs. 31, 32) **30**

— Spines at apex of scopae of sheath slender (Fig. 11); lancet without lateral armature, or pointed at apex (Fig. 24) **31**

30. Hindtibia and tarsus black (base of tibia may be orange); head white below antennae; forewing with basal anal cell, intercostal area blackish, vein M meets Sc+R basal to Sc and distance between M and Rs+M on Sc+R about half as long as vein M (Fig. 3); lancet as in Fig. 31. . . . . ***dibapha*** (Konow)

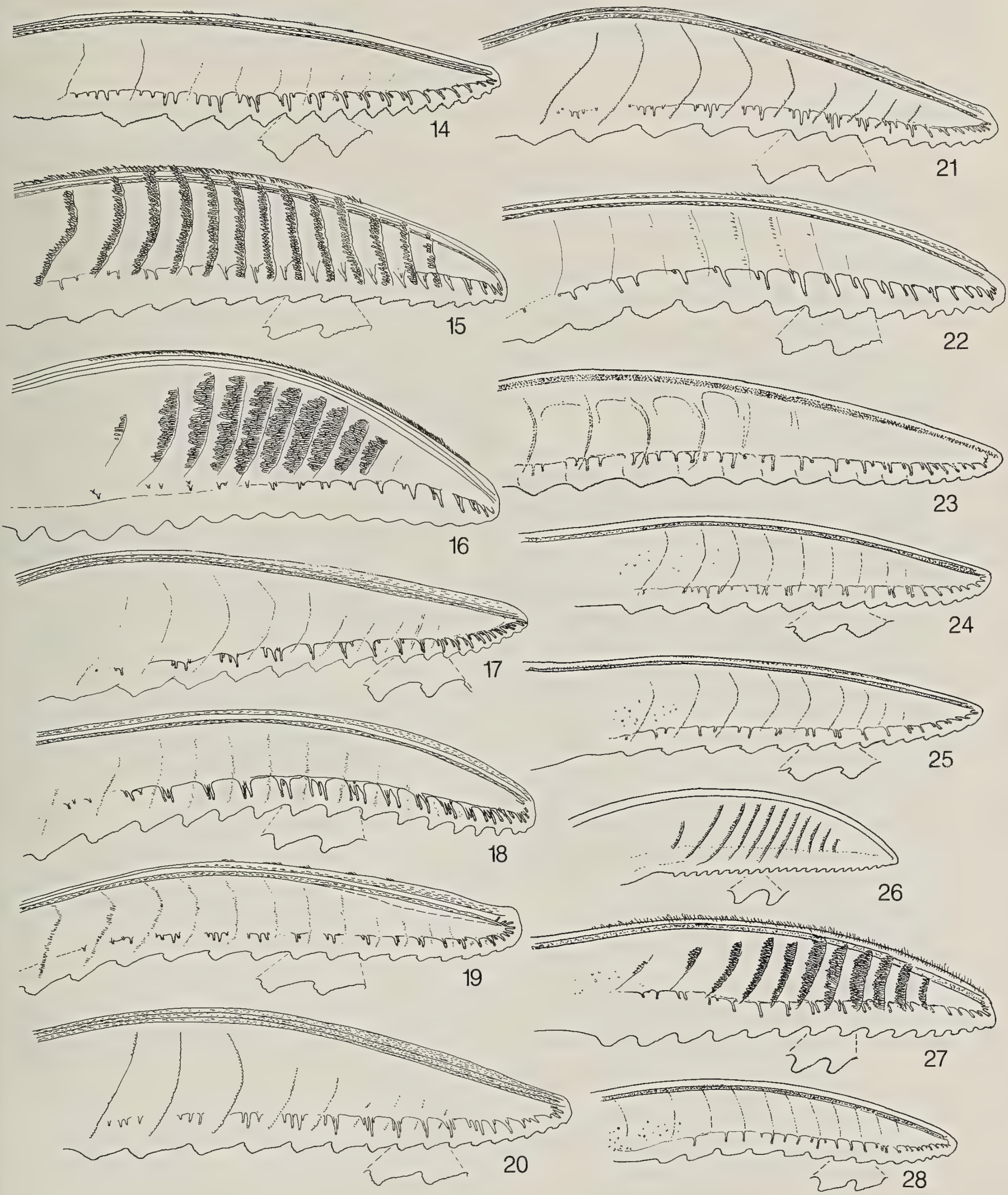
— Basal 3/4 hindtibia black, apical 1/4 white; tarsi white with apical 2-3 segments black; head black; forewing without basal anal cell, intercostal area yellow as rest of base of wing, vein M meets Sc+R apical to Sc, veins M and Rs+M meet Sc+R at nearly the same point (Fig. 2); lancet as in Fig. 32. . . . . ***guaca***, new species

31. Hindbasitarsus white (thorax all orange; tibiae black with basal 1/2-1/4 white; face white; lancet similar to that of *poecila*, Fig. 21; male genitalia as in Fig. 60). . . . . ***guatemalensis*** (Dalla Torre) (in part)

— Hindtarsus black. **32**

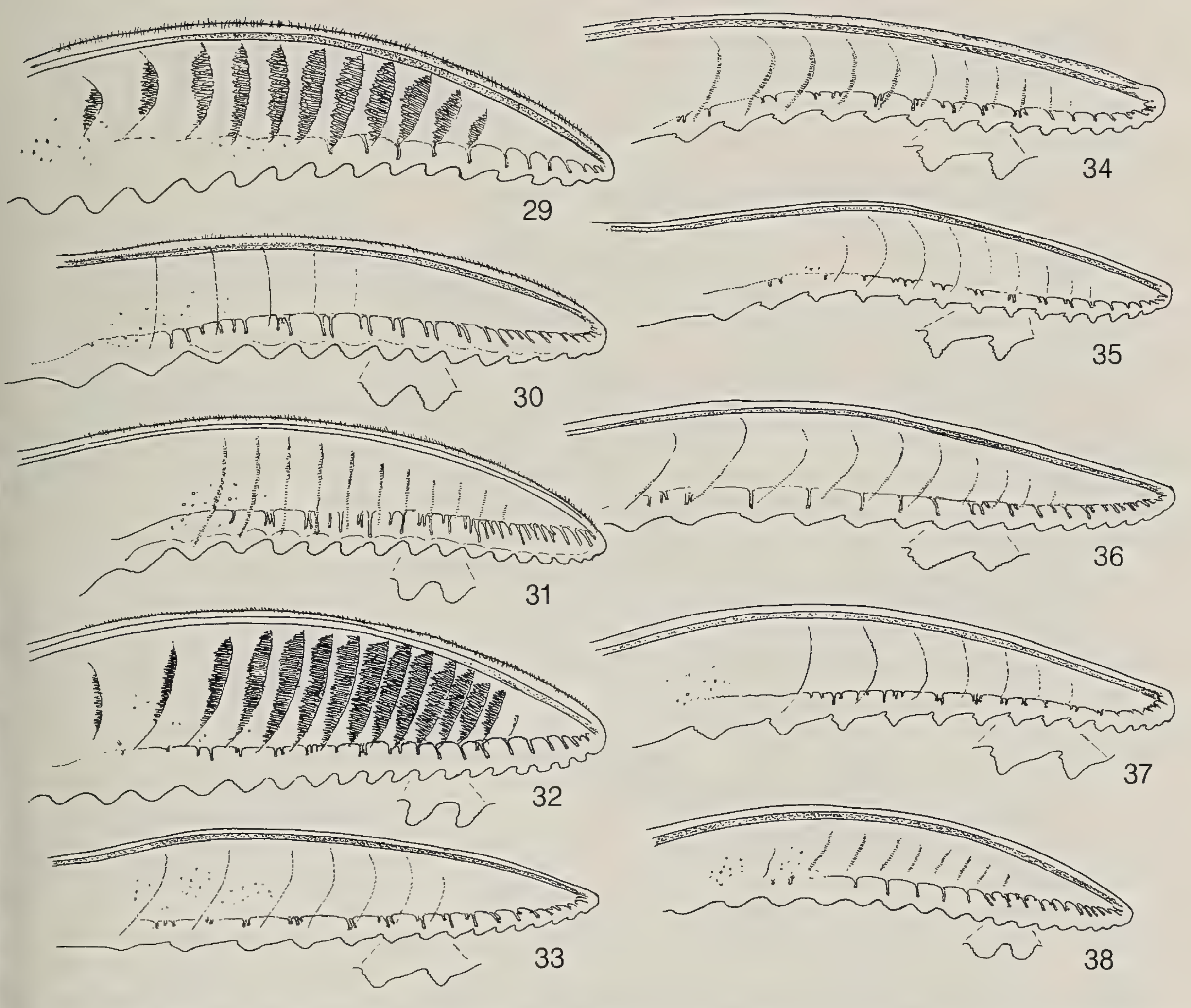
32. Hindtibia white, black only on apical 1/5-1/4; color of thorax variable, yellow with mesosternum usually black, but may be mostly black; lancet as in Fig. 24; male genitalia as in Fig. 59 (wings may be dark in some specimens and hindtibia black in some males). . . . . ***lepida*** (Klug) (in part)

— Hindtibia black; thorax commonly all orange, at most some black on mesonotal lateral lobes; lancet as in Fig. 14; male genitalia as in Fig. 54 . . . . ***melanocephala*** (Lepeletier) (in part)



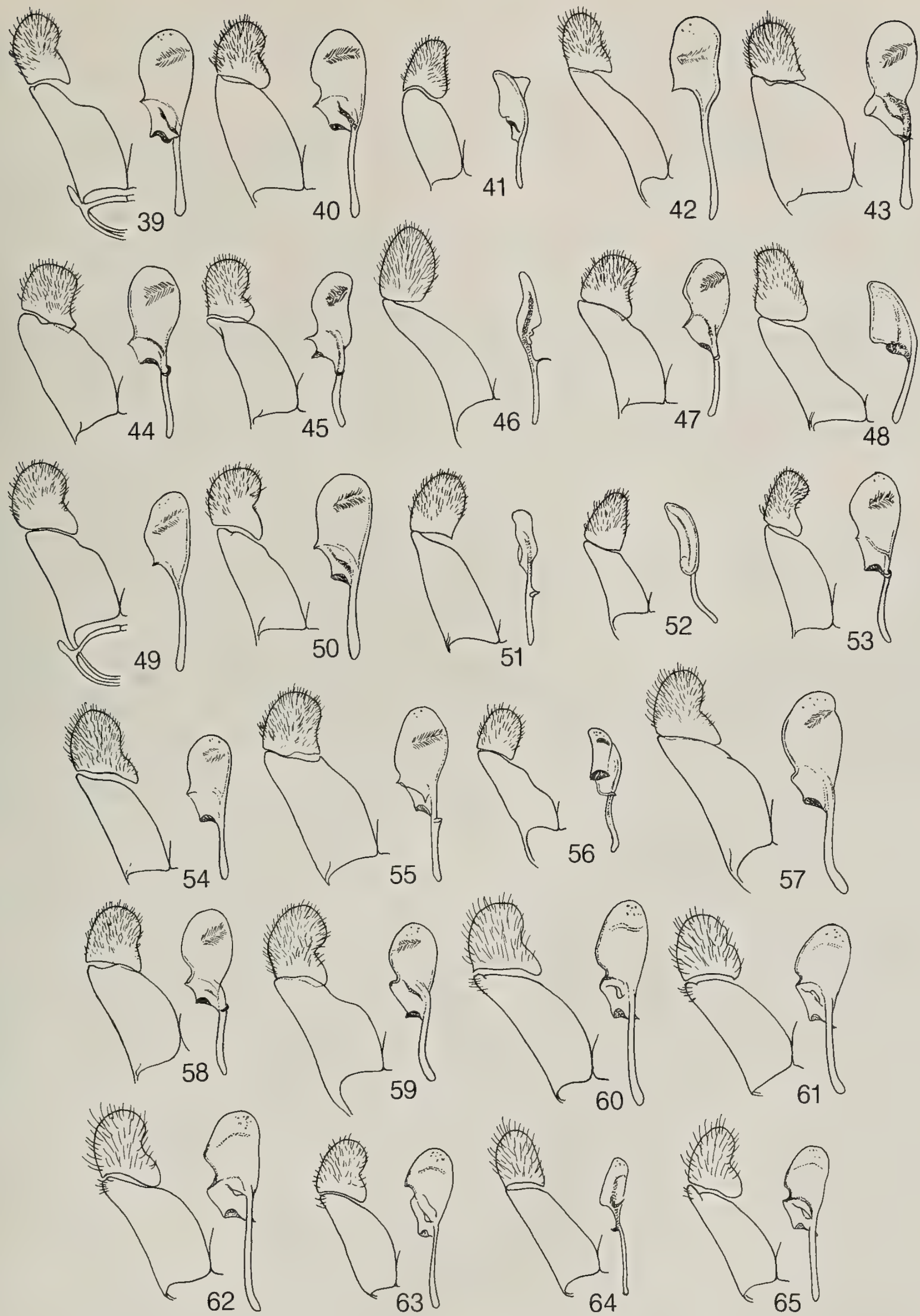
Figs. 14-28. *Scobina*, female lancets. 14, *S. melanocephala*; 15, *S. lurida*; 16, *S. bonplandi*; 17, *S. paradorsalis*; 18, *S. dorsalis*; 19, *S. melanopyga*; 20, *S. torquata*; 21, *S. poecila*; 22, *S. zantara*; 23, *S. notaticollis*; 24, *S. lepida*; 25, *S. tina*; 26, *S. eximia*; 27, *S. brusa*; 28, *S. melanaria*.

33. Hindtibia white or yellow, at least pale on basal 1/3 34
— Hindtibia black, at most pale at extreme base 44
34. Face around and below antennae white (black on thorax variable, from nearly all yellow to black on mesosternum, mesoprescutum, mesonotal lateral lobes, and tegulae; lancet as in Fig. 24; male genitalia as in Fig. 59) . . . . ***lepida*** (Klug) (in part)
— Head black 35
35. In forewing, vein M meets Sc+R basal to Sc, distance between M and Rs+M on forewing long, about half length or more of vein M (Fig. 3) 36
— In forewing, vein M meets Sc+R apical to Sc; veins M and Rs+M meet Sc+R at nearly the same point (Fig. 2) (except *diagonica*, Fig. 4, with distance between M and Rs+M long 37
36. Mesepisternum and mesonotal lateral lobes black; antenna black; lancet as in Fig. 22; male genitalia as in Fig. 41 . . . . ***zantara***, new species
— Mesepisternum and mesonotal lateral lobes orange or partly infuscated blackish; antenna with scape and pedicel usually white; lancet as in Fig. 15; male genitalia as in Fig. 52 . . . . ***lurida*** (Klug)
37. Sc of forewing diagonal to Sc+R and subparallel with vein M (Fig. 4) (thorax and hindbasitarsus orange; lancet as in Fig. 38; male genitalia as in Fig. 64) . . . . ***diagonica***, new species
— Sc of forewing perpendicular to Sc+R and not parallel with vein M (Fig. 2) 38
38. Pronotum black; mesonotum red with prescutum black (abdomen and tarsi black; lancet as in Fig. 33, male genitalia as in Fig. 63) . . . . ***emora***, new species (in part)
— Pronotum orange; mesonotum orange or black with scutellum yellow orange 39
39. Basal anal cell of forewing absent; tarsi orange or with only 4th tarsal segment black 40
— Basal anal cell of forewing present (Fig. 2); tarsi orange or black 42
40. Mesothorax mostly black with mesoscutellum yellow orange; (abdomen mostly black; lancet as in Fig. 34; male genitalia as in Fig. 44) . . . . ***xanthospila*** (Klug)
— Thorax orange, cervical sclerites and metathorax may be black 41
41. Abdomen orange with apical 2-3 segments and sheath black; cervical sclerites and metapleuron orange; legs orange with 4th tarsal segments and narrow stripe on inner margins of tibiae black . . . . ***testacea*** (Klug)
— Abdomen mostly black, whitish lateral and basal spots present, varying in size; cervical sclerites, metapleuron and metanotum except scutellum black; legs orange with hindcoxa, basal half of hindfemur, and apical 3 tarsal segments black (wings blackish but costa and stigma yellow). . . . . ***maculipes*** (Klug)
42. Apices of tibiae and entire tarsi black, bases of basitarsi may be whitish (lancet as in Fig. 20; male genitalia as in Fig. 45) . . . . ***torquata*** (Konow) (in part)
— Tibiae and tarsi orange, apical tarsal segments may be blackish 43
43. Lancet with annular spines (Fig. 16); 3 stout spines on inner apical margin of scopae of sheath (Fig. 13); lower interocular distance as long or longer than eye length (male genitalia as in Fig. 46) . . . . ***bonplandi*** (Jörgensen)
— Lancet without annular spines (as in Fig. 14); 2 stout spines on inner apical margin of scopae of sheath; lower interocular distance shorter than eye length. . . . . ***angusticeps***, new species
44. Face below antennae white (clypeus and labrum white in *nigricollis*) 45
— Head black. 48
45. Thorax with pleura and sterna orange (coloration variable; wings of female mostly blackish varying to yellowish with apex black; thorax all yellow or various amounts of black on mesonotal lobes; male with wings blackish or somewhat hyaline with blackish apex; lancet as in Fig. 14; male genitalia as in Fig. 54). . . . . ***melanocephala*** (Lepeletier) (in part)
— Mesosternum and/or mesopleuron black 46
46. Thorax black, lateral angles of pronotum dark orange; abdomen orange with basal plates, anterior margin of 2nd tergum, and apical segment black (basal two antennal segments reddish; clypeus and labrum whitish; basal anal cell present in forewing) . . . . ***nigricollis*** (Konow)
— Either mesopleuron or mesonotum orange; abdomen orange with apical 2 segments black 47
47. Mesopleuron black with only upper corner of mesepisternum orange; mesonotum orange except black marks on posterior corner of each lateral lobe; only male known. . . . . ***suda*** (Konow)
— Mesopleuron orange; mesonotum black with scutellum partly orange; only female known. . . . ***forficulata*** (Konow)



Figs. 29-38. *Scobina*, female lancets. 29, *S. collaris*; 30, *S. fascialis*; 31, *S. dibapha*; 32, *S. guaca*; 33, *S. emora*; 34, *S. xanthospila*; 35, *S. fulcrata*; 36, *S. bolivari*; 37, *S. poeciloides*; 38, *S. diagonica*.

48. Thorax black, lower mesepimeron and metapleuron may be orange but pronotum always black (basal anal cell of forewing absent) **49**
— Thorax usually extensively yellow or orange on mesopleuron or elsewhere, pronotum orange or at least lower 1/2 on sides orange **50**
49. Black, only hindfemur contrastingly orange (sheath stout in dorsal view, with stout spines in inner apical margin, Fig. 13; lancet as in Fig. 35; eyes small). . . . . ***fulcrata*** (Klug)
— Coxae, trochanters, and femora orange; abdomen orange ventrally, sometimes basal terga orange . . . . ***ventris***, new name
50. Mesepisternum and mesosternum black; mesonotum usually mostly black, or black with scutellum orange **51**
— Mesepisternum and/or mesosternum orange; mesonotum with or without black marks **53**
51. Abdomen orange with apical 2 or 3 segments black (thorax with mesepisternum, mesosternum, and mesoprescutum and mesonotal lateral lobes or only mesoprescutum black; lancet as in Fig. 36, male genitalia as in Fig. 42; *scitula* comes here also, but has costa, stigma, and tegula orange) . . . . ***bolivari*** (Konow)
— Abdomen mostly black above and at apex, orange ventrally **52**
52. Wings darkly, uniformly infuscated black (lancet as in Fig. 37; male genitalia as in Fig. 62). . . . . ***poeciloides*** (Ashmead) (in part)
— Wings hyaline at base, blackish at apex beyond stigma (only male known; thorax black with ventral part of cervical sclerites, pronotum, mesepimeron, and metapleuron orange yellow; tegula black; abdomen black dorsally and apical 3 sternites black, rest of sterna and terga on lateral margins orange yellow) . . . . ***basivitrata*** Malaise
53. Abdomen black, only basal sterna dark orange; thorax orange, middle of pronotum, small spot on mesoprescutum, and metanotum black (extreme apex of femora tipped with black) . . . . ***braunsi*** (Konow)
— Abdomen orange with apex black or various black markings on dorsum, not solidly black; thorax entirely orange or with black markings **54**
54. At least 2 of the 4 mesonotal lobes all or mostly black; mesosternum usually orange **55**
— Thorax orange or at most a black mark on mesoprescutum or mesosternum partly black **58**
55. Thorax black above; basal anal cell of forewing absent (lower 1/2 pronotum, lower 1/2 cervical sclerites, mesopleuron except black on upper corner and anterior margin, and metapleurae orange; clypeus orange; abdomen orange with basal plates, spots on terga 5 and 6 and terga 7 to apex black; apex of femora black) . . . . . . ***nigripennis*** (Enderlein)
— Some of the mesonotal lobes orange; basal anal cell of forewing present **56**
56. Mesoprescutum and mesoscutellum black (metascutellum black; abdomen with terga 6 to apex black, sterna orange; sheath slender in dorsal view, as in Fig. 11) . . . . ***basalis*** (Klug)
— Mesonotum with lateral lobes and/or prescutum with black, scutellum orange **57**
57. Mesonotum with lateral lobes and prescutum mostly black; tegula orange; Peru (costa and stigma orange; mesepisternum mostly black but suffused with orange; abdomen orange with apical 2 1/2 segments black; wings somewhat yellowish with apex blackish) . . . . ***scitula*** (Konow)
— Mesonotum with lateral lobes black and prescutum usually orange; tegula usually black; Mexico and Central America (lancet as in Fig. 37; male genitalia as in Fig. 62) . . . . ***poeciloides*** (Ashmead) (in part)
58. Abdomen orange, sheath orange or black, sometimes with few black spots centrally on apical terga (thorax orange or with small black lateral spot on each mesonotal lateral lobe near tegula; extreme bases of tibiae pale; lancet as in Fig. 37; male genitalia as in Fig. 62) . . . . ***poeciloides*** (Ashmead) (in part)
— Abdomen orange with apical 2 or 3 segments or apical 2 or 3 terga black or more extensive black areas on dorsum, sheath usually black **59**
59. Abdomen dorsally with black and orange pattern, either orange with a medial longitudinal black stripe, or black laterally with a medial longitudinal orange stripe **60**
— Abdomen orange with black apex or mostly solidly black above **61**
60. Abdomen orange with a medial longitudinal black stripe, apical 2 or 3 segments black; thorax orange with only metascutellum black . . . . ***vittata*** (Mocsáry)
— Abdomen with terga black laterally and with medial longitudinal orange stripe, apical 2 or 3 segments black; thorax orange with black stripe on each side of mesosternum . . . . ***bimaculata*** (Mocsáry)
61. Wings black, but costa and stigma paler, orange to yellow; basal anal cell of forewing absent **62**
— Wings, including costa and stigma, black; basal anal cell of forewing present (Fig. 2) or absent **63**



Figs. 39-65. *Scobina*, male genitalia. 39, *S. notaticollis*; 40, *S. poecila*; 41, *S. zantara*; 42, *S. bolivari*; 43, *S. rubricollis*; 44, *S. xanthospila*; 45, *S. torquata*; 46, *S. bonplandi*; 47, *S. strophosa*; 48, *S. fascialis*; 49, *S. tina*; 50, *S. inculta*; 51, *S. melanaria*; 52, *S. lurida*; 53, *S. styx*; 54, *S. melanocephala*; 55, *S. melanopyga*; 56, *S. dorsalis*; 57, *S. consobrina*; 58, *S. stigmaticollis*; 59, *S. lepida*; 60, *S. guatemalensis*; 61, *S. paradorsalis*; 62, *S. poecilioides*; 63, *S. emora*; 64, *S. diagonica*; 65, *S. thoracica*. (For most male genitalia, the ventral view of the left half of the genital capsule and the lateral view of the penis valve are shown.)

62. Mesoprescutum black on anterior 3/4; abdomen orange with terga 3 to apex and sterna 4 or 5 to apex black. . . . . ***notata*** (Klug)
— Thorax orange, at most middle of pronotum infuscated; abdomen orange with terga 5 or 6 and segments 7 to apex black (sheath broad, with short, stout spines, as in Fig. 13. . . . . ***helvola*** (Klug)
63. Thorax orange or only mesoprescutum with black mark on anterior 1/2 or less (abdomen of male may be mostly black dorsally; basal anal cell present in forewing; lancet as in Fig. 23; male genitalia as in Fig. 39); Panama to Bolivia. . . . . ***notaticollis*** (Konow)
— Thorax orange; southeastern Brazil to northeastern Argentina. **64**
64. Basal anal cell present in forewing (Fig. 2); hindfemur not black at apex; lancet similar to that of *melanocephala*, Fig. 14; male genitalia as in Fig. 65; sheath slender in dorsal view, with small inner apical spines, as in Fig. 11. . . . . ***.thoracica*** (Jörgensen)
— Basal anal cell absent in forewing; extreme apex of hindfemur commonly blackish; lancet as in Fig. 19; male genitalia as in Fig. 55; sheath stout in dorsal view, with stout spines on inner apical margin, Fig. 13 (some males with all black abdomen). . . . . ***melanopyga*** (Klug)

SPECIES

angusticeps Smith, **new species** — Brazil (Espirito Santo)

Scobina angusticeps Smith.

Female.—Length, 9.0 mm. Antenna with segments 1, 2, and extreme base of 3 orange, rest of 3rd black. Head black; maxilla and labium yellow orange. Thorax with pronotum yellow orange and with most of mesepisternum, mesosternum, mesonotum, and metanotum black except yellowish as follows: narrow line on meson of mesosternum, narrow line separating mesosternum and mesepisternum, margins of mesepisternum, margins of mesoprescutum forming a V-shaped mark, mesoscutellum, and metascutellum. Abdomen black, suffused with yellow orange which is more extensive on basal 3 or 4 sterna and meson of basal terga, especially central half of basal plates; sheath black. Legs yellow orange; hindcoxa with black spot at base; extreme apex of hindtibia with black ring; 2nd tarsal segments black at apices; all of apical 3 tarsal segments black. Wings uniformly moderately infuscated black; veins black, costa and stigma yellowish. Antennal length to head width as 11.5:6.2. Eyes large, lower interocular distance slightly less than eye length, as 3.4:3.6. Distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.8:0.7; malar space equal to diameter of front ocellus. Mostly shining with supraclypeal area next to eye roughened and irregularly rugose. Length of hindbasitarsus longer than length of remaining tarsal segments combined, as 3.6:3.4. Forewing with basal anal cell. Sheath from above with scopae slender; two stout spines on inner apical margin (similar to Fig. 13 but with 2 spines). Lancet (similar to *melanocephala*, Fig. 14) rounded at apex, without lateral armature, annuli curved.

Male.— Unknown.

Holotype.— F, "Brasil: Espirito Sto., Sta. Thereza, 2.VI.1928, 5 km NO, Leg.: O. Conde." (Eberswalde).

Remarks.— This species is very similar to both *bonplandi* and *xanthospila*. From *bonplandi* it is separated by the lack of annular spines on the lancet, presence of only two stout spines on the inner apical margin of the scopae of the sheath instead of three, the lower interocular distance less than the eye length instead of greater, and the distance between the hindocelli and the posterior margin of the head which is less than the distance from the eye to the hindocellus instead of equal. In addition, *bonplandi* has a broader orange stripe on the abdomen, though both are similar in color. *Scobina xanthospila* has several very small teeth on the apical inner margin of the scopae of the sheath and lacks the basal anal cell in the forewing.

basalis (Klug), **new combination** — Surinam

**Hylotoma basalis* Klug 1834: 237. F. "Surinam" (Berlin, F).— Kriechbaumer 1884: 287.— Norton 1867: 72.— Dalla Torre 1894: 326.
Labidarge basalis: Konow 1899a: 310.— Konow 1905a: 16.— Konow 1907a: 260, 262.

I have not seen specimens other than the holotype. The coloration is as follows: antenna and head black; thorax orange with center of pronotum, mesoprescutum, mesoscutellum, and metascutellum black; abdomen orange with 5th terga blackish infuscate, terga 6 to apex black, all sterna orange; legs orange with mid- and hindtibiae and all tarsi black; wings uniformly, lightly black infuscated, veins and stigma black. Sheath slender, as in Fig. 11.

basivitrata Malaise — Argentina (Chaco); Paraguay

**Scobina basivitrata* Malaise 1949: 1-2. M. "Paraguay (Villarica); Argentinian Chaco (Resistencia)" (Stockholm, M).

The male from Paraguay is labeled "typus." It is the only specimen I examined and is possibly the male of another species, but I have not been able to make associations. According to Malaise, it is separated mainly by the wings which are clear in the basal half with the apex brownish infuscated, otherwise it is similar to *bolivari* in color. The coloration is as follows: antenna and head black; thorax including tegula black with lower part of cervical sclerites, pronotum, mesepimeron, and metapleuron orange yellow; abdomen black dorsally, ventrally orange yellow with apical 3 sterna black; mid- and hindlegs yellow with tibiae and tarsi black; wings hyaline at base, little blacker toward apices; veins and stigma dark brown. This could be the male of *thoracica*.

bimaculata (Mocsáry), **new combination** — Brazil (Bahia)

**Labidarge bimaculata* Mocsáry 1909: 3-4. F. "Brasilia: Bahia" (Budapest, F).

I have not seen specimens comparable to this species. It could be a color variation of another species. The coloration is as follows: orange with head, two marks on mesosternum, apex of foretarsus, and mid- and hindtibiae and tarsi black; abdomen orange with transverse black bands on side and apex of dorsum, central longitudinal orange line to about 6th tergum; wings blackish infuscated.

bipartita (Cameron), **new combination** — Panama

**Hylotoma bipartita* Cameron 1883: 40-41. F. "Panama, Bugaba" (London, F).— Dalla Torre 1894: 327.
Arge bipartita: Konow 1905a: 18.
Labidarge bipartita: Konow 1907a: 259, 266.

I have seen only the holotype, BM# 1.116. The sheath has stout spines on the apical inner margin.

bolivari (Konow), **new combination** — Argentina (Jujuy); Bolivia; Colombia; Ecuador; Peru

**Labidarge bolivari* Konow 1899a: 310. F, M. "Bolivia (Yungas), Peru (Callanga, Cuczo)" (Eberswalde, F).— Konow 1905a: 16.— Konow 1907a: 260, 271-272.— Oehlke and Wudowenz 1984: 370 (4 M, 1 F syntypes at Eberswalde)

At Eberswalde, there are 1 F and 2 M from Yungas, Bolivia, and 1 M from Callanga, Cuczo, Peru, labeled "typus." The female from Bolivia is hereby designated lectotype; the 3 M are paralectotypes. A female at Madrid from Peru labeled "554" and with Konow's determination label may be part of the type series. I have seen a number of specimens from each of the above countries.

bonplandi (Jörgensen), **new combination** — Argentina (Misiones); Brazil (Santa Catarina, São Paulo)

**Labidarge bonplandi* Jörgensen 1913 (Oct.): 259-260. M. "Monte de Bonpland" (La Plata, M).
Caloptilia missionum* Schrottky 1913 (Nov.): 703-704. F, M. "Bompland" (La Plata, F). **New synonymy.
Stelidarge missionum: Forsius 1925a: 20.

Schrottky described *missionum* from both sexes, and Jörgensen described *bonplandi* from a male. Jörgensen must have described his species from the same male Schrottky used for his species since the male bears the same date as both authors stated: "20-IX-10 Misiones, Bompland, Jörgensen." The lectotype of *missionum*, here designated, is a female labeled "Argentina Bonpland, 22-IX-1909, P. Jörgensen", "Caloptilia missionum Schrottky, C. Schrottky det 1912," "Col. P. Jörgensen." The lancet is unusual for *Scobina* in that stout annular spines are present (Fig. 16) and the sheath (Fig. 13) has very stout spines on the inner apical margin. This is shared by only a few other species of the genus. I have seen a number of specimens from each of the above localities.

braunsi (Konow), **new combination** — Brazil (São Paulo)

**Labidarge Braunsi* Konow 1899a: 311-312. F. "Brasilia (Santos)" (Eberswalde, F).— Konow 1901: 57-58 (M).— Konow 1905a: 16.— Konow 1907a: 262, 422.— Oehlke and Wudowenz 1984: 370 (holotype).

This could be a color variation of another species, but I have not seen enough specimens to evaluate this possibility. The coloration is as follows: head black; thorax orange with metanotum, center of pronotum, and spot on mesoprescutum black; abdomen black with basal sterna dark orange and terga 2 and 3 with barely visible dark orange paired spots; legs orange with tibiae and tarsi black, apices of femora tipped with black; wings uniformly blackish infuscated.

brusa Smith, **new species** — Mexico (Colima, Jalisco)

Scobina brusa Smith

Female.— Length, 9.5 mm. Black with whitish pubescence covering head, thorax, and abdomen. Legs black with extreme bases of fore- and midfemora, apical 1/3 forefemur, basal 1/3 hindfemur, and basal 3/4 of tibiae white. Wings hyaline with blackish spot below anterior half of stigma; veins and stigma black. Antennal length to head width as 11.0:6.0; lower interocular distance to eye length as 3.5:3.1; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.9:1.0. Forewing with basal anal cell; vein M meets Sc+R basal to Sc and distance between M and Rs+M on Sc+R more than half length of vein M (as in Fig. 3). Length of hindbasitarsus to length of remaining tarsal segments combined as 3.5:3.5. Scopae of sheath stout, with 3 stout spines in inner apical margin (as in Fig. 13). Lancet as in Fig. 27, with long stout spines on annuli.

Male.— Unknown.

Holotype.— F, "Mexico, Colima, 21 mi. NW Manzanillo, VIII-25-1970, Malaise trap 10a-3p, MS&JS Wasbauer" (San Francisco)

Paratype.— MEXICO: Jalisco, La Floresta, Lago de Chapala, 1510 m, IX-4 to 5-1977, E. I. Schlinger (1 F). (Berkeley).

Remarks.—This species is very similar to *eximia*, but *eximia* has the apex of the forewing black, the basal two tarsal segments whitish, and much shorter spines on the annuli of the lancet (Fig. 26).

carbonaria (Klug), **new combination** — Brazil (Rio de Janeiro, São Paulo)

*Hylotoma *carbonaria* Klug 1834: 240. F. "Brasilien" (Berlin, F).— Norton 1867: 72.— Kriechbaumer 1884: 289.— Dalla Torre 1894: 329.

Labidarge carbonaria: Konow 1905a: 16.— Konow 1907a: 263, 426.

Stelidarge carbonaria: Malaise 1949: 2, fig. 1K (sheath; compared with *styx*).

Two female syntypes are at Berlin; the lectotype by present designation is labeled "13681," "St. Paul, Sello S.," "Typus," "*carbonaria* Kl., St. Paul, Sell." The other specimen, a paralectotype, has the same data but lacks a determination label. This species is entirely black; the scopae of the sheath are stout, as in Fig. 12, and the basal anal cell of the forewing is absent.

collaris (Klug), **new combination** — Brazil

**Hylotoma collaris* Klug 1834: 236. F. "Brasilien" (Berlin, F).— Norton 1867: 72.— Kriechbaumer 1884: 287.— Dalla Torre 1894: 330.

Labidarge collaris: Konow 1899a: 312.— Konow 1905a: 16.— Konow 1907a: 263, 425.

I have seen only one other specimen besides the holotype, and that is labeled "Brasil." The coloration is as follows: antenna and head black; thorax orange with cervical sclerites, mesosternum, and metapleuron black; abdomen and sheath black; legs black. The basal anal cell of the forewing is present, and the sheath has three stout spines (as in Fig. 13). The supraclypeal area near the eyes is dull and punctate.

consobrina (Norton) — Costa Rica; Guatemala; Mexico (Chiapas, Colima, Nayarit, Oaxaca, Sinaloa, Veracruz); Nicaragua; El Salvador

**Hylotoma consobrina* Norton 1872: 78. F. "Mexico" (Philadelphia, F).—Cresson 1880: 36.—Cameron 1883: 39.— Dalla Torre 1894: 330.— Cresson 1928: 5 (holotype).

Arge consobrina: Konow 1905a: 18.

Labidarge consobrina: Konow 1906c: 387.—Konow 1907a: 259, 270 (syn.: *fasciatipennis* Cameron).

Scobina consobrina: Smith 1971a: 526 (holotype).

**Hylotoma fasciatipennis* Cameron 1883: 41. F. "Guatemala, Capetillo" (London, F).— Dalla Torre 1894: 334.

Arge fasciatipennis: Konow 1905a: 19.— Konow 1906c: 387.

Host: *Sida* sp. (Malvaceae) (reared by J.-M. Maes, Leon, Nicaragua).

The holotype of *fasciatipennis* is BM# 1.63. This species is recognized by the yellow head and the forewing pattern which is yellow at the center and black and the base and apex. I have not seen color variations with blackish heads. I have seen many specimens from the above localities.

diagonica Smith, **new species** — Brazil (Santa Catarina)

Scobina diagonica Smith.

Female.—Length, 9.5-10.0 mm. Antenna and head black; mandible brownish; palpi orange. Thorax orange. Abdomen orange, terga and sterna darker orange to blackish from 3 to apex, light on 3rd becoming darker to black on apical 2 or 3 segments but with orange lateral stripe; sheath black or with orange stripe laterally. Legs orange with apical 4 tarsal segments black; hindtibia darker orange than rest of legs. Wings uniformly dark yellowish; veins brown, costa and stigma orange yellow. Antennal length to head width as 13.3:6.2; lower interocular distance to eye length as 3.6:3.4, eyes large and not converging below; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.8:0.7. Forewing with basal anal cell; vein M meets Sc+R apical to Sc, distance between M and Rs+M on Sc+R about 2/3 length of vein M; Sc diagonal, subparallel with vein M, not perpendicular to Sc+R (Fig. 4). Length of hindbasitarsus to length of remaining tarsal segments combined as 4.1:4.0. Scopae of sheath slender, with 2 stout spines on inner apical margin. Lancet as in Fig. 38.

Male.—Length, 9.0-9.5 mm. Coloration and structure similar to those of female; abdominal terga 4 or 5 to apex sometimes darker black. Genitalia as in Fig. 64.

Holotype.— F, "Brazil: Nova Teutonia, 27°11' B, 52° 23' L, 17.II.1938, Fritz Plaumann, B.M. 1938-458" (London).

Paratypes.— BRAZIL: Same locality as holotype except dates, 16.II.1938 (1 F), 11.II.1938 (1 F), 21.I.1938 (1 F), 15.II.1938 (1 F), 23.XII.1937 (1 F), 3.II.1938 (1 F), 18.II.1938 (1 M), 29.I.1937 (1 M), 29.IX.1938 (1 M), XII-1935 (2 M). (London, Washington).

Remarks.— The diagonal intercostal crossvein is diagnostic for this species. In all other species of *Scobina* I have examined, this crossvein is perpendicular to Sc+R. Also, even though M meets Sc+R apical to Sc in the forewing, the distance between Rs+M and M on Sc+R is relatively long, equal to two-thirds or more the length of vein M. Another diagnostic feature is the unusually high, sharp carinae of the head. This is difficult to describe and figure, but they are decidedly higher and more carinate than most other species I have seen. The orange thorax, base of the abdomen, and legs, and genitalia will also help separate this species from other *Scobina*.

dibapha (Konow), **new combination** — Colombia; Peru

**Labidarge dibapha* Konow 1899a: 311. F. "Peru (Callanga, Cuczo)" (Eberswalde, F).— Konow 1905a: 16.— MacGillivray 1906: pl. 38, fig. 78 (wings).— Konow 1907a: 419-420.— Oehlke and Wudowenz 1984: 377 (holotype).

This species is characterized in the key. I have seen one specimen from Colombia (Leticia, Amazonas).

dorsalis (Klug), **new combination** — Costa Rica; Guatemala; Mexico (Chiapas, Colima, Guerrero, Jalisco, Mexico, Michoacán, Morelos, Nayarit, Oaxaca, Sinaloa, Veracruz); El Salvador

**Hylotoma dorsalis* Klug 1834: 237. F. "Mexiko" (Berlin, F).— Norton 1867: 64, 67.— Norton 1872: 78 (F, M; similar to N. Amer. [*Arge*] *scapularis*).— Kirby 1882: 69 ("Oajaca").— Cameron 1883: 36-37 (Guatemala).— Kriechbaumer 1884: 287.— Dalla Torre 1894: 332.
Labidarge dorsalis: Konow 1905a: 16.— Konow 1907a: 258, 263.

This is one of two black species with red on the thorax from Mexico and Central America, the other being *paradorsalis*. It is relatively common in Mexico and Central America. See *paradorsalis* for diagnostic characters.

emora Smith, **new species** — Argentina (Jujuy, Salta, Tucumán)

Scobina emora Smith.

Female.—Length, 7.5 mm. Antenna and head black; palpi brownish. Thorax black with pronotum laterally, mesoprescutum, mesoscutellum, upper 1/2 of mesepimeron, and metapleuron red, or all black with only pronotum and mesonotum red usually with some blackish marks on mesoprescutum and/or scutellum. Abdomen black. Legs with coxae, trochanters, and fore- and midfemora white, hindfemur black on inner surface and white on outer surface, tibiae and tarsi black, sometimes with legs mostly black. Wings uniformly, darkly black infuscated; veins and stigma black. Antennal length to head width as 10.2:4.7; lower interocular distance to eye length as 2.7:2.2; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.6:0.6. Forewing with basal anal cell (absent in a few specimens); vein M meets Sc+R apical to Sc and veins M and Rs+M meet Sc+R at about the same point. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.5:2.5. Scopae of sheath slender, with short small spines on inner apical margin (as in Fig. 11). Lancet as in Fig. 33.

Male.—Length, 5.8-7.2 mm. Coloration and structure similar to that of female except upper 1/3 of mesepisternum may be red, upper 1/2 of mesepimeron may be red, anterior 1/2 of mesoscutellum usually red, tegulae red or black and legs whitish with only apical 1/5 of tibiae and entire tarsi black. Genitalia as in Fig. 63.

Holotype.—F, "Argentina, Horco Molle, Tuc., Apr. 3-10, 1966, L. A. Stange" (Tucumán).

Paratypes.— ARGENTINA: Same data as holotype except date, Mar. 7-13, 1966 (1 M); Salta, Campo Quijano, XII-81, M. Fritz (2 F, 6 M); Salta, Rosario de Lerma, XII-1982, M. A. Fritz (1 F); Jujuy, Posta Lozano, III-21-23-69, C.C. Porter (4 M), X-27-XI-2-68 (4 M), III-28-31-69 (5 M), 8-XII-69 (1 M), X-29-XI-4-68 (1 M), 15-17 Dec. 1967 (2 M), 28 Nov.-Dec. 1967, C. Porter, E. Willink (1 M); Jujuy, Alto la Vina, Mar. 13-20, '66, C. C. Porter (4 M); S. Pedro Colalao, Tucumán, XII-15/19-64, C.C. Porter (1 M); Tucumán, Trancas, Tacunas, XI-12-68, C.C. Porter (1 M), 1-30.XI.1969, L. Stange (1 M); Tucumán, Tafi - Lacavera, 28.XI.1951, R. Golbach (1 M); Jujuy, Camino a Cornisa, 11-III-1965, A. Willink (1 M). (Tucumán, Cambridge, Washington, Fritz Coll.).

Remarks.— The coloration of the legs differs between sexes. In the only females examined the legs are nearly all black or the tibiae and tarsi and the inner surface of the hindfemur are black, whereas in the male the legs are white except for the extreme apices of the tibiae and the tarsi which are black. Also, the pronotum is mostly red in the female, but black in the male. The white on the legs, red pattern of the thorax, and lancet and male genitalia distinguish this species from others.

eximia (Kirby) — Mexico (Veracruz)

**Hylotoma eximia* Kirby 1882: 65, pl. 5, fig. 11. F. "Mexico. Orizaba" (London, F).— Cameron 1883: 36.— Dalla Torre 1894: 333.
Arge eximia: Konow 1905a: 19.— Konow 1906c: 387.— Konow 1907a: 489.— Konow 1908b: 185.
Scobina eximia: Smith 1989b: 198.

I have seen only the holotype (BM# 1.114). This species is discussed under *brusa*.

fascialis (Norton) — Mexico (Chiapas, Morelos, Nayarit, Tabasco, Veracruz)

**Hylotoma fascialis* Norton 1867: 64, 69. M. "Mexico" (Genève, M).— Cameron 1883: 38-39.— Dalla Torre 1894: 334.
Arge fascialis: Konow 1905a: 19.
Labidarge fascialis: Konow 1907a: 260, 270.
Scobina fascialis: Smith 1971a: 526 (holotype).

I have seen a number of specimens from the above Mexican states. The female is similar in coloration to the male, and both run to the same couplet in the key to species.

forficulata (Konow), **new combination** — Peru

**Labidarge forficulata* Konow 1906b: 178. F. "Peru (Chanchamayo)" (Eberswalde, F).— Konow 1907a: 262, 422.— Oehlke and Wudowenz 1984: 381 (holotype)

I have seen very few examples of this species, and those also from Peru. The coloration is as follows: head black with face below antenna white; thorax orange with mesonotum (except most of scutellum) and mesosternum black; abdomen orange with apical 2 segments and sheath black; legs orange with mid- and hindtibiae and tarsi black, basal 1/4 hindtibia paler; wings hyaline, slightly blackish at apices.

fulcrata (Klug), **new combination** — Brazil (Rio de Janeiro, São Paulo)

**Hylotoma fulcrata* Klug 1834: 240. M. "Brasilien" (Berlin, M).— Norton 1867: 72.— Kirby 1882: 78 (Petropolis).— Kriechbaumer 1884: 289.— Dalla Torre 1894: 334.
Labidarge fulcrata: Konow 1905a: 16.
Stelidarge fulcrata: Konow 1907a: 192, 257.— Forsius 1925a: 20.

The holotype is labeled "St. Paul, Sello S." I have seen specimens from both of the above Brazilian states.

geniculata (Klug), **new combination** — Brazil (São Paulo)

**Hylotoma geniculata* Klug 1834: 237. F, M. "Brasilien" (Berlin, M).— Norton 1867: 72.— Kriechbaumer 1884: 287.— Dalla Torre 1894: 335.
Labidarge geniculata: Konow 1901: 58.— Konow 1905a: 16.— Konow 1907a: 262, 424.

A male and a female, both labeled types, are at Berlin; both are labeled "St. Paul, Sello S." The male has Klug's determination label and is hereby designated lectotype; the female is a paralectotype. The coloration is as follows: antenna and head black; thorax red with anterior edge of pronotum, cervical sclerites, metapleuron, and metanotum (except scutellum) black; abdomen black; legs black with extreme apices of femora orange to whitish; wings uniformly blackish infuscated.

guaca Smith, new species — Brazil (Minas Gerais)

Scobina guaca Smith.

Length, 11.5 mm. Scape, pedicel (flagellum missing) and head black; clypeus and mandible brownish, palpi orange. Thorax orange. Abdomen orange with segments 7 to apex and sheath black. Legs orange to white with basal 3/4 hindtibia black and apical 4 midtarsal segments and apical 2 hindtarsal segments black (foretarsus missing). Wings bright yellow with apex beyond stigma black; stigma and veins yellow in yellow area, black in black apical portion. Lower interocular distance to eye length as 3.5:3.4; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.7:1.0. Forewing without basal anal cell; vein M meets Sc+R apical to Sc, distance between Rs+M and M on Sc+R about 1/3 length of vein M. Length of hindbasitarsus to length of remaining tarsal segments combined as 4.5:4.3. Scopae of sheath stout, with 3 stout spines on inner apical margin (Fig. 13). Lancet as in Fig. 32; annuli 4-13 or 14 with stout spines.

Male.— Unknown.

Holotype.— F, "Minas Geraes, Cabo Vesda, Diaz off., anno 1920" (São Paulo). "Cabo Vesda" and "Diaz off." are handwritten on the label, and I am not certain of the spelling.

Remarks.— The bright coloration, stout spines of the scopae of the sheath, and annular spines on the lancet are diagnostic for this species.

guatemalensis (Dalla Torre), **new combination** — Costa Rica; Guatemala; Honduras; Mexico (Chiapas, Guererro, Michoacán, Morelos, Oaxaca, Puebla, San Luis Potosi, Tabasco, Veracruz, Yucatán); Nicaragua; Panama

Hylotoma annulipes Cameron 1883: 40, pl. 1, fig. 2. F, M. "Guatemala, San Geronimo; Panama" (London, F) (preoccupied by *Hylotoma annulipes* Klug 1834).

Labidarge annulipes: Konow 1906b: 177.— Konow 1907a: 259, 266-267.

Hylotoma semifuscus* Norton 1867: 64, 69-70. M. "Mexico" (Genève, M).— Cameron 1883: 39-40, pl. 1, fig. 11.— Dalla Torre 1894: 343. **New synonymy.

Arge semifusca: Konow 1905a: 21.

Labidarge semifusca: Konow 1907a: 259, 269.

Scobina semifusca: Smith 1971a: 526 (holotype).

Hylotoma guatemalensis Dalla Torre 1894: 335 (new name for *H. annulipes* Cameron).

Arge guatemalensis: Konow 1905a: 19.

Labidarge nimbata* Konow 1907c: 221. F. "Mexico" (Madrid, F).— Konow 1907a: 259, 268. **New synonymy.

Labidarge pictipes* Konow 1906b: 177. F. "Guatemala (Retalhulen)" (Eberswalde, F).— Konow 1907a: 259, 267-268.— Oehlke and Wudowenz 1984: 404 (holotype). **New synonymy.

Stelidarge bicoloripes* Enderlein 1919: 114. "F"=M. "Guatemala" (Warszawa, M). **New synonymy.

Host: *Sida* sp. (Malvaceae); reared specimen from Puente Teterete, Veracruz, Mexico, 4-VIII-89.

A female of *nimbata* at Madrid labeled "México, L. Conradt, 1903, Lab. ent. Escalera" and with Konow's determination label is hereby designated the lectotype. The type of *pictipes* has "Retalulen" on the label, a discrepancy in spelling from the original description. The lectotype of *annulipes*, here designated, is the female set aside as BM# 1.66, labeled "Hylotoma *annulipes* Cm., San Geronimo 3000 ft," "San Geronimo, Vera Paz, Champion." Color variation in this species includes the black to yellow head, hindcoxa, and hindfemur as well as the mesosternum and mesonotum which may be yellow or have blackish stripes. I have seen many specimens from Mexico to Panama.

helvola (Klug), **new combination** — Brazil

**Hylotoma helvola* Klug 1834: 238. F. "Brasilien" (Berlin, F).— Norton 1867: 72.— Kriechbaumer 1884: 288.— Dalla Torre 1894: 335.

Labidarge helvola: Konow 1899a: 310.— Konow 1905a: 16.— Konow 1907a: 261, 418.

I have seen only several specimens, those other than the holotype labeled only "Brasil." The coloration is as follows: antenna and head black; thorax orange with middle of pronotum blackish; abdomen orange with terga 5-6 and segments 7 to apex black; legs orange with mid- and hindtibiae and tarsi black; wings blackish with costa and stigma yellow to orange. The forewing lacks a basal anal cell, and the sheath has three stout spines, as in Fig. 13.

inculta (Konow), **new combination** — Argentina (Jujuy); Bolivia; Ecuador; Peru; Venezuela

**Labidarge inculta* Konow 1906b: 180. M. "Peru (Marcapata), Bolivia (Yungas, Mapiri)" (Eberswalde, M).— Konow 1907a: 263, 425-426.— Oehlke and Wudowenz 1984: 388 (5 M syntypes at Eberswalde).

Five males from "Marcapata, Peru" labeled "typus" are at Eberswalde. The one with Konow's determination label is selected the lectotype, the other four are paralectotypes. I did not see specimens from the Bolivia localities, but this is a relatively common species in the Andes from Venezuela to northern Argentina.

infuscata (Klug), **new combination** — Brazil (São Paulo)

**Hylotoma infuscata* Klug 1834: 236. M. "Brasilien" (Berlin, M).— Norton 1867: 72.— Kriechbaumer 1884: 287.— Dalla Torre 1894: 335.

Labidarge infuscata: Konow 1899a: 312.— Konow 1905a: 16.— Konow 1907a: 262, 423.

Two males are at Berlin. The lectotype, hereby designated, is labeled "13660," "Brasil. v. Olfers.," "Typus," and "infuscata Kl., Bras., v. Olf." The other male is a paralectotype and has the same labels but lacks the determination label. I have seen several females from São Paulo (Horto Florestal, São Paulo), and they are similar in coloration to the male: antenna and head black; thorax red with middle of pronotum, spot on mesoprescutum, and mesosternum black; abdomen black; fore- and midlegs black with femora dark orange, hindleg black with extreme apex of femur paler; wings darkly, uniformly black infuscated.

lepida (Klug), **new combination** — Costa Rica; El Salvador; Guatemala; Honduras; Mexico (Chiapas, Oaxaca, Veracruz); Nicaragua; Panama

**Hylotoma lepida* Klug 1834: 239. M. "Mexiko" (Berlin, M).— Norton 1867: 64, 71.— Norton 1872: 78.— Cameron 1883: 39.— Kriechbaumer 1884: 288.— Dalla Torre 1894: 336.

Labidarge lepida: Konow 1905a: 16.— Konow 1907a: 259, 268.

Hylotoma bivittata* Cameron 1883: 37, pl. 2, fig. 14. F, M. "Panama, Volcan de Chiriqui, 2000 to 3000 feet" (London, F)— Dalla Torre 1894: 327. **New synonymy.

Arge bivittata: Konow 1905a: 18.

Labidarge bivittata: Konow 1907a: 265-266 (M another species ?).

Hylotoma testacea* Cameron 1883: 37-38. F. "Costa Rica" (London, F) (Preoccupied by *Hylotoma testacea* Klug 1834). **New synonymy.

Arge testacea: Konow 1905a: 21.

Hylotoma nigriceps* Cameron 1883: 39, pl. 4, fig. 1. F, M. "Nicaragua, Chongales" (London, ?).—Dalla Torre 1894: 337 (*nicriceps* !). **New synonymy.

Arge nigriceps: Konow 1905a: 19.

Labidarge nigriceps: Konow 1907a: 259, 269 (syn.: *adusta* Konow).

Caloptilia nigriceps: Rohwer 1912a: 1.

Hylotoma albitibialis* Cameron 1883: 41. F. "Guatemala, Zapote" (London, F).— Dalla Torre 1894: 325. **New synonymy.

Arge albitibialis: Konow 1905a: 17.

Labidarge albitibialis: Konow 1907a: 259, 267.

Hylotoma cameronii Dalla Torre 1894: 328 (new name for *Hylotoma testacea* Cameron; *H. cameronii* Dalla Torre is preoccupied in *Scobina* by *Hemidianeura cameroni* Kirby 1886 [see *melanopyga*]).

Labidarge cameroni: Konow 1907a: 259, 269.

Labidarge adusta Konow 1904: 234. F. "Costa Rica" (not located).— Konow 1905: 16. **New synonymy.**

Labidarge fucosa* Konow 1904: 234. F. "Costa Rica (San Carlos)" (Eberswalde, F).—Konow 1905a: 16.—Konow 1907a: 258, 265.— Oehlke and Wudowenz 1984: (2 F syntypes at Eberswalde). **New synonymy.

Labidarge parca* Konow 1904: 234-235. F. "Costa Rica" (Eberswalde, F).— Konow 1905a: 17.— Konow 1907a: 258, 264.— Oehlke and Wudowenz 1984: 402 (holotype). **New synonymy.

Labidarge immunda* Konow 1904: 235. F. "Costa Rica" (Eberswalde, F).— Konow 1905a: 16.— Konow 1907a: 258, 263-264.— Oehlke and Wudowenz 1984: 388 (2 F syntypes at Eberswalde). **New synonymy.

Caloptilia immunda: Rohwer 1911b: 383.

The holotype of *lepida* is labeled "Jalappa." Two females of *immunda* Konow each labeled "typus" are at Eberswalde. The female labeled "Costa Rica, Am. m.," and with Konow's determination label is hereby selected lectotype. The other female labeled "Costa Rica, San Jose, 1903, Burgdorf" is a paralectotype. Two females or *fucosa* are at Eberswalde, both labeled "typus." A female labeled "Costa Rica, Am. m." and with Konow's determination label is the lectotype, and the other female labeled "Costa Rica, San Carlos" is a paralectotype. The holotype of *albitibialis* is BM# 1.73; of *nigriceps*, BM# 1.39; and of *testacea*, BM# 1.61. The specimen labeled as type of *nigriceps* has the apex of the abdomen broken; thus, the sex is unknown. The lectotype of *bivittata*, here designated, is the female set aside as BM #1.65, labeled "Hylotoma bivittata Cam., Type, B.C.A. i.37," "V. de Chiriqui, 2-3000 ft."

The head varies in color from mostly yellow above, yellow with a black transverse band, to mostly black. After studying series of specimens, especially from Costa Rica, I am convinced that this is a very color variable species encompassing the numerous forms described above. Structurally similar adults show a wide range of color, and comparing the extreme light and dark forms, it is hard to believe they are the same. Nonetheless, there are so many intermediates that it is impossible to separate them. The palest forms are represented by *lepida*, *albitibialis*, and *nigriceps*, all with an orange head and brightly bicolored wings and blackish hindfemur and blackish mesosternum in the latter two. *Hylotoma testacea* is similar to these but with the head black above. Those described as *immunda*, *fucosa*, *parca*, and *bivittata* have wings appearing uniformly dark but the base is sometimes paler than the apex and the costa and stigma are yellowish. *Hylotoma bivittata* has an orange thorax (including the mesosternum) but the mesonotal lateral lobes and tegula are black; *fucosa* and *parca* have the mesosternum and mesoprescutum black. That described as *immunda* is the extreme dark form with the thorax mostly black except for the yellow-orange pronotum, mesepisternum, mesoscutellum, and metanotum, the abdomen is black above and at its apex, and the wings are lightly yellowish with the apex faintly darker. The male of *lepida* is usually darker and some have the supraclypeal area blackish (though not as black as the rest of the head), most of the hindtibia blackish, and sometimes uniformly blackish wings.

lurida (Klug), **new combination** — Bolivia; Brazil (Ceará, Pará); Colombia; Ecuador; Peru; Surinam

**Hylotoma lurida* Klug 1834: 238. F. "Surinam" (Berlin, F).— Norton 1867: 72.— Kriechbaumer 1884: 288.— Dalla Torre 1894: 336.

Labidarge lurida: Konow 1904: 232.— Konow 1905a: 16.— Konow 1907a: 260, 417.

Labidarge valga* Konow 1904: 236. M. "Brasilia (Para)" (Eberswalde, M).— Konow 1905a: 17.— Konow 1907a: 260, 272, 417.— Oehlke and Wudowenz 1984: 418 (holotype). **New synonymy.

Konow's *valga* must be the male of *lurida* according to associated specimens I have seen; the male differs slightly from the female by having the extreme apex of each femur black and more than the apcial half of the hindtibia black. I have seen specimens from all of the above localities.

maculipes (Klug), **new combination** — Brazil (Minas Gerais, São Paulo)

**Hylotoma maculipes* Klug 1834: 238-239. F. "Brasilien" (Berlin, F).— Norton 1867: 72.— Kriechbaumer 1884: 336.— Dalla Torre 1894: 336.

Labidarge maculipes: Konow 1905a: 16.— Konow 1907a: 262, 423.

Two females were sent to me from Berlin, both labeled "13678," "Brasilien, Sello S.," "Typus." The specimen with the large green determination label is hereby designated lectotype, the other a paralectotype. I have seen one specimen from Barginha, M. Gerais.

melanaria (Klug), **new combination** — Brazil (Minas Gerais, Rio de Janeiro, São Paulo)

**Hylotoma melanaria* Klug 1834: 240-241. F. "Brasilien" (Berlin, F).— Norton 1867: 73.— Kriechbaumer 1884: 289.— Dalla Torre 1894: 336.

Labidarge melanaria: Konow 1905a: 16.— Konow 1907a: 263, 426.

I have seen specimens from each of the above Brazilian states.

melanocephala (Lepeletier) — Argentina (Salta); Bolivia; Brazil (Mato Grosso do Sul, Minas Geraes, Pará); Colombia; Ecuador; French Guiana; Guyana; Peru; Surinam; Venezuela

**Hylotoma melanocephala* Lepeletier 1823: 48. F. "Patria ignota" (Paris, F).

Hylotoma (*Scobina*) *melanocephala*: Lepeletier and Serville 1828: 574 (F, M, from Cayenne).

Scobina melanocephala: Kirby 1882: 41 (Amazons).— Dalla Torre 1894: 317.— Konow 1905a: 15.— Konow 1907a: 190.— Malaise 1937a: 49 (type lost; species characterized, probably same as *nubeculosa* Konow).

Hylotoma terminalis* Klug 1814: 297, pl. 7, fig. 5. F. "Para in Brasilien" (Berlin, F).— Klug 1834: 235.— Norton 1867: 73.— Kriechbaumer 1884: 63, 286.— Dalla Torre 1894: 344 (*terminata* !). **New synonymy.

Labidarge terminalis: Konow 1899a: 310.— Konow 1904: 232, 237.— Konow 1905a: 17.— Konow 1907a: 261, 420 (syn.: *dryope* Kirby).

Scobina terminalis: Mc Callan 1953: 126 (Venezuela).

*_Hylotoma dryope_ Kirby 1882: 78, pl. 6, fig. 3. F. "Amazons" (London, F).— Dalla Torre 1894: 332. **New synonymy.**

Labidarge dryope: Konow 1904: 237.— Konow 1905a: 16.

*_Labidarge vitreata_ Konow 1904: 235. M. "Brasilia (Pará)" (Eberswalde, M).— Konow 1905a: 17.— Konow 1907a: 262, 421.— Oehlke and Wudowenz 1984: 419 (holotype). **New synonymy.**

Caloptilia vitreata: Rohwer 1912a: 1 (probably male of _nubeculosa_ Konow).

*_Labidarge nubeculosa_ Konow 1904: 236. F. "Brasilia (Pará, Paramaribo)" (Eberswalde, F).— Konow 1905a: 16.— Konow 1907a: 262, 421-422.— Malaise 1937a: 49 (possible syn. of _melanocephala_).— Oehlke and Wudowenz 1984: 400 (3 F syntypes at Eberswalde). **New synonymy.**

Caloptilia nubeculosa: Rohwer 1912a: 1.

*_Labidarge tegularis_ Konow 1907c: 220-221. M. "Brasilia, Coca" (Madrid, M).— Konow 1907a: 262, 420-421.— Oehlke and Wudowenz 1984: 415 (1 M syntype at Eberswalde, "Brasilien, Coca"). **New synonymy.**

*_Caloptilia nubeculosa rosenbergi_ Rohwer 1911b: 383. F. "Chawchamayo, Peru" (Washington, F). **New synonymy.**

This is a color variable species and color forms are represented in the above synonymy. The wings of the female vary from mostly blackish to somewhat hyaline with a blackish apex to yellowish with a blackish apex. The wings of the male are nearly always blackish but may be nearly hyaline at the base with a blackish apex. The amount of black on the mesonotum varies from none to most of the prescutum, lateral lobes, and tegulae black; the darker mesonotum is more prevalent in males.

I was able to see a specimen that I regard as the holotype from Paris, and it may be the specimen referred to by Lepeletier and Serville in 1828. It bears a small round label with "Cayenne" written underneath. This specimen agrees with Malaise's (1937a) interpretation. It is the color form with darker wings and an orange thorax. The species described as _terminalis_, _dryope_, _nubeculosa_, and _rosenbergi_ have yellowish to pale yellowish wings with the apex blackish. Those species described as _vitreata_ and _tegularis_ represent males of _melanocephala_. The lectotype, here designated, of _L. tegularis_ is a male at Madrid labeled "Coca, Mattinez" and with Konow's determination label. Another male with the same data is a paralectotype. The type locality is probably in Ecuador, not Brazil. The lectotype, here designated, of _L. nubeculosa_ is a female labeled "Oyapock, 17.6.1904, Ducke," "coll. Konow," "TYPUS," "Labidarge nubeculosa Knw., Brasil, Para." Two other females labeled types are also at Eberswalde, one from Paramaibo, the other from "Brasil, Para, 27.3.1907, Ducke." Both are paralectotypes. The holotype of _dryope_ Kirby is BM #1.60.

melanopyga (Klug), **new combination** — Argentina (Entre Rios, Formosa, Misiones); Brazil (Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, São Paulo); Paraguay

*_Hylotoma melanopyga_ Klug 1834: 237. F. "Brasilien" (Berlin, F).— Norton 1867: 73.— Kriechbaumer 1884: 287.— Dalla Torre 1894: 337.

Labidarge melanopyga: Konow 1899a: 310.— Konow 1905a: 16.— Konow 1907a: 261, 417-418.

*_Hemidianeura cameroni_ Kirby 1886: 34, pl. 1, fig. 10. F. "Rio Grande do Sul" (London, F).— Dalla Torre 1894: 321 (_cameronii_).— Konow 1905a: 26. **New synonymy.**

*_Stelidarge diptycha_ Konow 1901: 58. F. "Brasilia" (Budapest, F).— Konow 1905a: 16.— Konow 1907a: 191, 192.— Oehlke and Wudowenz 1984: 377 ("1 F (?) syntypus, Brasilien" at Eberswalde). **New synonymy.**

Two females labeled types of _melanopyga_ are at Berlin, both have the data "13663," "Brasil, v. Olfers." The specimen with Klug's determination label is hereby selected lectotype and the other specimen is a paralectotype. Two females of _diptycha_ were sent to me from Budapest, both labeled "Brasilia, Blumenau," "typus, _Stelidarge_ diptycha Knw., 1901." One is hereby designated lectotype, the other a paralectotype, and they have been labeled as such. The holotype of _cameroni_ Kirby is BM# 1.59. This is a relatively common species in southeastern Brazil and northeastern Argentina.

nigricollis (Konow), **new combination** — Peru

*_Labidarge nigricollis_ Konow 1906a: 179-180. M. "Peru (Callanga Cuczo)" (Eberswalde, M).— Konow 1907a: 262, 423.— Oehlke and Wudowenz 1984: 398 (holotype).

This male could be a color form of another species. The coloration is as follows: head black with face around and below antennae mostly white; thorax black with lateral angles of pronotum dark orange; abdomen orange with basal plates, anterior margin of 2nd tergum, and apical segment black; legs orange, tibiae and tarsi black; wings uniformly, lightly black infuscated.

nigripennis (Enderlein), **new combination** — Ecuador

**Stelidarge nigripennis* Enderlein 1919: 114. "M"= F. "Ecuador. Sabanilla" (Warszawa, F).
Stelidarge fumipennis Forsius 1925a: 20, 21 (new name for *nigripennis* Enderlein, believed to be preoccupied in *Stelidarge* by *nigripenne* Schrottky [a species in Tenthredinidae]).

The coloration is as follows: antenna and head black, clypeus orange; thorax black with lower half of cervical sclerites, pronotum, and meso- and metapleurae orange (mesepisternum with black spot on upper angle and black stripe on anterior and lower margins); abdomen orange with basal plates and apical 3 segments black; legs orange with tibiae and tarsi black; wings lightly, uniformly black infuscated. Sheath with several very short spines on inner apical margin of scopae (as in Fig. 11).

nigripes (Konow), **new combination** — Colombia; Mexico (Guererro)

**Labidarge nigripes* Konow 1906b: 178-179. F. "Colombia (Ibagué)" (Eberswalde, F).— Konow 1907a: 259, 266.— Oehlke and Wudowenz 1984: 398 (holotype).

The coloration is as follows: antenna and head black; thorax orange with cervical sclerites, center of pronotum, and marks on mesosternum black; abdomen orange with apical segment and sheath black; legs black; wings lightly, uniformly black infuscated. Specimens from Mexico (Acaquizotla and Chilpancingo, Guererro) are identical to the holotype. A male from Colombia (6 mi. W. Cali, Valle, 1630 m) is similar in coloration but the mesoprescutum, mesonotal lateral lobes, lower mesepisternum, and mesosternum are black.

notata (Klug), **new combination** — Brazil

**Hylotoma notata* Klug 1834: 237. F. "Brasilien" (Berlin, F).— Norton 1867: 73.— Kriechbaumer 1884: 287.— Dalla Torre 1894: 338.
Labidarge notata: Konow 1904: 232.— Konow 1905a: 16.— Konow 1907a: 261, 418.

Two females regarded as types are at Berlin. The one with the labels "13664," "Brasil, v. Olfers.," "Typus," "and "notata Kl., Brasil, v. Olf." is hereby designated lectotype. The other specimen, without a determination label, is a paralectotype. The coloration is as follows: antenna and head black; thorax orange with spot on mesoprescutum black; abdomen black with basal 2 terga and basal 4 or 5 sterna orange; legs orange with tibiae and tarsi black; wings lightly, uniformly black infuscated; costa and stigma paler to orange.

notaticollis (Konow), **new combination** — Bolivia; Colombia; Costa Rica; Ecuador; Panama; Peru; Venezuela

**Labidarge notaticollis* Konow 1899a: 310-311. F. "Bolivia" (Eberswalde, F).— Konow 1905a: 16.— Konow 1907a: 261, 417 (Colombia).— Oehlke and Wudowenz 1984: 399 (2 F syntypes at Eberswalde).
Labidarge galumnata* Konow 1906b: 179. M. "Colombia (Ibagné Tolima)" (Eberswalde, M).— Konow 1907a: 258, 264-265.— Oehlke and Wudowenz 1984: 384 (holotype). **New synonymy.
Caloptilia nigrostoma* Rohwer 1912a: 1-2. F, M. "Paraiso, Canal Zone, Panama" (Washington, F). **New synonymy.

The only difference between the described species is the presence or absence of a black mark on the mesoprescutum. This black mark is usually most obvious in males. Also the type of *galumnata* (M) has most of the dorsum of the abdomen black. Two females of *notaticollis* labeled "typus" are at Eberswalde, one is labeled "Bolivia" the other "Mapiri, Bolivia." The former, with Konow's determination label, is here designated lectotype, and the other is a paralectotype.

paradorsalis Smith, **new species** — Costa Rica; Guatemala; Mexico (Guerrero, Jalisco, Michoacán, Morelos, Puebla, Veracruz)

Scobina paradorsalis Smith.

Female.— Length, 9.0-10.5 mm. Black with pronotum (except anterior margin), tegula, mesonotum, usually metanotum, upper 2/3 to 1/3 of mesepisternum, and upper 1/2 mesepimeron reddish; forefemur and foretibia whitish, mostly on outer surfaces. Wings darkly, uniformly infuscated black; veins and stigma black. Antennal length to head width as 11.0:6.3; lower interocular distance to eye length as 3.8:3.0; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.8:1.3. Forewing with basal anal cell; vein M meets Sc+R apical to Sc and veins M and Rs+M meet Sc+R at nearly the same point. Length of hindbasitarsus to length of remaining tarsal segments combined as 3.0:3.0. Scopae of sheath slender, spines on inner apical margin small (as in Fig. 11). Lancet as in Fig. 17.

Male.— Length, 7.5-8.5 mm. Coloration similar to that of female; mesepisternum may be nearly entirely black, pronotum may be black, and mesonotum may have prescutum black and/or scutellum black. Antennal length to head width as 10.2:5.0; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:1.0:1.0. Genitalia as in Fig. 61.

Holotype.— F, "Cuernavaca, Mor., Mexico, VI-1945, N.L.H. Krause" (Washington).

Paratypes.—COSTA RICA: Guanacaste Province, Santa Rosa National Park, 11-V-1-VI-1985, Malaise trap, D.H. Janzen (1 F, 2 M); same except dates, 27-IV-11-V-1985 (1 F), 1-22-VI-1985 (1 F), 5-26-X-1985 (1 M), 1-VII-78 (1 m), 8-VII-78 (1 m), 24-VII-78 (1 m), 24-V-78 (1 m), 23-VI-78 (1 m), 1-VII-77 (3 m), 2-VII-77 (4 m), 12-VII-77 (1 m), 24-VII-77 (1 m), 25-VI-77 (2 m), 5-VI-77 (1 m), 29-VI-77 (2 m), 5-VII-77 (1 m), 27-VII-77 (1 m). GUATEMALA: San Jose, 6.8, Fred K. Knab (1 F). MEXICO: "Mex" (2 F); Guadalajara, Crawford (1 M); Tierra Colorada, Guerrero, 2000 ft., Oct., H.H. Smith (1 F); Chilpancingo, Guerrero, 4600 ft., Aug., H.H. Smith (1 F); Amula, Guerrero, 6000 ft., H.H. Smith (1 M); Chilpancingo, Guer., 7-24-61, R. & K. Dreisbach (2 F), same, 3800', 30 July 1962, H.E. Evans (1 F); Puebla, 17.7 mi. SE Iz. da Matamoros, 20 Aug. 1969, 4500', George W. Byers (1 F); 11 mi N. Pihuamo, Jal., VII-19-66, P.M. & P.K. Wagner (1 M); Morelos, 6 mi. E Cuernavaca, 1 Sept. 1974, G. Bohart, W. Hanson (1 M); 6 mi NW Quinoga, Mich., VII-11-1968, F. D. Parker, L. A. Stange (1 M); Cotaxtla Exp. Sta., Cotaxtla, Ver., VIII-13-1962, D. H. Janzen (1 F); Ver., Lake Catemaco, 5 mi. S., VII-6-61, D.H. Janzen (1 M); Guerrero, Iguala, VIII-19-1981, A. & M. Michelbacher (1 M); 3 mi. E. Las Cruces, Guerrero, IX-27-1964, A.E. Michelbacher (1 M). (Berkeley, Champaign, London, Logan, College Station, Cambridge, Lawrence, Davis, Washington, Townes Coll.).

Remarks.— The coloration is very similar to that of *dorsalis* except that part of the mesepisternum is usually reddish. Structurally, *paradorsalis* differs from *dorsalis* by vein M meeting Sc+R apical to Sc and close to the point where Rs+M meets Sc+R, by the slender scopae of the female sheath which has much smaller spines on the inner apical margin, and by the lancet (compare Figs. 17, 18).

poecila (Klug), **new combination** — Belize; Guatemala; Honduras; Mexico (Campeche, Chiapas, Hidalgo, Puebla, Oaxaca, San Luis Potosi, Tabasco, Tamaulipas, Veracruz, Yucatán)

**Hylotoma poecila* Klug 1834: 239. M. "Mexiko" (Berlin, M).— Norton 1867: 64, 68-69 (Mexico records).— Cameron 1883: 38 (Guatemala).— Kriechbaumer 1884: 289.— Dalla Torre 1894: 339.

Labidarge poecila: Konow 1905a: 17.— Konow 1907a: 260, 271.— Konow 1907c: 221.— Konow 1907e: 489 (F).

Hylotoma intermedia* Cameron 1883: 38. F. "Guatemala, Panzos" (London, F).— Dalla Torre 1894: 335. **New synonymy.

Arge intermedia: Konow 1905a: 19.

Labidarge intermedia: Konow 1907a: 260, 270.

Caloptilia townsendi* Ashmead 1898: 212. F. No locality. (Washington, F).— Rohwer 1911a: 105-106 (F, M described; type F from "San Rafael, Jicoltepec, Mexico"). **New synonymy.

Labidarge pullipennis* Konow 1907c: 221. M. "Mexico" (Madrid, M).— Konow 1907a: 260, 271.— Oehlke and Wudowenz 1984: 406 ("M (?) holotypus, Mexiko. Nach der Beschreibung soll der Typus in Museum Madrid sein."). **New synonymy.

Scobina fasciata* Enderlein 1919: 113-114. F. "Mexiko" (Warszawa, F). **New synonymy.

The lectotype, by present designation, of *pullipennis* is a male at Madrid labeled "Mexico" and with Konow's determination label. The holotype of *intermedia* Cameron is BM #1.62. This is one of the most commonly collected species in Mexico. It has black tibiae and tarsi, a black head (usually with face paler), black at the apex of the abdomen, and bicolored wings with the base and apex black and yellow at the center. The mesonotum may be all orange or with black stripes on the mesonotal lateral lobes and sometimes on the prescutum, especially in some males.

poeciloides (Ashmead), **new combination** — Mexico (Baja California Sur, Chiapas, Chihuahua, Colima, Durango, Jalisco, Nayarit, San Luis Potosi, Sinaloa, Tabasco, Veracruz, Yucatán)

**Hylotoma poeciloides* Ashmead 1895: 542-543. M. "San José del Cabo" (San Francisco, M).

Caloptilia piceoterga* Rohwer 1911b: 383. M. "Cordoba, Vera Cruz, Mexico" (Washington, M). **New synonymy.

Color variation necessitates citing this species in several parts of the key. Most variation is in the male. The species described as *piceoterga* is a dark color form with most of the mesonotum, mesopleuron, mesosternum, and dorsum of the abdomen black. Females are mostly orange with the antenna, head, tibiae and tarsi, and sheath black, and usually with a small black spot on the mesonotal lateral lobes adjacent to the tegulae. This is a relatively common species in Mexico.

rubricollis (Klug), **new combination** — Argentina (Formosa, Misiones); Brazil (Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina, Santos, São Paulo)

**Hylotoma rubricollis* Klug 1834: 236. F, M. "Brasilien" (Berlin, F).— Norton 1867: 73.— Kriechbaumer 1884: 286.— Dalla Torre 1894: 342.
Labidarge rubricollis: Konow 1899a: 312.— Konow 1905a: 17.— Konow 1907a: 263, 425.
Stelidarge duckei* Konow 1906b: 253. M. "Brasilia (Barbacena)" (Eberswalde, M).— Konow 1907a: 191, 257.— Oehlke and Wudowenz 1984: 378 (holotype). **New synonymy.
Stelidarge bicolor* Jörgensen 1913: 256-258. F, (M misdet. ?). "Monte de Bonpland (Misiones)" (La Plata, F). **New synonymy.

I examined two of three specimens of *rubricollis* at Berlin. The lectotype, here designated, is a female labeled "13657," "Brasilien, Sello S.," "Typus," "*rubricollis* Kl., Brasil mer., Sell." The other specimen, a male, is a paralectotype. For *bicolor*, Jörgensen did not state how many specimens he had, only "en Septiembre - Diciembre." Six specimens under this name were sent to me from La Plata, three of which are *bicolor*, and the lectotype here designated is a female labeled "8-IX-10, Misiones, Bompland, Jörgensen," "*Stelidarge bicolor* n. sp.," "1838," and "Col. P. Jörgensen." Two other females are paralectotypes and have the same data except for the dates, 9-IX-10 and X-1910. The other three specimens, 2 females and 1 male, are *S. melanopyga*, consequently, the male Jörgensen described is apparently not *bicolor* if that was the male I examined. This species and *stigmaticollis* are similar and possibly represent color differences of a single species. In *rubricollis* the thorax is orange with sometimes the metapleuron, metanotum, and cervical sclerites black. *Scobina stigmaticollis* has more black. The mesosternum, lower part of the mesepisternum, mesoprescutum, and sometimes the tegula and mesoscutellum are black. The two are sympatric, and more information will be needed to determine their status.

scitula (Konow), **new combination** — Peru

**Labidarge scitula* Konow 1904: 233. M. "Peru (Callanga, Cuczo)" (Eberswalde, M).— Konow 1905a: 17.— Konow 1907a: 261, 419.— Oehlke and Wudowenz 1984: 411 (holotype).

This is possibly the male of another species. The coloration is as follows: head black; thorax black with upper mesepisternum, pronotum, and mesoscutellum orange; abdomen black; legs orange with tibiae and tarsi black; wings faintly yellowish infuscated.

stigmaticollis (Klug), **new combination** — Argentina (Misiones) ?; Brazil (Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina, São Paulo)

**Hylotoma stigmaticollis* Klug 1834: 236. M. "Brasilien" (Berlin, M).— Norton 1867: 73.— Kriechbaumer 1884: 286.— Dalla Torre 1894: 344.
Labidarge stigmaticollis: Konow 1899a: 312.— Konow 1905a: 17.— Konow 1907a: 263, 425.
Stelidarge stigmaticollis: Malaise 1941: 132.

I saw two males from Berlin. The lectotype here designated is labeled "13658," "St. Paul, Sello S.," "*stigmaticollis* Klug, St. Paul, Sell." The other male is a paralectotype and has the same data but lacks Klug's determination label. The color of the female is similar to that of the male. See discussion under *rubricollis*. I have seen specimens from each of the above localities. The Argentina record is based on a male, and I am not certain of its identity.

strophosa (Konow), **new combination** — Argentina (Jujuy, Tucumán); Bolivia; Colombia; Ecuador; Peru; Venezuela

**Labidarge strophosa* Konow 1906b: 180. M. "Peru (Marcapata), Bolivia (Yungas)" (Eberswalde, M).— Konow 1907a: 263, 425.— Oehlke and Wudowenz 1984: 414 (3 M syntypes at Eberswalde).
Labidarge miniatithorax* Enderlein 1919: 115-116. "F"= M. "Ecuador, Loja" (Warszawa, M). **New synonymy.

Three males of *strophosa* labeled as types are at Eberswalde, one from the Peru locality, the other two from the Bolivia locality. The one labeled "Marcapata, Peru" and with Konow's determination label is here designated lectotype, and the other two are paralectotypes. This species is widespread in the Andean region from Venezuela to northern Argentina. It is a black species with various amounts of red or orange on the thorax. Color variation is noted as follows: mesepisternum black or with upper quarter or half red; mesosternum usually black but may be dark reddish; pronotum red or with anterior half black to most all black; mesonotum red or prescutum or scutellum black; tegula red or black; metanotum red or black; basal 3 or 4 abdominal terga black or reddish to orange.

styx Malaise — Argentina (Jujuy, Salta, Santa Fé, Tucumán)

**Scobina styx* Malaise 1949: 2, 9, fig. 1J. F. "Argentina (*S.* Lorenzo)" (Stockholm, F).

This is one of the few entirely black species of *Scobina*, the others being *carbonaria* and some *dorsalis*.

suda (Konow), **new combination** — Peru

**Labidarge suda* Konow 1906b: 179. M. "Peru (Callanga Cuczo)" (Eberswalde, M).— Konow 1907a: 261, 419.— Oehlke and Wudowenz 1984: 414 (holotype).

This is possibly the male of another species. The coloration is as follows: head black with clypeus and labrum orange to white; thorax orange with mesosternum, mesepisternum (except upper corner), and small spot at posterior of each mesonotal lateral lobe black; abdomen orange, apical 2 segments black; legs orange with apex of midtibia, entire hindtibia, and tarsi black; wings uniformly, lightly black infuscated.

testacea (Klug), **new combination** — Brazil (Minas Gerais, São Paulo)

**Hylotoma testacea* Klug 1834: 238. F. "Brasilien" (Berlin, F).— Norton 1867: 73.— Kriechbaumer 1884: 288.— Dalla Torre 1894: 344.
Labidarge testacea: Konow 1904: 232.— Konow 1905a: 17.— Konow 1907a: 261, 418.

The coloration is as follows: head black; thorax and abdomen orange with apical 2 abdominal segments black; legs orange with narrow stripe on inner margin of hindtibia and 4th tarsal segment of each tarsus black; wings dark yellowish, costa and stigma yellowish.

thoracica (Jörgensen), **new combination** — Argentina (Corrientes, Cordoba, Entre Rios, Formosa, Misiones, San Luis, Salta, Tucumán); Brazil (Santa Catarina); Paraguay

**Stelidarge thoracica* Jörgensen 1913 (Oct.): 258-259. F, M. "Monte de Bonpland" (La Plata, M).
**Caloptilia thoracica* Schrottky 1913 (Nov.): 704. M. "Bompland" (La Plata, M). New synonymy.

Jörgensen attributed this species to Schrottky, but Jörgensen's description predates that of Schrottky's. Jörgensen described both sexes but Schrottky described only the male. The lectotype of *thoracica* Jörgensen, here designated, is a male labeled "Argentina, Bonpland, 5-IX-1909, P. Jörgensen," "*Caloptilia thoracica* Schrottky M, C. Schrottky det 1912," "Col. P. Jörgensen." The female is a paralectotype. The same male specimen that is the lectotype of *thoracica* Jörgensen is the holotype of *thoracica* Schrottky. This is a black species with various amounts of red on the thorax and base of the abdomen. Color variation is noted as follows: in the female, the mesosternum, small lateral marks on lateral portion of mesonotal lateral lobes, and dorsum of the abdomen may be black; in the male, the mesosternum, tegula, mesonotum, and mesepisternum may be black. Most males have the thorax red with the mesosternum, spot on anterior portion of the mesoprescutum, and spot on each mesonotal lateral lobe black. This species is relatively common in southeastern Brazil and northeastern Argentina.

tina Smith, **new species** — Argentina (Jujuy, Salta, Tucumán)

Scobina tina Smith.

Female.— Length, 8.5-9.5 mm. Head black; palpi white to orange. Thorax black with pronotum (except anterior margin), tegula, mesonotal lateral lobes, center and posterior mesoscutellum, and sometimes metanotum reddish; sometimes mesonotum entirely black and sometimes meseipisternum partly reddish. Abdomen black or with basal segments or terga to 5th orange. Legs black with outer surface of forefemur and foretibia whitish. Wings yellow with apex beyond stigma blackish; veins and stigma yellow in yellow part, black in apical black part. Antennal length to head width as 10.6:5.2; lower interocular distance to head width as 3.1:2.4; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.6:0.7. Forewing with basal anal cell; vein M meets Sc+R apical to Sc and veins M and Rs+M meet Sc+R at nearly the same point. Length of hindbasitarsus to length of remaining tarsal segments combined as 3.0:3.0. Scopae of sheath slender, with very short spines on inner apical margin (Fig. 11). Lancet as in Fig. 25.

Male.—Length, 6.5-8.0 mm. Coloration and variation similar to that of female, more commonly basal 5-6 segments of abdomen orange with apex black. Antennal length to head width as 10.8:4.7. Genitalia as in Fig. 49.

Holotype.—F, "Argentina, Horco Molle, Tuc., Mar. 7-13, 1966, L. A. Stange (Tucumán).

Paratypes.—ARGENTINA: Same data as for holotype (3 F, 13 M), same except Apr. 3-10, 1966 (5 M), same except Jan 15-19, 1966 (2 M); Villa Nogues, Tucumán, XI-26/28-64, 1250 m, C. Porter (3 F), same except XII-5/8-64 (1 F); Horco Molle, Tucumán, IV-9-30-1968, C.C. Porter (2 F, 2 M), same except dates, III-18-21-68 (1 M), Mar. 25-Apr. 30, '66 (3 F, 4 M), 10-23 Dec. 1967 (2 F), I-19-66, L. A. Stange (1 F), 8-V-1966, L. A. Stange (1 F); Tucumán, Horco Molle, Departamento Taff, 1-XII-1971, C. Porter (2 M), XI-24-71 (1 F); Tafi del Valle, Tucumán, March 3-12, '66, C.C. Porter (1 F. 1 M); Taficillo, Tucumán, 1700 m, I-1958, De La Sola (1 F); S. Pedro Colalao, Tucumán, XII-5/19-64, C.C. Porter (1 F); Tucumán, San Javier (C. Univ.), 10-I-1962, Willink (1 M); Tucumán, Cadillal, I-1922 (1 F); Catamarca, Gunancalá, 19-I-1960, A. Arganarás (1 F); La Caldera, Salta Pr., XII-11-75, R.M. Bohart (1 F); Jujuy, Posta Lozano, III-21-23-69, C.C.Porter (2 F), 8-XII-69 (1 M); Tucumán, I-1953, S.P. Colaloo, F.H. Walz (1 M); Prov. Tucumán, San Javier, 1100 m, XI-1977, R. Golbach (3 F); Salta, Campo Quijano, XII-81, M. Fritz (2 F); Salta, Rosario de Lerma, XII-1982, M.A. Fritz (1 M). (Tucumán, Washington, Cambridge, Davis, Gainesville, Townes Coll., Fritz Coll.).

Remarks.— Coloration is diagnostic for this species. It is black, though with some reddish on the thorax and basal abdominal segments, with contrasting yellow wings.

torquata (Konow), **new combination** — Argentina (Buenos Aires, Entre Rios, Misiones); Brazil (Rio Grande do Sul, Santa Catarina); Paraguay

**Labidarge torquata* Konow 1903: 106. F. "Brasil (Rio Grande do Sul)" (Eberswalde, F).— Konow 1905a: 17.— Konow 1907a: 262, 423-424.— Oehlke and Wudowenz 1984: 416 (holotype).

Labidarge torquata* var. *schrottkyi* Konow 1906b: 181. F, M. "Paraguay" (Eberswalde, F).— Konow 1907a: 424.— Oehlke and Wudowenz 1984: 410 (5 M, 1 F syntypes at Eberswalde). **New synonymy.

I saw 1 female and 5 males of *schrottkyi* from Eberswalde, each labeled "Villa Encarnat., Paraguay." The female is the lectotype and the males are paralectotypes. The variety described as *schrottkyi* is a paler form of *torquata*, with the coxae, femora, and mesoscutellum usually pale yellow orange and sometimes the costa and stigma of the forewing amber instead of black.

ventris Smith, **new name** — Brazil (Rio de Janeiro, São Paulo)

**Hylotoma ventralis* Klug 1834: 240. F, M. "Brasilien" (Berlin, M) (preoccupied by *Hylotoma ventralis* Spinola 1806).— Norton 1867: 73.— Kriechbaumer 1884: 289.— Dalla Torre 1894: 347.

Labidarge ventralis: Konow 1905a: 17.

Stelidarge ventralis: Konow 1907a: 192, 257.— Forsius 1925a: 20.

Of two males sent to me from Berlin, the one with the determination label "*ventralis* Kl., St. Paul., Sell." is here designated lectotype. The other male without a determination label is a paralectotype. The coloration is as follows: antenna and head black; thorax black; abdomen black dorsally, orange ventrally; legs orange with tibiae and tarsi black; wings darkly, uniformly black infuscated.

vittata (Mocsáry), **new combination** — Brazil (Minas Gerais)

**Labidarge vittata* Mocsáry 1909: 3. F. "Brasilia: Minas Gera.s" (Budapest, F).

This species is like *bivittata*, but has the thorax orange with the metascutellum black and the pattern of the abdominal dorsum is orange yellow with a median, longitudinal black stripe and apical two segments black. This is possibly a color variety of another species.

xanthospila (Klug), **new combination** — Brazil (Minas Gerais, Rio de Janeiro, São Paulo)

**Hylotoma xanthospila* Klug 1834: 239-240. F, M. "Brasilien" (Berlin, M).— Norton 1867: 73.— Kriechbaumer 1884: 289.— Dalla Torre 1894: 347.

Labidarge xanthospila: Konow 1903: 106.— Konow 1904: 232.— Konow 1905a: 17.— Konow 1907a: 261, 418.

Stelidarge fasciata* Forsius 1925a: 19-20. F. "Südbrasilien" (Stockholm, F) (preoccupied by *Scobina fasciata* Enderlein 1919). **New synonymy.

Forsius' *fasciata* is a female of this species. I saw two males of *xanthospila* from Berlin (2 of 5 examples); the one with the determination label "*xanthospila* Kl., St. Paul, Sell." is here designated lectotype. The other specimen is a paralectotype. The female Klug described must be among the three examples I did not see.

zantara Smith, **new species** — Brazil (Santa Catarina)

Scobina zantara Smith.

Female.— Length, 7.0-8.3 mm. Antenna and head black; palpi yellowish. Thorax orange yellow with mesepisternum and mesosternum and most of mesoprescutum and mesonotal lateral lobes black. Abdomen orange with apical 2 or 3 segments and sheath black. Legs orange to white with apical 1/5 hindtibia and tarsi black, fore- and midbasitarsi may be mostly whitish. Wings uniformly dark yellowish; veins brownish, stigma yellowish. Antennal length to head width as 10.5:4.8; lower interocular distance to eye length as 3.0:2.2; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.7:0.5. Forewing with basal anal cell; mein M meets Sc+R basal to Sc and some distance from where Rs+M meets Sc+R, distance between Rs+M and M on Sc+R more than half length of vein M (Fig. 3). Length of hindbasitarsus to length of remaining tarsal segments combined as 3.2:2.9. Sheath moderately stout, with 2 stout spines on inner apical margin. Lancet as in Fig. 22.

Male.— Length, 6.2-7.4 mm. Coloration similar to that of female, sometimes with abdomen darker being blackish laterally. Antennal length to head width as 10.5:4.3. Genitalia as in Fig. 41.

Holotype.— F, "Brasilien, Nova Teutonia, 27° 11' B, 52° 23' L, 300-500 m, 30-I-1962, Fritz Plaumann" (Washington).

Paratypes.— ARGENTINA: Misiones, Dos de Mayo, 18.IX.1973, Willink-Tomsic (1 F); Misiones, San Pedro, 16-XI-1973, Escobar-Claps (1 M). BRAZIL: Same data as for holotype (1 F), same except dates, Feb. 1965 (1 F), II-1966 (1 F), 16-I-1962 (1 F), 17-I-1967 (1 F), Sep. 1961 (1 F), 6-II-1962 (1 F), I-1962 (3 F), III-1968 (1 F), Feb. 1966 (1 F), Mar. 1966 (1 F), I-1966 (2 F), X-1968 (1 F), X-1966 (1 F), 30-III-1966 (1 F), 15 Mar. 1966 (1 F), Jan. 1966 (1 M), VIII-1969 (1 F), May 14, 1952 (1 F), Nov. 1937 (1 F), I-1937 (1 F), 27-I-1937 (1 F), 30-XI-1938 (1 F), 16-IV-1938 (1 F), 26-VIII-1938 (1 F, 1 M), 4-IX-1938 (1 F), 12-XI-1938 (1 F), 24-II-1938 (1 F), III-1967 (4 F, 2 M). (Washington, São Paulo, London, New Haven, Tucumán)

Remarks.— The coloration resembles some specimens of *torquata*, but the forewing venation of *zantara* (with vein M meeting Sc+R basal to Sc and some distance from Rs+M, Fig. 3) and lancet and male genitalia (Figs. 20, 22, 41, 45) separate the two.

Genus **ARGE** Schrank

Cryptus Jurine 1801: 163. Suppressed by Internatl. Comm. Zool. Nomencl., Op. 135, 1936.

Arge Schrank 1802: 209. Type species: *Tenthredo enodis* Linnaeus. Desig. by Rohwer 1911a.

Hylotoma Latreille 1802: 302. Type species: *Tenthredo rosae* Linnaeus. Monotypic.

Corynia Imhoff and Labram, in Labram and Imhoff 1836: 23. Type species: *Corynia rosarum* Imhoff and Labram. Desig. by Rohwer 1911a.

Acanthoptenos Ashmead 1898: 212. Type species: *Acanthoptenos weithii* Ashmead. Orig. desig.

Bathyblepta Konow 1906a: 123. Type species: *Bathyblepta procer* Konow. Monotypic.

Miocephala Konow 1907b: 162-163. Type species: *Miocephala chalybea* Konow. Monotypic.

Didocha Konow 1907d: 306. Type species: *Didocha braunsi* Konow. Monotypic.

Rhopalospiria Enderlein 1919: 116. Type species: *Rhopalospiria rubiginosa* (Beauvois). Orig. desig.

Triarge Forsius 1931: 19. Type species: *Triarge plumbea* Forsius. Orig. desig.

First and 2nd antennal segments each about as long as or longer than broad (Fig. 68). Head without high, sharp carinae, sculpturation of head with rounded elevations though sometimes blunt supraclypeal carina present; genal carina absent. Clypeus subtruncate; malar space equal to or shorter than diameter of front ocellus; eyes sightly converging below, lower interocular distance usually greater than eye length; maxillary palpus 6-segmented, labial palpus 4-segmented, segments of uniform width (Fig. 69), maxillary palpus usually as long as or longer than eye length. Pronotum with furrow extending from area of tegula to anterolateral margin. Forewing (Figs. 66, 67) with radial cell closed; intercostal vein present; costa narrower than intercostal area; basal anal cell present. Hindwing (Fig. 66) with radial cell closed; anal cell present. Mid- and hindtibia each with preapical spine (as in Fig. 5); apical tibial spines unually longer than apical width of tibiae; inner apical foretibial spine longer than outer spine; tarsal claws simple. Sheath of female rounded, without narrow scopae (Figs. 70, 71).

Arge is a large genus in the Ethiopian and Holarctic regions of the world with nearly 250 species. It is found throughout North America and extends as far south as Colombia in the neotropics. Species have the characteristics of *Scobina*, but the head lacks sharp carinae, there is no genal carina, a pronotal furrow is present, and the sheath is broadly rounded, not pincer-like as in *Scobina*.

Smith (1989) revised the genus for the New World. Only the species known from Mexico and southward are treated here, and all belong in the *humeralis* group of Smith (1989b), except *procera* which belongs in the *pectoralis* group. Hosts are not known for the species treated here, but two species in the *humeralis* group from eastern North America feed on species of *Rhus* and species of the *pectoralis* group which are most common in the temperate deciduous forests feed on *Betula*, *quercus*, *Ulmus*, *Salix*, and *Amelanchier*.

Males are poorly known and have not been associated with many species, therefore only a few are included and that part of the key should be used cautiously.

KEY TO SPECIES

1. In forewing vein 3r-m straight (Fig. 67); female sheath rounded in lateral view (Fig. 70) (orange with antenna, head, cervical sclerites, pronotum except lower lateral half, tegula, mesepimeron, metathorax, spot on posterior half of mesoscutellum, legs, and sheath black; lancet as in Fig. 72 . . . . ***procera*** (Klug)

— In forewing, vein 3r-m markedly curved (Fig. 66); female sheath concave below in lateral view (Fig. 71). **2**

2. Female **3**

— Male **13**

3. Head and thorax black **4**

— Head orange or orange with ocellar area and clypeus and labrum black <u>or</u> head black with large orange spot behind each eye; thorax usually mostly orange **9**

4. Legs entirely black **5**

— Legs with part of tibiae and usually part of tarsi white **6**

5. Wings bright orange, contrasting with black body; basal plates black; long conspicuous setae at base of apical sternite; lancet as in Fig. 75, serrulae pointed at apices . . . . ***flavoalaris*** Smith

— Wings black; basal plates white; without conspicuous setae at base of apical sternite; lancet as in Fig. 78, serrulae rounded at apices . . . . ***magnidens*** Smith

6. Wings black; white on legs confined to tibiae (lancet as in Fig. 74) . . . . ***basimacula*** (Cameron)

— Wings hyaline to yellow, commonly with a black spot below stigma or black streak in radial cell or antero-apical section of wing; white on legs on tibiae and tarsi **7**

7. Abdomen with most of basal plates and terga 4 to apex yellow orange (lancet as in Fig. 80) . . . . ***nugana*** Smith

— Abdomen black **8**

8. Forewing with black spot below stigma; lancet as in Fig. 79, serrulae very slender, those at apex extend around rounded apical margin . . . . ***mexicana*** Pasteels

— Forewing with black streak in antero-apical section following vein Rs; lancet as in Fig. 73, serrulae low and rounded . . . . ***arida*** Smith

9. Head black with large orange spot behind each eye; thorax black with upper 2/3 of mesepisternum orange (abdomen black with basal plates white, terga 2 and 6-9 orange; wings slightly orange with black streak in antero-apical section; lancet as in Fig. 81) . . . . ***rufomacula*** Smith

— Head orange, at most with ocellar area or clypeus and labrum black; thorax usually with orange on other parts in addition to mesepisternum **10**

10. Legs black (ocellar area, clypeus and labrum black; thorax orange with mesoprescutum, mesoscutellum, and mesosternum black; forewing with dark streak in antero-apical section; lancet as in Fig. 77, serrulae deep, annular hairs long) . . . . ***longiserrula*** Smith

— Legs with tibiae and tarsi mostly white, femora may be partly pale. **11**

11. Antenna orange, black only on apical 1/2-1/3 of flagellum; lancet as in Fig. 82, annular hairs short. . . . . ***spiculata*** (MacGillivray)

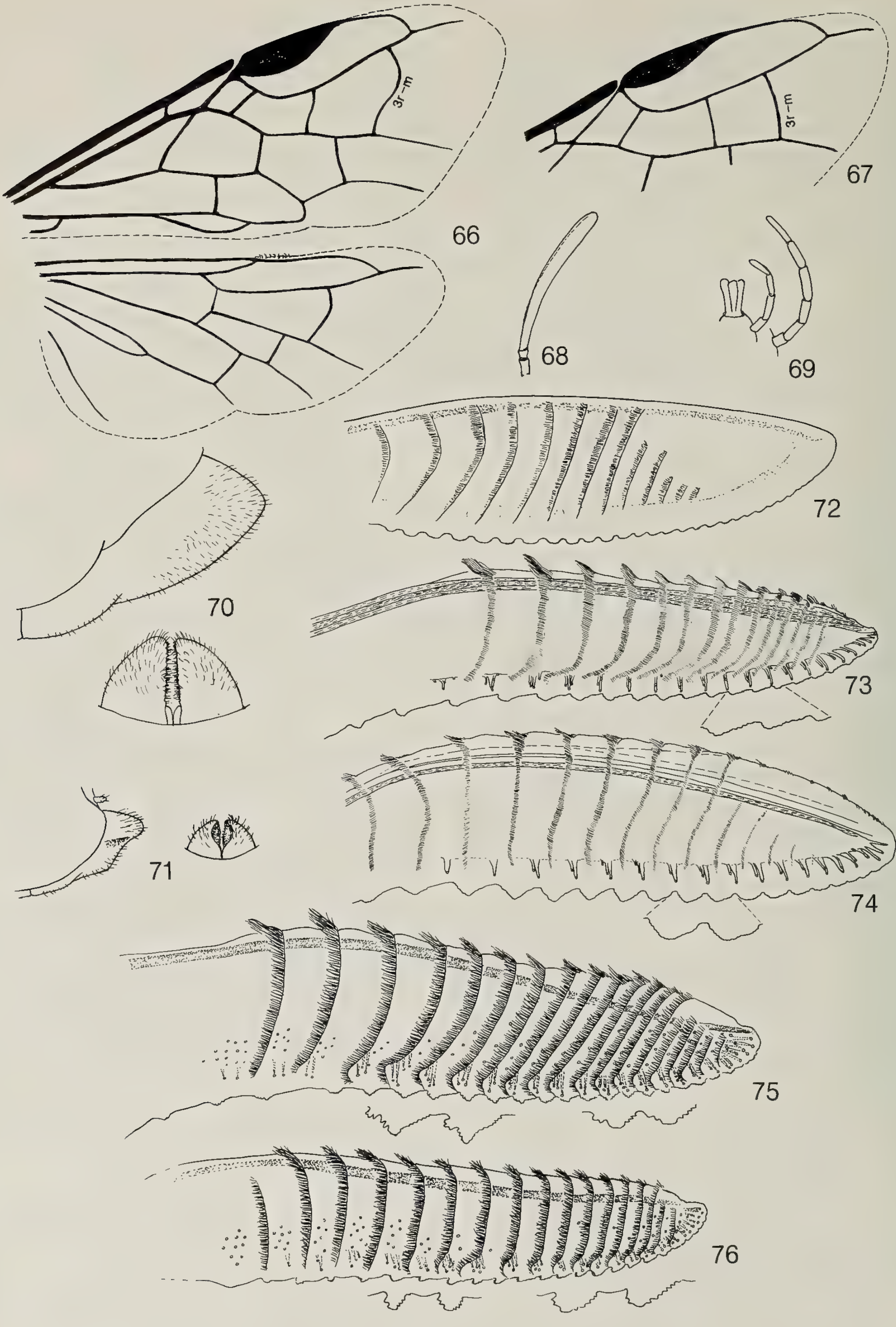
— Antenna black; lancet as in Figs. 76, 83, annular hairs long **12**

12. Mesoscutellum black (sometimes orange spot at center); abdomen orange or sometimes blackish bands on segments; lancet as in Fig. 76, serrulae more rounded. . . . . ***illuminata*** Smith

— Mesoscutellum orange; abdomen with only terga 2-4 orange; lancet as in Fig 83, serrulae more pointed at apices. . . . . ***vittata*** (Kirby)

13. Tibiae white **14**

— Legs black **15**



Figs. 66-76. *Arge*. 66, Forewing and hindwing of *A. spiculata*. 67, Forewing of *A. procera*. 68, Antenna of *A. spiculata*; 69, Palpi of *A. spiculata*; 70, Sheath of *A. procera*; 71, Sheath of *A. spiculata*. Lancets of 72, *A. procera*; 73, *A. arida*; 74, *A. basimacula*; 75, *A. flavoalaris*; 76, *A. illuminata*.

14. Wings black; genitalia as in Fig. 84 .... **basimacula** (Cameron)
— Wings hyaline, possibly blackish area in radial cell; genitalia as in Fig. 86 .... **arida** Smith
15. Wings black; genitalia as in Fig. 88 .... **spiculata** (MacGillivray)
— Wings hyaline **16**
16. Costa black, stigma yellow; blackish streak in radial cell of forewing; apical tergum black; genitalia as in Fig. 87 .... **vittata** (Kirby)
— Costa and stigma black; yellow extends to apex of forewing; apical tergum white; genitalia as in Fig. 85 .... **flavoalaris** Smith

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SPECIES

arida Smith — Mexico (Sonora); U.S.A. (Arizona)

**Arge arida* Smith 1989: 93-95, fig. 13, 27. F, M. "Huachuca Mts., Ariz." (Champaign, F).

basimacula (Cameron) - Colombia; Panama

**Hylotoma basimacula* Cameron 1883: 36. F. "Panama, Bugaba" (London, F).— Cameron 1899: 468, pl. 20, fig. 14.— Dalla Torre 1894: 326.
Arge basimacula: Konow 1905a: 17.— Konow 1906c: 387.— Konow 1907b: 164.— Konow 1907a: 489.— Konow 1908b: 184-185.— Smith 1989: 95-97, fig. 12, 23 (F, M).

The holotype is BM #1.06. This is the southernmost species of *Arge* in the New World. The only specimen I have seen from Colombia is labeled "Sainte Marthe, Vauvert 9-13" and is at Paris.

flavoalaris Smith — Mexico (Guerrero, Oaxaca)

**Arge flavoalaris* Smith 1989: 102-104, fig. 21, 26. F, M. "Mexico: State of Oaxaca, Monte Alban ruins, 8 mi. SW of Oaxaca" (San Francisco, F).

illuminata Smith — Mexico (Nuevo Leon); U.S.A. (Arizona, Texas)

**Arge illuminata* Smith 1989: 110-111, fig. 20. F. "Sunnyside, Cochise Co., Ariz." (Davis, F).

longiserrula Smith — Mexico (Nuevo Leon)

**Arge longiserrula* Smith 1989: 111-113, fig. 19. F. "Mexico, 10 mi. NW Providencia, Nuevo Leon, 6000'" (San Francisco, F).

magnidens Smith — Mexico (Guerrero)

**Arge magnidens* Smith 1989: 113-114, fig. 22. F. "9 mi. S Tierra Colorado, Gro., Mex." (Davis, F).

mexicana Pasteels — Mexico (Guanajuato, Jalisco, Nayarit)

**Arge mexicana* Pasteels 1952: 310-311, fig. 29b, c. F. "Guanaxuato" (Bruxelles, F).— Smith 1989: 114-115, fig. 11 (F, distribution)

nugana Smith — Mexico (Jalisco)

**Arge nugana* Smith 1989: 115-116, fig. 14. F. "Tuxpan, Jal., Mex." (Champaign, F).

procera (Klug) — Mexico

**Hylotoma procera* Klug 1834: 235. F. "Mexiko" (Berlin, F).— Norton 1867: 64, 68.— Kirby 1882: 70.— Cameron 1883: 37.— Kriechbaumer 1884: 286.— Dalla Torre 1894: 339.
Arge procera: Konow 1905a: 20.— Konow 1906c: 387.— Konow 1907b: 169.— Konow 1907a: 489.— Konow 1908b: 185.— Smith 1989: 133-134, fig. 44 (holotype redescribed).

I have seen only the holotype. It is unusual to find a member of the *pectoralis* group this far south since most occur in temperate North America.

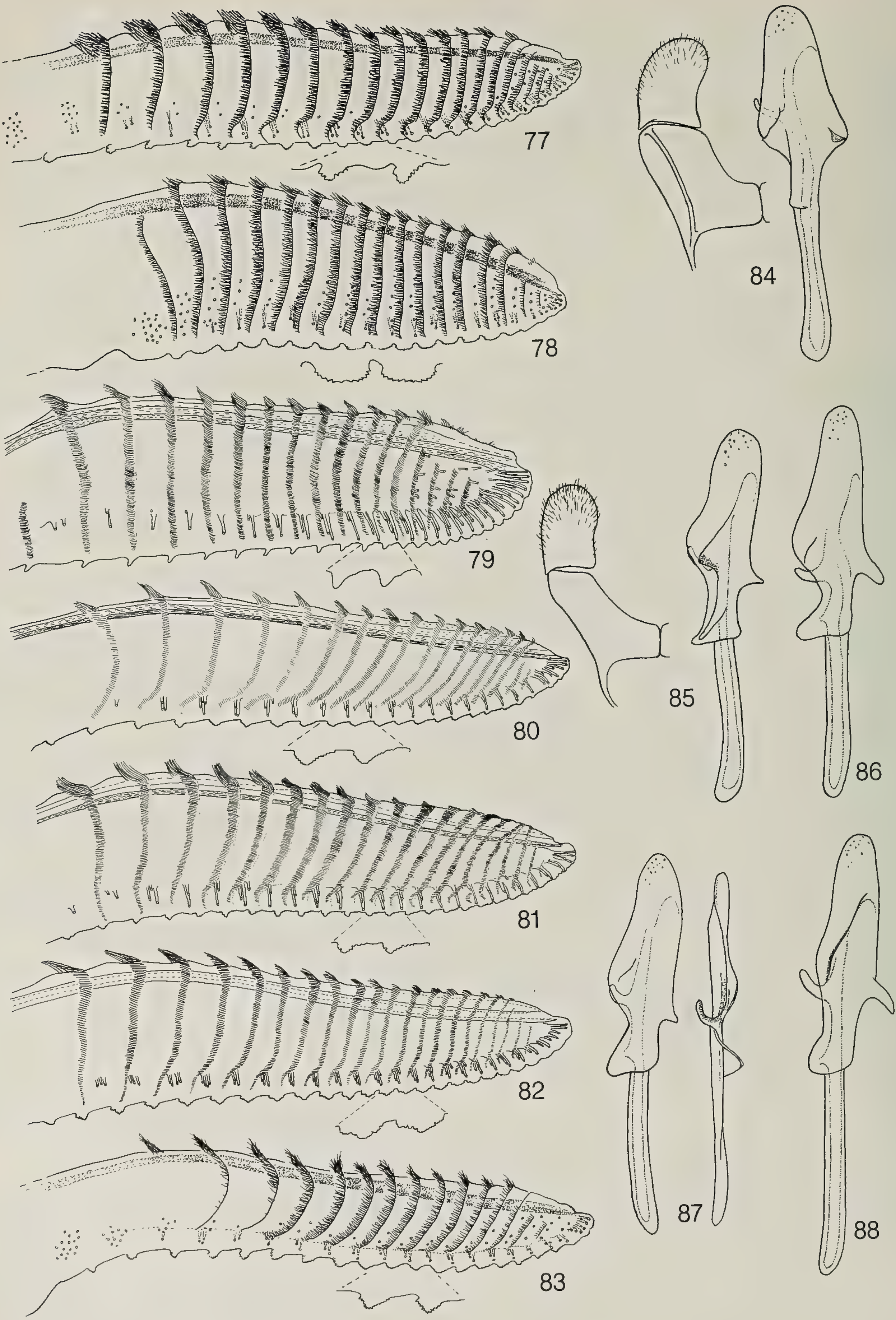
rufomacula Smith — Mexico (Veracruz)

**Arge rufomacula* Smith 1989: 116-118, fig. 17. F. "Cuesta de Misantla, Mexico" London, F).

spiculata (MacGillivray) — Mexico (Jalisco, Nayarit); U.S.A. (Arizona)

**Hylotoma spiculata* MacGillivray 1907: 308. F, M. "Oak Creek Canon, New Mexico, 6,000 ft." (Champaign, F).— Rohwer 1909: 14 (M in key).— Frison 1927: 249.— Webb 1980: 110 (holotype).
Arge spiculata: Ross 1951: 14.— Smith 1979: 22.— Smith 1989: 118-120, fig. 16, 29 (F, M; distribution).

The holotype is labeled Arizona, not New Mexico as given in the original description.



Figs. 77-88. *Arge*. Lancets of 77, *A. longiserrula*; 78, *A. magnidens*; 79, *A. mexicana*; 80, *A. nugana*; 81, *A. rufomacula*; 82, *A. spiculata*; 83, *A. vittata*. Male genitalia of 84, *A. basimacula*; 85, *A. flavoalaris*; 86, *A. arida*; 87, *A. vittata*; 88, *A. spiculata*.

vittata (Kirby) — Mexico (Chiapas, Nuevo Leon, San Luis Potosi, Veracruz)

**Hylotoma vittata* Kirby 1882: 70-71, pl. 6, fig. 2. F. "Mexico" (London, F).— Cameron 1883: 37.— Dalla Torre 1894: 357.

Arge vittata: Konow 1905a: 21.— Konow 1906c: 387.— Konow 1907b: 169.— Konow 1907a: 489.— Konow 1908b: 185.— Smith 1989: 122-124, fig. 18, 28 (F, M; distribution).

The holotype is BM# 1.105.

Mislabeled specimen: A female of *Arge pagana* (Panzer) (at Cambridge) is labeled "Chile." This is a palearctic species and its occurrence in Chile is highly questionable.

Subfamily ATOMACERINAE

Atomacerinae Benson 1938: 373.
Atomacerini Benson 1963: 634.

Antennal flagellum simple in both sexes (Figs. 90, 91); antennal length subequal to or as long as 1 3/4X head width; antennal insertions on head below level of middle of eyes. Head usually transverse from above and sharply narrowed behind eyes, broader than long; with or without interantennal carina; genal carina absent; eyes small, not converging below, lower interocular distance greater than eye length (Fig. 92). Malar space broad, 1-2X diameter of front ocellus; maxillary palpus 6-segmented, labial palpus 4-segmented (Fig. 94); labium trilobed; maxillary palpus usually longer than eye length; palpal segments of uniform width or 3rd labial palpal segment slightly broadened; each mandible 3-toothed (Fig. 93). Pronotum without diagonal furrow. Cenchri large and close together, distance between them less than half breadth of one; mesosternal-pleural suture faint. Sclerotized portion of basal plates narrow anteriorly, leaving large membranous area. Forewing (Fig. 89) with costa narrower than or subequal to intercostal area; intercostal crossvein (Sc) present; vein 1r joins stigma near junction of Sc+R and stigma; vein M meets Sc+R basal to junction of Rs+M and Sc+R, distance between M and Rs+M on Sc+R equal to more than half length of vein M; radial cell open to faintly closed at apex; with 3 or 4 cubital cells, last closed cubital cell longer on radius than on cubitus (except *A. recta*); basal anal cell absent. Hindwing (Fig. 89) with radial cell open; anal cell absent. Tibiae without preapical spines; inner foretibial spine about half length of outer spine; tarsal claws simple with large acute basal lobe (Fig. 95).

The Atomacerinae are characterized by the simple antennal flagellum of the male, short, broad head sharply narrowing behind the eyes in dorsal view, three-toothed mandibles, presence of an intercostal crossvein in the forewing, the radial cell of the hindwing open at its apex, absence of an anal cell in the hindwing, lack of preapical spines on the hindtibia, and the simple tarsal claws with an acute basal lobe. The general habitus of the head (broad, narrowing behind the eyes in dorsal view, and small widely separated eyes) and three-toothed mandibles are similar to the Erigleninae, but in that subfamily the male antennal flagellum is furcate, the intercostal crossvein is absent, and the tarsal claws are simple. The simple male antennal flagellum relates the Atomacerinae to the Arginae, but many other characteristics differ, such as the lack of preapical tibial spines. The members of this subfamily have usually been regarded as belonging to a separate suprageneric unit in the Argidae, and I believe the unique characters warrant subfamily status.

This subfamily is represented by a single genus, *Atomacera*.

Genus **ATOMACERA** Say

Atomacera Say 1836: 212. Type species: *Atomacera debilis* Say. Desig. by Malaise 1937a.

Micrarge Ashmead 1898: 213. Type species: *Atomacera ruficollis* Norton. Orig. desig.

Braunsiola Konow 1899a: 312. Type species: *Braunsiola truculenta* Konow. Monotypic.

Atomaceros Konow 1905a: 28. Emendation.

Spegazziniella Jörgensen 1913: 260. Type species: *Spegazziniella ovata* Jörgensen. Monotypic.

Argina Forsius 1925a: 2-3. Preoccupied by *Argina* Huebner 1819 and *Argina* Gray 1840. Type species: *Argina nubilipennis* Forsius. Orig. desig.

Arginella Forsius 1925b: 107. New name for *Argina* Forsius.

These are small sawflies, seldom more than 5 mm long, and are distinguished by the basal lobe of the tarsal claw, lack of a preapical spine on the hindtibia, lack of an anal cell in the hindwing, presence of an intercostal crossvein in the forewing, three-toothed mandibles, and the simple antennal flagellum in the male. The female sheaths are all slender and simple, without scopae, similar to Figs. 627-629. Other characters are in the subfamily description. All species are black or black with various reddish markings on the thorax.

Atomacera is found from southeastern Canada to northern Argentina. Only two species are found in eastern North America, *A. debilis* Say which feeds on *Desmodium* spp. and *A. decepta* Rohwer which feeds on *Hibiscus* spp. (Smith, 1979).

Malaise (1942) gave a key to species, but there are considerable additions. Many species are similar in coloration but differ in female lancet and male genitalia characters, consequently reliable species determination is by examination of the lancet and male genitalia. Though the male genitalia appear to have good specific characters, very few have been associated with females and many unassociated specimens may not be accurately identified in the following key. Because of color variation, mostly the amount of red on the thorax, some species are keyed in several places. The lancet should always be examined and compared with the illustrations when keying specimens since possible unknown color variations may lead to erroneous identification. Some groups appear to be complexes for which more material is needed to determine if several or only one variable species exists. This is especially true for *pubicornis* and *ebena*.

KEY TO SPECIES

Atomacera caerulea (Cameron) from Panama is not included. It is all black and would go to couplet 27, but the lancet was not examined.

1. Head, thorax, and legs black; abdomen reddish with sheath black (antenna longer than head width; interantennal crest rounded) ... ***rufiventris*** (Cameron)

— Entirely black or black with parts of thorax reddish ... **2**

2. Thorax all or partly reddish, red usually on one or more of following: pronotum, mesonotum, mesopleuron, tegula; legs black or tibiae partly whitish ... **3**

— Entirely black, some species with tibiae all or in part whitish ... **23**

3. Mesopleuron reddish ... **4**

— Mesopleuron black, only pronotum and/or mesonotum reddish ... **6**

4. Mesosternum black, legs black (pronotum, cervical sclerites, tegula, mesonotum except sometimes blackish marks on prescutum, and sometimes mesoscutellum reddish; antennal length subequal to head width; interantennal carina present, extending half way down supraclypeal area; lancet as in Fig. 96) ... ***plaumanni*** Malaise

— Mesosternum red; legs black or foreleg partly reddish ... **5**

5. Forecoxa, trochanters, and femora reddish; northern Argentina ... ***ovata*** (Jörgensen)

— Forecoxa, trochanters, and femora black; Panama (lancet as in Fig. 97) ... ***comana***, new species (in part)

6. Pronotum and sometimes tegula black, reddish marks on thorax confined to lobe(s) of mesonotum ... **7**

— Pronotum all or in part and tegula reddish, mesonotum all or partly reddish ... **10**

7. Antennal length subequal to head width; lancet as in Fig. 98, serrulae broad, concave at apex appearing to have two large teeth (tegula and mesoprescutum black) ... ***romani*** Malaise

— Antennal length about 1 1/3X head width; serrulae of lancet flat or rounded, but with distinct subbasal teeth (Figs. 99-101) ... **8**

8. Serrulae of lancet flat, subbasal teeth fine (Fig. 99) (tegula black; mesoprescutum and mesoscutellum black) ... ***serrata***, new species

— Serrulae of lancet deeper, rounded, subbasal teeth coarser (Figs. 100, 101) ... **9**

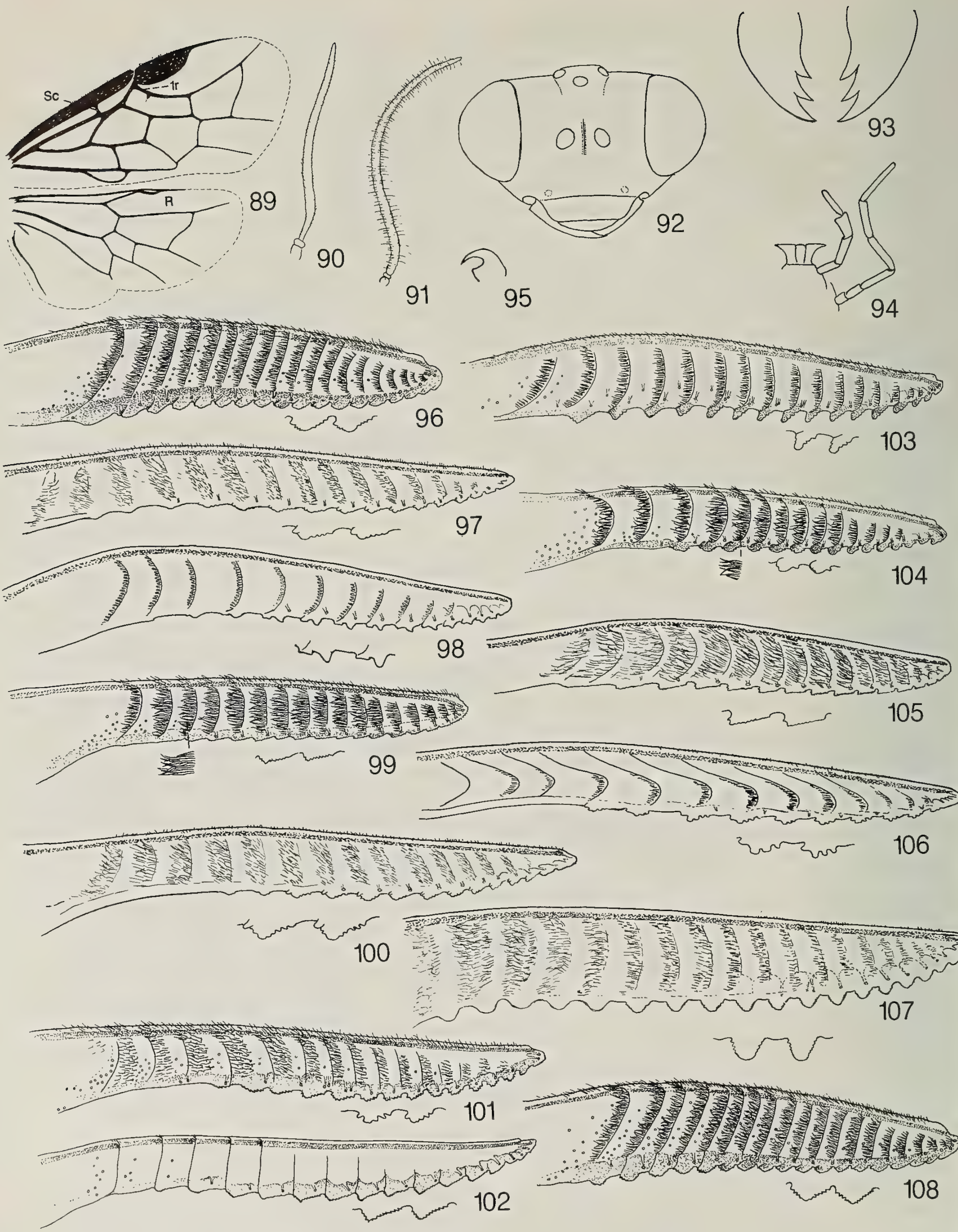
9. Lancet as in Fig. 100; mesonotum reddish ... ***lepidula*** (Konow)

— Lancet as in Fig. 101; mesonotum usually with prescutum and scutellum black (male genitalia as in Fig. 127) ... ***pubicornis*** (Fabricius)

10. Tibiae white, extreme apices may be blackish (lancet as in Fig. 102, annuli lacking hairs or spines; pronotum, tegula, and mesonotum usually entirely reddish; male genitalia as in Fig. 122; possibly a complex of several species) ... ***ebena*** Smith (in part)

— Tibiae black, foretibia may be partly whitish ... **11**

11. Most of pronotum, tegula, and sometimes adjacent parts of mesonotal lateral lobes reddish, most of mesonotum black **12**
— Pronotum, tegula, and mesonotum reddish, prescutum and/or scutellum may be black **15**
12. About lateral half of mesonotal lateral lobes and cervical sclerites red; lancet as in Fig. 103, with serrulae deep and rounded at apices (antennal length about 1 1/2X head width) . . . . . ***malleri*** Malaise
— Most of mesonotal lateral lobes, except sometimes extreme lateral corners, and cervical sclerites black; lancet as in Figs. 104-106, with serrulae low and rounded or truncated at apices **13**
13. Serrulae of lancet rounded at apices, with few distinct subbasal teeth, and annuli straighter (Fig. 104) . . . . . ***humeralis*** Malaise
— Serrulae of lancet flat at apices, with several large or small subbasal teeth; annuli sharply curved or straight (Figs. 105, 106) **14**
14. Lancet as in Fig. 105, subbasal teeth of serrulae fine, annuli straight, with long annular hairs . . . ***heda***, new species
— Lancet as in Fig. 106, subbasal teeth of serrulae coarse, annuli sharply curved, with short annular hairs (male genitalia as in Fig. 130) . . . . . ***diasi***, new species
15. Mesoprescutum and mesoscutellum black or only mesoprescutum black **16**
— Mesonotum red, if black present then only on part of mesoscutellum **19**
16. Mesoprescutum black, mesoscutellum red; pronotum black with posterolateral margins broadly orange (lancet as in Fig. 107, with large, deep, lobelike serrulae) . . . . . ***lobula***, new species
— Mesoprescutum and mesoscutellum black; pronotum red **17**
17. Cervical sclerites red (lancet as in Fig. 108) . . . . . ***triangulata*** Malaise
— Cervical sclerites black **18**
18. Serrulae of lancet low and flat, annular hairs long (Fig. 109) . . . . . ***flava***, new species
— Serrulae of lancet deeper and more pointed at apices, annular hairs short (Fig. 110) . . . . . ***hallex*** (Konow)
19. Serrulae of lancet deep, narrowly or broadly rounded at apices and annuli relatively straight (Figs. 111, 112) . . **20**
— Serrulae of lancet lower or pointed at apices, annuli straight or markedly curved (Figs. 97, 113, 114) **21**
20. Serrulae narrowly rounded at apices, about as far apart as width of one (Fig. 111) (male genitalia as in Fig. 123) . . . . . ***zonia***, new species
— Serrulae broadly rounded at apices, closer together than breadth of one (Fig. 112) . . . . . ***raza***, new species
21. Serrulae of lancet flat, each with 4 large posterior subbasal teeth, annular hairs short (Fig. 113) (forewing with 4 cubital cells) . . . . . ***nama***, new species
— Serrulae of lancet pointed or rounded at apices, usually with one or more anterior subbasal teeth and posterior subbasal teeth finer, annular hairs longer (Figs. 97, 114) **22**
22. Lancet as in Fig. 97, annuli straight; forewing with 4 cubital cells (veins 1m-cu and Rs of forewing interstitial) . . . . . ***comana***, new species (in part)
— Lancet as in Fig. 114, annuli on basal half curved; forewing usually with 3 cubital cells (male genitalia as in Fig. 128) . . . . . ***tria***, new species
23. Interantennal carina sharp, extending to clypeal suture and sometimes slightly onto clypeus (lancet as in Fig. 115; male genitalia as in Fig. 126) . . . . . ***coerulescens*** Malaise
— Interantennal carina shorter, not extending onto supraclypeal area, or absent **24**
24. Second and 3rd cubital crossveins subparallel, the later almost straight, the last closed cubital cell therefore quadrate, about as long on radius as on cubitus (male genitalia as in Fig. 129) . . . . . ***recta*** (Enderlein)
— Third cubital crossvein curved, 2nd and 3rd not subparallel but divergent, the last closed cubital cell much longer on radius than on cubitus (Fig. 89) **25**
25. Tibiae whitish **26**
— Tibiae black, foretibia may be white **27**
26. Antennal length longer than head width; trochanters black (lancet as in Fig. 102) . . . . . ***ebena*** Smith (in part)
— Antennal length subequal to head width; trochanters whitish . . . . . ***crassitarsus*** (Cameron)
27. Lancet short, with 10 or fewer serrulae (Figs. 116-118) (interantennal area rounded, no carina) **28**
— Lancet longer, with 12 or more serrulae (Figs. 119-121) **30**



Figs. 89-108. *Atomacera*. 89, Forewing and hindwing of *A. ebena*. 90, Female antenna of *A. ebena*. 91, Male antenna of *A. ebena*. 92, Front view of head of *A. ebena*. 93, Mandibles of *A. ebena*. 94, Palpi of *A. ebena*. 95, Tarsal claw of *A. ebena*. Lancets of 96, *A. plaumanni*; 97, *A. comana*; 98, *A. romani*; 99, *A. serrata*; 100, *A. lepidula*; 101, *A. pubicornis*; 102, *A. ebena*; 103, *A. malleri*; 104, *A. humeralis*; 105, *A. heda*; 106, *A. diasi*; 107, *A. lobula*; 108, *A. triangulata*.

28. Antennal length slightly less than head width; lancet as in Fig. 116, serrulae flat apically, each with one large anterior and 2 large posterior subbasal teeth .... ***mina***, new species
— Antennal length longer than head width; lancet as in Figs. 117, 118, serrulae without distinct posterior subbasal teeth **29**
29. Lancet as in Fig. 117, annular spines present, serrulae appear broad and concave at apices .... ***petroa***, new species
— Lancet as in Fig. 118, annular hairs present, serrulae narrow .... ***truculenta*** (Konow)
30. Serrulae of lancet large, lobelike, close together, annular hairs long (Fig. 119); short interantennal carina present (male genitalia as in Fig. 125) .... ***melini*** (Malaise)
— Serrulae of lancet flat or pointed at apices, usually farther apart, annular hairs short (Figs. 120, 121); interantennal area rounded **31**
31. Serrulae of lancet flat, truncate at apices, each without anterior and with 4 or 5 large posterior subbasal teeth (Fig. 120) (male genitalia as in Fig. 124) .... ***ginga*** Smith
— Serrulae of lancet flat or pointed at apices, with fine anterior and posterior subbasal teeth (Fig. 121) **32**
32. Apex of forefemur and foretibia whitish; 3.5 mm long; interantennal area rounded; without supraclypeal furrow (lancet as in Fig. 121) .... ***pumila*** Malaise
— Foreleg black; 3.5-4.5 mm long; small rounded tubercle on interantennal area; supraclypeal furrow distinct .... ***lopesi*** Malaise

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SPECIES

caerulea (Cameron), **new combination** — Panama

**Sericocera caerulea* Cameron 1883: 49. F. "Panama, Volcan de Chiriqui 3000 to 4000 feet" (London, F).— Dalla Torre 1894: 310.
Sericoceros coeruleus (!): Konow 1905a: 28.

The holotype is BM #1.126. The lancet was not examined. It is an entirely black species and is not included in the key.

coerulescens Malaise — Brazil (Santa Catarina, São Paulo)

**Atomacera coerulescens* Malaise 1942: 109. M. "Santa Catharina (Nova Teutonia)" (Stockholm, M).— Malaise 1949: 12 (F).

The holotype is labeled "Rio Grande do Sul, Nova Teutonia, Plaumann." The female is similar in color to the male. I have seen one specimen from São Paulo and additional specimens from Nova Teutonia.

comana Smith, **new species** - Panama

Atomacera comana Smith.

Female.— Length, 5.0 mm. Black; mesosternum, mesopleuron, cervical sclerites, and supraclypeal area reddish or black; pronotum, tegula, and mesonotum red; outer surface of foretibia whitish. Wings moderately infuscated black, lighter toward apices. Antennal length to head width as 5.7:3.6. Malar space about 1 1/2X diameter of front ocellus; lower interocular distance to eye length as 2.1:1.6; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.5:0.2. Forewing with 4 cubital cells, veins Rs and 1m-cu interstitial. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 97, with annuli straight, serrulae low with one anterior and several posterior subbasal teeth.

Male.— Unknown.

Holotype.— F, "Taboga Isl., Pan., Jun. 12, 11, August Busck" (Washington).

Paratype.— PANAMA: Canal Zone, Barro Colorado, 29-VII-1924, N. Banks (1 F) (Cambridge).

Remarks.— The holotype has the mesosternum, mesopleuron, and cervical sclerites reddish and a pale supraclypeal area. These structures of the paratype are black. The species is distinguished from other species by the red pronotum, tegula, and mesonotum, black legs, straight annuli of the lancet, and the presence of four cubital cells in the forewing with veins Rs and 1m-cu interstitial. In most other species vein Rs is absent (thus with three cubital cells) and vein 1m-cu meets M apical to Rs.

crassitarsis (Cameron), **new combination** — Panama

**Sericocera crassitarsis* Cameron 1883: 50-51. F, M. "Panama, Volcan de Chiriqui 2500 to 4000 feet" (London, F).— Dalla Torre 1894: 310.
Sericoceros crassitarsis: Konow 1905a: 28.

The lectotype, here designated, is the female set

Figs. 109-130. *Atomacera*. Lancets of 109, *A. flava*; 110, *A. hallex*; 111, *A. zonia*; 112, *A. raza*; 113, *A. nama*; 114, *A. tria*; 115, *A. coerulescens*; 116, *A. mina*; 117, *A. petroa*; 118, *A. truculenta*; 119, *A. melini*; 120, *A. ginga*; 121, *A. pumila*. Male genitalia of 122, *A. ebena*; 123, *A. zonia*; 124, *A. ginga*; 125, *A. melini*; 126, *A. coerulescens*; 127, *A. pubicornis*; 128, *A. tria*; 129, *A. recta*; 130, *A. diasi*.

aside as BM# 1.125, labeled "B.C.A. Hymen. I. *Sericocera* crassitarsis Cam.," "V. de Chiriqui, 25-4000 ft., Champion."

diasi Smith, **new species** — Brazil (D.F.)

Atomacera diasi Smith.

Female.— Length, 3.0-3.5 mm. Black; pronotum and tegula red, sometimes lateral corner of mesonotal lateral lobes adjacent to tegula reddish; supraclypeal area and clypeus sometimes brownish; outer surface of apex of forefemur and foretibia whitish. Wings moderately black infuscated, apex beyond stigma of forewing more hyaline. Antennal length to head width as 4.2:3.6. Lower interocular distance to eye length as 2.0:1.6; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.3. Forewing usually with 3 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 106, with serrulae flat at apices, each with 1 large anterior and 3 or 4 large posterior subbasal teeth; annuli markedly curved.

Male.—Length, 3.0-3.5 mm. Coloration and structure similar to those of female; antennal length to head width as 6.0:3.3. Genitalia as in Fig. 130.

Holotype.— F, "Res. Ecol. IBGE, Km 0 BR 251 - DF, 14-21/III/1980, T. Malaise 5:C.sujo," "Brasilia, D.F., Col. Braulio Dias." (Brasilia, IBGE).

Paratypes.— BRAZIL: Same locality as for holotype, 16-23-X-81, 3A-76-1 m (1 F); 18-25-III-82, 3A-98-2 m (1 F); 18-25-II-82, 3A-94-5 m (1 F); 4-11-III-82, 3A-96-4 m (2 F, 1 M); 1-7-IV-82, 3A-100-5 m (1 M); 9-II-1979, Tenda Malaise, Campo Sujo, 2A-1-4 (1 M); 29-X-5-XI-81, 3A-78-5 m (1 M). (Brasilia, IBGE; Washington).

Remarks.—The coloration of this species is similar to that of *malleri* and *humeralis*, but the lancet is very different (compare Figs. 103, 104, 106) in that the serrulae are truncated and with coarse subbasal teeth and the annuli are markedly curved.

The species is named for Braulio F. S. Dias, who has helped considerably in my studies.

ebena Smith, complex — Costa Rica; Mexico (Colima, Guerrero, Jalisco, Morelos, Nayarit, San Luis Potosi, Sonora, Veracruz, Yucatán); USA (Arizona)

Atomacera ebena Smith 1969b: 445-446, fig. 8, 22. F. "Ramsey Canyon, Huachuca Mts., Arizona" (Washington, F).— Smith 1979: 22.

I have seen a number of specimens from scattered localities from southern Arizona to Costa Rica that have the tibiae white and the thorax either black or with the pronotum and mesonotum red. All have lancets similar to Fig. 102, with the annuli lacking hairs or spines and the serrulae similar but with various degrees of depth. The male genitalia are similar to Fig. 122. There may be more than one species involved here, but series are needed from various parts of its range to determine the value of the slight differences noted. At present, all specimens with white tibiae and lancet and male genitalia similar to the figures are grouped here.

flava Smith, **new species** — Brazil (D.F.)

Atomacera flava Smith.

Female.— Length, 3.5 mm. Black with pronotum, tegula, and mesonotum except for most of prescutum and scutellum red; outer surface of foretibia whitish. Wings moderately infuscated black, more hyaline toward apices. Antennal length to head width as 4.1:3.1. Lower interocular distance to eye length as 1.8:1.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.3; malar space 2X diameter of front ocellus. Forewing with 4 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 109, serrulae serrate, with no anterior and 7-9 fine posterior subbasal teeth; annular hairs long.

Male.— Unknown.

Holotype.— F, "Res. Ecol. IBGE, Km 0 BR 251 - DF, 19 a 26-XI-81, 3A-81-5 J" (Brasilia, IBGE).

Paratype.— BRAZIL: Same data as for holotype except 16-22/XI/1979, T. Malaise 6: Mata (1 F) (Brasilia, IBGE).

Remarks.—The lancet is similar to *serrata* and *heda*, all three species having low serrulae and long annular hairs. The lack of anterior subbasal teeth on the serrulae, red pronotum and tegulae, and red mesonotum with the prescutum and scutellum mostly black are diagnostic for *flava*.

ginga Smith — Brazil (D.F., São Paulo)

Atomacera ginga Smith 1981: 283, fig. 16-18. F, M. "Res. Ecol. IBGE, Km 0 BR 251 - DF" (Brasilia, IBGE, F).

hallex (Konow) — Bolivia; Peru ?

**Braunsiola hallex* Konow 1908a: 144-145. F. "Brasilia (Iquitos)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 386 (holotype).
Atomacera hallex: Malaise 1942: 108 ("Upper or Peruvian Amazonas (Iquitos))"

I have seen one specimen from Bolivia, but the province name is not legible. Malaise questioned the type locality. It is probably Iquitos in Peru.

heda Smith, **new species** — Brazil (São Paulo)

Atomacera heda Smith.

Female.—Length, 3.5 mm. Black; pronotum orange, tegula dark orange; outer surface of apex of forefemur, foretibia, trochanters, and very narrow bands at extreme apices of mid- and hindfemora and extreme bases of mid- and hindtibiae whitish. Wings moderately black infuscated, more hyaline toward apices; veins and stigma black. Antennal length to head width as 3.7:3.2. Lower interocular distance to eye length as 1.7:1.4; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.2. Forewing with 3 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 105, with long annular spines; serrulae low, each with one prominent anterior subbasal tooth and 7-9 posterior subbasal teeth.

Male.— Unknown.

Holotype.— F, "Sto. André, S. Paulo, II-1962, L. Stowannenko" (São Paulo).

Remarks.— The lancet is similar to that of *serrata*, but *serrata* has the pronotum and tegulae black, the mesonotal lateral lobes red, and has no anterior subbasal teeth on the serrulae of the lancet.

humeralis Malaise — Brazil (Santa Catarina)

**Atomacera humeralis* Malaise 1942: 108. F. "Santa Catharina (Nova Teutonia)" (Stockholm, F).

I have examined additional specimens from the type locality.

lepidula (Konow) — Costa Rica; Guatemala; Mexico (Chiapas, Tabasco, Veracruz); Panama.

**Braunsiola lepidula* Konow 1908a: 144. M. "Costa Rica (Belize)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 392 (holotype).
Atomacera lepidula: Malaise 1942: 109.

I have examined specimens from all of the above localities.

lobula Smith, **new species** - Ecuador

Atomacera lobula Smith.

Female.— Length, 5.0 mm. Black with posterolateral corners of pronotum broadly, tegula, and mesonotum except for most of prescutum red. Wings moderately black infuscated, somewhat paler toward apices. Antennal length to head width as 5.5:4.3. Lower interocular distance to eye length as 2.1:2.0; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.7:0.3; malar space about 1 1/2X diameter of front ocellus. Forewing with 4 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 107, with large, lobelike serrulae very close together.

Male.— Unknown.

Holotype.— F, "Ecuador, Napo, Limoncocha, 250 m, 15-28.VI.1976, S. & J. Peck" (Ottawa).

Remarks.— Diagnostic features for *lobula* are the large serrulae of the lancet, red mesonotum with most of the prescutum black except for the posterior corner, red tegula, and the red lateral angles of the pronotum.

lopesi Malaise — Brazil (Rio de Janeiro)

**Atomacera lopesi* Malaise 1949: 11-12. F, M. "Brazil (Rio de Janeiro, Grajahu)" (Stockholm, F).

malleri Malaise — Brazil (Santa Catarina)

**Atomacera malleri* Malaise 1942: 108. F. "Santa Catharina (The Mafra Highland at 800 m.)" (Stockholm, F).

I have seen additional specimens from Nova Teutonia, Santa Catarina.

melini Malaise — Argentina (Jujuy, Salta, Tucumán); Peru

**Atomacera melini* Malaise 1942: 110. F. "Peru (Roque, 45 km. SSE of Moyobamba, 1000 m.)" (Stockholm, F).

I have examined specimens from each of the above localities.

mina Smith, new species - Venezuela

Atomacera mina Smith.

Female.— Length, 3.3 mm. Entirely black. Wings very lightly infuscated black, nearly hyaline toward apices; veins and stigma black. Antennal length to head width as 2.6:2.9. Malar space about 2X diameter of front ocellus; lower interocular distance to eye length as 1.5:1.2; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.4:0.4:0.2. Forewing with 3 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 116, with 10 serrulae, each truncate at apex and with 1 large anterior and 2 large posterior subbasal teeth; annular hairs present.

Male.— Unknown.

Holotype.— F, "swept, San Esteban, Venez., X-39, P. Anduze" (Washington).

Remarks.— The entirely black coloration, small size, antennal length shorter than head width, and lancet (Fig. 116) distinguish this species from congeners.

nama Smith, **new species** - Panama

Atomacera nama Smith.

Female.—Length, 4.0 mm. Black; pronotum, tegula, mesonotum, and metascutellum red. Wings moderately infuscated black, lighter toward apices; veins and stigma black. Antennal length to head width as 4.4:3.6. Malar space about 1.5x diameter of front ocellus; lower interocular distance to eye length as 2.2:1.8; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.5:0.5:0.3. Forewing with 4 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 113, with serrulae flat, each with 4 large posterior subbasal teeth, annular hairs very short.

Male.— Unknown.

Holotype.— F, "Chorrera, Panama, VIII-30-1946," "N.L.H. Krauss" (Washington).

Remarks.— The lancet (Fig. 113) is distinctive for this species, having very short annular hairs and flat serrulae with large posterior subbasal teeth.

ovata (Jörgensen) — Argentina (Misiones)

**Spegazziniella ovata* Jörgensen 1913: 260-261, fig. 3. F. "Monte de Bonpland" (La Plata, F).
Atomacera ovata: Malaise 1942: 108.

Jörgensen stated that he saw one female, and the holotype is the only specimen I examined.

petroa Smith, **new species** — Brazil (Rio de Janeiro)

Atomacera petroa Smith.

Female.— Length, 5.0 mm. Entirely black. Wings monderately infuscated black, slightly lighter toward apices. Antennal length to head width as 4.8:3.9. Malar space about 2X diameter of front ocellus; lower interocular distance to eye length as 2.0:1.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.2. Forewing with 3 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 117, with short annular spines, with 10 serrulae, each serrula broad and concave, appearing to have a large anterior and a large posterior tooth.

Male.— Unknown.

Holotype.— F, "Brasil, Petropolis, Dec. 1970, J. Maldonado C." (Washington).

Remarks.— The black coloration and unusual lancet (Fig. 117) are diagnostic for *petroa*.

plaumanni Malaise — Brazil (Santa Catarina)

**Atomacera plaumanni* Malaise 1942: 108. F. "Santa Catharina (Nova Teutonia)" (Stockholm, F).

I have seen additional specimens from the type locality.

pubicornis (Fabricius) — Bolivia; Brazil (Acre, Amazonas, Mato Grosso, Pará); Colombia; Ecuador; Guyana; Peru; Surinam; Trinidad and Tobago; Venezuela

Hylotoma pubicornis Fabricius 1804: 21. F, M. "Habitat in America meridionali" (Coll. Fabricius, ?).— Klug 1814: 300.— Klug 1819: 68, pl. 2, fig. 2.— Kriechbaumer 1884: 66.
Ptilia pubicornis: Lepeletier 1823: 50.— Norton 1867: 62.
Sericocera pubicornis: Kirby 1882: 34.— Dalla Torre 1894: 310.
Sericoceros pubicornis: Konow 1905a: 28.
Atomacera pubicornis: Malaise 1937b: 65 (types, F & M in Coll. Fabricius).— Malaise 1942: 109 (Guyana, Amazonas; syn.: *duckei* Konow, *nubilipennis* Forsius).

Braunsiola duckei Konow 1906b: 181-182. F, M. "Brasilia" (Eberswalde, F).— Oehlke and Wudowenz 1984: 378 (1 F, 1 M syntypes at Eberswalde).
Argina nubilipennis Forsius 1925a: 3-4. F. "Rio Branco, Amazonas" (Stockholm, F).
Atomacera sp.: Mc Callan 1953: 126 (Trinidad; reared from host a; parasite, *Mesochorus* sp.).

Hosts: a) *Ipomoea* sp.; b) a specimen from Venezuela bears the data "Pasando malla."

Two specimens, a male and female, both labeled types of *B. duckei* are at Eberswalde. The female labeled "Teffé, 22.6.1906, Ducke" is hereby designated lectotype. The male labeled "Teffé, 26.9.1904, Ducke" is a paralectotype.

Maxwell (1955) described the internal larval anatomy of an "*Atomacera* sp." from Trinidad and gave "*Brasso ipomoea*" as host. Her description may pertain to *pubicornis*. I have seen specimens from all of the above localities. It is a relatively common species in northern South America. I have examined specimens recorded as *Atomacera* sp. by Mc Callan (1953) and confirm their identity as this species.

pumila Malaise — Brazil (Santa Catarina)

Atomacera pumila Malaise 1942: 110. F. "Santa Catharina (Nova Teutonia)" (Stockholm, F).

raza Smith, **new species** — Costa Rica; Mexico (Vera Cruz)

Atomacera raza Smith.

Female.— Length, 4.5 mm. Black; pronotum and tegula red, mesonotum red with scutellum partly or mostly black; outer surface of foretibia whitish. Wings moderately, uniformly infuscated black; slightly lighter toward apices. Antennal length to head width as 5.0:3.5. Malar space about 1 1/2X diameter of front ocellus; lower interocular distance to eye length as 2.1:1.6; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.3. Forewing with 4 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 112, serrulae deep, broadly rounded at apices, close together.

Male.— Unknown.

Holotype.— F, "MEXVC 1959, Vera Cruz, NLKrauss vii" (Washington).

Paratype.—COSTA RICA: Escazu, May 26, 1967, H. & M. Townes (1 F) (Townes Coll.).

Remarks.— The black legs, red pronotum, tegula, and mesonotum with the scutellum mostly black, and the large, deep serrulae of the lancet are diagnostic features for this species.

recta (Enderlein) — Brazil (Santa Catarina)

Braunsiola recta Enderlein 1919: 117. "F"= M. "Südbrasilien. Santa Catharina" (Warszawa, M).
Atomacera recta: Malaise 1942: 110.

Enderlein described this species from "2 F." The specimen I saw was a male, labeled "S. Catharina, Lüderwaldt S.," "TYPE," "*Braunsiola recta* Enderl., type M, Dr. Enderlein det 1918." This specimen is hereby designated lectotype.

The last closed cubital cell of the forewing is quadrate, about as long on the radius as on the cubitus. In all other *Atomacera* species, this cell is much longer on the radius. I have examined several specimens from Nova Teutonia, Santa Catarina.

romani Malaise — Brazil (Amazonas); Surinam; Venezuela

Atomacera romani Malaise 1942: 109. F. "N. Amazonas (Rio Uaupés, Taracua)" (Stockholm, F).

I have seen specimens from Surinam and Cerro de la Neblina, Venezuela.

rufiventris (Cameron), **new combination** — Panama

Sericocera rufiventris Cameron 1883: 49. F. "Panama, Volcan de Chiriqui 2000 to 3000 feet" (London, F).— Dalla Torre 1894: 310.
Sericoceros rufiventris: Konow 1905a: 28.

The holotype is BM #1.127. The coloration of this species, black with an orange abdomen, is most unusual for *Atomacera*. I did not see specimens other than the holotype and did not examine the lancet. Because of its unusual color, it is taken out in the first couplet of the key.

serrata Smith, **new species** — Brazil (Santa Catarina)

Atomacera serrata Smith.

Female.— Length, 4.5-5.0 mm. Black; mesonotal lateral lobes red. Wings moderately black infuscated, paler at apices; veins and stigma black. Antennal length to head width as 4.5:3.8. Malar space 1 1/2X diameter of front ocellus; lower interocular distance to eye length as 2.0:1.7; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.6:0.3. Forewing with 4 cubital cells. Sheath slender; in lateral view straight above and rounded below. Lancet as in Fig. 99; serrulae flat, annular spines long, nearly equal to width of segments.

Male.— Unknown.

Holotype.— F, "Brasilien, Nova Teutonia, 27° 11' B, 52° 23' L, 300-500 m, 7-X-1949, Fritz Plaumann" (Washington).

Paratype.— BRAZIL: Same locality as for holotype, 20.IX.1938 (1 F). (London).

Remarks.— This is distinguished from other species by the red mesonotal lateral lobes and the low serrate serrulae and long annular spines of the lancet.

tria Smith, **new species** — Costa Rica; Guatemala; Honduras; Mexico (Chiapas, Jalisco, Morelos, Oaxaca, Puebla, Veracruz); Panama

Atomacera tria Smith.

Female.—Length, 3.8-4.5 mm. Black; pronotum, tegula, and mesonotum red, sometimes black spot on mesoscutellum and sometimes supraclypeal area brownish; outer surface of foretibia whitish. Wings moderately black infuscated, lighter toward apices. Antennal length to head width as 4.0:3.4. Malar space about 2X diameter of front ocellus; lower interocular distance to eye length as 1.7:1.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.3. Forewing usually with 3 cubital cells. Sheath slender, in lateral view straight above and rounded below. Lancet as in Fig. 114, with annuli on basal half curved, serrulae usually pointed at apices, each with 2 or 3 anterior and 3 to 5 fine posterior subbasal teeth.

Male.— Length, 3.5-4.0 mm. Color and structure similar to that of female, sometimes thorax black; antennal length to head width as 4.2:3.2. Genitalia as in Fig. 128.

Holotype.— F, "Escuintla, Chiapas [Mexico], Crawford" (Washington).

Paratypes.— COSTA RICA: S. Rosa Park., Guan., 1 Dec. 77, Dry Hill, D. H. Janzen (1 F). GUATEMALA: Escuintla, viii-1959, NLH Krauss (1 F); San Jose, V-16-51, E. S. Ross (1 F). HONDURAS: 16 km *N.* Siguatepeque, VI-14-1979, W.W. Middlekauff (1 F). MEXICO: Same data as for holotype (2 F); Tapachula, Chiapas, Crawford (1 F); Jalapa, Crawford (1 F, 3 M); Oaxaca, Crawford (1 F); Morelos, nr. Xochitepec, Rt. 95, km. 91, Aug. 1, 1965, O.S. Flint (1 F); Melanque, 11 km N Jalisco, 28-VII-1984, J.T. Doyen (2 F); Puebla, 13.3 mi. ne. Tehuitzingo, July 13-14, 1974, Clark, Murray, Ashe, Schaffner (1 F); Veracruz, Temazcal, July 19, 1980, Schaffner, Weaver, Friedlander (1 F); Oaxaca, 5 miles south Candelaria Loxicha, July 18-19, 1974, Clark, Murray, Ashe, Schaffner (1 F). PANAMA: Canal Zone, Summit, XI-1965, NLH Krauss (1 F); Limon Plantation, Chagres River, sweepings around cornfield, July 14, 1918, H.F. Dietz & J. Zetek (2 F); Barro Colo. Isld., Canal Zone, XII-25-1928, C. H. Curran (1 F), same, XII-30-1928 (1 F); Canal Zone, Red Tank., 30-VI-1924, N. Banks (1 M); Canal Zone, Ft. Davis, 5-VII-1924, N. Banks (1 F, 1 M); Canal Zone, Las Sabanas, 7-VII-1924, N. Banks (1 F). (Washington, New York, Cambridge, College Station, Berkeley, San Francisco)

Remarks.— The specimens examined from Mexico to Panama are all relatively uniform in appearance though the thorax of the male may be all black. Sometimes there is a blackish mark on the mesoscutellum, and, if present, its size varies. This species is distinguished from other *Atomacera* species by the black legs, red pronotum, tegula, and mesonotum, usual presence of only three cubital cells in the forewing, and the lancet (Fig. 114) which has the basal annuli markedly curved and the serrulae pointed at their apices with fine anterior and posterior subbasal teeth.

triangulata Malaise — Argentina (Entre Rios); Brazil (Santa Catarina)

**Atomacera triangulata* Malaise 1949: 12. F. "Santa Catharina (Nova Teutonia)" (Stockholm, F).

I have seen additional specimens from the type locality.

truculenta (Konow) — Brazil (Rio de Janeiro, São Paulo)

**Braunsiola truculenta* Konow 1899a: 312. F. "Brasilia (Santos)" (Eberswalde, F).— Konow 1905a: 23.— Oehlke and Wudowenz 1984: 417 (holotype).

Atomacera truculenta: Malaise 1942: 109.

I have seen specimens from Mangaratiba, Rio de Janeiro, and Guaruja, Ilha Santo Amaro, São Paulo.

zonia Smith, **new species** —U.S.A. (Arizona)

Atomacera zonia Smith.

Female.—Lenth, 3.5 mm. Black; pronotum, tegula, and mesonotum red, mesoscutellum sometimes with black spot anteriorly; labrum and mandibles brownish;

foretibia whitish. Wings moderately infuscated black, lighter toward apices; veins and stigma black. Antennal length to head width as 4.1:3.9. Malar space about 1 1/2X diameter of front ocellus; lower interocular distance to eye length as 1.8:1.6; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.6:0.2. Forewing with 4 cubital cells. Sheath slender, in lateral view straight above, rounded below. Lancet as in Fig. 111, with serrulae deep, narrowly rounded at apices, and as far apart as the width of one.

Male.— Length, 3.0 mm. Color and structure similar to that of female; antennal length to head width as 5.0:3.1. Genitalia as in Fig. 123.

Holotype.— F, "Portal, Ariz., VIII.28.1974, H. & M. Townes" (Townes Coll.).

Paratypes.— U.S.A.: Same data as for holotype except VIII.25.1974 (1 M), VIII.16.1974 (1 M), Sept. 2-12, 1976, J. van der Vecht (1 F). (Townes Coll.).

Remarks.—This species is distinguished from other *Atomacera* species by the black legs, red pronotum, tegula, and mesonotum, and the deep serrulae of the lancet (Fig. 111). The male is separated from *ebena*, the only other species known from Arizona by the red on the thorax, as in the female, and genitalia (compare Figs. 122, 123).

Subfamily ERIGLENINAE

Erigleninae Benson 1938: 375
Sericocerini Benson 1938: 376 (in part)
Sterictiphorinae Benson 1963: 634 (in part)

Antennal flagellum of male furcate (Fig. 137). Head without sharp carinae and without genal carina; transverse from above, broader than long; antennal insertions near or below level of middle of eyes (Figs. 132, 133, 157, 158). Maxillary palpus 6-segmented, labial palpus 4-segmented; labium 3-lobed (Figs. 135, 146, 162, 163). Each mandible with 3 teeth, 2 teeth, or left mandible with 3 teeth and right mandible with 2 teeth, teeth large and subequal in size (Figs. 134, 161, 191). Pronotum without diagonal furrow. Cervical sclerites pointed or rounded on meson, usually not approximate (Fig. 164). Cenchri closer together than breadth of one. Forewing (Figs. 131, 144, 156) with costal breadth equal to or broader than intercostal area; intercostal crossvein present or absent; radial cell open or closed; 1r joins base of stigma; M meets Sc+R far basal to point where Rs+M meets Sc+R. Hindwing (Figs. 131, 156) with radial cell open. Basal crossvein Cu_1 between $M+Cu_1$ and 1A present in forewing and hindwing, only hindwing, or absent. Tibiae without preapical spines; apical spines of foretibia subequal in length; tarsal claws simple.

This subfamily is characterized by the usually 3- or 2-toothed mandibles (right mandible with two teeth in *Subsymmia*) with the subapical teeth large and subequal in size, the head which is broader than long in both front and dorsal view and lacks carinae, sometimes presence of a basal crossvein (Cu_1) in the fore- and/or hindwing between veins $M+Cu_1$ and 1A, lack of preapical tibial spines, simple tarsal claws, and furcate antennal flagellum in the male. The general appearance of the head is very similar in all members of the subfamily. Separation from the Atomacerinae is discussed under that subfamily.

Social habits are more apparent than most other subfamilies, but not as advanced as in the Dielocerinae. Information on biology is scanty, but Martorell (1941) indicated that *Sericoceros krugii* females protect their eggs, and cocoons are formed in masses (see discussion under that species).

Genus **ERIGLENUM** Konow

Eriglenum Konow 1901: 60. Type species: *Eriglenum crudum* Konow. Monotypic.

Antenna (Figs. 136, 137) with 1st segment longer than broad, 2nd segment as long as broad, 3rd segment oval to rounded and of uniform thickness; antennal length about 1 1/3X head width or less. Clypeus subtruncate; malar space narrow to linear; interantennal carina low, indiscernable, supraclypeal and interantennal areas slightly convex; eyes small, converging below, lower interocular distance greater than eye length (Fig. 132); maxillary palpus 6-segmented, labial palpus 4-segmented (Fig. 135), 3rd segment of labial palpus and 4th segment of maxillary palpus short and broad, maxillary palpus subequal to eye length; each mandible with 3 sharp teeth on apical half (Fig. 134). Forewing (Fig. 131) with radial cell closed, with accessory vein at apex; with 3 cubital cells, sometimes apparently 4 when 1st cubital crossvein is indistinct; last closed cubital cell longer on radius than on cubitus; basal anal cell absent or weakly indicated; intercostal crossvein usually present but may be weak and difficult to see; crossvein Cu_1 present at base of wing between veins $M+Cu_1$ and 1A. Hindwing (Fig. 131) with anal cell present, cell slightly longer than its petiole; crossvein Cu_1 usually present at base of wing between veins $M+Cu_1$ and 1A. Hindcoxae contiguous; length of hindbasitarsus subequal to length of following tarsal segments combined; tarsal claws simple.

The female lancets and sheaths are very similar in all species, and the unusual shape of the sheath which is pincer-like in dorsal view (Fig. 138) is characteristic for *Eriglenum*. The crossvein at the base of the wings between veins M+Cu_1 and 1A also helps to distinguish *Eriglenum*, but this is also present in some other genera of Erigleninae.

Representatives of *Eriglenum* occur from southern Mexico to northern Argentina. Two species are widespread and show considerable color variation, especially in the amount of red on the thorax. Known hosts are *Machaerium* spp.

KEY TO SPECIES

1. Wings fasciate, hyaline with black at base and apex and along costal margin to stigma or only blackish at apex. **2**

— Wings uniformly blackish infuscated **3**

2. Thorax black; abdomen black with segments 3-6 and part of 7 orange; coxae orange; basal 1/2 of wings hyaline, apical 1/2 mostly blackish infuscated . . . . **amabalis** Malaise

— Thorax black with mesonotum except posterior 1/2 of prescutum and parapteron red; abdomen and coxae black; wings hyaline at center, blackish at base extending along costal margin to stigma and at apex (lancet as in Fig. 139) . . . . **tristum**, new species

3. Clypeus, scape, pedicel, tegula, and legs black; lancet as in Fig. 141; male genitalia as in Fig. 143 . . . . **crudum** Konow

— Clypeus, scape, pedicel, tegula, coxae, trochanters, femora amd bases of tibiae white (some males with legs darker, but the coxae and femora are paler than the tibiae and tarsi); lancet as in Fig. 140; male genitalia as in Fig. 142 . . . . **humeratum** Konow

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SPECIES

amabilis Malaise — Brazil (Espirito Santo)

**Eriglenum amabilis* Malaise 1949: 10-11. F. "Brazil (Espirito Santo, S:ta Tereza)" (Stockholm, F).

In addition to characters in the key: antenna and head black with apical 2 maxillary palpal segments white; legs orange with tibia and tarsi whitish, apical 1/4 of hindtibia black. The basal crossvein Cu_1 between M+Cu_1 and 1A is atrophied with only a stub present in the holotype.

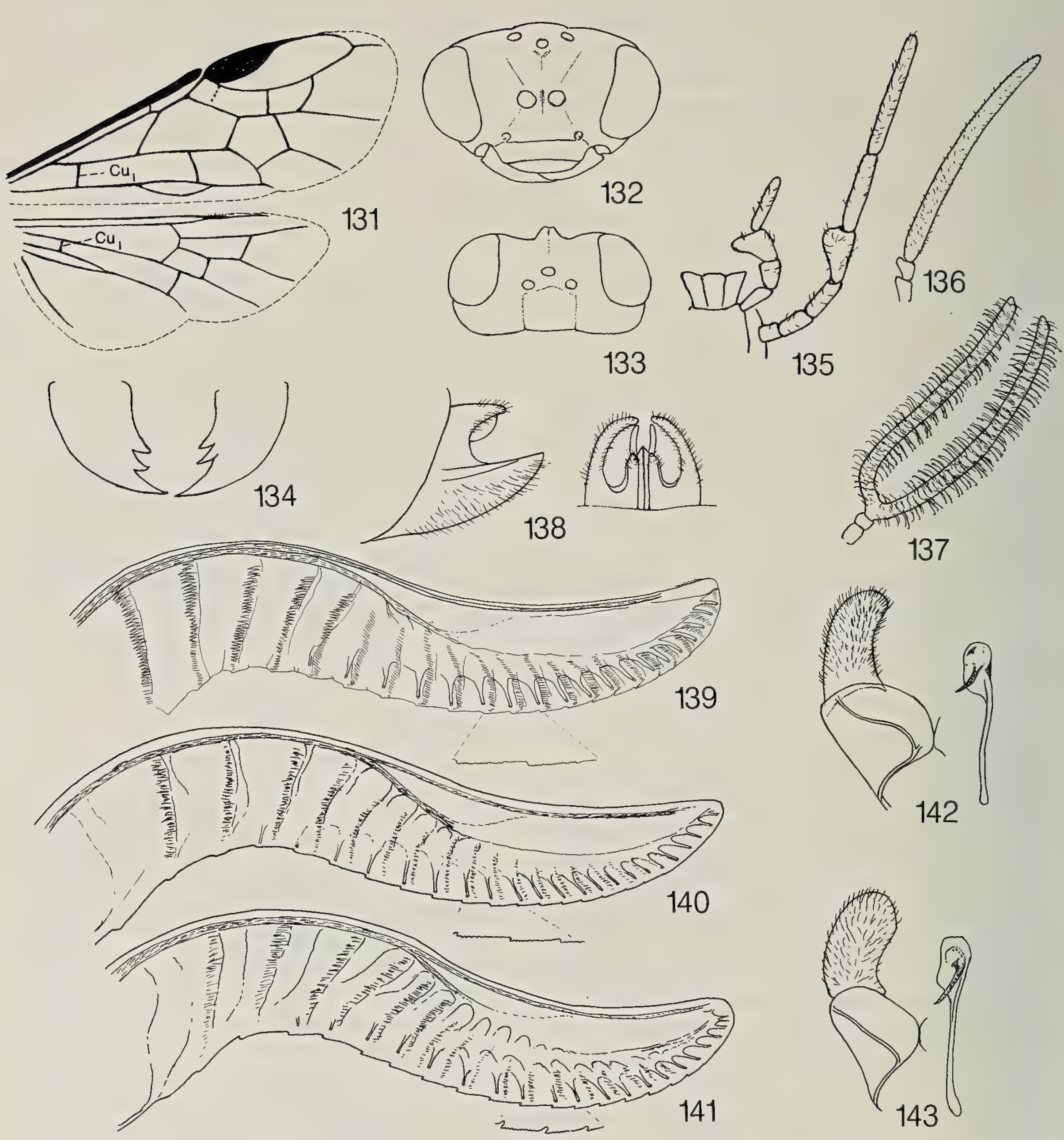
crudum Konow — Brazil (Amazonas, D.F.); Costa Rica; Honduras; Mexico (Chiapas)

**Eriglenum crudum* Konow 1901: 60-61. F, M. "Brasilia" (Budapest, F).— Konow 1905a: 22.— Malaise 1949: 11.— Oehlke and Wudowenz 1984: 375 (1 F syntype at Eberswalde).

Host: Reared from larvae on *Maechaerium biovulatum* (Leguminosae) in Costa Rica (Santa Rosa National Park, Guanacaste Province) by D. H. Janzen.

The lectotype, by present designation, is a female labeled "Brasilia, Manaos," "Typus 1907 *Eriglenum crudum* Knw." A male, with an additional label "*Eriglenum crudum* n. sp. FM" is a paralectotype. Konow did not mention Manaus in the original description. I did not examine the syntype at Eberswalde. The lectotype has the thorax black with the upper half of the mesepisternum, parapteron, and mesonotum (except anterior half of prescutum) orange. The specimens examined from Mexico (Santo Domingo, 15 mi SE Simojovel, Chiapas), Honduras (El Baqueron, Olancho), and Costa Rica are entirely black. The mexican record is the northernmost known for *Eriglenum*.

The two species with uniformly black wings, *crudum* and *humeratum* may be a complex of species. I have separated them by the presence or absence of the white on the clypeus, scape, pedicel and legs for lack of apparent morphological features. If morphological characters are present, they are subtle and longer series will be needed for their evaluation. Three series were examined, one each from Paraguay, Brazil (D.F.), and Venezuela. In these the amount of red on the thorax varied considerably, but the white markings appeared constant. I have seen only a few specimens from other scattered localities.



Figs. 131-143. *Eriglenum*. 131, Forewing and hindwing of *E. humeratum*. 132, Front view of head of *E. humeratum*. 133, Dorsal view of head of *E. humeratum*. 134, Mandibles of *E. humeratum*. 135, Palpi of *E. humeratum*. 136, Female antenna of *E. humeratum*. 137, Male antenna of *E. humeratum*. 138, Sheath of *E. humeratum*. Lancets of 139, *E. tristum*; 140, *E. humeratum*; 141, *E. crudum*. Male genitalia of 142, *E. humeratum*; 143, *E. crudum*.

humeratum Konow — Argentina (Misiones); Brazil (D.F., Paraná, Santa Catarina); Paraguay; Peru; Venezuela

**Eriglenum humeratum* Konow 1903: 106-107. F. "Peru (Rio Toro)" (Eberswalde, F).— Konow 1905a: 22.— Oehlke and Wudowenz 1984: 387 (holotype).
Hemidianeura albocoxa* Rohwer 1911b: 382. F, M. "San Bernardino, Paraguay" (Washington, F).— Malaise 1949: 11 (as syn. of *crudum* Konow). **New synonymy.

Host: Associated with a series from San Bernardino, Paraguay, there are a number of leaves with cocoons attached; the label reads "Puppen on Machaerium sp." The cocoons are spun singly between the leaves.

Although Malaise treated *albocoxa* as a synonym of *crudum*, definite color differences between the two, as outlined in the key, preclude their conspecificity. I saw two specimens of *humeratum* labeled as paratypes in London; both are from the type locality. The specimen designated as holotype by Oehlke and Wudowenz (1984) should be the lectotype. Specimens from a series from Venezuela (El Limon, AR, 450 m) are each associated with a cocoon attached to a small piece of leaf on each pin. There are no host data. These specimens are mostly black with the scape, pedicel, legs, and tegula white, but one specimen has red on the thorax.

tristum Smith, **new species** — Costa Rica

Eriglenum tristum Smith.

Female.—Length, 8.0 mm. Antenna and head black. Thorax black with mesonotum except for anterior half of prescutum, parapteron, line on upper edge of mesopleuron near parapteron, and upper 1/2 of mesepimeron red. Legs white with coxae except for apical margins, apical 2/3 hindtibia, and apical 2 hindtarsal segments black; midlegs missing. Abdomen black. Forewing hyaline at center, blackish infuscated at base and along costal margin to stigma and at apex beyond stigma; veins and stigma black. Sheath similar to *humeratum*, Fig. 138. Lancet as in Fig. 139.

Male.— Unknown.

Holotype.— F, "Costa Rica: Cartago, Turrialba, 2000', 20 July 1965, H. G. Real," "Herman G. Real Collection" (San Francisco).

Remarks.— The fasciate wings, black abdomen, black head, red mesonotum, and white legs separate *tristum* from other species of *Eriglenum*.

Genus **NEUROGYMNIA** Malaise

Neurogymnia Malaise 1937a: 58. Type species: *Neurogymnia hoffmani* Malaise. Orig. desig.

Antenna (Fig.148) with 1st segment longer than broad, 2nd segment broader than long; flagellum of female antenna tapering to apex, slightly laterally flattened, oval in cross-section, length about 2X head width. Head from above broad, strongly narrowing behind eyes; clypeus truncate; malar space broad, equal to or a little more than diameter of front ocellus; lower interocular distance greater than eye length (Fig. 147); interantennal area flat, rounded, without or with very short carina; palpi long, maxillary palpus longer than eye length, labial palpus 4-segmented, maxillary palpus 6-segmented (Fig. 146), 3rd segment of labial palpus slightly enlarged; each mandible with two sharp teeth and rounded inner ridge (Fig. 145). Forewing (Fig. 144) with intercostal crossvein present, very faint and difficult to see; radial cell with perpendicular crossvein near apex, apex of distal cell usually closed (open in a few specimens); 3 or 4 cubital cells, last closed cell about as long on radius as on cubitus; small basal anal cell present. Hindwing with anal cell present, shorter than its petiole; usually with basal crossvein (Cu_1) present between M+Cu_1 and 1A, but sometimes very faint. Hindbasitarsus longer than remaining tarsal segments combined; tarsal claws simple.

The unusual crossvein in the radial cell of the forewing (Fig. 144) is distinctive for this genus. The female sheaths (Fig. 149) of all species are very similar. The lancet is usually long with short segments, the annuli close together and with 28-50 serrulae (Figs. 150-154). The male genitalia are similar to that figured (Fig. 155), though I have seen very few males.

I have seen only a few specimens of this genus, and most species are represented by only several specimens. All specimens are from northern South America (Surinam) to Paraguay, mostly from Brasil. A record from Mexico is questionable (see *fusca*). Hosts are not known.

KEY TO SPECIES

1. Hindtarsus with basal 2 segments white, apical 3 segments black 2
— Hindtarsus black 3
2. Mesonotum and mesepisternum black; abdomen black, basal plates pale; coxae mostly black . . . . . ***fusca*** (Klug)
— Mesonotum with lateral margins of prescutum and scutellum orange; upper 1/3 of mesepisternum orange; abdomen black with basal 3 segments dark orange with black margins; coxae orange (lancet as in Fig. 150, with about 28 serrulae; male genitalia as in Fig. 155) . . . . . ***albitarsus***, new species
3. Wings blackish at base and apex and in intercostal area, hyaline to yellowish at center; thorax orange with most of mesoprescutum black; hindtibia black (lancet as in Fig. 151) . . . . . ***nigricosta***, new species
— Wings yellowish with apex beyond stigma blackish; thorax usually with more black, either on mesosternum or mesepisternum or on mesonotal lateral lobes; hindtibia whitish or orange basally 4
4. Mesepisternum and mesosternum orange; mesonotum with prescutum and lateral lobes black (basal 2 antennal segments white; lancet as in Fig. 152) . . . . . ***tria***, new species
— Mesosternum and/or at least lower 2/3 of mesepisternum black; mesonotum various 5
5. Mesonotum with only mesoprescutum black (lancet as in Fig. 153, long, slender, with about 50 serrulae) . . . . . ***longiserra***, new species
— Mesonotum with prescutum and lateral lobes black 6
6. Tegula orange; mesepisternum black; apex of abdomen and sheath black (lancet as in Fig. 154; sheath as in Fig. 149) . . . . . ***hoffmanni*** Malaise
— Tegula black; mesepisternum orange; abdomen orange, sheath orange with black at apex . . . ***hirticornis*** (Klug)

SPECIES

albitarsus Smith, **new species** — Brazil (São Paulo, Santa Catarina)

Neurogymnia albitarsus Smith.

Female.—Length, 9.0 mm. Antenna black, apex of 1st segment and entire 2nd segment whitish; head black, palpi whitish. Thorax blackish with cervical sclerites, pronotum, lateral margins of mesoprescutum, mesoscutellum, upper 1/3 or less of mesepisternum, mesepimeron, and metathorax orange. Abdomen black, basal 3 segments more or less orange with apical margins black. Legs orange with apical margin of hindtibia and apical 3 hindtarsal segments black, apical 2 or 3 fore- and midtarsal segments infuscated blackish, basal 2 hindtarsal segments white. Wings uniformly lightly infuscated yellowish; veins brownish, costa and stigma yellow orange. Antenna long, slender, antennal length to head width as 7.2:3.0. Lower interocular distance to eye length as 3.3:2.9; distances between eye and hindocellus, hindocelli, and hindocelli to posterior margin of head as 1.2:1.0:1.0. Length of hindbasitarsus longer than length of following tarsal segments combined, as 3.4:3.0. Sheath similar to Fig. 149. Lancet (Fig. 150) with about 28 serrulae; distances between serrulae subequal to width of one.

Male.— Length, 7.0 mm. Color similar to that of female, but abdomen mostly orange with blackish above. Antennal length to head width as 5.3:2.7. Distances between eye and hindocellus, hindocelli, and hindocelli to posterior margin of head as 1.0:1.0:0.5. Other features as for female. Genitalia as in Fig. 155.

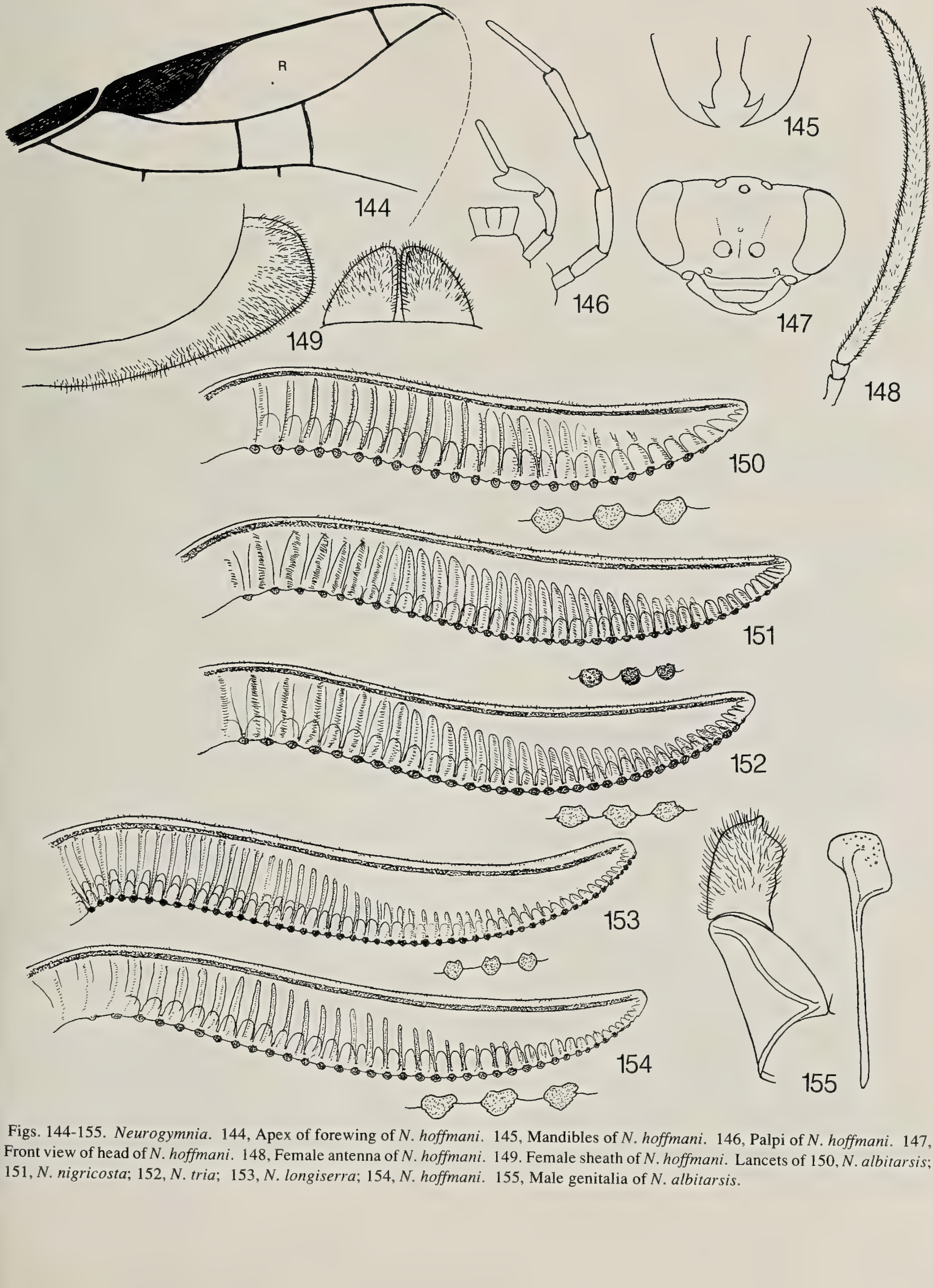
Holotype.—F, "Brazil: S.P., Sao Paulo, I-29-31-69, C. C. Porter" (Cambridge).

Paratypes.— BRAZIL: Same data as for holotype (1 M); Nova Teutonia, Santa Catarina, 26-III-1947, F. Plaumann (1 M) (Cambridge, New Haven).

Remarks.— This species is characterized by the white basal two segments of the tarsi, orange upper portion of the mesepisternum, and lancet and male genitalia as figured. The coloration is closest to that of *fusca* from Mexico, but only the male of *fusca* is known and I did not examine the genitalia.

fusca (Klug), **new combination** — Mexico

**Hylotoma fusca* Klug 1834: 247. M. "Mexiko" (Berlin, M).— Kriechbaumer 1884: 294.
Didymia fusca: Norton 1867: 60.— Weldon 1907: 302 (U.S.A., Colorado; listed [prob. misdet., specimen not seen and genus not known from U.S.A.]).
Ptilia fusca: Kirby 1882: 47.— Cameron 1883: 45.— Dalla Torre 1894: 320.— Konow 1905a: 26.



Figs. 144-155. *Neurogymnia*. 144, Apex of forewing of *N. hoffmani*. 145, Mandibles of *N. hoffmani*. 146, Palpi of *N. hoffmani*. 147, Front view of head of *N. hoffmani*. 148, Female antenna of *N. hoffmani*. 149. Female sheath of *N. hoffmani*. Lancets of 150, *N. albitarsis*; 151, *N. nigricosta*; 152, *N. tria*; 153, *N. longiserra*; 154, *N. hoffmani*. 155, Male genitalia of *N. albitarsis*.

The only specimens of *Neurogymnia* I have seen are from South America. It is possible that *fusca* is mislabeled.

hirticornis (Klug), **new combination** — Brazil (Bahia)

**Hylotoma hirticornis* Klug 1834: 247. F. "Brazilien" (Berlin, F).— Kriechbaumer 1884: 294.
Didymia hirticornis: Norton 1867: 60.
Ptilia hirticornis: Kirby 1882: 47.— Dalla Torre 1894: 320.— Konow 1905a: 26.

The holotype is labeled "Bahia, Fr."

hoffmanni Malaise — Brazil (Rio de Janeiro, Espirito Santo, Santa Catarina)

**Neurogymnia hoffmanni* Malaise 1937a: 58-59. F, M. "Nova Bremen, Santa Catharina, Brazil" (Stockholm, F).

Malaise stated that the "male was reared from a white cocoon." I have seen one specimen from Mangaratiba, Rio de Janeiro, and another from Linhares, Espirito Santo.

longiserra Smith, **new species** — Brazil (Mato Grosso, Rio de Janeiro)

Neurogymnia longiserra Smith.

Female.—Length, 9.0-9.5 mm. Antenna black with 2nd segment dark orange to brownish. Head black; palpi whitish. Thorax orange with mesosternum (except center), lower 2/3 or more of mesepisternum, and triangular area covering most of mesoprescutum black. Abdomen orange with apical 3 or 4 segments, or terga, and sheath black. Legs orange with apical 2 or 3 fore- and midtarsal segments, extreme apex of hindtibia and apical 1/4 of hindtibia on outer surface, and hindtarsus black. Wings yellowish, apex beyond stigma blackish; veins and stigma yellow orange; veins in darker apex brownish. Antennal length to head width as 6.0:3.1. Lower interocular distance to eye length as 3.6:3.1. Distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.2:1.2:1.0. Length of hindbasitarsus to length of remaining tarsal segments as 3.0:2.8. Sheath similar to Fig. 149. Lancet long, slender, with about 50 serrulae, serrulae except those on apical 1/4 or less of lancet farther apart than width of one, as in Fig. 153.

Male.— Unknown.

Holotype.— F, "Rio de Janeiro, Tijuce, Werner" (São Paulo).

Paratypes.— BRAZIL: Chapada (1 F); Rio de Janeiro (1 F) (Pittsburgh).

Remarks.— This species is distinguished from others by the black hindtarsus, yellow wings with the apices blackish, only the prescutum of the mesonotum black, and the unusually long lancet with about 50 serrulae.

nigricosta Smith, **new species** — Brazil (Pará); Surinam

Neurogymnia nigricosta Smith.

Female.— Length, 8.0-8.5 mm. Antenna with first 2 segments white, 3rd segment black. Head black, supraclypeal area may be whitish; palpi whitish. Thorax orange with black triangular mark covering most of mesoprescutum. Abdomen orange, apical 2 or 3 terga and sheath black, sheath more orange at base. Legs orange with apical 1 or 2 foretarsal segments and mid- and hindtibiae and tarsi black; inner surface of midtibia whitish and extreme base of midtibia whitish. Wings hyaline to yellowish with extreme base, intercostal area, and apex beyond stigma blackish; stigma and veins in hyaline to yellowish area yellowish to brownish, other veins brownish to black. Antennal length to head width as 6.0:3.0. Lower interocular distance to eye length as 3.3:3.0. Distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.2:1.0:0.7. Length of hindbasitarsus to remaining tarsal segments combined as 3.2:2.5. Sheath similar to Fig. 149. Lancet with about 38 serrulae, distance between serrulae subequal to width of one, Fig. 151.

Male.— Unknown.

Holotype.— F, "Belem, Brasilia, Km 90 F Candiru, 21-VII-1972, Para, Brasil, T. Pimentel, Col." (Belém).

Paratype.— SURINAM: Kabelebo River, Avanavero-Falls, 5-12.IV.1971, D. C. Geijskes (1 F, Leiden).

Remarks.— The black hindtarsus, maculation of the forewing which is black at the base, apex, and in the intercostal area and yellow at the center, orange thorax with only the mesoprescutum black, and lancet are diagnostic for this species.

tria Smith, **new species** — Brazil (Goias); Paraguay

Neurogymnia tria Smith.

Female.—Length, 7.5-8.0 mm. First and 2nd antennal segments white, 3rd segment black. Head black with supraclypeal area whitish, lateral margins of clypeus and most of labrum dark orange, and palpi whitish yellow. Thorax orange with black marks covering most of prescutum and mesonotal lateral lobes.

Abdomen orange with apical 2 or 3 terga and sheath black; base of sheath orange. Legs orange with apical 2 foretarsal segments black, apical 1/3 of midtibia on outer surface, midtarsus, and hindtibia and tarsus black (in paratype midleg orange with apical 3 tarsal segments black and only apical 1/2 of hindtibia black). Wings yellowish, blackish at apex beyond stigma; veins, costa, and stigma yellow orange, veins in darker apex brownish. Antennal length to head width as 5.8:3.7. Lower interocular distance to eye length as 3.0:2.7. Distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:0.5. Length of hindbasitarsus to remaining tarsal segments combined as 3.0:2.6. Sheath similar to Fig. 149. Lancet with about 37 serrulae, those on basal half farther apart or about as far apart as breadth of one, those on apical half closer together than breadth of one, Fig. 152.

Male.— Unknown.

Holotype.— F, "Est Goyas, Campinas, 1935, R. Spitz, coll." (São Paulo).

Paratype.—PARAGUAY: Asuncion, I.28.11.1974, col. R. Golbach (1 F, Tucumán).

Remarks.— This species is characterized by the black hindtarsus, yellow wings with the apices black, orange thorax with black only on the mesoprescutum and mesonotal lateral lobes, and lancet.

Genus **SERICOCEROS** Konow

Sericocera Brullé 1846: 669. Preoccupied by *Sericocera* Macquart 1834. Type species: *Sericocera spinolae* Brullé. Desig. by Rohwer 1911a.
Sericoceros Konow 1905a: 29. Emendation.
Sericocerus Mocsáry 1909: 8. Emendation.
Ardua Malaise 1937a: 53. Preoccupied by *Ardua* Giebel 1872. **New synonymy.** Type species: *Ardua marginipennis* Malaise. Orig. desig.
Neardua Malaise 1937a: 53-54. **New synonymy.** Type species: *Neardua pronotatus* Malaise. Orig. desig.
Adura Malaise 1941: 137. New name for *Ardua* Malaise.
Sericocerina Malaise 1955: 101. New name for *Sericocera* Brullé. Type species given as *Hylotoma gibba* Klug, but a new name takes the same type species as the name it replaces.
Weyrauchia Malaise 1955: 113-114. **New synonymy.** Type species: *weyrauchia rufonigra* Malaise. Orig. desig.
Xylosericocera Wolcott 1948: 749. Nomen nudum.
Schizocerina Smith 1969a: 541, 542. Mistake for *Sericocerina*.

Antenna (Figs. 159, 160) with 1st segment longer than broad, 2nd segment broader than long, 3rd segment of female antenna slender, of about uniform width; antennal length usually not more than 1.5X head width. Clypeus short, truncate, 3-4X broader than long (Fig. 157); malar space broad, subequal to or more than diameter of front ocellus; each mandible tridentate (Fig. 161); labial palpus 4-segmented, maxillary palpus 6-segmented (Figs. 162, 163) with segments of uniform width, maxillary palpus shorter than or slightly more than eye length; eyes small, slightly converging below (Fig. 157), lower interocular distance longer than eye length, sometimes as much as 2X longer; interantennal area not carinate, rounded; postocellar area short; head from above much broader than long (Fig. 158), sharply narrowing behind eyes, small in relation to thorax which, at pronotal angles, is much broader than head. Forewing (Fig. 156) with radial cell open; no intercostal crossvein; costal width equal to or greater than width of intercostal area; small basal anal cell present; 3 or 4 cubital cells, last closed cell usually longer on radius than on cubitus. Hindwing (Fig. 156) with anal cell present or absent, if present usually shorter than its petiole. Length of hindbasitarsus slightly shorter than or slightly longer than length of remaining tarsal segments combined; hindcoxae not contiguous, separated by distance nearly equal to breadth of one; tarsal claws simple.

All species are plump with a similar habitus, having a short, transverse head in relation to the enlarged thorax. The sheath, ovipositors, and male genitalia are all very similar. Thus, even though the hindwing is with or without an anal cell, the species included form a very distinctive group based on other characters.

A number of genera have been proposed. *Ardua* was based on a specimen without the anal cell in the hindwing and with a enlarged hindtibia (Fig. 166), but the enlarged hindtibia is most pronounced in the male, and it is the male of *mexicana*. Malaise separated *Neardua* by the "larger head" and the third cubital cell of the forewing small (as long on the cubitus as on the radius) and *Weyrauchia* by a "broader" head, a longer distance between the eyes (lower interocular distance two times the eye length), and no anal cell in the hindwing, but these characters are not significant since they occur in various forms and degrees throughout the genus. Malaise (1955) gave a key to species based on the "typical" forms, i.e., those not included in his above three genera, and those that have an anal cell in the hindwing. Smith (1971a) discussed the genus and reviewed the Mexican and Central American species. Most of the taxonomy is based on females. The sexes have not been associated for many species. The portion of the key for males should be used with caution. The male genitalia are similar in structure and the males appear to be more variable in coloration than are the females.

Representatives of *Sericoceros* occur from Mexico to northern Argentina with one species in the West Indies. The biology of the Puerto Rican species, *krugii*, was discussed by Martorell (1941). This and other species have been recorded from *Coccoloba* spp. and one species is recorded from *Lonchocarpus* sp.

KEY TO SPECIES

1. Female 2
— Male 18
2. Abdomen black; hindwing with anal cell, except sometimes in *albicollis* 3
— Abdomen orange; anal cell of hindwing present or absent 9
3. Head orange (tibiae and tarsi may be blackish; hindfemur sometimes blackish to brown; lancet as in Fig. 182) . . . . . ***dimidiatus*** Konow
— Head black, face below antennae may be orange 4
4. Legs yellow, at most blackish spot at extreme apices of tibiae and apical tarsal segments infuscated (forewing black, more hyaline apical to stigma; clypeus, labrum, and supraclypeal area orange; hindwing with very small or no anal cell; lancet as in Fig. 170) . . . . . ***albicollis*** (Klug)
— Legs with at least tibiae and tarsi mostly black 5
5. Legs, including coxae, entirely black; wings uniformly, darkly, black infuscated (lancet as in Fig. 171) . . . . . ***tannuus***, new species
— At least fore- and mid coxae and forefemur pale orange; wings blackish but becoming hyaline at apex beyond stigma 6
6. Face below antennae pale orange; all coxae and femora orange 7
— Head black; hindlegs entirely or at least hindfemur black 8
7. Lancet as in Fig. 172 . . . . . ***brasilianus*** (Klug)
— Lancet as in Fig. 173 . . . . . ***sutus***, new species
8. Palpi yellow orange; forefemur black to orange, midfemur blackish; lancet as in Fig. 174 . . . . . ***gibbus*** (Klug)
— Palpi black; fore- and midfemora orange; lancet as in Fig. 183 . . . . . ***nigripalpis*** (Malaise)
9. Anal cell of hindwing absent (Fig. 156); wings hyaline or blackish; legs entirely black or with only tibiae and tarsi black 10
— Anal cell of hindwing present; wings blackish, usually with apex beyond stigma more hyaline; legs with at most tibiae and tarsi black 14
10. Legs entirely and at least mesosternum black; wings uniformly blackish infuscated 11
— At least coxae, trochanters, and femora orange to yellow; wings hyaline with blackish infuscated spot at base and band below stigma, or blackish adjacent to veins 12
11. Dorsum of thorax orange or with mesoprescutum black; metanotum black (lancet as in Fig. 175) . . . . . ***alternator*** (Norton)
— Mesonotum with prescutum, spot in inner side of each lateral lobe, and spot on anterior margin of scutellum black . . . . . ***rufoniger*** (Malaise)
12. Wings hyaline with blackish infuscated areas confined to and adjacent to veins, interior of cells hyaline (lancet as in Fig. 176 . . . . . ***krugii*** (Cresson)
— Wings with black band below stigma and black spot at base 13
13. Extreme apices of femora and all tibiae and tarsi black; antenna long, length to head width as 5.0:3.3; lancet as in Fig. 177, with annular spines on basal 3 annuli . . . . . ***edwardsii*** (Cresson)
— Only tibiae, except for extreme bases, and tarsi black, or only apices of tibiae black, rarely extreme apices of femora black; antennal length to head width as 4.0:3.0; lancet as in Fig. 178, without annular spines (sheath as in Fig. 167) . . . . . ***mexicanus*** (Kirby)
14. Metanotum and first 2 abdominal segments black (mid- and hindtibiae and tarsi black; lancet as in Fig. 179) . . . . . ***zonorus***, new species
— Metanotum and abdomen orange 15

15. Tarsi pale (mid- and hindtibiae black; clypeus and labrum with brown lateral spots; 1st and 2nd terga blackish basally) . . . . ***palliditarsis*** (Malaise)

— Tarsi black, basitarsi may be whitish at extreme base **16**

16. Hindtibia with basal 1/3 entirely white or white on inner surface, apical 2/3 black; midtibia similar or with black at extreme apex only; basitarsi whitish at extreme base (lancet as in Fig. 180) . . . . ***vumirus***, new species

— Mid- and hindtibiae and tarsi black **17**

17. Sheath acutely pointed in dorsal view (Fig. 168); interantennal space distinctly keeled (orange with antenna, head, tibiae and tarsi black; wings dark) . . . . ***obscurus*** (Brullé)

— Sheath broad with projecting scopae in dorsal view (Fig. 169); interantennal space rounded (lancet as in Fig. 181) . . . . ***calanticatus*** (Konow)

18. Anal cell present in hindwing (holotype of *gaullei* [= *albicollis*] with cell inconspicuous) **19**

— Anal cell absent in hindwing (Fig. 156) **22**

19. Legs white, at most extreme apical portion of tibiae and tarsal segments black (thorax black, pronotum orange; head black; antennae, margin of clypeus, and labrum white; genitalia as in Fig. 184) . . . . ***albicollis*** (Klug)

— Legs black or orange or a combination of the two **20**

20. Mesonotum mostly black, orange laterally on prescutum and laterally on lateral lobes (pronotum orange; legs black with fore- and midcoxae, trochanters, extreme apices of femora and sometimes base of basitarsi whitish; genitalia as in Fig. 186) . . . . ***vumirus***, new species

— Mesonotum orange to red or sometimes only prescutum and/or scutellum blackish **21**

21. Thorax orange to red with mesosternum black, pronotum, mesoprescutum, mesoscutellum, and/or metathorax may be blackish; abdomen and legs black (genitalia as in Fig. 185) . . . . ***gibbus*** (Klug)

— Thorax black with mesonotum except scutellum and spot on mesepisternum red; legs black with trochanters and apex of forefemur orange; abdomen black with anterior half of venter orange . . . . ***nigrorubra*** (Malaise)

22. Legs orange, or orange with tibiae and tarsi black **23**

— Legs mostly black, may be pale at extreme apices of some segments **24**

23. Thorax and abdomen orange; wings hyaline basally, lightly infuscated from stigma to apices; antenna 2X head width; Mexico; genitalia as in Fig. 187 . . . . ***edwardsii*** (Cresson)

— Thorax orange with various amounts of black on mesonotum; abdomen black above, orange below; wings mostly hyaline to very slightly darker toward apices; antenna about 1 2/3X head width; West Indies; genitalia as in Fig. 188 . . . . ***krugii*** (Cresson)

24. Abdomen black above, orange below **25**

— Abdomen either all orange or all black **26**

25. Thorax mostly orange with mesosternum black (genitalia as in Fig. 189) . . . . ***mexicanus*** (Kirby)

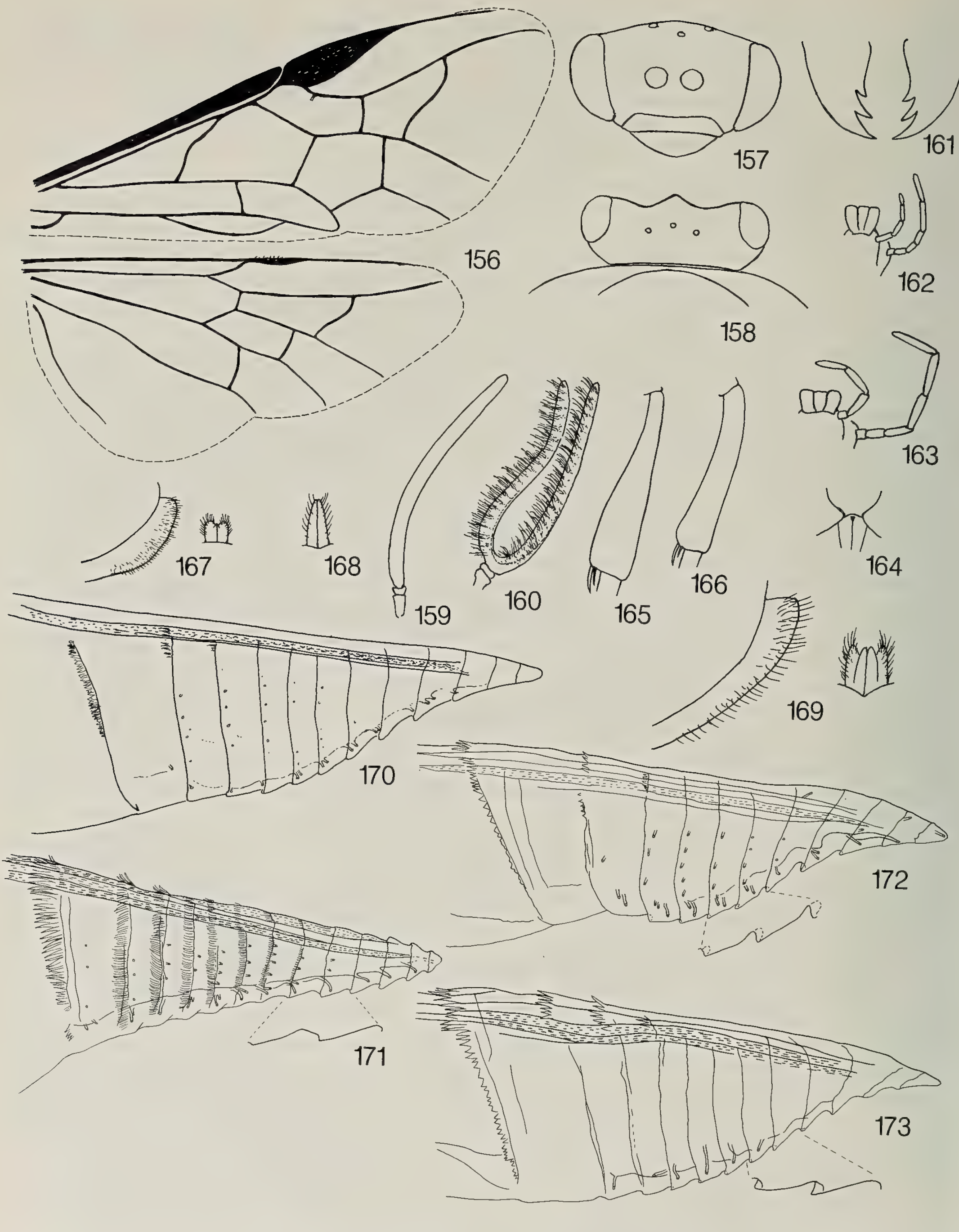
— Thorax black with pronotum orange . . . . ***pronotatus*** (Malaise)

26. Antenna long, nearly 2 1/3X head width (coloration variable, abdomen all orange or all black; thorax orange with metanotum and mesosternum black, black with pronotum and mesepisternum orange, or black with only pronotum, parapteron, and upper corner of mesepisternum orange; genitalia as in Fig. 190). . . . . ***alternator*** (Norton)

— Antenna about 1 1/3X head width **27**

27. Abdomen black; thorax orange with black mesonotum, metanotum, and mesosternum . . . . ***rufoniger*** (Malaise)

— Abdomen orange, only genital capsule black; thorax black with upper mesepisternum, mesepimeron, metapleuron, pronotum, tegula, lateral areas of mesoprescutum, and mesonotal lateral lobes orange . . . . ***ecuadoriensis*** (Enderlein)



Figs. 156-173. *Sericoceros*. 156, Forewing and hindwing of *S. alternator*. 157, Front view of head of *S. gibbus*. 158, Dorsal view of head of *S. gibbus*. 159, Female antenna of *S. gibbus*. 160, Male antenna of *S. gibbus*. 161, Mandibles of *S. gibbus*. 162, Palpi of *S. gibbus*. 163, Palpi of *S. vumirus*. 164, Cervical sclerites of *S. gibbus*. 165, Hindtibia of *S. edwardsii*. 166, Hindtibia of *S. mexicanus*. Female sheaths of 167, *S. mexicanus*; 168, *S. obscurus*; 169, *S. calantiacus*. Female lancets of 170, *S. albicollis*; 171, *S. tannuus*; 172, *S. brasilianus*; 173. *S. sutus*.

SPECIES

albicollis (Klug), **new combination** — Brazil; French Guiana; Trinidad and Tobago

**Hylotoma albicollis* Klug 1834: 245. No locality [Brazil ?]. (Berlin, F).— Kriechbaumer 1884: 292-293.
Schizocerus albicollis: Norton 1867: 56.
Ptenus albicollis: Kirby 1882: 52.— Konow 1905a: 25.
Ptenos albicollis: Dalla Torre 1894: 323.
Sericocerina albicollis: Malaise 1955: 103.
Ptenus gaullei* Konow 1906b: 183-184. F, M. "Guyana" (Eberswalde, F).— Oehlke and Wudowenz 1984: 384 ("F Lectotypus (des. D. R. Smith 1977), franz. Guyana"). **New synonymy.

Host: Two specimens at London from "Northern Range, Trinidad" are labeled "reared specimen, *Coccoloba* sp."

The holotype of *albicollis* is labeled "Brasil." The locality was not mentioned in the original description. Four specimens of *gaullei* with type labels are at Eberswalde, 1 M and 3 F. All are labeled "Guyana francaise." Oehlke and Wudowenz (1984) attributed the lectotype designation to me, but that was based on my label on the specimen and was not previously published. The lectotype is a female since species separation of this genus is based primarily on that sex. The other 3 specimens are paralectotypes. The hindwing has a very short, inconspicuous anal cell, absent in some specimens though with the base of 1A present. The anal cell is absent in the lectotype of *gaullei*. A few specimens have the radial cell of the forewing nearly closed.

alternator (Norton) — Guatemala; El Salvador; Mexico (Chiapas, Guerrero, Hidalgo, Michoacán, Puebla, Veracruz); Panama.

**Sericocera alternator* Norton 1867: 53. F. "Jalapa, Mexico" (Genève, F).— Cameron 1883: 46, pl. 3, fig. 4.— Dalla Torre 1894: 310.
Sericoceros alternator: Konow 1905a: 28.
Sericocerina alternator: Smith 1971a: 525 (holotype).
Sericocera plumicornis* Norton 1867: 52-53. M. "Cordova, t.c. Mexico" (Genève, M).— Cameron 1883: 47 (as syn. of *villosus* Norton).— Dalla Torre 1894: 310 (as syn. of *villosus*). **New synonymy.
Sericoceros plumicornis: Konow 1905a: 28.
Sericocerina plumicornis: Smith 1971a: 525 (holotype).
Sericocera quercus* Cameron 1883: 46-47, pl. 1, fig. 15. F. "Guatemala, Quiche Mountains 7000 to 9000 feet" (London, F) (see hosts).— Dalla Torre 1894: 310. **New synonymy.
Sericoceros quercus: Konow 1905a: 28.

Hosts: From Cameron (1883): "Mr. Champion sends along with the female a small bit of the leaf of an oak, on the lower side of which are arranged sixteen eggs in four rows. The eggs are about 1 millim. in length, of the usual shape, pinkish in colour, and are but slightly imbedded in the leaf, from which they stand erect."

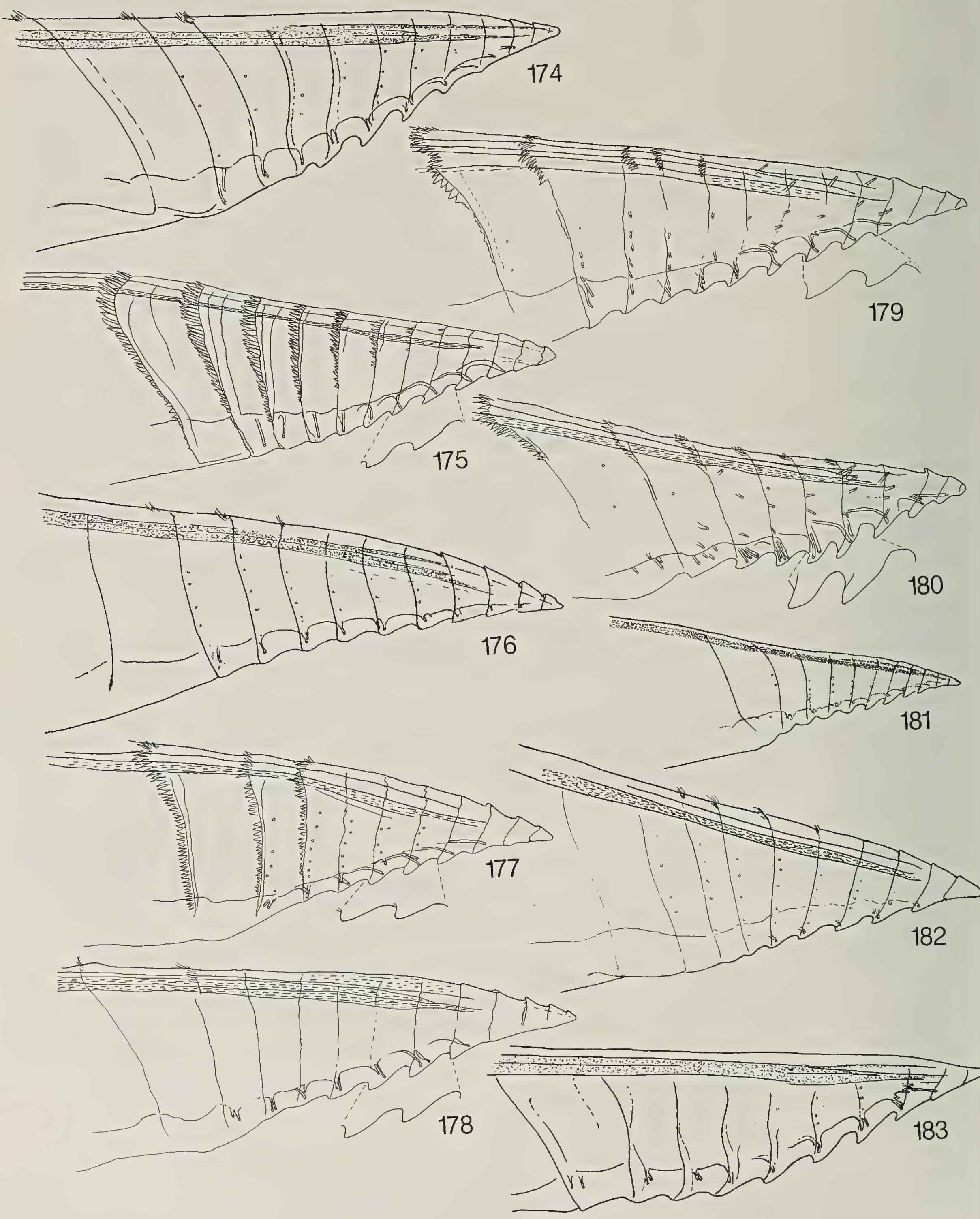
On the same pin as the holotype of *quercus* (BM #1,673) is a small piece of a leaf with several eggs "glued" on upright. Whether or not oak is the correct identification for the plant is open to question. Two adults and two larvae intercepted at U.S.Quarantine at Brownsville, Texas, from Mexico are labeled: Mexico (POE [port of entry] Brownsville, Tex.), 3-23-83, on *Tillandsia betamiano-minor* (root), 3-22-83.

The males of *alternator* show several color forms, some are colored as the female, others have only the mesonotum black, and others have the mesothorax black as well as the abdomen which is the color form described by Norton as *plumicornis*. A series of males from Veracruz, all with the same date and locality, have both orange and black color forms. Cameron's *quercus* differs from the typical females only by the presence of a black area on the mesoprescutum. Most specimens I have seen have the mesonotum entirely orange.

brasilianus (Klug), **new combination** — Brazil (Bahia, Pará)

**Hylotoma brasiliana* Klug 1814: 308-309. F. "Bahia" (Berlin, F).— Kirby 1882: 51 (as syn. of *americana* L.).— Kriechbaumer 1884: 74, 292.— Konow 1905a: 25 (as syn. of *americana* L.).
Schizocerus brasiliana: Norton 1867: 56.
Sericocerina brasiliana: Malaise 1955: 104.
Trailia nigro-lineata* Cameron 1878: 150. F. "Bahia" (London, F). **New synonymy.
Gymnia nigrolineata: Kirby 1882: 42.— Dalla Torre 1894: 318.— Konow 1905a: 27.
Sericocerina nigrolineata: Malaise 1955: 103.

The holotype of *nigrolineata* is BM #1.155. I have seen one specimen from Santarem, Brazil. *Incalia americana* (L.) is a species in the Pergidae (Syzygoniinae).



Figs. 174-183. *Sericoceros*, female lancets. 174, *S. gibbus*; 175, *S. alternator*; 176, *S. krugii*; 177, *S. edwardsii*; 178, *S.mexicanus*; 179, *S. zonorus*; 180, *S. vumirus*; 181, *S. calantiacus*; 182, *S. dimidiatus*; 183, *S. nigripalpis*.

calanticatus Konow — Brazil (Espirito Santo; Rio Grande do Norte)

**Sericoceros calanticatus* Konow 1906b: 245. F. "Brasilia (Espirito Santo)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 371 (holotype).
Sericocerus fulvus Mocsáry 1909: 8-9. F. "Brasilia: Rio Grande" (Budapest, F). **New synonymy.**
Sericocerina fulva: Malaise 1955: 103.

I have seen several specimens from Natal, Rio Grande do Norte.

dimidiatus Konow — Brazil (Amazonas); Colombia; Ecuador; Gyuana

**Sericoceros dimidiatus* Konow 1908a: 146. F. "Brasilia (Teffé)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 377 ("F (?) Holotypus, Teffé, 13.6.1906, leg. Ducke").
Sericocerina amazonica Malaise 1955: 103. F. "Amazonas" (Stockholm, F). **New synonymy.**
Sericocerina columbiana* Malaise 1955: 103. F. "Columbia (Bogota)" (Stockholm, F). **New synonymy.

I regard the specimen at Eberswalde as the holotype and am not sure why Oehlke and Wudowenz (1984) questioned it. I have seen specimens from New River, British Guiana, and Sto. Domingo, Pich. Prov., Ecuador, 680 m.

ecuadoriensis (Enderlein), **new combination** — Ecuador

**Gymnia ecuadoriensis* Enderlein 1919: 120. M. "Ecuador. Loja" (Warszawa, M).

This may be the male of another species, but, since the sexes are so different in *Sericoceros*, it is impossible to associate it at present.

edwardsii (Cresson) — Mexico (Oaxaca, Sinaloa)

**Sericocera edwardsii* Cresson 1880: 2. F, M. "Mazatlan, Mexico" (Philadelphia, F).— Cameron 1883: 45.— Dalla Torre 1894: 310.— Cresson 1916: 4 (lectotype).
Sericoceros edwardsi: Konow 1905a: 28.
Sericocerina edwardsii: Smith 1971a: 530 (lectotype).

Thus far, *edwardsii* is known from only a few localities. Specimens from Oaxaca are from 3 mi. E. Salina Cruz and 3 mi. E. La Ventosa. For other references using the name *edwardsii* (misidentifications), see *mexicanus* (Kirby). The two species have been confused, but can be separated by the length of the antenna and lancet structures as cited in the key. In the Macleay Museum, Sydney, there are 1F and 3M labeled "Mazatlan, Mexico, 24." The labels are identical to that on the Cresson's type in Philadelphia and are probably part of the type series.

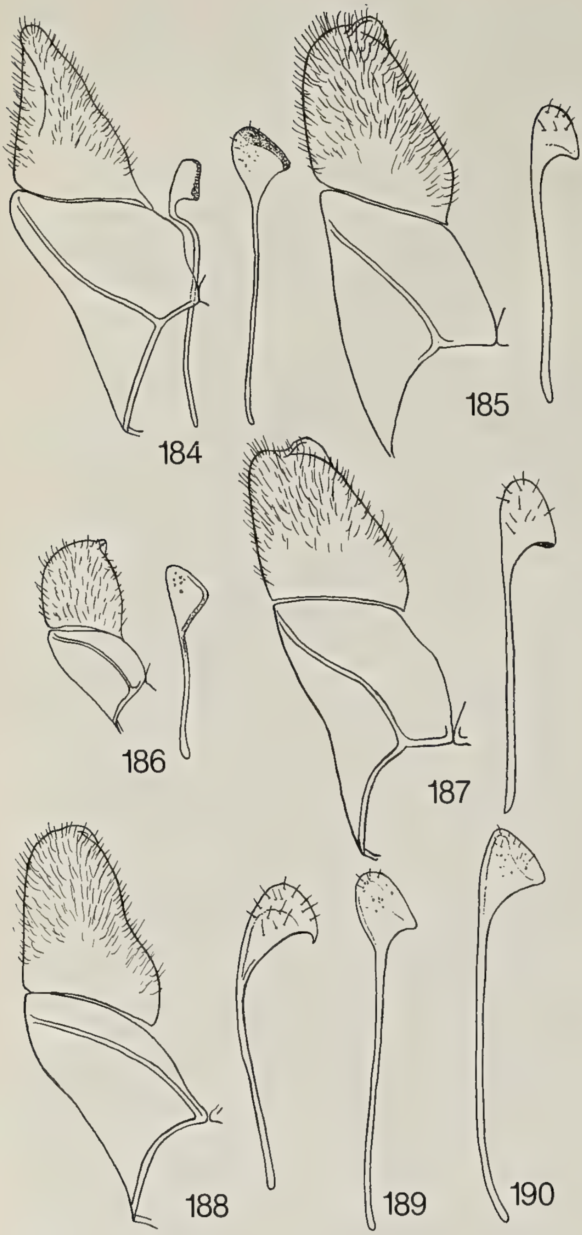
gibbus (Klug) — Bolivia; Brazil (Amapá, Amazonas, Ceará, Mato Grosso, Pará); Colombia; Costa Rica; Guatemala; Guyana; Honduras; Mexico (Chiapas, Veracruz); Panama; Peru; Surinam; Venezuela

Tenthredo americana: Fabricius 1793: 109 (misidentification, see Malaise 1955: 104).
**Hylotoma (Schizocera) gibba* Klug 1834: 245, pl. 2, fig. 7. F. Surinam. (Berlin, F).— Kriechbaumer 1884: 293.
Schizocerus gibba: Norton 1867: 56.
Scobina gibba: Kirby 1882: 41 (Brazil, Honduras).— Dalla Torre 1894: 317.
Sericoceros gibbus: Konow 1905a: 28.— Konow 1906b: 184 (syn.: *spinolae* Brullé).— Kimsey and Smith 1985: 197-199, fig. 24-31 (host a; larva; life history notes).
Sericocera gibba: Rohwer 1912c: 62 (Ceará, Brazil).
Sericocerina gibba: Malaise 1955: 104 (in key; distribution).
Sericocera spinolae Brullé 1846: 669, pl. 47, fig. 5. F ?. "l'Amerique meridionale" (Stockholm, M).— Norton 1867: 54.— Dalla Torre 1894: 310.— Malaise 1937a: 47 (type lost; neotype designated).
Sericoceros spinolae: Konow 1905a: 28.
**Sericocera villosa* Norton 1867: 53. F. "Cordova, t.c. Mexico" (Genève, F).— Cameron 1883: 47, pl. 2, fig. 15 (as syn. of *plumicornis* Norton).
Sericocerina villosa: Smith 1971a: 525 (holotype).

Hosts: a) *Coccoloba manzanillensis* (Polygonaceae); b) Specimens in Washington from Canal Zone were reared from *Coccoloba coracasana*; c) Reared from *Cocoloba guanacastensis* in Costa Rica by D. H. Janzen.

A specimen from Panama has a portion of a leaf on the pin with about 20 oval eggs attached perpendicularly.

According to Malaise (1955), *Tenthredo americana* of Fabricius (1793) is *gibbus*, not *americana* Linnaeus (1758) (see In*calia americana* (L.), Pergidae). Malaise (1937b) examined the Fabrician specimens and stated that they are the same as *spinolae* Brullé. Therefore the reference by Fabricius to *americana* must be regarded as a misidentification. This is a relatively common species from Mexico to northern South America.



Figs. 184-190. *Sericoceros*, male genitalia. 184, *S. albicollis*; 185, *S. gibbus*; 186, *S. vumirus*; 187, *S. edwardsii*; 188, *S. krugii*; 189, *S. mexicanus*; 190, *S. alternator*.

krugii (Cresson) - Dominican Republic; Puerto Rico; U.S. Virgin Islands (St. Thomas)

**Schizocera krugii* Cresson 1880: 2. M. "Porto Rico" (Philadelphia, M).— Dalla Torre 1894: 313.— Cresson 1916: 5 (type).— van Zwaluwenberg 1918: 28 (host f).— Martorell 1941: 141-144, fig. 1-4 (biology; hosts a-e).
Schizoceros krugi: Konow 1905a: 29.
Schizocerus krugii: Kirby 1882: 38.
Sericocera krugii: Kirby 1882: 389 (syn.: *zaddachi* Dewitz).— Wolcott 1948: 749-751, fig. 1-4 (biology).
Schizocerina (!) *krugii*: Smith 1969a: 542 (host e).
Sericocerina krugii: Smith 1971a: 530 (holotype).— Smith 1972: 181-183, fig. 43-46 (larva).
Schizoceras zaddachi Dewitz 1881: 207-208, fig. 12, 12A. F, M. Puerto Rico. (Berlin ?).

Hosts: a) *Coccoloba uvifera*; b) *Coccoloba grandifolia*; c) *Coccoloba pirifolia*; d) *Coccoloba laurifolia*; e) *Coccoloba venosa*; f) *Chrysobalanus icaco*.

Martorell (1941) discussed the biology of this species, indicating the presence of social habits similar to some of the Dielocerinae. He stated "During oviposition the females do not move from the egg-mass even if disturbed" and ". . . even after the last egg of a cluster is laid the females stay over the egg-mass as if they were brooding the eggs." The cocoons are usually in masses on the host leaves, but there is no communal covering of the cocoon mass. I have seen several cocoon masses, and the cocoons are randomly attached to each other in no particular order. This species has long been known from Puerto Rico. Only more recently has it been found on other islands. The data on the Virgin Islands specimens are "St. Thomas, Frenchman Bay Estate, 750', 17 Nov. 1978" (coll. of Mike Ivie, Montana State University, Bozeman), and the data on the Dominican Republic specimens are "Licey al Medio, Feb. 16, 1964" (Washington).

mexicanus (Kirby), **new combination** — Costa Rica; El Salvador; Guatemala; Honduras; Mexico (Colima, Oaxaca, Veracruz); Nicaragua; Panama

**Gymnia mexicana* Kirby 1882: 43, pl. 3, fig. 17. F. "Mexico. Orizaba" (London, F).— Dalla Torre 1894: 318.— Konow 1905a: 27.
Sericocera mexicana: Cameron 1883: 46.
Sericocerina mexicana: Malaise 1955: 1-2.
**Ardua marginipennis* Malaise 1937a: 53. M. "Nicaragua

(Corinto)" (Stockholm, M). **New synonymy.**
Sericocerina edwardsii: Smith 1972: 183, fig. 47-49 (larva; Honduras; host a; misidentification).

Hosts: a) *Coccoloba* sp.; b) From a series from La Ceiba, Honduras, "feeding on *Coccoloba uvifera*."

A portion of an unidentified leaf with about 20 eggs on the surface is associated with a specimen from Lake Catemaco, Veracruz (at New York).

The holotype of *mexicana* is BM #1.156 and is labeled "Mex." *Ardua marginipennis* was described from a male. A diagnostic feature for this species and genus was the enlarged hindtibia (Fig. 166). The hindtibia is more enlarged in the male than in the female.

nigripalpis (Malaise), **new combination**—Bolivia?; Brazil (São Paulo)

**Sericocerina nigripalpis* Malaise 1955: 104. F. "Brazil, Sao Paulo (Tabaguara)" (Stockholm, F).

The holotype is labeled "S. Paulo, Tabaguara, 24-3-1940, O. Monte, col." A female from "Bolivia" at London appears to be this species.

nigrorubra (Malaise), **new combination**—Brazil (Rio de Janeiro)

**Sericocerina nigrorubra* Malaise 1955: 102. M. "Rio de Janeiro (Grajahu)" (Stockholm, M).

The holotype is mostly black with the mesoprescutum, mesonotal lateral lobes, and spot on the mesopleuron red. I have not seen other specimens. It may be the male of another species.

obscurus (Brullé) — Brazil (Bahia, Rio de Janeiro)

Schizocera obscura Brullé 1846: 668, pl. 47, fig. 4. "l'Amérique méridionale" (lost ?).— Dalla Torre 1894: 313.
Schizocerus obscura: Norton 1867: 56.— Kirby 1882: 38.
Sericoceros obscurus: Konow 1905a: 28.
Sericocerina obscura: Malaise 1955: 102 (syn.: *compressicornis* Cameron; Santa Rita, Bahia).
**Trailia compressicornis* Cameron 1878: 149-150. F. "Brazil" (London, F).— Kirby 1882: 42 (as syn. of *tibialis* Spinola).

The holotype of *compressicornis* is BM #1.154. I have seen specimens from Itatiaya, 700 m, Est. do Rio, Brazil.

palliditarsis (Malaise), **new combination** — Brazil (Santa Catarina)

**Sericocerina palliditarsis* Malaise 1955: 103. F. "Brazil, Sta Catharina (Hansa Humbolt)" (Stockholm, F).

I have seen only the holotype. It is orange with the head (except palpi), antenna, and tibiae black, first two terga with blackish spots, and tarsi white.

pronotatus (Malaise), **new combination** — Brazil (Amazonas)

**Neardua pronotatus* Malaise 1937a: 54. M. "Amazonas" (Stockholm, M).

I have seen only the holotype. It is black with the antenna brownish, pronotum and venter of abdomen orange, and the extreme base of the hindtibia whitish. This could be the male of another species.

rufoniger (Malaise), **new combination** — Peru

**Weyrauchia rufonigra* Malaise 1955: 114. F, M. "Peru (Contumafa, 1700 m)" (Stockholm, F).

I have seen only the holotype. It has the antenna, head, and legs black; thorax orange with mesosternum, mesoprescutum, inner margins of mesonotal lateral lobes, and anterior margin of mesoscutellum black; and abdomen orange.

sutus Smith, **new species** — Argentina (Tucumán)

Sericoceros sutus Smith.

Female.— Length, 9.0 mm. Antenna with 1st and 2nd segments brownish, 3rd segment black. Head black with interantennal area, supraclypeal area, clypeus, labrum, and palpi whitish to orange. Thorax and abdomen orange. Legs orange with mid- and hindtibiae and tarsi, outer surface of foretibia, and foretarsus black. Wings darkly infuscated black, nearly hyaline at apex beyond stigma; veins and stigma black. Antennal length 1 1/3X head width, as 4.2:3.0; no carina between antennae; postocellar area nearly 3X broader than long; lower interocular distance to eye length as 2.0:1.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.5:0.7:0.4. Hindbasitarsus subequal to length of remaining tarsal segments combined, as 1.5:1.4. Forewing with 1st cubital crossvein present, therefore with 4 cubital cells; hindwing with anal cell. Sheath with short, slender, narrowly projecting scopae, in lateral view rounded (similar to Fig. 167). Lancet as in Fig. 173.

Male.— Unknown.

Holotype.— F, "RA, Tucuman, Los Nogales, III-1947, col. A. Ares." (Tucumán).

Remarks.— This species is close to *brasilianus* and is essentially identical in coloration. Differences in the lancet will separate the two (Figs. 172, 173). Also, in *brasilianus* the hyaline portion of the wing begins slightly basad to the stigma, whereas in *sutus* the hyaline portion does not begin until midway between the stigma and the apex of the forewing.

tannuus Smith, **new species** —Brazil (Minas Gerais)

Sericoceros tannuus Smith.

Female.— Length, 11.0 mm. Antenna and head black. Thorax orange with metathorax black except for dark reddish metascutellum; blackish infuscated stripes separate mesosternum and mesepisternum. Legs and abdomen black. Wings uniformly darkly infuscated black. Antennal length longer than head width, as 4.5:3.6; no carina between antennae; postocellar area 2X broader than long; lower interocular distance to eye length as 2.2:1.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.7:0.6. Forewing with 1st cubital crossvein weakly sclerotized and indistinct, therefore appearing to have 3 cubital cells. Hindwing with anal cell. Hindbasitarsus slightly shorter than remaining tarsal segments combined, as 1.6:1.8. Sheath with short, slender, posteriorly projecting scopae, rounded in lateral view (similar to Fig. 167). Lancet as in Fig. 171.

Male.— Unknown.

Holotype.— F, "Serra do Cipo, Santana do Riacho, MG, 9-XI-1967" (São Paulo).

Remarks.—The black head, legs, and abdomen, and the uniformly black infuscated wings will separate *tannuus* from other species. The species *brasilianus*, *gibbus*, and *nigripalpis* each have much of the front and middle legs orange, and each have the apices of the wings hyaline.

vumirus Smith, **new species** — Costa Rica; El Salvador; Mexico (Chiapas); Venezuela

Sericoceros vumirus Smith.

Female.— Length, 9.0-9.2 mm. Antenna black, scape and pedicel may be brownish to white. Head black; labrum and palpi white; clypeus and supraclypeal area may be brownish. Thorax and abdomen orange. Legs with coxae, trochanters, and femora orange; tibiae black with outer surface of foretibia, extreme base of midtibia, and basal 1/3 of hindtibia entirely or only on inner surface, white; tarsi black with extreme base of each basitarsus and sometimes part of 2nd tarsal segment of fore- and midlegs white. Wings darkly infuscated black, becoming hyaline at apices; veins and stigma black. Antennal length 1 1/4X head width, as 4.0:3.0; no carina between antennae; postocellar area 3X broader than long; lower interocular distance to eye length as 1.7:1.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.5:0.3; palpi as in Fig. 163, maxillary palpus slightly longer than eye length; mandible with 3rd tooth smaller than 2 apical teeth. Forewing with 1st cubital crossvein present or indistinct, therefore sometimes with 3 cubital cells; hindwing with anal cell. Hindbasitarsus subequal to length of remaining tarsal segments combined, as 1.6:1.6. Sheath with short, slender, posteriorly projecting scopae, in lateral view narrowly rounded at apex (similar to Fig. 167). Lancet with central serrulae deep (Fig. 180).

Male.— Length, 7.5-8.0 mm. Antenna black, pedicel may be whitish. Head black with labrum and palpi whitish. Thorax black with upper margin of mesepisternum, upper 1/2 of mesepimeron, pronotum, mesoprescutum laterally, and inner, anterior, and lateral margins of mesonotal lateral lobes orange. Abdomen black with basal 2-3 sterna orange. Legs black with forecoxa, apices of mid- and hindcoxae, trochanters, apices of femora, inner surface of foretibia, inner surfaces of mid- and hindtibiae at base, and sometimes bases of basitarsi whitish. Genitalia as in Fig. 186.

Holotype.— F, "Santa Rosa National Park, Guanacaste Province, Costa Rica, D. H. Janzen," "82SRNP-344" (Washington).

Paratypes.— COSTA RICA: Same data as for holotype (2 F, 1 M), same except "85-SNRP-444" (2 F, 2 M). EL SALVADOR: "9-9-54, P.A.B." (1 F); Los Chorros National Park, VII-16-1961, M. E. Irwin, collector (1 F); Santa Tecla, 900 m, 31-VII-1972, No. B435, Leg. S. & L. Steinhauser (1 F); Cerro, San Jacinta, 22-XII-1971, No. B456, Leg. S. & L. Steinhauser (1 F). MEXICO: Chiapas, 20 km NW Ocozocoautla, Savannah, 26-VIII-1972, Carolyn Mullinex (1 F). VENEZUELA: Cojedes-El Pinero, 13-V-1967, J. and B. Dechyne leg (1 F). (Davis; San Francisco; Gainesville; Maracay; Washington).

Host.— Reared from *Lonchocarpus minimiflorus* (Leguminosae) in Costa Rica, by D. H. Janzen.

Remarks.— This species is separated from other species of *Sericoceros* in the preceding key. The almost entirely orange thorax and abdomen and deep serrulae of the lancet are diagnostic.

zonorus Smith, **new species** — Brazil (Minas Gerais)

Sericoceros zonorus Smith.

Female.— Length 10.0 mm. Antenna and head black; palpi pale orange. Thorax orange, sometimes indistinct black area at center of mesoprescutum; metanotum black with scutellum dark orange. Legs orange with mid- and hindtibiae and tarsi and outer surface of foretibia and tarsi black; bases of fore- and midtibiae, inner surface of midtibia, and each tarsus may be brownish to orange. Abdomen orange with first 2 terga black, apical 1/2 of 2nd terga may be orange. Wings lightly, uniformly black infuscated, little or no lighter at apices; veins and stigma black. Antennal length 1 1/4X head width, as 4.1:3.4; no carina between antennae; postocellar area 2 1/2X broader than long; lower interocular distance to eye length as 2.3:1.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.6:0.5. Forewing with 1st cubital crossvein faint or absent, thus appearing to have 3 cubital cells; hindwing with anal cell. Hindtasitarsus subequal to length of following tarsal segments combined, as 1.3:1.4. Sheath with short, slender, posteriorly projecting scopae, in lateral view rounded, similar to Fig. 167. Lancet as in Fig. 179.

Male.— Unknown.

Holotype.— F, "Bello Horizonte, M. Geraes, Brazil, 1-6 Nov. '19, Cornell University Expedition" (Ithaca).

Paratypes.— BRAZIL: Same data as for holotype (1 F); "Bras.," "Museum Paris, Brésil, coll. O. Sichel 1867 (1 F). (Ithaca, Paris).

Remarks.— The presence of the anal cell in the hindwing and mostly black metanotum and two basal abdominal terga separate *zonorus* from other species of *Sericoceros*.

Genus **SUBSYMMIA** Malaise

Subsymmia Malaise 1955: 109-110. Type species: *Subsymmia machaerii* Malaise. Orig. desig.
Asymmia Malaise 1955: 111. **New synonymy**. Type species: *Asymmia albuquerquei* Malaise. Orig. desig.

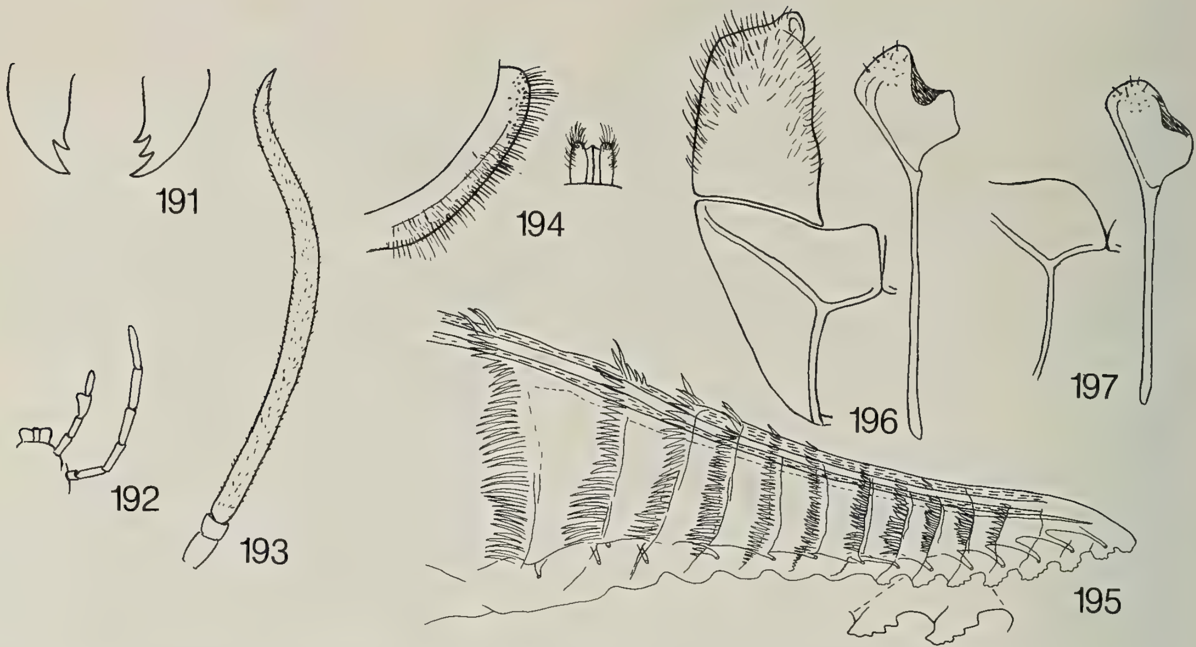
Antenna (Fig. 193) with 1st segment longer than broad, 2nd segment broader than long, 3rd segment long, tapering to pointed apex, laterally flattened; antennal length about 2X head width. Clypeus subtruncate (similar to Fig. 157); malar space broad, equal to or more than diameter of front ocellus; mandibles asymmetrical (Fig. 191), left mandible tridentate, right mandible bidentate; eyes small, slightly converging below, lower interocular distance greater than eye length; maxillary palpus slightly longer than eye length, labial palpus 4-segmented, maxillary palpus 6-segmented, segments of uniform width except 3rd labial palpal segment slightly wider than others (Fig. 192); interantennal area rounded, not carinate. Head from above sharply narrowing behind eyes, short and broad, similar to *Sericoceros* (Fig. 158); postocellar area broader than long. Forewing without intercostal crossvein; radial cell open; 4 cubital cells, last closed cell longest on radius; small basal anal cell present. Hindwing with anal cell present, about as long as its petiole. Hindbasitarsus a little longer than following segments combined; tarsal claws simple; hindcoxae separated by distance of about 3/4 breadth of one.

Species of this genus are very similar to those of *Sericoceros* but have asymmetrical mandibles, a longer (about two times head width), more tapering, and laterally flattened third antennal segment, and the anal cell of the hindwing about as long as its petiole. *Subsymmia* was supposed to have subsymmetric mandibles whereas *Asymmia* asymmetrical mandibles. Malaise was mistaken about *Subsymmia*, and both genera are considered synonymous since there are no other differentiating characters.

The genus is known only from southeastern Brazil and northeastern Argentina.

KEY TO SPECIES

1. Hindtarsus white; palpi white; wings yellowish infuscated; male genitalia as in Fig. 196 (sheath and lancet as in Figs. 194, 195) . . . . **annulipes** (Schrottky)
— Hindtarsus black; palpi blackish infuscated; wings lightly blackish infuscated; male genitalia as in Fig. 197 . . . . **albuquerquei** (Malaise)



Figs. 191-197. *Subsymmia*. 191, Mandibles of *S. annulipes*. 192, Palpi of *S. annulipes*. 193, Female antenna of *S. annulipes*. 194, Female sheath of *S. annulipes*. 195, Female lancet of *S. annulipes*. Male genitalia of 196, *S. annulipes*; 197, *S. albuquerquei*.

SPECIES

albuquerquei (Malaise), **new combination** —
Brazil (Rio de Janeiro)

Asymmia albuquerquei Malaise 1955: 111. F, M. "Rio de Janeiro (Corcovado and Grajahu)" (not located).

The type was not found at Stockholm, but two males which are probably paratypes were located. One is labeled "Corcovado - Rio D.F., 7-1948, Albuquerque col." and the other the same except "1.6.1947, Wygodzinsky col." Malaise described the species from 1 F and 2 M.

annulipes (Schrottky), **new combination** —
Argentina (Misiones); Brazil (Paraná, Santa Catarina, São Paulo)

**Brachyphatnus annulipes* Jörgensen 1913 (Oct.): 262. M. "Monte de Bonpland". Nomen nudum.
**Brachyphatnus annulipes* Schrottky 1913 (Nov.): 703. M. "Bompland" (La Plata, M).— Malaise 1955: 108.
Subsymmia machaerii* Malaise 1955: 110: F, M. "Argentina, Missiones (Loreto)" (Stockholm, F) (host a). **New synonymy.

Host: a) "Ex *Machaerium* sp.?"

Subfamily DIELOCERINAE

Dielocerinae Benson 1938: 375.
Pachylotinae Benson 1938: 375.
Theminae Benson 1938: 375.
Topotritini Benson 1938: 375.
Dielocerini Benson 1963: 634.

Antennal flagellum of male furcate (Fig. 203). Antennal insertions located below level of middle of eyes (Figs. 200, 228, 238); head without sharp carinae and without genal carina; head from above extremely enlarged behind eyes (Figs. 201, 229, 230). Maxillary palpus 3-6 segmented, labial palpus 3-4 segmented (Figs. 205, 215, 227, 241, 262), maxillary palpus shorter than eye length; labium trilobed or without lobes (in *Themos*). Mandibles both simple or with small basal lobe on right mandible and possibly 2 or 3 small crenulations at base of left mandible (Figs. 204, 216, 240, 261); mandibles of *Themos* swollen at base so their thickness is half or more length of a mandible (Fig. 239). Pronotum without diagonal groove. Cervical sclerites narrow to broadly rounded on meson, nearly broadly meeting (Fig. 263). Cenchri closer together than half breadth of one. Forewing (Figs. 198, 256) with or without (in *Themos*) intercostal crossvein (Sc); costa narrower to about same width as intercostal area, in males or some genera costa more swollen and

End of Part A

Sc apparently absent or difficult to see; 1r joins stigma near base of stigma; veins M and Rs+M meet Sc+R close together or well separated; radial cell closed; basal anal cell present or absent; basal crossvein Cu_1 between $M+Cu_1$ and 1A present in *Mallerina*. Hindwing (Figs. 198, 236) with radial cell open at apex; anal cell present or absent; crossvein Cu_1 present in *Mallerina*. Mid- and hindtibiae without preapical spines; apical spines of foretibia subequal in length; *Pachylota* without apical tibial spines (Fig. 231). Tarsal claws simple or bifid (in *Themos* all claws bifid or foreclaw bifid and mid- and hindclaws simple with large basal lobe, Figs. 242, 243).

Species of this subfamily are the largest of Argidae, most being more than 10 mm long. Most have small eyes with the lower interocular distance greater than the eye length and have the head broadened behind the eyes in dorsal view. Some members show some unusual characteristics such as the lack of apical tibial spines in *Pachylota*, "inflated" mandibles, inner tooth of the tarsal claws, and reduced palpi without labial lobes in *Themos*, and presence of a basal crossvein (Cu_1) in *Mallerina*. Other characteristics that help to separate this subfamily are the bifurcate antennal flagellum of the male, lack of preapical tibial spines, lack of inner teeth on the mandibles or right mandible with a basal lobe, usual presence of an intercostal crossvein and lack of a basal anal cell in the forewing, and very short palpi.

In addition, where habits are known, subsocial habits reach their highest development in the Dielocerinae. Females of some species exhibit maternal care or protection of eggs and larvae, the larvae feed gregariously usually in a distinctive pattern, and cocoon masses are formed on the trunks of trees or shrubs protected by a common covering of their own making. The most detailed account is that by Dias (1976) for *Dielocerus diasi*.

Genus **DIELOCERUS** Curtis

Dielocerus Curtis 1844: 250. Type species: *Dielocerus ellisii* Curtis. Desig. by Rohwer 1911a.
Dielocera Cameron 1878: 147. Emendation.
Dieloceros Konow 1899a: 313. Emendation.

Antenna with 1st segment longer than broad, 2nd segment about as long as broad; 3rd segment of female antenna thick, usually somewhat laterally flattened and with slight lobe at base (Figs. 202, 203); antennal length not more than 1.24 x head width. Clypeus with central semicircular emargination (Fig. 200); labrum rounded; malar space equal to or greater than diameter of front ocellus; right mandible with basal tooth, left mandible simple (Fig. 204), mandibles slightly enlarged at base in lateral view, evenly tapering; palpi short, maxillary palpus about half eye length, maxillary palpus 5-6 segmented, labial palpus 4-segmented, labium 3-lobed (Fig. 205); interantennal area low and rounded, sometimes with very low ridge next to each antennal socket; eyes small, converging below, lower interocular distance much longer than eye length (Fig. 200); head from above distinctly broadened behind eyes (Fig. 201); postocellar area long. Cenchri large but slightly farther apart than other genera, separated by distance of about 3/4 breadth of one. Forewing (Figs. 198, 199) with costa narrower than or equal to intercostal area (more swollen in males than females); intercostal crossvein (Sc) present (sometimes difficult to see if area is blackish infuscated); radial cell closed, with short accessory vein; basal anal cell absent; 4 cubital cells, the last closed cubital cell nearly quadrate, sometimes a little longer on cubitus than on radius; vein M meets Sc+R basal to point where Rs+M meets Sc+R, the distance equal to less than half length of M. Hindwing (Fig. 198) without anal cell, vein 2A+3A entirely or partially atrophied, anal cell never complete. Tarsal claws simple.

Species of *Dielocerus* are large and robust, 9-15 mm long. They are separated from other genera by the intercostal crossvein and closed radial cell of the forewing (the antero-apical margin of the forewing is uneven in *diasi*, Fig. 198, similar to the male of *Pachylosticta* [Cimbicidae, Smith 1989a, Fig. 29]), emarginated clypeus, broadened head behind the eyes in dorsal view, lack of a complete anal cell in the hindwing, and simple tarsal claws. They may be confused with the large species of *Themos*, but *Themos* have very enlarged mandibles, "bulbous" in lateral view, a truncate clypeus, have an inner tooth on one or more of the tarsal claws, lack labial lobes, and have 3-segmented maxillary and labial palpi. *Digelasinus* is very similar to *Dielocerus* but is separated by the presence of a complete anal cell in the hindwing.

Females remain with and protect their eggs which are attached to a leaf surface. The larvae are gregarious and form cocoon masses underneath a common covering on tree or shrub trunks. For a detailed description, see Dias (1976) for *diasi*. *Dielocerus fasciatus* (Smith and Adis, 1984), *ocreatus*, and *formosus* are also known to form similar mass cocoons. Adults are not commonly collected individually. Most are obtained when cocoon masses are found and adults emerge. *Dielocerus* has been recorded from Ecuador, Peru, and throughout most of Brazil.

KEY TO SPECIES

1. Female 2
— Male 5
2. Wings yellowish infuscated; yellow orange with blackish marks on only mesonotal lateral lobes and hindtibia (lancet as in Fig. 207) . . . . ***ocreatus***, new species
— Wings hyaline with infuscated black spot at base, dark band below stigma, and dark spot at apex; head and abdomen mostly black; thorax orange to red, sometimes with black markings 3
3. Mesonotum black, rest of thorax orange; hindtibia and hindtarsus black; less than 10 mm long (costa black, intercostal area infuscated black; apical wing margin even, without apical notch; lancet similar to that of *diasi*, Fig. 209 . . . . ***fasciatus*** (Enderlein)
— Thorax orange; hindtibia and/or hindtarsus with orange; 12-15 mm long 4
4. Costa black; intercostal area usually black infuscated; antero-apical wing margin even (Fig. 199); apical 4 hindtarsal segments usually black; lancet as in Fig. 208 . . . . ***formosus*** (Klug)
— Costa white; intercostal area hyaline; antero-apical margin of forewing convex (Fig. 198); apical 4 hindtarsal segments orange; lancet as in Fig. 209 (sheath as in Fig. 206) . . . . ***diasi*** Smith
5. Head above antennae black; mesonotum black; costa black 6
— Head orange; mesoprescutum orange, rest of mesonotum black; costa whitish (*hyaloptera* with posterior portion of mesoprescutum and of mesoscutellum brownish) 7
6. Apical 4 hindtarsal segment black; orange on hindorbits restricted to lower 1/3; large, 12-13 mm long; male genitalia as in Fig. 211 . . . . ***formosus*** (Klug)
— Hindtarsus orange; orange on hindorbits extends nearly to top of eye; small, less than 9 mm long; male genitalia as in Fig. 213 . . . . ***fasciatus*** (Enderlein)
7. Abdomen black with at most basal sterna orange; mesonotum except prescutum black; wings hyaline, costa white (male genitalia as in Fig. 210) . . . . ***diasi*** Smith
— Abdomen orange, basal plates and lateral areas of terga may be blackish; mesonotum black or with black marks on prescutum and each lateral lobe; wings hyaline or yellow, costa orange or white 8
8. Mesonotum with black mark on prescutum and each lateral lobe; metanotum orange; wings yellowish infuscated with costa and stigma and apical veins yellowish orange, basal veins dark brown (male genitalia as in Fig. 212) . . . . ***ocreatus*** new species
— Mesonotum black, brownish on posterior portion of prescutum and of scutellum; metanotum blackish; wings hyaline with costa whitish, and veins and stigma dark brown to black . . . . ***hyaloptera*** (Perty)

SPECIES

diasi Smith — Brazil (D.F., Goiás, Mato Grosso, Minas Gerais)

**Dielocerus diasi* Smith 1975: 369-374, fig. 1, 5, 6, 8, 9, 12-16. F, M, larva. "Brasilia, D.F., Brasil, reared, emerged in lab." (Brasilia, IBGE, F) (host a).— Dias 1976: 461-501, fig. (biology, gregarious behavior; host a).— Smith and Adis 1984: 720-721 (in key).

Host: a) *Sclerolobium aureum* (Leguminosae).

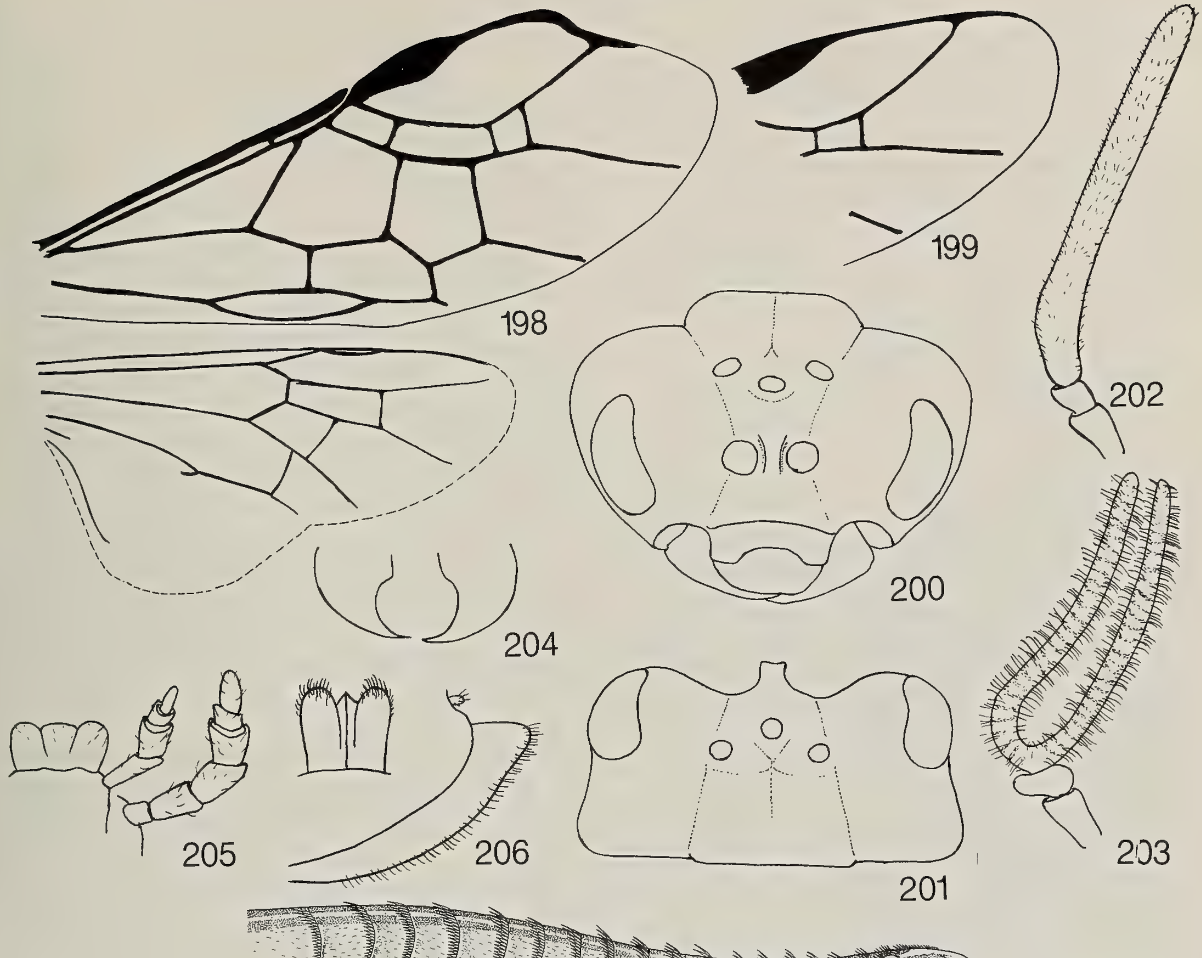
Dias (1976) gave an excellent account of the biology, habits, and behavior of this species. Other than D.F., I have seen specimens from Chapada, Mato Grosso; Viannopolis, Goias; and Nova Lima and Coromandel, Minas Gerais.

fasciatus (Enderlein) — Brazil (Amazonas); Ecuador; Peru

**Eriglenum fasciatum* Enderlein 1919: 117. F. "Ecuador. Cuvaray" (Warszawa, F).
Digelasinus fasciatum: Malaise 1941: 134.
Dielocerus fasciatus: Smith and Adis 1984: 720-721 (Amazonas; biological note; cocoons found on tree trunks of host a; F, M in key).

Host: a) *Sclerolobium paniculatum* (Leguminosae).

This species was recorded from Brazil (Manaos, Amazonas) by Smith and Adis (1984). The only other specimens I have seen are the holotype and one from Pucallpa, Peru, X-2-1954.



Figs. 198-209. *Dielocerus*. 198, Forewing and hindwing of *D. diasi*. 199, Forewing of *D. formosus*. 200, Front view of head of *D. diasi*. 201, Dorsal view of head of *D. diasi*. 202, Female antenna of *D. diasi*. 203, Male antenna of *D. diasi*. 204, Mandibles of *D. diasi*. 205, Palpi of *D. diasi*. 206, Female sheath of *D. diasi*. Female lancets of 207, *D. ocreatus*; 208, *D. formosus*; 209, *D. diasi*. (Figs. 208, 209, not shaded.)

formosus (Klug)—Brazil (Bahia, Espirito Santo, Minas Gerais, Pernambuco, Rio de Janeiro)

**Hylotoma* (*Schizocera*) *formosa* Klug 1834: 248. F. "Brasilien" (Berlin, F).— Sichel 1862: 119, 595, pl. 14, fig. 1 (found in house in France; cocoons from Brazil).— Norton 1867: 59.— Kriechbaumer 1884: 294.
Dielocerus formosus: Kirby 1882: 50.— Dalla Torre 1894: 322.— MacGillivray 1906: pl. 39, fig. 79 (wings).— Lima 1927: 129-134 (biological notes, nest; Pernambuco).— Lima 1927: 1366-1367 (same article).— Monte 1941: 145-146 (host a).— Lima 1960: 346.— Silva et al. 1968: 621 (Minas Gerais; host a).— Smith 1975: 373, fig. 2, 3, 7, 10, 11 (compared with *diasi*).— Smith and Adis 1984: 720-721 (in key).
Dieloceros formosus: Konow 1905a: 24, pl. 2, fig. 5 (M; syn.: *serratus* Kirby, *ellisii* Curtis).
**Dielocerus ellisii* Curtis 1844: 248, pl. 31, fig. 1-7. F, M, cocoon mass. Brazil. (London, F) (biology, social behavior).— Smith 1866: 323-324 (Catagallo, Brazil; cites Curtis' 1844 biological notes).— Kirby 1882: 50, pl. 4, fig. 1 (syn.: *curtisi* Cameron).— Dalla Torre 1894: 322.— Bischoff 1927: 181, 530, fig. 79, 80 (communal larval cocoon mass figured).
**Dielocera curtisi* Cameron 1878: 147. M. "Brazil" (London, M).
Dieolceros curtesi (!): Konow 1905a: 151 (in index only).
**Ptenus serratus* Kirby 1882: 51, pl. 4, fig. 2, 3. F. M. "Brazil. Catagallo" (London, F).
Ptenos serratus: Dalla Torre 1894: 324.
Dielocerus sp.: Parker et al. 1953: 45 (Haquaquecetuba, Brazil; parasite: *Hylotomomyia dielocera* Tns.).

Hosts: a) In*ga* sp. (Leguminosae).

Since *formosus* and *diasi* are so closely related and similar in many color features, they may have been confused in the literature. The only localities from which I have seen specimens of *formosus* are Espirito Santo, Minas Gerais, Rio de Janeiro, and Bahia. Lima (1927) recorded it from Pernambuco. I have not seen specimens to verify the identifications of Lima's (1927), Monte's (1941) and Silva et al. (1968) records from Minas Gerais. I have examined types of all the species above and found them to represent the same species. The holotype of *curtisi* Cameron is BM #1.118, a M labeled "Dielocera ? curtisi Cam. Type. Brazil." The lectotype of *ellisii* Curtis, here designated, is the F set aside as the type in London, BM #1.119; it bears only a determination label. The lectotype of *serratus* Kirby is the F set aside as type in London, BM #1.117, labeled "Braz." and with a determination label.

hyaloptera (Perty) **new combination** — Brazil

**Shizocera hyaloptera* Perty 1833: 130, pl. 26, fig. 6. M. "Amazonum flumen" (München, M).
Schizocerus hyaloptera: Norton 1867: 56.
Scobina hyaloptera: Kirby 1882: 40.— Dalla Torre 1894: 317.— Konow 1905a: 15.— Konow 1907a: 191.

The single male at München is hereby designated lectotype. It is labeled "3103" and "2. Brasil. Sch. hyaloptera Pty." Perty did not state how many specimens he had. I have not seen specimens resembling *hyaloptera*, it could be a color variant of another species, but I am keeping it separate until this can be resolved. The lectotype is orange with the antennal flagellum, mesonotum, and metanotum black (posterior portion of mesoprescutum and of mesoscutellum brownish), and basal plates a little darker than rest of the abdomen. The wings are hyaline with the costa whitish and the veins and stigma brownish to black.

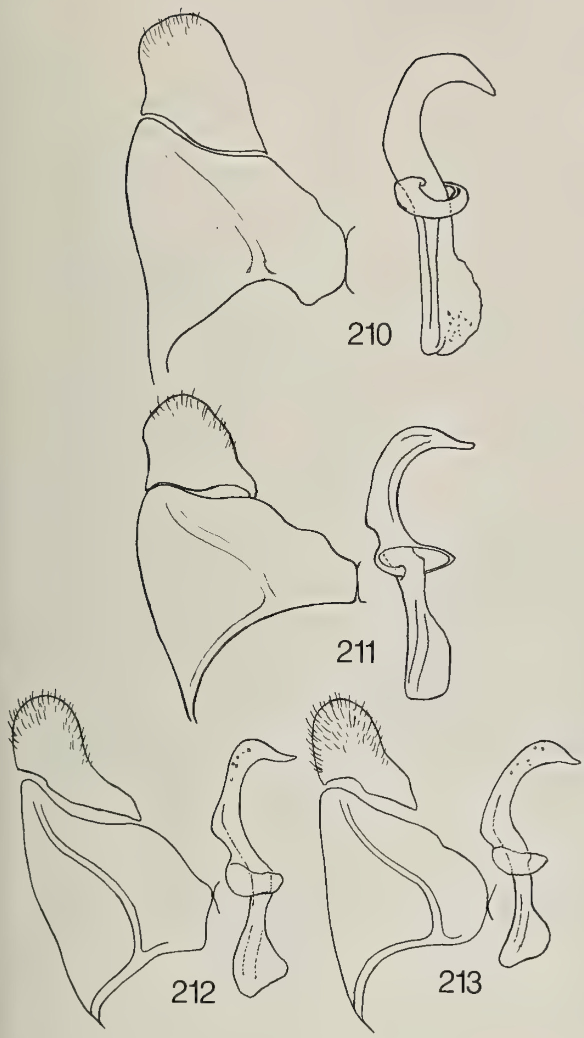
ocreatus Smith, **new species** — Brazil (Mato Grosso)

Dielocerus ocreatus Smith.

Female.— Length, 9.0-11.0 mm. Entirely dull yellow orange with apex of mandible black and light blackish areas on outer surface of hindtibia, stripe on mesonotal lateral lobes, metapostnotum, and center of basal 4 or 5 abdominal terga. Wings uniformly, lightly yellowish infuscated, costa and stigma orange yellow as for body, other veins black. Antennal length subequal to head width. Clypeus with central semicircular emargination; malar space slightly less than diameter of front ocellus; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:1.4; head broadened behind eyes in dorsal view (as in Fig. 201); lower interocular distance to eye length as 2.5:2.0, eyes small and slightly coverging below. Length of hindbasitarsus shorter than length of following tarsal segments combined, subequal to following 2 1/3 segments. Sheath similar to that of *diasi*, Fig. 206. Lancet as in Fig. 207.

Male.—Length, 9.0-10.0 mm. Coloration similar to that of female except outer surface of 3rd antennal segment, broad stripes on mesoprescutum and mesonotal lateral lobes, and sometimes anterolateral portion of mesoscutellum black; hindtibia orange yellow. Antennal length about 1.25X head width. Genitalia as in Fig. 212.

Holotype.— F, "Sao Felix, MT, VIII-1969, Bill Hamilton leg," "reared from cocoon collected on 25-VII-1968, Bill Hamilton, leg." (Brasilia, IBGE). Sao Felix is in Mato Grosso State, Brazil (near Ilha do Bananal).



Figs. 210-213. *Dielocerus*, male genitalia. 210, *D. diasi*; 211, *D. formosus*; 212, *D. ocreatus*; 213, *D. fasciatus*.

Paratypes.— BRAZIL: Same data as for holotype (9F, 4M) (Brasilia, IBGE; Washington).

Host.— A note with the specimens states that they were reared from a mass cocoon found on a small tree (15 to 20 ft. tall), locally called "Carvoeiro," in cerrado vegetation.

Discussion.— The yellowish wings and nearly entirely orange yellow color are unlike any other species of *Dielocerus*.

Genus **DIGELASINUS** Malaise

Digelasinus Malaise 1937a: 52. Type species: *Ptenus diversipes* Kirby. Orig. desig.

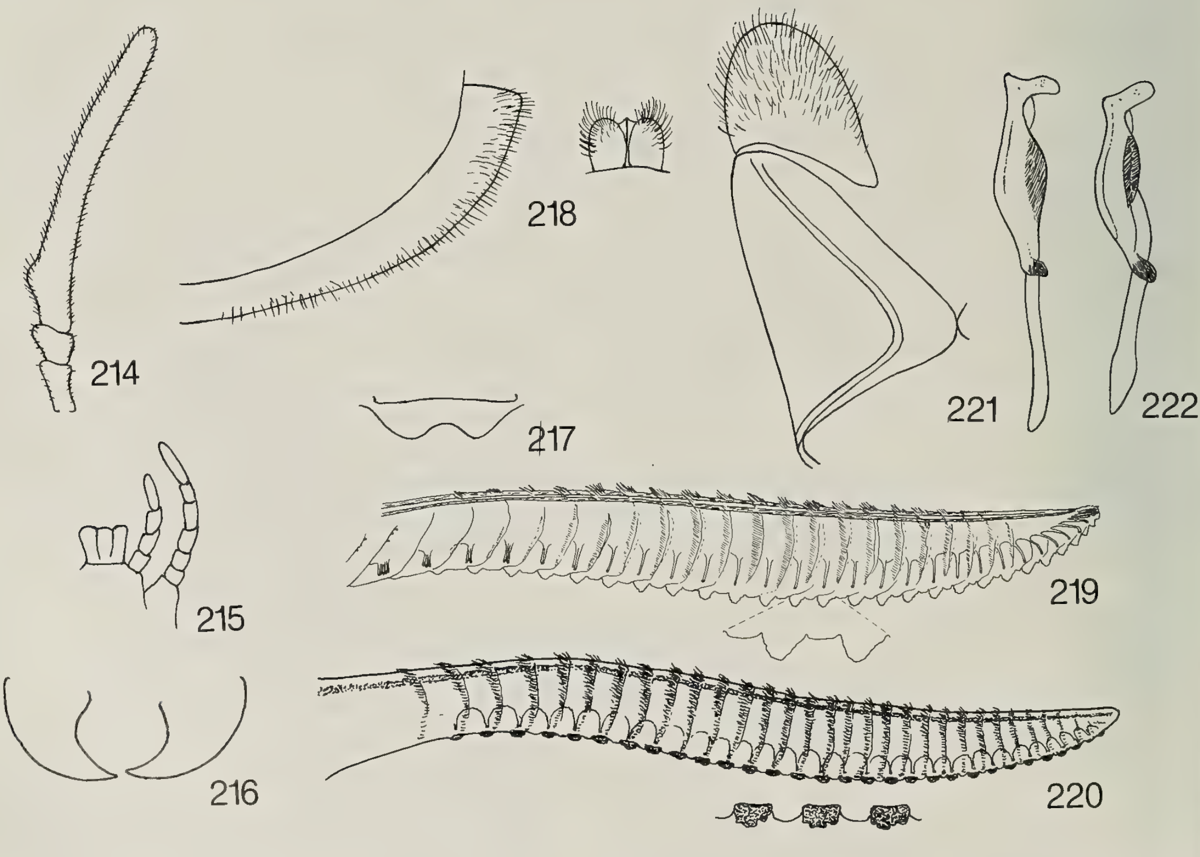
Antenna (Fig. 214) with 1st segment longer than broad, 2nd segment as long as broad, 3rd segment of female antenna stout, somewhat laterally flattened, usually with slight lobe at base, not much longer than head width. Clypeus with shallow, broad, semicircular emargination (Fig. 217); malar space nearly equal to diameter of front ocellus; labrum rounded; supraclypeal and interantennal area convex, without interantennal carina; eyes far apart, slightly converging below, lower interocular distance slightly greater than eye length; left mandible simple, right mandible with very small basal tooth (Fig. 216), mandibles in lateral view narrow and evenly tapering; maxillary palpus 6-segmented, shorter than eye length, labial palpus 4-segmented, labium 3-lobed (Fig. 215); head from above broadened behind eyes (as in Fig. 201). Cenchri large and close together, separated by distance of 1/3 or less breadth of one. Forewing (similar to *Dielocerus*, Fig. 198, but antero-apical margin even) with costa narrower than intercostal area (somewhat more swollen in males than in females); intercostal crossvein (Sc) present but sometimes difficult to see in black infuscation; radial cell closed and with accessory vein at apex; 4 cubital cells with last closed cell quadrate, about as long on radius as on cubitus; no basal anal cell; distance betwen M and Rs+M on Sc+R equal to half length or less of vein M. Hindwing with anal cell, cell slightly longer than its petiole. Hindbasitarsus slightly shorter than remaining tarsal segments combined; tarsal claws simple.

These are large, robust, shining insects, the females about 13-15 mm long and the males about 10 mm long. The two species have dark blackish wings and are mostly black with orange or reddish only on the thorax and parts of the legs. The wings of the males are nearly hyaline with a blackish band below the stigma.

Digelasinus is close to *Dielocerus*, but is separated by the closed anal cell of the hindwing, larger lobe at the base of the flagellum of the female antenna, and differently shaped male genitalia (compare Figs. 210-213, 221, 222). The two species of *Digelasinus* appear to form a distinct group, and I prefer to keep the genera separate. Little is known of the biology of *Digelasinus* except for notes by Lima (1937), Monte (1946), and some mass cocoons associated with specimens in London. Representatives are known only from Brazil, Paraguay, and Venezuela.

KEY TO SPECIES

1. Female 2
— Male 3
2. Legs with coxae, trochanters, and femora orange, tibiae and tarsi black; thorax orange, at most with black spots on posterior of mesoprescutum and anterior of mesoscutellum; lancet as in Fig. 220 .... ***violaceus*** (Kirby)
— Hindleg black; midleg with coxa orange, femur orange or black, and tibia and tarsus black; foreleg with coxa, trochanter, and femur orange, tibia and tarsus black; thorax orange with various amounts of black on mesonotum, entirely black to orange with only mesoscutellum black, with intermediates; lancet as in Fig. 219 (sheath as in Fig. 218) .... ***diversipes*** (Kirby)
3. Legs with coxae, trochanters, and femora orange, tibiae and tarsi black; mesonotum black; genitalia as in Fig. 222 .... ***violaceus*** (Kirby)
— Hindleg black; midleg black or with coxa, trochanter, and part of femur orange; foreleg as for *violaceus*; mesonotum black or black with prescutum orange; genitalia as in Fig. 221 .... ***diversipes*** (Kirby)



Figs. 214-222. *Digelasinus*. 214, Female antenna of *D. diversipes*. 215, Palpi of *D. diversipes*. 216, Mandibles of *D. diversipes*. 217, Clypeus of *D. diversipes*. 218, Female sheath of *D. diversipes*. Female lancets of 219, *D. diversipes*; 220, *D. violaceus*. Male genitalia of 221, *D. diversipes*; 222, *D. violaceus*.

SPECIES

diversipes (Kirby) — Brazil (Goiás, Minas Gerais, Pará, Pernambuco, São Paulo); Venezuela

**Ptenus diversipes* Kirby 1882: 52, pl. 4, fig. 4. F. "Amazons. Santarem" (London, F).
Ptenos diversipes: Dalla Torre 1894: 324.
Dieloceros diversipes: Konow 1905a: 24.
Dielocerus diversipes: Lima 1937: 539-541 (Minas Gerais; parasite; host a).— Monte 1946: 591 (biological note).
Digelasinus diversipes: Malaise 1937a: 52.—Lima 1960: 348 (host a; parasite).— Silva et al. 1968: 622 (Minas Gerais; araçazeiro, goiabeiro e pau pomba).
**Ptenus consors* Kirby 1882: 52, pl. 4, fig. 6. F. "East Brazil" (London, F). New synonymy.
Ptenos consors: Dalla Torre 1894: 324.
Dieloceros consors: Konow 1905a: 24.

Host: a) *Erythroxylon* sp.

A tightly packed cocoon mass is associated with specimens of this species at London. It is round, about 1.5" in diameter, and has a common covering. It is from Pernambuco. A specimen from Vicosa, Minas Gerais is labeled "occur on Myrtaceae." The holotype of *P. diversipes* is BM #1.123, and the holotype of *P. consors* is BM #1.122. I have seen other specimens from São Paulo; Rio Verde and Campinas, Goias; Oriximiná, Pará; and Sanare, Venezuela.

violaceus (Kirby), **new combination** — Brazil (Goiás, Minas Gerais, Rio de Janeiro, São Paulo); Paraguay

**Ptenus violaceus* Kirby 1882: 52, pl. 4, fig. 5. F. "Brazil. Rio Janeiro" (London, F).
Ptenos violaceus: Dalla Torre 1894: 324.
Dieloceros violaceus: Konow 1905a: 24.

The holotype is BM #1.121. I have seen specimens from Varginha, s. Minas Gerais; Est. Biol. Boraceia, Salesopolis, S.P.; Serra da Bocaina, S.J. Barreiros, S.P.; Cor Paciencia, Goiás; and Pirapo, Paraguay.

Genus MALLERINA Malaise

Mallerina Malaise 1941: 134. Type species: *Mallerina tricolor* Malaise. Orig. desig.

Antenna with 1st segment longer than broad, 2nd segment broader than long, 3rd segment of female antenna uniformly slender; antennal length subequal to head width. Clypeus flat, shallowly emarginated at center; malar space less than half diameter of front ocellus; supraclypeal area convex, protuberant; interantennal ridge broadly truncate; mandibles not examined; palpi stout, shorter than eye length, labial palpus apparently 3-segmented, maxillary palpus apparently 4-segmented (as recorded by Malaise, 1942; palpi not easily observed in holotype of *tricolor*); eyes small, far apart, slightly converging below, lower interocular distance greater than eye length; head from above enlarged behind eyes. Forewing with radial cell closed, with accessory vein at apex; intercostal crossvein (Sc) present, not always distinct in black infuscation; distance between M and Rs+M on Sc+R equal to less than half length of vein M; basal anal cell absent, anal stub straight; basal crossvein Cu_1 from $M+Cu_1$ to 1A present (as in in *Eriglenum*, Fig. 131); with 4 cubital cells. Hindwing with basal crossvein Cu_1 present; anal cell present, slightly longer than its petiole. Hindbasitarsus shorter than following segments combined; tarsal claws simple.

The presence of an intercostal crossvein, reduced palpi, large size (16-17 mm long), simple tarsal claws, and general habitus relates this genus to *Digelasinus*, *Topotrita*, and *Dielocerus*. *Mallerina*, however, is unique in the Dielocerinae because of the presence of a basal crossvein (Cu_1) in the wings. Additionally, *Dielocerus* lacks the anal cell in the hindwing and *Topotrita* has three cutibal cells in the forewing. I have seen only the type of *tricolor*. A male from "Rio Negro, Bolivia" (at London) may be this or another species (male genitalia, Fig. 224). Though *Mallerina* is close to the ones mentioned above with an intercostal crossvein in the forewing, I prefer to keep it separate until more material is available for study.

SPECIES

tricolor Malaise — Brazil (Santa Catarina)

**Mallerina tricolor* Malaise 1941: 134. F. "Brasilien (S:ta Catharina)" (Stockholm, F).— Malaise 1942: 104-105, fig. 7, 8c (F described from "Brazil, Santa Catharina, Hansa Humbolt at 60 m. altitude").— Lima 1960: 347, 348, fig. 61.

The female sheath is as in Fig. 223. The lancet was not examined. The color of the holotype is as follows: Antenna and head black, palpi yellow; thorax entirely orange; abdomen orange with apical 2 segments and sheath black; legs orange with apical midtarsal segment brownish and apex of hindtibia and entire hindtarsus black; forewing blackish, hyaline toward apex; veins and stigma black.

Figs. 223-224. *Mallerina*. 223, Female sheath of *M. tricolor*. 224, Male genitalia of *M.* sp.

Genus **PACHYLOTA** Westwood

Pachylota Westwood 1841: 24. Type species: *Pachylota audouinii* Westwood. Monotypic.

Antenna short, slightly longer than or subequal to head width; 1st segment triangular, longer than broad; 2nd segment broader than long; 3rd segment of female antenna stout, laterally flattened (Fig. 225). Clypeus with broad semicircular central emargination; labrum with semicircular central emargination (Fig. 226); each mandible simple; palpi (Fig. 227) short, maxillary palpus shorter than eye length, maxillary palpus 5-segmented with first segment short and broad and apical 2 segments slender, labial palpus 4-segmented; labium 3-lobed; malar space nearly 2X longer than diameter of front ocellus; 2 short carinae between antennae, one adjacent to each antennal insertion; eyes small, scarcely converging, lower interocular distance nearly 2X eye length (Fig. 228); head from above very long and broadened behind eyes, length of head behind eyes equal to eye length; postocellar area about as long as 2X distance between hindocelli (Figs. 229, 230). Ventral arms of cervical sclerites broadly rounded and meeting on meson; distance between cenchri about 3/4X breadth of one. Forewing with radial cell closed, with long accessory vein at apex; intercostal crossvein present; 4 cubital cells, last closed cell as long on radius as on cubitus, quadrate; distance between veins Rs+M and M on Sc+R equal to less than half length of vein M; basal anal cell absent. Hindwing with anal cell present, longer than its petiole. Tibiae without preapical or apical spines; tarsi (Fig. 231) stout, laterally flattened, hindbasitarsus as long as following 3 segments combined; apical tarsal segment broad, with tarsal claws situated far apart; tarsal claws simple (Fig. 232).

These large species (12-15 mm long) form a most unusual group in the Argidae because of the modified tarsi and lack of tibial spurs. Other characters, including the habits of the larvae which form cocoon masses, place them in the Dielocerinae and close to *Dielocerus* and *Topotrita*. Because of the modification of the legs, *Pachylota* is kept separate. The two species have the antennae, head, pronotum, and most of the legs orange, with the rest of the thorax and abdomen black. The wings are blackish infuscated with a hyaline band just apical to the stigma and a small hyaline spot below the subcosta at center.

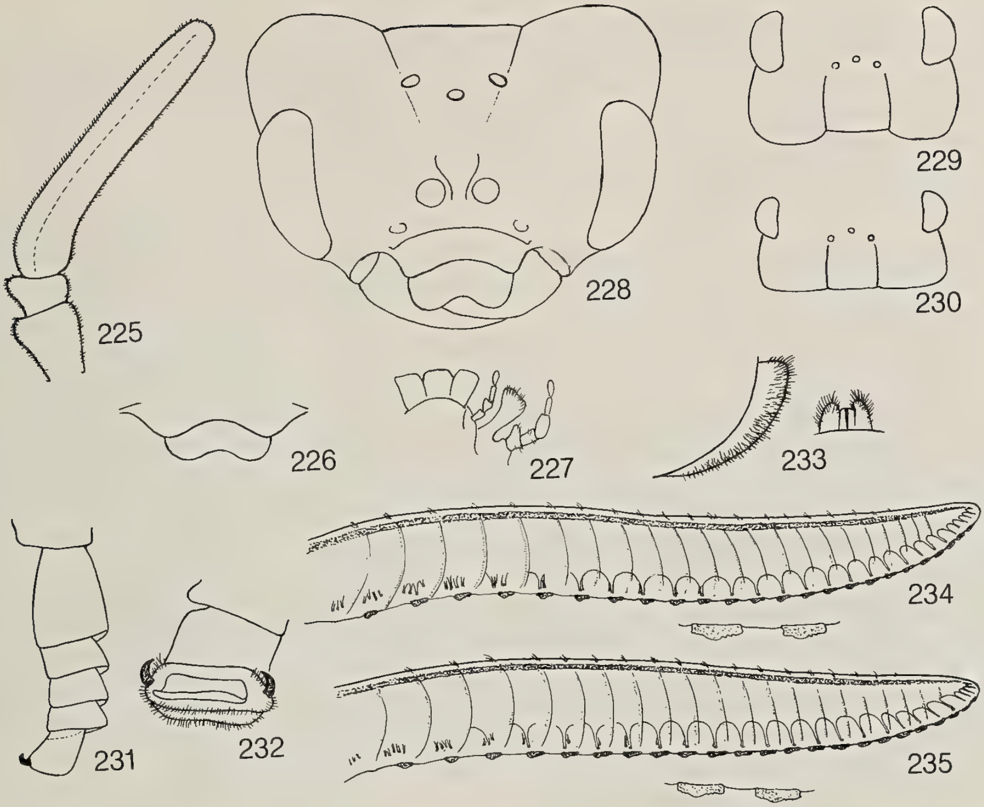
The only published information on biology is a statement by Benson (1938) that *Pachylota* larvae are social, building a communal nest, and the female sits over and protects them (presumably the eggs and young larvae). This information may have been assumed from a cocoon mass associated with *audouinii* in the collection at London.

The genus is known only from Guyana and the Amazon Basin in Brazil.

KEY TO SPECIES

1. Head from above markedly concave behind (Fig. 229); head orange; thorax (except pronotum), abdomen, hindleg, and midtibia and midtarsus black, or midleg may be all black; lancet as in Fig. 234 (sheath as in Fig. 233).. ***audouinii*** Westwood

— Head from above straight behind (Fig. 230); head orange with spot near ocelli and sometimes posterior margin of head blackish; thorax with at least mesosternum and lower mesepisternum orange, sometimes part of mesonotum; hindtibia and hindtarsus black, rest of legs orange; lancet as in Fig. 235.................... ***sulcicornis*** (Cameron)



Figs. 225-235. *Pachylota*. 225, Female antenna of *P. audouinii*. 226, Clypeus of *P. audouinii*. 227, Palpi of *P. audouinii*. 228, Front view of head of *P. audouinii*. 229, Dorsal view of head of *P. audouinii*. 230, Dorsal view of head of *P. sulcicornis*. 231, Tarsus of *P. audouinii*. 232, Apical tarsal segments and claws of *P. audouinii*. 233, Female sheath of *P. audouinii*. Lancets of 234, *P. audouinii*; 235, *P. sulcicornis*.

SPECIES

audouinii Westwood — Brazil (Amazonas, Pará); Guyana

Pachylota audouinii Westwood 1841: 24, fig. F. "Habitat in Africa (tropicali ?)" (London ?) ("Received from Professor Audouin, Jardin des Plantes").— Brullé 1846: 667, pl. 47, fig. 6 (*audouini*).— Norton 1867: 73.— Kirby 1882: 54 ("West Africa ? or South America ?").— Dalla Torre 1894: 324 (Africa).— Cameron 1883: 51 (type supposed to be from West Africa - no doubt a mistake for S. America).— Konow 1905a: 23 (*Audouini*; Brazil).—MacGillivray 1906: pl. 38, fig. 77 (wings).— Benson 1938: 372, fig. 23, 31 (S. America).— Malaise 1941: 134 (Amazonas).

Host: Specimens in London from Pará bear a label "on Mahea sp."

Westwood apparently thought this species was from Africa, but if the original specimen was taken in a botanical garden, its origin would be doubtful. One specimen in London is labeled "Afric. Trop." A cocoon mass in which many cocoons are arranged perpendicular to the substrate and are covered by a common shelter is associated with specimens from Pará (at London). The host on these specimens, *Mahea*, is apparently not a New World plant.

I have seen other specimens from Guyana (British Guiana, Potago Rd.) and Brazil (Nova Olinda, Rio Purus; S. Gabriel, Rio Negro, Amazonas; Itaituba).

sulcicornis (Cameron), **new combination** — Brazil (Pará)

**Dielocera sulcicornis* Cameron 1878: 145-146. F. "Prainha, Lower Amazons" (London, F).
Ptenus sulcicornis: Kirby 1882: 51.
Ptenos sulcicornis: Dalla Torre 1894: 324.
Dieloceros sulcicornis: Konow 1905a: 24.

The holotype is BM #1.124. I have seen one other specimen, that from Santarem, Brazil.

Genus **THEMOS** Norton

Themos Norton 1867: 36, 58-59. Type species: *Themos hyaline* Norton. Desig. by Rohwer 1911a.
Themus Schulz 1906: 84. Emendation.
Adiernia Enderlein 1919: 119. **New synonymy.** Type species: *Adiernia semiadusta* Enderlein. Orig. desig.

Antenna short, not more than 1 1/3X head width; 1st segment longer than broad; 2nd segment broader than long; 3rd segment of female antenna laterally compressed, slightly increasing in width toward apex, apex rounded (Fig. 237). Clypeus truncate to subtruncate, about 2X broader than long; labrum truncate; malar space subequal to or slightly less than diameter of front ocellus; mandibles "inflated," bulbous and very large at base tapering to narrow apex in lateral view (Fig. 239); right mandible with tooth near base, left mandible simple or 1 or 2 crenulations near center (Fig. 240); palpi short, less than eye length, maxillary and labial palpi each 3-segmented, with labial palpus subequal to or longer than maxillary palpus, labium simple, without lobes (Fig. 241); eyes small, far apart, scarcely converging below, lower interocular distance about 2X eye length (Fig. 238); head from above enlarged behind eyes, postocellar area long, convex. Forewing (Fig. 236) with radial cell open to faintly closed (R may be faint thus cell sometimes appearing open) with long accessory vein at apex; costa narrower than intercostal area; no intercostal crossvein (Sc); distance between M and Rs+M on Sc+R half or less length of vein M; 3 cubital cells, the last closed cell about as long on radius as on cubitus; small basal anal cell present (forewing of male with costa about as broad as intercostal area). Hindwing (Fig. 236) with anal cell present, of various lengths. Hindbasitarsus about as long as remaining tarsal segments combined. Each tarsal claw with inner tooth and basal lobe (Figs. 242, 243), or only foreclaw with inner tooth and basal lobe and mid- and hindclaws simple each with basal lobe.

These are large, plump species, mostly 9-15 mm long. Many are orange or orange and black with the forewing hyaline or darkly black infuscated and the apex beyond the stigma hyaline. The enlarged mandibles and reduced palpi with the labium lacking lobes are distinctive for *Themos* though the mandibles of a few genera such as *Durgoa* approach them in size.

Malaise (1955) gave a key to *Themos* and (1949) a key to *Adiernia*. *Adierna* included those species with the foreclaw bifid and the mid- and hindclaws simple with a basal lobe, and *Themos* included those species with each tarsal claw bifid. However because of the similarity of mandibles, palpi, and other characters including those of the lancet and male genitalia, I believe all the species included belong to one unit. The male is known for only two species, thus unassociated males may not be correctly identified using the following key. Coloration of sexes, where both are known, is very different.

The biology of one species, *olfersii*, was studied in detail by Dias (1975). He discussed the maternal care of the eggs and larvae by the female and gregarious feeding habits of the larvae. The larvae form cocoons in the soil under the host plant, but it is not known if they cocoon together or not. The cocoon site differs from that of other Dielocerinae which form mass cocoons on tree or shrub trunks and have a communal covering.

Representatives of *Themos* occur from Venezuela and Surinam south to Bolivia and southern Brazil.

KEY TO SPECIES

1. Wings hyaline (each tarsal claw with small or large inner tooth) 2
— Forewing dark black to purplish, apex of wing beyond stigma hyaline 4
2. Yellow, with 3rd or 2nd and 3rd antennal segments, extreme apices of tibiae, and veins (Sc+R, M, M+Cu, 1A, cu-a, Cu_1b, and apex of Rs) in basal half of forewing black (specimen from Venezuela has mesosternum black, apex of stigma black, and most of tarsal segments 2-4 black) . . . . ***laqueatus*** (Enderlein) (F)
— Black and orange, at least dorsum of head, mesonotum, and apex of abdomen black, veins and stigma black 3
3. Mesopleuron and mesosternum orange; abdomen orange with apex black; legs orange . . . . . ***nigronotum*** Malaise (M)
— Mesopleuron and mesosternum black; abdomen black with basal 2-3 sterna orange; legs whitish with apical 4 tarsal segments, extreme apices of tibia, mid- and hindfemora except extreme apices, and coxae and inner surface and apical 1/3 of outer surface of forefemur black (male genitalia as in Fig. 254) . . . . ***olfersii*** (Klug) (M)
4. Abdomen orange 5
— Abdomen black 8

5. Foretarsal claw with inner tooth (Fig. 242), mid- and hindtarsal claws simple with only basal lobe (Fig. 243); midclaw sometimes with minute inner tooth 6
– Each tarsal claw with inner tooth and basal lobe (Fig. 242) 7
6. Apical tarsal segment pale, rest of tarsi black or with black stripe on inner surface; 3rd antennal segment with yellowish-brown pubescense; apex of stigma yellow . . . . ***semiadusta*** (Enderlein) (F)
– Tarsi black, only hindbasitarsus with pale stripe on outer surface at base; 3rd antennal segment with black pubescense; stigma entirely black . . . . ***vigilax*** (Malaise) (F)
7. Sheath orange; body orange; tibiae brownish; about 15 mm long; lancet as in Fig. 249 . . . . ***boliviensis*** Smith (F)
– Sheath black; body yellowish; tibiae lined with black above, yellow below; about 9 mm long; lancet as in Fig. 251 (sheath as in Fig. 246) . . . . ***ochreus***, new species (F)
8. Legs orange, or with only apical 1/5 of tibiae and entire tarsi black 9
– Mid- and hindlegs black or entire tibiae and tarsi black 10
9. Legs entirely orange, or extreme apices of tibiae, apices of basitarsi, and apical 4 tarsal segments blackish; abdomen black ventrally; metanotum black; foretarsal claw with inner tooth (Fig. 242), mid- and hindtarsal claws simple with only basal lobe (Fig. 243); lancet as in Fig. 250, sheath as in Fig. 245 . . . . ***surinamensis*** (Klug) (F)
– Apical 1/5 of tibiae and entire tarsi of mid- and hindlegs black, those of foreleg black only on inner surface; basal abdominal sterna orange; metanotum orange; each tarsal claw with inner tooth and basal lobe (Fig. 242); lancet as in Fig. 248, sheath as in Fig. 247 . . . . ***olfersii*** (Klug) (F)
10. Legs with apices of femora and tibiae and tarsi entirely black (each tarsal claw with inner tooth and basal lobe, Fig. 242; lancet as in Fig. 252; sheath as in Fig. 244; male genitalia as in Fig. 255) . . . . ***malaisei***, new species (F, M)
– Mid- and hindlegs, except for trochanters, black; foreleg with most of tibia and entire tarsus black 11
11. Foretarsal claw with small inner tooth (Fig. 242), mid- and hindtarsal claws simple, only with basal lobe (Fig. 243) . . . . ***similis*** Mocsáry (F)
– Each tarsal claw with a long inner tooth and basal lobe (Fig. 242) (lancet as in Fig. 253). . . . . ***concinnus*** Mocsáry (F)

SPECIES

boliviensis Smith — Bolivia

**Themos boliviensis* Smith 1975: 375, fig. 21. F. "Rosario, Lake Rogagua, Bolivia" (Washington, F).

The lancet and structural characters are similar to those of *malaisei*, only the coloration differs between the two. This could be a color variety, but variation was not evident in series of *malaisei* studied.

concinnus Mocsáry — Peru

**Themos concinnus* Mocsáry 1909: 8. F. "Peru: Pachitea" (Budapest, F).— Malaise 1955: 116.

One specimen other than the holotype has been examined, that a F from "El Campamiento, Peru."

hyaline Norton

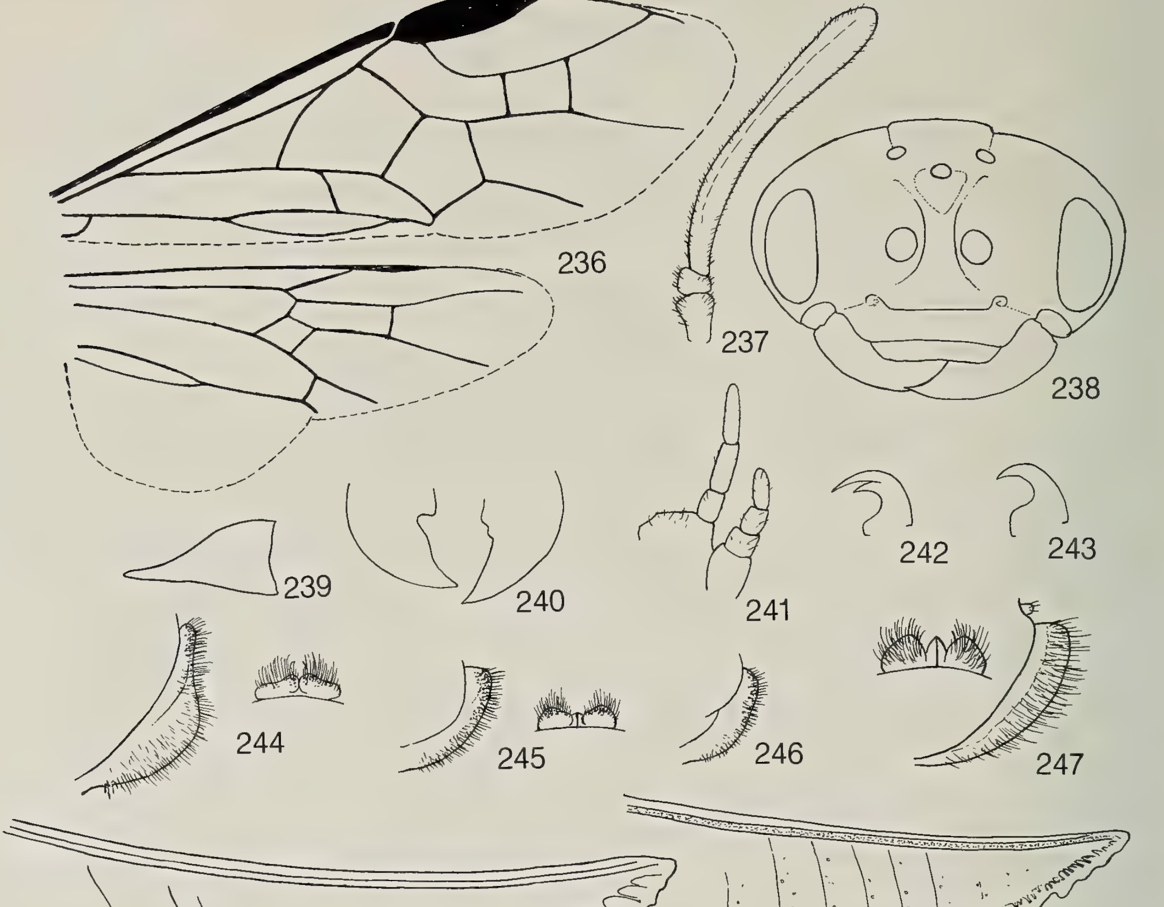
Themos hyaline Norton 1867: 58. M. "Pennsylvania. One male. This came from the Smithsonian Institute and is marked Pennsylvania, but is probably from Mexico or South America." (lost ?).— Dalla Torre 1894: 318.— Konow 1905a: 27.—Malaise 1955: 116 (? syn. of *olfersii*).—Smith 1971a: 524 (holotype not located).

Norton described a male, and the coloration he gives is similar to that of females of *concinnus* and *similis*, but the males of those species are not known. Norton's species cannot be placed until more information on males is available. Most *Themos* are known from females only. This species is not included in the key.

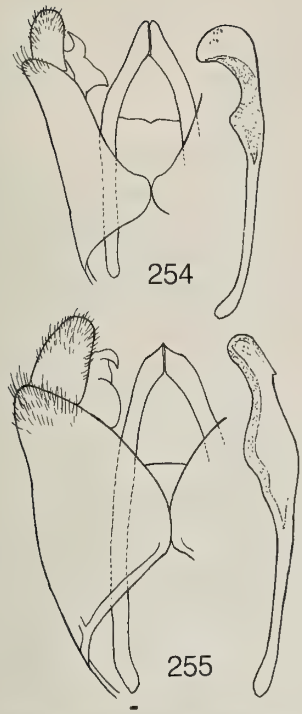
laqueatus (Enderlein) - Ecuador; Venezuela

**Themus laqueatus* Enderlein 1919: 118-119. F. "Ecuador. Baños" (Warszawa, F).
Themos laqueatus: Malaise 1955: 116.

Enderlein examined "2 F", and both are at Warszawa. Both are labeled "Baños (Ecuad.) R. Haensch S.", one with the label "Type" the other "Co=Typus". The specimen labeled type is hereby designated lectotype, the other is a paralectotype. A female from Tabay, Venezuela (Townes Coll.) is similar to the types but has most of the second antennal segment orange, the mesosternum black, the apex of the stigma black, and the extreme apices of the basitarsi and most of tarsal segments 2-4 black. As I could not find structural differences, I regard this as a color variant.



Figs. 236-253. *Themos*. 236, Forewing and hindwing of *T. malaisei*. 237, Female antenna of *T. malaisei*. 238, Front view of head of *T. malaisei*. 239, Side view of mandibles of *T. malaisei*. 240, Mandibles of *T. malaisei*. 241, Palpi of *T. malaisei*. 242, Tarsal claw of *T. malaisei*. 243, Tarsal claw of *T. surinamensis*. Female sheaths of 244, *T. malaisei*; 245, *T. surinamensis*; 246, *T. ochreus*; 247, *T. olfersii*. Female lancets of 248, *T. olfersii*; 249, *T. boliviensis*; 250, *T. surinamensis*; 251, *T. ochreus*; 252, *T. malaisei*; 253, *T. concinnus*.



Figs. 254-255. *Themos*, male genitalia. 254, *T. olfersii*; 255, *T. malaisei*.

malaisei Smith, **new species** — Bolivia; Brazil (Goias, Mato Grosso, São Paulo)

Themos olfersii: Malaise 1955: 116 (misidentification).

Themos malaisei Smith.

Female.—Length, 14.0-17.0 mm. Antenna with 1st segment orange, 2nd segment usually with basal 1/2 orange, apical 1/2 black, 3rd segment black. Head and thorax orange, only metanotum black but dark orange at center. Legs orange; foreleg with black stripe on outer surface of tibia and first 4 tarsal segments; mid- and hindlegs with extreme apices of femora, tibiae entirely, and first 4 tarsal segments black; apical tarsal segments brownish, paler than black preceding segments. Abdomen black. Wings black to purplish to apex of stigma, apex beyond apex of stigma hyaline; veins and stigma black. Antennal length to head width as 5.4:5.5. Lower interocular distance to eye length as 3.3:1.7; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.7:1.2. Length of hindbasitarsus to remaining tarsal segments combined as 2.6:2.5. Sheath thick, scopae blunt (Fig. 244). Lancet short, with deep serrulae and with annuli distinct and protruding (Fig. 252).

Male.—Length, 11.0:13.0 mm. Coloration similar to that of female. Genitalia as in Fig. 255.

Holotype.— F, "São Paulo, Ypiranga, XII-32, 22.147" (São Paulo).

Paratypes.— BOLIVIA: Santiago, Santa Cruz, 8/13-II-1958, Monros (3 F). BRAZIL: Same data as for holotype (4 F, 2 M); same data as for holotype except XII-31 (1 F, 1 M); S. Paulo, XII-02, M. Beron lg. (1 F); S. Paulo, Ypiranga, Lange de Morretes, Coll. 1-II-1937 (1 F); Barueri, Sao Paulo, 3-II-1962, K. Lenko col. (with portion of leaf with eggs on surface) (1 F); Utiariti, Rio Papagaio Mato Grosso, 1-12.XI.1966, Ko and Pereira (1 F); "22 147" (probably same as type locality) (2 F); Annapolis, Goiaz, XII-29-35, G. Fairchild, collector (1 F) (São Paulo, Cambridge, Tucumán, Washington).

Host.— According to Dias (personal correspondence), *Luehea* sp. (Tiliaceae).

Discussion.— Those specimens from the type locality also have a determination label "Parasyzygonia cyanoptera Kl.", but that species is in the Pergidae. Also the last line on the locality label is handwritten and illegible.

This species has been confused with *olfersii*, no doubt due to their similar coloration. However, *olfersii* has most of the tibiae orange, and the males are colored differently than the females and have hyaline wings. In *malaisei*, the tibiae are black and the males are colored similar to the females. The genitalia are also distinct as shown in Figs. 248, 252, 254. 255. The species in Malaise's (1955) key is *malaisei*, not *olfersii*.

nigronotum Malaise — Brazil (Minas Gerais)

Themos nigronotum Malaise 1955: 116. M. "Brazil (Minas Gerais)" (Stockholm, M).

This is possibly the male of another species. I have seen only the holotype. It is orange with the antenna, head, mesonotum, and apex of abdomen black; wings hyaline to lightly, uniformly blackish infuscated.

ochreus Smith, **new species** - Ecuador; Peru

Themos ochreus Smith.

Female.— Length, 9.0 mm. Antenna with 1st and 2nd segments yellow, 3rd segment black. Head, thorax, and abdomen yellow. Legs yellow with black stripe on full length of outer surfaces of fore- and midtibiae and tarsi, outer surface of extreme apex of hindtibia and hindtarsus entirely black; apical tarsal segments brownish, paler than preceding segments. Sheath black.

Forewing blackish to about middle of stigma, hyaline from middle of stigma to apex of wing; hindwing lightly infuscated, hyaline apically; veins and stigma black. Antennal length to head width as 3.5:3.0. Lower interocular distance to eye length as 2.9:1.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.4:0.5. Length of hindbasitarsus to remaining tarsal segments combined as 1.6:1.4. Each tarsal claw with small inner tooth and basal lobe. Sheath with blunt scopae (Fig. 246). Lancet short, serrulae shallow (Fig. 251).

Male.— Unknown.

Holotype.— F, "Upper R. Pachitea, Peru, Jul 21, '30, Cornell U. Exped., Cornell U. Lot 569, Sub. 264" (Ithaca).

Paratype.— ECUADOR: Compana Cocha, 8-8-84 (1 F) (Onore Coll.).

Discussion.— The coloration of *ochreus* is almost identical to that of *semiadusta* except for the black sheath. In *ochreus*, each tarsal claw has an inner tooth, the sheath is narrow in dorsal view, and the size is much smaller (9-11 mm vs. 13 mm). The Ecuador specimen also has a black outer stripe on the hindtibia, but only the 1st antennal segment is yellow, and its length is about 11 mm. It is otherwise the same as the holotype.

olfersii (Klug) — Brazil (D.F., Goiás, Mato Grosso, São Paulo)

Hylotoma (Schizocera) olfersii Klug 1834: 249. F. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 295.

Themos olfersii: Norton 1867: 58.— Kirby 1882: 44.— Dalla Torre 1894: 319.— Konow 1905a: 27 (*Olfersi*).— Malaise 1955: 116 (*hyaline* Norton a possible syn. [*olfersii* in Malaise's key is actually the species here described as *malaisei*, at least in part]).— Smith 1975: 374-375 (F, M; host a).— Dias 1975: 401-432 (biology; maternal care, gregarious behavior of larvae; D.F.; host a).— Smith 1981: 287 (D.F. records).

Host: a) *Eriotheca pubescens* (Bombacaceae)

Two females of *olfersii* are at Berlin, both labeled "13727" and "Brasil. v. Olfers." The specimen with the large green determination label is here designated lectotype, the other with a small white label "*olfersii*" is a paralectotype. I have seen several specimens with a leaf associated on the same pin each bearing 30-50 eggs on the surface. Dias (1975) gave an excellent account of the biology, habits, and behavior of this species.

semiadusta (Enderlein), **new combination** — Ecuador

Adiernia semiadusta Enderlein 1919: 119-120. F. "Ecuador. Balzapamba" (Warszawa, F).

I have seen only the holotype. It is about 13 mm long, orange with the antenna, inner surfaces of fore- and midtibiae, apex of hindtibia, and inner surfaces of first four tarsal segments black; apical tarsal segments yellow; forewing black with apex beyoind stigma hyaline.

similis Mocsáry — Brazil (Amazonas, Pará); Peru

Themos similis Mocsáry 1909: 8. F. "Brasilia: Manaos ad Amazonas" (Budapest, F).

Adiernia surinamensis similis: Malaise 1955: 117.

Other than the holotype, I have seen specimens from Guajara, Mu. Ananindeua, Pará, Brazil, and Tingo Maria, Peru.

surinamensis (Klug) — Brazil (Goias, Pará); Ecuador; Surinam; Venezuela

Hylotoma surinamensis Klug 1814: 307. F. "Surinam" (Berlin, F).— Klug 1834: 249.— Kriechbaumer 1884: 73, 295.

Themos surinamensis: Norton 1867: 58.— Kirby 1882: 44.— Dalla Torre 1894: 319.— Konow 1905a: 27.

Adiernia surinamensis: Malaise 1949: 4.— Malaise 1955: 116.

Host: A specimen from Venezuela bears a label "reared from larva on Ceiba pentandra", 2 others "ex leads of 'cremon' Thespesia populnea (L.) Soland." Fernandez-Yepéz (personal correspondence) stated that he observed larvae feeding on *Ceiba pentandra* in Venezuela but egg laying was on *Thespesia populnea* and no larval feeding was observed on the latter.

Three F of *surinamensis* are at Berlin, each labeled "13726" and "Surinam, Cordua". The specimen with the large green determination label is hereby designated lectotype, the other two with a white label "*surinamensis*" are paralectotypes.

vigilax (Malaise), **new combination** — Brazil (Rio de Janeiro)

Adiernia vigilax Malaise 1949: 2-3, 4, pl. I. F. "Brazil, Est. Rio de Janeiro, Nova Friburgo, 900 m" (Stockholm, F).

From Malaise (1949): "Females sitting on underside of leaf in which they deposited 68 and 87 reddish yellow eggs, respectively. Even in death the females tried to protect their eggs with their bodies." Part of a leaf with eggs on the surface are on the same pin as the holotype.

Genus **TOPOTRITA** Kirby

Topotrita Kirby 1882: 48. Type species: *Hylotoma leucocephala* Klug. Monotypic.

Antenna with 1st segment longer than broad; 2nd segment broader than long; 3rd segment of female antenna laterally compressed, rounded at apex (Fig. 257); antennal length not much more than head width. Malar space distinct, equal to or more than diameter of front ocellus; clypeus truncate, about 2 1/2X broader than long; labrum rounded; both mandibles simple (Fig. 261), slender in lateral view but slightly enlarged at extreme base (Fig. 260); eyes small, scarcely converging below, lower interocular distance greater than eye length (Fig. 257); palpi (Fig. 262) short, maxillary palpus shorter than eye length, maxillary palpus 5-segmented, labial palpus 4-segmented, each uniformly slender, labium 3-lobed; head from above enlarged behind eyes, postocellar area slightly broader than long. Cenchri large and close together, separated by distance of less than half the breadth of one; ventral arms of cervical sclerites broadly rounded on meson and nearly meeting (Fig. 263). Forewing (Fig. 256) with radial cell closed, with accessory vein at apex; costa narrower than intercostal area; intercostal vein (Sc) present; basal anal cell absent; 3 cubital cells, vein 2r-m absent (which normally encloses the 3rd cubital cell) thus the last closed cell (2nd cubital cell) 2X longer than broad and about as long above as below; distance between veins M and Rs+M on Sc+R short, less than half length of vein M. Hindwing with anal cell present, nearly twice as long as its petiole. Length of hindbasitarsus shorter than length of remaining tarsal segments combined; tarsal claws simple.

These are large, plump sawflies, 10-16 mm long, and all have the head, pronotum, and usually the forelegs orange contrasting with the black, shining remaining parts of the thorax and abdomen. The wings are uniformly, darkly, black infusated. Diagnostic features are the lack of vein 2r-m in the forewing, truncate clypeus, simple mandibles, small eyes, head broadened behind the eyes in dorsal view, and the presence of the anal cell in the hindwing.

The species included are those that were separated by Malaise (1955). So few specimens are available (I have seen about 8 including the types) that it is impossible to determine if the sculpturation of the head is constant and valid for species separation. I have seen only one male, that being the one Malaise described as *malleri*.

Nothing is known of the biology. The genus is distributed from northern South America south to Peru and southeastern Brazil.

KEY TO SPECIES

1. A narrow, deep, complete horizontal furrow in back of ocelli separating ocelli from postocellar area (lancet as in Fig. 266, with annuli close together and serrulae close together separated by a distance equal to half or less the width of a serrula; sheath as in Fig. 265).. ***weyrauchi*** Malaise

— Without furrow in back of ocelli, postocellar area blending in with ocellar basin without interruption or a short transverse furrow only immediately behind each ocellus.. 2

2. In profile, head appearing flattened and elongated behind (Fig. 258); larger, 14-16 mm long (lancet with annuli farther apart, serrulae farther apart than *weyrauchi*, Fig. 266, separated by distance equal to the width of a serrula).. ***leucocephala*** (Klug)

— In profile, head rounded, not appearing elongated behind (Fig. 259); smaller, female 13 mm long, male 10 mm long.. ***malleri*** Malaise

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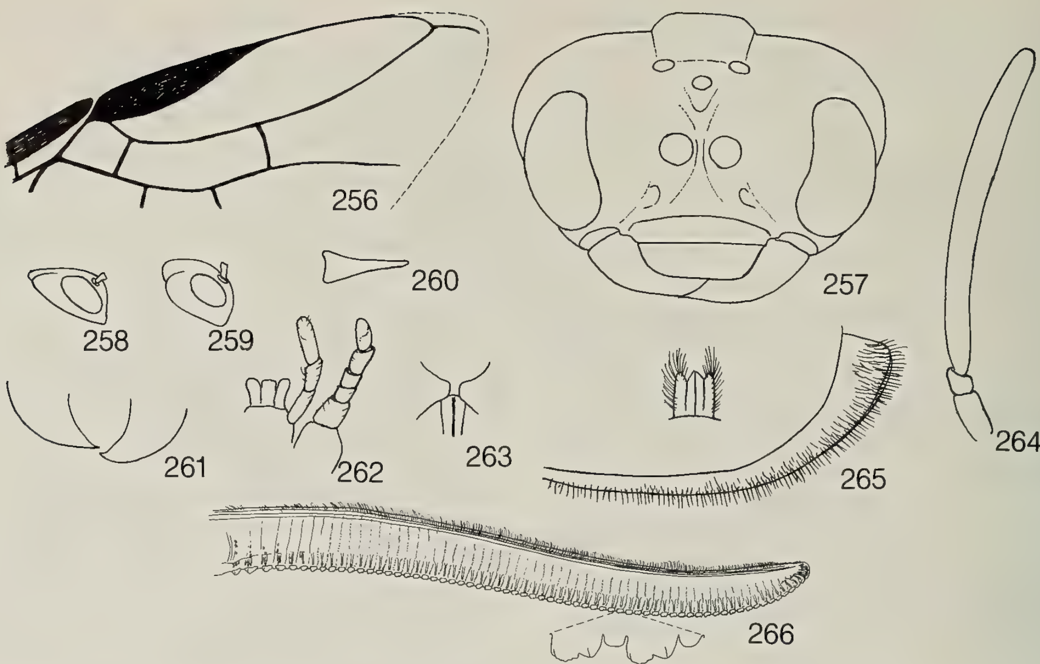
SPECIES

leucocephala (Klug) - French Guiana; Guyana; Surinam

**Hylotoma leucocephala* Klug 1834: 248. F. "Cayenne" (Berlin, F).— Spinola 1840: 132-133 (Cayenne, F).—Norton 1867: 59.— Kriechbaumer 1884: 295.

Topotrita leucocephala: Kirby 1882: 48.— Dalla Torre 1894: 321.— Konow 1905a: 23.— Malaise 1937a: 52-53 (M; Cayenne, Santa Catarina [specimen later described as *malleri*]).— Benson 1930: 620 (British Guiana).— Malaise 1955: 100.

I have seen specimens from Surinam, French Guiana, and the specimen Benson recorded from Guyana.



Figs. 256-266. *Topotrita.* 256, Apex of forewing of *T. weyrauchi.* 257, Front view of head of *T. weyrauchi.* 258, Side view of head of *T. leucocephala.* 259, Side view of head of *T. malleri.* 260, Side view of mandible of *T. leucocephala.* 261, Mandibles of *T. leucocephala.* 262, Palpi of *T. weyrauchi.* 263, Cervical sclerites of *T. weyrauchi.* 264, Female antenna of *T. weyrauchi.* 265, Female sheath of *T. weyrauchi.* 266, Female lancet of *T. weyrauchi.*

malleri Malaise — Brazil (Santa Catarina)

Topotrita leucocephala: Malaise 1937a: 52-53 (in part).
**Topotrita malleri* Malaise 1955: 100. F, M. "Brazil (Santa Catharina, Hansa Humbolt, 60 m., lowland)" (Stockholm, F).

I have seen only the two specimens Malaise described.

weyrauchi Malaise — Brazil (Pará) ?; Peru; Venezuela

**Topotrita weyrauchi* Malaise 1955: 100. F. "Peru (Valle Chanchamayo, 800 m)" (Stockholm, F).

I saw one specimen from Paraitepny, Bol., Venezuela. A specimen from Santarem, Brazil, is similar to *weyrauchi*, but it is smaller and the serrulae of the lancet are slightly farther apart than those of *weyrauchi* (Fig. 266). I provisionally refer this specimen to *weyrauchi*.

Subfamily STERICTIPHORINAE

Sterictophorinae (!) Benson 1938: 375.— Benson 1963: 637 (in part)
Ptiliini Benson 1938: 375
Sterictiphorini Benson 1938: 376 (in part)
Sericocerini Benson 1938: 376 (in part)
Trichorhachinae Benson 1938: 373
Trichorhachini Benson 1963: 634.

Antennal flagellum of male bifurcate (Fig. 273). Head with or without interantennal carina, without genal and other facial carinae. Antennal insertions on head located near or below level of middle of eyes (Figs. 268, 389, 496, 620). Maxillary palpus 6-segmented, labial palpus 4-segmented; labium 3-lobed; 3rd or 2nd and 3rd segments of labial palpus and 4th segment of maxillary palpus sometimes enlarged (Figs. 271, 343, 344, 392, 393, 500, 538-540, 624). Left mandible simple or with small crenulations or teeth near center; right mandible with basal tooth (Figs. 270, 342, 391, 499, 536, 537, 623). Pronotum without diagonal furrow. Cenchri closer together than half breadth of one. Forewing (Figs. 267, 338, 388, 495, 532, 533, 619) without intercostal crossvein (Sc); costa narrower to broader than intercostal area; vein 1r joins base of stigma, apical to junction of stigma and Sc+R; veins M and Rs+M join Sc+R far apart, distance between them on Sc+R usually half or more length of vein M; radial cell open or closed at its apex. Hindwing (Figs. 267, 338, 388, 495, 532, 533, 619) with radial cell open; anal cell present or absent. Wings without basal crossvein Cu_1 between $M+Cu_1$ and 1A. Mid- and hindtibiae without preapical spines; foretibial spurs subequal in length; tarsal claws simple (simple with basal lobe in *Acrogymnidea*, Fig. 294; with long inner tooth in *Neoptilia*, Fig. 469).

This is a large and diverse subfamily, but I see no reason to attempt to further subdivide it. Some further groupings are suggested based on the size of the eyes, head shape, interantennal carina, differences in the maxillary and labial palpi, and general pattern of the female lancets and male genitalia, but there are too many gradations between extremes to form stable units. Though some wing venational differences are convenient for separating some genera and for use in the key (e.g., open or closed radial cell of the forewing, presence or absence of the anal cell of the hindwing), I do not believe they are useful for forming suprageneric categories. They have been relied on too heavily by past workers. Some genera, and even species, have differences in wing venation, and complete reliance on wing venation would separate closely related species.

Benson (1938) provisionally divided this subfamily into the tribes Ptilini, Topotritini, Sterictiphorini, and Sericocerini by the open or closed radial cell of the forewing (Benson mentioned hindwing, but this must have been a mistake) and whether or not the hindcoxae were contiguous or well separated. Some genera in these tribes are here placed elsewhere, those in the Sericocerini in Erigleninae and *Topotrita* in Dielocerinae. Benson (1963) placed everything in the Sterictiphorinae except for those genera in the Arginae and Zenarginae, and noted several tribes. Most of what he included in the Sterictiphorini, except *Eriglenum*, are here included in the Sterictiphorinae.

Key characters for the Sterictiphorinae are the furcate male antennal flagellum, lack of preapical tibial spines, lack of an intercostal vein in the forewing, vein 1r of the forewing joining the stigma, commonly swollen costa of the forewing, absence of basal crossvein Cu_1, usually simple tarsal claws, normal palpi with the maxillary palpus 6-segmented and labial palpus 4-segmented, and the mandibles (left mandible simple or nearly so, right mandible with basal tooth or ridge).

So far as is known, social habits are not developed, and larvae do not form cocoon masses.

Genus ACROGYMNIA Malaise

Hemigymnia Malaise 1937a: 54. Preoccupied by *Hemigymnia* Arnaud 1898. Type species: *Hemigymnia pusilla* Malaise. Orig. desig.

Acrogymnia Malaise 1941: 140. New name for *Hemigymnia* Malaise.

Antenna slender, 1st segment longer than broad, 2nd segment longer than broad, 3rd segment of female antenna tapering to apex, usually rounded (Fig. 272). Eyes large, converging below, lower interocular distance less than eye length (Fig. 268); head from above sharply narrowing behind eyes, postocellar area short, much broader than long (Fig. 269); malar space linear; high sharp carina between antennae, Y-shaped above antennae and lower arm usually bisecting supraclypeal area to clypeus (Fig. 268); left mandible simple or with 1 or 2 small crenulations or teeth at center, right mandible with basal tooth (Fig. 270); palpi as long as eye length, labial palpus may have 2nd and/or 3rd segments enlarged, maxillary palpus usually with segments uniformly slender (Fig. 271). Mesoscutellum flat, in some species sides extended laterally as carinae. Forewing (Fig. 267) with costa swollen, equal to or broader than intercostal area, radial cell open at apex; small basal anal cell present; 3 or 4 cubital cells, the last closed cell broader than long and about as long on cubitus as on radius; distance between M and Rs+M on Sc+R equal to about 1/2-3/4 length of vein M. Hindwing (Fig. 267) usually with anal cell, cell shorter than or equal to its petiole. Length of hindbasitarsus equal to or longer than length of following tarsal segments combined; tarsal claws simple.

Malaise gave a key to species in 1955, but the genus is larger than he indicated. Relevant characters for separation of *Acrogymnia* are the high, sharp, Y-shaped interantennal carina, large eyes which converge below and the lower interocular distance shorter than the eye length, open radial cell of the forewing, quadrate third cubital cell of the forewing, presence of an anal cell in the hindwing (except *acella*), and the palpi which are uniformly slender or only with the third or second and third segments of the labial palpus enlarged. It is close to *Acrogymnidea*, but *Acrogymnidea* has a basal lobe on the tarsal claws. It may also be confused with *Hemidianeura* and *Manaos*, but those two genera have the radial cell of the forewing closed and the interantennal carina is not as pronounced or Y-shaped.

Hosts and biologies are not known. The genus is known from Costa Rica south to northern Argentina.

KEY TO SPECIES

1. Thorax red, in several males some black on anterior half of mesoprescutum and posterior margins of mesonotal lateral lobes (abdomen orange with apical 3-4 segments black; legs orange with foretarsus and mid- and hindtibiae and tarsi black; lancet as in Fig. 282; sheath as in Fig. 280; male genitalia as in Fig. 291) .... ***rufina*** Malaise
— Thorax black or at least with mesosternum and part of mesepisternum black, usually some black on lobes of mesonotum **2**
2. Abdomen orange with apical 2-4 segments black and sometimes black laterally on segments 2-4, basal plates may be black **3**
— Abdomen black or with only basal sterna orange or 1st and 2nd segments brownish **4**
3. Legs orange, apices of fore- and midtarsi black, apex of hindtibia and usually all hindtarsus black; mesonotum mostly black except apex of scutellum; lancet as in Fig. 283, with serrulae rounded and annular spines numerous; sheath as in Fig. 278 (male genitalia as in Fig. 289) .... ***scutimacula*** Malaise
— Legs black with forefemur and tibia and midtibia mostly orange; mesonotum with black on anterior portion of prescutum and most of scutellum; lancet as in Fig. 284, without lateral spines and serrulae flat; sheath as in Fig. 281 .... ***diamantinensis*** Malaise
4. Legs black, at most with whitish on foretibia or whitish on some coxae **5**
— Legs orange or white and black **8**
5. Hindwing without anal cell; parapteron orange (lancet as in Fig. 287, with short annular spines; male genitalia as in Fig. 293) .... ***acella***, new species
— Hindwing with anal cell; parapteron black **6**
6. Thorax black with only pronotum and tegula red (lancet as in Fig. 285; sheath as in Fig. 275; male genitalia as in Fig. 288) .... ***imbogea*** Smith
— Thorax also with some red on mesonotum **7**
7. Pronotum red, upper portion of mesepisternum red, mesonotum red with scutellum black (lancet as in Fig. 286; sheath as in Fig. 277; male genitalia as in Fig. 290) .... ***palama***, new species
— Pronotum black, mesepisternum black, mesonotum mostly red with anterior portion of prescutum black .... ***transtillata*** (Konow)
8. Thorax black or black with tegula and pronotum brownish **9**
— Thorax with mesepisternum, tegula, or pronotum reddish **10**
9. Pronotum and tegula black .... ***pauxilla*** (Konow)
— Pronotum and tegula dark brownish (sheath as in Fig. 276) .... ***pusilla*** (Malaise)
10. Thorax black with lower half of cervical sclerites, lateral pronotum, upper mesopleuron, and tegula orange; legs orange with mid- and hindtibiae and tarsi black; wings hyaline, costa and stigma amber (male genitalia as in Fig. 292) .. .. ***lopesi*** Malaise
— Thorax black with only pronotum and tegula orange; legs with tibiae and tarsi black, coxae and trochanters whitish, femora orange to dark brown; wings lightly uniformly black infuscated, veins and stigma black (antenna 1 1/2X head width) .... ***coxalis*** (Konow)

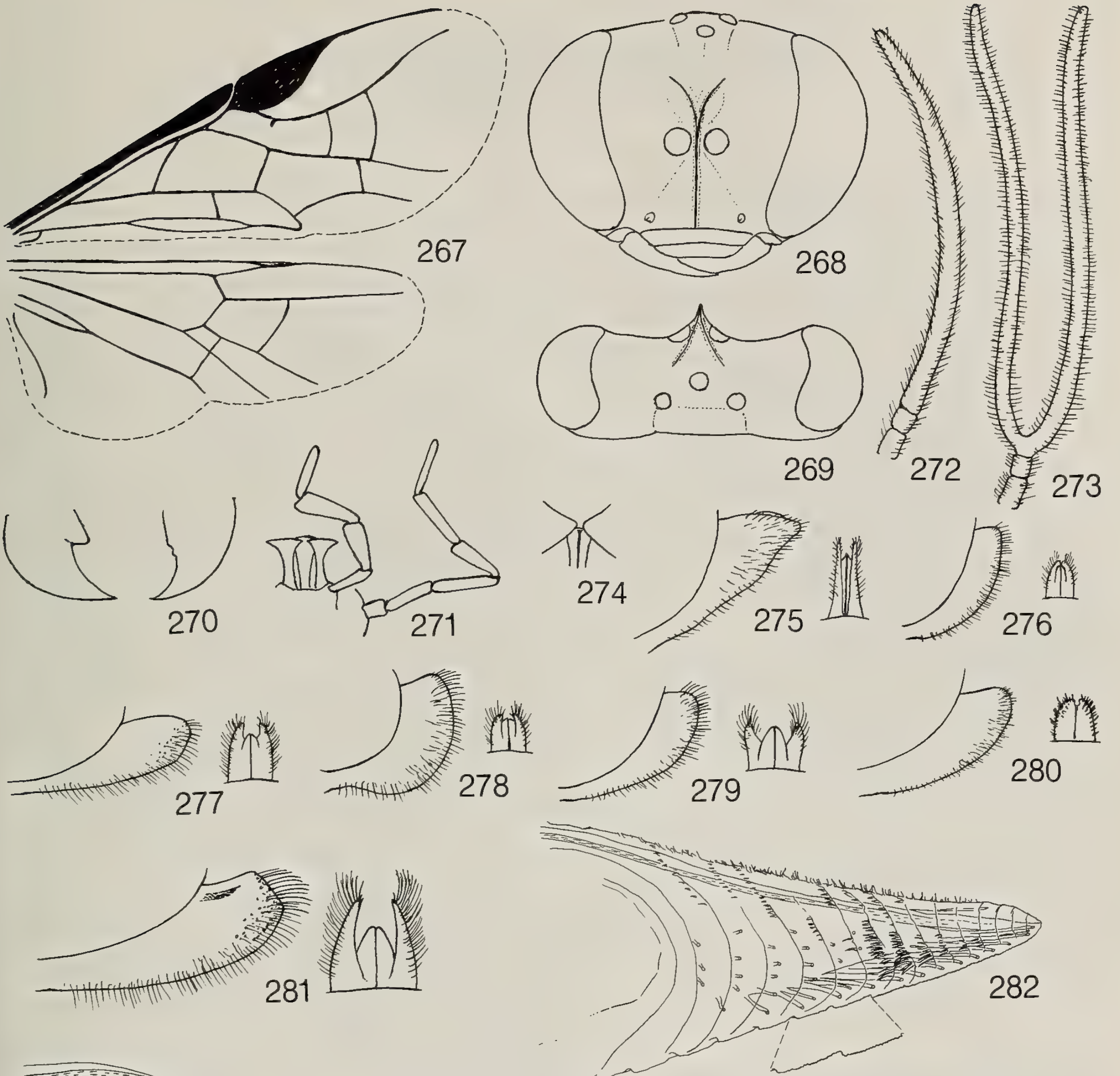
SPECIES

acella Smith, **new species** — Brazil (D.F.)

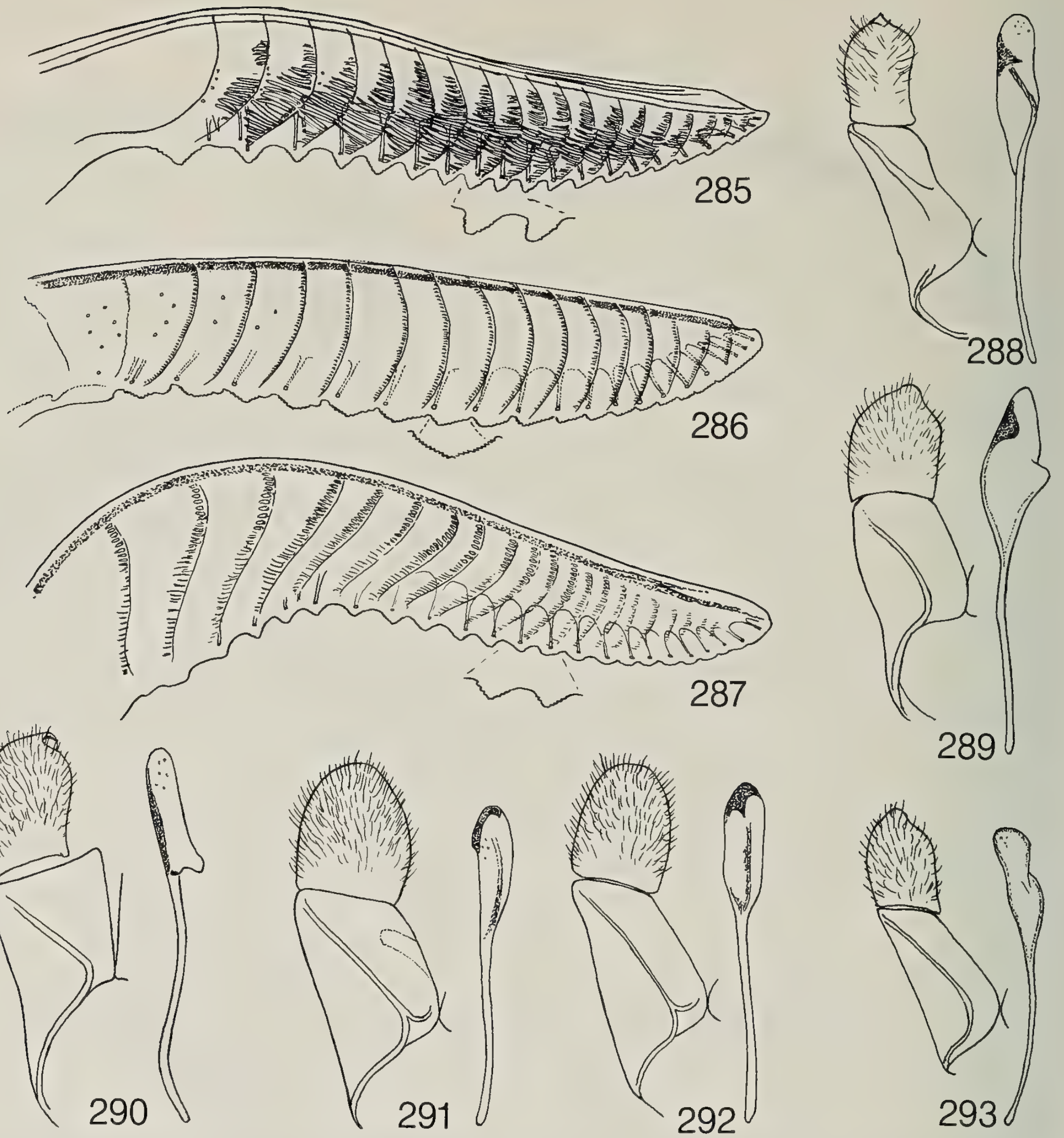
Acrogynmia acella Smith.

Female.— Length, 5.0-5.5 mm. Black with pronotum, parapteron, and tegula orange; apex of forefemur and foretibia whitish. Wings moderately, uniformly black infuscated. Antennal length to head width as 5.2:3.8. Clypeus subtruncate; interantennal carina bisects supraclypeal area to clypeus, Y-shaped above; 3rd segment of labial palpus enlarged; segments of maxillary palpus uniformly slender; lower interocular distance to eye length as 2.0:2.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.5. Forewing with 3 cubital cells, last closed cell short, rectangular, as long on radius as on cubitus. Hindwing without anal cell. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.5:1.5. Sheath as in Fig. 279, with slender, posteriorly projecting scopae. Lancet as in Fig. 287.

Male.— Length, 4.5-5.0 mm. Coloration as for female but may have trochanters, apices of coxae,



Figs. 267-284. *Acrogymnia*. 267, Forewing and hindwing of *A. scutimacula*. 268, Front view of head of *A. scutimacula*. 269, Dorsal view of head of *A. scutimacula*. 270, Mandibles of *A. palama*. 271, Palpi of *A. palama*. 272, Female antenna of *A. palama*. 273, Male antenna of *A. palama*. 274, Cervical sclerites of *A. palama*. Female sheaths of 275, *A. imbogea*; 276, *A. pusilla*; 277, *A. palama*; 278, *A. scutimacula*; 279, *A. acella*; 280, *A. rufina*; 281, *A. diamantensis*. Female lancets of 282, *A. rufina*; 283, *A. scutimacula*; 284, *A. diamantensis*.



Figs. 285-293. *Acrogymnia*. Lancets of 285, *A. imbogea*; 286, *A. palama*; 287, *A. acella*. Male genitalia of 288, *A. imbogea*; 289, *A. scutimacula*; 290, *A. palama*; 291, *A. rufina*; 292, *A. lopesi*; 293, *A. acella*.

extreme apices of femora, and extreme bases of tibiae whitish. Antennal length to head width as 5.0:3.5. Lower interocular distance to eye length as 1.9:2.0. Genitalia as in Fig. 293.

Holotype.— F, "Res. Ecol. IBGE, Km 0 BR 251 - DF, 07 a 14-X-82, 3A-117-5m" (Brasilia, IBGE).

Paratypes.— BRAZIL: Same locality as for holotype, 26-I-2-II-84 (1 F), 9-16-XI-1979 (1 F), 7-14-XI-1980 (1 M), 21-28-XII-1979 (1 M), 13-14-XI-1978 (1 M), 10-17-X-1980 (1 M), 14-21-X-1982 (1 M) (Brasilia, IBGE; Washington).

Remarks.—This is an unusual species of *Acrogymnia* in that the anal cell of the hindwing is absent, thus it might be confused with *Tanymeles*. I place it in *Acrogymnia*, however, because of the high, Y-shaped interantennal carina which bisects the supraclypeal area; the short, rectangular third cubital cell; and the resemblance of the lancet to other *Acrogymnia* species. The coloration is almost identical to that of *imbogea*, from the same locality, but in *acella* the parapteron is orange, the pronotum is black, the anal cell is absent, the lancets differ (Figs. 285, 287), especially the shorter annular spines, and the male genitalia differ (Figs. 288, 293).

coxalis (Konow) — Brazil (Pará)

**Sericoceros coxalis* Konow 1906b: 249. M. "Brasilia (Obidos, B. Tapajos)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 375 ("M lectotypus . . . (des. D.R.Smith 1978), Obidos, 4.8.1902, leg. Ducke").
Acrogymnia coxalis: Smith 1981: 285.

I studied 2 M specimens from Eberswalde, both with type labels. One is labeled "Obidos, 4.8.1902, Ducke," the other "R. Tapajos, Itaituba, 19.8.1902, Ducke." The specimen from Obidos is the lectotype as stated by Oehlke and Wudowenz (1984). I did not publish on this after labeling and returning the specimen in 1978. The other male from Itaituba is a paralectotype.

diamantinensis Malaise — Brazil (Minas Gerais)

**Acrogymnia diamantinensis* Malaise 1955: 104. F. "Brazil, Minas (Campos de Diamantina)" (Stockholm, F).

I have seen only the holotype. The sketch of the lancet (Fig. 284) is from the exerted lancet of the holotype.

imbogea Smith — Brazil (D.F.)

**Acrogymnia imbogea* Smith 1981: 284-285, fig. 23-25. F, M. "Res. Ecol. IBGE, Km 0 Br 251 - DF" (Brasilia, IBGE, F).

I have seen specimens only from the type locality.

lopesi Malaise — Brazil (Rio de Janeiro)

**Acrogymnia lopesi* Malaise 1949: 10. M. "Brazil (Rio de Janeiro, Grajahu)" (Stockholm, M).— Malaise 1955: 105.

I have seen several specimens from Reprêsa Rio Grande, Guanabara, Brazil.

palama Smith, **new species** — Costa Rica; Panama.

Acrogymnia palama Smith.

Female.— Length, 6.3-7.0 mm. Head and antenna black. Thorax orange with cervical sclerites, mesosternum, meso- and metapleurae (except sometimes upper 1/5 of mesepisternum and upper 1/2 of mesepimeron), most of mesoscutellum, and metanotum except for spot behind each cenchrus black. Legs black, trochanters whitish, fore- and midcoxae dark reddish, foretibia brownish. Abdomen black. Wings lightly, uniformly black infuscated; veins and stigma black. Antennal length 1 4/5X head width, as 7.0:3.8. Interantennal carina high, sharp, Y-shaped above antennae, bisecting supraclypeal area below; eyes large and converging below, lower interocular distance slightly less than eye length, as 0.8:1.0; malar space linear; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:1.0:0.5. Length of hindbasitarsus longer than length of following tarsal segments combined. Sheath as in Fig. 277. Lancet as in Fig. 286.

Male.—Length, 5.3-6.0 mm. Color and structure as for female. Antennal length about 1 2/3X head width. Genitalia as in Fig. 290.

Holotype.— F, "Costa Rica, Guanacaste Province, Santa Rosa National Park, D. H. Janzen," "11-V-1-VI-1985, Malaise trap BH-11-0" (Washington).

Paratypes.— COSTA RICA: Same data as for holotype, different trap numbers (24 F, M); same locality as for holotype, all from Malaise traps, trap number omitted, with following dates: 1-22-IV-85 (15 F, M), 29-VIII-14-IX-1985 (9 F, M), 14-IX-5-X-1985 (1 F), 5-26-X-1985 (2 F), 3-24-VIII-1985 (10 F, M), 13-VII-3-VIII-1985 (5 F, M), 16-XI-6-XII-1985 (1 F), 24-V-14-VI-1985 (5 F, M), 26-X-16-XI-1985 (4 F, M), 22-VI-13-VII-1985 (3 F), 2-26-X-1985 (1 F), 6-VI-1976 (1 M), 8-VII-1978 (1 M), 3-VII-1978 (1 M), 7-VII-1978 (1 M), 1-VI-78 (1 M), 14-VII-1977 (1 M), 5-VII-1977 (1 M),

4-IX-1977 (1 M), 7-VII-1977 (2 M), 15-VIII-1977 (1 M), 16-VIII-1977 (1 M), 15-VII-1977 (1 M), 3-VIII-1977 (1 M), 20-VII-1977 (1 M), 1-VII-1977 (1 M), 3-VII-1977 (1 M), 28-VII-1977 (1 M), 4-VII-1977 (1 M), 10-VIII-1977 (1 M), 10-VIII-1977 (1 M), 20-VIII-1977 (1 M), 27-VIII-1977 (1 M), 31-X-1977 (1 M), 6-VII-1977 (1 M), 6-VIII-1977 (1 M), 13-VI-1976 (1 M), 13-VII-1977 (1 M), 12-VII-1977 (1 M), 9-VIII-1977 (1 M), 18-VII-1977 (1 M), 10-VI-1977 (1 M), 12-VI-1977 (1 M), 1-X-1977 (1 M), 16-VI-1977 (1 m), 17-VI-1977 (1 M), 5-VII-1977 (1 F), 13-VIII-1977 (1 M). PANAMA: Taboga Isl., Jun. 9, 11, August Busck (1 F); 4 km N Balboa, Pan Am Hwy, Canal Zone, VI-19-1974, M. L. Siri (1 M); Arraijan A-O, May 18, 1953, Blanton traps, V. Alvarez (1 M); Panama Prov., 5± km SW Balboa, on "Vine" Road, past Palo Seco, 8-23-1984, H.L. Dozier (1 F) (Davis, London, Panama, Townes Coll., Washington).

Remarks.—This species is characterized in the key. The lancet lacks annular spines. It appears to be a relatively common species in Costa Rica.

pauxilla (Konow) — Brazil (São Paulo)

**Sericoceros pauxillus* Konow 1906b: 250. M. "Brasilia (Santos)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 403 (holotype).
Acrogymnia pauxilla: Smith 1981: 285.

This is very similar in color to *pusilla* and may be the male of that species. The pronotum and tegulae are more blackish rather than orange to brown as in *pusilla*. I have seen only the holotype.

pusilla (Malaise) — Brazil (Santa Catarina)

**Hemigymnia pusilla* Malaise 1937a: 54-55. F. "Rio Grande do Sul, Nova Teutonia, Brazil" (Stockholm, F).
Acrogymnia pusilla: Malaise 1941: 140.—Malaise 1955: 105.

See discussion under *pauxilla*. The holotype is labeled as above, but Nova Teutonia is in Santa Catarina. I have seen additional specimens from Nova Teutonia.

rufina Malaise — Brazil (Minas Gerais, Rio de Janeiro, São Paulo)

**Acrogymnia rufina* Malaise 1949: 9-10. F. "Brazil (Rio de Janeiro, Grajahu and Palmeiras)" (Stockholm, F).— Malaise 1955: 105 (F, M).

The male sometimes has several black marks on the mesonotum, otherwise the thorax in most specimens is entirely red. I have seen a number of specimens from each of the Brazilian states listed above.

scutimacula Malaise — Brazil (Santa Catarina)

**Acrogymnia scutimacula* Malaise 1942: 106. F, M. "Santa Catharina, Nova Teutonia" (Stockholm, F).— Malaise 1955: 105.

The holotype F and allotype M are labeled "Rio Gr. do Sul, Nova Teutonia, Plaumann." I have seen many additional specimens from the type locality.

transtillata (Konow) — Peru

**Gymnia transtillata* Konow 1906b: 191-192. M. "Peru (Callanga Cuczo)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 417 (holotype).
Acrogymnia transtillata: Smith 1981: 285.

I have seen only the holotype. It is black with the tegula, mesonotal lateral lobes, mesoscutellum, and apex of mesoprescutum red; legs black with forefemur and tibia brown; wings lightly, uniformly blackish infuscated.

Genus **ACROGYMNIDEA** Malaise

Acrogymnidea Malaise 1955: 106-107. Type species: *Acrogymnidea rioensis* Malaise. Orig. desig.

Antenna (Fig. 297) with 1st and 2nd segments each longer than broad, 3rd segment of female antenna slender or somewhat enlarged at center and flattened. Eyes large, converging below, lower interocular distance less than eye length, as about 3.0:3.5; high sharp interantennal carina, Y-shaped above antennae and bisecting supraclypeal area to clypeus below (as in *Acrogymnia*, Fig. 268); head from above sharply narrowing behind eyes; left mandible simple, right mandible with basal tooth (Fig. 295); palpi as long as eye length, 3rd labial palpal segment enlarged, maxillary palpal segments uniformly slender (Fig. 296); malar space linear. Forewing with radial cell open at apex; costa as broad or broader than intercostal area; small basal anal cell present; 3 cubital cells with last closed cell nearly quadrate, about as long on radius as on cubitus; distance between Rs+M and M on Sc+R equal to more than half length of vein M. Hindwing with anal cell, cell about equal in length or a little shorter than its petiole (wings similar to those of *Acrogymnia*, Fig. 267). Mesoscutellum rounded on margins, not carinate. Tarsal claw with single outer tooth and with large, acute basal lobe (Fig. 294).

Most characters are similar to *Acrogymnia*, including the extremely high interantennal carina. The main difference is the acute basal lobe of the tarsal claw in *Acrogymnidea* which occurs in only one other genus, *Atomacera*. Two species are added to this previously monotypic genus.

Hosts and biologies are not known. The genus occurs from Surinam and Ecuador to southeastern Brazil.

KEY TO SPECIES

1. Mostly black with pronotum, tegula, parapteron, basal sternites, spots at center of 3rd and 4th terga, and legs except for part or all of hindtibia and hindtarsus orange (3rd antennal segment slender; female sheath as in Fig. 299; lancet as in Fig. 302; male genitalia as in Fig. 304) . . . . ***rioensis*** Malaise
— Mostly red or yellow with black only on mesonotum, mesosternum, and at apex of abdomen **2**
2. Mesosternum black; tibiae and tarsi mostly yellow, only apex of fore- and midtibiae and 3rd and 4th or 2nd to 4th tarsal segments of each leg black; forewing faintly yellowish, blackish at apex; 3rd antennal segment slender; lancet as in Fig. 303; sheath as in Fig. 300 . . . . ***udata***, new species
— Underthorax entirely red; tibiae and tarsi black; wings uniformly blackish infuscated; 3rd antennal segment broad, similar to Fig. 297; lancet as in Fig. 301; sheath as in Fig. 298 . . . . ***surinamensis***, new species

SPECIES

rioensis Malaise — Brazil (Minas Gerais, Rio de Janeiro, São Paulo)

**Acrogymnidea rioensis* Malaise 1955: 107. F, M. "Brazil, Rio de Janeiro (Mend*s 92 kms from Rio, and Nova Friburgo)" (Stockholm, F).

Other than the types, I have seen specimens from the following localities in Brazil: Serra do Caraca, *S.* Barbara, Minas Gerais; Barueri, São Paulo; São Paulo.

surinamensis Smith, **new species** - Surinam

Acrogymnidea surinamensis Smith.

Female.— Length, 10.0 mm. Antenna black. Head black with interantennal carina, supraclypeal area, clypeus, labrum, mandible, and palpi orange. Thorax red with large black spots on mesoprescutum and mesonotal lateral lobes. Legs orange red with tibiae and tarsi black. Abdomen red; sheath black. Wings uniformly, lightly, black infuscated; veins and stigma black. Antennal length 2X head width; 1st segment 2X length of 2nd segment; 3rd segment laterally flattened, broader at center than at base or apex (similar to Fig. 297). Postocellar area 2X broader than long. Sheath with short, posteriorly projecting scopae, in lateral view rounded at apex (Fig. 298). Lancet as in Fig. 301.

Male.— Unknown.

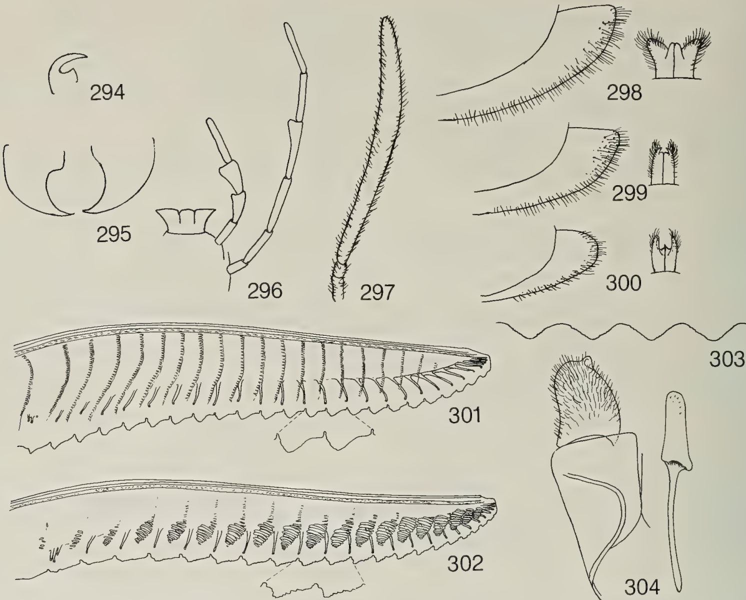
Holotype.—F, "Suriname, Paramaribo, Charlesburg, 29 April 1963, P. H. v. Doesburg, Jr." (Leiden).

Remarks.— The orange abdomen, orange thorax except for the black marks on the mesonotum, and orange legs with the tibiae and tarsi black will separate *surinamensis* from the other two species of *Acrogymnidea*.

udata Smith, **new species** - Ecuador

Acrogymnidea udata Smith.

Female.— Length 9.5 mm. Antenna with outer surfaces of 1st and 2nd segments yellow, inner surfaces black; 3rd segment black. Head black with interantennal carina, supraclypeal area, clypeus, labrum, mandibles, and palpi yellow. Thorax yellow with mesosternum and mesonotum black, spots on lateral edges of mesoprescutum and posterior margin of mesoscutellum yellow. Legs yellowish with following blackish: extreme apices of fore- and midtibiae, 3rd and 4th fore- and midtarsal segments, streak on outer surface of apical 1/3 of hindtibia, and 2nd to 4th hindtarsal segments. Abdomen yellow with apical segment and sheath black, next to last segment mostly black except for lateral margin. Wings faintly yellowish with apex beyond stigma in forewing blackish; stigma brownish with ventral margin more yellowish; veins brownish to more blackish at apex of forewing. Antennal length slightly less than 2X head width; 1st segment 2X longer than 2nd segment; 3rd segment not laterally flattened



Figs. 294-304. *Acrogymnidea*. 294, Tarsal claw of *A. rioensis*. 295, Mandibles of *A. udata*. 296, Palpi of *A. udata*. 297, Female antenna of *A. rioensis*. Female sheaths of 298, *A. surinamensis*; 299, *A. rioensis*; 300, *A. udata*. Female lancets of 301, *A. surinamensis*; 302, *A. rioensis*; 303, *A. udata* (central serrulae). 304, Male genitalia of *A. rioensis*.

and of uniform thickness throughout. Sheath with short, blunt, posteriorly projecting scopae; in lateral view rounded at apex (Fig. 300). Serrulae of lancet as in Fig. 303, otherwise similar to that of *surinamensis*, Fig. 301.

Male.— Unknown.

Holotype.— F, "Sto. Domingo, 680 m., Pich. Prov. Ecuador, V.15-30.1975, S. and J. Peck." (Townes Coll.)

Remarks.— The black mesosternum, black mesonotum, mostly yellowish tibiae and tarsi, and lancet will distinguish *udata* from the other two species. Compare the lancets of the three species of *Acrogymnidea* in Figs. 301-303 for separation.

Genus **ADURGOA** Malaise

Adurgoa Malaise 1937a: 52. Type species: *Hylotoma bonariensis* Holmgren. Orig. desig.

Antenna (Fig. 306) with 1st segment as long as broad with deep circular furrow near base, 2nd segment broader than long, 3rd segment of female antenna slender and may be slightly compressed, tapering toward apex; antennal length shorter than or not more than 1 1/3X head width. Malar space narrow, less than diameter of front ocellus; clypeus truncate; supraclypeal area convex and smooth, interantennal carina rounded without median furrow; eyes small, lower interocular distance longer than eye length (Fig. 307); head from above broadened behind eyes; palpi short, all segments uniformly slender (Fig. 309), maxillary palpus about 1/2 eye length; each mandible with basal tooth (Fig. 308). Forewing (Fig. 305) with radial cell closed, with broader than intercostal area; small basal anal cell present; 4 cubital cells with last closed cell about same length on radius as on cubitus; distance between Rs+M and M on Sc+R more than half length of vein M. Hindwing (Fig. 305) with anal cell present, usually shorter than its petiole. Tarsal claws simple.

This genus is very similar to *Durgoa*, but *Adurgoa* lacks a furrow on the interantennal carina, has a convex, smooth supraclypeal area, has the second antennal segment broader than long, has a quadrate third cubital cell, has the palpal segments of uniform width, and the lancets are shorter with 16 or fewer segments. The lancets of *Durgoa* are long with more than 20 segments (Figs. 385-387).

"*Cassia*" is on the labels of two specimens of *gonagra* from Argentina. Otherwise hosts and biologies are not known. The genus is found in northern Argentina and adjacent countries.

KEY TO SPECIES

1. Mostly black with following whitish: supraclypeal area, center of clypeus, labrum, pronotum (except center), tegula, sometimes part or all of mesoscutellum, metascutellum, sometimes apical margins of abdominal segments, apices of femora, and basal 1/3 of tibiae (sheath as in Fig. 310; lancet as in Fig. 313; male genitalia as in Fig. 316). . . . . ***gonagra*** (Klug)

— Mostly orange, especially mesopleuron, mesoscutellum, and most of legs; abdomen black or orange with black apex. **2**

2. Abdomen mostly black. .... ***ovalis*** (Klug)

— Abdomen orange with apical segments black **3**

3. Coxae orange; at least apical 2/3 of hindtibia black; costa black; clypeus and supraclypeal area black to brownish; lancet with short annular setae, not spines, Fig. 314; sheath as in Fig. 312 .... ***mamillata*** (Konow)

— Coxae, except apices, black; only apical 1/3 of hindtibia black; costa mostly orange; clypeus and supraclypeal area whitish; lancet with long annular spines, Fig. 315; sheath as in Fig. 311. .... ***willinki***, new species

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SPECIES

gonagra (Klug), **new combination** — Argentina (Buenos Aires, Entre Rios); Brazil ("Südbrasilien")

**Hylotoma gonagra* Klug 1834: 251. F. "Südbrasilien" (Berlin, F).— Kriechbaumer 1884: 290.
Ptilia gonagra: Norton 1867: 62.
Hemidianeura gonagra: Kirby 1882: 49, 389 (Argentina).— Dalla Torre 1894: 321.
Ptenus gonagra: Konow 1905a: 25.— Konow 1906b: 182.
Hylotoma bonariensis* Holmgren 1868: 391. F. "Buenos Ayres" (Stockholm, F). **New synonymy.
Ptenus bonariensis: Kirby 1882: 53.— Konow 1905a: 25.
Ptenos bonariensis: Dalla Torre 1894: 323.—Jörgensen 1913: 251.— Forsius 1925a: 6.
Adurgoa bonariensis: Malaise 1937a: 52.

Host: Two specimens from Buenos Aires, Argentina, collected by Jörgensen in 1914 bear the data "esc. l. Cassia."

I have seen additional specimens from Luján, Buenos Aires Province, and Entre Rios Province, Argentina.

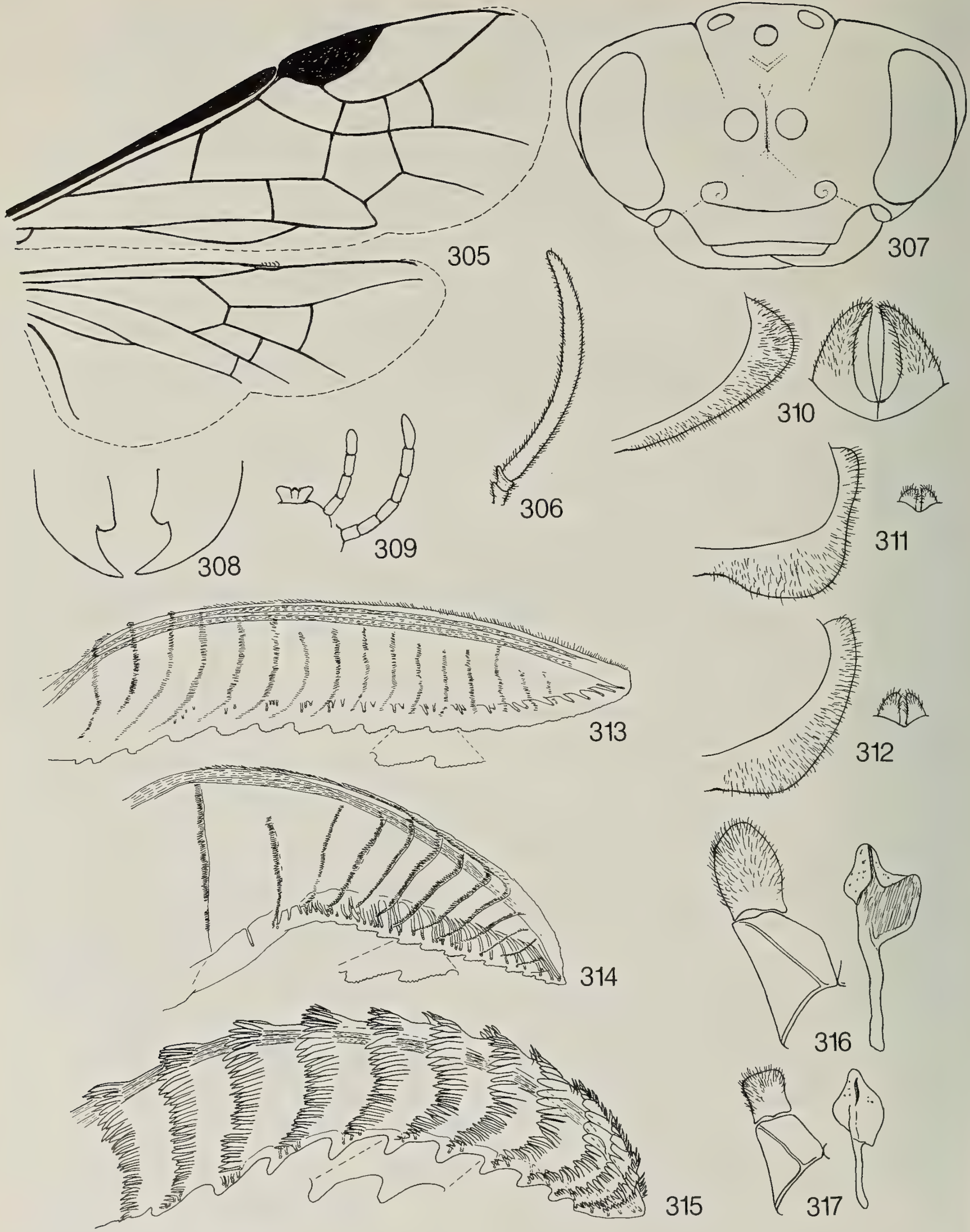
mamillata (Konow), **new combination** — Argentina (Catamarca, Cordoba, Tucumán); Bolivia

**Tanyphatna mamillata* Konow 1906b: 253. F. "Bolivia (Santa Cruz)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 394 ("2 F Lecto- und Paralectotypus (des. D.R.Smith 1978)").

Two females, both the same species and from the same locality, "Sta. Cruz, Süd-Bolivia, *H.* Rolle, Berlin, SW11," are at Eberswalde; the specimen with Konow's determination label is the lectotype, the other a paralectotype, as I labeled them in 1978. Oehlke and Wudowenz attributed this designation to me, but I had not published on it. I have seen specimens from the following Argentina localities: Catamarca, Dpto. Aconquija, El Alamito, 1500 m; Tucumán, Trancas, San Pedro de Colalao; Cordoba.

ovalis (Klug), **new combination** — Argentina; Paraguay; Uruguay

**Hylotoma ovalis* Klug 1834: 241. F. "Montevideo" (Berlin, F).— Kriechbaumer 1884: 290.
Ptilia ovalis: Norton 1867: 62.



Figs. 305-317. *Adurgoa*. 305, Forewing and hindwing of *A. gonagra*. 306, Female antenna of *A. gonagra*. 307, Front view of head of *A. gonagra*. 308, Mandibles of *A. gonagra*. 309, Palpi of *A. gonagra*. Female sheaths of 310, *A. gonagra*; 311, *A. willinki*; 312, *A. mammilata*. Female lancets of 313, *A. gonagra*; 314, *A. mammilata*; 315, *A. willinki*. Male genitalia of 316, *A. gonagra*; 317, *A.* sp.

Hemidianeura ovalis: Kirby 1882: 49.— Dalla Torre 1894: 322.— Brethès 1927: 335 (Paraguay: Villarrica).
Nematoneura ovalis: Konow 1905a: 24.— Jörgensen 1913: 251 (Argentina).

I have seen only the holotype. The Paraguay and Argentina records are from the literature. The sheath is similar to the short, broad sheath of *mamillata* and *willinki*; the color is similar to those two species also, but the abdomen is black with faint lateral yellow stripes, the coxae are mostly black, the basal parts of the mid- and hindtibiae are blackish, and the apical two-thirds of the hindtibia is black. More specimens are needed to evaluate the status of this species.

willinki Smith, **new species** — Argentina (Formosa, Santa Fé)

Adurgoa willinki Smith.

Female.— Length, 5.5-6.0 mm. Head black with supraclypeal area, clypeus, and palpi whitish to yellow orange. Thorax orange with mesosternum (except line at center), lower 1/5 or less of mesepisternum, lower half of mesepimeron, extreme lower edge of metapleuron, mesoprescutum, and mesonotal lateral lobes (except lateral downturned portions) black. Abdomen orange with apical 3-4 segments, 1 or 2 terga anterior to these segments, and sheath black. Legs orange with coxae (except apical margins and sometimes lateral stripe on hindcoxa), apical 1/3 of hindtibia, and hindtarsus black. Wings lightly uniformly black infuscated; veins and stigma black, costa orange becoming blackish at apex. Antenna with 1st segment about as long as broad, 2nd segment broader than long, 3rd segment slender, not flattened, slightly tapering toward apex; antennal length equal to or slightly shorter than head width. Malar space linear; supraclypeal area convex, shining; rounded interantennal carina without a furrow; distances between eye and hindocellus, hindocelli, and hindocellus and posterior margin of head as 0.8:1.0:1.0. Length of hindbasitarsus shorter than length of remaining tarsal segments combined, subequal to following 3 segments. Sheath as in Fig. 311. Lancet as in Fig. 315.

Male.— Unknown.

Holotype.—F, "RA, Santa Fe, Villa Ana, 18.II.1946, Hayward, Willink" (Tucumán).

Paratype.— ARGENTINA: Formosa, Riacho Negro, 24.XI.1950, Monros-Willink (1 F) (Tucumán).

Remarks.— The coloration is most similar to *mamillata*, but *willinki* is separated by those color features in the key as well as by the lancet which has long annular spines.

Genus **APROSTHEMA** Konow

Aprosthema Konow 1899c: 149. Type species: *Hylotoma brevicornis* Fallén. Desig. by Rohwer 1911a.
Lyrola Ross 1937: 55. Type species: *Schizocera brunniventris* Cresson. Orig. desig.

Length of female antenna shorter than head width, of male to 1.5X longer than head width, 1st and 2nd segments each broader than long, 3rd segment of female antenna short and broad (Figs. 318, 319). Eyes small, not converging below, lower interocular distance longer than eye length; head from above broader than long, sharply narrowing behind eyes, and depressed or concave anteriorly between eyes (Fig. 318); without interantennal carina; malar space broader than diameter of front ocellus; clypeus truncate; labrum rounded; left mandible simple, right mandible with basal tooth; palpi shorter than eye length, segments uniformly narrow. Forewing with radial cell open; costa about as broad as intercostal area; 4 cubital cells, last closed cell rectangular, as long on radius as on cubitus; distance between M and Rs+M on Sc+R about half length of vein M; basal anal cell absent. Hindwing with anal cell present, slightly longer than its petiole. Tarsal claws simple.

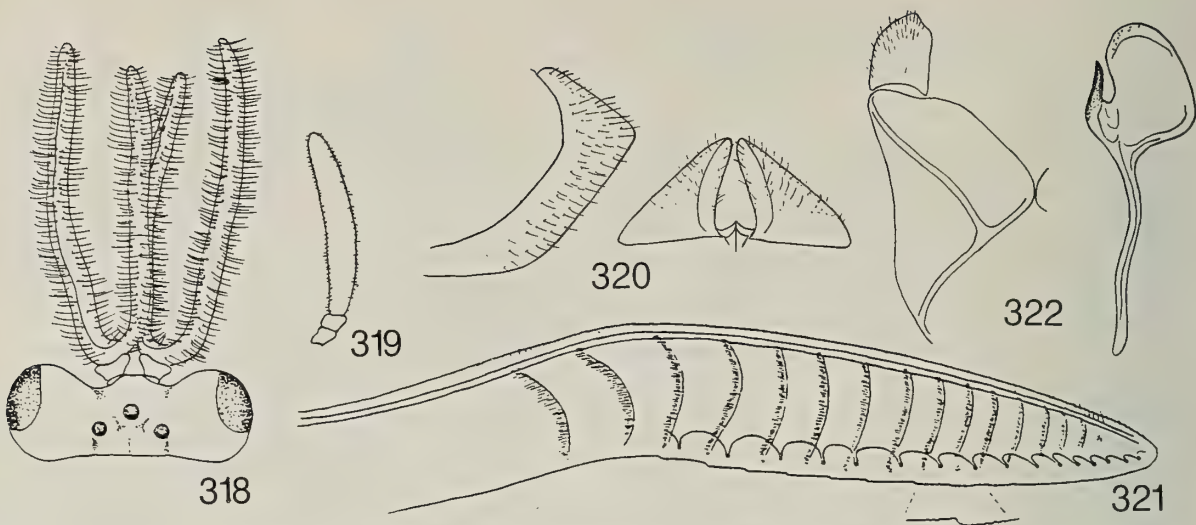
This genus is recognized by the broad head, depressed between the eyes in dorsal view, broad malar space, short and uniformly slender palpi, open radial cell of the forewing, absence of a basal anal cell in the forewing, and the anal cell of the hindwing longer than its petiole.

Aprosthema is a holarctic genus with about 15 species. Smith (1971b) treated two species in western North America, one of which reaches northern Mexico.

SPECIES

brunniventre (Cresson) — Mexico (Baja California Norte); U.S.A. (California, Nevada, Oregon, Washington)

**Schizocera brunniventris* Cresson 1880: 2. F, M. "Nevada" (Philadelphia, F).— Dalla Torre 1894: 312.— Konow 1905a: 29.— Cresson 1916: 3 (holotype).
Lyrola brunniventris: Ross 1937: 55 (syn.: *tristis* Cresson, *fumipennis* Dyar; hosts b, c).
Aprosthema brunniventris: Ross 1951: 15 (host c).— Smith 1971b: 547-549, fig. 8, 9, 21, 22, 53, 85, 86 (description; genitalia fig.; hosts a, b).— Smith 1972: 170-171, fig. 11-15 (larva; host b).— Smith 1979: 23 (host b).
**Schizocera tristis* Cresson 1880: 52. F, M. "Washington Territory" (Philadelphia, F).— Dalla Torre 1894: 314.— Konow 1905a: 29.— Cresson 1916: 9 (holotype).



Figs. 318-322. *Aprosthema brunniventre*. 318, Dorsal view of head of male. 319, Female antenna. 320, Female sheath. 321, Female lancet. 322, Male genitalia.

**Schizocera tristis* var. *fumipennis* Dyar 1893: 195. F, M, larva. Yosemite, California. (Washington, F) (host a; biological notes).— Smith 1971b: 548 (lectotype).— Smith 1987: 370, 387 (lectotype; discussion of Dyar's work).

Hosts: a) *Hosackia grandiflora*; b) *Hosackia*; c) *Lotus* (Leguminosae).

The female sheath, female lancet, and male genitalia are as in Figs. 320-322. I have seen three specimens from Baja California Norte, Mexico: 20 mi. N. Punta Prieta, III-29-1973; 1 mi NE El Socorro, III-25-1973, sand dunes. One bears the data "on Malacothrix californica: and another "Oenothera (Camissonia) bistorta." These are probably adult collection data. All specimens are in the Berkeley collection.

Genus **BRACHYPHATNUS** Konow

Brachyphatnus Konow 1906b: 250-251. Type species: *Brachyphatnus debilicornis* Konow. Desig. by Rohwer 1911a.

Antennal length in female usually less than head width, in male slightly longer than head width; 1st segment longer than broad, 2nd segment broader than long; 3rd segment of female antenna round in cross section (Fig. 325). Clypeus truncate to slightly emarginate; interantennal area rounded, without sharp carina; malar space equal to or less than diameter of front ocellus; eyes small, only slightly converging below, with lower interocular distance greater than eye length (Fig. 324); head from above narrowing behind eyes; palpi shorter than or subequal to eye length, segments of uniform width (Fig. 327); left mandible simple, right mandible with basal tooth (Fig. 326). Forewing (Fig. 323) with radial cell open at apex; costa swollen, broader than intercostal area; with 3 or 4 cubital cells, the last closed cubital cell square, as long on radius as on cubitus; basal anal cell present; distance between M and Rs+M on Sc+R half or more length of vein M. Hindwing (Fig. 323) with anal cell, sometimes basal portion faint and appearing open, length of cell subequal to length of its petiole. Hindtibia with collar at apex, hindtibial spurs arising from base of collar and not extending much beyond apex of collar (Fig. 328); length of hindbasitarsus shorter than length of remaining tarsal segments combined; tarsal claws simple.

Brachyphatnus resembles *Sphacophilus* and *Schizocerella*, but it is separated from them and other genera by the collar at the apex of the hindtibia and presence of an anal cell in the hindwing. Malaise (1955) gave a key to species, but "*B. annulipes*" in his key belongs to the genus *Subsymmia*, and "*B. jenseni*" is a misidentification and is the same as the new species described here. *Brachyphatnus jenseni* Konow belongs in the genus *Schizocerella*.

This genus is known only from Uruguay, Argentina, and northern Chile. Hosts are not known except for one label associating a specimen of *tegularis* with Malvaceae and Parker et al. (1953) record of *tegularis* from *Malva* sp.

KEY TO SPECIES

1. Female 2
— Male 4
2. Mesonotum black with margins of lobes orange; abdomen orange dorsally (sheath as in Fig. 329; lancet as in Fig. 332). . . . . ***vescus***, new species
— Mesonotum red; abdomen black 3
3. Mesopleuron black; tegula red; wings hyaline with costa and stigma amber to light brown; lancet as in Fig. 334; sheath as in Fig. 331 . . . . ***debilicornis*** Konow
— Mesopleuron usually partly or all red; tegula black; wings lightly infuscated black with costa and stigma black; lancet as in Fig. 333; sheath as in Fig. 330 . . . . ***tegularis*** (Konow)
4. Thorax with pronotum and usually part of mesonotum and mesopleuron orange to red; abdomen black, sometimes segments 2-6 orange to reddish (genitalia as in Fig. 337) . . . . ***tegularis*** (Konow)
— Thorax black with tegula black or partly white; abdomen black 5
5. Head in profile with supraclypeal area distinctly protuberant; antennae only slightly longer than head width; genitalia as in Fig. 336 . . . . ***debilicornis*** Konow
— Head in profile with supraclypeal area flattened; antennae about 1 1/3X head width; genitalia as in Fig. 335 . . . . ***vescus***, new species

SPECIES

debilicornis Konow — Argentina (Mendoza, Salta)

**Brachyphatnus debilicornis* Konow 1906b: 251-252. F, M. "Rep. Argentina (Mendoza)" (Eberswalde, F).— Jörgensen 1913: 261.— Malaise 1955: 109.— Oehlke and Wudowenz 1984: 376 (2 M, 1 F syntypes at Eberswalde).

I examined the three synytpes from Eberswalde. All are labeled "Mendoza, Amer. mer." The female is here designated lectotype, the two males are paralectotypes. I have examined additional specimens from Mendoza and one specimen from Salta, Argentina.

tegularis (Konow) — Argentina (Buenos Aires, La Rioja, Salta, Santa Fé, Santiago del Estero, Tucumán); Uruguay

**Schizoceros tegularis* Konow 1899b: 403. F, M. "Argentina resp. (Buenos Aires, Tandil, Chacabuco)" (Eberswalde, M).— Konow 1905a: 29.— Oehlke and Wudowenz 1984: 415 (1 F syntype at Eberswalde).
Brachyphatnus tegularis: Konow 1906b: 251.— Malaise 1955: 109.
Schizocera tegularis: Enderlein 1919: 120 (Mendoza [probably not *tegularis*]).
Sterictiphora sp.: Parker et al. 1953: 45 (Los Brenas, Argentina; host a; parasite: *Boethus* sp.).
Brachyphatnus tegularis rosarioensis* Malaise 1955: 109. M. "Argentina, Prov. Santa Fé (Rosario)" (München, M). **New synonymy.

Hosts: a) on *Malva* sp. (Malvaceae); b) "Malvaceae" is on labels of two specimens from Uruguay.

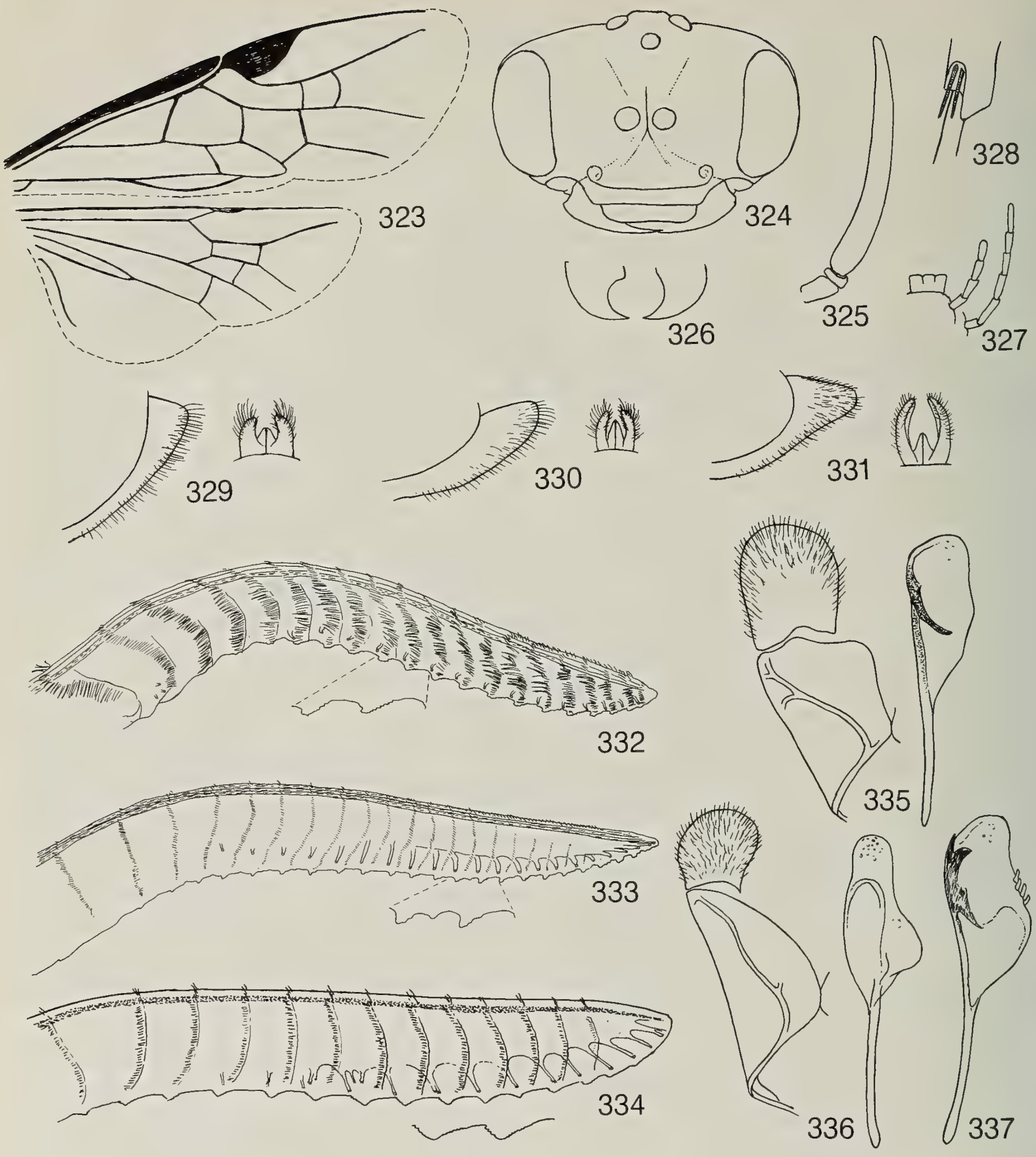
Malaise's subspecies is a male of *tegularis*. The color differs slightly from most males in that the tegula and clypeus are mostly black. I saw one male labeled "type" of *tegularis* from Eberswalde and "Rep. Argent." is on the determination label. I am designating this specimen the lectotype. The female and possibly other specimens of the type series may be unlocated at Buenos Aires. I have examined specimens from the following Argentina localities: Yuto; Tucumán, Villa Marcos Paz; Oran, Abra Grande, Salta; Santiago del Estero, Termas de Rio Hondo; Salta, Rio Mescado; La Rioja; Buenos Aires. The Uruguay specimens are from Las Brenas, Chaco.

vescus Smith, new species—Chile (Atacama, Coquimbo)

Brachyphatnus jenseni: Malaise 1955: 108 (misidentification).

Brachyphatnus vescus Smith.

Female.— Length, 4.8-5.2 mm. Antenna black. Head black, spot on supraclypeal area, clypeus, mandible, and mouthparts yellow orange; labrum whitish. Thorax black, pronotum, lines along sutures of mesonotum, lateral margins of mesonotum, posterior margin of mesoscutellum, and metascutellum orange. Abdomen mostly dark orange above, blackish below; dorsum suffused with blackish on lateral margins and



Figs. 323-337. *Brachyphatnus*. 323, Forewing and hindwing of *B. tegularis*. 324, Front view of head of *B. debilicornis*. 325, Female antenna of *B. debilicornis*. 326, Mandibles of *B. debilicornis*. 327, Palpi of *B. debilicornis*. 328, Apex of hindtibia of *B. debilicornis*. Female sheaths of 329, *B. vescus*; 330, *B. tegularis*; 331, *B. debilicornis*. Female lancets of 332, *B. vescus*; 333, *B. tegularis*; 334, *B. debilicornis*. Male genitalia of 335, *B. vescus*; 336, *B. debilicornis*; 337, *B. tegularis*.

at apex, venter suffused with orange at base. Sheath black with orange spot laterally at base. Legs yellow orange with most of coxae (except extreme apices), most of forefemur (except extreme apex), about basal 2/3 of midfemur, and about basal 1/3 to 1/2 of hindfemur black. Wings hyaline; veins and stigma brownish to black with costa except extreme apex white. Antennal length about 4/5 head width. Malar space less than 1/2 diameter of front ocellus; interantennal area rounded; supraclypeal area, in profile, not protuberant; clypeus truncate; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.5:2.0:1.0; lower interocular distance 1 1/2X eye length. Length of hindbasitarsus subequal in length to 3 following tarsal segments combined. Sheath (Fig. 329) with stout scopae. Lancet as in Fig. 332, with long annular hairs.

Male.— Length, 4.7-5.0 mm. Head, thorax and abdomen black, only labrum, mandible, palpi, and posterior 1/2 of tegula white to yellow orange; legs colored as in female. Antennal length about 1.75X head width. Genitalia as in Fig. 335.

Holotype.— F, "Chile, Atacama: Pajonales, X-19-1971, Rozen and Pena" (New York).

Paratypes.— CHILE: Same data as for holotype (1 F, 6 M); Atacama, 55 km S. Copiapo, X-21-1971, Rozen and Peña (2 M); Atacama, 26 mi S. Copiapo, X-19-1969, Rozen and Peña, collectors (2 M), X-18-1969 (1 M), X-22-1969 (1 M); Coquimbo: Llano de la Higuera, N. of El Tofo, X-14-1971, Rozen and Peña (6 F, 1 M); 10 k Norte Copiapo, Desierto, VIII-1965, R. Charlin, collector (1 M); N. Castilla, Vallenar, Prov. Atacama, 24 Oct. 1969, coll. L.E. Peña (2 F, 5 M). (Mus. Nac. Santiago, New York, San Francisco, Washington).

Remarks.— This species is separated from other species of *Brachyphatnus* by the mostly black thorax (without reddish markings) and more orange abdomen (not black on dorsum) and by the genitalia (compare Figs. 332-337). Some variation of color is evident. The clypeus and supraclypeal area is black in some specimens and the upper corner or margin of the mesepisternum may be yellow orange.

Malaise (1955) included this species in his key under the name "*jenseni*" (see *Schizocerella*).

Genus **DIDYMIA** Lepeletier and Serville

Didymia Lepeletier and Serville 1828: 574. Type species: *Hylotoma martini* Lepeletier. Monotypic.

Gymnia Brullé 1846: 668. "*Gymnia* Lep." listed in synonymy of *Didymia*; the only species in *Didymia* mentioned is *martini* Lepeletier; Lepeletier apparently did not describe the genus.

Rusobria Cameron 1878: 150. **New synonymy.** Type species *Rusobria carinata* Cameron. Desig. by Rohwer 1911a.

Tanyphatna Konow 1906b: 187. **New synonymy.** Type species: *Tanyphatna pellos* Konow. Desig. by Rohwer 1911a.

Hemidianeurina Forsius 1925: 6. Type species: *Hemidianeurina nobilis* Forsius. Orig. desig.

Antennal length usually not more than 1.5X head width; 1st segment longer than broad; 2nd segment only slightly longer than broad in female, usually broader than long in male; 3rd segment of female antenna usually slightly laterally flattened (Figs. 340, 341). Clypeus subtruncate; malar space linear; left mandible simple, right mandible with basal tooth (Fig. 342); maxillary palpus longer than eye length, with 4th segment dilated, 3rd and sometimes 2nd labial palpal segments dilated (Figs. 343, 344); eyes usually large, converging below, lower interocular distance shorter than or slightly greater than eye length (Fig. 339); head from above usually narrowing behind eyes; interantennal carina low and rounded or sharp and bisecting half or less of supraclypeal area below. Forewing (Fig. 338) with radial cell closed at apex and with long accessory vein, usually 3 cubital cells (4 in a few species) with last closed cubital cell much longer on radius than on cubitus; costa slightly narrower than to broader than intercostal area; distance between M and Rs+M on Sc+R equal to about half length of vein M; small basal anal cell present. Hindwing (Fig. 338) with anal cell, usually shorter than or equal to its petiole. Tarsal claws simple.

Members of *Didymia* are somewhat diverse in size and color, but the following help define the genus: eyes large and converging below; linear malar space; long maxillary palpus; segment 3 of labial palpus and segment 4 of maxillary palpus short and strongly dilated; interantennal area usually rounded or with a low carina; radial cell of forewing closed with long accessory vein; last closed cubital cell longer on radius than on cubitus; and anal cell present in hindwing. The female sheath of most species is broad with blunt postero-laterally projecting scopae.

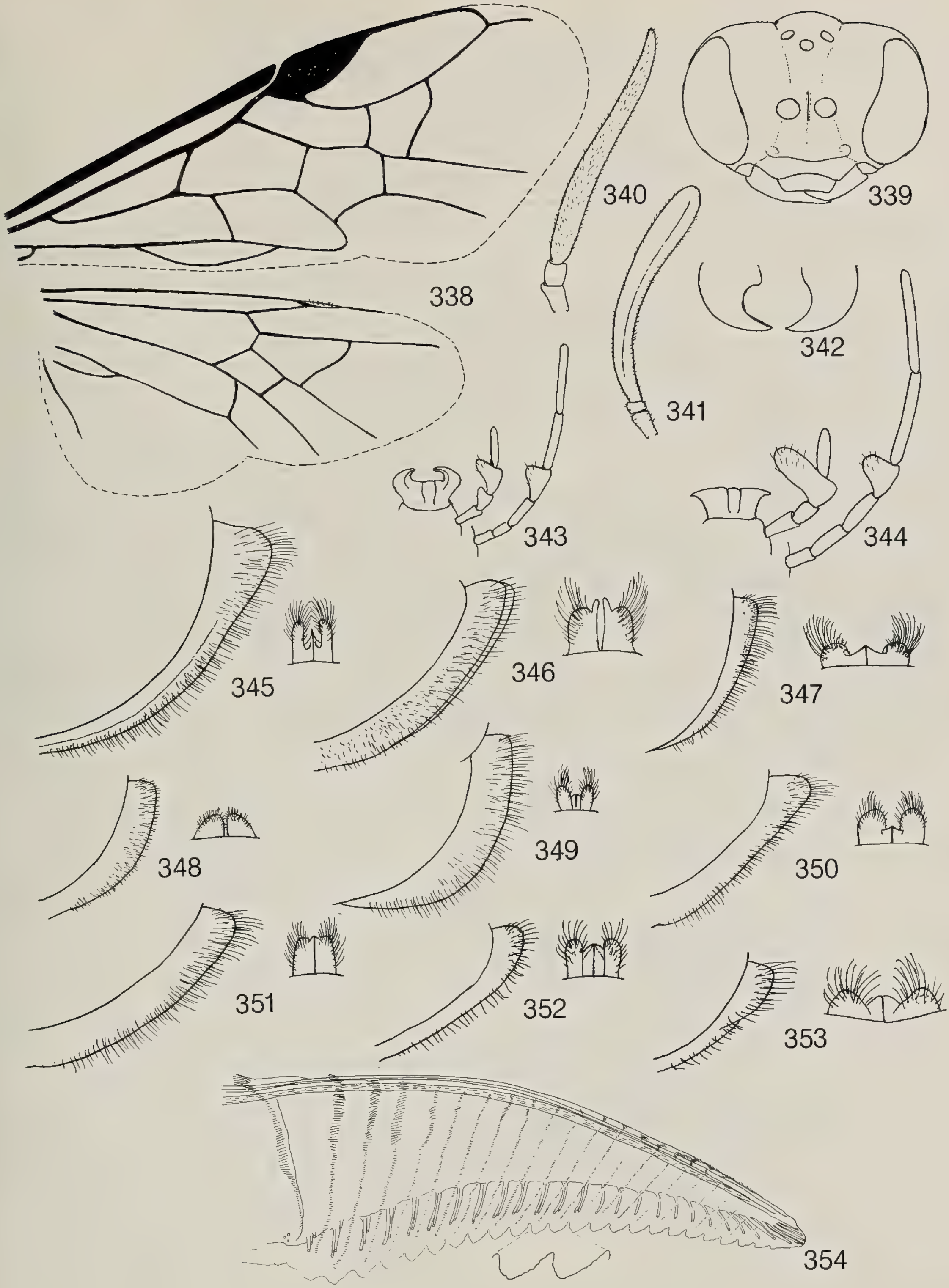
Many of these species were once placed in *Ptilia*, and *Didymia* was considered synonymous with *Ptilia* by some authors (e.g., Konow 1905a). Malaise (1949) gave characters to separate the two genera, primarily the presence of an interantennal carina and the rounded blunt sawsheath of the female of *Didymia*. In *Ptilia*, the face between the antennae is more depressed, and the female sawsheath is narrow in dorsal view and acute at its apex in lateral view. Also, the female lancets of *Ptilia* are short and triangular, usually with less than 12 segments (Figs. 505-509). *Tanyphatna* was separated by the somewhat smaller eyes with the lower interocular distance slightly greater than the eye length, the somewhat more compressed female antenna, and the head in dorsal view more broadened behind the eyes. I do not consider these sufficient for generic separation inasmuch as there are degrees of gradation within the genus.

Malaise (1949) regarded *Tanyphatna catinifera* Konow as type species of *Tanyphatna*; however, Rohwer (1911a) had already designated the type. The genus name *Gymnia* first appeared in Brullé (1846). Later authors attributed the name to Spinola (1851) who characterized it and described two species. Rohwer (1911a) designated *G. apicalis* Spinola as type species of *Gymnia* Spinola. *Gymnia* Spinola is listed in the synonymy of *Tanymeles* as a preoccupied name.

Little is known of the biology and only two host plants, *Rourea* and *Connarus*, have been recorded. The genus is known from Panama and Surinam south to Peru and southern Brazil.

KEY TO SPECIES

1. Abdomen black, or black with basal 3 or 4 terga laterally and basal 3 or 4 sterna orange **2**
— Abdomen yellow or orange, apical 3 or 4 segments may be black **11**
2. Thorax black **3**
— Thorax with pronotum and/or part or all of mesothorax red or orange **5**
3. Abdomen black or with basal 3 or 4 terga laterally and basal 3 or 4 sterna orange; forewing with broad black band below stigma, base and apex hyaline (sheath as in Fig. 347; lancet as in Fig. 361) . . . . ***connarusae***, new species
— Abdomen black; forewing with black band below stigma and black at base or hyaline with apex black **4**
4. Foreleg black; 3 cubital cells in forewing; forewing hyaline at base, infuscated black from base of stigma to apex . . . . ***pellos*** Konow
— Foretibia and/or tarsus with white; 3 or 4 cubital cells in forewing; forewing infuscated black at base, center, and apex with hyaline bands between (sheath as in Fig. 345; lancet as in Fig. 363) . . . . ***carbonaria*** (Cameron)
5. Thorax black with only mesonotum partly or all red or orange **6**
— Other parts of thorax with some orange or red coloration **7**
6. Mesonotum orange, may be blackish at apex of prescutum or on scutellum; forewing lightly, uniformly infuscated, a little paler toward apex; 4 cubital cells in forewing . . . . ***crassicornis*** (Cameron)
— Mesonotum with lateral lobes orange, prescutum and scutellum black; forewing infuscated basally and beyond base of stigma, hyaline at center; 3 cubital cells in forewing . . . . ***soror*** (Kirby)
7. Legs white with apex of hindtibia and tarsus black; clypeus and supraclypeal area white (forewing black at base, below stigma, and at apex, with 2 hyaline bands in between; thorax black with pronotum, tegula, mesonotal lateral lobes, mesoscutellum, upper 1/3 mesepisternum, and metathorax orange; sheath as in Fig. 348; lancet as in Fig. 362; male genitalia as in Fig. 371 . . . . ***bicolor*** (Kirby)
— Legs black, foretibia may be paler; clypeus and supraclypeal area black **8**
8. Forewing uniformly hyaline; thorax black with pronotum, mesonotal lateral lobes, and mesoscutellum orange . . . . ***pumilio*** (Kirby)
— Forewing fasciate or hyaline with apex more blackish; thorax with different color combination **9**
9. Forewing black at base and below stigma, hyaline at center and at apex; thorax black with pronotum, mesopleuron, mesonotal lateral lobes and mesoscutellum orange (sheath as in Fig. 349; lancet as in Fig. 360) . . . . ***nasuta*** (Cameron)
— Forewing hyaline at base, blackish toward apex; thorax with different color combination **10**
10. Thorax with only pronotum and mesoprescutum orange; female antenna longer than head width; lancet as in Fig. 358; male genitalia as in Fig. 370 . . . . ***resa***, new species
— Thorax with pronotum, tegula, mesoscutellum, and metascutellum orange; female antenna shorter than head width; lancet as in Fig. 359; male genitalia as in Fig. 369 (sheath as in Fig. 352) . . . . ***breva***, new species



Figs. 338-354. *Didymia*. 338, Forewing and hindwing of *D. martini*. 339, Front view of head of *D. martini*. 340, Female antenna of *D. martini*. 341, Female antenna of *D. carbonaria*. 342, Mandibles of *D. trigemmis*. 343, Palpi of *D. martini*. 344, Palpi of *D. carbonaria*. Female sheaths of 345, *D. carbonaria*; 346, *D. unifasciata*; 347, *D. connarusae*; 348, *D. bicolor*; 349, *D. nasuta*; 350, *D. elegans*; 351, *D. trigemma*; 352, *D. breva*; 353, *D. martini*. 354, Female lancet of *D. trigemma*

11. Thorax black 12
— Thorax orange or reddish, at most black marks on lobes of mesonotum and/or on mesosternum 15
12. Legs black (lancet as in Fig. 364; abdominal segments 2-4 orange; antennal length subequal to head width) . . . . . **teusa**, new species
— Legs white or mostly orange 13
13. Legs entirely white (forewing blackish with somewhat hyaline center band) . . . . . **albipes** (Konow)
— Legs orange with some black on hindtibia and tarsus and sometimes on femora 14
14. Legs orange with hindtibia and tarsus sometimes black; forewing black at base, apex, and below stigma, with intervening areas hyaline; abdominal segments 2-6 orange (lancet as in Fig. 355; sheath as in Fig. 350; male genitalia as in Fig. 368 . . . . . **elegans** (Klug)
— Legs orange with apices of mid- and hindfemora, apex of hindtibia, and entire hindtarsus black; forewing uniformly black, but somewhat paler beyond stigma; abdominal segments 1-6 orange . . . . . **lugubris** (Klug)
15. Abdomen orange; mesoprescutum and/or mesonotal lateral lobes and mesosternum sometimes with black spots (forewing yellow with apex blackish; legs yellow with hindtarsus black; lancet as in Fig. 354; sheath as in Fig.351; male genitalia as in Fig. 367 . . . . . **trigemina** (Klug)
— Apical 2-4 segments of abdomen black; thorax entirely pale or with black marks 16
16. Thorax entirely orange; forewing yellowish with only apex black (lancet as in Fig. 356; sheath as in Fig. 353; male genitalia as in Fig. 366) . . . . . **martini** (Lepeletier)
— Thorax with some black markings; forewing black at base and apex, sometimes also at center 17
17. Thorax orange with only lateral deflexed sides of mesonotal lateral lobes black; head black (legs orange; forewing black at base, apex, and center, with 2 yellowish bands) . . . . . **bella** Malaise
— Black marks on mesosternum, mesoprescutum, and mesonotal lateral lobes; clypeus and supraclypeal area white 18
18. Legs orange; forewing black at base, apex, and center, with 2 yellowish bands; mesoscutellum orange . . . . . **carinata** (Cameron)
— Legs orange with hindtarsus black; forewing black at base and apex, yellow at center; mesoscutellum usually black (lancet as in Fig. 357; sheath as in Fig. 346; male genitalia as in Fig. 365) . . . . . **unifasciata** Smith

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SPECIES

albipes (Konow), **new combination** — Brazil (Espirito Santo)

**Ptilia albipes* Konow 1901: 61. F. "Brasilia (Espirito Santo)" (Budapest, F).— Konow 1905a: 16.— Malaise 1949: 8 (separation from *D. fumipennis*).— Oehlke and Wudowenz 1984: 365 (1 F syntype at Eberswalde).

Two females are at Budapest, both are labeled Espirito Santo and both have the label "typus, *Ptilia* albipes Konow 1901." One is hereby designated lectotype, the other a paralectotype, and they have been labeled such. I did not examine the synytpe at Eberswalde.

bella Malaise — Brazil (Minas Gerais, Rio de Janeiro, São Paulo)

**Didymia bella* Malaise 1949: 7-8. M. "Brazil (São Paulo)" (Stockholm, M).

The coloration of both sexes is similar. The female lancet of specimens studied from Itatiaya, Est. do Rio, is similar to that of *martini* (Fig. 356).

bicolor (Kirby), **new combination** — Brazil (Amazonas, Pará); Surinam

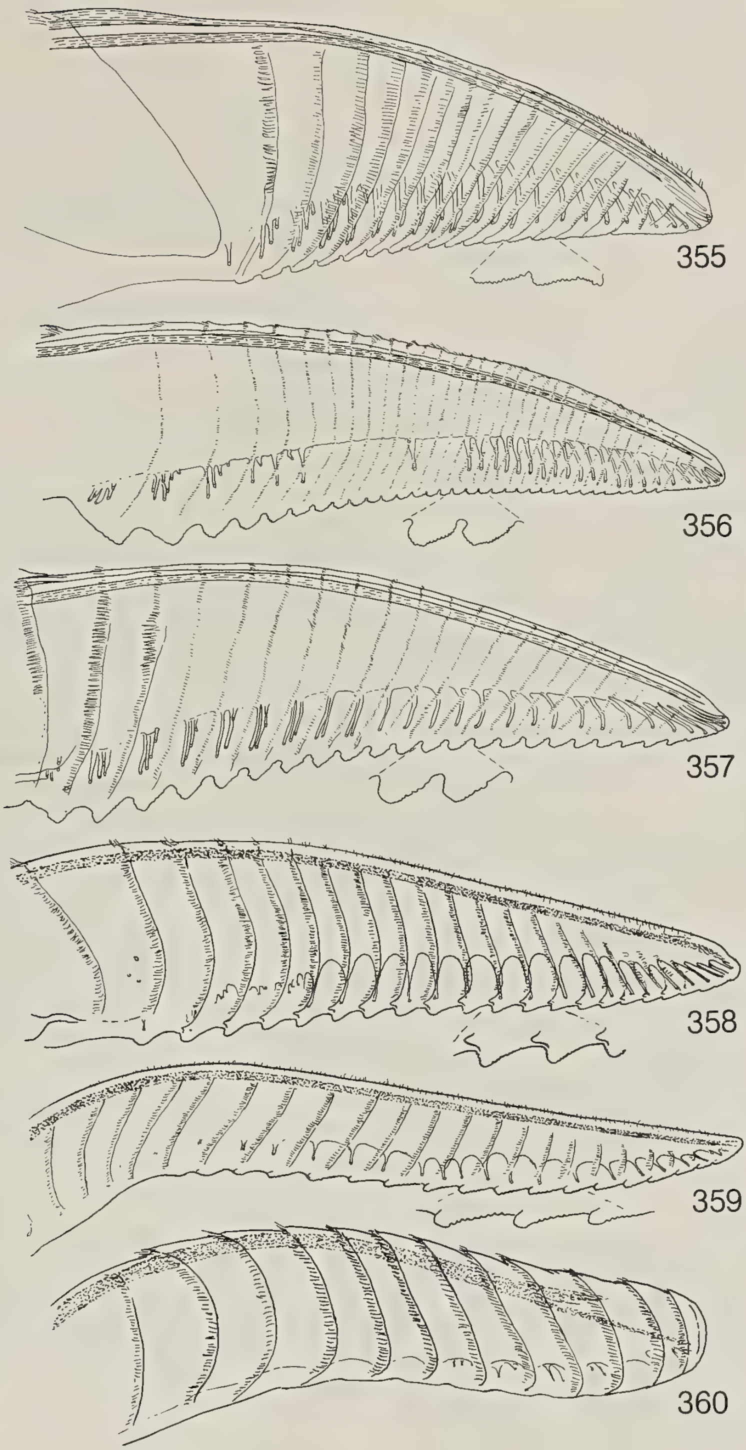
**Ptilia bicolor* Kirby 1882: 46-47, pl. 3, fig. 12. F. "Brazil, Tapajos" (London, F).— Dalla Torre 1894: 319.— Konow 1905a: 26.

The holotype is BM #1.143. I have seen a series associating the sexes from 60 km N Manaos, Amazonas, Brazil, and a single specimen from Surinam (Zanderij I.).

breva Smith, **new species** — Brazil (D.F.)

Didymia breva Smith.

Female.— Length, 5.7-6.0 mm. Black with pronotum, tegula, mesoscutellum, and metascutellum orange; apex of forefemur and foretibia whitish. Wings subhyaline, forewing a little darker from stigma to apex; veins and stigma black. Antennal length to head width as 4.8:5.2. Clypeus slightly emarginated at center; short, straight interantennal carina present; 3rd labial palpal segment and 4th maxillary palpal segment enlarged; lower interocular distance to eye length as 2.9:2.6; distances between eye and hindocellus,



Figs. 355-360. *Didymia*, female lancets. 355, *D. elegans*; 356, *D. martini*; 357, *D. unifasciata*; 358, *D. resa*; 359, *D. breva*; 360, *D. nasuta*.

hindocelli, and hindocelli and posterior margin of head as 0.8:1.0:1.5. Forewing with costa as broad as intercostal area; 3 cubital cells. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.5:1.8. Sheath as in Fig. 352. Lancet as in Fig. 359.

Male.— Length, 5.5 mm. Coloration similar to that of female. Antennal length to head width as 7.5:4.4. Lower interocular distance to eye length as 2.5:2.0; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.8:0.9. Genitalia as in Fig. 369.

Holotype.— F, "Res. Ecol. IBGE, KM 0 BR 251 - DF, 26/IX-3/X/1980, T. Malaise 4: cerrado," "Brasilia, D.F., col. Braulio Dias" (Brasilia, IBGE).

Paratypes.— BRAZIL: Same locality as for holotype, 25/IX-2/X/1981, 5:C. Sujo (1 F), 11-25/IX/1981, 4: cerrado (1 M) (Brasilia, IBGE; Washington).

Remarks.— This species is black with only the pronotum, tegula, and meso- and metascutellum orange, the female antenna is shorter than the head width, and the postocellar area is about as broad as long, longer than in most other species of *Didymia*. The lancet and male genitalia as figured will also help separate *breva* from other species.

carbonaria (Cameron), **new combination** — Brazil (Amazonas, Pará)

Dielocera carbonaria Cameron 1878: 147-148. F. "Villa Nova, Brazil" (London, F).
Dielocerus carbonaria: Kirby 1882: 50.— Dalla Torre 1894: 322.
Dieloceros carbonarius: Konow 1905a: 24.
Nematoneura mitellata* Konow 1906b: 186-187. F. "Brasilia (Itaituba)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 396 (holotype). **New synonymy.
Tanyphatna mitellata: Malaise 1937a: 50.

The holotype of *carbonaria* is BM #1.120. I have seen specimens from Uypiranga, Rio Negro, 14 km from Manaos, Amazonas, and Rio Javary, Amazonas, Brazil.

carinata (Cameron), **new combination** — Brazil

**Rusobria carinata* Cameron 1878: 151. F. "Brazil" (London, F).
Ptilia carinata: Kirby 1882: 46.— Dalla Torre 1894: 319.— Konow 1905a: 26.

The holotype is BM #1.142. This is the only specimen I examined.

connarusae Smith, **new species** — Brazil (D.F.)

Didymia connarusae Smith.

Female.— Length, 5.2-8.2 mm. Black, outer surface of foretibia whitish, hindtrochanter whitish to brownish, basal 4 terga laterally orange, basal 3 or 4 sterna orange. Forewing hyaline with large black area below stigma covering radial cell and adjacent areas and extending as a narrow band to posterior margin of wing; hindwing hyaline with blackish apex; veins and stigma black. Antennal length about 1 1/5X head width; 3rd segment uniformly thick, laterally flattened. Lower interocular distance slightly shorter than eye length, as 3.2:3.4; malar space linear; supraclypeal area and clypeus finely punctate, rest of head mostly shining; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:1.4:1.4. Length of hindbasitarsus shorter than length of following segments combined, subequal to following 3 segments combined. Sheath with stout, rounded scopae, Fig. 347. Lancet as in Fig. 361.

Male.— Unknown.

Holotype.— F, "Brasilia, D. F., col. Braulio Dias," "Cerrado Lago Sul, 24-II-1976, female pondo ovos no galho jovem," "Planta hospedeira: Connarus fulvus Planchon" (Brasilia, IBGE).

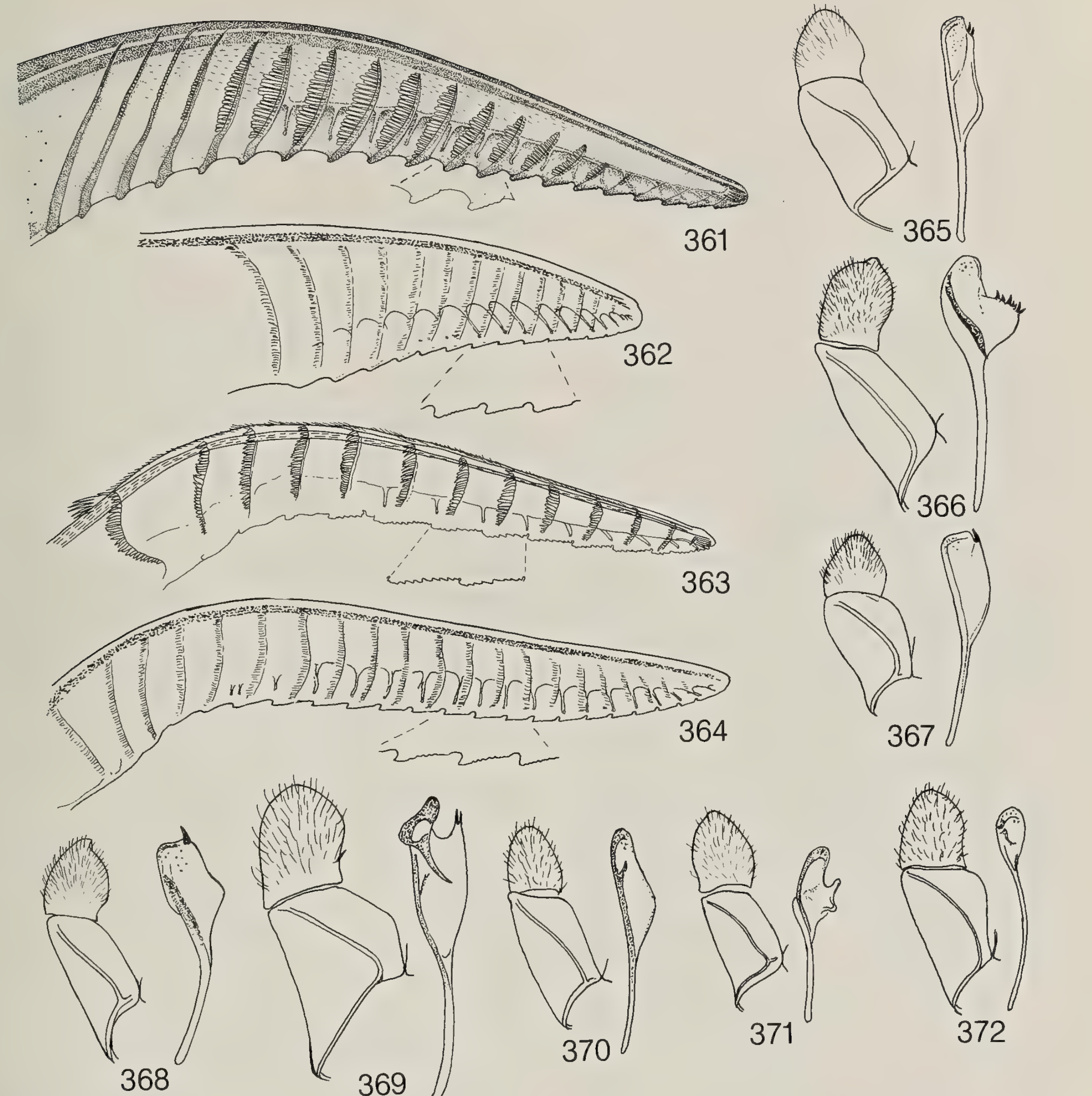
Paratypes.— BRAZIL: Same locality as for holotype except 7-IV-1976, found dead on the ground under *Connarus fulvus* (1 F); Sobradinho, D.F., Sifio St. Clemente, Ferreira (Faz. Paranoá), 30-X-1983, Braulio Dias, Pardo ovos em arbusto de *Connarus fulvus* c/± 75 cm de altura (1 F); Brasilia, D.F., proxima Recor, 27-XII-83, Braulio Dias (4 F); Res. Ecol. IBGE, KM 0 BR 251 - DF, 10-12-XII-83, J. Silva (1 F), same except date, 8-9-XII-83 (1 F) (Brasilia, IBGE; Washington).

Host.— *Connarus fulvus* (Connaraceae), reared by B. F. S. Dias.

Remarks.— The black coloration with the basal terga laterally and basal sterna orange and hyaline wings with the black beneath the stigma will separate this species. The long annular spines of the lancet are also diagnostic. Though all specimens are structurally the same, the size ranges from 5.2 mm to 8.2 mm in length.

crassicornis (Cameron), **new combination** — Brazil (Amazonas)

**Dielocera crassicornis* Cameron 1878: 146. F. "Amazons" (London, F).
Hemidianeura crassicornis: Kirby 1882: 50.— Dalla Torre 1894: 321.— Konow 1905a: 26.



Figs. 361-372. *Didymia*. Female lancets of 361, *D. connarusae*; 362, *D. bicolor*; 363, *D. carbonaria*; 364, *D. teusa*. Male genitalia of 365, *D. unifasciata*; 366, *D. martini*; 367, *D. trigemma*; 368, *D. elegans*; 369, *D. breva*; 370, *D. resa*; 371, *D. bicolor*; 372, *D.* sp. (Only Fig. 361 shaded.)

Tanyphatna discophora* Konow 1908a: 145. F. "Brasilia (S. Antonio do Icá)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 377 (holotype). **New synonymy.

The holotype of *crassicornis* (BM #1.146) lacks the head, but other characters conform to *Didymia* and are the same as for *discophora* Konow. Two specimens studied from near Manaus, Brazil, are identical to *crassicornis*. There are four cubital cells in the forewing.

elegans (Klug) — Brazil (Rio de Janeiro, Santa Catarina, São Paulo)

**Hylotoma (Schizocera) elegans* Klug 1834: 247. F, M. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 247.
Didymia elegans: Norton 1867: 60.— Malaise 1949: 8 (separation from *D. fumipennis*).
Ptilia elegans: Kirby 1882: 47.— Dalla Torre 1894: 320.— Konow 1905a: 26.

A female and a male at Berlin are the same species and bear the same data: "13719," "Brasil. v. Olfers." The female with the large green determination label of Klug is hereby designated lectotype; the male is a paralectotype. I have studied specimens from each of the above Brazilian states.

lugubris (Klug) — Brazil (Minas Gerais, Rio de Janeiro)

**Hylotoma lugubris* Klug 1834: 247. F. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 294.
Didymia lugubris: Norton 1867: 60.
Ptilia lugubris: Kirby 1882: 47.— Dalla Torre 1894: 320.— Konow 1905a: 27.
Didymia fumipennis* Malaise 1949: 8. F. "Brazil" (Stockholm, F). **New synonymy.

The holotype of *lugubris* is labeled "Rio Jan., Beys." I have seen one specimen from "Mar de Hespanha, E. Minas, Brazil."

martini (Lepeletier) — Brazil (Espirito Santo, Minas Gerais, Rio de Janeiro)

Hylotoma martini Lepeletier 1823: 48. M "E Brasilia" (Paris, F).— Lepeletier and Serville 1828: 573 (in subg. *Didymia*).— Klug 1834: 245.— Kriechbaumer 1884: 293.
Didymia martini: Brullé 1846: 669, pl. 47, fig. 8.— Norton 1867: 60.— Malaise 1949: 5 (syn.: *melanura* Lepeletier, *catinifera* Konow).
Ptilia martini: Kirby 1882: 45.— Dalla Torre 1894: 320 (*martinii*).— Konow 1905a: 27.
**Ptilia melanura* Lepeletier and Serville 1828: 238. F. "Amérique méridionale" (Paris, F).— Dalla Torre 1894: 320.— Konow 1905a: 27.
**Tanyphatna catinifera* Konow 1906b: 188. F. "Brasilia" (Eberswalde, F).— Oehlke and Wudowenz 1984: 372 (holotype).
Ptilia catinifera: Malaise 1937a: 50.

A female specimen at Paris agrees with the traditional concept of this species and bears a handwritten label "melanura Lep." Another specimen at Paris is labeled "*martini* [ ] Lep." (middle word not legible). It has pale antennae and the supraclypeal area and clypeus are pale orange, and therefore does not exactly fit the description of *martini* ("antenna and head black"). This specimen is *Ptilia melanictera* (Klug), and if were regarded as the holotype, *martini* must be transferred to *Ptilia*. The specimen is also a female, not a male, further evidence that it is probably not the type of *martini*. I have seen specimens from each of the above Brazilian states.

nasuta (Cameron), **new combination** — Panama

**Ptilia nasuta* Cameron 1883: 44-45, pl. 3, fig. 1. F. "Panama, David, Chiriqui" (London, F).— Dalla Torre 1894: 320.— Konow 1905a: 27.

The holotype is BM #1.145. I have seen one specimen from Barro Colorado, Canal Zone, Panama.

pellos (Konow), **new combination** — Brazil (Pará)

**Tanyphatna pellos* Konow 1906b: 187-188. M. "Brasilia (Obidos)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 403 (holotype).

This may be the male of *carbonaria*.

pumilio (Kirby), **new combination** — Brazil (Amazonas); Surinam

**Ptilia pumilio* Kirby 1882: 47, pl. 3, fig. 13. F. "Amazons" (London, F).— Dalla Torre 1894: 321.— Konow 1905a: 27.

The holotype at London has no type number. I saw one specimen from Zanderi I., Surinam.

resa Smith, **new species** — Brazil (D.F., Goiás)

Didymia resa Smith.

Female.— Length, 6.0-7.5 mm. Black with pronotum, sometimes tegula, mesoprescutum and adjacent areas of mesonotal lateral lobes orange; orange on pronotum usually paler than that on mesonotum; apical 1/2 forefemur, foretibia, and about first 2 foretarsal segments whitish. Forewing hyaline at base, light blackish from base of stigma to apex; veins and stigma black. Antennal length to head width as 6.2:5.7. Lower interocular distance to eye length as 3.3:3.0; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.1:1.4; short, straight interantennal carina present; clypeus slightly emarginated at center; 3rd labial palpal segment and 4th maxillary palpal segment greatly enlarged; left mandible with 2 minute teeth at center. Forewing with costa swollen, broader than intercostal area; first cubital crossvein present or absent, therefore with either 3 or 4 cubital cells. Length of hindbasitarsus slightly longer than length of remaining tarsal segments combined. Sheath similar to that of *bicolor*, Fig. 348. Lancet as in Fig. 358.

Male.—Length, 5.5-6.8 mm. Coloration as for that of female but tegula usually black. Antennal length to head width as 10.0:5.1. Lower interocular distance to eye length as 3.0:2.3. Distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:1.1:1.4. Genitalia as in Fig. 370, with valve long, slender, rounded at apex and without spines.

Holotype.—F, "Res. Ecol. IBGE, KM 0 BR 251 - D.F., 5-11-X-1979, Equipe Ecol. An.," "Tenda Malaise, Cerrado 3A-17M-4" (Brasilia, IBGE).

Paratypes.— BRAZIL: Same data as for holotype except dates, trap numbers omitted, 12-19-IX-1970 (5 F), 24-31-X-1980 (1 F), 16-24-IX-1982 (1 F), 19-VIII-2-IX-1982 (1 F), 24-30-IX-1982 (1 F, 1 M), 16-VIII-1984 (1 F), 16-24-IX-1981 (1 F), 24-30-IX-1981 (2 F), 9-16-IX-1981 (1 F), 8-16-IX-1983 (2 F), 1-8-IX-1983 (1 F), 29-VIII-5-IX-1981 (1 F), 10-17-X-1980 (1 F, 1 M), 2-X-1978 (1 M), 25-IX-2-X-1981 (1 M), 1-25-IX-1981 (1 M); Goiás, Sta. Isabel, R. Araguaia, Isla do Banand, X-27 to XI-4 1960, B. Malkin leg (1 F) (Brasilia, IBGE; Chicago; Washington).

Remarks.— The hyaline wings with the apices somewhat blackish, mostly black legs, and black thorax with the pronotum and mesoprescutum orange separate *resa* from *crassicornis*, *soror*, *bicolor*, and *nasuta*. The latter three have fasciate wings (hyaline with black bands), the latter two have part of the mesepisternum orange, and *bicolor* has white legs.

soror (Kirby), **new combination** — Brazil

**Ptilia soror* Kirby 1882: 48, pl. 3, fig. 14. F. "Amazons" (London, F).— Dalla Torre 1894: 321.— Konow 1905a: 27.

The holotype is BM #1.144, labeled "Braz." I have not seen other specimens.

teusa Smith, **new species** — Brazil (D.F.)

Didymia teusa Smith.

Female.—Length, 6.0 mm. Black; palpi brownish; apex of forefemur, foretibia, and foretarsus brownish; abdominal segments 2-4 orange with black spots at center of terga. Wings hyaline, forewing with black stripe below stigma; veins and stigma black. Antennal length to head width as 4.7:4.7. Clypeus slightly emarginated at center; 3rd labial palpal segment and 4th maxillary palpal segment enlarged; short, straight interantennal carina present; lower interocular distance to eye length as 3.5:3.4; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.9:0.7. Forewing with costa as broad as intercosal area; 3 cubital cells. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.6:1.8. Sheath similar to that of *bicolor*, Fig. 348. Lancet as in Fig. 364, with short annular spines and serrulae flat.

Male.— Unknown.

Holotype.— F, "Res. Ecol. IBGE, KM 0 BR 251 - DF, 25/IX-2/X/1981, T. Malaise 2: cerrado" (Brasilia, IBGE).

Remarks.— The coloration is similar to that of *connarusae*, but the lancet is distinct in that the serrulae are flat and the annular spines are short. Additionally in *teusa*, the length of the antenna is subequal to the head width, and the dark band below the stigma in the forewing is not so broad. In *connarusae*, the antenna is one and a half times the head width and the black on the forewing is broader, appearing as a large spot below and around the stigma.

trigemina (Klug) — Brazil (Mato Grosso, Pará); Peru

**Hylotoma trigemina* Klug 1814: 307-308. F. "Brasilien" (Berlin, F).— Klug 1834: 246.— Kriechbaumer 1884: 73, 293.

Didymia trigemina: Norton 1867: 61.

Ptilia trigemina: Kirby 1882: 45.— Dalla Torre 1894: 321.— Konow 1905a: 27.— Forsius 1934: 48 (syn.: *nobilis* Forsius).

Didymia verticalis* Spinola 1851: 6-7. M. "Para" (Torino, M). **New synonymy.

Ptilia verticalis: Kirby 1882: 45.— Dalla Torre 1894: 321.— Konow 1905a: 27.

**Hemidianeurina nobilis* Forsius 1925a: 6-8. F. "Brasilia, Amazonas, Rio Autáz, Cururuzinho" (Stockholm, F).

I have studied specimens from Chapada, Mato Grosso, and Santarem, Pará, Brazil, and Dept. Loreto, Pucallpa, Peru.

uberaba (Brèthes), **new combination** — Brazil (Minas Gerais)

**Ptilia uberaba* Brèthes 1927: 335. F. "Uberaba, Minas" (Eberswalde, F).— Oehlke and Wudowenz 1984: 417 (holotype).

The wing venatation places *uberaba* in *Didymia*; in appearance, however, it resembles species in *Triptenus*, but that genus lacks an anal cell in the hindwing.

unifasciata Smith - Panama

**Didymia unifasciata* Smith in Kimsey and Smith 1985: 192-195, fig. 1-5, 11-19. F, M, larva. "Trinidad Rio, Pan." (Washington, F) (larva, host a, life history notes).

Host: a) *Rouria glabra* (Connaraceae).

Genus **DUCKEANA** Malaise

Duckeana Malaise 1941: 137. Type species: *Ptenus prodigus* Konow. Orig. desig.

Antennal length shorter than head width; first segment longer than broad, 2nd segment broader than long, 3rd segment of female antenna compressed. Eyes converging below, lower interocular distance slightly greater than eye length; head from above broadened behind eyes, postocellar area 1.5X broader than long; interantennal ridge broad and round, protuberant in side view; malar space linear; clypeus and labrum subtruncate; length of maxillary palpus subequal to eye length, segments of labial and maxillary palpi slender, of uniform width (Fig. 374). Forewing (Fig. 373) with radial cell indistinctly open (apex faint and could appear closed); costa swollen, broader than intercostal area; 3 cubital cells, first cubital crossvein represented by a stub; last closed cubital cell longer on radius than on cubitus; basal anal cell present. Hindwing without anal cell. Hindtibia slightly compressed and broadened toward apex; length of hindbasitarsus a little shorter than length of remaining tarsal segments combined; tarsal claws simple.

Malaise's 1941 description was in a key, but he gave a more detailed description in 1942. Malaise related this genus to *Schizocerella*, probably because of the absence of the anal cell in the hindwing. Though it shares this with *Schizocerella*, the larger eyes which converge below, head broadened behind the eyes from above, the last closed cubital cell of the forewing which is longer on the radius than on the cubitus, and unusual slender sheath (Figs. 375, 376) preclude its placement there. It could also be confused with some other genera that lack an anal cell in the hindwing, such as *Triptenus*, *Tanymeles*, and some *Hemidianeura*, but *Duckeana* has uniformly slender, short palpi unlike any members of these genera and the radial cell of the forewing apparently open at its apex. Since only one specimen is known, I am keeping *Duckeana* separate. Several characters, including the radial cell of the forewing which appears open at its apex, the number of cubital cells of the forewing, and characters in the male, need to be evaluated by a study of longer series.

SPECIES

prodiga (Konow) — Brazil (Pará)

**Ptenus prodigus* Konow 1906b: 184-185. F. "Brasilia (Obidos)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 406 (holotype).
Ptenos prodigus: Forsius 1925: 5.
Duckeana prodigus: Malaise 1941: 137.— Malaise 1942: 105.

Only the holotype was examined: length, 7.2 mm; antenna black with 3rd segment paler at base and beneath; head and mouthparts blackish; thorax black with pronotum, parapteron, upper 1/4 mesopleuron, and most of mesonotum orange yellow, mesonotum with large black areas on prescutum and lateral lobes; abdomen and sheath black; legs black, paler to dark orange are: foreleg, midfemur, midtibia, and inner surface of hindtibia; wings hyaline, forewing lightly

Figs. 373-376. *Duckeana prodiga*. 373, Apex of forewing. 374, Palpi. 375, Apex of abdomen and lateral view of female sheath. 376, Dorsal view of female sheath.

blackish from base of stigma to apex; sheath bladelike (Figs. 375, 376), with apical terga appearing to overhang sheath.

Genus DURGOA Malaise

Durgoa Malaise 1937a: 50-51. Type species: *Tanyphatna exilipalpis* Konow. Orig. desig.

Antennal length slightly longer than head width, with 1st segment longer than broad, 2nd segment about as long as broad, 3rd segment of female antenna slender, oval in cross section (Fig. 381). Eyes small, slightly converging below, lower interocular distance greater than eye length (Fig. 378); head from above slightly broadened behind eyes; clypeus subtruncate; malar space less than or equal to diameter of front ocellus; supraclypeal and interantennal areas convex, without sharp interantennal carina, with furrow on interantennal area; palpi short, maxillary palpus shorter than or subequal to eye length, 3rd segment of labial palpus enlarged, 4th segment of maxillary palpus slightly enlarged (Fig. 380); mandibles rather broad at base, tapering to apex, left mandible simple, right mandible with basal tooth (Fig. 379). Forewing (Fig. 377) with costa narrower or equal to intercostal area; radial cell closed, with short accessory vein at apex; 4 cubital cells, last closed cell longer on radius than on cubitus; distance between M and Rs+M on Sc+R half or more length of vein M; small basal anal cell present. Hindwing (Fig. 377) with anal cell, cell a little longer than its petiole. Length of hindbasitarsus subequal in length to following tarsal segments combined; tarsal claws simple.

Most species of this genus are relatively large, 10-11 mm long (an exceptional specimen is 15 mm long) and are yellow and black except *nigra* which is black with reddish-orange marks on the thorax. I have not seen associated males. The genus is recognized by the large size, second antennal segment about as long as broad, convex interantennal area, small eyes with the lower interocular distance greater than the eye length, head from above broadened behind the eyes, mandibles enlarged at bases, closed radial cell of the forewing, last closed cubital cell of the forewing longer on the radius than on the cubitus, presence of an anal cell in the hindwing, and long, multisegmented female lancets (Figs. 385-387). *Adurgoa* is similar, but that genus has the 2nd antennal segment broader than long, lacks a furrow on the interantennal area, the last closed cubital cell is quadrate, the palpal segments are uniformly narrow, and the female lancet is shorter, with 16 or fewer segments (Figs. 313-315).

Several specimens were taken from leaves of Leguminosae. Other than this, hosts and biologies are not known. Representatives occur in Peru, Venezuela, and most of Brazil.

KEY TO SPECIES

1. Wings uniformly, darkly or lightly black infuscated, veins and stigma black; thorax entirely yellow or reddish orange and black 2

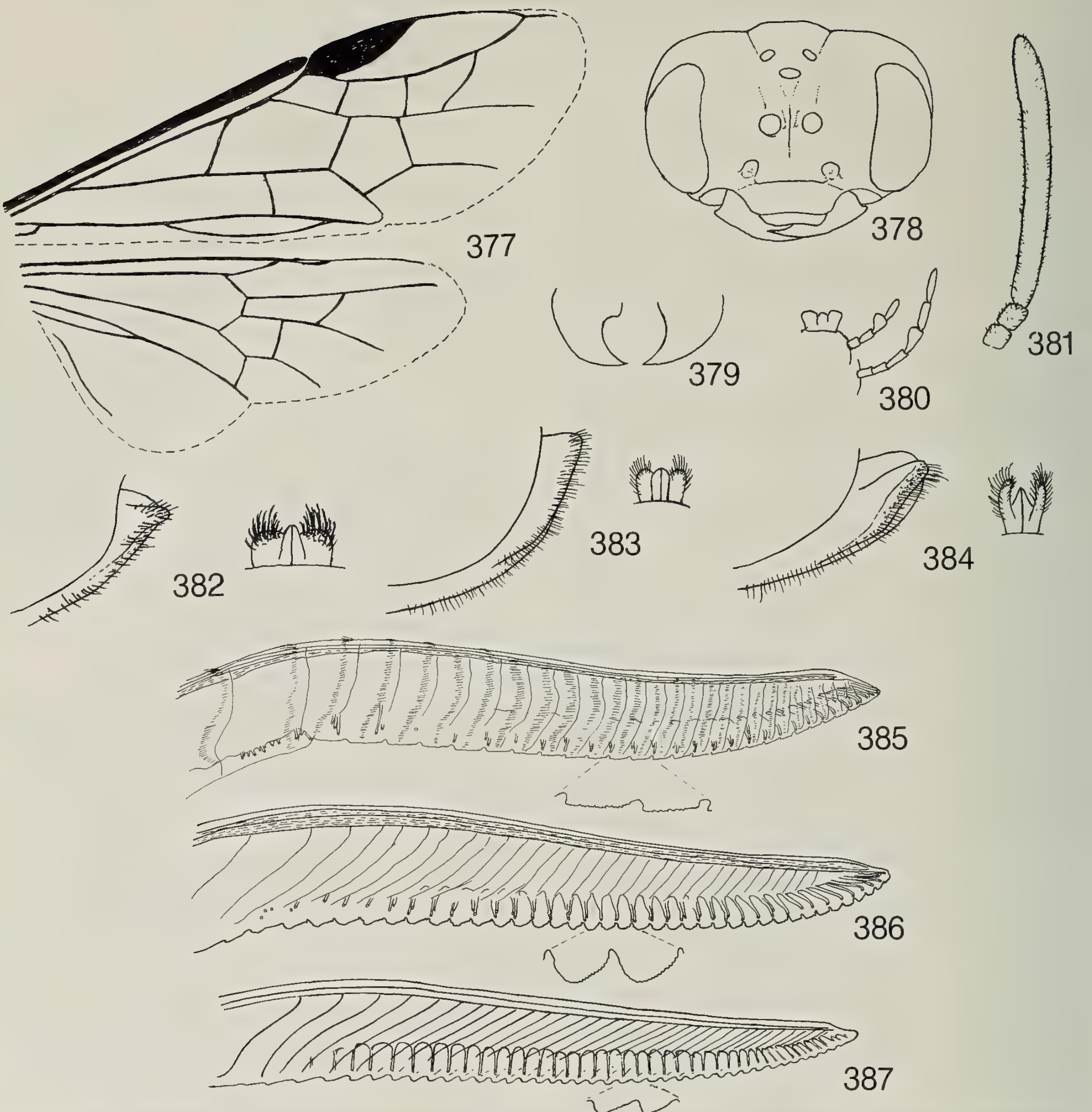
— Wings yellowish with apex beyond stigma black, veins and stigma yellow in yellow area; thorax yellow with black only on mesosternum and mesoprescutum 3

2. Thorax orange yellow; abdomen yellow with apical 2 or 3 segments black; sheath as in Fig. 384; lancet as in Fig. 386 . . . . ***mattogrossensis*** Malaise

— Thorax black with following red orange: pronotum (except center), mesonotum (except triangular spot on prescutum and center of scutellum), upper 2/3 mesepisternum, upper 1/2 mesepimeron, and tegula; abdomen black; sheath as in Fig. 382, lancet as in Fig. 387 . . . . ***nigra*** Smith

3. Apical 3/4 hindtibia black; mesoprescutum and each side of mesosternum blackish, sometimes mesonotal lateral lobes, tegula, and most of mesepisternum also black; sheath similar to that of *exilipalpis* . . . . ***atriceps*** (Kirby)

— Legs entirely yellow orange; thorax entirely orange or black areas only on each side of mesosternum and lower mesepisternum; sheath as in Fig. 383 (lancet as in Fig. 385) . . . . ***exilipalpis*** (Konow)



Figs. 377-387. *Durgoa*. 377, Forewing and hindwing of *D. exilipalpis*. 378, Front view of head of *D. exilipalpis*. 379, Mandibles of *D. exilipalpis*. 380, Palpi of *D. exilipalpis*. 381, Female antenna of *D. nigra*. Female sheaths of 382, *D. nigra*; 383, *D. exilipalpis*; 384, *D. mattogrossensis*. Female lancets of 385, *D. exilipalpis*; 386, *D. mattogrossensis*; 387, *D. nigra*.

SPECIES

atriceps (Kirby) — Brazil (Espirito Santo)

**Ptenus atriceps* Kirby 1882: 53, pl. 4, fig. 8. F. "Brazil ? Rio Janeiro ?" (London, F).
Ptenos atriceps: Dalla Torre 1894: 323.
Hemidianeura atriceps: Konow 1905a: 26.
Durgoa atriceps: Smith 1981: 283.

The holotype is BM #1.147. It lacks locality data. I have seen one specimen from "Corrego do Ita, E. Santo, Brazil."

exilipalpis (Konow) — Brazil (Santa Catarina)

**Tanyphatna exilipalpis* Konow 1906b: 188-189. F. "Brasilia (Colon, Hansa)" (Eberswalde, F).—Oehlke and Wudowenz 1984: 380 (holotype).
Durgoa exilipalpis: Malaise 1937a: 50-51.

Other than the holotype, I have seen one specimen from Nova Teutonia, Santa Catarina.

mattogrossensis Malaise — Brazil (Bahia, Mato Grosso, Minas Gerais); Peru; Venezuela.

**Durgoa mattogrossensis* Malaise 1937a: 51, fig. 1. F. "Matto Grosso" (Paris, F).

Host: Specimens from Bahia are labeled "on leaves of Leguminosae."

A specimen from Peru (Middle Rio Ucayali) is similar structurally, but has the clypeus and supraclypeal area orange; the head is all black in other specimens examined. Additional localities are Brazil (Mar de Hespanha, E. Minas) and Venezuela (Guatire Valley, "El Marquez"; Rancho Grande, E. Aragua).

nigra Smith — Brazil (D.F., Goiás)

**Durgoa nigra* Smith 1980: 281-282, fig. 13-15. F. "Res. Ecol. IBGE, Km 0 BR 251 - DF" (Brasilia, IBGE, F).

I have seen one specimen labeled "Faz. Paraiso, 8-2-1962, Brasil GO."

Genus **HEMIDIANEURA** Kirby

Ptenos Norton 1872: 77. Preoccupied by *Ptenos* Gray 1843. **New synonymy.** Type species: *Ptenos niger* Norton. Desig. by Rohwer 1911a.
Hemidianeura Kirby 1882: 48. Type species: *Hemidianeura nigricornis* Kirby. Desig. by Rohwer 1911a.
Ptenus Kirby 1882: 51. New name for *Ptenos* Norton.
Ptenellus Malaise 1937a: 56. New name for *Ptenos* Norton. Type species given as *Ptenos nigripectus* (!) Norton, but a new name takes the same type species as the preoccupied name.
Oigodianeura Malaise 1957: 7-8. **New synonymy.** Type species: *Hemidianeura coeliaca* Konow. Orig. desig.
Argenia Malaise 1949: 59-60. **New synonymy.** Type species: *Argenia viridana* Malaise. Monotypic.

Antenna (Fig. 394) with 1st segment longer than broad, 2nd segment as broad as or broader than long, 3rd segment of female antenna slender, round or oval in cross-section, tapering to apex, commonly curved; antennal length longer than head width. Clypeus subtruncate or with shallow central, semicircular emargination (Fig. 395); malar space linear to slightly evident; eyes large, converging below, lower interocular distance usually less than eye length (Fig. 389); head from above sharply narrowing behind eyes (Fig. 390); interantennal carina low, round to sharp, not extending onto convex supraclypeal area; maxillary palpus as long as or longer than eye length, 3rd segment of labial palpus enlarged, 4th segment of maxillary palpus slightly to moderately enlarged (Figs. 392, 393); left mandible simple or with two small teeth or crenulations, right mandible with basal tooth (Fig. 391). Forewing (Fig. 388) with radial cell closed, with short apical accessory vein; costa swollen, equal to or broader than intercostal area; 4 cubital cells, last closed cell rectangular or quadrate, as long as or longer on cubitus than on radius; distance between M and Rs+M on Sc+R almost equal to length of vein M; small basal anal cell present. Hindwing (Fig. 388) with or without anal cell, if present cell shorter than or subequal in length to its petiole. Length of hindbasitarsus subequal to or slightly longer than length of following tarsal segments combined; tarsal claws simple.

Most species are moderate in size, 6.0-8.0 mm long. The genus is recognized by the forewing venation which has a closed radial cell with an accessory vein at its apex and 4 cubital cells with the last closed cell characteristically quadrate or rectangular, by the large eyes which are usually closer together than the eye length, and by the usually curled antennae.

Ptenus is synonymized here since its type species, *niger* (= *texanus*), corresponds to the definition of

Hemidianeura. Among the species in my 1970 revision of *Ptenus*, *texanus* and *vanus* are characteristic of *Hemidianeura* and are transferred here. The other species treated in that revision are now placed in a new genus, *Zynzus*. The two species transferred to *Hemidianeura* are those with a shallow, central semicircular emargination of the clypeus. *Oigodianeura* was proposed by Malaise because of the absence of an anal cell in the hindwing. This is variable in *Hemidianeura*, where, even in at least two species, *plumicornis* and *plaumanni*, the anal cell is present or absent. All other characters of those species placed in *Oigodianeura* by Malaise (1957) are similar to *Hemidianeura*. *Argenia* also belongs here even though the holotype of *A. viridana* has the last closed cubital cell slightly longer on the radius than on the cubitus. In other specimens of *A. viridana* I have seen, the last closed cubital cell is as long on the radius as on the cubitus, and this venation in the holotype may be exceptional.

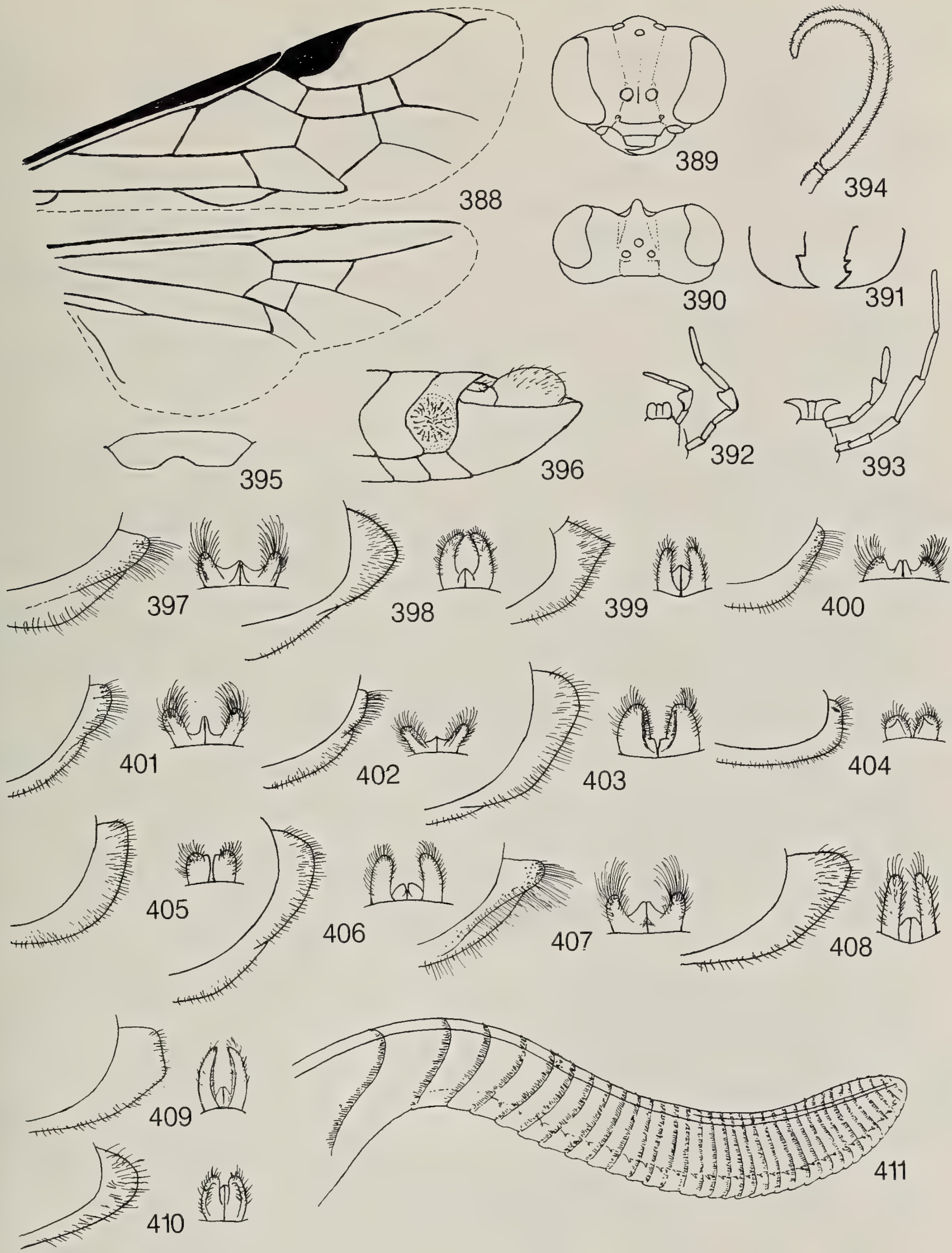
Males of two species, *natna* and *nantina*, have unusual round depressions on the abdomen, one on each side of the eighth tergite (Fig. 396). They are deep, round, and with numerous, stiff inwardly projecting hairs. I have not seen this in other argids and do not know their function.

Species groups may be formed on the basis of the emarginate clypeus and long slender lancet which are characteristic of *texanus*, *evansi*, *dasua*, and *vanus*. All others have a subtruncate clypeus and differently shaped lancet.

Though Malaise (1937a, 1957) gave a key to species, there are numerous additions and changes represented in this classification. The genus is now known from southwestern United States to northern Argentina. Hosts are not known. Only a few males are associated, and the following key is based mostly on females. The part of the key dealing with males should be used with caution.

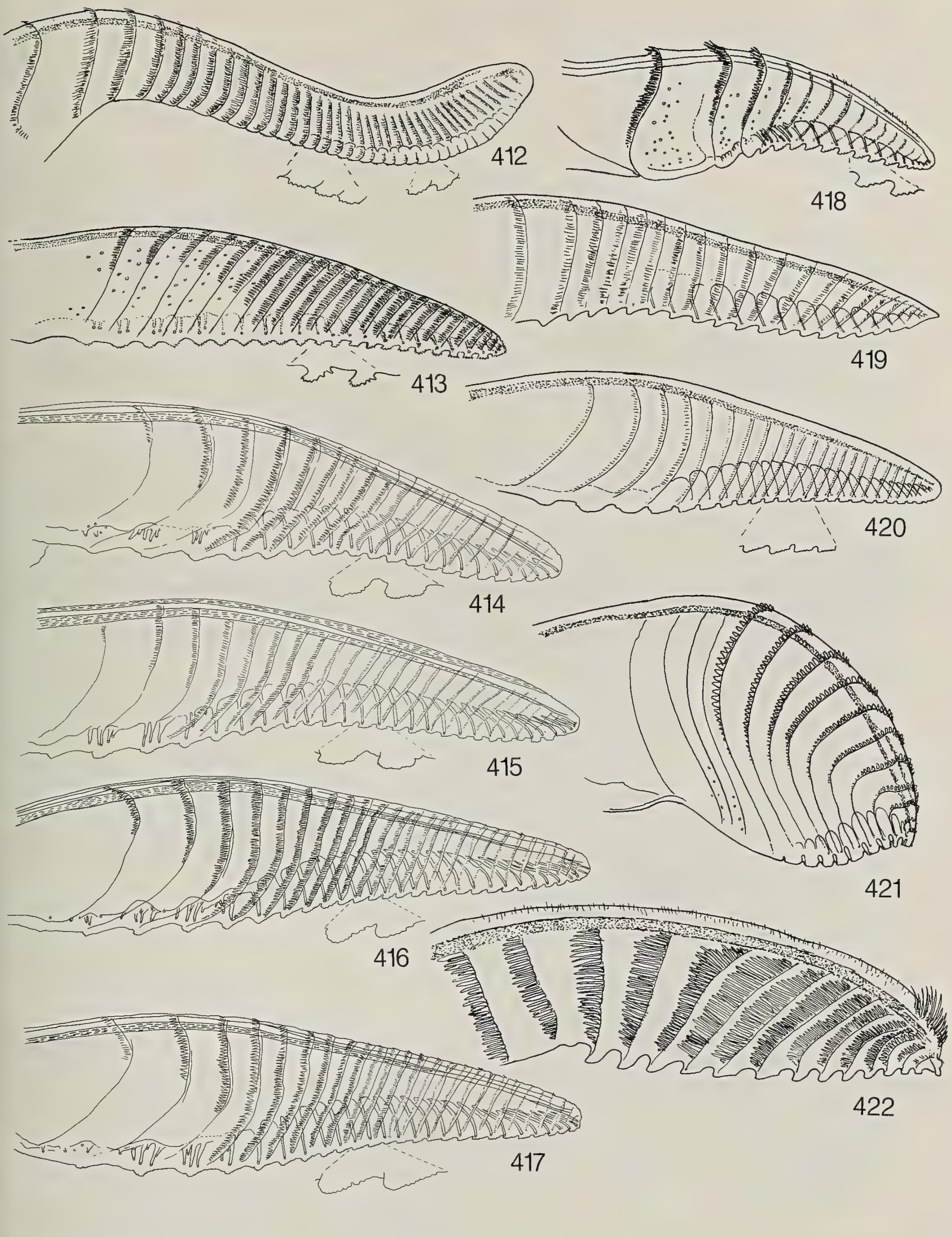
KEY TO SPECIES

1. Female **2**
— Male **30**
2. Forewing bicolored, hyaline or yellowish with apex and sometimes base infuscated black **3**
— Forewing uniformly colored, light to dark blackish **9**
3. Thorax black, pronotum, mesoscutellum, and spot on upper mesopleuron may be reddish **4**
— Thorax mostly yellow or orange, black marks sometimes present on mesonotum or mesosternum **5**
4. Forewing infuscated black at base and apex, hyaline at center; thorax black; abdomen orange with apical 3-4 segments black; (sheath as in Fig. 407, lancet as in Fig. 416; anal cell of hindwing present or absent) . . . . ***plumicornis*** (Klug)
— Forewing yellowish with apices infuscated black; thorax black with mesoscutellum and spot beneath base of wings pale; abdomen black with basal 5 terga and sterna pale at center (hindwing without anal cell). . . . ***coeliaca*** (Konow)
5. Face below antenna whitish or yellowish; base of forewing with infuscated black spot; hindwing with anal cell . . . **6**
— Head black; base of forewing yellowish; hindwing usually without anal cell **7**
6. Mesonotal lateral lobes and sometimes mesoprescutum with black marks; base of forewing broadly infuscated black; legs yellow, apices of fore- and midtarsi blackish; sheath similar to that of *propleuralis*, Fig. 397 . . . . ***apicalis*** Mocsáry
— Mesonotum orange or only prescutum with black mark; only extreme base of forewing with small black spot; tibiae and tarsi usually black; sheath as in Fig. 405 (lancet as in Fig. 419) . . . . ***nigricornis*** Kirby
7. Thorax and legs orange yellow; 3 basal abdominal segments orange; 1st and 2nd antennal segments and base of 3rd yellowish brown; clypeus yellowish . . . . ***flavicornis*** Benson
— Thorax orange yellow or with black marks on mesonotum and sometimes mesosternum; legs with tibiae and tarsi black (base of tibiae may be pale); basal 5 or more abdominal terga orange; antenna black; clypeus black **8**
8. Thorax yellowish, only cervical sclerites somewhat blackish; lancet as in Fig. 420; sheath as in Fig. 397. . . . . ***propleuralis*** (Malaise)
— Each mesonotal lobe of thorax with black marks, mesosternum partly black; lancet as in Fig. 417; sheath similar to that of *plumicornis*, Fig. 407 (anal cell of hindwing present or absent) . . . . ***plaumanni*** (Malaise)
9. Entirely black (sheath as in Fig. 399, lancet as in Fig. 421 . . . . ***atripes*** (Holmgren)
— White or orange markings on some part of head, body, or legs **10**



Figs. 388-411. *Hemidianeura*. 388, Forewing and hindwing of *H. ephippiata*. 389, Front view of head of *H. delta*. 390, Dorsal view of head of *H. delta*. 391, Mandibles of *H. delta*. 392, Palpi of *H. natna*. 393, Palpi of *H. delta*. 394, Female antenna of *H. delta*. 395, Clypeus of *H. texana*. 396, Apex of male abdomen showing cavities of *H. natna*. Female sheaths of 397, *H. propleuralis*; 398, *H. quidra*; 399, *H. atripes*; 400, *H. delta*; 401, *H. ephippiata*; 402, *H. dominicaensis*; 403, *H. plana*; 404, *H. viridana*; 405, *H. nigricornis*; 406, *H. dasua*; 407, *H. plumicornis*; 408, *H. nantinus*; 409, *H. texana*; 410, *H. natna*. 411, Female lancet of *H. texana*

10. Abdomen entirely or partly orange 11
— Abdomen black 13
11. Legs yellow orange, only apex of hindtibia and hindtarsus black; thorax orange with mesoprescutum black (sheath as in Fig. 404; lancet as in Fig. 422 . . . . ***viridana*** (Malaise)
— Legs black, foretibia whitish; thorax black 12
12. Head black; abdomen orange; sheath as in Fig. 403; lancet as in Fig. 423 . . . . ***plana***, new species
— Supraclypeal area and usually clypeus, labrum and palpi whitish to dull orange; abdomen black above, orange below; sheath similar to that of *delta* as in Fig. 400; lancet as in Fig. 424 . . . . ***menkei***, new species
13. Legs white, contrasting with black tarsi and apices of tibiae; part of coxae and femora may be blackish 14
— Legs black, part of foreleg, tibiae or knees may be whitish 20
14. Thorax black (sheath similar to that of *plumicornis*, Fig. 407; lancet as in Fig. 414) . . . . ***leucopoda*** (Cameron) (in part)
— Part of thorax orange or reddish 15
15. Mesonotum black, lateral corners may be reddish and mesopleuron may be reddish 16
— Mesonotum mostly red or orange, sometimes with black mark on prescutum and/or scutellum; mesopleuron red or black 17
16. Mesopleuron reddish; head black; larger, ca. 7.0 mm long; Mexico; sheath similar to that of *plumicornis*, Fig. 407; lancet as in Fig. 415 . . . . ***filiformis*** (Norton)
— Mesopleuron black; face below antennae whitish; smaller, ca. 4.0 mm long; Dominica; sheath as in Fig. 402, lancet as in Fig. 425 . . . . ***dominicaensis***, new species
17. Legs, mesonotum, mesopleuron, and face below antenna pale; sheath similar to that of *dominacaensis*, Fig. 402 . . . . ***thoracica*** (Ashmead)
— Some black on one or more of above areas 18
18. Mesonotum red with prescutum and scutellum black; pronotum white; mesopleuron black; 1st and 2nd antennal segments blackish to dark reddish (sheath as in Fig. 400; lancet as in Fig. 426 . . . . ***delta*** Malaise
— Mesonotum and mesopleuron reddish, sometimes with black mark on mesoprescutum or mesoscutellum; pronotum orange; 1st or 1st and 2nd antennal segments white or black 19
19. Antenna black; mesoscutellum black; sheath similar to that of *plumicornis*, Fig. 407; lancet as in Fig. 413 . . . . ***midea***, new species
— First or 1st and 2nd antennal segments usually all or partly white; mesonotum red with prescutum usually black; sheath similar to that of *plumicornis*, Fig. 407; lancet as in Fig. 414 . . . . ***leucopoda*** (Cameron) (in part)
20. Entirely black except for some white on tibiae (clypeus emarginated at center) 21
— Some yellow, orange, or reddish markings on head or thorax 23
21. Legs black (lancet long, serrulae flat, Fig. 427; sheath similar to that of *texanus*, Fig. 409). . . . ***evansi***, new species
— Legs with tibiae mostly white or apices of femora and bases of tibiae whitish 22
22. Legs black with apices of femora and bases of tibiae whitish; lancet long, as in Fig. 428; sheath as in Fig. 408 . . . . ***nantina***, new species
— Legs black with apices of fore- and midfemora, fore- and midtarsi, and basal 3/4 of hindtibia white; lancet short, as in Fig. 429; sheath as in Fig. 406 . . . . ***dasua***, new species
23. Thorax black with pronotum and tegula whitish (supraclypeal area laterally, foreleg, apices of femora, mid- and hindtibiae, and basal lateral area of abdomen whitish; sheath similar to that of *nigricornis*, Fig. 405) . . . ***fucata*** (Konow)
— Mesonotum partly red 24
24. Tibiae whitish (mesonotum red with prescutum black) 25
— Legs black, foretibia may be whitish 27
25. Pronotum black (sheath as in Fig. 398; lancet as in Fig. 430) . . . . ***quidra***, new species
— Pronotum reddish 26
26. Sheath slender with small scopae (Fig. 409); clypeus emarginated at center (Fig. 395); lancet as in Fig. 411 . . . . ***texana*** (Norton)
— Sheath broad, with large lateral scopae (similar to that of *ephippiata*, Fig. 401); clypeus subtruncate; lancet as in Fig. 431 . . . . ***kuscheli*** Malaise (in part)
27. Pronotum, mesonotum, and tegula reddish; clypeus emarginate (as in Fig. 395) (sheath similar to *texana*, Fig. 409; lancet as in Fig. 412) . . . . ***vana*** (Smith)
— One or more of above areas partly black; clypeus subtruncate 28



Figs. 412-422. *Hemidianeura*, female lancets. 412, *H. vana*; 413, *H. midea*; 414, *H. leucopoda*; 415, *H. filifornis*; 416, *H. plumicornis*; 417, *H. plaumanni*; 418, *H. natna*; 419, *H. nigricornis*; 420, *H. propleuralis*; 421, *H. atripes*; 422, *H. viridana*.

28. Pronotum and tegula usually black; mesonotum at most with black mark on prescutum (sheath as in Fig. 401; lancet as in Fig. 432) . . . . **ephippiata** (Klug)
— Pronotum and tegula usually reddish; both mesoprescutum and mesoscutellum with black marks 29
29. Lancet short, Fig. 418; sheath as in Fig. 410 . . . . **natna** Smith
— Lancet long, Fig. 431; sheath similar to that of *ephippiata*, Fig. 401 . . . . **kuscheli** Malaise (in part)
30. Abdomen orange, apical 2 or 3 segments may be black 31
— Abdomen black, at most with basal 2 segments brownish to orange 33
31. Thorax and legs black . . . . **mexicana** (Cresson)
— Thorax and legs extensively orange 32
32. Thorax black with only pronotum and tegula yellow orange; genitalia as in Fig. 438 . . . . **viridana** (Malaise)
— Thorax orange with mesonotal lateral lobes and tegula black; genitalia as in Fig. 440 . . . . **nigricornis** Kirby
33. Basal abdominal segments brownish to orange 34
— Abdomen black 35
34. Legs black, only foretibia whitish; thorax black with posterior margin of pronotum and mesonotum except black marks on prescutum and scutellum, red . . . . **ruminata** (Konow)
— Legs orange with tibiae and tarsi black; thorax red with mesoprescutum and 2 marks on mesosternum black . . . . **fuscipennis** Mocsáry
35. Legs white, contrasting with black apex of tibiae and tarsi 36
— Legs black, at most with white on tibiae and apices of femora or only foretibia 38
36. Antennal segments 1 and 2 black (thorax black with pronotum and sometimes mesopleuron red) . . . . **filiformis** (Norton)
— Antennal segments 1 and 2 usually white 37
37. Mesopleuron and mesonotum black; supraclypeal area white; genitalia as in Fig. 436 . . . . . . **dominicaensis**, new species
— Mesopleuron, at least upper portion, and mesonotum mostly red; supraclypeal area usually black; genitalia as in Fig. 437 . . . . **leucopoda** (Cameron)
38. Mesonotum red with prescutum or prescutum and scutellum black (legs black, only foretibia whitish) 39
— Mesonotum black 40
39. Mesonotum red with only prescutum usually black; 8th tergite without lateral pits . . . . **ephippiata** (Klug)
— Mesonotum red with prescutum and scutellum black; 8th tergite with round, deep pit on each side (Fig. 396) (genitalia as in Fig. 435) . . . . **natna** Smith
40. Eighth tergite with round, deep pit on each side (Fig. 396) (legs black or with extreme apices of femora and bases of tibiae whitish; genitalia as in Fig. 441) . . . . **nantina**, new species
— Eighth tergite without pits 41
41. Legs black with tibiae whitish or partly white (thorax black or sometimes with pronotum reddish; genitalia as in Fig. 433) . . . . **texana** (Norton)
— Legs black with only foretibia whitish 42
42. Thorax black; genitalia as in Fig. 434 . . . . **vana** (Smith)
— Thorax with pronotum and mesonotum red; genitalia as in Fig. 439 . . . . **quidra**, new species

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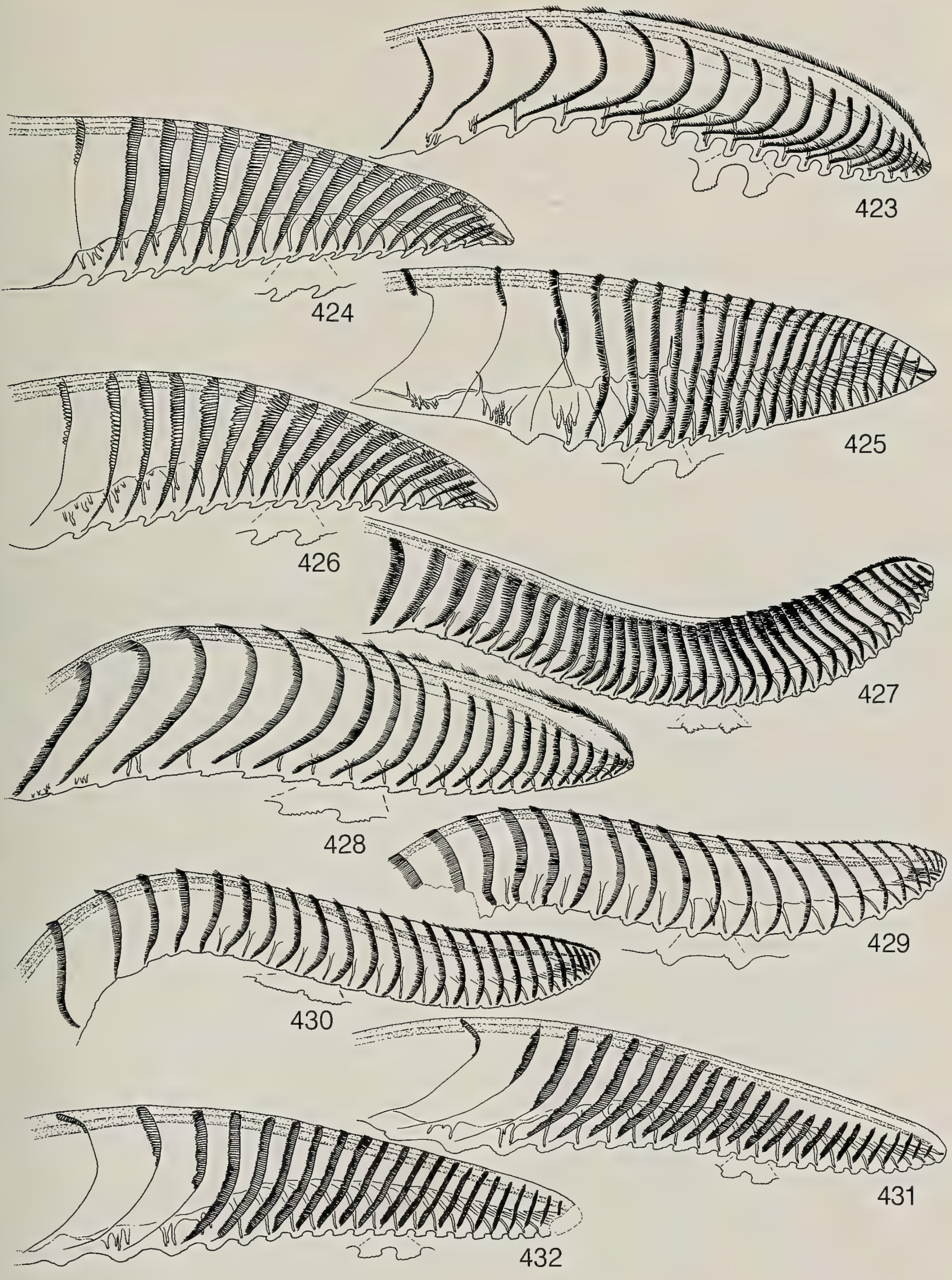
SPECIES

albicerata (Konow), **new combination** — Peru

**Schizocerus albiceratus* Konow 1903: 108. F. "Peru (Marcapata)" (Eberswalde, F).— Konow 1905a: 29.— Oehlke and Wudowenz 1984: 365 (1 F syntype, without head, at Eberswalde).

The female at Eberswalde labeled "Marcapata, Peru" is here designated lectotype. The head is missing, but other characters such as the wing venation, sheath, and lancet place this in *Hemidianeura*. It is not included in the key but appears to be close to *nigricornis* (lancet Fig. 419). The coloration is as follows: Thorax red orange with cervical sclerites, mesoprescutum, prosternum, lower half of mesepisternum, mesosternum, and metapleruon black and tegula, mesoscutellum, and metascutellum whitish; abdomen black; legs yellow orange with tarsi and extreme apex of hindtibia black.



Figs. 423-432. *Hemidianeura*, female lancets. 423, *H. plana*; 424, *H. menkei*; 425, *H. dominicaensis*; 426, *H. delta*; 427, *H. evansi*; 428, *H. nantina*; 429, *H. dasua*; 430, *H. quidra*; 431, *H. kuscheli*; 432, *H. ephippiata*.

apicalis Mocsáry — Brazil (Amazonas, Pará); French Guiana

Hemidianeura apicalis Mocsáry 1909: 7. F. "Brasilia: Fonteboa ad Amazonas" (Budapest, F).— Malaise 1957: 10.

I have examined specimens from French Guiana (Kaw) and Brazil (S. Gabriel, Rio Negro, Amazonas; Marajo P. Pedras, Pará).

atripes (Holmgren), **new combination** — Brazil (Rio de Janeiro)

**Hylotoma atripes* Holmgren 1868: 391. F. "Brasilia (Rio Janeiro)" (Stockholm, F).— Dalla Torre 1894: 326.
Labidarge atripes: Konow 1905a: 16.

I have seen several additional specimens from Rio de Janeiro.

coeliaca Konow — Brazil (Rio Grande do Sul)

Hemidianeura coeliaca Konow 1903: 108. F. "Brasilia (R. Grande do Sul)" (Eberswalde, F).— Konow 1905a: 26.— Oehlke and Wudowenz 1984: 374 (holotype).
Oigodianeura coeliaca: Malaise 1957: 8.

The type was not examined, but the species was well characterized by Malaise (1957).

dasua Smith, **new species** — Guatemala

Hemidianeura dasua Smith.

Female.— Length, 6.5 mm. Black; palpi whitish; fore- and midtibiae, extreme apices of fore- and midfemora, foretarsus, midbasitarsus, and basal 3/4 hindtibia white. Wings moderately, uniformly blackish infuscated. Antennal length to head width as 3.6:2.3. Clypeus with small semicircular central emargination; short, blunt, high interantennal carina present; lower interocular distance to eye length as 2.2:2.2; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.8:0.7. Length of hindbasitarsus to length of remaing tarsal segments combined as 1.0:1.3. Sheath with scopae, in lateral view rounded (Fig. 406). Lancet as in Fig. 429.

Male.— Unknown.

Holotype.— F, "Duenas, Guate., 4500 ft., VIII-18-1947, F. Johnson Donor Cols. C. and P. Vaurie" (New York).

Remarks.— The black coloration with part of the legs white and lancet are distinctive for this species. It is related to *texana*, *vana*, *quidra*, and *evansi* by the sheath shape, general appearance of the lancet, and emargination of the clypeus, however, the former three species have red markings on the thorax and *evansi* has black legs.

delta Malaise — Brazil (Santa Catarina); Peru

Hemidianeura delta Malaise 1957: 11. F. "Brasil, Sta Catharina (Nova Teutonia)" (Stockholm, F).

A specimen from Peru (Chanchamayo) is similar to this species, but the mesonotum is entirely red. The holotype has the mesoprescutum and mesoscutellum black.

dominicaensis Smith, **new species** — Dominica

Hemidianeura thoracica: Smith 1969a: 542 (in part).

Hemidianeura dominicaensis Smith.

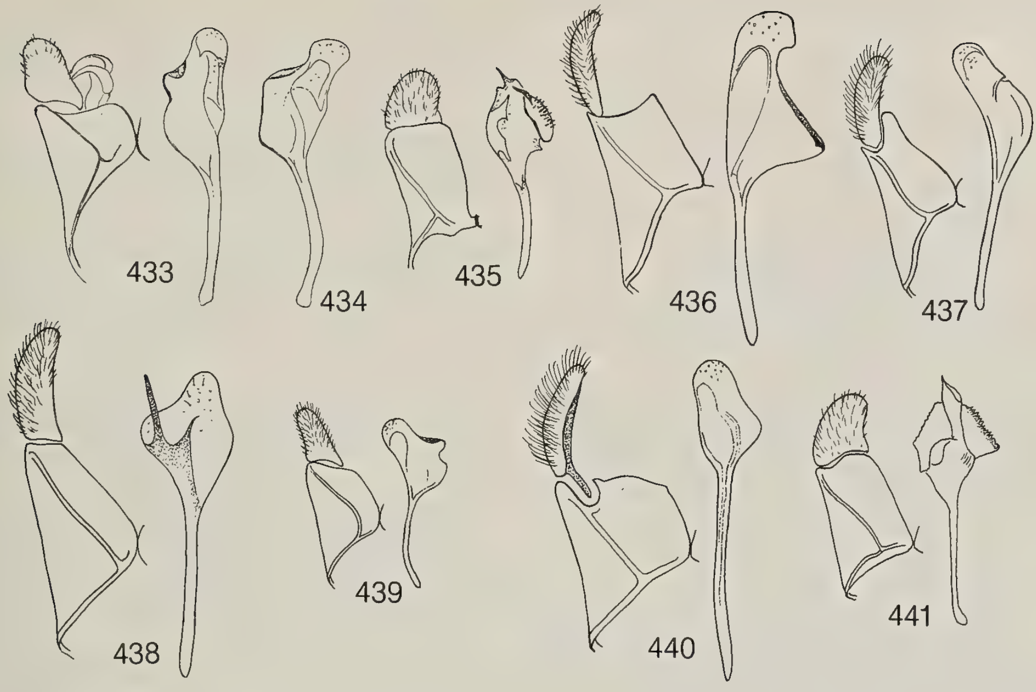
Female.— Length, 4.0 mm. Antenna black, segments 1 and 2 white. Head black with clypeus, supraclypeal area, labrum, and palpi white. Thorax black with cervical sclerites, pronotum, and tegula pale orange; posterior margin of mesoscutellum brownish as is mesepimeron and metepimeron. Legs white with apical 3 or 4 fore- and midtarsal segments, hindtarsus, and extreme apex of hindtibia black. Abdomen black. Wings very lightly infuscated blackish, nearly hyaline; veins and stigma black. Antennal length slightly longer than head width, as 1.8:1.7. Clypeus truncate; interantennal area rounded; lower interocular distance to eye length as 1.6:1.9; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:1.0:0.4. Length of hindbasitarsus to length of remaining tarsal segments combined as 0.6:0.6. Sheath with laterally protruding scopae (Fig. 402). Lancet as in Fig. 425.

Male.— Length, 4.0 mm. Coloration as for that of female. Antennal length to head width as 2.3:1.7. Genitalia as in Fig. 436.

Holotype.— F, "Dominica, Mth. Layou R., III-13-1965, H. E. Evans, Bredin-Archbold Smithsonian Biol. Surv. Dominica" (Washington).

Paratypes.— DOMINICA: same data as for holotype (1 M); Clarke Hall, IV-5-1964, O. S. Flint, Jr. (1 M); Clarke Hall, X-12-18-1964, P. J. Spangler (1 M) (Washington).

Remarks.— In 1969a, I recorded this species as *thoracica*, a species described from Grenada. It is close to *thoracica* except for its mostly black thorax.



Figs. 433-441. *Hemidianeura*, male genitalia. 433, *H. texana*; 434, *H. vana*; 435, *H. natna*; 436, *H. dominicaensis*; 437, *H. leucopoda*; 438, *H. viridana*; 439, *H. quidra*; 440, *H. nigricornis*; 441, *H. nantina*.

ephippiata (Klug) — Brazil (Amapá, Amazonas, Pará); French Guiana; Guyana; Surinam

**Hylotoma ephippiata* Klug 1834: 242. M. "Surinam" (Berlin, M).— Kriechbaumer 1884: 321.
Ptilia ephippiata: Norton 1867: 62.
Hemidianeura ephippiata: Kirby 1882: 49.— Dalla Torre 1894: 321.— Malaise 1957: 12 (syn.: *bicolor* Kirby, *tenebrica* Konow; Suriname, lower Amazonas, French Guiana).
Ptenus ephippiatus: Konow 1905a: 25.
**Scobina bicolor* Kirby 1882: 41, pl. 3, fig. 6. F. "Amazons. Villa Nova" (London, F).— Dalla Torre 1894: 317.— Konow 1905a: 15.
**Hemidianeura tenebrica* Konow 1906b: 191. F. "Surinam" (Eberswalde, F).— Oehlke and Wudowenz 1984: 415 (holotype).
Sericoceros procus* Konow 1906b: 248. M. "Brasilia (Oyapick)" (Eberswalde, M)— Oehlke and Wudowenz 1984: 406 (holotype). **New synonymy.

The holotype of *bicolor* (BM #1.159) represents a color variant, having the pronotum, tegula, and mesonotum red with black only on the mesoscutellum. I have seen additional specimens from Surinam and Amazonas, Brazil, and one from Blairmont, British Guiana.

evansi Smith, **new species** — Mexico (Morelos)

Hemidianeura evansi Smith.

Female.— Length, 6.0 mm. Black, only maxillary palpi and foretibia whitish. Wings uniformly subhyaline; veins and stigma black. Antennal length to head width as 3.4:2.4; flagellum laterally flattened. Clypeus with shallow, semicircular, central emargination; short, high, sharp interantennal carina present; lower interocular distance shorter than eye length, as 1.0:1.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.9:0.7. Length of hindbasitarsus slightly shorter than length of remaining tarsal segments combined. Sheath similar to that of *texana*, as in Fig. 409. Lancet as in Fig. 427.

Male.— Unknown.

Holotype.— F, "Guadalajara, Crawford" (Washington).

Paratype.— MEXICO: 30-40 km NE Cuernavaca, Mor., 7-8000', VII-31-62, H. E. Evans, collector (1 F) (Cambridge).

Remarks.—This species is similar to *dasua* in color, but the mid- and hindtibiae are black and the lancet is long with the serrulae flat. It is also similar to *texana*, *quidra*, and *vana* except for the black legs and body. It shares the central emargination of the clypeus with those four species.

filiformis (Norton) — Mexico (Oaxaca, Veracruz)

**Ptilia filiformis* Norton 1867: 62. F, M. "Cordova, t.c. Mexico" (Genève, F).
Hemidianeura filiformis: Kirby 1882: 48.— Smith 1971a: 525 (lectotype).
Dielocera filiformis: Cameron 1883: 43 (syn.: *scapularis* Kirby).
Dielocerus filiformis: Dalla Torre 1894: 322.
Dieloceros filiformis: Konow 1905a: 24.
**Hemidianeura scapularis* Kirby 1882: 49, pl. 3, fig. 15. M. "Mexico. Oajaca" (London, M).— Malaise 1957: 11.

The type of *scapularis* (BM #1.161) is like the female except the mesopleuron is all black and there is a little more black on the hindtibia. I have seen additional specimens from Veracruz.

flavicornis Benson — Brazil (Espirito Santo)

**Hemidianeura apicalis* Enderlein 1919: 118. F. "Südbrasilien. Espirito Santo" (Warszawa, F) (preoccupied by *Hemidianeura apicalis* Mocsáry 1909).
Hemidianeura flavicornis Benson 1930b: 107 (new name for *apicalis* Enderlein).— Malaise 1957: 9.

fucata Konow — Brazil (Santa Catarina)

**Hemidianeura fucata* Konow 1906b: 189-190. F. "Brasilia (St. Katharina)" (Eberswalde, F).— Malaise 1957: 9 (not a *Hemidianeura*).— Oehlke and Wudowenz 1984: 383 ("F Lectotypus (des. D.R. Smith)").

The last closed cubital cell is barely longer on the radius than on the cubitus and was thereby rejected from *Hemidianeura* by Malaise; however, in all other respects, *fucata* belongs to this genus. A male and a female are at Eberswalde. The female is the lectotype. I labeled the specimen but did not publish on it prior to Oehlke and Wudowenz (1984). The male is probably the one Konow questionably associated with *fucata*. It is not part of the type series and is not *fucata* but another unidentified species of *Hemidianeura*.

fuscipennis Mocsáry — Peru

Hemidianeura fuscipennis Mocsáry 1909: 8. M. "Peru: Pebas ad Amazonas" (Budapest, M).— Malaise 1957: 10.

I did not examine the holotype. The species is well characterized by Malaise (1957).

kuscheli Malaise — Bolivia; Peru

**Hemidianeura kuscheli* Malaise 1957: 12. F. "Bolivia (Irupana, Siquiljara 4100-4200 m)" (Stockholm, F).

I examined a single specimen from Peru (Estancia Naranjal, San Ramon, Dep. Junin, 1000 m).

leucopoda (Cameron) — Costa Rica; Ecuador; Guyana; Honduras; Mexico (Chiapas, San Luis Potosi, Tabasco, Veracruz); Panama; Surinam; Venezuela

**Sericocera leucopoda* Cameron 1883: 48, pl. 3, fig. 3. F. "Panama, Bugaba" (London, F).— Dalla Torre 1894: 310.
Sericoceros leucopus (!): Konow 1905a: 28.
Hemidianeura leucopoda: Malaise 1957: 12.
Sericocera laeta* Cameron 1883: 48. F. "Panama, San Felix" (London, F).— Dalla Torre 1894: 310. **New synonymy.
Sericoceros laetus: Konow 1905a: 28.
Hemidianeura laeta: Malaise 1957: 12.

Host: Specimens from Venezuela bear a label "caterpillar on Inya sp."

The amount of white on the antenna, presence or absence of black on the mesoprescutum, and amount of black on the hindtibia varies in this species. I failed to find structural differences between specimens of different color combinations or between specimens from northern South America and Mexico and believe both the descriptions above represent the same species. The holotype of *laeta* (BM # 1.162) has the apical half of the hindtibia black and the antenna black. The holotype of *leucopoda* (BM #1.160) has only the extreme apex of the hindtibia black and the first two antennal segments partly white. This is a relatively common species, and I have examined specimens from all of the above countries and provinces.

menkei Smith, **new species** — Venezuela

Hemidianeura menkei Smith.

Female.— Length, 5.5 mm. Antenna black; head black with supraclypeal area, anterior 1/2 of clypeus, labrum, and palpi whitish. Thorax black. Legs black with foretibia whitish. Abdomen black above, orange below; sheath black. Wings lightly, uniformly infuscated black; veins and stigma black. Antennal length about 2X head width, as 4.0:2.1. Clypeus subtruncate; malar space linear; interantennal area rounded; lower interocular distance shorter than eye length, as 1.8:2.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.7:0.4.

Length of hindbasitarsus slightly longer than length of following tarsal segments combined. Sheath similar to that of *delta*, Fig. 400. Lancet as in Fig. 424.

Male.— Unknown.

Holotype.—F, "Venezuela: Aragua Rancho Grande, 8-11 June 1976, A. S. Menke and D. Vincent" (Washington).

Remarks.— The mostly black color with the supraclypeal area, clypeus, labrum, and palpi white and the venter of the abdomen orange are unlike other species of *Hemidianeura*.

mexicana (Cresson) — Mexico

**Ptilia mexicana* Cresson 1880: 3. M. "Mexico" (Philadelphia, M).— Cresson 1916: 6 (holotype).
Hemidianeura mexicana: Kirby 1882: 49.—Dalla Torre 1894: 322.—Konow 1905a: 26.—Smith 1971a: 530 (holotype).

I have seen only the holotype of this species.

midea Smith, **new species** — Mexico (Veracruz)

Hemidianeura midea Smith.

Female.— Length, 7.0 mm. First 2 antennal segments black (3rd missing). Head and mouthparts black. Thorax orange with cervical sclerites, mesosternum, anterior margin of mesoprescutum, mesoscutellum, and metathorax black. Legs white with forecoxa, basal halves of mid- and hindcoxae, most of forefemur, basal 1/3 of outer surface of midfemur, most of outer surface of foretibia, extreme apices of mid- and hindtibiae, and all tarsi black. Abdomen and sheath black. Wings lightly, uniformly black infuscated; veins and stigma black. Clypeus subtruncate; lower interocular distance shorter than eye length, as 2.2:2.5; interantennal area with short, blunt elevation; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:0.9:0.5. Length of hindbasitarsus subequal to length of remaining tarsal segments combined. Sheath similar to that of *plumicornis*, Fig. 407. Lancet as in Fig. 413.

Male.— Unknown.

Holotype.— F, "Cordoba, Mex., 16 Mch '08, Fred K. Knab, collector" (Washington).

Remarks.—This species is similar to *leucopoda* but has the basal antennal segments black and a structurally different lancet (Figs. 413, 414).

nantina Smith, **new species** — Brazil (D.F.)

Hemidianeura nantina Smith.

Female.— Length, 5.8-6.3 mm. Black with apical 1/4 femora, entire foretibia, and basal 1/3 of mid- and hindtibiae whitish. Wings lightly, uniformly blackish infuscated; veins and stigma black. Antennal length to head width as 5.2:4.2. Short, straight carina between antennae; lower interocular distance to eye length as 2.2:2.1; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:0.6:0.6; 3rd segment of labial palpus broader than other segments, 4th segment of maxillary palpus slightly broader than other segments. Forewing with 4 cubital cells, last closed cell slightly longer on radius than on cubitus Length of hindbasitarsus to length of remaining tarsal segments combined as 1.7:2.2. Sheath rounded in lateral view, in dorsal view with short posteriorly projecting scopae (Fig. 408). Lancet as in Fig. 428, annuli curved.

Male.— Length, 5.3-5.9 mm. Coloration as for that of female but sometimes legs mostly black and sterna of abdomen with whitish apical margins. Antennal length to head width as 6.0:4.2. Lower interocular distance to eye length as 2.1:2.1; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.6:0.6. Eighth tergite with a large circular depression or pit on each side, each bearing numerus inwardly projecting stiff hairs (Fig. 396). Genitalia as in Fig. 441, valve with apical spine.

Holotype.— F, "Res. Ecol. IBGE, KM 0 BR 251 - D.F., 14 a 21-III-80, 3A-32-4 J" (Brasilia, IBGE).

Paratypes.— BRAZIL: Same data as for holotype (1 M); same except for dates, 10-17-X-1980 (1 F), 7-14-XI-1980 (1 F), 9-16-XI-1979 (1 F), 23-29-X-1981 (1 F), 11-19, 26/X-5/XI/1979 (1 F), 11-25-IX-1981 (1 M), 3-10-XII-1981 (1 M) (Brasilia, IBGE; Washington).

Remarks.—This species is similar to *natna* in color and the presence of pits on the eighth tergite of the male. The almost entirely black coloration, shape of the male valve (Fig. 435, 441), and female lancet (Fig. 418, 428), however, separate the two species

natna Smith — Brazil (D.F.)

**Hemidianeura natna* Smith 1981: 285-286, fig. 33-35. F, M. "Res. Ecol. IBGE, Km 0 BR 251 - DF" (Brasilia, IBGE, F)

The left mandible has two, small, sharp teeth near its center, unlike the nearly simple left mandible of most *Hemidianeura*. The male has circular depressions on each side of the eighth tergite as described in the introduction to the genus..

nigricornis Kirby — Brazil (Pará, Amazonas); French Guiana; Peru; Surinam.

**Hemidianeura nigricornis* Kirby 1882: 49, pl. 3, fig. 16. F. "Amazonas. Santarem" (London, F).— Dalla Torre 1894: 322.— Konow 1905a: 26.— Malaise 1957: 10.
Hemidianeura illisa* Konow 1906b: 190-191. M. "Brasilia (Obidos)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 388 (2 M syntypes at Eberswalde). **New synonymy.
Hemidianeura nigricornis illisa: Malaise 1957: 10.

Both syntypes of *illisa* at Eberswalde are labeled "Obidos 1904." The one with Konow's determination label is hereby selected lectotype and the other is a paralectotype. The holotype of *nigricornis* is BM #1.138. The only difference between *illisa* and *nigricornis* is the presence or absence of a black mark on the mesoprescutum. Malaise chose to separate these forms as subspecies. I have seen specimens from Surinam (Zanderij), Peru (Loreto, Pucallpa), and French Guiana (Nouveau Chantier)

plana Smith, **new species** — Brazil (Santa Catarina)

Hemidianeura plana Smith.

Female.— Length, 7.0 mm. Antenna, head, and thorax black. Legs black with apical halves of fore- and midfemora and most of hindfemur light orange, basal halves of tibiae whitish. Abdomen orange, apical 1-2 segments and sheath black. Wings darkly, uniformly infuscated black; veins and stigma black. Antennal length to head widht as 4.0:2.5. Clypeus subtruncate; malar space linear; lower interocular distance shorter than eye length, as 1.2:1.5; interantennal area with short, blunt elevation; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:0.7. Length of hindbasitarsus subequal to length of following tarsal segments combined. Sheath rounded in lateral view, with slender scopae, similar to that of *dasua*, Fig. 406. Lancet as in Fig. 423.

Male.— Unknown.

Holotype.— F, "Mafra, S. Cath., Brazil, Dec. 1940, A. Maller, col., Frank Johnson, donor" (New York).

Paratype.— BRAZIL: Nova Teutonia, 27° 11'B, 52° 23' L, 300-500 m, XI-1967, Fritz Plaumann (1 F) (New Haven).

Remarks.— The black wings, black head and thorax, mostly orange abdomen, and unusual lancet (Fig. 423) separate this species from other *Hemidianeura*. The color is similar to *plumicornis* except for the uniformly dark wings, and the lancet (Figs. 416, 423) and sheath (Figs. 406, 407) are decidedly different.

plaumanni (Malaise), **new combination** — Brazil (Santa Catarina)

Oigodianeura plaumanni Malaise 1957: 8. F. "Brazil, Sta Catharina (Nova Teutonia)" (Stockholm, F).

I have seen additional specimens from the type locality.

plumicornis (Klug) — Brazil (Rio de Janeiro, São Paulo, Santa Catarina)

**Hylotoma plumicornis* Klug 1834: 241. F. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 290.
Ptilia plumicornis: Norton 1867: 62.
Hemidianeura plumicornis: Kirby 1882: 49.— Dalla Torre 1894: 322.— Konow 1905a: 26.— Malaise 1957: 9.
Hemidianeura hyalinata* Mocsáry 1909: 7. F. "Brasilia: Blumenau" (Budapest, F). **New synonymy.

There are 2 females of *plumicornis* at Berlin, both labeled "13683" and "Brasil v. Olfers." The specimen with the large green determination label is hereby selected lectotype, the other with "*plumicornis*" on a white piece of paper is a paralectotype. I have examined specimens from the following Brazilian states: Rio de Janeiro, São Paulo (Barueri; Boracsia), and Santa Catarina (Hansa Humbolt).

propleuralis (Malaise), **new combination** — Brazil (Paraná, Rio de Janeiro, Santa Catarina, São Paulo)

Oigodianeura propleuralis Malaise 1957: 8. F. "Brazil, Sao Paulo (Serra da Cantareicia)" (Stockholm, F).

I have seen specimens from São Paulo, Paraná (Rolandia), Rio de Janeiro, and Santa Catarina (Pinhal).

quidra Smith, **new species** — Mexico (Guerrero, Veracruz)

Hemidianeura quidra Smith.

Female.—Length, 7.0 mm. Antenna and head black; palpi whitish. Thorax black with tegula and mesonotum, except black mark on anterior 1/2 of prescutum, reddish. Abdomen black. Legs black with foretibia and foretarsus except for apical 3 or 4 segments and basal 2/3 of mid- and hindtibiae white. Wings darkly, uniformly black infuscated; veins and stigma black. Antennal length to head width as 3.8:2.3. Clypeus with slight, central, semicircular emargination; lower interocular distance to eye length as 2.3:2.3; interantennal area with short, blunt elevation; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.6:0.9. Length of hindbasitarsus to length of reamining tarsal segments combined as 1.0:1.3. Sheath with long slender scopae directed posteriorly, Fig. 398. Lancet as in Fig. 430.

Male.—Length, 6.8 mm. Similar in color to female except for reddish pronotum and mesonotum. Antennal length to head width as 4.3:2.3. Genitalia as in Fig. 439.

Holotype.—F, "12 miles south Chilpancingo, Gro., Mexico, VII-12-66, P. M. and P. K. Wagner" (College Station).

Paratypes.— MEXICO: Cordoba, Crawford (1 F); 9 mi S. Tierra Colorado, Gro., VII-21 1963, F. D. Parker, L. A. Stange (4 F, 1 M) (Davis, Washington).

Remarks.— This species most closely resembles *texana* but is distinguished by the black pronotum and shorter lancet with fewer serrulae (Figs. 411, 430). The white tibiae, black pronotum, and short lancet will separate *quidra* from *vana*.

ruminata (Konow) — Brazil (Pará)

**Sericoceros ruminatus* Konow 1906b: 248-249. M. "Brasilia (Obidos)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 409 (holotype).
Hemidianeura ruminata: Smith 1981: 286.

This species is close to *ephippiata* but the last closed cubital cell is quadrate (instead of shorter than long) and the pronotum and basal abdominal segments are paler to dark orange. I choose to leave *ruminata* separate for now.

texana (Norton), **new combination** — Mexico (Coahuila, San Luis Potosi, Yucatán ?); U.S.A. (Texas)

**Ptilia texana* Norton 1869: 367. F, M. "Texas" (Philadelphia, F).— Cresson 1928: 9 (holotype).
Ptenos texanus: Norton 1872: 77.— Dalla Torre 1894: 324.— Forsius 1925a: 6.
Ptenus texanus: Kirby 1882: 53.— Konow 1905a: 26 (syn.: *niger* Norton).— Ross 1951: 16.— Smith 1970: 94-95, fig. 4, 14, 15, 18, 31, 41.— Greenbaum 1975: 166 (distribution).— Smith 1979: 24.

**Ptenos niger* Norton 1872: 77. M. "Texas" (Philadelphia, M).— Cresson 1880: 36.— Dalla Torre 1894: 324.— Forsius 1925: 6.— Cresson 1928: 7 (holotype).
Ptenus niger: Kirby 1882: 53.— Ross 1951: 16.

A specimen from Yucatán (Vicente Solis) is similar but has the mesoprescutum, upper portion of the mesepisternum, and metanotum red rather than black.

thoracica Ashmead — Grenada

**Hemidianeura thoracica* Ashmead 1900b: 298, 366. F. "Grenada - Balthazar, Grand Etang" (London, F).— Malaise 1937: 10.— Smith 1969a: 542 (in part).

Of the two specimens described, one is in London the other in Washington. The specimen in London is hereby designated lectotype, the Washington specimen a paralectotype. The lectotype is labeled "Grand Etang (windward side) 1900 ft., Grenada, W.I., H.H. Smith" and is BM #1.139.

vana (Smith), **new combination** — Mexico (Chihuahua, Coahulia, San Luis Potosi Veracruz); U.S.A. (Arizona, New Mexico)

**Ptenus vanus* Smith 1970: 96, 98, fig. 32. F, M. "S.F. Deer Cr. Can., Peloncillo Mts., N.*M*., 5000'" (Washington, F).— Greenbaum 1975: 166 (Veracruz).— Smith 1979: 24.

I have seen specimens from 10 mi. N. Cd. Jiminez, Chihuahua, and El Naranjo, El Salto, S.L.P.

viridana (Malaise), **new combination** — Argentina (Tucumán); Brazil (D.F.)

**Argenia viridana* Malaise 1949: 60-61. F, M. "Argentina (Tucumán, Villa Padre Monti)" (Tucumán, F).

Paratypes of this species are in Stockholm. The left mandible has two small teeth near the center and the right mandible has a small subapical tooth near the apical tooth unlike most *Hemidianeura* which have the left mandible nearly simple and right mandible with a basal lobe. I have seen additional specimens from the province of Tucumán, Argentina, and several specimens from Res. Ecol., IBGE, Brasilia, D.F., Brazil, with the following dates: 18-25-III-82, 17-24-III-83, 29-III-5-IV-84, 31-III-7-IV-83. The specimens are identical to those from Tucumán.

Genus MANAOS Rohwer

Manaos Rohwer 1912c: 62. Type species: *Manaos nigrinotatus* Rohwer. Orig. desig.

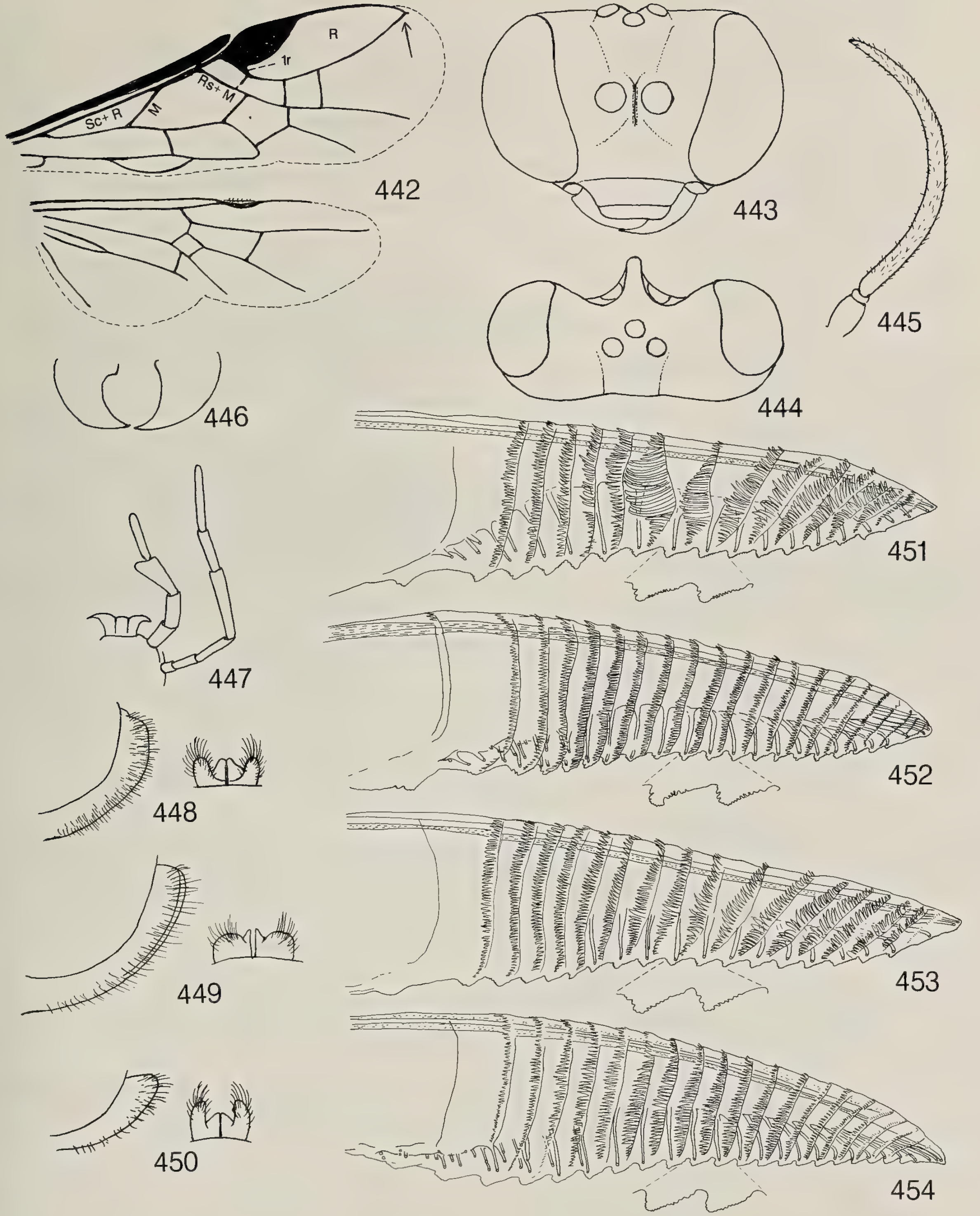
Antenna (Fig. 445) with 1st segment enlarged, oval, and broader than 2nd and 3rd segments, longer than broad; 2nd segment short, broader than long; 3rd segment of female antenna long, oval or circular in cross-section and tapering to apex; antennal length usually 2X or more head width. Eyes large, converging below, lower interocular distance less than eye length (Fig. 443), close to posterior margin of head in side view; head from above sharply narrowing behind eyes (Fig. 444); interantennal carina high, sharp, not Y-shaped above and ending at top of supraclypeal area below (Fig. 443); supraclypeal area convex; ocelli large, closer together than the diameter of one; clypeus truncate; malar space linear; length of maxillary palpus longer than eye length, palpi without enlarged segments or only 3rd segment of labial palpus slightly enlarged (Fig. 447); left mandible simple, right mandible with basal tooth (Fig. 446). Forewing (Fig. 442) with costa swollen, broader than intercostal area; radial cell closed, with none or a very short stub as accessory vein; 3 or 4 cubital cells, the last closed cell quadrate, as long as or slightly longer on cubitus as on radius; distance between M and Rs+M on Sc+R equal to or greater than length of vein M; basal anal cell present. Hindwing (Fig. 442) with anal cell present, equal to or longer than its petiole. Length of hindbasitarsus usually longer than length of remaining tarsal segments combined; tarsal claws simple.

All species are very similar in appearance, usually yellow to orange with black marks on the thorax, with uniformly black or fasciate wings, and about 6 to 7 mm in length. The sheath is very similar in all species, as are also the female lancet and male genitalia. The genus is close to *Hemidianeura*, and it was treated as a subgenus of *Hemidianeura* by Malaise (1937a), but *Manaos* lacks a long accessory vein at the apex of the radial cell of the forewing, has the apex of the radial cell closer to the apex of the wing, has a short, sharp, high, interantennal carina, has large ocelli with the distance between them less than the diameter of one, and has a much enlarged first antennal segment.

Species determination is difficult, and the female lancet should be examined for identification. Additional material is needed to evaluate the status of some species. The genus is found from Central America to Argentina. Hosts are not known.

KEY TO SPECIES

1. Head orange 2
– Head black above antenna; clypeus and supraclypeal area whitish 4
2. Forewing yellowish with apex black in female, base and apex black in male; stigma usually yellow; annular spines of lancet not noticeably enlarged at center (Fig. 452) (male genitalia as in Fig. 460) . . . . ***toula***, new species
– Wings uniformly blackish infuscated; veins and stigma black; central annuli of lancet with enormously enlarged spines (Figs. 451, 455) 3
3. Apex of abdomen usually blackish, at least apical terga; lancet as in Fig. 451; male genitalia as in Fig. 458 . . . . ***filicornis*** (Klug)
– Abdomen orange; lancet as in Fig. 455; male genitalia as in Fig. 464 . . . . ***maculipennis*** (Forsius)
4. Forewing fasciate, yellowish at center, black at base and apex and sometimes at anterior margin 5
– Forewing uniformly blackish infuscated 7
5. Abdomen orange (thorax orange, only mesonotal lateral lobes black) . . . . ***bigrammatus*** (Konow)
– Abdomen yellow to orange, apical 2-4 segments black. 6
6. Annular spines of lancet short, those on apical half of lancet shorter than or no longer than those on basal half of lancet (Fig. 454); mesonotum black (a specimen from Mexico has lateral lobes black, prescutum and scutellum orange yellow); large, 7.0 mm long; (male genitalia as in Fig. 462) . . . . ***kimseyae*** Smith
– Annular spines on apical half of lancet long, longer than those on basal half of lancet (Fig. 453); mesonotum with scutellum and/or prescutum mostly orange yellow; small, about 5.0 mm long . . . . ***declivis*** (Konow)
7. Mesopleuron and mesosternum black; femora mostly black; (male genitalia as in Fig. 461) . . . . ***wygodzinskyi*** Malaise
– Mesopleuron orange, mesosternum orange or with black marks; femora orange 8



Figs. 442-454. *Manaos*. 442, Forewing and hindwing of *M. filicornis*. 443, Front view of head of *M. filicornis*. 444, Dorsal view of head of *M. filicornis*. 445, Female antenna of *M. filicornis*. 446, Mandibles of *M. filicornis*. 447, Palpi of *M. filicornis*. Female sheaths of 448, *M. toulus*; 449, *M. kimseyi*; 450, *M. filicornis*. Female lancets of 451, *M. filicornis*; 452, *M. toula*; 453, *M. declivis*; 454, *M. kimseyi*.

8. Mesonotum black; annular spines of lancet shorter than distance between segments (Fig. 456) (male genitalia as in Fig. 463; mesopleuron and mesosternum orange) . . . . ***mulsus*** (Konow)
– Mesonotum partly orange; annular spines near center of lancet usually long and overlapping (Fig. 457) **9**
9. Mesosternum black or with black marks on each side; mesonotum usually with black on prescutum and lateral lobes (lancet as in Fig. 457; male genitalia as in Fig. 459) . . . . ***mammeatus*** (Konow)
– Mesosternum orange; mesonotum orange or only lateral lobes black **10**
10. Mesonotum orange . . . . ***ricatus*** (Konow)
– Mesonotum with lateral lobes black (male genitalia as in Fig. 465; species similar and identical in coloration; the type of *affinis* is smaller and has the sheath orange, that of *romani* is larger and has the sheath blackish; presently I cannot determine if these are valid species) . . . . ***affinis*** (Forsius), ***romani*** (Forsius)

SPECIES

affinis (Forsius), **new combination** — Brazil (Amazonas)

**Sericoceros affinis* Forsius 1925a: 12-13. F, M. "Rio Purus" (Stockholm, F) (allotype from Ria Autáz).

The specimens at Stockholm were labeled the reverse, the male from Rio Autáz as type, the female from Rio Purus as cotype. Specimens similar to *affinis* and *romani* have been collected in Peru (Chanchamayo) and Brazil (Pará, Amapá, Mato Grosso).

bigrammatus (Konow), **new combination** — Brazil (Amazonas)

**Sericoceros bigrammatus* Konow 1906b: 246. F. "Brasilia (Amazonas)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 369 (holotype).

The holotype lacks a head, but other characters place it in *Manaos*. It is labeled "Massauari, Amazonas."

declivis (Konow), **new combination** — Brazil (Amapá, Pará); Honduras; Surinam

**Sericoceros declivis* Konow 1906b: 246-247. F. "Brasilia (Oyapock)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 376 ("F Lectotypus (des. D.R.Smith 1978) und 1 F, ohne Kopf, Paralectotypus").

Two females at Eberswalde bear the same data: "Oyapock, 9.6.1904, Ducke." I labeled the specimens in 1978 but did not publish a lectotype designation. The specimen with Konow's determination label is the lectotype, the other specimen lacking the head is the paralectotype. The Honduran specimen is similar in color and structure; however, the pale areas appear more yellow than orange. I have seen other specimens from Surinam (Coppename River, Voltz Plateau) and Brazil (Pará, km 90 F Jaboti; Santarem).

filicornis (Klug), **new combination** — Argentina; Brazil (Minas Gerais, Rio de Janeiro, Santa Catarina)

**Hylotoma* (*Schizocera*) *filicornis* Klug 1834: 244. F, M. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 292.
Schizocerus filicornis: Norton 1867: 56.— Kirby 1882: 28.
Schizocera filicornis: Dalla Torre 1894: 312.
Sericoceros filicornis: Konow 1905a: 29.— Konow 1906b: 251.

Two females of *filicornis* are at Berlin, both labeled "13702" and "Brazil, v. Olvers." The specimen with the large, green determination label is hereby selected the lectotype and the other specimen a paralectotype. I have seen specimens from each of the above Brazilian states. A specimen from Argentina is labeled "Bemberg, Argentina."

kimseyae Smith — Costa Rica; Mexico (Veracruz); Panama

**Manaos kimseyi* Smith in Kimsey and Smith 1985: 195-197. fig. 6-10, 32-39. F, M, larva. "Canal Zone, Pan., Barro Colorado I." (Davis, F) (host a; biological note).

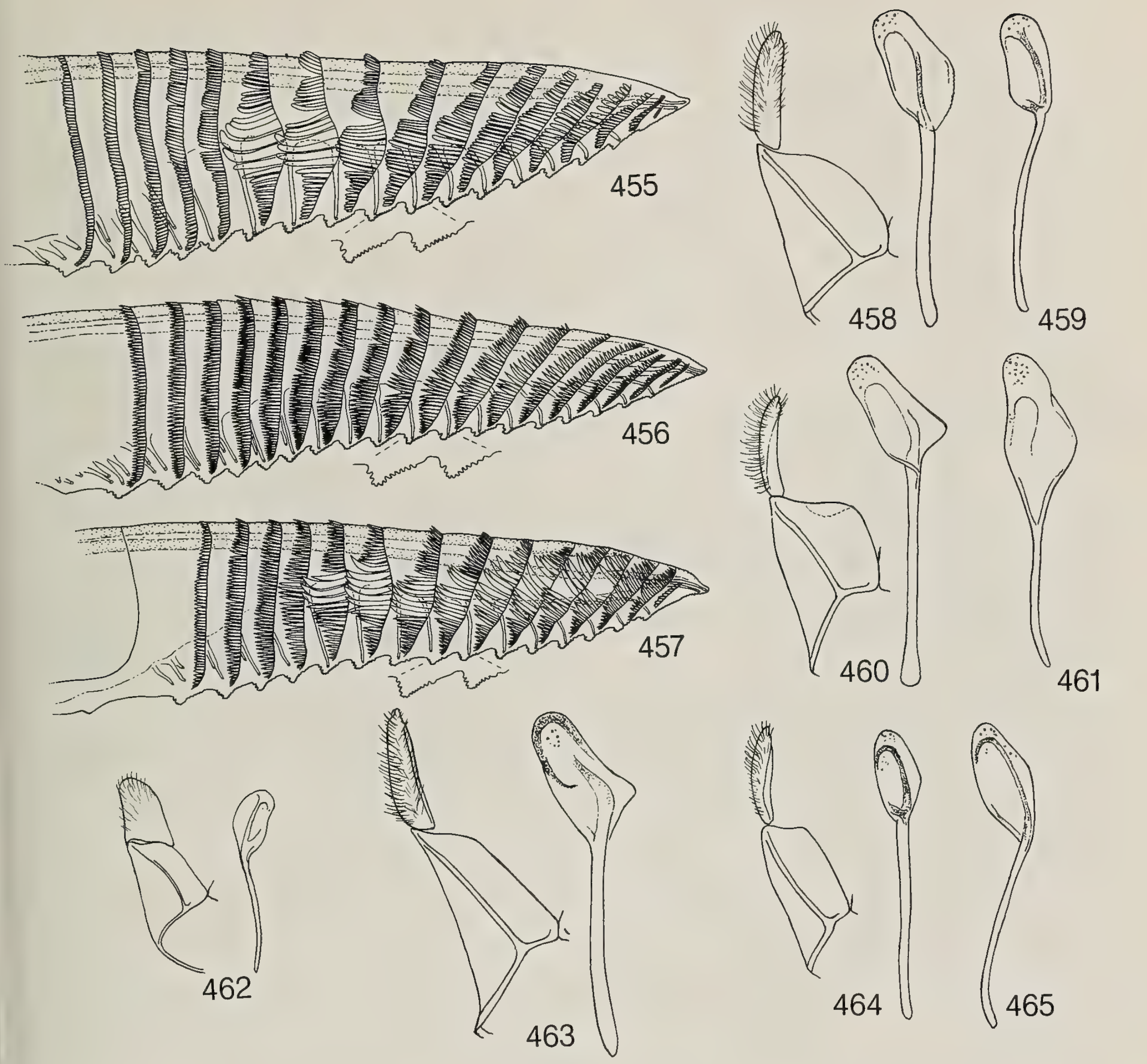
Hosts: a) *Inga phagifolium* (Leguminosae)

The specimen from Costa Rica is from Puntarenas Prov., Golfito; the specimen from Mexico from Puente Nacional, Veracruz.

maculipennis (Forsius), **new combination** — Brazil (Amazonas); Guyana

**Sericoceros maculipennis* Forsius 1925a: 8-9. F. "Rio Autaz, Cururuzinho" (Stockholm, F).
Sericoceros pusillus* Forsius 1925a: 11-12. F. "Rio Autaz, Cururuzinho" (Stockholm, F). **New synonymy.

Both of Forsius' species are identical except *pusillus* is slightly smaller in size. The Guyana specimens examined are from "Demerara R."



Figs. 455-465. *Manaos*. Female lancets of 455, *M. maculipennis*; 456, *M. mulsus*; 457, *M. mammeatus*. Male genitalia of 458, *M. filicornis*; 459, *M. mammeatus*; 460, *M. toula*; 461, *M. wygodzinskyi*; 462, *M. kimseyi*; 463, *M. mulsus*; 464, *M. maculipennis*; 465, *M. affinis*.

mammeatus (Konow), **new combination** — Bolivia; Ecuador; Peru

**Sericoceros mammeatus* Konow 1906b: 247-248. M. "Peru (Marcapata), Bolivia (Mapiri)" (Eberswalde, M).—Oehlke and Wudowenz 1984: 394 ("M Lectotypus (des. D.R.Smith 1977), Bolivien, Mapiri; 1 M, Paralectotypus, Peru, Marcapata").

Although I labeled the specimens in the Eberswald collection, I did not publish on the lectotype designation. I have seen specimens from Ecuador (Coca; Napo, Limoncocha; and Peru (Quincemil, Cuzco Dep.; Rio Santiago).

mulsus (Konow), **new combination** — Brazil (Amazonas, Pará); Peru; Surinam

**Sericoceros mulsus* Konow 1906b: 247. F, M. "Brasilia (Para, Teffe, Prainha, R. Japura)" (Eberswalde, M).—Oehlke and Wudowenz 1984: 396 ("M Lectotypus (des. D.R.Smith 1977)" and 2 M, 2F paralectotypes).

Manaos nigrinotatus* Rohwer 1912c: 62-63. M. "Manaos, Brazil" (Washington, M). **New synonymy.

Eight specimens of *mulsus* were sent to me: 2 M, 1F from Pará, 25-6-1903; 1 M Barcellos 1-VII-1905; 1 F Prainha, 12-5-1903; 1 M R. Japura, 19-9-1904; 1 M Teffe, 3-10-1904; 1 M Teffe, 1-10-1904. The Barcellos specimen cannot be a type since the locality was not mentioned by Konow. The Japura specimen is probably another species. The lectotype desiganted by Oehlke and Wudowenz is one of the males from Pará, the other specimens are paralectotypes. I labeled these in 1977 but did not publish on the designations. I have seen specimens from Surinam (Blakawatra; Zanderij; Onverolacht) and Peru (Avispas).

ricatus (Konow), **new combination** — Brazil (Pará)

**Sericoceros ricatus* Konow 1906b: 245-246. F. "Brasilia (Itaituba)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 408 (holotype).

romani (Forsius), **new combination** — Brazil (Amazonas)

**Sericoceros romani* Forsius 1925a: 10-11. F. "Amazonas: Manaos, Rio Purus, Hyutánahã, Rio Autáz, Cururuzinho" (Stockholm, F).

Sericoceros apicalis* Forsius 1925a: 21-22. F. "Amazonas, Fontebôa" (Stockholm, F). **New synonymy.

I examined 2 females of *romani* from Stockholm. The one labeled "Rio Purus" is hereby designated lectotype, the other labeled "Cururuzinho" is a paralectotype. The lectotype of *romani* and the holotype of *apicalis* are identical.

toula Smith, **new species** — Ecuador; Peru

Manaos toula Smith.

Female.— Length, 7.0 mm. Orange with 2nd and 3rd antennal segments, hindtarsus, and apical 1/3 hindtibia black. Wings orange, apex beyond stigma blackish; veins in pale area and stigma orange, veins at apex in dark area black. Antennal length to head width as 7.0:2.5. Lower interocular distance to eye length as 1.7:2.6; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:0.4:0.5; ocelli large, distance between hindocelli equal to diameter of one. Length of hindbasitarsus longer than length of remaining tarsal segments combined. Sheath with blunt scopae, as in Fig. 448. Lancet as in Fig. 452.

Male.— Length, 5.5-6.5 mm. Coloration as for that of female, but wings also blackish infuscated at base. Antennal length to head width as 6.2:2.2. Genitalia as in Fig. 460.

Holotype.—F, "Peru: Monson Valley, Tingo Maria, IX-23-1954, E. I. Schlinger and E. S. Ross, collectors" (San Francisco).

Paratypes.— ECUADOR: Pastaza, Cusuimi, Rio Cusuimi, 150 km SE of Puyo, V-15-31-1971, leg. B. Malkin; elev. 320 m. (1 F). PERU: Same data as for holotype (4 M), same except X-26-1954 (1 M) (San Francisco, Chicago).

Remarks.— The nearly entirely orange coloration and the yellowish wings with the black apices will separate *toula* from other species of *Manaos*. The specimen from Ecuador has the stigma and costa more blackish.

wygodzinskyi Malaise — Brazil (Rio de Janeiro)

Manaos wygodzinskyi Malaise 1949: 12-13. F, M. "Brazil (Rio de Janeiro, Grajahu)" (Stockholm, F).

Genus **NEOPTILIA** Ashmead

Neoptilia Ashmead 1898: 213. Type species: *Neoptilia mexicana* Ashmead. Orig. desig.
Pseudocyphona Ashmead 1898: 211. Type species:*Pseudocyphona mexicana* Ashmead. Orig. desig.
Rhagonyx Konow 1903: 108-109. Type species: *Rhagonyx lituratus* Konow. Monotypic.

Antenna (Fig. 470) with 1st segment longer than broad, 2nd segment slightly broader than long, 3rd segment of female antenna stout, laterally flattened; antennal length subequal to or slightly more than head width. Malar space linear to about half diameter of front ocellus; clypeus very shallowly semicircularly emarginated to subtruncate; palpi (Fig. 472) without enlarged segments, maxillary palpus shorter to a little longer than eye length; left mandible simple or with 1 or 2 small crenulations near center, right mandible with basal tooth (Fig. 471); eyes small, slightly converging below, lower interocular distance subequal to or greater than eye length (Fig. 468); from above, head broadened behind eyes; interantennal area not carinate, low and convex. Forewing (Figs. 466, 467) with radial cell closed (faintly open in several species), with accessory vein; costa swollen, subequal to or greater than width of intercostal area; 3 or 4 cubital cells, last closed cell longer on radius than on cubitus; distance between M and Rs+M on Sc+R short, less than half length of vein M; small basal anal cell present. Hindwing with anal cell present, longer than its petiole. Length of hindbasitarsus shorter to slightly longer than length of remaining tarsal segments combined; hindtibial spines inserted in collar basal to apex of hindtibia, the spines not or little exceeding the apex of the collar (similar to Fig. 328); tarsal claws with long inner tooth (Fig. 469). Male genitalia with harpe fused to gonostipes (Fig. 489).

These moderate to large species, about 10-12 mm in length, are distinguished by the bifid tarsal claws, small eyes with the lower interocular distance equal to or greater than the eye length, head from above broadened behind eyes, and the fused harpe and gonostipes of the male genitalia. The latter is unique in the Argidae. In addition to the fused harpe and gonostipes, the gonostipes are developed posteriorly on their inner margin into preputial lobes (parapenis) in several species (Figs. 492-494). The parapenis occurs in most other Tenthredinoidea except Pergidae, and are unknown in most other Argidae.

Smith (1971b) revised those species found in the southwestern United States. The genus occurs from southwestern United States to Venezuela and Ecuador. Known hosts are plants of the Malvaceae.

KEY TO SPECIES

1. Abdomen orange 2
— Abdomen black, at most basal terga or center of basal terga pale 5
2. Forewing hyaline at base, blackish on apical 1/2 to 2/3 3
— Forewing uniformly blackish infuscated 4
3. Scopae of sheath slender, leaflike (Fig. 474); serrulae of lancet narrower, farther apart (Fig. 482); abdomen orange usually with black spots laterally on terga 2-4 (male genitalia as in Fig. 492) . . . . ***biramosa*** (Klug)
— Scopae of sheath narrow, more peglike (Fig. 479); serrulae of lancet large and close together (Fig. 485); abdomen orange with black mark only on each side of tergum 2 . . . . ***opulesa***, new species
4. Mesosternum black; legs black; lancet as in Fig. 480; sheath as in Fig. 475; male genitalia as in Fig. 489 . . . . ***malvacearum*** (Cockerell)
— Thorax orange; legs with femora orange; lancet as in Fig. 483; sheath similar to that of *biramosa*, Fig. 474; male genitalia as in Fig. 494 (mostly orange species rather than red and black in *malvacearum*) . . . . . . ***liturata*** (Konow)
5. Legs whitish, apices of tibiae and tarsi black (thorax with mesepisternum, mesosternum, and mesoprescutum black; pronotum whitish; mesonotal lateral lobes blackish to reddish, mesoscutellum white; lancet as in Fig. 486; sheath as in Fig. 477; male genitalia as in Fig. 493) . . . . ***imitatrix*** (Cameron)
— Legs black, coxae and trochanters may be whitish 6
6. Pronotum black 7
— Pronotum red or yellowish 8
7. Serrulae of lancet flat (Fig. 484); scopae of sheath thick, but leaflike and protruding (Fig. 478); tegula black; small black spot on anterior 1/2 of each mesonotal lateral lobe . . . . ***nyvsa***, new species
— Serrulae of lancet deep (Fig. 487); sheath broad, without lateral protruding scopae (similar to *tora*, Fig. 473); tegula and mesonotum red . . . . ***stata***, new species

8. Upper 1/4 to 1/2 of mesepisternum red (pronotum and mesonotum red; lancet as in Fig. 481; sheath as in Fig. 476; male genitalia as in Fig. 490; male with mesepisternum, mesoprescutum, and mesoscutellum black, rest of thorax red) . . . . ***xicana*** Smith
— Mesepisternum black **9**
9. Pronotum, tegula, mesonotum, and metanotum red; lancet similar to *xicana*, Fig. 481; sheath as in Fig. 473 (male genitalia as in Fig. 491; male with mesepisternum, and parapteron black, rest of thorax including mesonotum red) . . . . ***tora*** Smith
— Pronotum, parapteron, and upper 1/2 of mesepimeron yellow to red; mesonotum with prescutum black, lateral lobes red with lateral deflexed sides black, scutellum yellow to reddish; lancet as in Fig. 488; sheath similar to *opulesa*, Fig. 479; . . . . ***palla***, new species

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SPECIES

biramosa (Klug) — Costa Rica; Guatemala; Honduras; Mexico (Aguascalientes, Chiapas, D.F., Guerrero, Jalisco, Michoacán, Morelos, Nayarit, Oaxaca, San Luis Potosi, Sinaloa, Veracruz, Yucatán); Panama; El Salvador

**Hylotoma biramosa* Klug 1834: 242-243. M. "Mexiko" (Berlin, M).— Kriechbaumer 1884: 291.
Ptilia biramosa: Norton 1867: 61.
Ptenus biramosa: Kirby 1882: 53.
Dielocera biramosa: Cameron 1883: 42, pl. 1, fig. 10.
Dielocerus biramosus: Dalla Torre 1894: 322.
Dieloceros biramosus: Konow 1905a: 24.
Neoptilia biramosa: Smith 1973: 30 (holotype; syn.: *varicolor* Norton, *mexicana* Ashmead).
**Pachylota varicolor* Norton 1872: 79. F. "Mexico" (Philadelphia, F).— Cresson 1880: 37.— Cameron 1883: 51.—Dalla Torre 1894: 324 (*variicolor*!).—Konow 1905a: 23.— Cresson 1928: 5 (holotype).
Neoptilia varicolor: Smith 1971a: 526 (holotype).— Smith 1971b: 538, 541-542, fig. 1, 10, 14, 15, 51, 79, 82 (F, M; description, distribution).
**Neoptilia mexicana* Ashmead 1898: 213. F. M. No locality. (Washington, F).— Rohwer 1911a: 107 (F. M described; holotype from "San Rafael, Jicoltepec, Mexico").

Host: Specimens from Catemaco, Veracruz, were "reared on leaves of *Sida densiflora*" (Malvaceae).

This is one of the more common species in Mexico and Central America. I have seen many specimens from the above localities. Vein 3r-m of the forewing has an apically projecting stub at its center in most specimens examined (Fig. 466). I have not seen this in other Argidae.

imitatrix (Cameron), **new combination** — Guatemala; Mexico (Tamaulipas)

**Dielocera imitatrix* Cameron 1883: 42-43, pl. 1, fig. 4. F. "Guatemala, Duenas" (London, F) (as *Ptilia imitatrix* on legend for figure).
Dielocerus imitator: Dalla Torre 1894: 323 (emendation ?).
Dieloceros imitator: Konow 1905a: 24.

The holotype is BM #1.137. I have seen additional specimens from Guatemala and one specimen from Mexico (9 mi. S. Villigran, Tamaulipas).

liturata (Konow), **new combination** — Ecuador

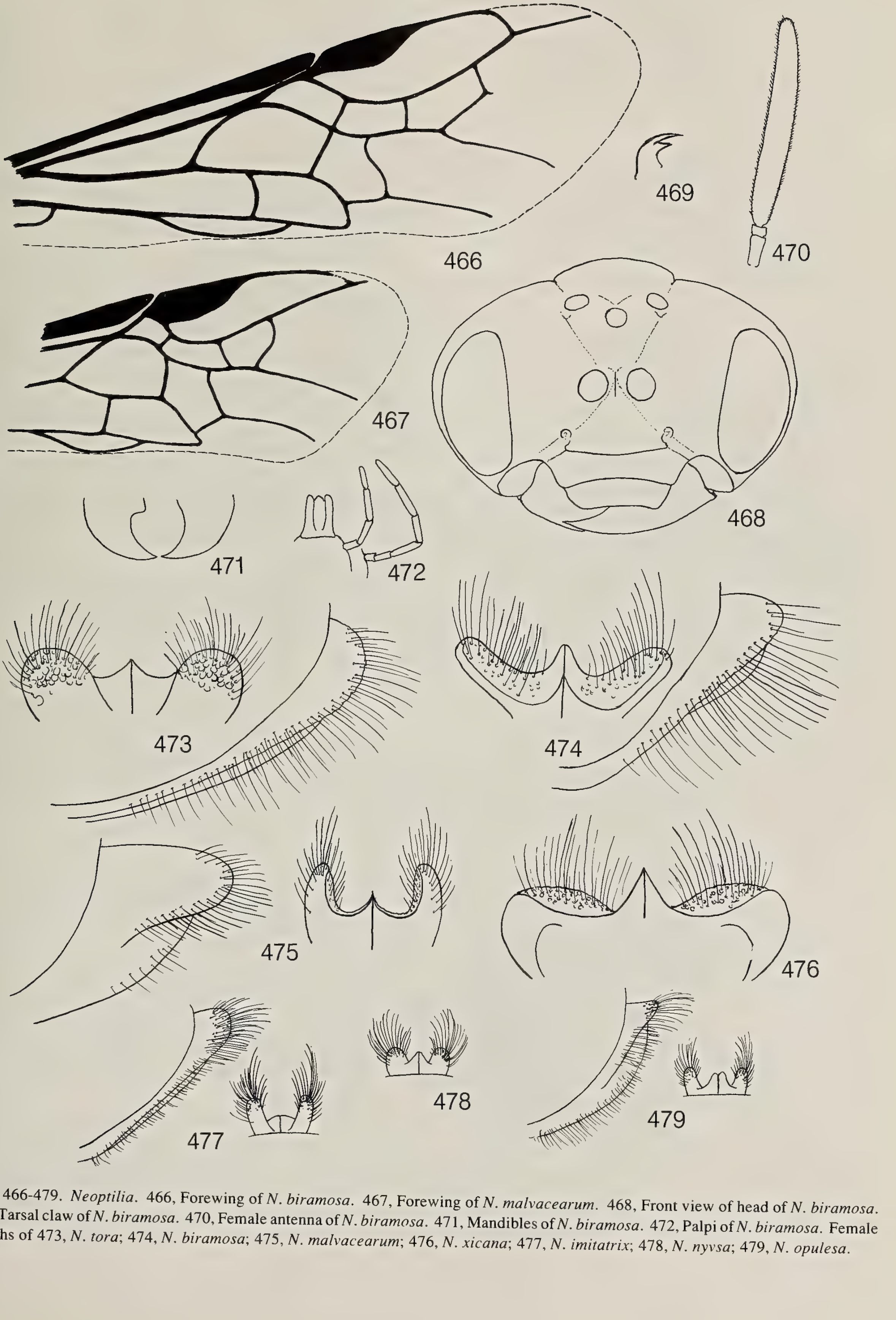
**Rhagonyx lituratus* Konow 1903: 108. F. "Ecuador (Guayaquil)" (Eberswalde, F).— Konow 1905a: 25.— Oehlke and Wudowenz 1984: 393 ("2 F, vom genannten fundort. Das eine F wurde von D. R. Smith als Lectotypus designiert").

Host: Reared from *Sida rhombifolia* (Malvaceae) from "along banks of Rio Guayas, northwest of Guayaquil, Ecuador."

Two females are at Eberswalde, both labeled "Ecuador, Guayaqil, 3.1901." I labeled one as lectotype but did not publish on it prior to Oehlke and Wudowenz (1984). The other specimen is a paralectotype. This is the southernmost species of *Neoptilia*.

malvacearum (Cockerell) — Mexico (Chihuahua, México, Tamaulipas); U.S.A. (Arizona, New Mexico, Texas)

**Nematoneura malvacearum* Cockerell 1894: 251-253. F, M, larva. "Santa Fé, N. Mex." (Washington, M) (biological note; hosts a, e).
Neoptilia malvacearum: Rohwer 1912d: 207.—Ross 1951: 15 (host c).— Burks 1967: 15 (host a).— Smith 1971b: 539-540, fig. 2, 12, 13, 49, 76, 80 (F, M; description; hosts a-



Figs. 466-479. *Neoptilia*. 466, Forewing of *N. biramosa*. 467, Forewing of *N. malvacearum*. 468, Front view of head of *N. biramosa*. 469, Tarsal claw of *N. biramosa*. 470, Female antenna of *N. biramosa*. 471, Mandibles of *N. biramosa*. 472, Palpi of *N. biramosa*. Female sheaths of 473, *N. tora*; 474, *N. biramosa*; 475, *N. malvacearum*; 476, *N. xicana*; 477, *N. imitatrix*; 478, *N. nyvsa*; 479, *N. opulesa*.

d).— Smith 1972: 179-181, fig. 39-42 (larva; hosts a-d).— Smith 1979: 23-24 (hosts a-d).

Hosts: a) *Althaea rosea*; b) *Malvastrum* sp.; c) *Malva* sp.; d) *Sphaeralcea* sp.; e) *Sphaeralcea angustifolia*, (Malvaceae).

The only specimens I have seen from Mexico are from the states of México (Teotihuacan) and Chihuahua (36 mi. SE Cd. Jiminez). Also two U. *S*. Plant Quarantine interceptions, are labeled "Tampico, Mex. (POE Brownsville, Tex.), on Hibiscus esculentus" and "Juarez, Mex. (POE El Paso, Tex.), on mixed vegetables."

nyvsa Smith, **new species** — Guatemala

Neoptilia nyvsa Smith.

Female.—Length, 12.0 mm. Black, mesonotum red with small black spot on anterior half of each lateral lobe. Wings uniformly moderately black infuscated; veins and stigma black. Antennal length to head width as 5.0:3.4. Lower intercoular distance to head width as 2.1:1.4; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.4:0.8. Length of hindbasitarsus slightly shorter than length of remaining tarsal segments combined. Sheath with short narrow scopae (Fig. 478). Serrulae of lancet flat, those on apical 1/2 of lancet not differentiated from each other (Fig. 484).

Male.— Unknown.

Holotype.— F, "Guatem." (Cambridge).

Remarks.— The black coloration, except for the mesonotum, and the flat serrulae of the lancet will distinguish *nyvsa*. No other species of *Neoptilia* have such flat serrulae.

opulesa Smith, **new species** — Panama ?, Venezuela

Neoptilia opulesa Smith.

Female.—Length, 9.5 mm. Antenna and head black, palpi brownish. Thorax black with pronotum except for black mesal area (in front of mesoprescutum) orange. Legs black with forecoxa and foretrochanter white, apices of mid- and hindcoxae and entire mid- and hindtrochanters white, narrow white line on inner surface of forefemur, and outer surface of foretibia whitish. Abdomen orange with basal plates and lateral spots on 2nd tergum black. Wings hyaline with apex from base of stigma moderately blackish; veins and stigma blackish. Head and thorax with dense whitish pubescence, absent on mesosternum. Antennal length to head width as 4.6:3.2. Lower interocular distance to eye length as 1.9:1.4; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.4:0.7. Length of hindbasitarsus slightly shorter than length of remaining tarsal segments combined. Sheath with narrow peglike scopae (Fig. 479). Serrulae of lancet large, rounded, close together (Fig. 485).

Male.— Unknown.

Holotype.— F, "Venezuela: Guarico, Hato Masaguaral (44 km S Calabozo) May 3-10, 1985, Menke and Carpenter" (Washington).

Paratype.— VENEZUELA: El Baul, Cojedes, 20-VII-1967, J. and B. Bechyne, leg (1 F) (Maracay).

Remarks.— A male from Panama (Chiriqui, Potrerillos, 3600') may be this species as it is similarly colored. *Neoptilia biramosa* is very similar to *opulesa* and is the only species with which it may be confused; however, *opulesa* has large, rounded serrulae that are close together, narrower scopae of the sheath, and whitish coxae and trochanters.

palla Smith, **new species** — Honduras; Mexico (Yucatán)

Neoptilia palla Smith.

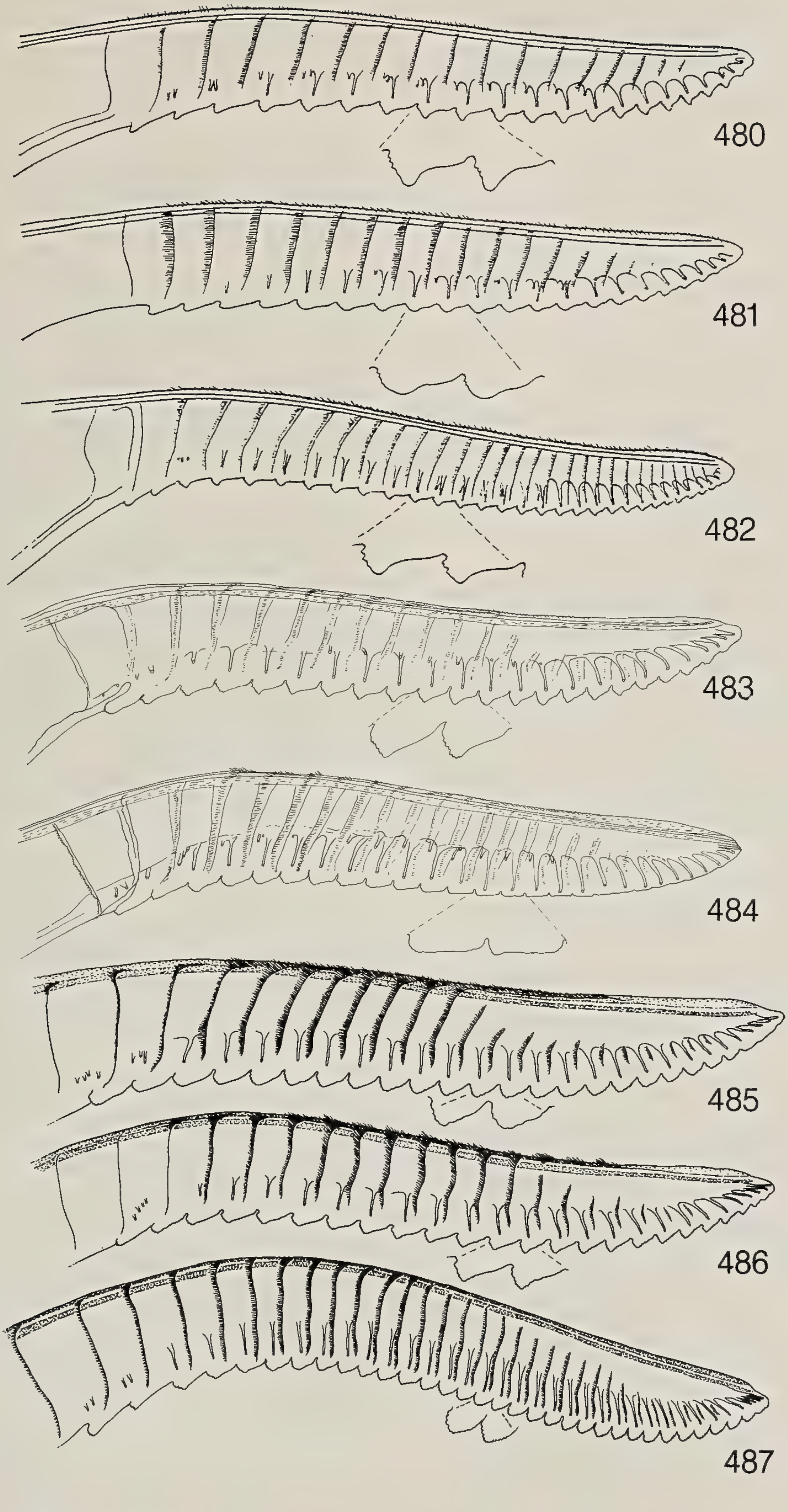
Female.—Length, 9.5 mm. Antenna and head black. Thorax black with lower portion of cervical sclerites, pronotum, tegula, parapteron, upper 1/2 of mesepimeron, and mesonotum (except for black anterior 2/3 of prescutum and blackish deflexed sides of lateral lobes) red. Legs black with apices of coxae and entire trochanters whitish. Abdomen black. Wings uniformly, darkly black infuscated; veins and stigma black. Head and thorax with moderate whitish pubescence, absent on lower portion of mesepisternum and mesosternum. Antenna slightly laterally flattened, 3rd segment of uniform width throughout, not tapering; antennal length to head width as 4.4:3.2. Lower interocular distance to eye length as 1.7:1.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.5:0.6:0.7. Length of hindbasitarsus slightly shorter than length of remaining tarsal segments combined. Sheath with narrow, thick scopae (similar to that of *opulesa*, Fig. 479). Serrulae of lancet close together, lobelike, with several anterior and no posterior subbasal teeth (Fig. 488).

Male.— Unknown.

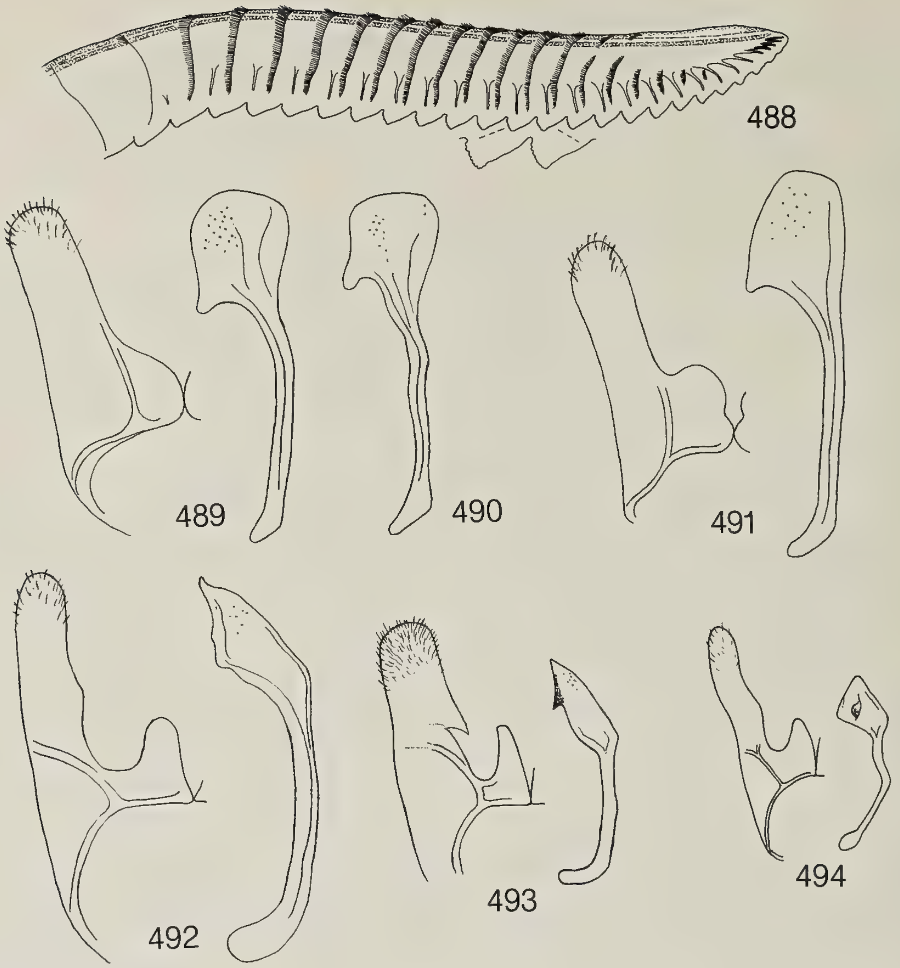
Holotype.— F, "Chichen Itza, Yucatan, Mex., VI-29, collection J. Bequaert" (Cambridge).

Paratype.— HONDURAS: El Boqueron, Olancho, 10-XII-1979, R.W. Jones (1 F) (College Station).

Remarks.— The coloration of the thorax, whitish



Figs. 480-487. *Neoptilia*, female lancets. 480, *N. malvacearum*; 481, *N. xicana*; 482, *N. biramosa*; 483, *N. liturata*; 484, *N. nyvsa*; 485, *N. opulesa*; 486, *N. imitatrix*; 487, *N. stata*.



Figs. 488-494. *Neoptilia*. Female lancet of 488, *N. palla*. Male genitalia of 489, *N. malvacearum*; 490, *N. xicana*; 491, *N. tora*; 492, *N. biramosa*; 493, *N. imitatrix*; 494, *N. liturata*.

trochanters, slender third antennal segment, and lancet will distinguish *palla*. The black abdomen and legs may confuse *palla* with *stata*, *tora*, and *xicana*. The paratype has the pronotum, tegula, cervical sclerites, parapteron, upper half of the mesepisternum, and mesoscutellum yellow and the mesonotal lateral lobes red. The contrasting colors are not as apparent in the holotype.

stata Smith, **new species** — Guatemala

Neoptilia stata Smith.

Female.—Length, 10.5 mm. Black with mesonotum and tegula red and outer surface of foretibia whitish. Wings darkly, uniformly black infuscated; veins and stigma black. Head and thorax with moderate whitish pubescence, absent on lower mesepisternum and mesosternum. Antenna with 3rd segment broad, laterally flattened, and distinctly tapering toward apex. Antennal length to head width as 4.3:3.2. Lower interocular distance to eye length as 2.0:1.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.6:0.7. Length of hindbasitarsus slightly shorter than length of remaining tarsal segments combined. Sheath broad, scopae not distinct and not decidedly protruding (similar to that of *tora*, Fig. 473). Serrulae of lancet rounded, lobelike, close together (Fig. 487).

Male.— Unknown.

Holotype.— F, "Salama, Guate., 3000 ft., VII-29-1947, F. Johnson Donor, Cols. C. and P. Vaurie" (New York).

Remarks.— The black coloration with only the mesonotum and tegula red, lack of distinct scopae on the sheath, and lobelike serrulae of the lancet will separate *stata* from other species of *Neoptilia*.

tora Smith — U.S.A. (Texas)

**Neoptilia tora* Smith 1971b: 540-541, fig. 16, 17, 78, 81. F, M. "Maxwell, Texas" (Washington, M).— Smith 1979: 24.

This species is listed because it may occur in Mexico. One specimen was reared from "Welde," but I don't know what this common name refers to. Some *Reseda* spp. are sometimes referred to as "weld."

xicana Smith — Mexico (Colima, San Luis Potosi, Tamaulipas, Veracruz)

**Pseudocyphona mexicana* Ashmead 1898: 211. F. No locality. (Washington, F) (preoccupied in *Neoptilia* by *mexicana* Ashmead 1898: 213).— Rohwer 1911a: 106 (holotype F, from "San Rafael, Jicoltepec, Mexico").
Neoptilia xicana Smith 1971b: 542-543 (F, M; new name for *Pseudocyphona mexicana* Ashmead).

Genus **PTILIA** Lepeletier

Ptilia Lepeletier 1823: 49. Type species: *Ptilia brasiliensis* Lepeletier. Desig. by Rohwer 1911a.

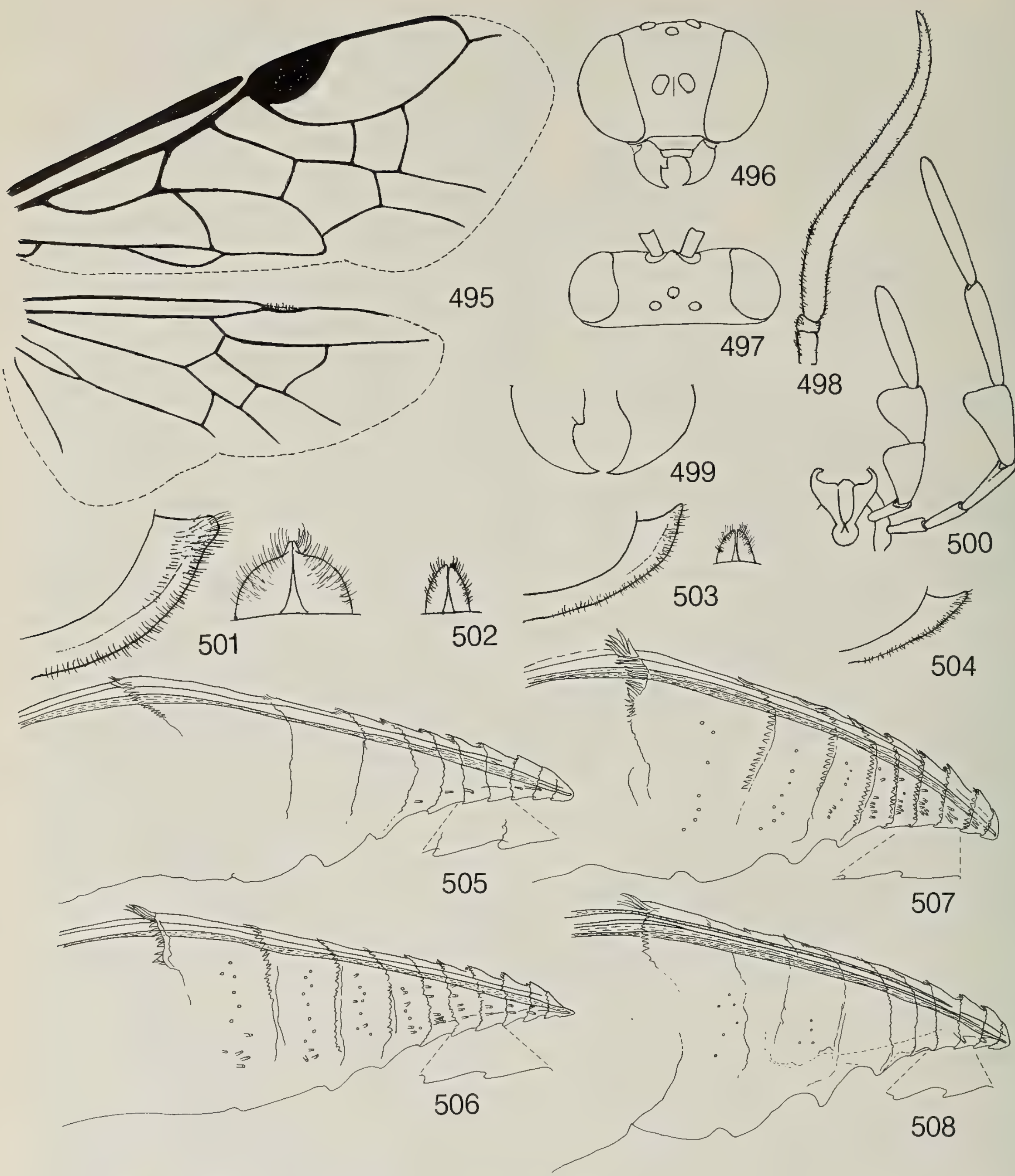
Antenna (Fig. 498) with 1st segment longer than broad, 2nd segment broader than long; 3rd segment of female antenna usually curved, slender, laterally flattened, tapering to pointed apex; antennal length longer than head width. Malar space linear; clypeus subtruncate; palpi long, maxillary palpus longer than eye length, 2nd and 3rd segments of labial palpus and 4th segment of maxillary palpus enlarged (Fig. 500); left mandible simple, right mandible with basal tooth (Fig. 499); eyes large and converging below, lower interocular distance less than eye length (Fig. 496), in side view, close to posterior margin of head; head from above sharply narrowing behind eyes and slightly depressed anteriorly between eyes, postocellar area much broader than long (Fig. 497); interantennal carina low, rounded. Forewing (Fig. 495) with radial cell closed and accessory vein at apex; costa narrower than intercostal area; 3 cubital cells, last closed cell as long as or slightly longer on radius than on cubitus; distance between M and Rs+M on Sc+R subequal to or longer than length of vein M; small basal anal cell present. Hindwing (Fig. 495) with anal cell present, shorter than its petiole. Length of hindbasitarsus longer than length of remaining tarsal segments combined; tarsal claws simple. Female sheath pointed and acute at apex in lateral view (Figs. 501-504).

The curved, flattened, tapering antennae, large eyes with the lower interocular distance much shorter than the eye length, closed radial cell and presence of three cubital cells in the forewing, and pointed female sheaths are characteristic of *Ptilia*. The short, triangular female lancets are also diagnostic (Figs. 505-509). Most species are yellow or orange and black and have yellowish wings with various black patterns. They are among the more striking sawflies of the neotropics. Malaise (1949) gave a key to some of the species treated here.

Ptilia occurs from Mexico to southeastern Brazil. Two host plants are known, *Cnestidium* sp. and *Rourea* sp., both Connaraceae.

KEY TO SPECIES

1. Forewing yellow with only apex black; abdomen black, at least from 4th segment to apex 2
— Forewing infuscated black at both base and apex, yellowish at center; only apical 2 or 3 abdominal segments black 5
2. Midleg and hindleg black; mesosternum orange or black (abdomen black with only basal plates orange; sheath as in Fig. 501; lancet as in Fig. 508; male genitalia as in Fig. 510) . . . . **brasiliensis** Lepeletier
— Midtibia and hindtibia partly and respective tarsi white; mesosternum orange 3
3. Mesonotum black (mid- and hindcoxae and trochanters orange; basal 3 abdominal segments orange; lancet as in Fig. 507; male genitalia as in Fig. 512 . . . . **townesi**, new species
— Thorax orange 4
4. Abdomen black with only basal plates orange; mid- and hindcoxae and trochanters usually black (sheath as in Fig. 502) . . . . **megaptera** (Cameron)
— Abdomen black with basal 3 segments orange; mid- and hindcoxae and trochanters orange . . . . . **melanictera** (Klug)
5. Black at apex of wing mostly confined to radial cell; thorax orange with mesonotum mostly black; antennal length about 1.25X head width (sheath as in Fig. 504; lancet as in Fig. 506 . . . . **una**, new species
— Entire apical part of wing beyond stigma infuscated black; color of thorax various; antennal length about 1.75X head width 6



Figs. 495-508. *Ptilia*. 495, Forewing and hindwing of *P. versicolor*. 496, Front view of head of *P. versicolor*. 497, Dorsal view of head of *P. versicolor*. 498, Female antenna of *P. versicolor*. 499, Mandibles of *P. versicolor*. 500, Palpi of *P. versicolor*. Female sheaths of 501, *P. brasiliensis*; 502, *P. megaptera*; 503, *P. versicolor*; 504, *P. una*. Female lancets of 505, *P. versicolor*; 506, *P. una*; 507, *P. townesi*; 508, *P. brasiliensis*.

6. Basal black part of forewing with central hyaline spot; thorax orange, usually with mesonotum except scutellum black; lancet as in Fig. 505; male genitalia as in Fig. 511 (sheath as in Fig. 503) .... **versicolor** (Klug)
— Basal black part of forewing solid black; thorax may be mostly orange, but mesosternum and mesonotum may have various amounts of black; lancet as in Fig. 509; male genitalia as in Fig. 513 .... **peletieri** (Gray)

SPECIES

brasiliensis Lepeletier — Brazil (Amazonas ?, Minas Gerais, Rio de Janeiro, Santa Catarina, São Paulo); French Guiana

Ptilia brasiliensis Lepeletier 1823: 50. F. "E Brasilia" (lost ?).— Blanchard 1840: 230.— Norton 1867: 62.— Kirby 1882: 44 (syn.: *xanthoptera* Perty).— Dalla Torre 1894: 319.— Konow 1905a: 26.— Malaise 1949: 6 (Minas Gerais, further records).— Mc Callan 1953: 126 (Trinidad).
**Schizocera xanthoptera* Perty 1833: 130, pl. 26, fig. 5. F, M. "Habitat ad flumen Rio negro dietum, Prov. ejusdem nominis" (München, M).
Hylotoma (*Schizocera*) *xanthoptera*: Klug 1834: 246.— Kriechbaumer 1884: 293.
Schizocerus xanthoptera: Norton 1867: 56.

Host: Specimens at the Instituto Oswaldo Cruz from Itatiaya, Est. do Rio, 700 m, bear a label "ex cocoon an Sapucaya zweig." This may be what is called Sapucaia (*Lecythis* sp., Lecythidaceae).

Perty had more than one specimen of *xanthoptera* as he figured the antennae of both sexes and stated differences in his description. Three specimens were sent to me from München. The lectotype of *xanthoptera* Perty, hereby designated, is a male labeled "l. Bras. Rio negro, Sch. *xanthoptera* Pty."; paralectotypes are one female labeled "689" (the head is missing and the abdomen and hindwings are glued onto a separate card on the same pin) and one female without a label. Another female in the same series sent to me from München is without labels and is a female of *Didymia martini* (Lepeletier) which superficially resembles *brasiliensis* in color. I have not seen specimens from Trinidad and was unable to examine those recorded by McCallan (1953). Trinidad is considerably out of the range of most other specimens I have studied. According to M. Ivie, a specimen of *Adiaclema tetricum* (Konow) (Tenthredinidae) from Trinidad was determined as *Ptilia brasiliensis*, and the specimens from Trinidad may be this *Adiaclema*. The coloration of the two is nearly identical. M. Ivie (personal correspondence) compared a specimen of *Adiaclema* with those in the the collection of the University of the West Indies, St. Augustine, Trinidad. The specimen from French Guiana is labeled "Cayenne."

megaptera (Cameron) — Brazil (Espirito Santo)

**Rusobria megaptera* Cameron 1878: 151. F. "Brazil" (London, F).
Ptilia megaptera: Kirby 1882: 44.— Dalla Torre 1894: 320.— Konow 1905a: 27.
Ptilia megaloptera Schulz 1906: 84 (emendation).

The holotype is BM #1.140. I have seen several additional specimens from Espirito Santo.

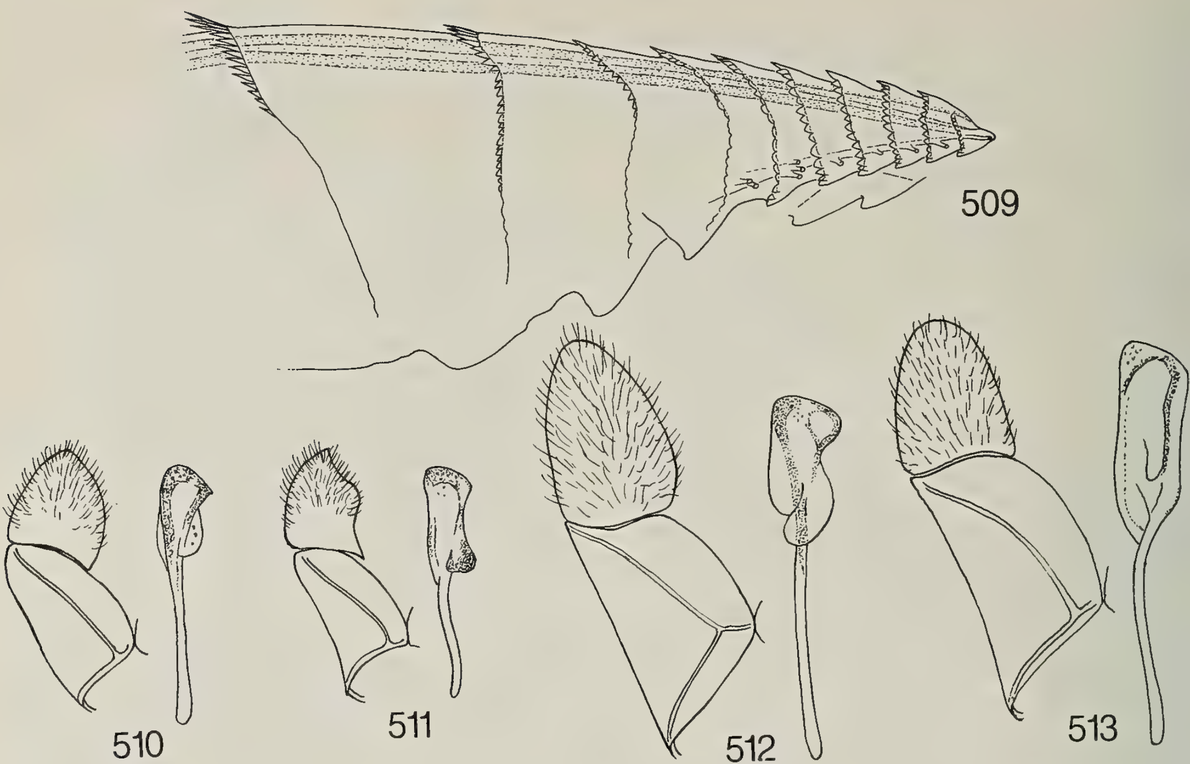
melanictera (Klug) — Brazil (Alagoas, Pará, Rio de Janeiro)

**Hylotoma melanictera* Klug 1814: 309-310. F. "Pará in Brasilien" (Berlin, F).— Klug 1834: 245.— Kriechbaumer 1884: 75, 293.
Didymia melanictera: Norton 1867: 61.
Ptilia melanictera: Kirby 1882: 45 (Rio Janeiro).— Dalla Torre 1894: 320.— Konow 1905a: 27.— Malaise 1949: 6.

Four females of *melanictera* are at Berlin, each labeled "13714" and "Bahia, Para." The specimen with the large green determination label is hereby selected lectotype and the other three specimens are paralectotypes. The Rio de Janeiro record is from Kirby (1882). A specimen at Paris labeled "*martini* Lep." is this species. It is probably not the type of *martini* since its color differs from the original description and is the wrong sex (see *Didymia martini*).

peletieri (Gray) — Brazil (Amazonas, Mato Grosso); Colombia; Costa Rica; Guyana; Panama; Surinam; Trinidad and Tobago (both islands); Venezuela

**Schizocerus peletieri* Gray 1832: 403, pl. 66, fig. 1. M. "Carthagena" (London, M).
Ptilia peletieri: Kirby 1882: 44 (*Peletierii*).— Dalla Torre 1894: 320.— Konow 1905a: 27.
Hylotoma concinna* Klug 1834: 246, pl. 2, fig. 8. M. "Mexiko" (!) (Berlin, M).— Kriechbaumer 1884: 293. **New synonymy.
Ptilia concinna: Kirby 1882: 46.— Cameron 1883: 44 (based on Klug's wrong locality).— Dalla Torre 1894: 319.— Konow 1905a: 26.— Malaise 1949: 7.— Kimsey and Smith 1985: 199-200, fig. 20-23 (larva; host a; biological note; Panama)
Didymia concinna: Norton 1867: 59.



Figs. 509-513. *Ptilia*. Female lancet of 509, *P. peletieri*. Male genitalia of 510, *P. brasiliensis*; 511, *P. versicolor*; 512, *P. townesi*; 513, *P. peletieri*.

Rusobria leucosoma* Cameron 1878: 151-152. F. "Amazonia" (London, F). **New synonymy.

Ptilia leucosoma: Kirby 1882: 45.— Dalla Torre 1894: 320.— Konow 1905a: 27.— Benson 1930a: 620-621 (British Guiana).— Malaise 1949: 7.— Mc Callan 1953: 126 (British Guiana).

Ptilia lauta* Konow 1904: 239-240. F. "Costa Rica" (Eberswalde, F).— Konow 1905a: 27.— Oehlke and Wudowenz 1984: 392 ("F Lectotypus (des. D. R. Smith)"). **New synonymy.

Ptilia lautiformis* Rohwer 1912a: 2. F, M. "Alhajueto, Panama" (Washington, F). **New synonymy.

Host: a) *Cnestidium rufescens* (Connaraceae)

The holotype of *peletieri* was not separated in the type collection in London, but I did locate one male labeled "Carthagena" in their general collection. This specimen agrees with Gray's description and illustration. The type locality stated as "Carthagena" must be Cartagena, Colombia. The label on Klug's type of *concinna* reads "Surinam," and the specimen compares with other specimens I have seen from Surinam. I have not seen specimens from Mexico and therefore believe Klug gave the wrong locality in his description. I studied two females of *lauta* at Eberswalde. The specimen from "Costa Rica, Atenas" and with Konow's determination label is the lectotype as stated by Oehlke and Wudowenz (1984). I labeled it but did not publish on the designation prior to Oehlke and Wudowenz. The other specimen from "Costa Rica, Belize" is *Ptilia versicolor* Klug. The holotype of *leucosoma* Cameron is BM #1.148. The variation in the amount of black on the mesonotum led to the description of the several species listed in the above synonymy. Klug's *concinna* is the paler form with a black mark only on the mesoprescutum, whereas *lauta* and *lautiformis* have most of the mesonotum black and *leucosoma* has the mesosternum black in addition to the mesonotum. The paler forms seem to be most common in Surinam and Guyana. One specimen from Trinidad has a yellow fibrous cocoon on the same pin and the label reads "cocoon from St. Pats." This species and *versicolor* are close and the genitalia are similar. The infuscation at the base of the wing seems constant and is the main character for separating the two.

townesi Smith, **new species** — Brazil (Minas Gerais)

Ptilia townesi Smith.

Female.— Length, 7.0-9.0 mm. Antenna brownish to black; head and mouthparts black. Thorax orange with mesonotum black (apex of scutellum may be dark orange). Fore- and midlegs orange with tibiae and tarsi whitish; hindleg with coxa, trochanter, and extreme base of femur orange, most of femur except base black, tibia and tarsus white. Abdomen black with basal 3 segments orange. Forewing orange with apex beyond stigma black. Antennal length to head width as 6.0:3.0. Lower interocular distance to eye length as 1.2:2.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.4:0.5:0.3. Sheath short, acutely rounded at apex (similar to Fig. 501). Lancet as in Fig. 507.

Male.— Length, 6.8-8.1 mm. Coloration similar to that of female. Antennal length to head width as 5.8:3.0. Genitalia as in Fig. 512.

Holotype.—F, "Pedra Azul, M.G., Brazil, Nov., 70, F. *M*. Oliveira" (Townes Coll.).

Paratypes.— BRAZIL: Same locality as for holotype, XI-1971, Seabra and Oliveira (1 F); Aguas Vermelhas, 15° 45' S, 11° 28' W, 800 m., Dec. '83, Alvarenga (11 F, 7 M) (Townes Coll.; Gainesville).

Remarks.— The black mesonotum will separate *townesi* from *brasiliensis*, *megaloptera*, and *melanictera*, the three species with which it most likely confused.

una Smith, **new species** — Brazil (Amazonas, Goiás, Mato Grosso, Pará); Colombia; Guyana

Ptilia una Smith.

Female.—Length, 5.7-6.2 mm. Antenna brownish, anterior surfaces of first 2 segments whitish; head black with supraclypeal area, clypeus, and mouthparts white to orange. Thorax orange with mesonotum except for apical 1/2 to 2/3 of scutellum black. Legs orange with apical 1/5 or less of hindtibia and entire hindtarsus black. Abdomen orange with apical 3 segments and sheath black. Wings hyaline with intercostal area of fore- and hindwings, small spot at base of forewing, spot half way between base and stigma of forewing, and spot occupying apical 2/3 of radial cell of fore- and hindwings black; stigma and veins in pale parts yellowish, in black parts blackish. Antennal length to head width as 3.6:2.8. Lower interocular distance to eye length as 2.4:3.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:1.0:0.6. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.4:2.3. Sheath narrow and sharply pointed at apex (Fig. 504). Lancet short and triangular with ventral margin straight (Fig. 506).

Male.— Unknown.

Holotype.— F, "Demerara R., Brit. Guiana, 20.III.1913" (Ithaca).

Paratypes.— BRAZIL: Vill Vera, W50°30', S12° 30', October 1973, M. Alvarenga (2 F); Tucuruf, Pará, I-1979, M. Alvarenga (1 F); Sinop, M. Grosso, 12°31'S, 55°37'W, Oct. 1976, M. Alvarenga (1 F); Amazonas, 60 km. N. Manaos, Fazenda Esteio, 2F3, km 23, II-4-1986, B.C. Klein (1 F), same, 12-XI-1986 (1 F), same 12-XII-1985 (1 F). COLOMBIA: 26 km E. Santa Marta, 15-II-1979, R. Wilkerson, 0-50M (1 F). GUYANA: Same data as for holotype, II-28-1913 (1 F), II-24-1913 (1 F); Kartabo Bartica District, 21-VII-1922 (cocoon attached) (1 F) (Ithaca; Gainesville; Manaos; New York; Townes Coll.).

Remarks.— The black spot at the apex of the forewing is confined mostly to the radial cell, differing from other species of *Ptilia* which have the entire apex of the wings beyond the stigma black infuscated. The lancet is straighter on the ventral margin and the sheath is narrower than in the related *peletieri* and *versicolor*. Also, the shorter antenna of *una* which is about 1.25 times the head width, versus the longer antennae of *peletieri* and *versicolor* which are about 1.75 or more times the head width, is an additional character.

versicolor (Klug) — Belize; Costa Rica; Guatemala; Honduras; Mexico (Chiapas, Guerrero, Jalisco, Nayarit, Oaxaca, Quintana Roo, San Luis Potosi, Tabasco, Tamaulipas, Veracruz, Yucatán)

Hylotoma (*Schizocera*) *versicolor* Klug 1834: 246. F. "Mexiko" (Berlin, F).— Kriechbaumer 1884: 321.

Ptilia versicolor: Kirby 1882: 46.— Cameron 1883: 44, pl. 1, fig. 9 (syn.: *basipunctata* Kirby).— Dalla Torre 1894: 321.— Konow 1905a: 27.— Malaise 1949: 7.

Didymia versicolor: Norton 1867: 60 (Cordova and Tampico, Mex.).

**Ptilia basipunctata* Kirby 1882: 46, pl. 3, fig. 11. F. "Mexico, Vera Cruz, Honduras" (London, F).

Host: Reared from *Rourea glabra* (Connaraceae) in Costa Rica by D.H. Janzen. The cocoons are fragile and fibrous and are found on twigs.

The holotype of *basipunctata* is BM #1.141. This is a relatively common species in Mexico and Central America. I have seen specimens from all of the localities listed above.

Genus SCHIZOCERELLA Forsius

Schizocerella Forsius 1927: 19. Type species: *Schizocerella axillaris* Forsius. Orig. desig.

Sofus Malaise 1937a: 57. Type species: *Schizocera pilicornis* Holmgren. Orig. desig.

Sterictiphora subg. *Leston* Ross 1937: 54. Type species: *Schizocerus zabriskei* Webster and Malley. Orig. desig.

Antenna (Figs. 516-518) with 1st segment broader than long to slightly longer than broad, 2nd segment as long as broad or slightly broader than long; 3rd segment of female antenna slightly laterally compressed, of uniform width to rounded apex; antennal length slightly shorter than to slightly longer than head width. Clypeus truncate to slightly emarginate (Fig. 521) at center; malar space nearly linear to about 1/2 diameter of an ocellus; left mandible simple, right mandible with small basal tooth (Fig. 519); mouthparts short, maxillary palpus subequal to or slightly shorter than eye length, segments of palpi of uniform width or 3rd segment of labial palpus and 4th segment of maxillary palpus slightly enlarged (Fig. 520); eyes small, slightly converging below, lower interocular distance greater than eye length (Fig. 515); interantennal carina rather sharp or rounded, low and straight, not bisecting supraclypeal area below; head from above narrowing behind eyes. Forewing (Fig. 514) with radial cell open; costa swollen, broader than intercostal area; small basal anal cell present; usually 3 cubital cells with the last closed cell quadrate, about as long on radius as on cubitus; distance between M and Rs+M on Sc+R half or more than length of vein M. Hindwing (Fig. 514) with anal cell absent. Length of hindbasitarsus subequal to or slightly shorter than length of remaining tarsal segments combined; tarsal claws simple.

Species of *Schizocerella* are small, 6 mm or less in length, with short antennae, a short interantennal carina, eyes far apart below with the lower interocular distance greater than the eye length, palpi short and with slightly or without expanded segments, radial cell of the forewing open, and anal cell of the hindwing absent. They may be confused with *Brachyphatnus*, especially within the geographic range of that genus, but are separated by the absence of the anal cell in the hindwing and the lack of a collar at the apex of the hindtibia, the apical spines of the hindtibia arising at the apex of the hindtibia.

Schizocerella pilicornis is the most common species, ranging from Canada to Argentina and adventive in Australia. It may be native to southern South America and spread to other parts of its range by commerce. Other than *pilicornis* only a few other species are known, and I have available only a few specimens from scattered localities referable to this genus, mostly from Brazil, Bolivia, and northern Argentina. Because of their small size, others are apt to be discovered, and more material will be necessary to adequately determine the true size and distribution of the genus, excluding *pilicornis*. With this in mind, the following key should be used cautiously.

Smith (1971b) treated *Schizocerella* for North America, including only *S. pilicornis*. Malaise (1941) synonymized *Leston* under his genus *Sofus*, and Benson (1963) synonymized *Sofus* under *Schizocerella*. Forsius based his genus, *Schizocerella*, on Australian specimens.

KEY TO SPECIES

1. Typical coloration black with pronotum, tegula, and mesonotal lateral lobes orange, abdomen with lateral longitudinal yellow to orange stripes, and legs black with apices of fore- and midfemora, fore- and midtibiae, and basal half or less of hindtibia white (amount of orange on mesonotum and laterally on abdomen may vary, mesonotum may be entirely black especially in males; sheath as in Fig. 522, with long, slender, posteriorly projecting scopae; lancet as in Fig. 526; male genitalia as in Fig. 529). . . . . **pilicornis** (Holmgren)

— Coloration not not as above (check also structural features and illustrations) **2**

2. Sheath from above with very short projecting scopae, in lateral view truncate at apex (Fig. 523); faint brownish longitudinal lateral stripe on abdomen (black with supraclypeal area and clypeus brownish; pronotum, tegula and parapteron orange, and tibiae except for extreme apices white) . . . . **kierychi**, new species

— Sheath from above with long, slender, posteriorly projecting scopae, in lateral view rounded (Figs. 524, 525); abdomen black **3**

3. Head black; thorax black with only pronotum, mesepimeron, and sometimes parapteron orange; legs black with basal 1/3 or less of tibiae white; sheath as in Fig. 524; lancet as in Fig. 527; male genitalia as in Fig. 531. . . . . ***treza*** Smith

— Head black with supraclypeal area and clypeus brownish; thorax black with pronotum, tegula, mesepimeron and mesonotum orange except for black spots on prescutum and lateral lobes; legs black with apices of femora and tibiae and tarsi entirely white; sheath as in Fig. 525; lancet as in Fig. 528; male genitalia as in Fig. 530. . . . . ***jenseni*** (Konow)

SPECIES

jenseni (Konow) — Argentina (Chaco, Mendoza, Salta)

**Brachyphatnus jenseni* Konow 1906b: 252. F, M. "Rep. Argentina (Mendoza)" (Eberswalde, F).—Jörgensen 1913: 261.— Malaise 1955: 108 (not *jenseni*, misidentification; see *Brachyphatnus vescus*).— Oehlke and Wudowenz 1984: 390 ("F Lectotypus, 1 M, 2 F, Paralectotypen (des. D.R.Smith), vom obigen Fundort").
Schizocerella jenseni: Smith 1981: 287.

Malaise's (1955) *jenseni*, in his key to *Brachyphatnus*, is a misidentification and is the species described elsewhere as *Brachyphatnus vescus*. The types of *jenseni* lack an anal cell in the hindwing and do not have a collar at the apex of the hindtibia, the hindtibial spurs arising at the apex of the hindtibia and therefore greatly exceeding the apex of the hindtibia. One male and 3 females were sent to me from Eberswalde, and all have the same data: "Mendoza, Amer. Mer.", with Konow's determination label on the male. Since species of this genus are more easily separated by females I labeled a female lectotype and the other two females and male as paralectotypes. I did not publish on this prior to Oehlke and Wudowenz (1984).

kierychi Smith, **new species** — Brazil (Santa Catarina)

Schizocerella kierychi Smith.

Female.—Length, 4.5 mm. Antenna and head black with supraclypeal area, clypeus, labrum, and palpi brownish. Thorax black with pronotum, parapteron, and tegula orange, and brownish marks on side of mesoprescutum, inner and outer margins of mesonotal lateral lobes, and outer margins of mesoscutellum. Abdomen black with terga brownish laterally, appearing as a pale lateral margin. Legs black with tibiae whitish except for apical 1/3 of hindtibia and extreme apices of fore- and midtibiae; hindtibia brighter white than fore- and midtibiae. Wings very lightly, uniformly infuscated black, nearly hyaline; veins and stigma brownish. Antennal length about 3/4X head width, as 2.0:2.6; 1st and 2nd segments each broader than long, 3rd segment slightly laterally flattened, narrowing toward apex. Clypeus broadly, shallowly semicircularly emarginated; malar space linear; maxillary palpus subequal to eye length; short, sharp, straight interantennal carina present; lower interocular distance greater than eye length; postocellar area 2X broader than long; head from above sharply narrowing behind eyes; head shining, without punctures and without deep furrows. Length of hindbasitarsus equal to length of remaining tarsal segments combined. Sheath slender, long, very slight scopa at apex, in lateral view, truncated at apex (Fig. 533). Lancet not examined.

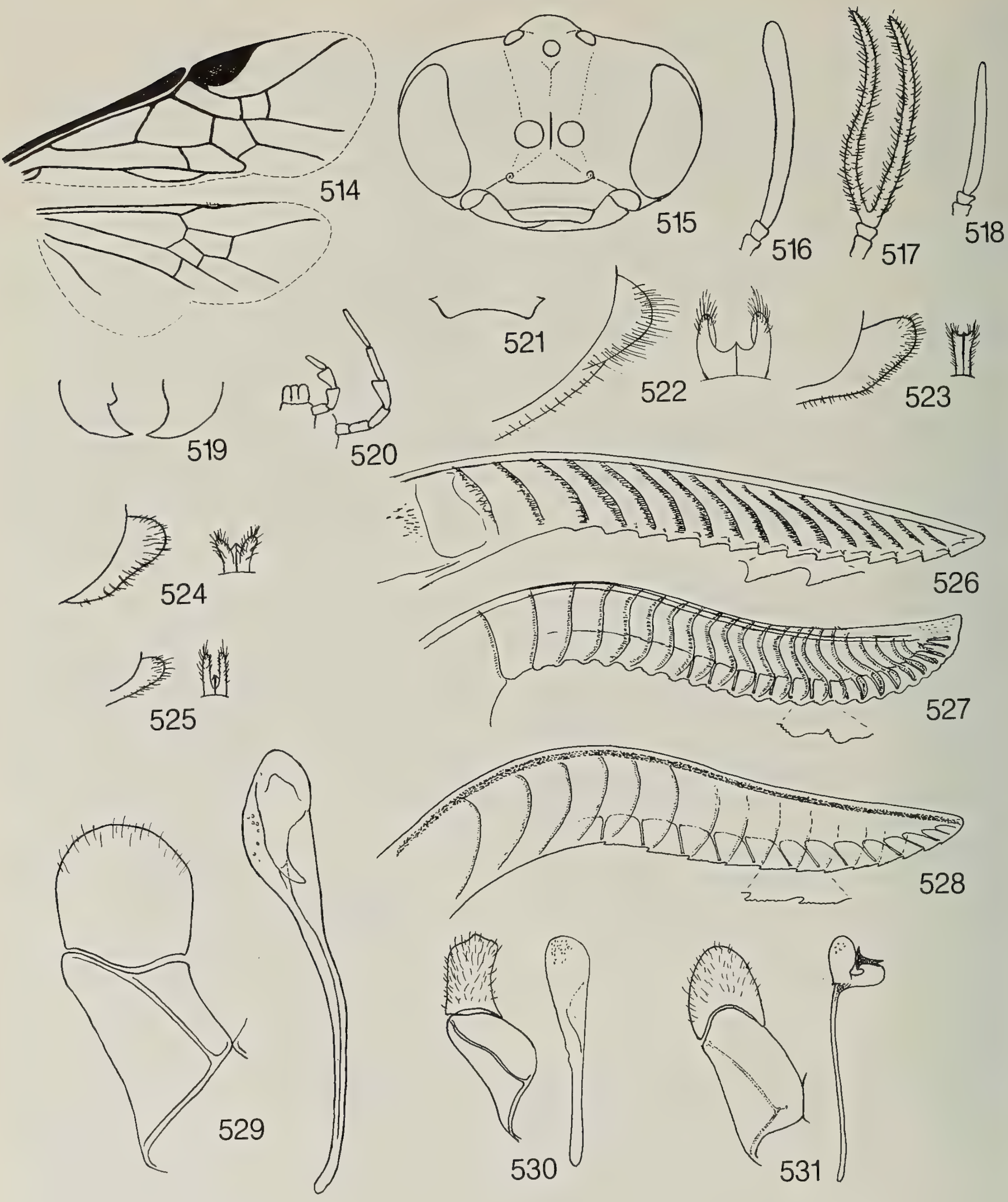
Male.— Unknown.

Holotype.— F, "S. Catarina, Luderwaldt" (Warszawa).

Remarks.—This species resembles *pilicornis* but the clypeus is semicircularly emarginated, and the sheath in lateral view is truncate at its apex and in dorsal view has very short scopae (compare Figs. 522, 523). The sheath structure also separates *kierychi* from the other species treated here.

pilicornis (Holmgren) — Argentina (Buenos Aires, Catamarca, Cordoba, Jujuy, Salta, Santa Fé, Tucumán, Yuto); Australia; Bolivia; Brazil (Rio de Janeiro, São Paulo); Canada; Guatemala; Mexico (Aguascalientes, Baja California Norte, Chihuahua, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Morelos, Nuevo Leon, Oaxaca, Puebla, Sinaloa, Sonora, Tabasco, Tamaulipas); El Salvador; U.S.A.; Uruguay.

Schizocera pilicornis Holmgren 1868: 391-392. F, M. "Brasilia (Rio Jan. et Buen. Ayres)" (Stockholm, ?).— Konow 1900: 58 (compared with *Ptenus gonager* Klug).— Konow 1905a: 25 (as syn. of *gonager*).
Gymnia pilicornis: Kirby 1882: 43.— Dalla Torre 1894: 318.
Sofus pilicornis: Malaise 1937a: 57, 58 (Argentina, s. Brazil; syn.: *lateralis* Konow).— Ross 1951: 16 (syn.: *zabriskiei* Webster and Malley).— Maxwell 1955: 35 (internal larval anatomy).— Kenchington 1972: 111-116 (silk gland morphology).
Schizocerella pilicornis: Benson 1963: 632-633 (syn.: *scapularis* Forsius; host a; in Australia).— Force 1965:



Figs. 514-531. *Schizocerella*. 514, Forewing and hindwing of *S. pilicornis*. 515, Front view of head of *S. pilicornis*. 516, Female antenna of *S. pilicornis*. 517, Male antenna of *S. pilicornis*. 518, Female antenna of *S. kierychi*. 519, Mandibles of *S. pilicornis*. 520, Palpi of *S. pilicornis*. 521, Clypeus of *S. kierychi*. Female sheaths of 522, *S. pilicornis*; 523, *S. kierychi*; 524, *S. treza*; 525, *S. jenseni*. Female lancets of 526, *S. pilicornis*; 527, *S. treza*: 528, *S. jenseni*. Male genitalia of 529, *S. pilicornis*; 530, *S. jenseni*; 531, *S. treza*.

157-160 (in central Calif.).— Moore 1966: 341, 344 (Australia; host a).— Burks 1967: 14 (N. Amer.).— Riek 1970: 890 (introduced, mines in leaves of host a in eastern Australia).— E. Smith 1970: 47, fig. 14A (defense mechanism; biol. notes; Calif.).— Smith 1971b: 544-546, fig. 3, 19, 20, 52, 83, 84 (F, M described; genitalia fig.; distribution; host b).— Smith 1972: 171-172, fig. 16-19 (larva, host b).— Lavigne and Tepedino 1976: 2 (Wyoming).—Gorske and Hoppen 1976: 326 (as biological control agent of purslane, host a).— Gorske et al. 1976: 580-582 (host specificity and response to selected pesticides; Ill.; hosts a, c).— Gorske and Sell 1976: 271-274 (genetic differences among biotypes; host a).—Gorske et al. 1977a: 104-106 (bionomics; Ill.; host a).— Gorske et al. 1977b: 6-7 (biological control; host a).— Gorske and Hoppen 1978: 14-15 (use for biological control of hosts a, c).— Gorske et al. 1978: 73-76 (use for biological control of purslane).— Gorske and Maddox 1978: 235-243 (a microsporidium in larvae).— Smith 1979: 25 (host b).— Clement and Norris 1982: 16-18 (use for biological control of host a in Calif.).

**Schizoceros lateralis* Konow 1899b: 403-404. F, M. "Argentina resp. et Uruguay" (Eberswalde, M).— Konow 1905a: 29.— Oehlke and Wudowenz 1984: 392 ("M Lectotypus (des. D.R.Smith 1971), Argentinien. 1 F, ohne Fundort, müsste demnach Paralectotypus sein").

Brachyphatnus lateralis: Konow 1906b: 251.— Jörgensen 1913: 251.

**Schizocerus zabriskei* Webster and Malley 1900: 51. F, M. Wooster, Ohio. (not located).— Webster 1900: 318-319 (sudden disappearance in Ohio; host a; parasite).— Dyar 1900: 31 (*zabriskiei*; leafminers in host a; N.Y.; larva; biol. note).— MacGillivray 1910: 592 (N.J.).— Garlick 1922: 240 (host a; feeding habits).—Yuasa 1923: 102 (*zabriskiei*; larva).— Frost 1925: 410, 412 (feeding habit).— Taylor 1931: 462 (Dyar's rule applied to larvae).

Aprosthema zabriskei: Markovitch 1916: 139-140 (life history, parasites; Minn.; host a).

Sterictiphora zabriskiei: Rohwer 1926: 877 (N.Y.; host a).— Ross 1937: 54 (syn.: *sericeiformis* Rohwer, *lineatus* Rohwer, *collaris* Rohwer, *johnsoni* MacGillivray).

**Schizocerus sericeiformis* Rohwer 1908: 112-113. M. "Stratton, Nebraska" (Washington, M).

**Schizocerus lineatus* Rohwer 1909: 12. F. "Geneva, Nebraska" (Washington, F).—Smith 1971b: 545 (lectotype).—Smith 1983: 367 (notes on lectotype).

Sterictiphora lineata: Rohwer 1912b: 97 (Colo.).— Rohwer 1926: 877 (N.Y.).— Smith 1943: 383 (Kansas; note; host a).

**Schizocerus collaris* Rohwer 1909: 13. F. "Antonito, Conejos Co., alt. 7,888 ft., Colorado; also Nebraska, "office window", March 24, 1899, and Harlan, Nebr." (Washington, F).— Smith 1983: 367 (notes on lectotype).

Sterictiphora collaris: Rohwer 1912b: 97 (Colo.).

"*S. johnsoni*" Ashmead 1900a: 602 (Riverton, N.J.; nomen nudum).

**Schizocerus johnsoni* MacGillivray 1909: 403-404. F. "Riverton and Avalon, New Jersey" (Champaign, F).— MacGillivray 1910: 592 (N.J.).— Frison 1927: 260 (holotype).— Webb 1980: 111 (holotype F at Champaign).

Schizocerus bilineatus Rohwer in MacGillivray 1910: 592 (listed for N.J.; nomen nudum).

Schizocerella axillaris Forsius 1927: 19 (not described, given only as type species of genus).

**Schizocerella scapularis* Forsius 1927: 19-21. F. "Broadwater, New South Wales" (London, F) (one paratype from Brisbane, Queensland).

Hosts: a) *Portulaca oleraceae*, purslane; b) *Portulaca* sp.; c) *Montia perfoliata*.

I could not locate the type of *pilicornis* Holmgren. Usage is based on the traditional concept of this species. A male and a female of *Brachyphatnus lateralis* were sent to me from Eberswalde. The male bears the data "Argentinien", "Coll. Konow", "Typus", and Konow's determination label. This specimen is the lectotype The female has only two labels "Coll. Konow" and "Typus" and is a paralectotype. I labeled the two specimens as such but did not publish on them prior to the designation by Oehlke and Wudowenz (1984). The holotype of *S. scapularis* Forsius is BM #1.165. Larvae of *pilicornis* are either leaf miners or external leaf feeders. Gorske and other authors (1976-1978) have discussed these biotypes and genetic differences as well as the potential use of this species in biological control of its host plant which is a pest weed in North America.

treza Smith — Brazil (D.F., Goiás, Minas Gerais)

**Schizocerella treza* Smith 1981: 287, fig. 38, 39. F. "Res. Ecol. IBGE, Km 0 BR 251 - DF" (IBGE, F).

Host: *Banisteriopsis* sp. (Malpighiaceae)

The male, previously unknown, is similar in coloration to the female. The male genitalia are as in Fig. 531. Specimens from Braulio Dias bear the following data: Arrependidos, Munic., Cristalina, GO, BR 251, beira Corrego Gueiroba, emergia 15-17-VI-1985, ex larva em *Banisteriopsis* sp., cipo em capoeira ± 20 larvas em folha nova. A specimen from Belo Horizonte, Minas Gerais is 7 mm long, the other specimens examined are about 5.0-6.0 mm long.

Genus SPHACOPHILUS Provancher

Sphacophilus Provancher 1889: 427. Type species: *Sphacophilus crawii* Provancher. Monotypic.

Sphacophilus subg. *Litocolus* Smith 1971b: 556. Type species: *Atomacera cellularis* Say. Orig. desig.

Sphacophilus subg. *Ceocolus* Smith 1971b: 562. Type species: *Schizocerus abdominalis* Cresson. Orig. desig.

Antenna (Fig. 541, 542) with 1st segment longer than broad, 2nd segment about as long as broad; 3rd segment of female antenna usually of uniform width or slightly tapering to rounded apex, sometimes laterally flattened; antennal length 1 to 2X head width. Clypeus truncate to subtruncate; malar space linear to equal to diameter of front ocellus, usually about 1/2 diameter of front ocellus; mouthparts relatively long, maxillary palpus equal to or longer than eye length, palpal segments not enlarged or sometimes 3rd segment of labial palpus slightly larger than others (Figs. 538, 539); left mandible simple or with few crenulations at base, right mandible with small tooth near base (Figs. 536, 537); eyes usually slightly converging below, lower interocular distance equal to or greater than eye length (exceptionally slightly less than eye length in several species) (Figs. 534, 535); head from above narrowing behind eyes; interantennal carina usually present, usually low, rounded, not bisecting supraclypeal area below; supraclypeal area convex. Forewing (Figs. 532, 533) with radial cell open at apex; costa usually broader than intercostal area; with small basal anal cell; with 3, rarely 4, cubital cells, the last closed cubital cell quadrate, as long as or slightly longer on radius than on cubitus; distance between M and Rs+M on Sc+R half or more length of vein M. Hindwing (Figs. 532, 533) with anal cell present, usually equal to or shorter than its petiole. Length of hindbasitarsus usually shorter than length of remaining tarsal segments combined, exceptionally as long as or slightly longer; tarsal claws simple.

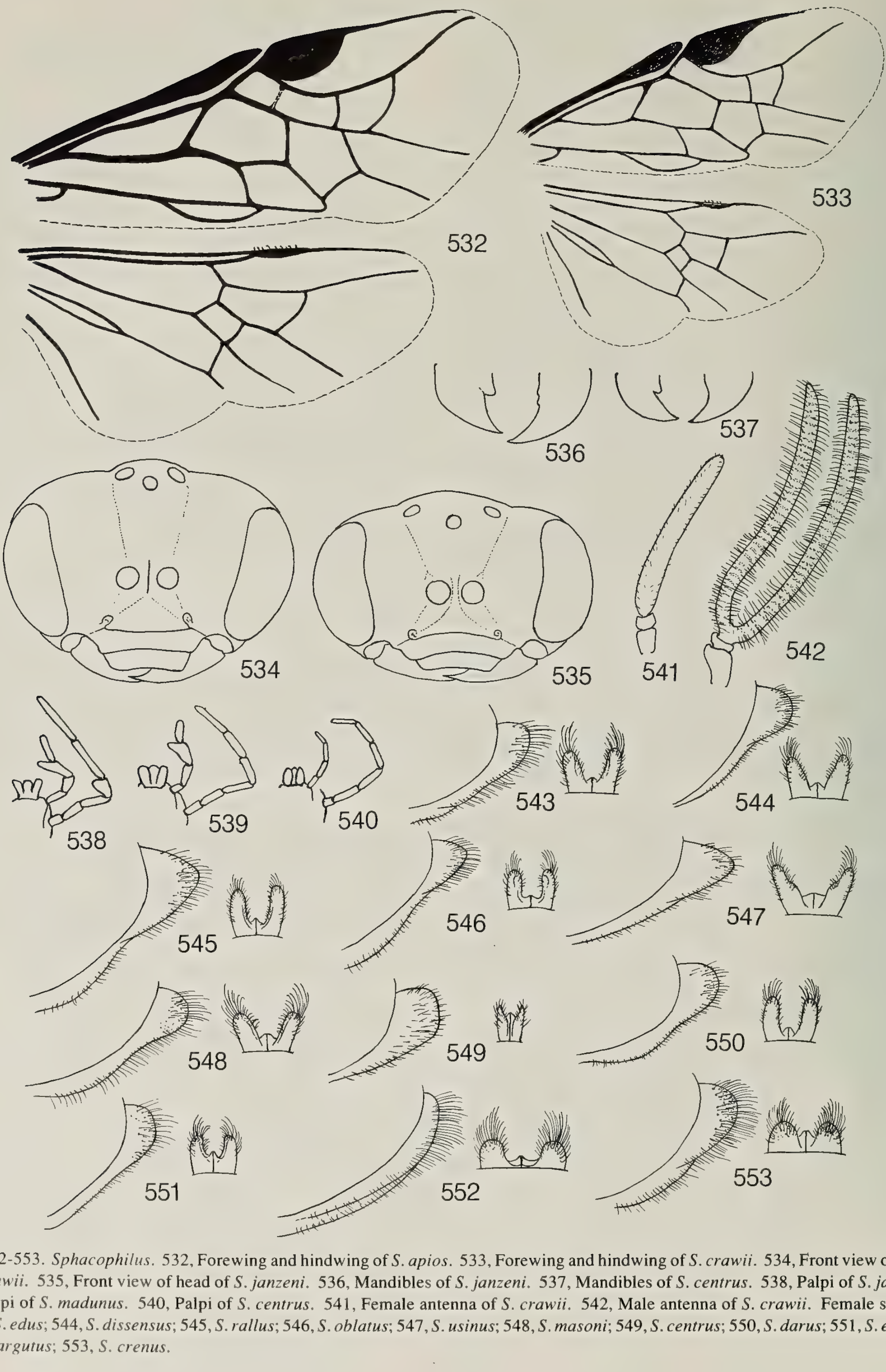
The following key characters will separate members of this genus: open radial cell of forewing; usually 3 cubital cells in forewing with the last closed cell quadrate; basal anal cell present in forewing; hindwing with anal cell; eyes normally far apart with lower interocular distance usually longer than eye length; and palpi slightly longer than or subequal to eye length with segments usually of uniform width.

This genus is most diverse from southwestern United States to Central America and is relatively common in this area. Only a few species occur further north and south of this range. Separate keys are presented for southwestern United States to Central America and for South America. Most known hosts are members of the Convolvulaceae and Leguminosae. North American species not included in the key are: *cellularis* (Say), eastern U.S., on *Convolvulus* and *Ipomoea*; *abdominalis* (Cresson), central U.S., on *Psoralea*; *albicosta* Smith, northwestern U.S., on *Psoralea*; *apios* (Ross), central and eastern U.S., on *Desmodium*, *Psoralea*; *nigriceps* (Konow), south central Canada, central U.S., on *Petalostemum*; *plumiger* (Klug), southeastern U.S., on *Petalostemum*; and *precarius* Smith, southeastern U.S. Smith (1971b) revised the North American (north of Mexico) members of *Sphacophilus* and proposed three subgenera, but I prefer not to use them here. The study was based on the fauna I studied at that time. Since then, I have examined numerous species from Mexico southwards and have noticed some gradation and difficulty in placing some species in the subgenera I defined. Most species can be placed in the three groups, and their diagnostic characters coincide with the proposed subgenera, but I believe species groups are best utilized. These groups may be defined as follows. (1) Previously the typical subgenus. This group includes *crawii* and *invitus*, separated by the cylindrical scopae of the sheath, presence of lateral spines on the lancet, short antenna which is subequal to the head width, and the lack of spines on the male penis valve. *Sphacophilus moniliatus* from South America may belong here. (2) *Litocolus* was used for those species with a simple, long sheath, long, multisegmented lancet, and presence of a short dorsal spine and lack of a lateral spine on the male penis valve (species included in couplets 4-14 and 43 of key). (3) *Ceocolus* was used for those species with a distinct scopa on the sheath, short, more triangular lancet, and presence of a long lateral spine on the male penis valve (species included in couplets 16, 17, 20-38, and 44-50 of key; most South American species would also belong here).

Most of the taxonomy is based on females. Males of few species have been associated, and differentiation is sometimes difficult because of subtle characters in the genitalia. The portion of the key treating males should be used with this in mind. The key to South American species should be used cautiously. Very few are known and more are apt to be discovered.

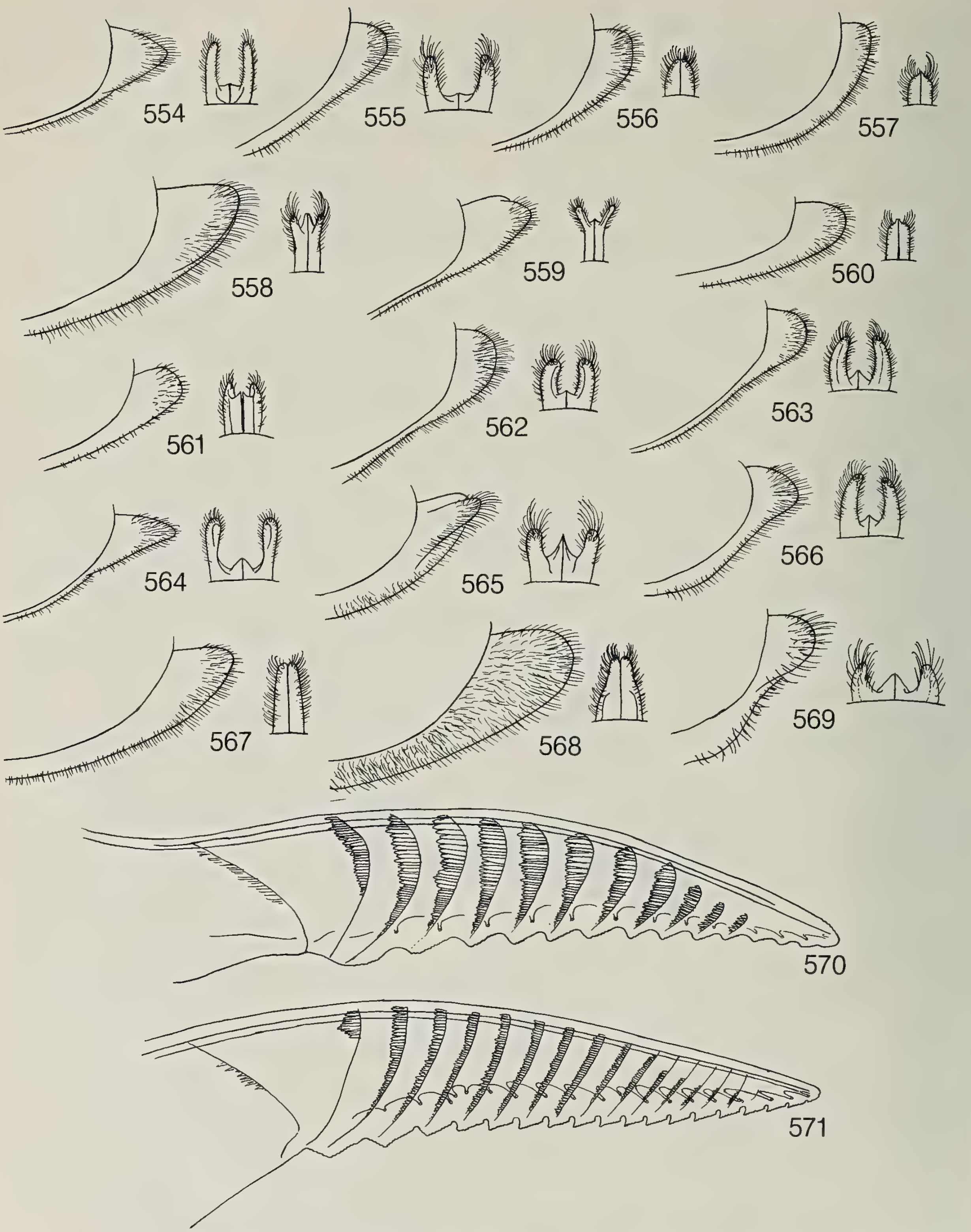
KEY TO SPECIES OF SOUTHEASTERN U.S. TO PANAMA

1. Female 2
– Male 39
2. Sheath simple (Figs. 556, 557, 560, 567, 568), or with very short scopae (Fig. 558). 3
– Sheath broad, with posteriorly or laterally expanded scopae (Figs. 543-555, 559, 561-566, 569) 15
3. Abdomen black (legs mostly black; orange to red only on mesonotum and sometimes pronotum) 4
– Abdomen mostly orange, apex may be black or some blackish marks on terga (legs orange or black) 6
4. Legs black with apices of coxae, trochanters, extreme bases of femora, inner surfaces of tibiae, and basitarsi white; mesonotum blackish with reddish lines on sutures (lancet as in Fig. 597; sheath similar to *iotus*, Fig. 567) . . . . ***panitus***, new species
– Legs black, foretibia and basal 1/3 or less of mid- and hindtibiae may be whitish; mesonotum red or red with black on lateral margins of lateral lobes 5
5. Pronotum and tegula black, mesonotum orange; basal 1/3 or less of mid- and hindtibiae usually white; lancet as in Fig. 599; sheath similar to *iotus*, Fig. 567 . . . . ***jucunus***, new species
– Pronotum orange, tegula orange or black, mesonotum orange with lateral areas of lateral lobes black; legs black; lancet as in Fig. 598; sheath as in Fig. 567 . . . . ***iotus***, new species
6. Mesopleuron and mesonotum black or black on lateral lobes (mid- and hindlegs mostly black with apices of coxae and trochanters orange; abdomen with apical 2-3 segments usually black or most all orange with sheath black; lancet as in Fig. 596; sheath as in Fig. 568) . . . . ***odontus***, new species
– Mesopleuron mostly orange or orange on upper portion and most of mesonotum orange 7
7. Legs orange to yellow with mid- and hindtibiae and tarsi or only hindtibiae and tarsi black; base of tibiae may be whitish 8
– Legs also with femora mostly black 9
8. Legs with apical 2/3 hindtibia and hindtarsus black; mesonotum with black on prescutum and lateral lobes; supraclypeal area black; lancet as in Fig. 601; sheath similar to *iotus*, Fig. 567 . . . . ***nuntius***, new species (in part)
– Legs with mid- and hindtibiae and mid- and hindtarsi black; thorax orange; supraclypeal area orange; lancet as in Fig. 600; sheath as in Fig. 560 . . . . ***madunus***, new species
9. Sheath with very short apical scopae (Figs. 558) (thorax orange with tegulae black, mesosternum sometimes with black marks on each side; abdomen orange, sheath black; antennal flagellum laterally flattened; lancet as in Fig. 572) . . . . ***orus*** Smith
– Sheath simple, without scopae (Figs. 556, 557) 10
10. Lancet short, with about 15 segments; serrulae distinct, pointed at apices (Fig. 576) (sheath as in Fig. 556; thorax orange with cervical sclerites, mesosternum, and lower or almost entire mesepisternum black; mesoprescutum sometimes with black mark; abdomen orange, sheath black) . . . . ***orthius*** Smith
– Lancet long, with 20 or more segments; serrulae low, flat, sometimes not differentiated from each other (Figs. 573-575) 11
11. Abdomen orange with apical 2 or 3 abdominal segments and sheath black (may be some variation, should run specimens through both couplets 12 and 13) 12
– Abdomen orange, sheath black or black on apical margin 13
12. Mesonotum orange with lateral lobes black; serrulae of lancet low and not well differentiated from each other, especially at apex (Fig. 574); sheath as in Fig. 557 (cervical sclerites, mesosternum, and lower mesepisternum black; fore- and midtibiae and basal 1/4 or less of hindtibia white) . . . . ***apiculus*** Smith
– Mesonotum orange; serrulae of lancet slightly deeper and distinguished from each other, even toward apex (Fig. 573); sheath like *iotus*, Fig. 567 (other color as for *apiculus*) . . . . ***partitus*** Smith
13. Head black; legs black; serrulae of lancet deeper and distinguished fron each other (several specimens do not fit the species below, but not enough material is available to determine their status) . . . . **unidentified species**
– Head black with clypeus and usually supraclypeal area whitish to orange; part of legs white or orange; serrulae of lancet continuous and not clearly distinguished from each other (Figs. 575, 600) 14



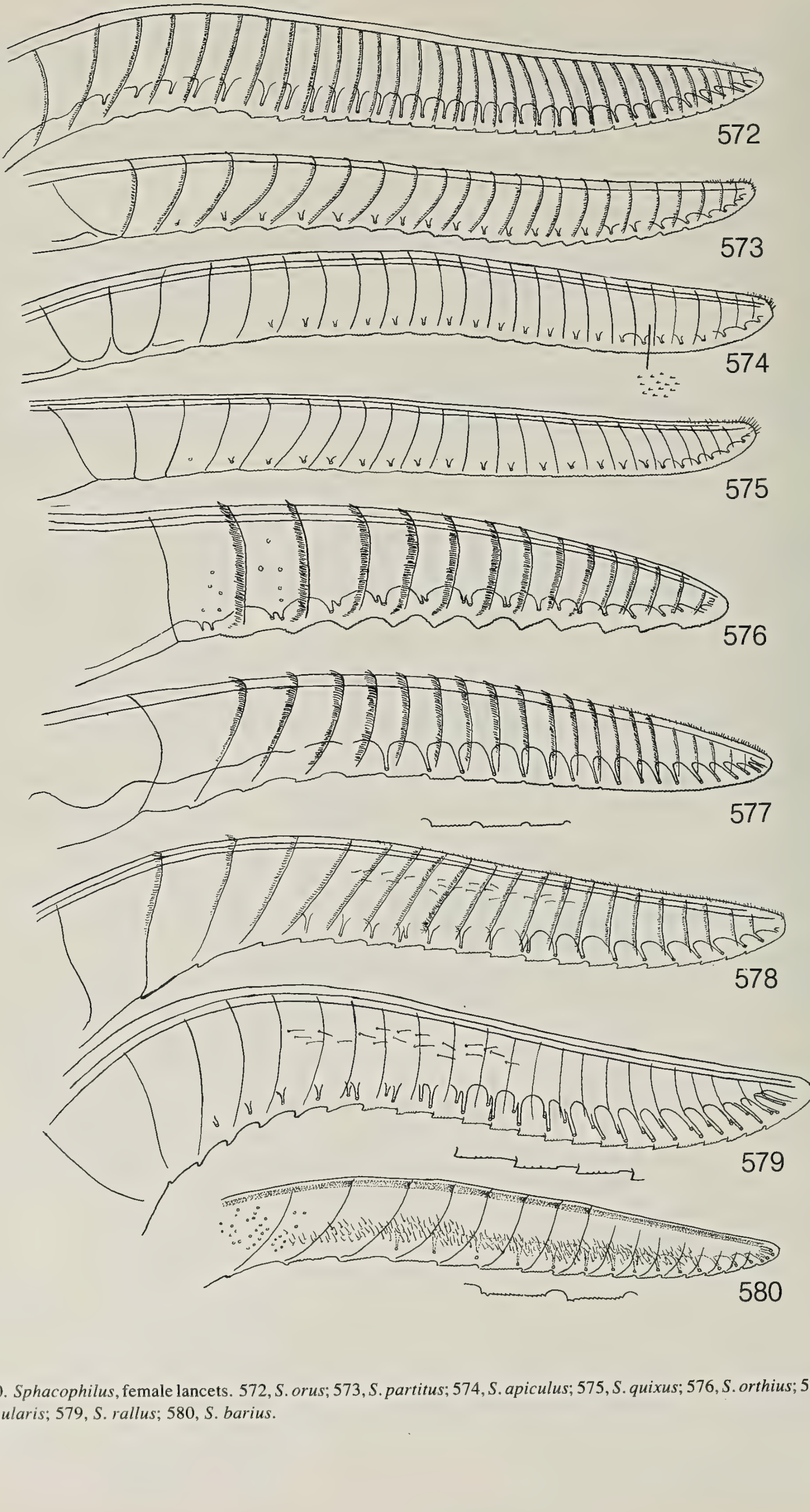
Figs. 532-553. *Sphacophilus.* 532, Forewing and hindwing of *S. apios.* 533, Forewing and hindwing of *S. crawii.* 534, Front view of head of *S. crawii.* 535, Front view of head of *S. janzeni.* 536, Mandibles of *S. janzeni.* 537, Mandibles of *S. centrus.* 538, Palpi of *S. janzeni.* 539, Palpi of *S. madunus.* 540, Palpi of *S. centrus.* 541, Female antenna of *S. crawii.* 542, Male antenna of *S. crawii.* Female sheaths of 543, *S. edus*; 544, *S. dissensus*; 545, *S. rallus*; 546, *S. oblatus*; 547, *S. usinus*; 548, *S. masoni*; 549, *S. centrus*; 550, *S. darus*; 551, *S. evansi*; 552, *S. argutus*; 553, *S. crenus.*

14. Thorax orange or sometimes with mesosternum partly black; sheath black; fore– and midtibiae and hindtibiae at base white; lancet as in Fig. 575; sheath similar to *iotus*, Fig. 567 . . . . **quixus** Smith
– Thorax orange with cervical sclerites black; sheath orange, only apcial margin black; mid- and hindtibiae and tarsi black; lancet as in Fig. 600; sheath as in Fig. 560 . . . . **madunus**, new species (in part)
15. Sheath slender, divided only at apex into slender posterio–laterally projecting scopae (Fig. 559) **16**
– Sheath broad, with slender or thick laterally projecting scopae extending from base or center of sheath (Figs. 543-555) **18**
16. Entirely black, only outer surface of foretibia whitish . . . . **truncatus** (Cameron)
– Thorax and abdomen mostly orange **17**
17. Thorax orange, sometimes with darkened areas on each side of mesoscutellum; abdomen orange; clypeus evenly punctate; malar space subequal to diameter of an ocellus; antenna less than 2X head width; lancet as in Fig. 582 (sheath as in Fig. 559) . . . . **holmus**, new species
– Thorax with mesosternum and mesoprescutum black or mostly black, mesepisternum and sometimes dorsum or apex of abdomen black; clypeus shining, with few or no punctures; malar space broader than diameter of an ocellus; antenna about 2 1/4X head width; lancet as in Fig. 602 (head seen in front view shorter and broader than that of *holmus*, eyes appearing smaller and more widely separated) . . . . **latus**, new species
18. Lancet with distinct annular spines (Figs. 570, 571); scopae of sheath somewhat cylindrical (best seen in lateral view, Fig. 565); mostly black (antennal length less than head width) **19**
– Lancet with annular hairs, not stout spines (Figs. 577–581, 584–595, 603, 604); scopae of sheath broader or triangular (Figs. 544-555, 561-564); color various, usually considerable orange or red on thorax and/or abdomen **20**
19. Annular spines short, equal to 1/2 or less width of segment; lancet with about 17 serrulae, each serrula truncate and separated by distinct notch (Fig. 571) (sheath as in Fig. 565) . . . . **crawii** Provancher
– Annular spines long, those on dorsal part of annuli more than 1/2 width of segment; lancet with about 13 serrulae, each serrula rounded at apex and not separated by deep notch (Fig. 570) . . . . **invitus** (Cresson)
20. Entirely black (antenna with 3rd segment stout, length less than head width; lancet as in Fig. 581; sheath as in Fig. 564) . . . . **memmonius** Smith
– Thorax and/or abdomen with some orange or red markings **21**
21. Serrulae of lancet without subbasal teeth, deep and hooklike (Figs. 583, 588) **22**
– Serrulae of lancet with subbasal teeth, flat, pointed, or rounded at apices (Figs. 577, 578, 586, 589, 590) **23**
22. Thorax black; lancet as in Fig. 583; sheath as in Fig. 566 . . . . **ceraus**, new species
– Thorax orange, mesosternum and mesoprescutum usualy blackish; lancet as in Fig. 588; sheath as in Fig. 555 . . . . **hamus** Smith
23. Head mostly orange, clypeus, spot on inner margin of each eye, ocellar area, and area anterior and posterior to ocelli may be black (thorax and abdomen orange) **24**
– Head black, clypeus and supraclypeal area may be pale **26**
24. Legs black (clypeus, labrum, mandible, palpi, ocellar area, and area anterior and posterior to ocellar area black; lancet as in Fig. 589; sheath as in Fig. 569) . . . . **tenuous**, new species
– Legs orange with tibiae and tarsi entirely or partly black **25**
25. Serrulae of lancet flat (Fig. 590); head and mouthparts orange, only area immediately surrounding ocelli blackish; tibiae orange with outer surfaces of apical halves black; sheath as in Fig. 552 . . . . **argutus** Smith
– Serrulae of lancet deep, separated from each other by deep notch (Fig. 586); head orange with anterior margin of clypeus, labrum, palpi, and ocellar and surrounding area usually black; hindtibia black, other tibiae black usually only on outer surfaces; sheath as in Fig. 553 . . . . **crenus** Smith
26. Thorax entirely black (legs black, abdomen orange with apical segments and longitudinal stripe on dorsum black, or dorsum mostly black) **27**
– Thorax with red or orange markings **28**
27. Lancet as in Fig. 587, with few dorsal hairs; abdomen orange with apical 2-3 segments and faint longitudinal dorsal stripe black (sheath as in Fig. 562) . . . . **scutinus**, new species
– Lancet with serrulae not exactly as in Fig. 587, usually with many hairs on dorsum; abdomen various (miscellaneous specimens that do not fit *scutinus*, but too few to determine their status or describe further). . . . . **unidentified species**



Figs. 554-571. *Sphacophilus*. Female sheaths of 554, *S. triangularis*; 555, *S. hamus*; 556, *S. orthius*; 557, *S. apiculus*; 558, *S. orus*; 559, *S. holmus*; 560, *S. madunus*; 561, *S. janzeni*; 562, *S. scutinus*; 563, *S. barius*; 564, *S. memmonius*; 565, *S. crawii*; 566, *S. ceraus*; 567, *S. iotus*; 568, *S. odontus*; 569, *S. tenuous*. Female lancets of 570, *S. invitus*; 571, *S. crawii*.

28. Mostly orange, sometimes with black on cervical sclerites, mesosternum, mesoprescutum and/or apical abdominal segments; legs black or orange with part of tibiae and tarsi black (a number of unidentified specimens may not fit descriptions exactly) 29
– Black with contrasting red only on thorax 32
29. Serrulae on apical half of lancet continuous, not differentiated from each other (Fig. 577) (sheath as in Fig. 546; usually mostly orange with outer surfaces of apical halves of mid- and hindtibiae and entire mid- and hindtarsi black, sometimes femora, mesosternum, and/or mesoprescutum blackish) . . . . ***oblatus*** Smith
– Serrulae of lancet all distinct, separated by notch or area without subbasal teeth (Figs. 578-580) 30
30. Thorax and abdomen orange, sheath black; legs orange with outer surface of apical half of hindtibia black; scopae of sheath pointed at apex, triangular in lateral view (Fig. 554) (lancet as in Fig. 578) . . . . ***triangularis*** Smith
– Thorax with mesosternum and usually mesoprescutum black, sometimes entire mesopleuron black; abdomen orange or black; legs black; scopae of sheath rounded at apex in lateral view (Figs. 545, 563) 31
31. Thorax orange with tegula, cervical sclerite, mesosternum, and lower 1/3 or less of mesepisternum black; antenna 2X head width; lancet as in Fig. 579; sheath as in Fig. 545 . . . . ***rallus*** Smith
– Thorax with tegula orange, mesonotum orange with at least prescutum black, mesosternum and sometimes entire mesepisternum black; antenna less than 2X head width, usually about 1 3/4X head width; lancet as in Fig. 580 sheath as in Fig. 563 . . . . ***barius***, new species
32. Dorsal and ventral halves of lancet different (Figs. 594, 595, 603); wings subhyaline, with area below stigma blackish 33
– Annuli of lancet continuous from dorsum to venter, not different on dorsal and ventral halves (Figs. 584, 591-593); wings uniformly lightly or darkly infuscated black 35
33. Mesopleuron black (lower interocular distance greater than eye length; lancet as in Fig. 603; sheath as in Fig. 561) . . . . ***janzeni***, new species
– Upper portion of mesepisternum and upper half of mesepimeron red 34
34. Lower interocular distance greater than eye length; mesoscutellum red; scopae of sheath, stout, large (Fig. 550); lancet as in Fig. 595 . . . . ***darus***, new species
– Lower interocular distance subequal to eye length; mesoscutellum mostly black; scopae of sheath more slender (Fig. 543); lancet as in Fig. 594 . . . . ***edus***, new species
35. Serrulae of lancet relatively deep (Fig. 591) (sheath as in Fig. 544; thorax red with cervical sclerite, mesosternum, sometimes lower part of mesepisternum, lower half of mesepimeron, triangular spot on mesoprescutum, and metathorax black) . . . . ***dissensus*** Smith
– Serrulae of lancet flat (Figs. 584, 592, 593) 36
36. Lancet broad at base, tapering to more pointed apex (Figs. 592, 593) 37
– Lancet of more uniform width, rounded at apex (Fig. 584) 38
37. Thorax black with only mesonotum red; lancet as in Fig. 592; sheath as in Fig. 547 . . . . ***usinus***, new species
– Thorax with pronotum and mesonotum orange with cervical sclerite, mesosternum, lower 1/2 of mesepisternum and mesepimeron, and triangular spot on mesoprescutum black; lancet as in Fig. 593; sheath as in Fig. 548 . . . . ***masoni***, new species
38. Thorax with pronotum, mesonotum, and tegula red or orange, mesepisternum black to mostly orange, with intermediates; lancet as in Fig. 584; sheath as in Fig. 551 . . . . ***evansi***, new species
– Thorax with mesoprescutum black (lancet similar to *evansi*, but unable to determine if variation in color exists) . . . . **unidentified species**
39. Black with pronotum orange and mid- and hindbasitarsi and following 2 segments white; wings dark (genitalia not examined, probably with lateral spine as in Figs. 607—618) . . . . ***leucotarsis*** (Cameron)
– A different combination of colors 40
40. Penis valve without spines (Figs. 605. 606) 41
– Penis valve with short or long lateral or dorsal spines (Figs. 607-618) 42
41. Penis valve straight, apex of about same width throughout (Fig. 605) . . . . ***invitus*** (Cresson)
– Penis valve curved ventrally at apex, widest point usually at apex (Fig. 606) . . . . ***crawii*** Provancher
42. Penis valve with short dorsal spine, without long lateral spine (Figs. 607, 608) 43
– Penis valve without dorsal spine, with long lateral spine (Figs. 609—618) 44
43. Tibiae whitish; penis valve narrow at apex (Fig. 607) . . . . ***quixus*** Smith
– Legs black, only foretibia whitish; penis valve broader at apex (Fig. 608) . . . . ***orus*** Smith

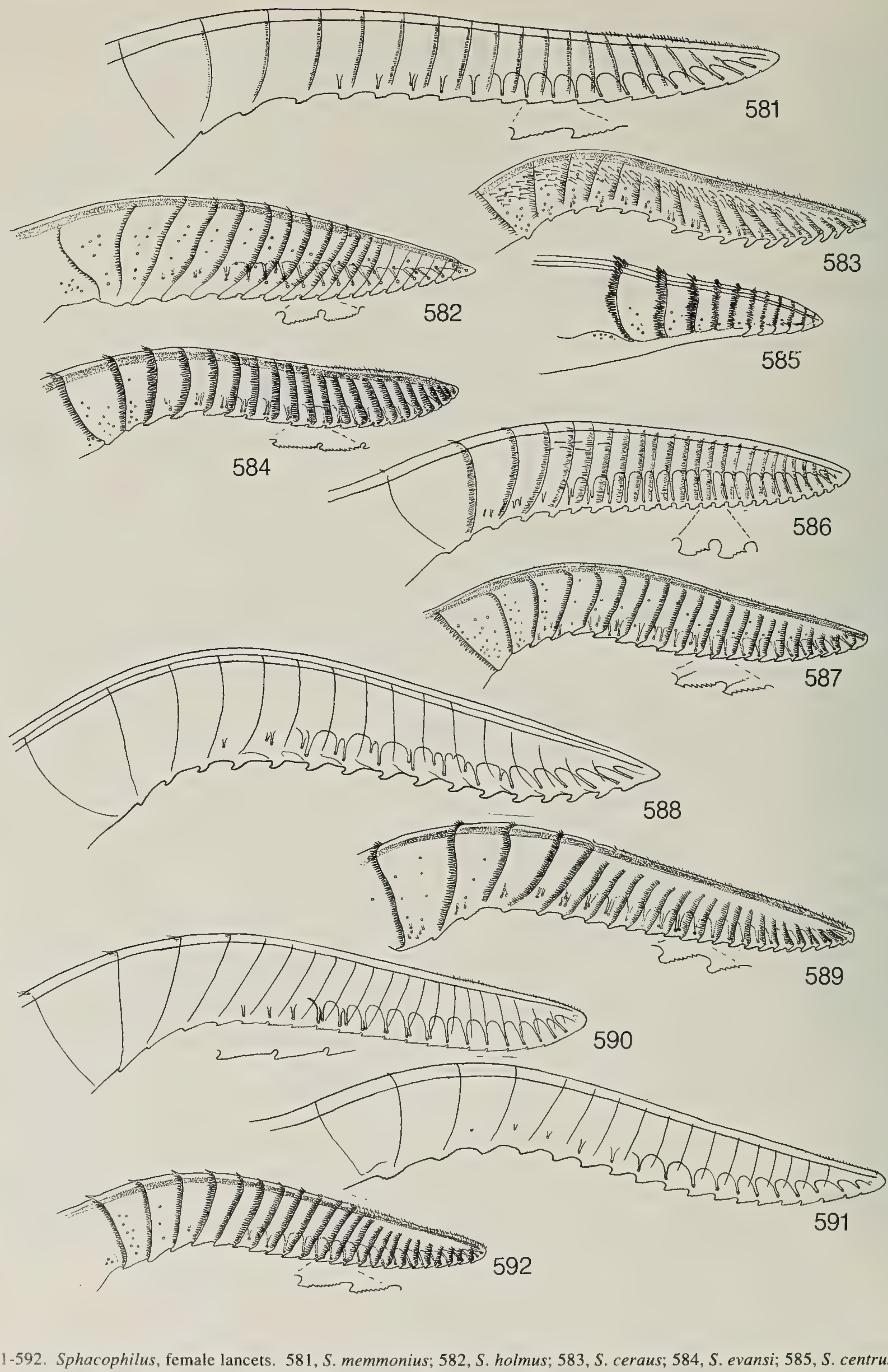


Figs. 572-580. *Sphacophilus*, female lancets. 572, *S. orus*; 573, *S. partitus*; 574, *S. apiculus*; 575, *S. quixus*; 576, *S. orthius*; 577, *S. oblatus*; 578, *S. triangularis*; 579, *S. rallus*; 580, *S. barius*.

44. Legs orange, coxae, bases of femora and/or apices of tibiae and entire tarsi may be blackish (abdomen orange; mesepisternum, pronotum, and mesoscutellum orange; genitalia as in Fig. 611). . . . . ***oblatus*** Smith
– Legs black **45**
45. Entirely black **46**
– Some red or orange on abdomen and/or thorax **47**
46. Genitalia as in Fig. 609 . . . . ***evansi***, new species
– Genitalia as in Fig. 610 . . . . ***dissensus***, Smith
47. Abdomen black (pronotum, mesonotal lateral lobes and mesoscutellum red; spine of penis valve directed anteriorly, Fig. 613) . . . . ***barius***, new species
– Abdomen orange, apical 1 or 2 segments may be black **48**
48. Thorax black or black with mesonotal lateral lobes and mesoscutellum red; pronotum sometimes orange in *holmus* **49**
– Thorax partly red or orange or with mesonotal lateral lobes mostly black **50**
49. Genitalia as in Fig. 612 . . . . ***holmus***, new species
– Genitalia as in Fig. 614 . . . . ***latus***, new species
50. Mesonotum black; tegula black; genitalia as in Fig. 616 . . . . ***crenus*** Smith
– Usually mesoscutellum or lateral areas of mesonotum reddish; tegula red; genitalia as in Fig. 615 . . . . ***hamus*** Smith

KEY TO SPECIES OF SOUTH AMERICA

1. Head below antennae, thorax, abdomen, and legs mostly orange; black are: head above antennae, mesonotum, basal sterna, apical 1-2 terga, sheath, apical 1/2 to 2/3 hindtibia, and mid- and hindtarsi (wings lightly blackish, darker at base and apex; sheath similar to *centrus*, Fig. 549, but more rounded in lateral view) . . . . . . ***peratus*** (Konow)
– Mostly black or black above and orange below; pronotum, tegula, mesonotum, or pleurae and mesosternum may be red to orange; abdomen may be partly orange; legs black or yellow orange **2**
2. Supraclypeal area, clypeus, and labrum yellow; thorax black above, orange yellow below; abdomen black with 2nd tergum white and sterna entirely orange yellow (antenna black with 1st segment yellow and 2nd segment yellow with black on outer surface; wings hyaline with intercostal area and radial cell of forewing more blackish; sheath slender, similar to *iotus*, Fig. 567) . . . . ***cultricornis*** (Konow)
– Head black; thorax with pleurae and mesosternum mostly black; abdomen black, orange with basal plates and apical 2 segments black, or black with orange laterally on segments 2-6 . . . . **3**
3. Abdomen orange with basal plates and apical 2 segments black or black with orange laterally on segments 2-6 . . . **4**
– Abdomen black **5**
4. Thorax black; abdomen orange with basal plates and apical 2 segments black; sheath similar to *hamus*, Fig. 555 . . . . ***.piceiventris*** (Klug)
– Thorax black with pronotum and tegula orange; abdomen black with segments 2-6 orange laterally; sheath similar to *rallus*, Fig. 545 (lancet as in Fig. 604) . . . . ***defius***, new species
5. Thorax black with pronotum, parapteron, tegula, mesonotum (except posterior margin of scutellum), and upper 1/4 of mesopleuron red (2 or 3 labial palpal segments appear enlarged in holotype; sheath similar to that of *orus*, Fig. 558, but shorter in lateral view) . . . . ***blandus*** (Konow)
– Thorax black with pronotum and tegula red; mesonotum may be orange with prescutum black (palpal segments narrow, of uniform width) **6**
6. Mesonotum black; sheath broad in lateral view with short, blunt scopae, Fig. 549 (lancet as in Fig. 585; male genitalia as in Fig. 617) . . . . ***centrus*** Smith
– Mesonotum orange, prescutum with black spot; sheath narrower in lateral view, with round, cylindrical scopae, similar to *crawii*, Fig. 565, but scopae broader in lateral view . . . . ***moniliatus*** (Konow)



Figs. 581-592. *Sphacophilus*, female lancets. 581, *S. memmonius*; 582, *S. holmus*; 583, *S. ceraus*; 584, *S. evansi*; 585, *S. centrus*; 586, *S. crenus*; 587, *S. scutinus*; 588, *S. hamus*; 589, *S. tenuous*; 590, *S. argutus*; 591, *S. dissensus*; 592, *S. usinus*.

SPECIES

apiculus Smith —U.S.A. (Arizona)

**Sphacophilus* (*Litocolus*) *apiculus* Smith 1971b: 556-557, fig. 58. F. "Ramsey Canyon, Huachuca Mts., Arizona" (Washington, F).— Smith 1979: 25.

This species will probably be found in Mexico.

argutus Smith —U.S.A. (Arizona; New Mexico)

**Sphacophilus* (*Ceocolus*) *argutus* Smith 1971b: 566-567, fig. 45, 46, 66. F. "Tucson Mts., Arizona" (Washington, F).— Smith 1979: 26.

I have seen several specimens from Hatch, New Mexico. This species will likely be found in Mexico.

barius Smith, **new species** — Costa Rica (?); Mexico (Colima, Guerrero, Morelos)

Sphacophilus barius Smith.

Female.— Length, 7.0-7.5 mm. Antenna and head black. Thorax reddish with spot on mesoprescutum, cervical sclerites, mesosternum, and lower 1/2 of mesepisternum black, metathorax black or red. Legs and abdomen black or abdomen dark reddish. Wings darkly, uniformly blackish infuscated; veins and stigma black. Antenna with 1st segment as long as broad, 2nd segment slightly broader than long, 3rd segment tapering to apex; antennal length to head width as 7.5:4.5. Malar space equal to diameter of front ocellus; lower interocular distance to eye length as 2.8:1.8; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.8:0.7. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.8:3.5, subequal to length of following 3 tarsal segments. Sheath round in lateral view, halves of scopae slender, projecting posteriorly, long (Fig. 563). Lancet long, serrulae low and flat, with 16-18 serrulae (Fig. 580).

Male.— Length, 7.0 mm. Coloration similar to female except for mostly black mesopleuron. Antennal length to head width as 7.1:4.0. Genitalia as in Fig. 613.

Holotype.— F, "Cuernavaca, Mor., Mex., 9 '23, E.G. Smyth" (Washington).

Paratypes.— COSTA RICA: (POE JFKIA) [interception, port of entry John F. Kennedy International Airport, New York] on legume, 10-15-78, D. Walters (2 F, 1 M). MEXICO: Colima, X-1954, N. L. H. Krauss (1 F); 9 mi N. Taxco, Gro., 5700', August 29, 1963, 44, N. L. H. Krauss, Morelos (1 F); Cuernavaca, Mor., VII-9-61, R. and K. Dreisbach (1 F); Chilpancingo, Guer., 7-24-61, R. and K. Dreisbach (1 F); Xochicalco, Mor., 7-13-61, 4000', R. and K. Dreisbach (2 F). (Champaign, Washington).

Remarks.— The black body with the mostly red thorax, sheath shape and lancet as illustrated will separate *barius* from other species. The specimen from Cuernavaca by Krauss and the one from Xochicalco have the metathorax and abdomen red, otherwise all characters are the same as for the dark colored specimens. Such color variation is also known in other argids, such as *S. apios* (Ross) in the United States.

blandus (Konow) — Brazil (Pará)

**Gymnia blanda* Konow 1906b: 192. F. "Brasilia (Itaituba)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 370 (holotype).

Sphacophilus blandus: Smith 1981: 287.

I have seen only the holotype of this species.

centrus Smith — Brazil (D.F., Goiás)

**Sphacophilus centrus* Smith 1981: 286-287, fig. 36-37. F. "Res. Ecol. IBGE, Km 0 BR 251 - DF" (IBGE, F).

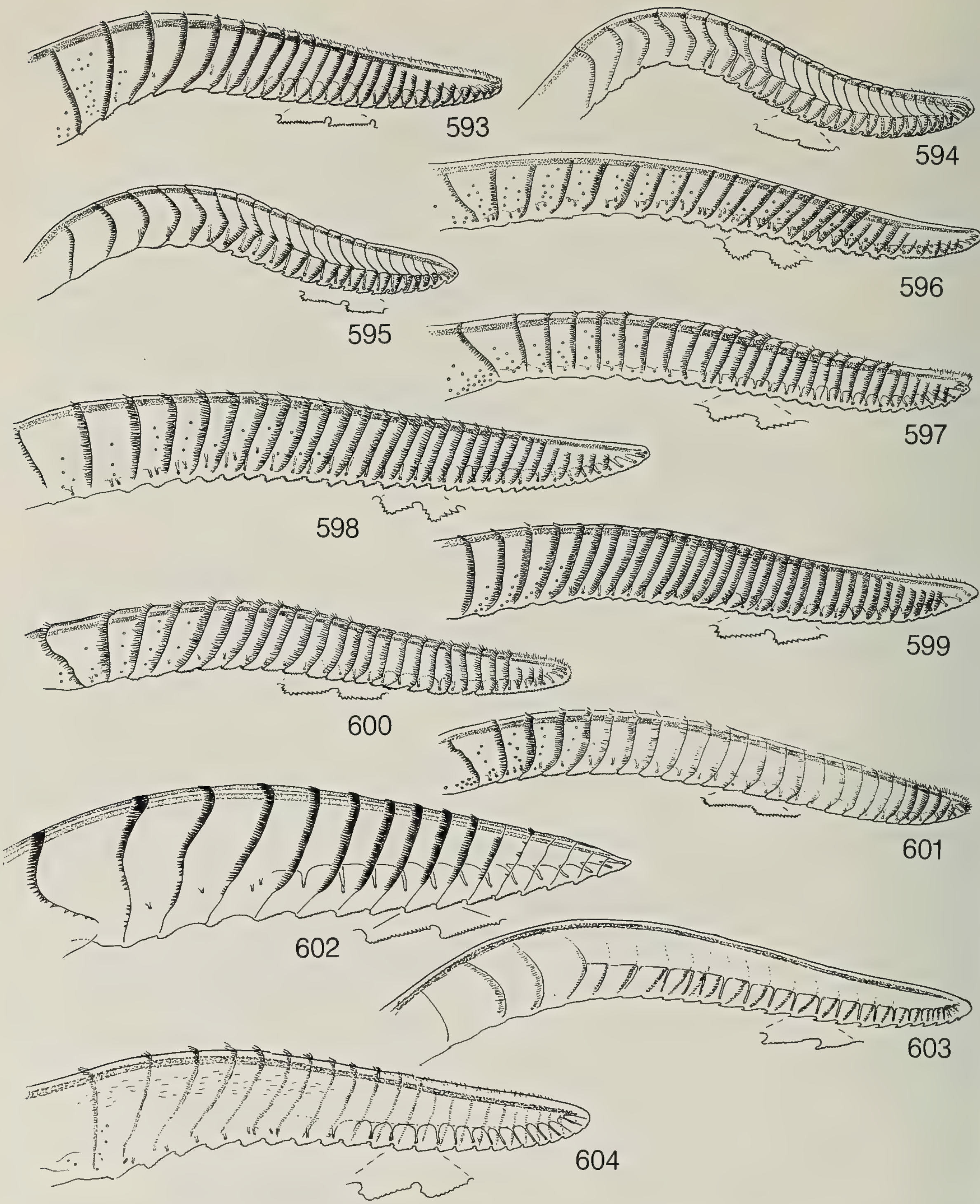
Host: *Stylosanthes guyanensis* (Leguminosae)

Both sexes are black with the pronotum, tegula, and sometimes the mesonotum adjacent to the tegula orange. I have seen females with the abdomen entirely black and black with segments 2-7 partly to entirely orange. The female sheath is as in Fig. 549; lancet as in Fig. 585; and male genitalia as in Fig. 617. Specimens sent to me from Braulio Dias have the following data: Sobiadiulio, D.F., "sur *Stylosanthes guyanensis*," dates of emergence 5-9-III-84, 29-II-84; Rio dos Waeaeas, Sto. Aut. Descobato - GO, 12-II-84, F pega poudo ovos em *Stylosanthes* sp.

ceraus Smith, **new species** — Mexico (Morelos)

Sphacophilus ceraus Smith.

Female.—Length, 6.0 mm. Antenna and head black. Thorax black, side of pronotum brownish. Legs black, apex of forefemur and foretibia whitish. Abdomen orange, margins of sheath black. Wings hyaline, veins and stigma dark brownish to black. Antenna with 1st segment as long as broad, 2nd segment a little broader than long, 3rd segment subequal to head width; anten-



Figs. 593-604. *Sphacophilus*, female lancets. 593, *S. masoni*; 594, *S. edus*; 595, *S. darus*; 596, *S. odontus*; 597, *S. panitus*; 598, *S. iotus*; 599, *S. jucunus*; 600, *S. madunus*; 601, *S. nuntius*; 602, *S. latus*; 603, *S. janzeni*; 604, *S. defius*.

distance to eye length as 2.5:2.0; malar space less than 1/2 diameter of front ocellus; postocellar area 3X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.9:0.6. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.2:2.0, subequal to length of following 2 segments. Sheath rounded in lateral view; scopae slender, long, directed posteriorly (Fig. 566). Lancet with serrulae long, pointed at apices, each directed anteriorly, without subbasal teeth, "hooklike" in appearance; 16 serrulae; lancet slightly constricted toward base (Fig. 583).

Male.— Unknown.

Holotype.— F, "Cuernavaca, Mor., Mexico, VI-1945, N. L. H. Krauss" (Washington).

Paratypes.— MEXICO: Cuernavaca, Crawford (1 F); Cuernavaca, Mor., VI-7-59, 5500', H. E. and M. A. Evans (1 F). (Washington, Ithaca).

Remarks.— The lancet of *ceraus* (Fig. 583) resembles that of *hamus* (Fig. 588) by the hooklike appearance of the serrulae. The lancet of *ceraus*, however, is constricted toward its base, and *ceraus* has the thorax black, not mostly orange as in *hamus*. Also the antenna of *hamus* is longer, being about 1 1/2X the head width instead of only slightly longer than the head width in *ceraus*.

crawii Provancher —U.S.A. (Arizona, California, Idaho, New Mexico, Oregon)

**Sphacophilus crawii* Provancher 1889: 427. F. "Los Angeles" (Washington, F).—Ross 1951b: 16.—Smith 1971: 553-554, fig. 55, 89 (F, M).— Smith 1979: 25.
Sterictiphora crawii: Ross 1937: 54.

There are a number of records from southern California and Arizona. This species will undoubtedly be found in Mexico.

crenus Smith —U.S.A. (Texas)

**Sphacophilus* (*Ceocolus*) *crenus* Smith 1971b: 567, fig. 40, 73, 98. F, M. "Davis Mts., Texas" (Washington, F).— Smith 1979: 26.

I have seen additional specimens from Alpine and Big Bend, Texas. This species will undoubtedly be found in Mexico.

cultricornis (Konow), **new combination** — Bolivia

**Gymnia cultricornis* Konow 1906b: 243-244. F. "Bolivia (S. Antonio)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 376 (holotype).

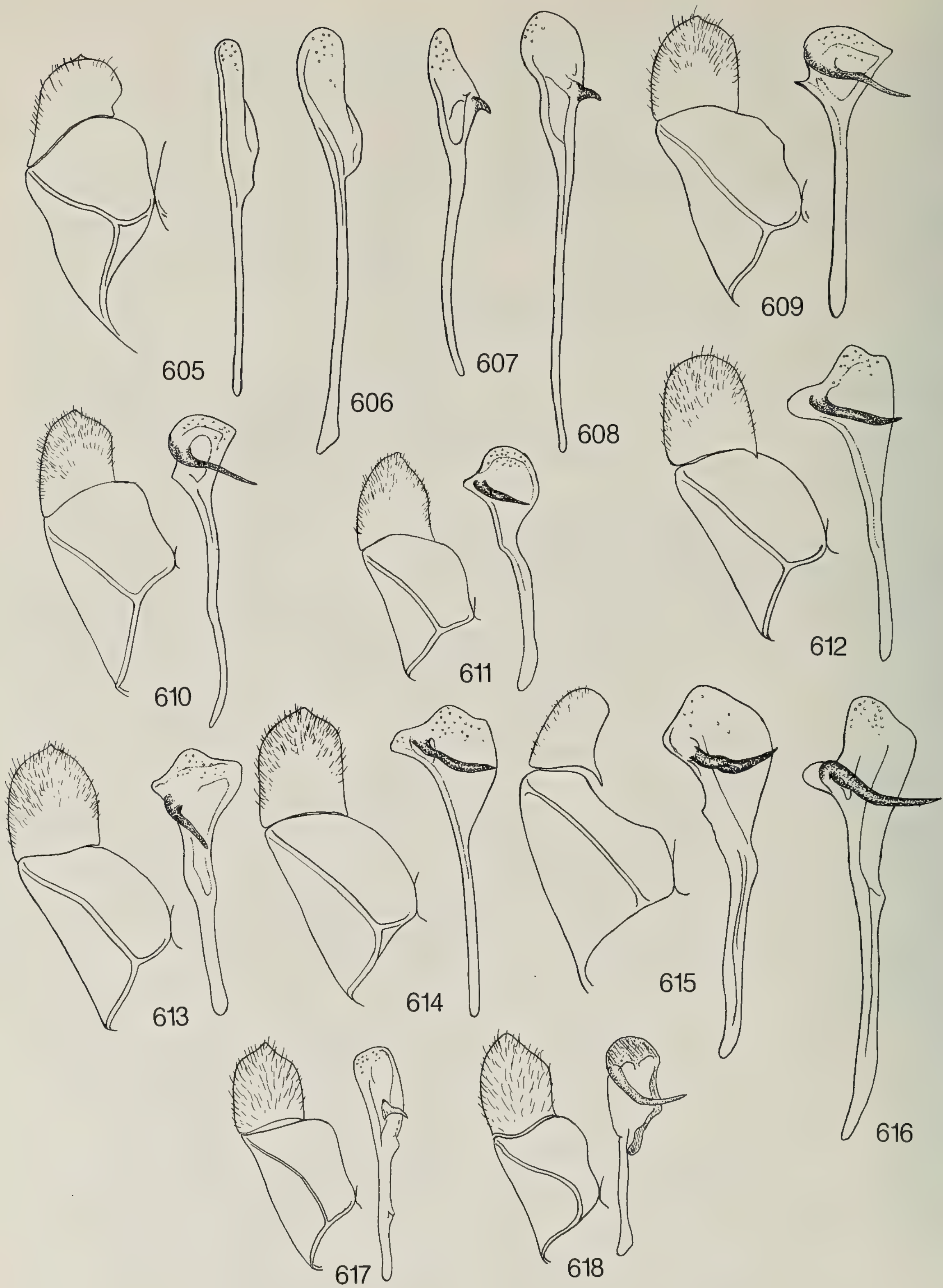
I have seen only the holotype. It is an unusual species and is redescribed here.

Female.— Length 9.5 mm. Antenna black with 1st segment yellow and 2nd segment yellow on inner surface. Head black with supraclypeal area, clypeus, labrum, and palpi pale yellow. Thorax black with lower half of pronotum and entire underthorax orange yellow except for parapteron and upper margin of mesopleuron and mesepimeron; small white spot on extreme posterior corner of each mesonotal lateral lobe. Abdomen black dorsally with 2nd tergum entirely white, laterally and ventrally yellow orange. Legs yellow orange with hindtarsus black. Wings hyaline with intercostal cell and radial cell of forewing mostly blackish infuscated; veins and stigma light brown. Antennal length 1 1/4X head width; flagellum flat, enlarged at apical half. Clypeus truncate; mandibles simple; malar space linear; length of maxillary palpus subequal to eye length, segments of maxillary palpus of uniform width, 3rd segment of labial palpus enlarged; eyes slightly converging below, lower interocular distance shorter than eye length; head from above sharply narrowing behind eyes; without interantennal carina. Forewing with last closed cubital cell longer on radius than on cubitus. Length of hindbasitarsus longer than length of following tarsal segments combined. Sheath slender, without scopae, similar to *iotus*, Fig. 567.

darus Smith, **new species** — Mexico (Nayarit)

Sphacophilus darus Smith.

Female.— Length, 5.5 mm. Black with pronotum, parapteron, upper corners of mesepisternum, upper 1/2 of mesepimeron, and mesonotum except for triangular black mark on prescutum red to orange. Wings uniformly lightly infuscated black, with darker spot below stigma; veins and stigma black. Antenna with 1st segment longer than broad, 2nd segment broader than long, 3rd segment stout, enlarged toward apex; antennal length to head width as 6.0:5.0. Malar space linear; lower interocular distance to eye length as 2.6:2.3; in lateral view, eyes close to posterior margin of head; postocellar area 2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:1.0. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.3:1.4. Sheath rounded in lateral view, scopae slender, directed posteriorly (Fig. 550). Lancet "weak", lightly sclerotized, serrulae flat, about 21 serrulae; dorsal and ventral halves of lancet different, with annuli separated and directed in different directions on each half (Fig. 595).



Figs. 605-618. *Sphacophilus*, male genitalia. 605, *S. invitus*; 606, *S. crawii*; 607, *S. quixus*; 608, *S. orus*; 609, *S. evansi*; 610, *S. dissensus*; 611, *S. oblatus*; 612, *S. holmus*; 613, *S. barius*; 614, *S. latus*; 615, *S. hamus*; 616, *S. crenus*; 617, *S. centrus*; 618, *S. janzeni*.

Male.— Unknown.

Holotype.— F, "10 mi. east San Blas, Nay., Mex., 5000', June 17, 1963, Scullen and Bolinger, col." (Washington).

Remarks.—The lancet as figured is similar to that of *edus* except for the slight differences in the shape of the serrulae. The antenna of the two species differ, that of *darus* enlarged apically and that of *edus* of uniform width or slightly tapering to a pointed apex.

defius Smith, **new species** — Brazil (D.F.)

Sphacophilus defius Smith.

Female.— Length, 5.8 mm. Black with pronotum, tegula, and abdominal segments 2-6 orange laterally; apex of forefemur, foretibia, and forebasitarsus whitish. Wings lightly, uniformly blackish infuscated; veins and stigma black. Antennal length to head width as 6.3:4.4. Maxillary palpus shorter than eye length; palpi with segments uniformly slender, none enlarged; lower interocular distance to eye length as 2.5:2.0; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.8:0.6. Forewing with 3 cubital cells, last closed cell slightly longer on radius than on cubitus. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.6:2.5. Sheath with slender posteriorly projecting scopae, similar to *rallus*, Fig. 545. Lancet long, as in Fig. 604.

Male.— Unknown.

Holotype.— F, "Res. Ecol. IBGE, KM 0 BR 251 - DF, 17 a 18-XI-1978, Malaise-3-100," "Brasilia, D.F. col. Braulio Dias" (Brasilia, IBGE).

Remarks.—This species is separated from others by the long lancet and black coloration with the pronotum, tegula, and lateral areas of abdominal segments 2-6 orange.

dissensus Smith — Mexico (Chihuahua); U.S.A. (Arizona)

**Sphacophilus* (*Ceocolus*) *dissensus* Smith 1971b: 568, fig. 64. F. "Indian Pine, Arizona" (Washington, F).— Smith 1979: 26.

I have seen specimens from the following localities in Mexico, all in the state of Chihuahua: Sta. Barabara, 6200'; 3 mi W Sta. Barabara; 5 mi S Villa Matamoros; Cujteco; 5 mi S Terrero.

edus Smith, **new species** — Panama

Sphacophilus edus Smith.

Female.— Length, 5.5 mm. Black with pronotum, parapteron, upper corner of mesepisternum, upper 1/2 of mesepimeron, and mesonotum except for large black spots on prescutum and scutellum red to orange. Wings lightly infuscated blackish with darker blackish mark below stigma; veins and stigma black. Antenna with 1st segment longer than broad, 2nd segment broader than long, 3rd segment laterally flattened, of equal width to slightly tapering at apex to bluntly pointed tip; antennal length to head width as 6.0:6.5. Malar space linear; eyes large, lower interocular distance to eye length as 2.3:2.3; in lateral view eyes close to posterior margin of head; postocellar area 2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:1.1:0.7. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.3:1.3. Sheath rounded in lateral view; scopae slender, directed posteriorly (Fig. 543). Lancet with serrulae flat, about 27 serrulae; upper and lower halves of lancet different, with annuli directed in different directions on each half (Fig. 594).

Male.— Unknown.

Holotype.— F, "Las Cruces, CZ, Pan., II.10.11, Aug. Busck, collector" (Washington).

Paratype.—PANAMA: Frijoles, Canal Zone, Nov. 9, 1930, coll. H. F. Schwarz (1 F). (New York).

Remarks.—The lancet resembles that of *darus* (Fig. 550), but the serrulae differ slightly as figured. The more obvious character is the longer, more slender (apically), and laterally flattened antenna of *edus*.

evansi Smith, **new species** — Mexico (Jalisco)

Sphacophilus evansi Smith.

Female.— Length, 5.0-6.0 mm. Black with pronotum, tegula, parapteron, and mesonotum red; mesepisternum black or mostly red, metanotum dark red; apex of forefemur and foretibia on outer surfaces whitish. Wings moderately, uniformly infuscated black; veins and stigma black. Antenna with 1st segment longer than broad, 2nd segment broader than long, 3rd segment uniformly wide to rounded apex; antennal length to head width as 5.0:4.5. Malar space equal to 1/2 diameter of front ocellus; lower interocular distance to eye length as 2.8:2.0; postocellar area 2 1/2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:0.9. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.3:2.0;

subequal to length of 3 following segments. Scopa of sheath slender, directed posteriorly; in lateral view sheath rounded (Fig. 551). Lancet with serrulae low, flat, each with about 8-10 teeth on margin; about 18 serrulae (Fig. 584).

Male.— Length, 4.5-5.0 mm. Black with foretibia whitish. Antennal length to head width as 5.2:4.1. Genitalia as in Fig. 609.

Holotype.— F, "Mexico, Jal., Guadalajara, VII-17-20-65, H. E. Evans" (Ithaca).

Paratypes.— MEXICO: Same data as for holotype (6 F, 2 M); same data except VII-23-28-65 (2 F); same data except July 17, 1951 (3 F); same data except July 16, 1951 (2 F); same data except VII-23-28-65 (2 F, 1 M); same data except Aug. 2, 1947, B. Malkin (1 F) (Ithaca, Washington).

Remarks.—This species is very similar to *dissensus* except for the entirely red mesonotum in *evansi* and differences in the lancet as illustrated.

hamus Smith —U.S.A. (Arizona, New Mexico)

**Sphacophilus* (*Ceocolus*) *hamus* Smith 1971b: 568-569, fig. 32, 63, 102, 103. F, M. "E. Turkey Crk., Cochise County, Arizona" (Washington, F).— Smith 1979: 26.

I have seen specimens from Rodeo, Hidalgo Co., New Mexico. This species is likely to be found in Mexico.

holmus Smith, **new species** — Costa Rica; Guatemala; Mexico (Guerrero, Morelos, Veracruz)

Sphacophilus holmus Smith.

Female.— Length, 5.0-5.3 mm. Antenna and head black, supraclypeal area may be brownish. Thorax and abdomen orange, sometimes mesosternum, mesoprescutum, and apical 2 or 3 terga blackish; sheath black. Legs black, apex of forefemur and foretibia whitish. Wings lightly, uniformly blackish infuscated; veins and stigma black. Antenna with 1st segment longer than broad, 2nd segment broader than long, 3rd segment slender, tapering to pointed apex; antennal length to head width as 8.0:4.0. Malar space linear; clypeus evenly punctate; lower interocular distance to eye length as 2.4:1.8; postocellar area a little more than 2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.8:0.5. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.4:2.2; subequal to 3 following segments. Sheath slender, at apex slender short scopae diverging laterally; in lateral view triangular (Fig. 559). Serrulae of lancet flat, each with 10 small teeth on margin, separated from each other by rounded notch; about 19 serrulae; annuli directed posteriorly toward dorsum (Fig. 582).

Male.— Length, 5.0-5.2 mm. Coloration similar to female or thorax usually black with pronotum and tegula more orange. Antennal length to head width as 7.6:3.8. Genitalia as in Fig 612.

Holotype.— F, "Yepocapa, Guatemala, May 1948, H. T. Dalmat, collector" (Washington).

Paratypes.— COSTA RICA: Guanacaste Prov., Santa Rosa National Park, D. H. Janzen, 22-VI-13-VII-1985 (1 F). GUATEMALA: Same data as for holotype (1 F, 2 M). MEXICO: Iguala, Guerrero, 7-21-61, R. and K. Dreisbach (1 F, 2 M); Huijintlan, Mor., VII-21-61, R. and K. Dreisbach (2 F); Minatitlan, Ver., 8/26-IX/1/61, R. and K. Dreisbach (1 F); Cordoba, Ver., May 14, 1946, J. and *D*. Pallister (1 F); Guerrero, 2.5 miles NE Cacahuamilpa, July 6, 1974, Clark, Murray, Ashe, Schaffner (1 F); Yautepec, Mor., VII-13-1963, F. D. Parker, L. A. Stange (1 F). (Champaign, Washington, New York, College Station, Davis).

Remarks.— The unusual shape of the sheath (Fig. 559), lancet (Fig. 582), and coloration will distinguish *holmus*. Color variation is evident. On the thorax the mesoprescutum and mesosternum may sometimes be blackish, and in one specimen the mesopleuron and abdomen are more blackish than orange. This species is near *latus*, but that species has the clypeus impunctate and shining, eyes large, and head more rounded.

invitus (Cresson) — Mexico (Baja California Norte, Colima); U.S.A. (Arizona, California, Colorado, Nevada, New Mexico, Oregon, Utah, Washington)

**Schizocera*? *invita* Cresson 1880: 3. F. "Nev." (Philadelphia, F).— Dalla Torre 1894: 313.— Konow 1905a: 29.— Cresson 1916: 5 (holotype).

Sphacophilus invitus: Ross 1951: 16.— Smith 1971b: 554-555, fig. 28, 29, 54, 87, 88.— Smith 1979: 25.

Host: In southern Arizona (Sierra Vista) adults were reared from larvae feeding on *Eriogonum wrightii* (Polygonaceae).

I have seen specimens from the following localities in Mexico: Baja Calif., Sierra San Pedro Martir, trail, La Joya to Oak Pastura; Baja Calif., San Felipe; Manzanillo, Colima. Noel McFarland of Sierra Vista, Arizona, reared this species from the above host. He noted that the larva eats only the pubescense of the epidermal layer from the green (growing) inflorescence stems of the plant. There was very rapid emergence. Larvae quit feeding about August 13 and the first adult emerged by August 21.

iotus Smith, **new species** — Mexico (Guerrero, Morelos, Puebla)

Sphacophilus iotus Smith.

Female.— Length, 7.0-7.5 mm. Black, with pronotum, parapteron, and mesonotum except for blackish lateral margins and sometimes apex of scutllem, red; labrum brownish; tegula may be dark reddish. Legs black with apex of forefemur and foretibia whitish. Wings darkly, uniformly, black infuscated; veins and stigma black. Antenna with 1st segment 2X longer than broad, 2nd segment slightly longer than broad, 3rd segment of uniform width to rounded apex, laterally flattened; antennal length to head width as 7.5:4.9. Malar space less than 1/2 diameter of front ocellus; lower interocular distance to eye length as 2.8:2.5; postocellar area about 1 1/3X broader than long. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.5:2.5. Sheath slender, simple, without scopae; rounded at apex in lateral view (Fig. 567). Lancet long, with about 35 serrulae, those at apex not distinguished from each other; each serrula rather rounded, with 1 or 2 anterior and 4 or 5 posterior subbasal teeth on basal and central serrulae (Fig. 598).

Male.— Unknown.

Holotype.—F, "Mexico, Mor., Cuernavaca, VI 1959, N. L. H. Krauss" (Washington).

Paratypes.—MEXICO: Same data as for holotype (1 F); Gro., Taxco, vii 1959, N. L. H. Krauss (1 F); Puebla, 4.4 mi SW Acatepec, July 9, 1981, Bogar, Schaffner, Friedlander (1 F); Puebla, 13.3 mi. NE Tehuitzingo, July 13-14, 1974, Clark, Murray, Ashe, Schaffner (1 F); Morelos, 6 mi E Cuernavaca, 1 Sept. 1974, W. Hanson, G. Bohart (1 F). (Washington, College Station, Logan).

Remarks.— This species belongs in the group of species with a simple female sheath. It is separated from other species in the preceding key by coloration and lancet features.

janzeni Smith, **new species** — Costa Rica

Spahcophilus janzeni Smith.

Female.— Length, 5.0-5.5 mm. Antenna and head black; apex of mandible reddish. Thorax black with pronotum (except narrow anterior margin and meson) and mesonotum (except triangular spot on prescutum) reddish. Legs black with apex of forefemur and outer surface of foretibia whitish. Abdomen black. Wings moderately, uniformly black infuscated, somewhat more hyaline toward apices; veins and stigma black. Antennal length to head width as 5.5:4.3. Malar space linear; lower interocular distance to eye length as 2.6:2.0; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:1.1:0.6. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.5:1.7. Sheath with short, posteriorly projecting scopae; rounded in lateral view (Fig. 561). Lancet long, dorsal and ventral halves of a different pattern (Fig. 603).

Male.— Length, 4.2-4.8 mm. Coloration similar to that of female, with mesepisternum in some specimens brownish. Antennal length to head width as 8.0:4.2; other ratios similar to those of female. Genitalia as in Fig. 618.

Holotype.— F, "Santa Rosa National Park, Guanacaste Province, Costa Rica, D. H. Janzen," "82-SRNP-526" (Washington).

Paratypes.— COSTA RICA: Same data as holotype (3 F, 2 M); same data as holotype except 83-SRNP-970 (4 F, 8 M); same data as holotype except 80-SRNP-137 (2 F, 4 M); same locality, from Malaise traps, 1-22-VI-85 (2 F), 22-VI-13-VII-85 (3 F), 11-V-1-VI-85 (3 F), 28-VII-77 (1 F), 1 XII-77 (1 F), 19-VIII-77 (1 F), 10-XI-77 (1 M), 17-VI-77 (1 F), 15-V-77 (1F), 7-IX-77 (1 F), 6-VII-77 (1 F), 31-X-77 (1F), 21-X-77 (1 F), 29-IX-77 (1F), 3-VI-78 (1 F), 21-VIII-77 (1 F), 27-X-77 (1 F), 9-X-77 (1 F), 3-XII-76 (1 F). (Washington, Townes Coll., London).

Host.— Reared from *Hymenaea courbani* (Leguminosae) in Costa Rica by D.H. Janzen.

Remarks.— The general appearance and ovipositor structure most resemble *edus* (Fig. 594) and *darus* (Fig. 595). The three species are separated in the key to species.

jucunus Smith, **new species** — Mexico (Morelos, Veracruz)

Sphacophilus jucunus Smith.

Female.—Length, 7.0 mm. Black with mesonotum orange; dark reddish to brown spot on lateral angles of pronotum; apex of forefemur, foretibia and basal 1/4 of mid- and hindtibiae white. Wings darkly, uniformly black infuscated; veins and stigma black. Antennal length to head width as 6.4:5.7. Malar space nearly linear; lower interocular distance to eye length as 2.9:2.4; postocellar area 1 1/3X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:1.0. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.5:2.4. Sheath slender, simple, without scopae; in lateral view straight above, rounded below and at apex (similar to *iotus*, Fig. 567). Lancet long, serrulae flat with 1 or 2 anterior and about 8 posterior subbasal teeth; about 34 serrulae, those at extreme apex of lancet not differentiated from each other (Fig. 599).

Male.— Unknown.

Holotype.— F, "Cuernavaca, Mor., Mexico, VI-1945, N. L. H. Krauss" (Washington).

Other specimens.— MEXICO: Minatitlan, Ver., 8/26-IX/1/61, R. and K. Dreisbach (1 F); Morelos, 7.3 mi. S. Yautepec, 1 Aug. 1969, 4400', George W. Byers (1 F).

Remarks.— This species is similar to *iotus*, but the black pronotum, white at the base of the mid- and hindtibiae, and more flattened serrulae of the lancet will distinguish *jucunus*.

latus Smith, **new species** — Costa Rica; Honduras; Mexico (Chihuahua, Guerrero, México, Michoacán, Morelos)

Sphacophilus latus Smith.

Female.— Length, 5.5-6.5 mm. Antenna and head black. Thorax orange with triangular spot on mesoprescutum, mesosternum, and cervical sclerites black; mesepisternum orange, partly black, or all black. Abdomen orange with sheath and sommetimes apical 1 or 2 segments black, sometimes mostly black. Legs black, foretibia and tarsus more orange. Wings moderately uniformly infuscated black. Antennal length to head width as 9.0:4.0. Lower interocular distance to eye length as 2.4:1.7; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:0.8:0.5; head strongly narrowing behind eyes; malar space subequal to diameter of front ocellus. Clypeus smooth, shining, with very few widely scattered punctures. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.7:2.7. Sheath similar to that of *holmus* (Fig. 559). Lancet similar to that of *holmus* (Fig. 582).

Male.— Length, 5.0-6.0 mm. Color and structure similar to female; mid- and hindtibiae sometimes pale. Antennal length to head width as 8.1:3.5. Genitalia as in Fig. 614.

Holotype.—F, "Huijintlan, Mor., Mex., VII-21-61, R. and K. Dreisbach" (Champaign).

Paratypes.— COSTA RICA: Guanacaste Prov., Santa Rosa National Park, D. H. Janzen, 13-VII-3-VIII-1985 (1 F), 24-VIII-14-IX-1985 (1 F). HONDURAS: Tegucigalpa, VIII-26-17, F. J. Dyer, No. 29652 (1 F). MEXICO: Chilpancingo, Guer., 7-24-61, R. and K. Dreisbach (1 F); Xochicalco, Mor., 7-13-61, 4000', R. and K. Dreisbach (3 F); Tequesquitengo, Mor., 7-15-61, R. and K. Dreisbach (1 F); Cotija, Michoacán, IX-14-1965, B. Villegas (2 F, 6 M), same but IX-18-1965 (1 M); Yautepec, Mor., VII-13-1963, F. D. Parker, L. A. Stange (6 M); 5 mi S Villa Matamoros, Chih., VII-18-1967, R. C. Gardner, C. R. Kovacic, K. Lorenzen (1 M); Actopan, Mor., 7-13-61, R. and K. Dreisbach (1 M); Valle de Bravo, Mex., 6500', 3 Aug. 1962, H. E. Evans (1 F); Morelos, 6 mi E. Cuernavaca, 1 Sept. 1974, W. Hanson, G. Bohart (1 F) (Champaign, London, Washington, Ithaca, Logan).

Remarks.— This species is similar to *holmus*, and the two are separated in the key to species.

leucotarsis (Cameron), **new combination** — Guatemala

**Sericocera leucotarsis* Cameron 1883: 47-48, pl. 3, fig. 2. F (?). "Guatemala, Cerro Zunil, 4000 ft." (London, M).— Dalla Torre 1894: 310.
Sericoceros leucotarsis: Konow 1905a: 28.

Cameron stated the female was figured, but he did not state which sex he described. The holotype is a male, BM #1.157. This species is black with the pronotum orange and the mid- and hindtarsi white with the apical two segments black. The wings are darkly, black infuscated. This may be the male of *panitus*. The genitalia were not examined.

madunus Smith, **new species** — Costa Rica; Guatemala; Mexico (Veracruz)

Sphacophilus madunus Smith.

Female.—Length, 5.0 mm. Antenna and head black, supraclypeal area, clypeus, and labrum brownish. Thorax and abdomen orange, cervical sclerites and apical margin of sheath black. Legs black, some white on femora, or whitish to orange with inner surfaces of foretibia, foretarsus, and mid- and hindtibiae and tarsi black. Wings lightly, uniformly black infuscated; veins and stigma black. Antenna with 1st segment longer than broad, 2nd segment as broad as long; 3rd segment slightly laterally flattened, slightly tapering to apex; antennal length to head width as 4.6:3.7. Malar space less than 1/2 diameter of front ocellus; lower interocular distance to eye length as 2.2:1.7; postocellar area 2 1/2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.7:0.5. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.6:1.6. Sheath simple, without scopae, rounded in lateral view (Fig. 560). Serrulae of lancet flat, separated on basal 1/2, with continual row of small teeth and not distinguished from each other on apical 1/2 (Fig. 600).

Male.— Unknown.

Holotype.— F, "Costa Rica, Guanacaste Province, Santa Rosa National Park, D.H. Janzen," "Malaise trap H-4-C, 1-22-VI-1985" (Washington).

Paratypes.— COSTA RICA: Same data as for holotype except dates, 22-VI-13-VII-1985 (1 F), 13-VII-3-VIII-1985 (1 F), 3-24-VIII-1985 (1 F), 16-XI-7-XII-1985 (1 F). GUATEMALA: Esquintia Prov., May 14, 1965, swept ex Cymbopogon spp., E. J. Hambleton (1 F) (London, Washington).

Other specimens.— MEXICO: Tepic, Aug., Goldsmith (1 F); Puente Nationale, V.C., VIII-10-61 (1 F, 1 M)..

Remarks.—The sheath and lancet place this species close to *quixus* from southern Arizona, but *madunus* has the thorax entirely orange and the mid- and hindtibiae entirely black. Also, the lancet of *madunus* has the serrulae more distinctly differentiated on the basal half and a greater number of serrulae than does *quixus* (Fig. 575). The "other specimens" from Mexico have the lower interocular distance nearly equal to the eye length and the hindbasitarsus slightly longer than the length of the remaining tarsal segments combined, but the color and lancet structure are the same.

masoni Smith, **new species** — Mexico (Durango)

Sphacophilus masoni Smith.

Famale.— Length, 6.0 mm. Black with pronotum, tegula, parapteron, upper 1/2 of mesepisternum, and mesonotum except for black on prescutum, red; apex of forefemur and outer surface of foretibia whitish. Wings uniformly, moderately infuscated black; veins and stigma black. Antenna with 1st segment longer than broad; 2nd segment broader than long; 3rd segment of uniform thickness, bluntly rounded at apex; antennal length to head width as 5.8:4.7. Malar space less than 1/2 diameter of front ocellus; lower interocular distance to eye length as 2.7:2.0; postocellar area 2 1/2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:0.8:0.8. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.7:2.5, subequal to length of 3 following segments. Sheath round in lateral view, with slender scopae directed posteriorly (Fig. 548). Serrulae of lancet flat, each with 8-10 small subbasal teeth on margin; about 23 serrulae, each distinct; annuli directed posteriorly toward dorsum (Fig. 593).

Male.— Unknown.

Holotype.— F, "Mex., Dgo., 7 mi. W. Durango, 7000', 22 July 1964, W. R. M. Mason" (Ottawa).

Remarks.— This species is close to *evansi* and *dissensus* but can be separated from each by the lancet, the annuli of which are directed forward instead of backward in *evansi* (Fig. 584) and the flatter serrulae in *dissensus* (Fig. 591). The black mark on the mesoprescutum will help distinguish *masoni* from *evansi*.

memmonius Smith — U.S.A. (Arizona, California)

**Sphacophilus* (*Ceocolus*) *memmonius* Smith 1971b: 570, 572, fig. 33, 62. F. "12.2 mi. W. Glamis, Algadones sand dunes, Imperial Co., California" (Washington, F).— Smith 1979: 26.

I have seen additional records from San Diego and Riverside counties in California and from 5 mi E Tacna, Yuma Co., Arizona. This species is likely to occur in Mexico.

moniliatus (Konow) — Argentina (Entre Rios)

**Schizoceros moniliatus* Konow 1899b: 404. F. "Argentian resp. (Parana)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 396 (holotype).

Sericoceros moniliatus: Konow 1905a: 29.—Jörgensen 1913: 251.

Sphacophilus moniliatus: Smith 1981: 287.

The holotype is labeled "Parana, Mrz." This is the only specimen I have seen. It has broad but cylindrical scopae on the sheath, similar to the sheaths of *crawii* and *invitus* (Fig. 565).

nuntius Smith, **new species** — Mexico (Guerrero, Morelos, Oaxaca)

Sphacophilus nuntius Smith.

Female.—Length, 7.0 mm. Antenna and head black; palpi white. Thorax mostly orange red with cervical sclerites, mesosternum, and most of mesoprescutum and mesonotal lateral lobes black. Abdomen orange with basal sterna and middle of terga to apex and sheath blackish. Legs white to orange, hindtibia black with basal 1/5 white. Wings subhyaline, veins and stigma black. Antenna with 1st segment longer than broad; 2nd segment slightly longer than broad; 3rd segment slightly laterally flattened, mostly of uniform thickness; antennal length to head width as 7.8:4.5. Malar space linear; lower interocular distance to eye length as 2.6:2.3; postocellar area nearly 3X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:0.6:0.6. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.8:2.6. Sheath simple, without scopae; in lateral view rounded at apex (similar to *iotus*, Fig. 567). Lancet long, serrulae flat, with about 25 distinct serrulae, apex of lancet without serrulae separated from each other (Fig. 601).

Male.— Unknown.

Holotype.—F, "Cuernavaca, X-44, N. L. H. Krauss," "Mexico, Morelos" (Washington).

Paratypes.— MEXICO: Oaxaca, Crawford (2 F); Morelos, 7.3 mi. S. Yautepec, 2 Aug. 1969, 4400', George W. Byers (1 F); Amula, Guerrero, 6000 ft., Aug., H. H. Smith (1 F). (Washington, Lawrence, London).

Remarks.— The long antennae, coloration, and flat serrulae of the lancet will separate *nuntius* from other *Sphacophilus* species with a simple sheath.

oblatus Smith — Mexico (Sonora); U.S.A. (Arizona; New Mexico; Texas)

**Sphacophilus* (*Ceocolus*) *oblatus* Smith 1971b: 576, 578, fig. 34, 35, 65. F. "Bear Valley, Arizona, S. slope Tumacacori Mt., 4000', sycamore-oak-ash in valley" (Washington, F).— Smith 1979: 26.

I have seen additional specimens from Rodeo, New Mexico; Bastropor, Fayette Co., Texas; 6 mi S Nogales, ca. 4000', Sonora; and Alamos, Sonora.

odontus Smith, **new species** — Mexico (Guerrero, Michoacán, Morelos)

Sphacophilus odontus Smith.

Female.— Length, 7.5 mm. Black with pronotum and basal 5 sterna orange; basal 2 terga brownish; apex of coxae, trochanters, and foretibia whitish. Wings uniformly infuscated black; veins and stigma black. Antenna with 1st segment longer than broad; 2nd segment as long as broad; 3rd segment slightly laterally flattened, of uniform thickness; antennal length to head width as 9.5:5.5. Malar space linear; lower interocular distance to eye length as 3.3:2.8; postocellar area 2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.8:1.0. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.8:2.8. Sheath simple, without scopae; in lateral view rounded at apex (Fig. 568). Lancet with serrulae low, rounded, each with about 6 coarse subbasal teeth on margin; apical portion without distinct serrulae; about 21 distinct serrulae present (Fig. 596).

Male.— Unknown.

Holotype.—F, "Mex., Mor., Cuernavaca, viii, 1959, N. Krauss" (Washington).

Paratypes.— MEXICO: 6 mi NW Quiroga, Mich., VII-11-1963, F. D. Parker, L. A. Stange (1 F); Xucumanatlan, Guerrero, 7000 ft., July, H. H. Smith (1 F). (Davis, London).

Remarks.—From other species with a simple sheath, *odontus* is separated by its mostly black coloration with the pronotum and sterna orange and by the shape of the serrulae of the lancet, as in Fig. 596.

orthius Smith — U.S.A. (Arizona)

**Sphacophilus* (*Litocolus*) *orthius* Smith 1971b: 558-559, fig. 25, 59. F. "Canelo, Arizona" (Washington, F).— Smith 1979: 25.

This species will probably be found in Mexico.

orus Smith — Mexico (Jalisco, Veracruz); U.S.A. (Arizona)

**Sphacophilus* (*Litocolus*) *orus* Smith 1971b: 559-560, fig. 26, 27, 60, 94. F, M. "Sabino Canyon, Arizona" (Washington, F).— Smith 1979: 25.

I have seen specimens from Rio Santiago, 15 mi. N. Guadalajara, Jalisco, and Puente Nation, Veracruz.

panitus Smith, **new species** — Guatemala

Sphacophilus panitus Smith.

Female.—Length, 5.5 mm. Antenna and head black. Thorax black with pronotum orange and margins of mesoprescutum and lateral lobes of mesonotum dark reddish. Abdomen black. Legs black with apical halves of coxae, trochanters, extreme bases of femora, and each basitarsus white, 2nd tarsal segments whitish but dark at apices. Wings very lightly, uniformly black infuscated; veins and stigma black. Antenna with 1st segment longer than broad; 2nd segment very slightly longer than broad; 3rd segment laterally flattened, of nearly uniform width, very slightly tapering toward apex; antennal length to head width as 7.0:4.3. Malar space nearly linear; lower interocular distance to eye length as 2.3:2.0; postocellar area little more than 2X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.7:0.6. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.1:2.0. Sheath simple, without scopae; in lateral view rounded at apex (similar to *iotus*, Fig. 567). Lancet with serrulae low, pointed at apices, each with 1 or 2 anterior and 5 or 6 posterior subbasal teeth; about 26 serrulae (Fig. 597).

Male.— Unknown.

Holotype.—F, "Guatemala City, Guatemala, 7-1923, E. G. Smyth," "Chittenden No. 11b78" (Washington).

Remarks.— The lancet of *panitus* differs from most other *Sphacophilus* with a simple sheath in that each serrula is distinct. Also, the black coloration with the pronotum orange and much of the coxae and basitarsi white will help to distinguish this species from congeners. This may be be female of *leucotarsis*.

partitus Smith — U.S.A. (Arizona)

**Sphacophilus* (*Litocolus*) *partitus* Smith 1971b: 560-561, fig. 61. F. "*S*. Fork Cave Creek, Cochise Co., Chiricahua Mts., Arizona, 5400'" (Washington, F).— Smith 1979: 25.

This species will probably be found in Mexico.

peratus (Konow) — Brazil (Pará)

**Gynmia perata* Konow 1906b: 241-242. F. "Brasilia (Obidos)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 403 (holotype).
Sphacophilus peratus: Smith 1981: 287.

I have seen only the holotype. It is the only predominately orange species known from South America.

piceiventris (Klug), **new combination** — Brazil

**Hylotoma piceiventris* Klug 1834: 250-251. F. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 296.
Sericocera piceiventris: Norton 1867: 54.
Gymnia piceiventris: Kirby 1882: 43.— Dalla Torre 1894: 318.— Konow 1905a: 27.

I have seen only the holotype.

quixus Smith — U.S.A. (Arizona, New Mexico, Texas)

**Sphacophilus* (*Litocolus*) *quixus* Smith 1971b: 561-562, fig. 57, 93. F, M. "Tucson, Arizona" (Washington, F) (host a).— Smith 1979: 25 (host a).

Host: a) Adults were collected on morning glory, probably *Ipomoea* sp.

I have seen specimens from Rodeo and Hatch, New Mexico. This species undoubtedly occurs in Mexico.

rallus Smith —U.S.A. (Arizona)

**Sphacophilus* (*Ceocolus*) *rallus* Smith 1971b: 578, 580, fig. 68. F. "Marble Peak, north slope Santa Catalina Mts., Pima Co., Arizona" (Washington, F).— Smith 1979: 26.

This species probably occurs in Mexico.

scutinus Smith, **new species** — Mexico (Durango, Sinaloa)

Sphacophilus scutinus Smith.

Female.— Length, 6.5 mm. Black, only abdomen red with apical segment, longitudinal medial line on dorsum, and sheath black. Apex of forefemur and outer surface of foretibia whitish. Wings darkly uniformly black infuscated; veins and stigma black. Antenna with 1st segment longer than broad; 2nd segment broader than long; 3rd segment tapering to pointed apex; antennal length to head width as 10.0:5.1. Malar space equal to 1/2 diameter of front ocellus; lower interocular distance to eye length as 3.0:2.2; postocellar area about 3X broader than long; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:0.6. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.3:3.0. Sheath short, round at apex in lateral view; scopae short and blunt, directed posteriorly (Fig. 562). Serrulae of lancet flat, each without anterior and with 4 or 5 posterior subbasal teeth; about 19 serrulae (Fig. 587).

Male.— Unknown.

Holotype.—F, "8 mi. W. El Palmito, Sin., Mexico, 6500', 4-VIII-1964, J. E. H. Martin" (Ottawa).

Paratypes.— MEXICO: 6.5 mi. E. Potrerillos, Sinaloa, VIII-21-1964, M. E. Irwin (1 F); 10 mi. W. El Salto, Dgo., 9000', 30-VI-1964, J. E. H. Martin (1 F). (Ottawa, Riverside).

Remarks.— The entirely black thorax and mostly red abdomen will help to separate *scutinus*, as well as the long antennae and short blunt scopae of the sheath. The lancet resembles that of *rallus* (Fig. 579), but *rallus* has slenderer, longer scopae on the sheath (Fig. 545).

tenuous Smith, **new species** — Mexico (Chihuahua); U.S.A. (Arizona)

Sphacophilus tenuous Smith.

Female.— Length, 7.0 mm. Orange with antenna, broad stripe on head from near posterior end of postocellar area extending between antennae to labrum (except for orange spot above antennae), legs except for coxae, and sheath black. Wings uniformly, darkly black infuscated; veins and stigma black. Antenna with 1st segment longer than broad; 2nd segment broader than long; 3rd segment laterally flattened, tapering to pointed apex; antennal length to head width as 6.3:5.7. Malar space less than 1/2 diameter of front ocellus; lower interocular distance to eye length as 3.2:2.3; postocellar area 2 1/2X broader than long; head broadened behind eyes; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.2:1.0:1.0. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.4:2.3, subequal in length to 2 following segments. Sheath rounded in lateral view; scopae slender, directed posteriorly (Fig. 569). Lancet with serrulae low, rounded at apices with no anterior and 3 or 4 fine posterior subbasal teeth; about 21 serrulae (Fig. 589).

Male.— Unknown.

Holotype.— F, "2 mi. W. Sonoita, Ariz., Jul. 26, 1962, Werner, Bequaert, Noller" (Washington).

Other specimens.— MEXICO: Chihuahua, La Campana, 8 Sept. 1973, W. J. Hanson, B. A. Haws (1 F) (Logan).

Remarks.— The mostly reddish color of the head places *tenuous* near *argutus* and *crenus*, but in *tenuous* there is a blck stripe down the center of the head, the legs except for the coxae are black, and the lancet differs as shown in Figs. 586, 588, 590. *Sphacophilus hamus* from Mexico is also similar, but it has a black head and much deeper serrulae on the lancet (Fig. 588).

triangularis Smith — Mexico (Nuevo Leon); U.S.A. (Arizona)

**Sphacophilus* (*Ceocolus*) *triangularis* Smith 1971b: 580, fig. 30, 31, 67. F. "Douglas, Arizona" (Washington, F).— Smith 1979: 26.

I have seen specimens from Monterrey, Nuevo Leon.

truncatus (Cameron), **new combination** — Guatemala

**Sericocera truncata* Cameron 1883: 49-50. F, M. "Guatemala, Duenas F, San Geronimo M" (London, F).— Dalla Torre 1894: 310.

Sericoceros truncatus: Konow 1905a: 28.

The lectotype, here designated, is the female specimen set aside as the type in London, BM #1.158. It is labeled "B.C.A. Hymen. I. *Sericoceros* truncatus Cam," "Duenas, Guatemala, G.C. Champion." It is entirely black with only the outer surface of the foretibia whitish. The wings are uniformly, darkly black infuscated. The sheath is similar to that of *holmus*, Fig. 559.

usinus Smith, **new species** — Mexico (Chiapas)

Sphacophilus usinus Smith.

Female.—Length, 6.0 mm. Black with mesonotum except for posterior margin of scutellum red; apex of forefemur and outer surface of foretibia whitish. Wings moderately, uniformly black infuscated; veins and stigma black. Antenna with 1st segment longer than broad; 2nd segment as long as broad; 3rd segment slightly tapering to apex; antennal length to head width as 6.3:4.6. Malar space slightly less than diameter of front ocellus; lower interocular distance to eye length as 3.0:2.0; postocellar area 1 1/2X broader than long; distances between eye and hindocellus, hindocelli, hindocelli and posterior margin of head as 1.0:0.9:0.9. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.0:2.3. Sheath in lateral view narrowing to rounded apex; scopae slender, long, directed posterolaterally (Fig. 547). Lancet with serrulae flat, each with no anterior and 6-8 posterior subbasal teeth; about 22 serrulae (Fig. 592).

Male.— Unknown.

Holotype.—F, "Mexico, Chis., 20-25 mi. N. Huixtla, 3000', 4.VI.1969, B. V. Peterson" (Ottawa).

Remarks.— The combination of the black coloration with only the mesonotum red and characters of the lancet will distinguish *usinus* from other species of *Sphacophilus* that have scopae on the sheath.

Genus TANYMELES Konow

Gymnia Spinola 1851: 23. Preoccupied by *Gymnia* Brullé 1846. Type species: *Gymnia apicalis* Spinola. Desig. by Rohwer 1911a.

Tanymeles Konow 1906b: 244. Type species: *Tanymeles hilarulus* Konow. Monotypic.

Antenna (Fig. 622) with 1st and 2nd segments each longer than broad; 3rd segment of female antenna laterally flattened, tapering to pointed apex; antennal length usually not more than 1 1/2X head width. Clypeus truncate; malar space linear; eyes large, slightly converging below, lower interocular distance less than eye length (Fig. 620) (except a few males); low, short, sharp interantennal carina present, sometimes extending onto supraclypeal area below; head from above sharply narrowing behind eyes (Fig. 621); palpi (Fig. 624) long, maxillary palpus longer than eye length, 3rd segment of labial palpus enlarged, maxillary palpus without enlarged segments; left mandible simple, right mandible with basal tooth (Fig. 623). Forewing (Fig. 619) with radial cell open; costa swollen, as broad as or broader than intercostal area; 3 cubital cells, the last closed cell longer on radius than on cubitus; distance between veins M and Rs+M on Sc+R equal to half or more length of vein M; small basal anal cell present. Hindwing (Fig. 619) without anal cell. Length of hindbasitarsus longer than length of remaining tarsal segments combined; tarsal claw simple.

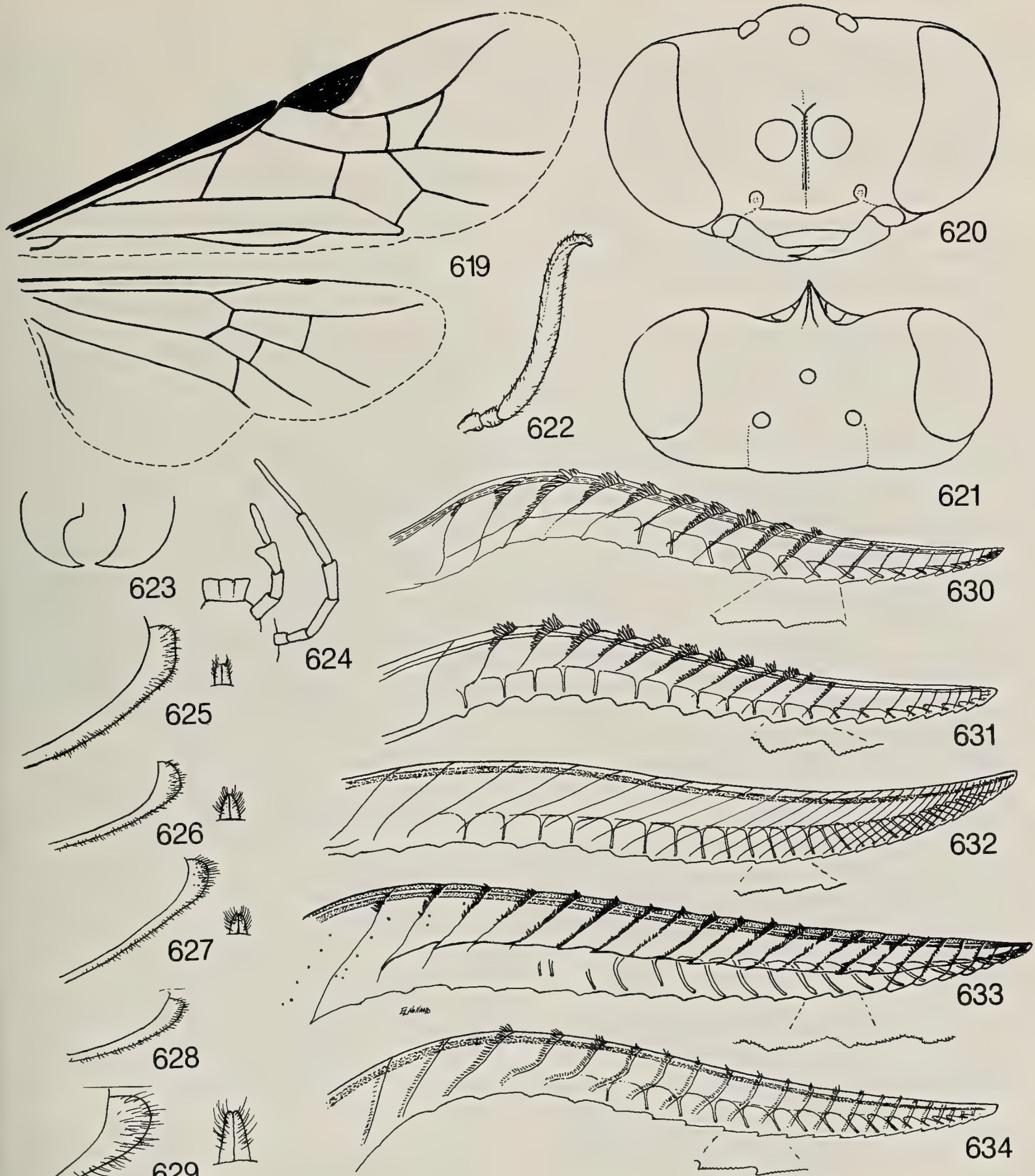
These are mostly small species, about 6 mm long or less, and are recognized by the open radial cell of the forewing, lack of an anal cell in the hindwing, short and sharp interantennal carina, usually large eyes which converge below with the lower interocular distance less than the eye length, and the flattened, tapering antennal flagellum of the female. The head is usually smooth and rather shining and lacks deep furrows or pits. The general habitus is very similar for all species, the female lancets of all are very uniform in structure (Figs. 630-640), and the female sheaths are usually slender and bladelike (Figs. 625-629).

Malaise (1937a, 1955) gave keys to species. The treatment here expands on Malaise's work, but, because of their small size, many more will probably be discovered. Most species are known from one or a few specimens. Representatives have been found from Venezuela to Bolivia and southeastern Brazil. Hosts and biologies are not known.

KEY TO SPECIES

1. Forewing yellow and black, black at base and apex, or black only at apex 2
— Forewing uniformly hyaline or black, stigma may be yellowish and small area around stigma may be yellowish . . . 4
2. Forewing yellow with black at base and apex (sheath as in Fig. 625; lancet as in Fig. 632) . . . . ***fasciatus***, new species
— Forewing yellow with black only at apex 3
3. Thorax entirely orange; lancet as in Fig. 633 . . . . ***suritus***, new species
— Thorax orange with prescutum and mesonotal lateral lobes black; lancet as in Fig. 634 (sheath as in Fig. 626) . . . . ***rasitus***, new species
4. Head orange, at most with ocellar and/or postocellar area black 5
— Head mostly black, at most with clypeus, mouthparts, supraclypeal area, and small spot on frons whitish to yellow 8
5. Thorax orange with mesonotum and metanotum black (other than thorax, yellow orange with 2nd and 3rd antennal segments, ocellar and postocellar areas, apical 1-2 terga, sheath, apical 1/3 of hindtibia, and hindtarsus black; sheath similar to *rasitus*, Fig. 626) . . . . ***galumnatus*** (Konow)
— Thorax orange 6
6. Forewing blackish in female but stigma yellow and area near stigma yellowish to hyaline (length 5.0-6.0 mm) . . . . ***urcacensis*** (Cameron)
— Forewing darkly, uniformly black infuscated, veins and stigma black 7
7. Interocellar area orange; postocellar area 3X broader than long; length 4.0-5.0 mm; lancet as in Fig. 635 (sheath as in Fig. 628) . . . . ***tosus***, new species
— Interocellar area black; postocellar area 2X broader than long; length 5.8-6.2 mm; lancet as in Fig. 636 . . . . ***medeus***, new species
8. Dorsum of abdomen black, venter and lateral downturned areas of terga orange (thorax orange; lancet as in Fig. 637) . . . . ***critus***, new species
— Abdomen black or orange with apex black 9

9. Abdomen mostly orange, basal plates and apical 2 or 3 segments and sheath may be black **10**
— Abdomen black, pale areas sometimes on lateral margins, at base, or on central terga **16**
10. Legs and thorax black (lower interocular distance slightly longer than eye length; female sheath with outwardly projecting scopae unlike most *Tanymeles*, similar to Fig. 543) .... ***segrex*** (Konow)
— Legs partly orange, at least coxae and femora; thorax usually with considerable orange, or black with mesosternum orange **11**
11. Thorax black, or black with mesosternum orange (lancet as in Fig. 630). .... ***hypoleucus*** (Klug)
— Thorax more orange, especially on pronotum and mesonotum **12**
12. Thorax entirely orange, may have black spot laterally on each mesonotal lateral lobe **13**
— Underthorax and/or parts of mesonotum black **14**
13. Mid- and hindtibiae black, pale only at extreme bases; black spot laterally on mesonotal lateral lobes; sheath similar to *inconspicuus*, Fig. 629 .... ***hilarulus*** Konow
— Apical 1/3 or less of mid- and hindtibiae black; mesonotum orange; sheath similar to *tosus*, Fig. 628 (lancet as in Fig. 638; male genitalia as in Fig. 642) .... ***rossi***, new species
14. Mesopleuron and mesosternum black; mesonotum with prescutum, anterior halves of lateral lobes, and spot on scutellum black (legs orange with apical 4 segments for foretarsus, mid- and hindtarsi, and apical 1/3 hindtibiae black) .... ***amictorianus*** (Konow)
— Underthorax orange yellow; mesonotum with prescutum and/or lateral lobes black, margins of lobes may be orange **15**
15. Antenna black (legs orange with apical 1/5 hindtibia, hindtarsus central 3 segments of midtarsus, and apical 1 or 2 segments of foretarsus black; lancet as in Fig. 639) .... ***bequearti***, new species
— Antenna with first 2 segments orange, flagellum pale becoming blackish toward apex .... ***apicalis*** (Spinola)
16. Legs, especially femora, mostly black; thorax mostly black with pronotum and some contiguous parts or most of mesonotum orange to red **17**
— Legs mostly orange yellow, at least all femora orange yellow; thorax mostly orange yellow with parts of mesonotum and sometimes mesosternum and lower portion of mesopleuron black **20**
17. Black, basal 1 or 2 sterna may be orange (lower interocular distance slightly greater than eye length .... ***nigritus*** (Klug)
— Pronotum and usually part of mesonotum orange **18**
18. Mesonotum reddish with spot on prescutum black; tegula black (legs black, only white on forefemur; sheath similar to *inconspicuus*, Fig. 629) .... ***compressicornis*** (Klug)
— Mesonotum orange yellow with most of prescutum and scutellum black; tegula orange yellow **19**
19. Basal 1/3 to 1/2 of mid- and hindtibiae white; head black (forelegs absent on holotype; one other specimen has apex of forefemur and foretibia except black line on inner surface white) .... ***mesomelus*** (Klug)
— Tibiae black; supraclypeal area whitish (foreleg mostly light orange in female; male with base of tibiae pale; lancet as in Fig. 631; male genitalia as in Fig. 641; sheath as in Fig. 629; this and *mesomela* are possibly the same; more specimens are needed to evaluate the two) .... ***inconspicuus*** (Kirby)
20. Legs whitish, only apical 1 or 2 segments of each tarsus blackish (abdomen with basal plates and terga whitish at center) .... ***praecox*** (Klug)
— Legs with at least apex of hindtibia and hindtarsus black **21**
21. Mesoscutellum orange (mesonotum with prescutum and most of anterior 2/3 of lateral lobes black; mesosternum and lower 1/2 of mesopleuron black; upper 1/2 of mesopleuron light orange; lancet as in Fig. 640; sheath as in Fig. 627; male genitalia as in Fig. 643) .... ***wizunus***, new species
— Mesoscutellum black **22**
22. Mesonotum orange with scutellum and posterior halves of lateral lobes black; abdomen black with basal sterna orange; femora orange yellow .... ***alternus*** (Konow)
— Mesonotum orange with prescutum and scutellum black; abdomen black above, mostly orange yellow below except for black apical segment and hypandrium; femora mostly black .... ***socius*** (Konow)



Figs. 619-634. *Tanymeles*. 619, Forewing and hindwing of *T. inconspicuus*. 620, Front view of head of *T. hypoleucus*. 621, Dorsal view of head of *T. hypoleucus*. 622, Female antenna of *T. inconspicuus*. 623, Mandibles of *T. hypoleucus*. 624, Palpi of *T. hypoleucus*. Female sheaths of 625, *T. fasciatus;* 626, *T. rasitus*; 627, *T. wizunus*; 628, *T. tosus*; 629, *T. inconspicuus*. Female lancets of 630, *T. hypoleucus;* 631, *T. inconspicuus;* 632, *T. fasciatus;* 633, *T. suritus*; 634, *T. rasitus*.

SPECIES

alternus (Konow), **new combination** — Brazil (Pará)

**Gymnia alterna* Konow 1906b: 241. F. "Brasilia (Itaituba)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 365 (holotype).

I have seen only the holotype: 6.2 mm long; antenna and head black, palpi orange; thorax orange with mesepisternum, mesosternum, posterior corner of mesoprescutum, posterior half of mesonotal lateral lobes, mesoscutellum, and metanotum black; abdomen black with basal sterna orange; legs orange yellow with apical halves of fore- and midtibiae, apical third of hindtibia, and tarsi black; wings lightly infuscated, intercostal area and spot at apex of radial cell darker; veins and stigma black.

amictorianus (Konow), **new combination** — Peru

**Gymnia amictoriana* Konow 1906b: 242-243. F. "Peru (Pachitea)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 366 (holotype).

I have seen only the holotype: 6.0 mm long; antennae missing except 1st segment pale orange; head black with area below antennae, palpi, and small spot above and between antennae whitish to orange; thorax orange with mesopleuron, mesosternum, mesoprescutum, and anterior half of mesonotal lateral lobes black, mesoscutellum infuscated; abdomen orange with apical 2-3 segments and sheath black; legs orange with apical third of hindtibia, apical 4 segments of foretarsus, and mid- and hindtarsi black; wings uniformly black infuscated; veins and stigma black.

apicalis (Spinola) — Brazil (Amazonas, Pará)

**Gymnia apicalis* Spinola 1851: 7. M. (Para) (Torino, M).— Dalla Torre 1894: 317.— Konow 1905a: 27.

Tanymeles apicalis: Malaise 1955: 113 (syn.: *urcacensis* Cameron; *analis* Malaise).

According to Malaise, the head is orange in the female (*urcacensis*) and black in the male (*apicalis*), and he synonymized the two. I do not believe he had enough specimens to make a definite association and have separated the two species here. The male holotype is 6.0 mm long; antenna with 1st and 2nd segments yellow, 3rd segment infuscate to blacker toward apex; head black with supraclypeal area, clypeus, and mouthparts yellow; thorax orange with large black spots on mesoprescutum and mesonotal lateral lobes; abdomen orange with apical 2-3 segments black; legs orange with apex of hindtibia narrowly blackish (tarsi missing). I have seen one specimen from Santarem, Brazil.

bequaerti Smith, **new species** — Brazil (Acre)

Tanymeles bequaerti Smith.

Female.— Length, 5.5-6.0 mm. Antenna black. Head black with supraclypeal area, clypeus, labrum, mandibles, and palpi light orange. Thorax orange with mesoprescutum and most of mesonotal lateral lobes except for posterior margins black. Legs orange with apical 1/5 hindtibia, hindtarsus, central 3 segments of midtarsus, and apical 1 or 2 segments of foretarsus black. Abdomen orange with apical 3 or 4 segments and sheath black. Wings hyaline to very lightly uniformly infuscated black, a little darker at apices; veins and stigma black. Antennal length to head width as 5.8:5.2; 1st segment subequal in length to 2nd segment, 3rd segment laterally compressed, tapering to apex. Postocellar area 2X broader than long; lower interocular distance to eye length as 2.5:3.2; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:1.0:0.9. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.3:1.8. Sheath slender, without scopae, in lateral view rounded at apex (as *rasitus*, Fig. 626). Lancet as in Fig. 639.

Male.— Unknown.

Holotype.— F, "Rio Branco, Amazonas, San Alberto, 27-VIII-24, J. Bequaert collection" (Cambridge).

Paratypes.— BRAZIL: same data as for holotype, but without San Alberto, and different date, 28-VIII-24 (3 F) (Cambridge).

Remarks.— *Tanymeles amictoranus* from Peru resembles *bequaerti* but the former has only the apical two abdominal segments black and has the mesopleuron, mesosternum, and most of the midtarsus black. Most of the antennae are missing in the holotype of *amictoranus*, but first antennal segment is white.

compressicornis (Klug) — Brazil (D.F., São Paulo ?)

**Hylotoma (Schizocera) compressicornis* Klug 1834: 249-250. F. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 295.

Sericocera compressicornis: Norton 1867: 53.

Gymnia compressicornis: Kirby 1882: 42 (Santarem).— Dalla Torre 1894: 318.

Sericoceros compressicornis: Konow 1905a: 28.

Tanymeles compressicornis: Malaise 1955: 112 ("leg Olfers and accordingly possibly from Sao Paulo?").

The head of the holotype is missing. Kirby's identification of a specimen from Santarem is questionable. I did not see his specimen. I saw one specimen from D.F., Brazil. The holotype is black with whitish on the outer surface of the forefemur and with the pronotum, mesonotal lateral lobes, and mesoscutellum red; wings lightly, uniformly black infuscated. The antennae and head of the specimen from D.F., Brazil, are black.

critus Smith, **new species** — Brazil (Rondônia)

Tanymeles critus Smith.

Female.—Length, 4.5 mm. Antenna and head black; spot on center of supraclypeal area, clypeus, labrum, mandible except apex, and palpi white. Thorax orange. Abdomen black above, lateral downturned portion of terga and sterna orange. Legs orange with tibiae (except whitish bases) and tarsi black; foretibia paler, blackish infuscated only at apex and on outer surface; sheath black. Wings uniformly moderately blackish infuscated; veins and stigma black. Antenna stout, antennal length subequal to head width. Distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.5:1.0:0.4; lower interocular distance to eye length as 1.8:2.5. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.2:1.3. Sheath slender, as in *rasitus* (Fig. 626). Lancet as in Fig 637.

Male.— Unknown.

Holotype.—F, "Brazil, Rondonia: Rio Guapore opposite mouth of Rio Baures (Bol.), September 26-29, 1964, Bousemand and Lussenhop" (New York).

Paratype.—BRAZIL: same data as for holotype (1 F) (New York).

Remarks.— This is a small species, recognized by the orange thorax, orange abdomen with a black dorsum, and orange legs with the tibiae, except for whitish bases, and tarsi black.

fasciatus Smith, **new species** — Venezuela

Tanymeles fasciatus Smith.

Female.— Length, 9.0 mm. Antenna whitish to light orange with apical part of 3rd segment becoming blackish. Head black with supraclypeal area, clypeus, labrum, mandibles, and palpi light orange. Thorax orange with mesoprescutum and mesonotal lateral lobes except for posterior margins black. Legs light orange or yellowish, only extreme apex of hindtibia and entire hindtarsus black. Abdomen orange with apical 2 segments and sheath black. Forewing yellowish at center, infuscated black at base and apex; veins yellow in yellowsh part, black in black part; stigma yellow. Antennal length 1 1/5X head width, as 8.5:7.2; 1st segment subequal in length to 2nd segment; 3rd segment laterally flattened, not tapering but of uniform width to bluntly rounded apex. Lower interocular distance to eye length as 2.0:3.7; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:1.0:0.9. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.8:2.5. Sheath simple, without scopae, slender, in lateral view rounded (Fig. 625). Lancet as in Fig. 632.

Male.— Unknown.

Holotype.— F, "Venezuela-Zulia, El Tucuco, 420 m., 21-27-V-1971, J. Rosales, J. Salcedo, A. Ramirez, Venezuela Inst. Zool. Agricola Fac. Agronomia Univ. Central" (Maracay).

Remarks.— This is an unusually large species of *Tanymeles*, and the yellow wings which are black at both the bases and apices are not known elsewhere in *Tanymeles*. Other color characters and lancet structure will help distinguish *fasciatus* from other *Tanymeles* species.

galumnatus (Konow), **new combination** — Brazil (Pará)

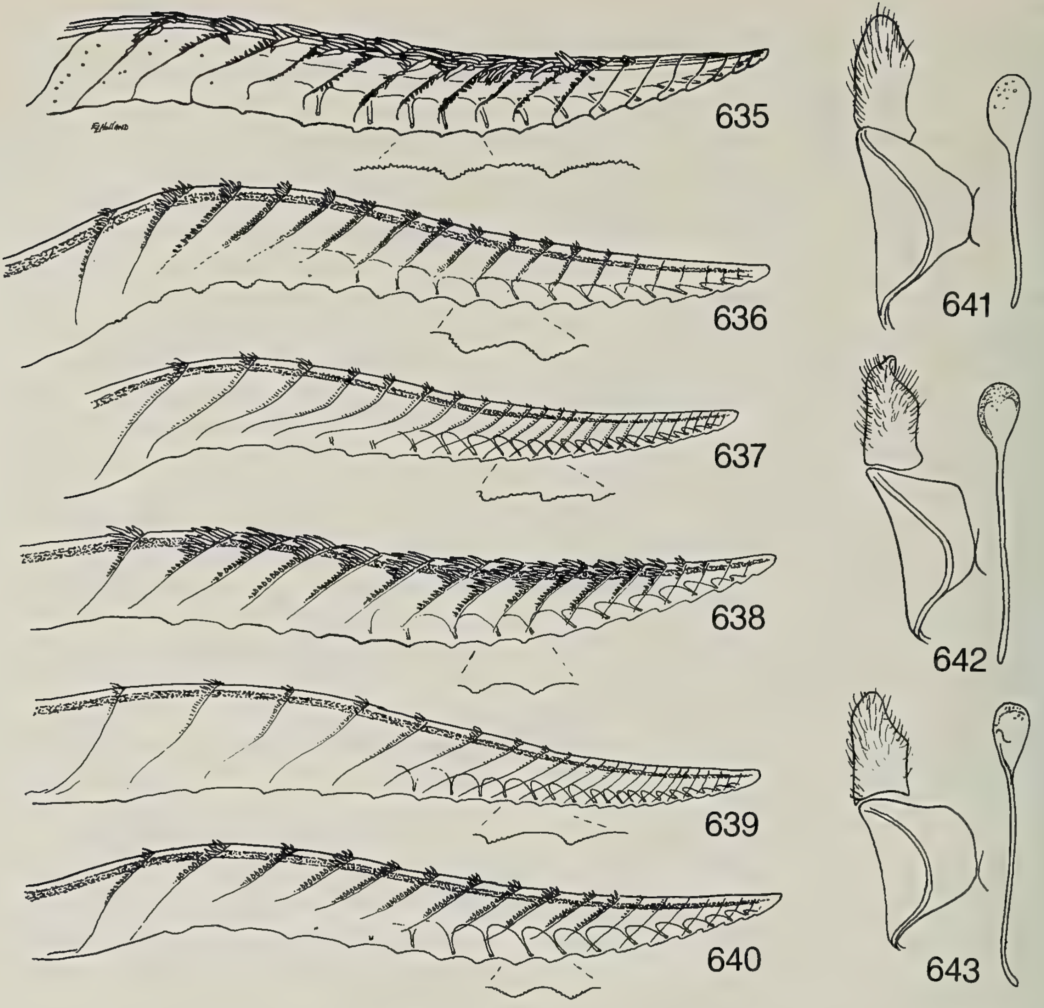
**Gymnia galumnata* Konow 1906b: 242. F. "Brasilia (Itaituba)" (Eberswalde, F).— Oehlke and Wudowenz 1984: 384 (holotype).

I have seen only the holotype: length, 5.9 mm; yellow orange with following black: 2nd and 3rd antennal segments, inter- and postocellar area, meso- and metanotum, apical 1-2 abdominal terga, sheath, apical third to half of hindtibia, and hindtarsus; fore- and midtarsi infuscate; wings uniformly blackish infuscated, veins and stigma black.

hilarulus Konow — Brazil (Pará)

**Tanymeles hilarulus* Konow 1906b: 244-245. F. "Brasilia (Itaituba)" (Eberswalde, F).— Malaise 1937a: 56 (in key).— Malaise 1955: 113 (in key).— Oehlke and Wudowenz 1984: 387 (holotype).

I have seen only the holotype: length, 5.0 mm; antenna black with 1st segment orange; head black with supraclypeal area, clypeus, and mouthparts orange; thorax orange with black spot on each mesonotal lateral lobe; abdomen orange with apical 2 segments and sheath black; legs orange with foretarsus, mid- and hindtibiae and tarsi black; wings hyaline, faintly infuscated toward apices; veins and stigma black.



Figs. 635-643. *Tanymeles*. Female lancets of 635, *T. tosus*; 636, *T. medeus*; 637, *T. critus*; 638, *T. rossi*; 639, *T. bequaerti*; 640, *T. wizunus*. Male genitalia of 641, *T. inconspicuus*; 642, *T. rossi* ?; 643, *T. wizunus*.

hypoleucus (Klug) — Brazil (Rio de Janeiro, São Paulo)

**Hylotoma* (*Schizocera*) *hypoleuca* Klug 1834: 250. M. "Brasilien" (Berlin, M).— Kriechbaumer 1884: 296.
Sericocera hypoleuca: Norton 1867: 53.
Gymnia hypoleuca: Kirby 1882: 43.— Dalla Torre 1894: 318.
Schizoceros hypoleucus: Konow 1905a: 29.
Brachyphatnus hypoleuca: Konow 1906b: 251.
Tanymeles hypoleucus: Malaise 1955: 112 (São Paulo ?).

This species is black with the palpi, sometimes mesosternum, abdomen except for apical one or two segments, and legs except for apical 2/3 of hindtibia and hindtarsus orange. Both sexes are similarly colored. I have seen several specimens from Rio de Janeiro.

inconspicuus (Kirby) — Brazil (Ceará, D.F., Mato Grosso, Pará)

**Gymnia inconspicua* Kirby 1882: 42, pl. 3, fig. 9, 10. F, M. "Amazons, Santarem" (London, F).— Dalla Torre 1894: 318.— Konow 1905a: 27.
Ptenos inconspicua: Konow 1906b: 186.— Forsius 1925a: 6 (same as *Ptenos humeratus* Konow ?).
Tanymeles inconspicua: Malaise 1937a: 55, 56.— Malaise 1955: 112 (as syn. of *mesomelas*).— Smith 1981: 285, fig. 29-32 (D.F. records; genitalia fig.).

I believe *inconspicuus* is a valid species not a synonym as Malaise (1955) proposed. The color of the tibiae differs from that of *mesomelus*, and *inconspicuus* is found in the interior of Brazil rather than on the southeastern coast. The color of *inconspicuus* is black with the foretibia and supraclypeal area whitish. That of *mesomelus* is black with the bases of the mid- and hindtibiae white and has the supraclypeal area black. The specimen set aside as the type, BM #1.163, is hereby selected lectotype. It is a female from "Brazil, Santarem" and has the abdomen missing. I have seen specimens from Chapada, D.F., and Santarem, Brazil. The coloration is as follows: antenna and head black, supraclypeal area and palpi whitish; thorax black with pronotum, tegula, and extreme lateral margins of mesonotum orange; legs black with foretibia whitish; abdomen missing but black in other specimens examined; wings hyaline, apices lightly infuscated; veins and stigma black.

medeus Smith, **new species** — Brazil (D.F.)

Tanymeles medeus Smith.

Female.— Length, 5.8-6.2 mm. Orange with antenna, interocellar area, apex of sheath, apical 1/3 hindtibia, apex of midtibia, and mid- and hindtarsi black; foretarsus blackish. Sometimes medial black spots on terga 5-8, blackish band separating mesosternum and mesepisternum, and black spots on posterior portion of mesonotal lateral lobes. Wings uniformly, darkly black infuscated; veins and stigma black. Antennal flagellum flattened; antennal length to head width as 6.5:5.2. Third segment of labial palpus and 4th segment of maxillary palpus slightly enlarged, that of maxillary palpus not as noticeable as labial palpus; lower interocular distance to head width as 2.6:2.9; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:1.0:0.8; postocellar area 2X broader than long. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.6:1.6. Sheath bladelike, without scopae, similar to *rasitus*, Fig. 626. Lancet as in Fig. 636.

Male.— Unknown.

Holotype.— F, "Res. Ecol. IBGE, KM 0, BR 251 - DF, 09 a 16-X-81, 3A-75-9 m" (Brasilia, IBGE).

Paratypes.— BRAZIL: Same data as holotype (3 F), same except dates, 29-X-5-XI-81 (1 F), 24-30-IX-81 (1 F) (Brasilia, IBGE; Washington).

Remarks.— This species is similar to *tosus* in color, but *tosus* has a much shorter postocellar area, about three times broader than long with the ocelli very close to the posterior margin of the head, and the interocellar area is orange.

mesomelus (Klug) — Brazil (Ceará, Mato Grosso, Rio de Janeiro, São Paulo ?)

Hylotoma (Schizocera) mesomela Klug 1834: 250. F. "Brasilien" (Berlin, F).— Kriechbaumer 1884: 296.
Sericocera mesomela: Norton 1867: 54.
Gymnia mesomela: Kirby 1882: 42.— Dalla Torre 1894: 318.
Sericoceros mesomelas: Konow 1905a: 28.
Tanymeles mesomelus: Malaise 1955: 112 (syn.: *inconspicua* Kirby).

I have seen specimens from Araripe, Ceará; "S. Paul."; and Chapada, Brazil. The coloration of the holotype is as follows: head and antenna black; palpi yellowish; thorax black with cervical sclerites, parapteron, pronotum, and tegula orange; legs black with basal 1/3 of midtibia and basal 1/2 of hindtibia whitish to orange; abdomen black; wings hyaline, slightly infuscated toward apices; veins and stigma black. See discussion under *inconspicuus*.

nigritus (Klug), **new combination** — Brazil

**Hylotoma nigrita* Klug 1834: 250. M. "Brasilien" (Berlin, M).— Kriechbaumer 1884: 296.
Sericocera nigrita: Norton 1867: 54.
Gymnia nigrita: Kirby 1882: 43.— Dalla Torre 1894: 318.
Schizoceros nigritus: Konow 1905a: 29.
Brachyphatnus nigritus: Konow 1906b: 251.

The lower interocular distance of this species is a little longer than the eye length, but the eyes converge below and some males of *Tanymeles* have a longer lower interocular distance than do the females. This character would place *nigritus* in *Schizocerella*, but other characters support its placement in *Tanymeles*, e.g., lack of furrows or pits on the head, short, sharp interantennal carina, forewing venation (especially the last closed cubital cell which is much longer on the radius than on the cubitus), long palpi, and its general habitus. The coloration is black with the outer surface of the foretibia whitish and the first sternum orange to brown.

praecox (Klug), **new combination** — Brazil (Bahia)

**Hylotoma praecox* Klug 1834: 249. "M" = F. "Bahia in Brasilien" (Berlin, F).— Kriechbaumer 1884: 318.
Sericocera praecox: Norton 1867: 54.
Gymnia praecox: Kirby 1882: 42.— Dalla Torre 1894: 318.
Sericoceros praecox: Konow 1905a: 28.

The holotype is a female, not a male as stated by Klug. Length 7.0 mm, with coloration as follows:

Antenna black with 1st segment white; head black with interantennal area, supraclypeual area, clypeus, labrum, and palpi whitish; thorax with pronotum, tegula, parapteron, most of metanotum, narrow stripe at middle of mesosternum, mesepimeron, cervical sclerites, and metapleuron white, mesonotum red with scutellum and spot at posterior corner of each lateral lobe black; abdomen black with basal plates and 2nd tergum whitish at center; legs white, apical 1 or 2 tarsal segments blackish; wings uniformly lightly blackish; veins and stigma black.

rasitus Smith, **new species** — Peru

Tanymeles rasitus Smith.

Female.— Length, 8.0 mm. Antenna with 1st and 2nd segments yellow, 3rd segment yellow at base, black on apical 2/3. Head black with palpi, mandible, labrum, clypeus, supraclypeal area, interantennal carina, and part of paraantennal fields white to yellowish. Thorax yellow orange with mesoprescutum and mesonotal lateral lobes except for margins black. Legs entirely yellow orange. Abdomen yellow orange with dorsum of segment 3 to apex, apical 2 segments entirely, and sheath black. Forewing yellow orange with apex black; stigma yellow and veins yellow in yellowish part, brownish in infuscated apex. Antennal length 1 1/2X head width, as 9.3:6.1; 1st and 2nd segments subequal in length; 3rd segment laterally flattened, slightly tapering toward apex. Lower interocular distance to eye length as 2.5:3.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:1.0:0.8; postocellar area 3X broader than long. Length of hindbasitarsus to length of remaining tarsal segments cobmined as 2.5:1.8. Sheath slender, simple, without scopae, in lateral view rounded at apex (Fig. 626). Lancet as in Fig. 634.

Male.— Unknown.

Holotype.—F, "Peru: Monson Valley, Tingo Maria, X-26-1954, E. I. Schlinger and E. S. Ross, collectors" (San Francisco).

Remarks.— The yellowish wings with the apices black, black mesoprescutum and mesonotal lateral lobes, and lancet will separate *rasitus* from *suritus* (Fig. 633). Both species have yellowish wings with only the apices infuscated.

rossi Smith, **new species** — Peru

Tanymeles rossi Smith.

Female.— Length, 5.0 mm. Antenna black. Head black with supraclypeal area, clypeus, labrum, and palpi light orange. Thorax orange. Legs orange with apical 1/3 of hindtibia and all hindtarsus black. Abdomen orange with apical 2 segments and sheath black. Wings lightly, uniformly blackish infuscated; veins and stigma black. Antennal length 1 1/3X head width, as 5.3:4.0; 1st and 2nd segments subequal in length; 3rd segment not distnctly laterally flattened, tapering toward apex. Lower interocular distance to eye length as 1.7:2.4; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.7:0.3; postocellar area 5X broader than long. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.5:1.2. Sheath slender, simple, without scopae, in lateral view rounded at apex (similar to *tosus*, Fig. 628). Lancet as in Fig. 638.

Male.— Unknown.

Holotype.—F, "El Campamionto, Peru, col. Perene, 22-24 June '20, Cornell Univ. Expedition Lot 607" (Ithaca).

Remarks.— A specimen that may be the male (genitalia, Fig. 642) is also from Peru (10 km NW Pucallpa, X-1954) as it is simarlarly colored, but the association is not certain. The mostly black head, orange legs and thorax, and orange abdomen with the apical segments black will separate *rossi* from other *Tanymeles* species.

segrex (Konow), **new combination** — Brazil (Pará)

**Ptenos segrex* Konow 1906b: 185-186. F. "Brasilia (Obidos)" (Eberswalde, F).—Forsius 1925a: 5.—Oehlke and Wudowenz 1984: 411 (holotype).

The sheath has distinct, expanded scopae, similar to Fig. 543, unlike other species of *Tanymeles*. I have seen only the holotype: length, 6.0 mm; antenna, head, thorax, and legs black; labrum with brownish tinge; abdomen orange with basal plates, posterior transverse stripes on terga 2-5 covering about half of each, and segments beyond 5th black; wings hyaline, slightly infuscated at apices; veins and stigma black.

socius (Konow), **new combination** — Brazil (Pará)

**Sericoceros socius* Konow 1906b: 249-250. M. "Brasilia (Obidos)" (Eberswalde, M).— Oehlke and Wudowenz 1984: 413 ("5 M Lectotypus und Paralectotypen (des. D.R.Smith 1977), Obidos 1904").

Six males labeled as types are at Eberswalde, 5 or which are from Obidos. One of these is the lectotype, the other 4 paralectotypes. I labeled these in 1977 but did not publish on it prior to Oehlke and Wudowenz (1984). The other male appears to be from "Alemquer," but the handwriting is not clear. It cannot be part of the type series since Konow did not mention that locality. The eyes are farther apart than the eye length, as 4.2:3.0, and it may be necessary to transfer this to *Schizocerella*. The palpi are long, typical for *Tanymeles*, and some males of *Tanymeles* have short, widely separated eyes. The lectotype is about 5 mm long; antenna and head black; thorax black with pronotum, tegula, and parapteron yellow orange; abdomen black above, mostly yellow orange beneath except for black apical segment and hypandrium; legs with coxae and trocanters black, femora black with apical third white, tibiae white with apical 1/5 to 1/4 black, midtarsus whitish but blackish apically, hindtarsus black; wings hyaline; veins and stigma black.

suritus Smith, **new species** — Peru

Tanymeles suritus Smith.

Female.— Length, 8.2-8.5 mm. Antenna yellow to light orange with apical 1/3 of 3rd segment blackish. Head black with interantennal carina, supraclypeal area, clypeus, labrum, mandibles, and palpi yellow to light orange. Thorax orange. Legs orange. Abdomen orange with dorsum of 4th to last segment, apical 3 segments entirely, and sheath black. Forewing yellow with apex blackish infuscated; stigma yellow and veins yellow in yellow part, blackish in infuscated part. Antennal length 1 2/3X head width, as 10.2:6.2; 1st and 2nd segments subequal in length; 3rd segment laterally flattened and tapering toward apex. Lower interocular distance to eye length as 2.5:3.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:1.2:0.6; postocellar area 3X broader than long. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.8:2.1. Sheath simple, slender, without scopae, in lateral view rounded at apex (like *fasciatus*, Fig. 625). Lancet as in Fig. 633.

Male.— Unknown.

Holotype.—F, "Peru: Monson Valley, Tingo Maria, X-21-1954, E. I. Schlinger and E. S. Ross, collectors" (San Francisco).

Paratypes.— PERU: Same data as for holotype except X-26-1954 (1 F) (San Francisco).

Remarks.—The yellow wings with the black apices and the entirely orange thorax will separate *suritus* from other species. The closest species, *rasitus* (lancet, Fig. 634), also from Peru, has the mesonotum partly black and the antenna not as tapering but of more uniform width toward its apex.

tosus Smith, **new species** — Bolivia

Tanymeles tosus Smith.

Female.— Length, 4.1 mm. Orange with antenna except for base of 1st segment, sheath, apex of hindtibia, and hindtarsus black. Wings uniformly, darkly black infuscated; veins and stigma black. Antennal length 1 1/4X head width, as 6.3:4.6; 1st and 2nd segments each subequal in length; 3rd segment laterally flattened and tapering to apex. Lower interocular distance to eye length as 2.0:2.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.7:0.4; postocellar area 3X broader than long. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.6:1.4. Sheath slender, simple, without scopae, in lateral view rounded at apex (Fig. 628). Lancet as in Fig. 635.

Male.— Unknown.

Holotype.— F, "Bolivia: Dept. Beni Rio Itenez at mouth of Rio Baures, X-10-1964, J. K. Bouseman, Collector" (New York).

Other specimen.— Bolivia, Beni, 40 km E San Borja (Washington).

Remarks.— The mostly entirely orange coloration will distinguish *tosus* from other species. It is near *apicalis*, but the wings are more darkly and uniformly infuscated and its size is smaller.

urcacensis (Cameron), **new combination** — Brazil (Amazonas)

**Trailia urcacensis* Cameron 1878: 149. F. "Urcaca, Rio Purus, Amazons" (London, F).
Gymnia urcacensis: Kirby 1882: 41.— Dalla Torre 1894: 318.— Konow 1905a: 27.
Gymnia analis: Forsius 1925a: 8 (not Cameron, misidentification).
Tanymeles analis Malaise 1937a: 56. F, M. "Amazonas (Rio Autaz)" (Stockholm, F). **New synonymy.**

See remarks under *apicalis*. The holotype is BM #1.164. This species is orange with the 2nd and 3rd antennal segments, sheath, tarsi, and the apex of the hindtibia black. The wings are hyaline but lightly infuscated at their apices. The sheath is slender from above and rounded in lateral view.

wizunus Smith, **new species** — Peru

Tanymeles wizunus Smith.

Female.—Length, 5.5-6.0 mm. Antenna black with 1st segment orange yellow. Head black with interantennal carina, supraclypeal area, clypeus, and labrum light orange; mandible and palpi black. Thorax black with cervical sclerites, tegula, pronotum, upper 1/2 of mesepisternum, mesepimeron, metapleuron, extreme posterior corner of mesoprescutum, and metanotum light orange to yellow. Legs light orange with tarsi and apical 1/5 of hindtibia black. Abdomen black. Wings uniformly blackish infuscated; veins and stigma black. Antennal length 1 2/3X head width, as 7.8:4.7; 1st segment slightly longer and broader than 2nd segment; 3rd segment laterally flattened and tapering to apex. Lower interocular distance to eye length as 2.3:2.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.6:0.9:0.5. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.5:1.5. Sheath simple, slender, without scopae, in lateral view rounded at apex (Fig. 627). Lancet as in Fig. 640.

Male.— Length, 5.2 mm. Coloration similar to that of female. Antennal length to head width as 4.1:2.3. Genitalia as in Fig. 643.

Holotype.—F, "Peru: Monson Valley, Tingo Maria, X-19-1954, E. I. Schlinger and E. S. Ross, collectors" (San Francisco).

Paratypes.— PERU: Same data as for holotype, except X-25-1954 (1 F); 10 km. N.W. Pucallpa, X-3-1954, E. I. Schlinger & E. S. Ross (1 M) (San Francisco).

Remarks.— This species is close to *alternus* but is separated by the pale upper portion of the mesepisternum, black on the anterior portion of the mesonotum (not the posterior portion), and the pale apices of the fore- and midtibiae (blackish in *alternus*).

Genus **TRAILIA** Cameron

Trailia Cameron 1878: 148-149. Type species: *Trailia analis* Cameron. Desig. by Rohwer 1911a.

Antenna (Fig. 645) with 1st segment longer than broad, 2nd segment slightly longer than broad, 3rd segment of female antenna laterally flattened and tapering to acute apex; antennal length about 1 1/2X head width. Malar space less than 1/2 diameter of front ocellus to nearly linear; clypeus subtruncate; left mandible simple, right mandible with basal tooth (Fig. 648); maxillary palpus longer than eye length, 2nd and 3rd segments of labial palpus enlarged, segments of maxillary palpus not enlarged or 4th very slightly so (Fig. 649); eyes large and converging below, lower interocular distance less than eye length (Fig. 646); head from above sharply narrowing behind eyes (Fig. 647); very short, low but sharp interantennal carina present. Forewing (Fig. 644) with radial cell open; costa narrower to about equal to width of intercostal area; 3 cubital cells with last closed cell longer on radius than on cubitus; distance between M and Rs+M on Sc+R subequal to length of vein M. Hindwing (Fig. 644) with anal cell, cell shorter than its petiole. Hindbasitarsus longer than length of remaining tarsal segments combined; tarsal claws simple.

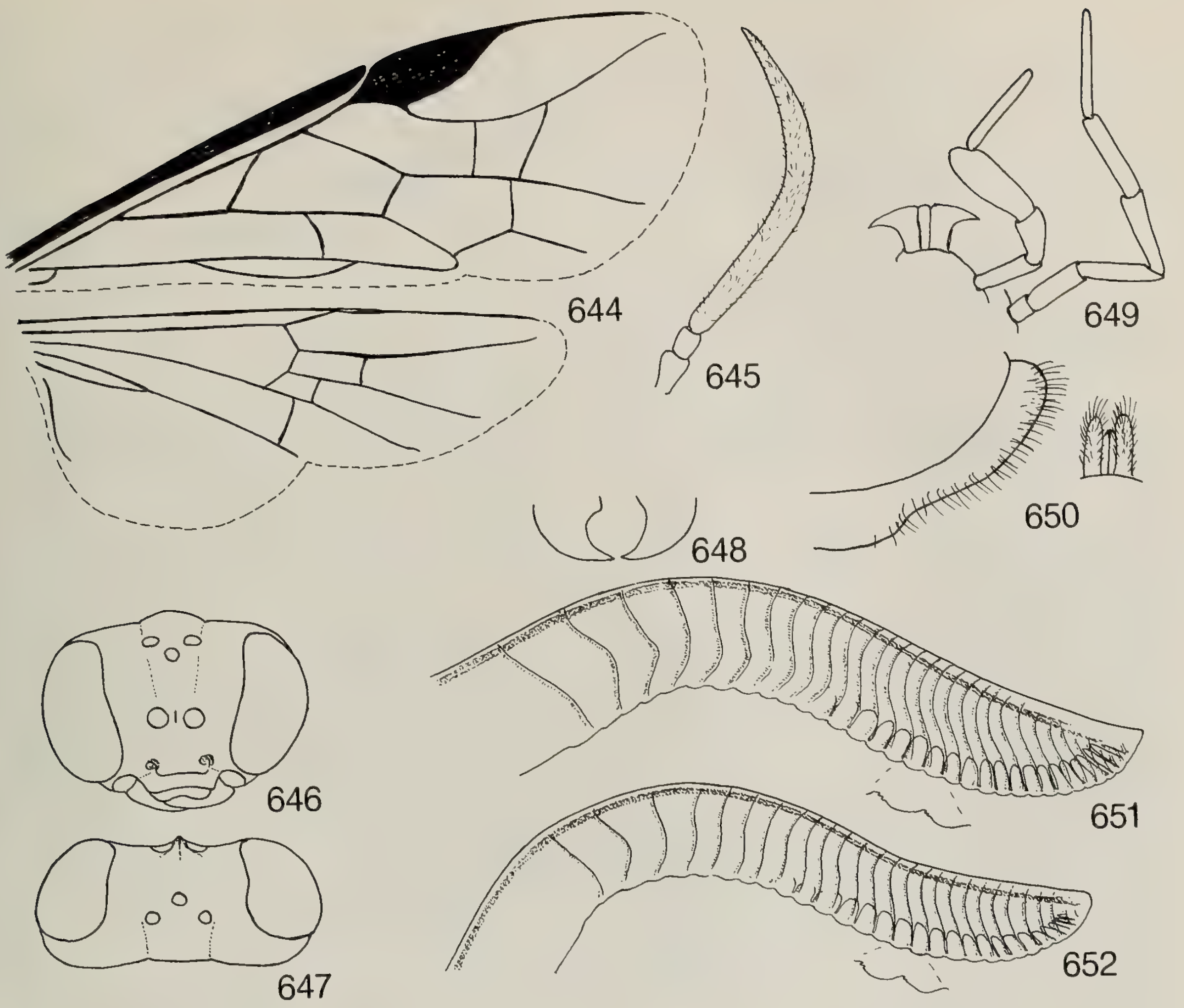
This genus is recognized by the open radial cell of the forewing, presence of an anal cell in the hindwing, large eyes with the lower interocular distance less than the eye length, lack of enlarged segments of the maxillary palpus, and flattened, curved antennal flagellum of the female. It superficially resembles *Ptilia*, but *Ptilia* has a closed radial cell in the forewing, an extremely enlarged fourth segment of the maxillary palpus, acutely pointed female sheaths in lateral view, and short, triangular lancets (Figs. 501-509). Except for the open radial cell of the forewing, *Trailia* could also be confused with *Didymia* and *Hemidianeura*; however, *Didymia* has an enlarged fourth segment of the maxillary palpus and *Hemidianeura* has the last closed cubital cell of the forewing quadrate, no longer on the radius than on the cubitus. Despite these close affinities with other genera, I believe it is best to retain *Trailia* as a separate genus.

Two species are known. I have seen very few specimens and no males. The species are found in Guyana, Brazil, and Bolivia.

KEY TO SPECIES

1. Malar space distinct, about half diameter of front ocellus; serrulae of lancet with small anterior subbasal teeth (Fig. 651) (sheath as in Fig. 650). . . . . ***analis*** Cameron

— Malar space nearly linear; serrulae of lancet with 2 or 3 large anterior subbasal teeth (Fig. 652) . ***silana***, new species



Figs. 644-652. *Trailia*. 644, Forewing and hindwing of *T. analis*; 645, Female antenna of *T. analis*. 646, Front view of head of *T. analis*. 647, Dorsal view of head of *T. analis*. 648, Mandibles of *T. analis*. 649, Palpi of *T. analis*. 650, Female sheath of *T. analis*. Female lancets of 651, *T. analis*; 652, *T. silana*.

SPECIES

analis Cameron — Bolivia; Brazil (Amazonas, Mato Grosso)

**Trailia analis* Cameron 1878: 149. F. "Brazil" (London, F).
Gymnia analis: Kirby 1882: 41.— Konow 1905a: 27.— Konow 1906b: 242.

The holotype is BM #1.166. The only locality on the holotype is "Brazil." I have seen specimens from Hyutanahan, Rio Purus, Brazil; Chapada, Brazil; and Prov. del Sara, 450 m, Bolivia. Most specimens have the thorax orange yellow with large black spots on the mesoprescutum and mesonotal lateral lobes, but one of the specimens from Bolivia has only the mesoprescutum blackish.

silana Smith, **new species** — Guyana

Trailia silana Smith.

Female.— Length, 7.0 mm. Antenna with 1st and 2nd segments and base of flagellum yellow, apical 2/3 of flagellum black. Head black with supraclypeal area, clypeus, labrum, and palpi yellow. Thorax yellow with most of mesoprescutum and mesonotal lateral lobes black (anterolateral portions of mesoprescutum and lateral portions of lateral lobes yellow). Abdomen yellow with apical 2 terga and sheath black. Legs yellow with extreme apex of hindtibia and hindtarsus black. Wings yellowish with apex of forewing beyond stigma blackish and extreme base slightly blackish; veins and stigma yellow in yellow portion, blackish is black portion. Antennal length to head width as 4.4:2.5. Lower interocular distance to eye length as 1.1:1.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.8:0.9:0.5; very short interantennal carina present; malar space nearly linear, less than 1/4 diameter of front ocellus. Sheath with narrow, posteriorly projecting scopae, in lateral view rounded (similar to *analis*, Fig. 650). Lancet as in Fig. 652, each serrula with several coarse anterior subbasal teeth.

Male.— Unknown.

Holotype.— F, "Bartica, Brit. Guiana, II-21-1913" (Ithaca).

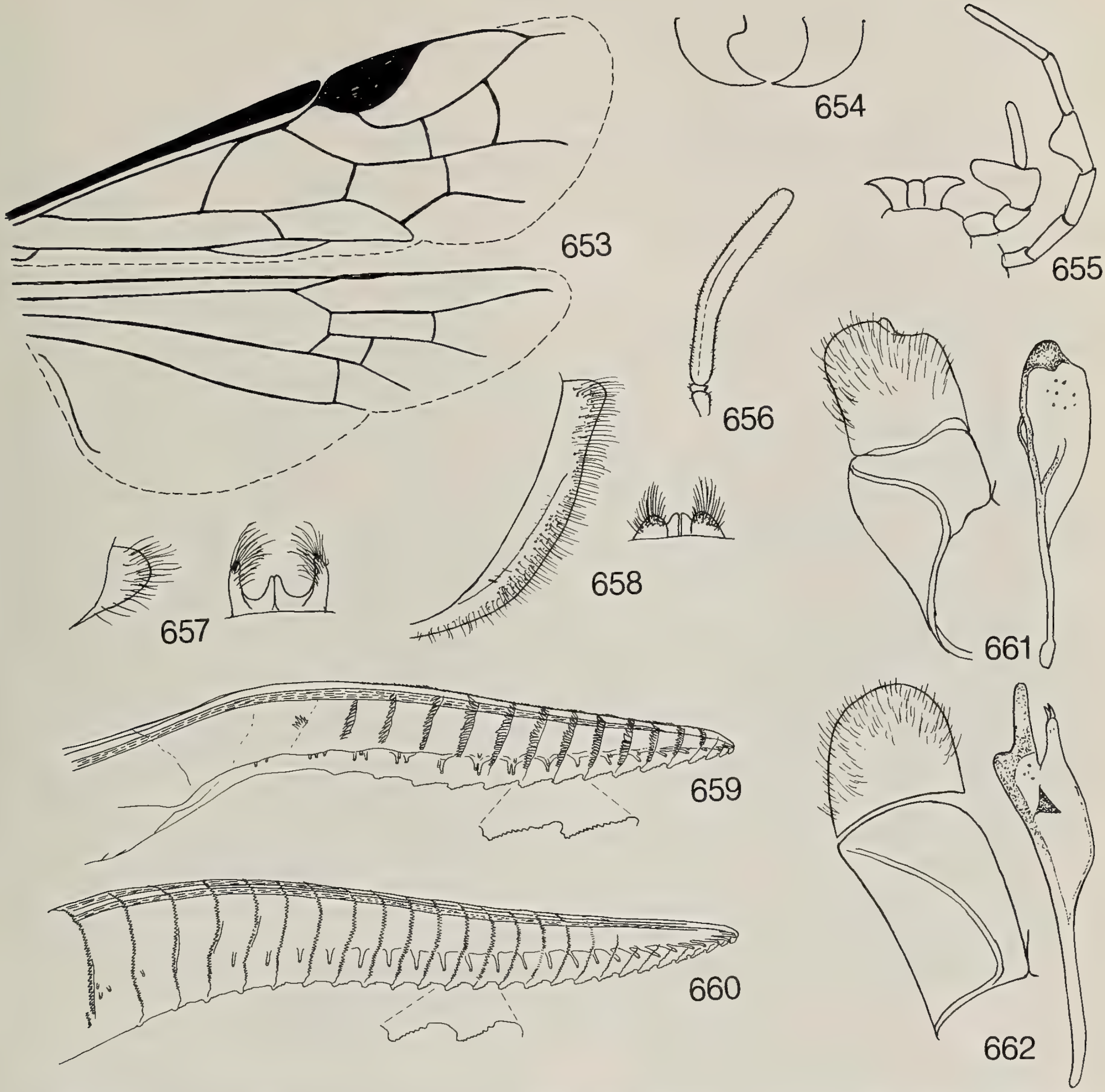
Remarks.— This species and *analis* are identical in coloration. The differences are the narrower malar space of *silana*, serrulae of the lancet (Figs. 651, 652), and smaller size, the specimens of *analis* examined being over 8 mm in length.

Genus TRIPTENUS Malaise

Triptenus Malaise 1937a: 56-57. Type species: *Ptenos romani* Forsius. Orig. desig.

Antenna (Fig. 656) stout, length less than 1 1/2X head width; 1st segment longer than broad; 2nd segment broader than long; 3rd segment of female antenna faintly clublike, broadened toward rounded apex, laterally flattened. Malar space linear to slightly evident; clypeus subtruncate, very slightly circularly emarginated; eyes relatively large, slightly converging below, lower interocular distance subequal to or less than eye length (as in *Didymia*, Fig. 339); head from above narrowing behind eyes; left mandible simple, right mandible with basal tooth (Fig. 654); interantennal area low without sharp carina; palpi (Fig. 655) long, maxillary palpus longer than eye length, 3rd segment of labial palpus and 4th segment of maxillary palpus greatly enlarged. Forewing (Fig. 653) with radial cell closed with accessory vein at apex; small basal anal cell present; 3 cubital cells, last closed cell slightly longer on radius than on cubitus; distance between M and Rs+M on Sc+R more than half length of vein M. Hindwing (Fig. 653) with anal cell absent. Length of hindbasitarsus equal to or shorter than length of remaining tarsal segments combined; tarsal claw simple.

This genus is very similar to *Didymia* and would key to that genus if it were not for the absence of the anal cell in the hindwing. Even though there is such a resemblence to *Didymia*, I choose to keep it separate. *Triptenus* may be separated from other genera that lack an anal cell in the hindwing by the closed radial cell of the forewing, presence of three cubital cells in the forewing, the large, coverging eyes, and the third segment of the labial palpus and fourth segment of the maxillary palpus which are obviously expanded. The genus occurs in Panama, Venezuela, and Brazil. Hosts are not known.



Figs. 653-662. *Triptenus*. 653, Forewing and hindwing of *T. humeratus*. 654, Mandibles of *T. humeratus*. 655, Palpi of *T. humeratus*. 656, Female antenna of *T. romani*. Female sheaths of 657, *T. humeratus*; 658, *T. romani*. Female lancets of 659, *T. romani*; 660, *T. humeratus*. Male genitalia of 661, *T. humeratus*; 662, *T. romani*.

KEY TO SPECIES

1. Thorax black, pronotum and tegula orange; mid- and hindlegs black, extreme base of hindtibia whitish in male; forewing blackish infuscated from base of stigma to apex, darkest below stigma, gradually lighter toward apex; female sheath with long, slender scopae (Fig. 657); lancet as in Fig. 660; male genitalia as in Fig. 661 .... ***humeratus*** (Konow)

— Thorax black, pronotum, upper 1/3 or more of mesepisternum, and sutures of mesoprescutum orange; basal 1/2 of mid- and hindtibiae white, in male mostly all white; forewing with black band below stigma and black at apex with hyaline band between blackish parts; female sheath with short, stout scopae (Fig. 658); lancet as in Fig. 659; male genitalia as in Fig. 662 .... ***romani*** (Forsius)

SPECIES

humeratus (Konow) — Brazil (Amazonas, D.F., Goiás, Pará)

**Ptenos humeratus* Konow 1906b: 185. F, M. "Brasilia (Obidos)" (Eberswalde, F).—Forsius 1925a: 6.—Oehlke and Wudowenz 1984: 387 ("F Lectotypus (beide des. D.R.Smith 1977), 1 M Paralectotypus, Obidos, 1904").
Triptenus humeratus: Smith 1981: 285, fig. 26-28 (D.F. records; female and male genitalia fig.).

A female and a male at Eberswalde both have type labels and both are labeled "Obidos 1904." I labeled these lectotype and paralectotype in 1977, but did not publish on this prior to Oehlke and Wudowenz (1984). I have seen specimens from La Puraquequara, AM, and Goiás, Gurupl., 800 km N of Brasilia, Brazil.

romani (Forsius) — Brazil (Amazonas); Panama; Venezuela

**Ptenos romani* Forsius 1925a: 4-5. F. "Rio Autaz, Cururuzinho" (Stockholm, F).
Triptenus romani: Malaise 1937a: 57.

I have seen specimens from Curiche, Choco, Colon, Panama, and Monagas, Jusepin, Venezuela.

Genus **TROCHOPHORA** Konow

Trochophora Konow 1905b: 158. Type species: *Trochophora duckei* Konow. Monotypic.

Antenna (Fig. 667) with 1st segment about as long as broad; 2nd segment broader than long; 3rd segment of female antenna stout, slightly laterally compressed, rounded at apex; antennal length shorter than 1 1/2X head width. Malar space linear; clypeus truncate; eyes large and coverging below, lower interocular distance subequal to eye length (similar to *Didymia*, Fig. 339); interantennal area with low carina; head from above narrowing behind eyes; left mandible with two small crenulations near center, right mandible with basal tooth (Fig. 665); palpi (Fig. 666) with maxillary palpus longer than eye length, 2nd and 3rd segments of labial palpus and 4th segment of maxillary palpus enlarged. Forewing (Fig. 663) with radial cell closed with long accessory vein at apex; costa swollen, as broad or broader than intercostal area; small basal anal cell present; distance between M and Rs+M on Sc+R equal to half or more length of vein M; 3 or 4 cubital cells with last closed cell longest on radius. Hindwing (Figs. 663, 664) with anal cell present, shorter than or equal to its petiole; jugal area greatly enlarged, broader and longer than rest of hindwing. Length of hindbasitarsus longer than length of remaining tarsal segments combined; tarsal claws simple.

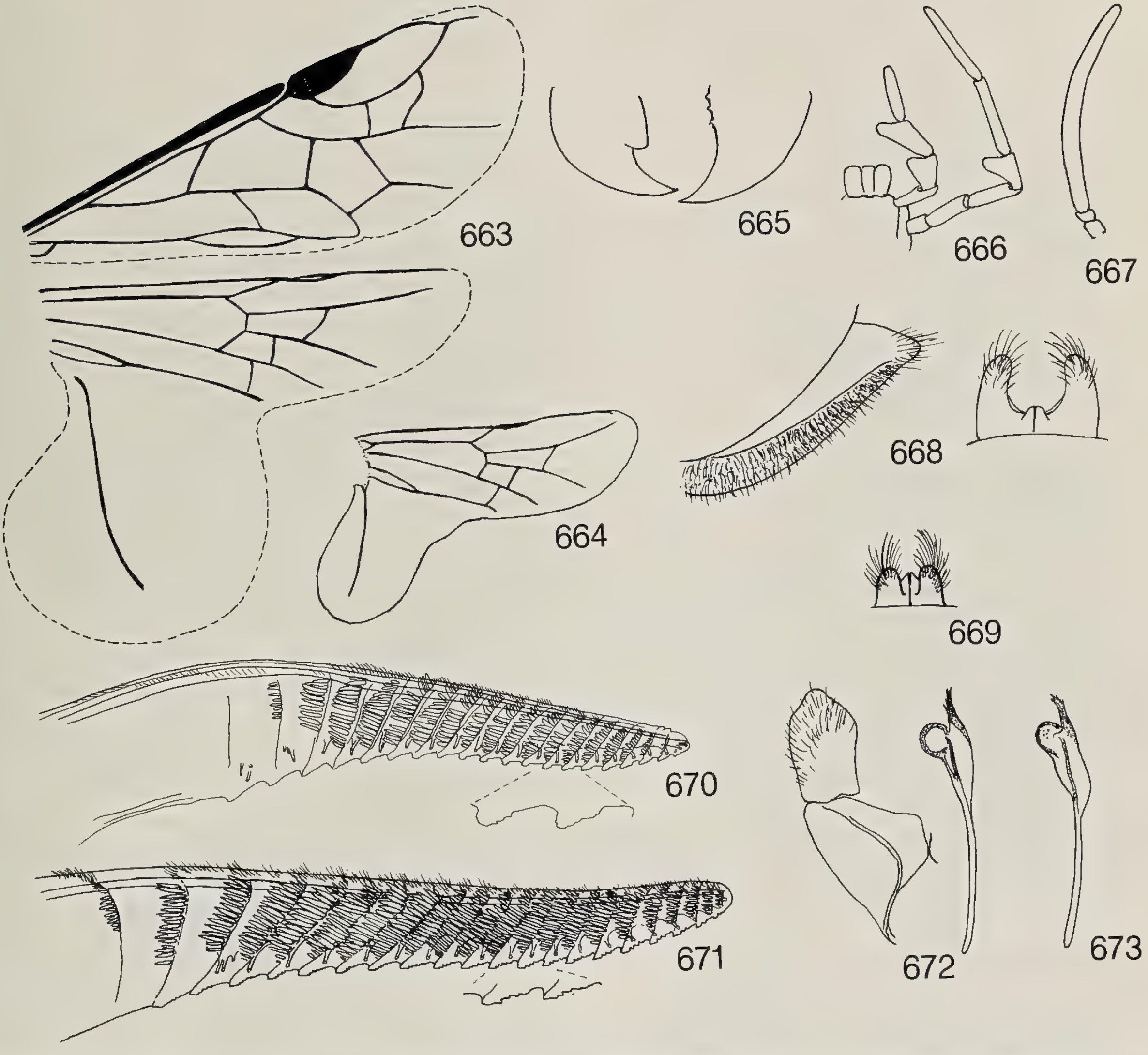
This genus is immediately recognized by the extremely enlarged jugal area of the hindwing. Such an enlargement is not known elsewhere in sawflies. All other characters are similar to *Didymia*, and, if it were not for the unusual hindwings, the species would be placed in that genus.

Representatives of *Trochophora* are found from Costa Rica to Brazil. *Rourea* sp. is the host plant for one species.

KEY TO SPECIES

1. Jugum of hindwing narrow and oblong (Fig. 664); lancet with about 20 serrulae, lateral spines overlapping (Fig.671); sheath as in Fig. 668; male genitalia as in Fig. 672 .... ***opla*** Smith

— Jugum of hindwing broad and rounded (Fig. 663); lancet with 15-20 serrulae, lateral spines not overlapping, less than the width of a segment (Fig. 670); sheath as in Fig. 669; male genitalia as in Fig. 673 .... ***lobata*** (Erichson)



Figs. 663-673. *Trochophora*. 663, Forewing and hindwing of *T. lobata*. 664, Hindwing of *T. opla*. 665, Mandibles of *T. lobata*. 666, Palpi of *T. lobata*. 667, Female antenna of *T. lobata*. Female sheaths of 668, *T. opla*; 669, *T. lobata*. Female lancets of 670, *T. lobata*; 671, *T. opla*. Male genitalia of 672, *T. opla*; 673, *T. lobata*.

SPECIES

lobata (Erichson) — Brazil (Amazonas, Maranhão, Mato Grosso, Pará, Roraima); Costa Rica; Guyana; Panama; Venezuela

Hylotoma lobata Erichson 1848: 587. British Guiana (not located).
Dielocerus lobata: Kirby 1882: 50.— Dalla Torre 1894: 323.
Dieloceros lobatus: Konow 1905a: 25.
Trochophora lobata: Malaise 1941: 138 (syn.: *duckei* Konow).
**Trochophora duckei* Konow 1905b: 158-159. F, M. "Brasilia (Maranhao, *S*. Luiz; R. Tapaios, Itaituba)" (Eberswalde, M).— Konow 1905a: 25.— Hobby 1937: 72, fig. 1 (note on unusual enlargement of hindwing).— Oehlke and Wudowenz 1984: 379 ("M Lectotypus (des. D.R.Smith), Maranhão *S*. Luiz, 19.9.1903, leg. Ducke; 1 Exemplar (ohne Flügel und Abdomen), Paralectotypus, R. Tapaios, Itaituba, 28.8.1902, leg. Ducke").

Host: Reared from *Rourea glabra* (Connaraceae) in Costa Rica, Santa Rosa National Park, Guanacaste Province, by D. H. Janzen.

A male at Eberswalde labeled "Maranhão, *S*. Luiz" is the lectotype. A female from R. Tapaios, Itaituba is a paralectotype and has the abdomen missing, no wings except for the left hindwing, and lacks the four hindlegs. The male has the hindtibia white with the apical 1/3 black. I labeled the lectotype and paralectotype but did not publish on the designations prior to Oehlke and Wudowenz (1984). I have seen specimens from Surumu, Roraima, Brazil; Chapada, Mato Grosso, Brazil; Manaus, Brazil; "Venezuela"; Santa Rosa Park, Costa Rica; and La Chorrera, Panama.

opla Smith — Brazil (D.F.)

**Trochophora opla* Smith 1981: 283-284, fig. 19-22. F, M. "Res. Ecol. IBGE, Km 0 BR 251 - DF" (Brasilia, IBGE, F).

Genus **ZYNZUS**, **new genus**

Type species: *Ptenus magnus* Smith.

Antenna (Fig. 680, 681) with 1st segment as long as or slightly longer than broad; 2nd segment broader than long; 3rd segment of female antenna usually of uniform width, rounded at apex, sometimes laterally compressed; antennal length slightly less than head width to not more than 1 1/4X head width. Malar space linear to slightly evident; eyes small to moderately large, slightly converging below, lower interocular distance equal to or slightly greater than eye length (Fig. 675); head from above narrowing behind eyes; interantennal area rounded or with low carina, supraclypeal area convex; clypeus truncate to subtruncate; left mandible simple, right mandible with basal tooth (Fig. 677); maxillary palpus shorter than or subequal to eye length, without enlarged segments or 3rd segment of labial palpus slightly enlarged (Figs. 678, 679). Forewing (Fig. 674) with radial cell closed with accessory vein at apex; small basal anal cell present; distance between veins M and Rs+M on Sc+R about half or more length of vein M; 3 or 4 cubital cells with last closed cell small, about as long on radius as on cubitus. Hindwing (Fig. 674) with anal cell absent. Length of hindbasitarsus shorter than length of remaining tarsal segments combined; tarsal claws simple.

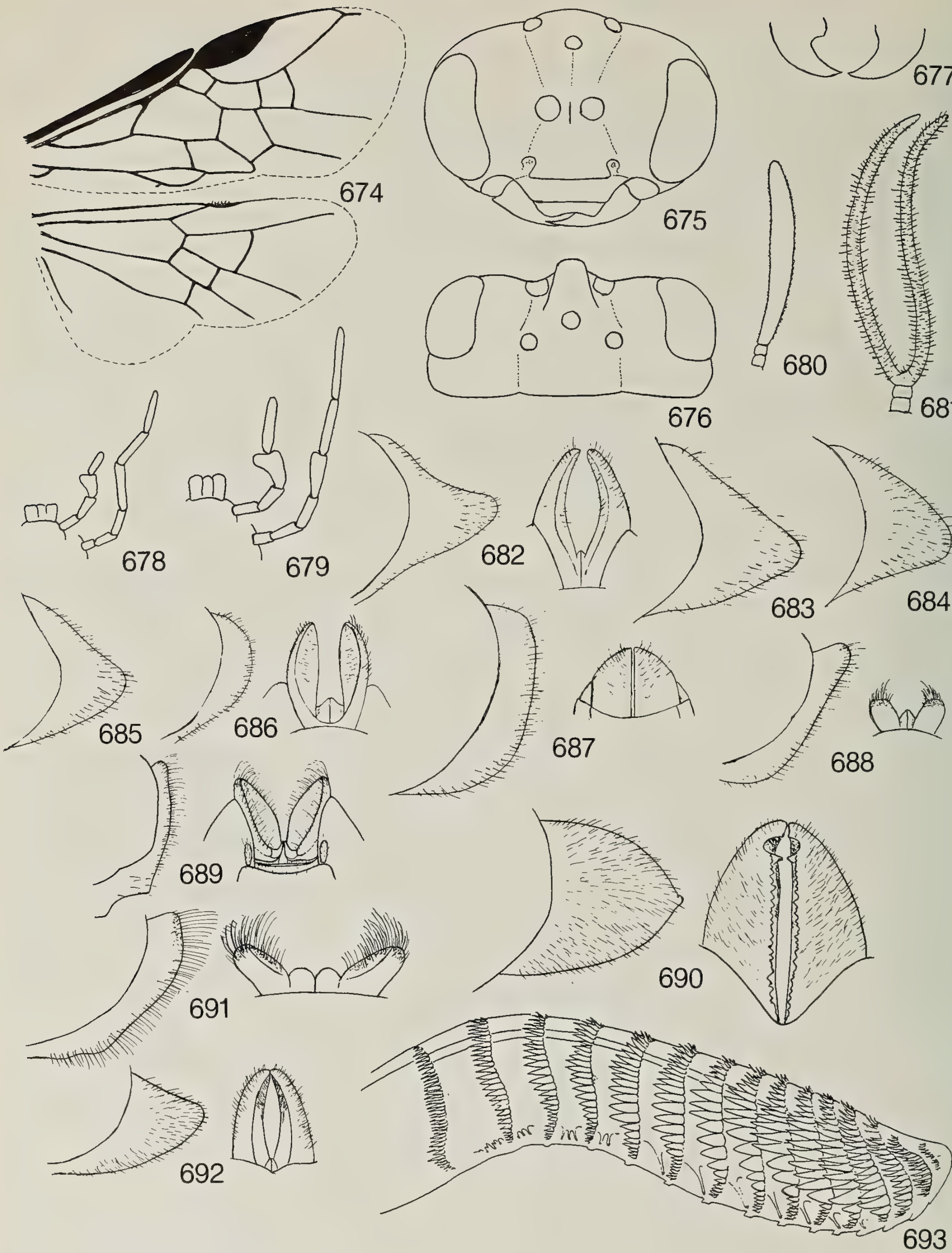
This group of species was previously placed in *Ptenus*. The type species of *Ptenus* is atypical for this group and is here referred to *Hemidianeura*, therefore this group of species does not have a generic name. All species of *Zynzus* are small, usually about 8 mm or less in length, with short antennae, widely separated eyes with the lower interocular distance usually greater than the eye length, short palpi commonly without enlarged segments, lack the anal cell in the hindwing, have a short, quadrate last closed cubital cell in the forewing, and have the radial cell of the forewing closed with a long accessory vein at its apex.

Zynzus is found in southwestern United States to Central America. Smith (1970) treated the species north of Mexico, and all these species are included in the following key except for *texanus* and *vanus* which are transferred to *Hemidianeura*. Males have not been associated for many species, thus, that part of the key should be used with this in mind. Host plants include *Acacia*, *Mimosa*, and *Desmanthus*.

The genus name is an arbitrary combination of letters. The gender is masculine.

KEY TO SPECIES

1. Female 2
— Male 20
2. Sheath with dorsal margin slanting downward to a rounded or acutely round apex near ventral margin (Figs. 682-685, 690, 692); lancet usually with large annular spines and rounded at apex (Figs. 693-701) 3
— Sheath with rounded apex near dorsal margin or apex broadly rounded or truncate (Figs. 686-689, 691); lancet usually pointed at apex, long and slender or triangular, with none or short annular spines (Figs. 702-710) 12
3. Abdomen black 4
— Abdomen orange, or orange with some black on dorsum or venter 8
4. Thorax black 5
— Thorax with pronotum orange, mesonotum usually partly orange 6
5. Antenna short, slightly less than head width; lancet with short spines, usually not overlapping (Fig. 694); smaller species, about 5.0 mm long; sheath as in Fig. 685, with minute inner teeth .... ***parvus*** (Smith)
— Antenna longer, about 1 1/4X head width; lancet with numerous slender spines, those on anterodorsal area overlapping (Fig. 701); larger species, about 8.5 mm long; sheath as in Fig. 690, with large inner teeth ... ***menkei***, new species
6. Mesonotum black or dark brown, pale areas, if present, confined to lateral margins or sutures between lobes; mesopleuron black (lancet as in Fig. 696; sheath as in Fig. 684 .... ***vargus*** (Smith) (in part)
— Mesonotum and sometimes part of mesopleuron orange 7
7. Upper 1/3 of mesopleuron orange; lancet as in Fig. 698 .... ***townesi***, new species
— Mesopleuron black; lancet as in Fig. 700 .... ***retus***, new species
8. Wings hyaline with apex from base of stigma infuscated black; abdomen orange with sterna black (lancet as in Fig. 697; sheath as in Fig. 692) .... ***apicofuscus***, new species
— Wings uniform in coloration; abdomen orange, if partly black not with pattern as above 9
9. Thorax mostly black except for orange pronotum and sometimes mesonotal lateral lobes; abdomen partly black on dorsum and/or venter 10
— Thorax orange with mesosternum black; abdomen orange 11
10. Mesonotum black; lancet with annular spines short (Fig. 696); mid- and hindtibiae white except for black apical 1/3 of hindtibia (sheath as in Fig. 684) .... ***vargus*** (Smith) (in part)
— Mesonotum with lateral lobes orange, prescutum and scutellum black; lancet with long annular spines (Fig. 699); mid- and hindlegs black .... ***usirus***, new species
11. Dorsal margin of sheath straight (Fig. 683); costa of forewing black; annular spines of lancet broad (Fig. 695) .... ***nigropectus*** (Norton)
— Dorsal margin of sheath slightly concave (Fig. 682); costa of forewing sometimes whitish; lancet with slenderer annular spines (Fig. 693) .... ***magnus*** (Smith)
12. Lancet long, slender, with 17 or more serrulae, without annular spines (Figs. 704, 710); sheath short and broad in lateral view, straight at apex (Figs. 687, 689) 13
— Lancet short, triangular, with 12 or fewer serrulae and with annular spines (Figs. 702, 703, 705-709); sheath in lateral view rounded or straight above and rounded below (Figs. 686, 688, 691) 14
13. Sheath with broad scopae in dorsal view (Fig. 687); all serrulae of lancet similiar in structure (Fig. 710); pronotum and metanotum white .... ***patulus*** (Smith)
— Sheath with slender scopae in dorsal view (Fig. 689); lancet with basal 4 or 5 serrulae longer and more protruding than apical serrulae (Fig. 704); pronotum and metanotum black .... ***apulatus*** (Greenbaum)
14. Abdomen black with brown to light orange markings possible on sterna and/or laterally 15
— Abdomen orange or orange with apical 2 or 3 segments black 16
15. Sheath broadly rounded at apex (Fig. 686); lancet as in Fig. 705 .... ***imus*** (Smith)
— Sheath straight above, rounded below (Fig. 688); lancet as in Fig. 706 .... ***crassulus*** (Cameron)
16. Thorax black (lancet as in Fig. 709) .... ***luteiventris*** (Cameron)
— Thorax orange or orange with mesosternum and/or spots on mesonotum black 17
17. Serrulae shallow, about 9 in number (Fig. 707) (thorax orange) .... ***bicolor*** (Smith)
— Serrulae deep, protruding, 11-12 in number (Figs. 702, 703, 708) (note: the species in couplets 18 and 19 are very similar and unknown color varieties may complicate species identification) 18



Figs. 674-693. *Zynzus*. 674, Forewing and hindwing of *Z. nigropectus*. 675, Front view of head of *Z. nigropectus*. 676, Dorsal view of head of *Z. nigropectus*. 677, Mandibles of *Z. nigropectus*. 678, Palpi of *Z. nigropectus*. 679, Palpi of *Z. patulus*. 680, Female antenna of *Z. nigropectus*. 681, Male antenna of *Z. nigropectus*. Female sheaths of 682, *Z. magnus*; 683, *Z. nigropectus*; 684, *Z. vargus*; 685, *Z. parvus*; 686, *Z. imus*; 687, *Z. patulus*; 688, *Z. crassulus*; 689, *Z. apulatus*; 690, *Z. menkei*; 691, *Z. himus*; 692, *Z. apicofuscus*. 693, Female lancet of *Z. magnus*.

18. Mesonotum orange; mesosternum usually orange or sometimes partly black (lancet as in Fig. 702; sheath as in Fig. 691) .... ***himus***, new species
— Mesonotum orange with black marks on prescutum and/or lateral lobes; mesosternum black **19**
19. Lancet as in Fig. 703; mesonotum with only prescutum black .... ***dusurus***, new species
— Lancet as in Fig. 708; mesonotum with prescutum and lateral lobes usually black .... ***jocus*** (Smith)
20. Abdomen orange **21**
— Abdomen black **23**
21. Thorax black; penis valve long, apex oblong (Fig. 715) .... ***bicolor*** (Smith)
— Thorax black with pronotum and tegula orange; apex of penis valve quadrate (Figs. 711, 712) **22**
22. Genitalia as in Fig. 712; mesepimeron black; costa white .... ***magnus*** (Smith)
— Genitalia as in Fig. 711; upper 1/2 of mesepimeron orange; costa brownish to black .... ***nigropectus*** (Norton)
23. Pronotum orange (the 3 species here are difficult to separate, all have similar genitalia, Figs. 716, 717, 719, and I have seen only one associated male each of *imus* and *vargus*) ..... ***crassulus*** (Cameron), ***imus*** (Smith), ***vargus*** (Smith)
— Thorax black, tegula may be pale **24**
24. Tibiae and usually basitarsi white, apex of hindtibia may be black **25**
— Hindleg black, some white may be present on fore- and midtibiae **27**
25. Penis valve oblong (Fig. 713); tegula black .... ***parvus*** (Smith)
— Penis valve with lateral lobe (Figs. 718, 722); tegula black or white **26**
26. Penis valve as in Fig. 718; tegula white .... ***apulatus*** (Greenbaum)
— Penis valve as in Fig. 722; tegula black .... ***menkei***, new species
27. Penis valve with dorsal and vental lobes (Fig. 714) .... ***patulus*** (Smith)
— Penis valve oblong (Figs. 720, 721) .... ***himus***, new species, ***jocus*** (Smith)

SPECIES

apicofuscus Smith, **new species** — Mexico (Sinaloa)

Zynzus apicofuscus Smith.

Female.—Length, 5.5 mm. Antenna and head black, supraclypeal area may be brownish. Thorax black with upper 1/3 or less of mesepisternum, pronotum, and mesonotum except for black on prescutum and apex of scutellum orange. Legs black with foretibia and tarsus and basal 1/2 of midtibia whitish. Abdomen orange with 1st and 2nd terga, all sterna, apical 2 segments and sheath black. Wings hyaline with apex from base of stigma blackish infuscated; veins and stigma black, costa brownish. Antennal length to head width as 5.8:5.2. Lower interocular distance to eye length as 2.7:2.5; distances between eye and hindocellus, hindocelli, hindocelli and posterior margin of head as 0.9:0.8:0.7. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.7:2.2. Sheath with large leaflike scopae, in dorsal view longer than broad, in lateral view with dorsal and ventral margins straight, meeting at narrowly rounded apex (Fig. 692). Lancet with small ventral teeth, large annular spines, and each annulus from 4 to apex with about 4 spines larger and broader than others (Fig. 697).

Male.— Unknown.

Holotype.— F, "Mazatlan, Mexico, Sinaloa State, II-28-67, E. Ball Jr. and A. T. Barnes, colls." (Washington).

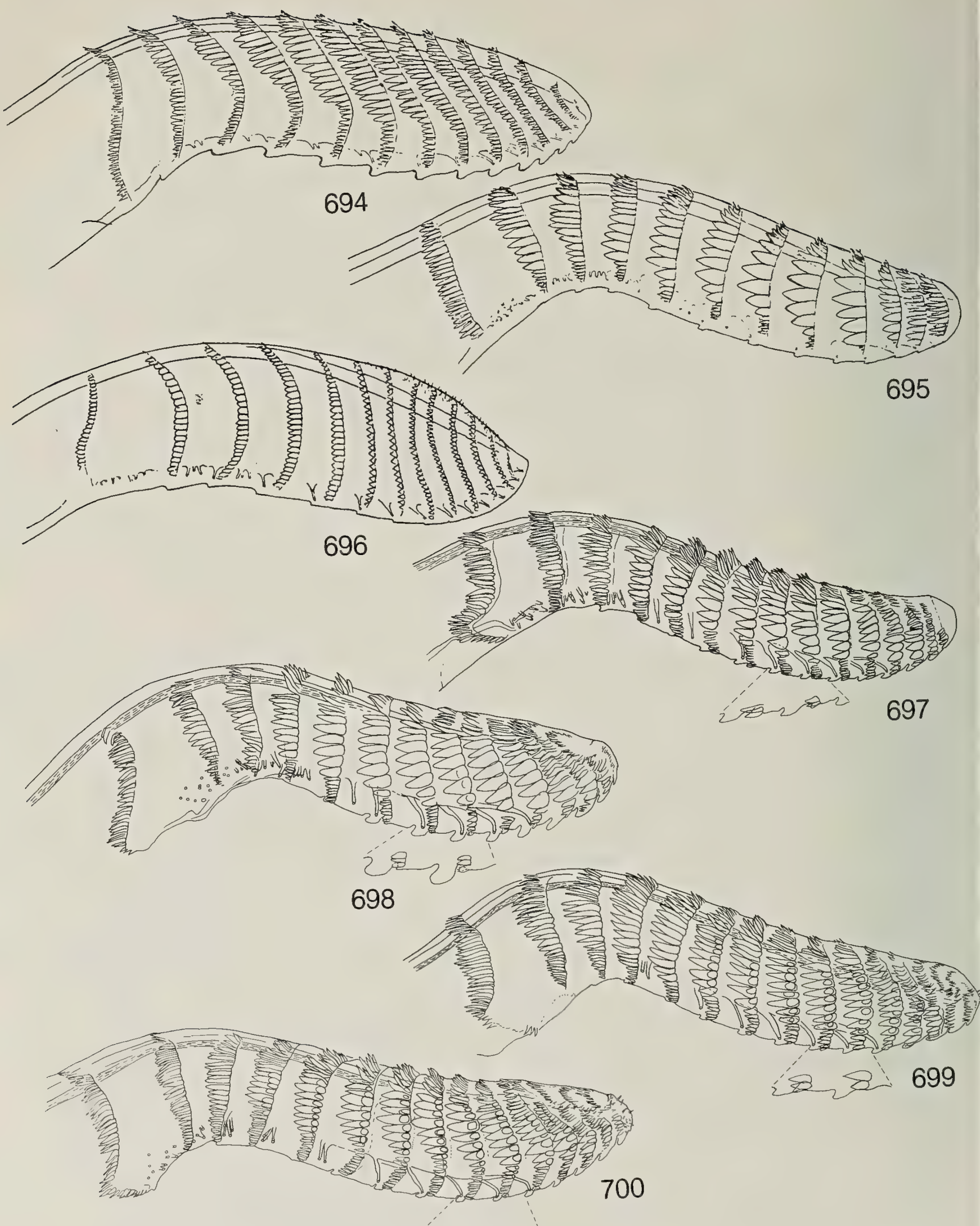
Paratype.— MEXICO: Mazatlan, Sinaloa, 7-18-59, H. E. Evans (1 F) (Ithaca).

Remarks.— The apical infuscation of the wings, unknown in other *Zynzus* species, coloration, and lancet as figured will separate *apicofuscus*.

apulatus (Greenbaum), **new combination** — Mexico (Chihuahua, Jalisco, Queretero, San Luis Potosi, Sonora); U.S.A. (Arizona)

Ptenus apulatus Greenbaum 1974: 423-425, fig. 2, 4, 6. F. "Molino Basin, Santa Catalina Mts., Pima County, Arizona, 4600 ft." (Gainesville, F).— Smith 1979: 24.

I have seen specimens from the following Mexican localities: 4 mi W Manzamitla, Jalisco, 6800'; pine forest, 7 mi S Manzamitla; Buena Vista, Chihuahua; 19 mi S Parrita, Chihuahua; Tepatitlan, Jalisco; Sonora, 14 mi N Guaymas.



Figs. 694-700. *Zynzus*, female lancets. 694, *Z. parvus*; 695, *Z. nigropectus*; 696, *Z. vargus*; 697, *Z. apicofuscus*; 698, *Z. townesi*; 699, *Z. usirus*; 700, *Z. retus*.

bicolor (Smith), **new combination** — Mexico (Nuevo Leon, San Luis Potosi, Tamaulipas, Veracruz); U.S.A. (Texas)

**Ptenus bicolor* Smith 1970: 82, 83-84, fig. 26, 33, 37. F, M. "Laredo, Texas" (Washington, F) (host a).— Smith 1972: 176, 178-179, fig. 34-38 (larva; host a).— Greenbaum 1975: 165 (Nuevo Leon, San Luis Potosi, Tamaulipas, Veracruz).— Smith 1979: 24 (host a).

Host: a) *Acacia farnesiana* (Leguminosae)

I have seen specimens from the following Mexican localities: Monterrey, N.L.; Matamoros, Tamaulipas; Pujal, S.L.P.; Playa Altamira, Tamaulipas; El Limon, Tamaulipas; San Fernando, Tamaulipas; San Ignacio, Linares, N.L.

crassulus (Cameron), **new combination** — Mexico (Baja California Norte, Baja California Sur, Coahuila, Oaxaca, Nuevo Leon, San Luis Potosi, Sonora, Tamaulipas, Zacatecas); U.S.A. (Arizona, California, New Mexico, Texas)

**Ptilia crassula* Cameron 1884: 484-485. F. "Northern Sonora, Mexico" (London, F).— Dalla Torre 1894: 319.— Cameron 1899: 468, pl. 20, fig. 18.— Konow 1905a: 26.

Ptenus crassulus: Smith 1980: 482 (syn.: *nigerrima* Cameron, *modestius* Smith)

**Ptilia nigerrima* Cameron 1884: 485. M. "Northern Sonora, Mexico" (London, M).— Dalla Torre 1894: 320.— Cameron 1899: 469, pl. 20, fig. 19.— Konow 1905a: 27.

**Ptenus modestius* Smith 1970: 82, 88, 90-91, fig. 16, 17, 25, 29, 38. F, M. "Continental, Arizona" (Washington, F) (Ariz., Calif., Tex.; adults collected from mesquite).— Greenbaum 1975: 165 (distribution; Tamaulipas).— Smith 1979: 24.

Host: Specimens from Tamaulipas were "taken from *Prosopis laevigatus*." Other adults were collected from mesquite (Smith, 1970), and I have seen collection records from *Larrea tridentata* from Mexicali, Mexico.

The holotype of *crassula* is BM #1.134, and that of *nigerrima* is BM #1.136. I have seen specimens from the following Mexican states: Sonora, Coahuila, Nuevo Leon, Baja California Norte, Baja California Sur, San Luis Potosi, Oaxaca, Zacatecas, and Tamaulipas.

dusurus Smith, **new species** — Mexico (Michoacán)

Zynzus dusurus Smith.

Female.—Length, 7.3 mm. Antenna and head black. Thorax orange with large triangular spot on mesoprescutum, mesoscutellum, and cervical sclerites black. Legs black with foretibia and tarsus whitish. Abdomen orange, sheath black. Wings very lightly uniformly infuscated blackish; veins and stigma black. Antennal length to head width as 6.0:5.3. Lower interocular distance to eye length as 2.9:2.5; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:1.0. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.7:2.6. Sheath with short scopae, from above broader than long, in lateral view short and rounded at apex near dorsal margin (similar to *crassula*, Fig. 688). Lancet triangular, apical serrulae long and pointed, each with 3 or 4 fine posterior subbasal teeth, annular spines short and triangular, 4th annulus with about 12 spines (Fig. 703).

Male.— Unknown.

Holotype.— F, "4 mi E Morelia, Mich., Mex., VII-9'59, 6500', H. E. Evans" (Ithaca).

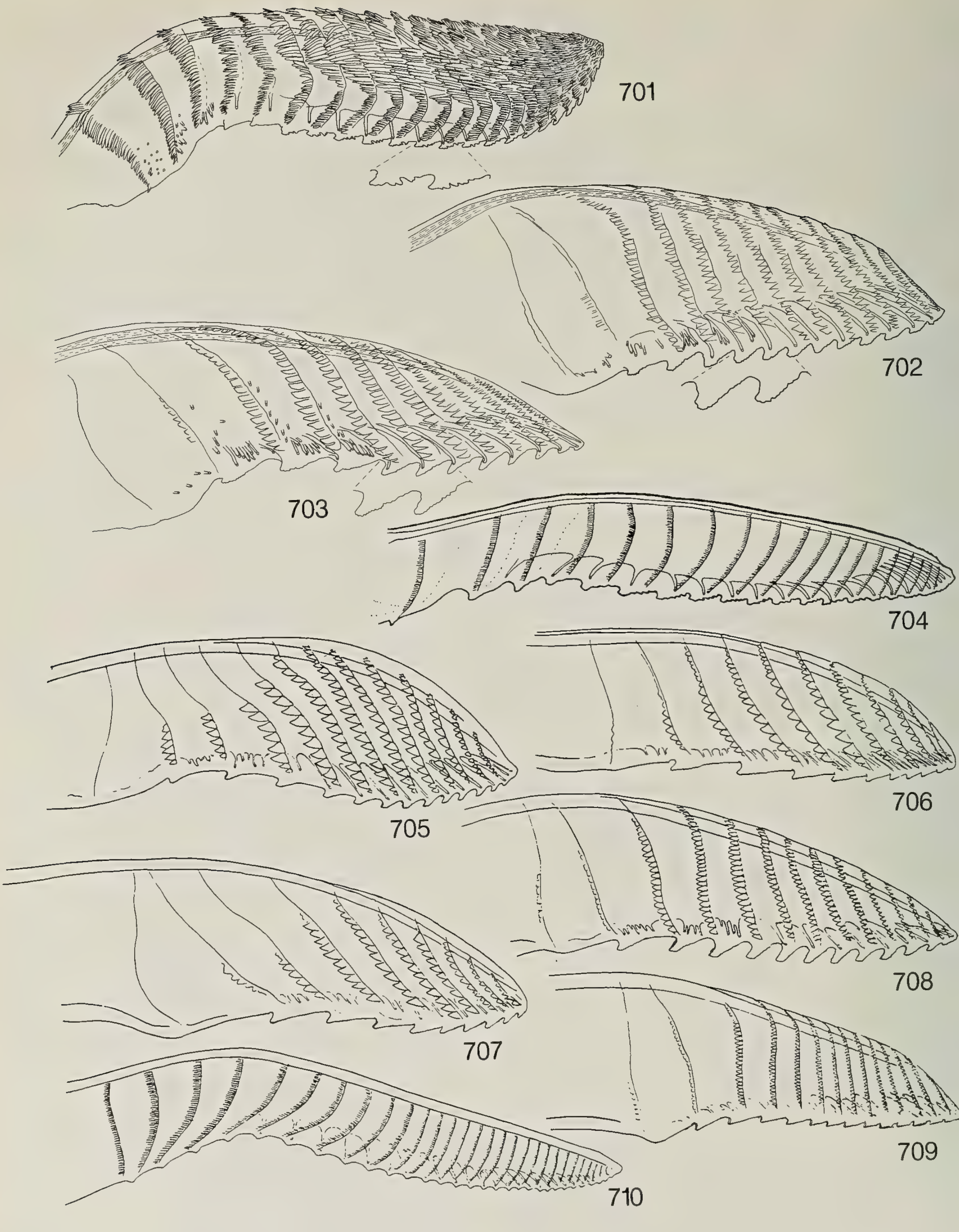
Remarks.— The lancet is similar to that of *jocus* (Fig. 708), but the annular spines are larger and fewer in number in *dusurus*. The fourth annulus of *jocus* has about 18 spines.

himus Smith, **new species** — Mexico (Nayarit, Sonora)

Zynzus himus Smith.

Female.— Length, 5.0-5.4 mm. Antenna and head black, clypeus and supraclypeal area brownish. Thorax orange, only anterior margin of cervical sclerites black. Legs black with fore- and midtibiae and tarsi whitish. Abdomen orange, sheath black. Wings lightly uniformly infuscated blackish; veins and stigma black. Antennal length to head width as 4.0:4.0. Lower interocular distance to eye length as 2.3:1.8; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.7:0.7:0.6. Length of hindbasitarsus to length or remaining tarsal segments combined as 1.0:1.7. Sheath with short scopae, in dorsal view broader than long, in lateral view short, rounded at apex near dorsal margin (Fig. 691). Lancet with short, triangular annular spines, spines on full length of annuli from 3rd to apex of lancet; serrulae moderately deep, each with 3 or 4 fine posterior subbasal teeth (Fig. 702).

Male.— Length, 4.7-5.0 mm. Black with foretibia and foretarsus whitish and apical margins of abdominal



Figs. 701-710. *Zynzus*, female lancets. 701, *Z. menkei*; 702, *Z. himus*; 703, *Z. dusurus*; 704, *Z. apulatus*; 705, *Z. imus*; 706, *Z. crassulus*; 707, *Z. bicolor*; 708, *Z. jocus*; 709, *Z. luteiventris*; 710, *Z. patulus*.

segments narrowly whitish; pronotum sometimes brownish. Antennal length to head width as 4.8:3.8. Genitalia as in Fig. 720.

Holotype.—F, "5 mi S Santa Ana, Son., Mex., VIII-14-1964, H. R. Burke and J. Apperson" (College Station).

Paratypes.— MEXICO: Same data as for holotype (1 F); El Oasis, Sonora, July 17, 1954, M. Cazier, W. Gertsch, Bradts (10 F, 5 M); Concordia, Sinaloa, VII-4-1963, F.D. Parker, L. A. Stange (10 F, 3 M); 14 mi. N. Rosario, Sinaloa, Oct. 1, 1950, Ray F. Smith (1 F); 5 mi. S. Mazatlan, Sinaloa, VIII-3-1953, D. Rockefeller Mex. Exp. 1953, C. & P. Vaurie (1 F); 20 mi. S. of Acaponeta, Nayarit, Sept. 2, 1957, J. C. Schaffner (1 F); 50 mi. N. of Mazatlan, Sinaloa, Sept. 5, 1957, J. C. Schaffner (1 M) (Ames, New York, Berkeley, Washington).

Remarks.— This species is very similar to *bicolor*, and almost identical in coloration. The lancet of *himus* differs from that of *bicolor* (Fig. 707) by the deeper serrulae and presence of annular spines on the full length of the third annulus to the apex of the lancet.

imus (Smith), **new combination** — Mexico (Tamaulipas); U.S.A. (Texas)

Ptenus imus Smith 1970: 82, 84, 86, fig. 10, 11, 24. F. "Laredo, Texas" (Washington, F).— Greenbaum 1975: 165 (distribution).— Smith 1979: 24.

I have seen a specimen from 7 mi S Antiguo Morelos, Tamaulipas, Mexico.

jocus (Smith), **new combination** — Mexico (Chihuahua, Puebla, Sinaloa, Sonora); U.S.A. (Arizona).

**Ptenus jocus* Smith 1970: 82, 86, fig. 27. F. "W. sl. Patagonia Mts., on Lochiel Rd., Sta. Cruz Co., Arizona, 5330', mesquite-chaparral" (Washington, F).— Smith 1979: 24.

Host: A series from Cochise Co., Arizona, SE Huachuca Mtns, Ash Canyon Road, 5100', was reared from larvae feeding on *Mimosa grahami* (Leguminosae) by Noel McFarland of Sierra Vista, Arizona.

I have seen specimens from Alamos, Sonora; 10 mi. W. Alamos, Sonora; Sta. Barbara, 6200', Chihuahua; 3 mi. N. Petalcingo, Puebla; and Chupaderos, Sinaloa.

luteiventris (Cameron), **new combination** — Mexico (Sonora); U.S.A. (Arizona)

**Ptilia luteiventris* Cameron 1884: 485. F. "Northern Sonora, Mexico" (London, F).— Dalla Torre 1894: 320.— Cameron 1899: 468.— Konow 1905a: 27.

Ptenus luteiventris: Smith 1980: 482 (syn.: *torridus* Smith).

**Ptenus torridus* Smith 1970: 82, 96, fig. 28. F. "Canelo, Arizona" (Washington, F).— Smith 1979: 24.

The holotype of *luteiventris* is BM #1.135.

magnus (Smith), **new combination** — Mexico (Chihuahua, Jalisco, Michoacán, San Luis Potosi, Sinaloa); U.S.A. (Arizona, New Mexico, Texas)

**Ptenus magnus* Smith 1970: 81, 82, 86-88, fig. 6, 7, 20, 36. F, M. "2 mi. W. Sonoita, Arizona" (Washington, F)— Greenbaum 1975: 165 (distribution).— Smith 1979: 24.

Host: A specimen from New Mexico was taken "on *Asclepias* sp."

I have seen specimens from the following Mexican localities: Valles, S.L.P.; Cotija, Mich.; Tecolotan, Jalisco; 4 mi NW Choix, Sinaloa; Santo Nino, Chihuahua.

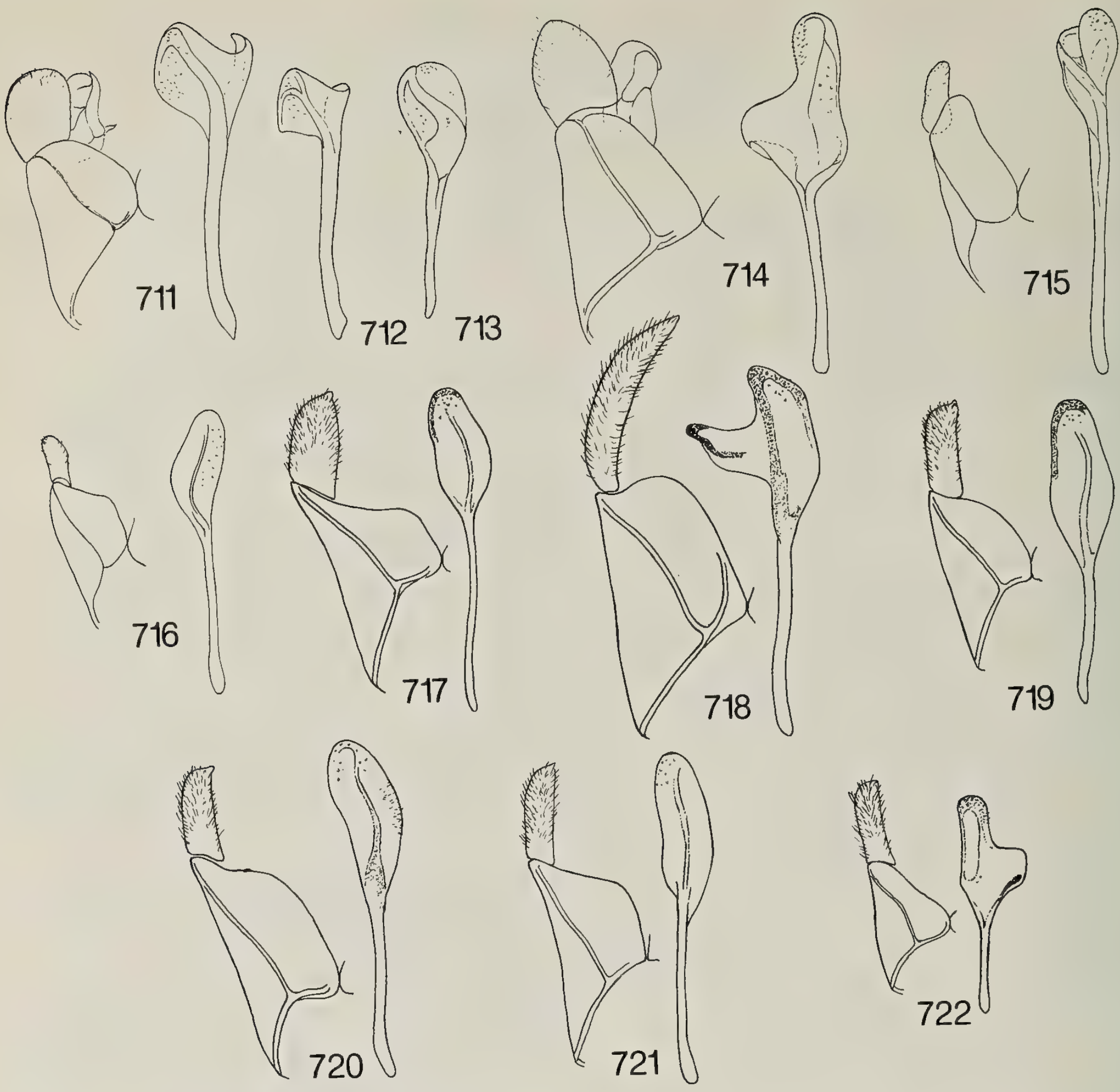
menkei Smith, **new species** — Mexico (Sinaloa); U.S.A. (Arizona)

Zynzus menkei Smith.

Female.—Length, 8.5-8.8 mm. Black, only foretibia, forebasitarsus, outer surface of midtibia, and basal 1/4 hindtibia whitish. Wings hyaline; veins and stigma black. Antennal length to head width as 7.2:5.8. Lower interocular distance to eye length as 3.0:2.8; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:1.0:0.9. Length of hindtasitarsus to length of remaining tarsal segments combined as 2.0:2.6. Sheath with large scopae and large stout inner spines, from above a little longer than broad, in lateral view broadly rounded (Fig. 690). Lancet with numerous, slender annular spines; each serrula with 3 or 4 posterior subbasal teeth (Fig. 701).

Male.— Length, 6.0-6.7 mm. Black with palpi, foretibia, foretarsus, mid- and hindtibiae (except black line on inner surfaces), and extreme base of mid- and hindbasitarsi white. Antennal length to head width as 6.8:5.1. Genitalia as in Fig. 722.

Holotype.—F, "Ariz., Pima Co., Madera Cyn, 4400 ft., Sta. Rita Mtns., Aug. 1-2, 1975, Menke and Pulawski" (Washington).



Figs. 711-722. *Zynzus*, male genitalia. 711, *Z. nigropectus*; 712, *Z. magnus*; 713, *Z. parvus*; 714, *Z. patulus*; 715, *Z. bicolor*; 716, *Z. crassulus*; 717, *Z. vargus*; 718, *Z. apulatus*; 719, *Z. imus*; 720, *Z. himus*; 721, *Z. jocus*; 722, *Z. menkei*.

Paratypes.— U.S.A.: Arizona, same data as for holotype (1 F); Sta. Cruz Co., Madera Canyon, VIII-21-1981, R. Davidson, Malaise Trap (1 F, 1 M), same data, VIII-20-1981 (1 M). MEXICO: 4 mi NW Choix, Sin., VIII-31-1968, T. A. Sears, R. C. Gardner, C. S. Glaser (1 F, 1 M) (Berkeley, Washington).

Other specimens.— MEXICO: 4 mi NW Choix, Sin., 1-IX-1968, T. A. Sears, R. C. Gardner, C. S. Glaser (3 M); same data, VIII-29-1968 (1 M); 5.5 mi NW Choix, Sin., IX-5-1968, same collectors (3 M).

Remarks.— The coloration and sheath shape of *menkei* are very similar to *patulus* (Fig. 687), but the sheath of *menkei* is more rounded in lateral view, the lancet has numerous slender spines on each annulus, and each serrula has several coarse posterior subbasal teeth. The other specimens listed are unassociated males which are difficult to identify. They agree with the single paratype male.

nigropectus (Norton), **new combination** — Mexico (Nuevo Leon, San Luis Potosi, Tamaulipas, Veracruz); U.S.A. (Arkansas, Louisiana, Mississippi, Oklahoma, Texas)

**Ptenos nigropectus* Norton 1872: 77. F. "Texas" (Philadelphia, F).— Cresson 1880: 36 (*nigripectus*).— Dalla Torre 1894: 324 (*nigripectus*).— Konow 1904: 239 (*nigripectus*).— Konow 1906b: 183 (*nigripectus*).— Forsius 1925a: 5.— Cresson 1928: 8 (holotype).

Ptenus nigropectus: Kirby 1882: 54.— Konow 1905a: 26 (*nigripectus*).— Ross 1951: 16.— Smith 1970: 81, 82, 91-92, fig. 1-3, 5, 22, 35, 39 (F, M described; host a).— Greenbaum 1975: 165 (distribution; Nuevo Leon, Veracruz).— Smith 1979: 24 (hosts b?, c).

Ptenellus nigripectus (!): Malaise 1937a: 56.

Hosts: a) *Desmanthus illinoensis*; b) *Desmanthus* sp.; c) *Acacia angustissima* (Leguminosae).

I have seen specimens from the following Mexican localities: C. Victoria, Tamps.; Vallecillo, 102± km S Laredo; 1 mi S. Cd. Valles, S.L.P.; 6 mi N Manuel, Tamps.; 13 mi N. Cienaga de Flores, N.L.; 2 mi E Cuidad Manto, Tamps.; 29 mi S. Cd. Victoria, Tamps.; and 3.7 mi. fr. Montemorelos, N.L.

parvus (Smith), **new combination** — Mexico (Sonora); U.S.A. (Arizona, Texas)

**Ptenus parvus* Smith 1970: 81, 83, 92, 94, fig. 9, 21, 30. F, M. "Arizona, Cochise Co., 3 mi. W. Portal" (Washington, F) (specimens swept from *Acacia*).— Greenbaum 1975: 166 (distribution).— Smith 1979: 24.

I have seen specimens from 4 mi S Hermosillo, Sonora.

patulus (Smith), **new combination** — Mexico (Baja California Sur); U.S.A. (Arizona)

**Ptenus patulus* Smith 1970: 82, 83, 94, fig. 12, 13, 19, 34, 40. F, M. "Sonoita, Arizona, Pima Co., about 5000 ft." (Washington, F).— Smith 1979: 24.

I have seen specimens from Baja California Sur: La Laguna, 1675-1725 m, Sierra de La Laguna.

retus Smith, **new species** — Mexico (Veracruz)

Zynzus retus Smith.

Female.— Length, 6.0 mm. Black, pronotum and mesonotum orange with very small black spot on mesal area of pronotum and anterior margin of mesoprescutum. Wings uniformly moderately infuscated black; veins and stigma black. Antennal length to head width as 6.0:4.8. Lower interocular distance to eye length as 2.4:2.2; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.8:0.7. Length of hindbasitarsus to length of remaining tarsal segments combined as 2.0:2.8. Sheath with large leaflike scopae, in dorsal view longer than broad, in lateral view with dorsal margin straight and slanting downward, meeting ventral margin at narrowly rounded apex (similar to *nigropectus*, Fig. 683). Lancet clublike, serrulae small, with large annular spines, segments 4 to apex with about 6 large broad spines on each annulus and with large spines distant from ventral margin of lancet (Fig. 700).

Male.— Unknown.

Holotype.— F, "Orizaba, Ver., Mex., 8/12-22/61, R. and K. Dreisbach" (Champaign).

Paratype.— MEXICO: Tequesquitengo, Mor., 7-15-61, R. & K. Dreisbach (1 F) (East Lansing).

Remarks.—The black coloration with the pronotum and mesonotum orange and lancet as figured will separate *retus* fron other species of *Zynzus*.

townesi Smith, **new species** — Mexico (San Luis Potosi)

Zynzus townesi Smith.

Female.—Length, 5.5 mm. Black with upper 1/2 of mesepisternum, pronotum, and mesonotum orange; foretibia whitish. Wings uniformly blackish infuscated, veins and stigma black. Antennal length to head width as 6.8:4.1. Lower interocular distance to eye length as 3.8:3.2; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 1.0:0.8:0.7. Sheath with large leaflike scopae, in dorsal view longer than broad, in lateral view with dorsal margin straight, slanted downward, and meeting ventral margin at narrowly rounded apex (similar to *nigropectus*, Fig. 683). Lancet short and clublike, with rather deep serrulae and with large spinelike lateral armature, segments 4 to apex with 6 or 7 spines on each annulus much larger and broader than others (Fig. 698).

Male.— Unknown.

Holotype.— F, "nr. El Naranjo, 64 km. W. N. Morelos, S.L.P., Mex., X.7.62, Oak For., H. and M. Townes" (Townes Coll.).

Remarks.—The coloration which is black with only parts of the thorax orange and the lancet which has large annular spines and relatively deep serrulae are diagnostic for *townesi* and will separate it from other species of *Zynzus*.

usirus Smith, **new species** — Mexico (Sonora)

Zynzus usirus Smith.

Female.—Length, 6.8 mm. Antenna and head black. Thorax black with pronotum, tegula, lateral margins of mesoprescutum, and most of mesonotal lateral lobes except for posterior margins orange. Legs black with foretibia and tarsus whitish. Abdomen black dorsally and at apex with terga laterally and sterna orange. Wings uniformly lightly blackish infuscated; veins and stigma black. Antennal length to head width as 4.8:4.5. Lower interocular distance to eye length as 2.5:2.3; distances between eye and hindocellus, hindocelli, and hindocelli and posterior margin of head as 0.9:0.8:0.8. Length of hindbasitarsus to length of remaining tarsal segments combined as 1.6:2.5. Sheath with large leaflike scopae, in dorsal view longer than broad, in lateral view with dorsal margin straight and slanting downward to broadly rounded apex (similar to *nigropectus*, Fig. 683). Lancet short, clublike, with low serrulae and large annular spines, each annulus from 4 to apex with about 6 spines larger and broader than others (Fig. 699).

Male.— Unknown.

Holotype.— F, "Mex., Sonora, 9 mi. SE of Vicam, 11-VIII-1960, P. H. Arnaud, Jr., E. S. Ross, D. C. Rentz" (San Francisco).

Remarks.— The sheath and lancet resemble other *Zynzus* species that have a large scopa that slants downward, but the sheath is more rounded at its apex in *usirus*. The coloration and lancet also differ from other species of *Zynzus*.

vargus (Smith), **new combination** — Mexico (Nuevo Leon, San Luis Potosi, Tamaulipas)

**Ptenus vargus* Smith 1970: 81, 98-99, fig. 8, 23. F. "Mexico (Brownsville, Tex. POE [Port of Entry]" (Washington, F).— Greenbaum 1975: 166 (distribution; Nuevo Leon, San Luis Potosi).— Smith 1979: 24.

I have seen specimens from the following Mexican localities: 23 mi S Linares, Tamps.; 20 mi S Montamorelos, N.L.; 7.5 mi S Monterrey, N.L.; 5 mi S Linares, N.L.

UNPLACED TAXA OF ARGIDAE

UNPLACED GENERA

The type species of the following genera have not been located and it is impossible to place the genera from their descriptions.

Gymniopterus Ashmead 1898: 213. Type species: *Gymniopterus singularis* Ashmead. Orig. desig.

Nematoneura André 1881: 576-577. Type species: *Nematoneura violaceipennis* André. Monotypic.

UNPLACED SPECIES

Types of the following species have not been located. It is impossible to place them from their original descriptions.

Schyzocera axillaris Spinola 1840: 150-152. F. "Cayenne".
Gymnia axillaris: Kirby 1882: 43.— Dalla Torre 1894: 318.— Konow 1905a: 27.

Hylotoma josephi Konow 1884: 278. "Corfu".— Dalla Torre 1894: 337 (as syn. of *melanopyga* Klug).
Arge josephi: Konow 1887: 26 (Bogota ?).

This may not be neotropical, but Konow (1887) indicated that it may be from Bogota (Colombia).

Hylotoma (*Schizocera*) *nasicornis* Curtis 1844: 254-255. M. No locality.
Ptilia nasicornis: Kirby 1882: 47.— Dalla Torre 1894: 320 (Brazil).— Konow 1905a: 27.

In the original description, Curtis stated "head with 2 elevated lines arising at outer ocella and forming an elongated triangle terminating in little tooth or horn between antenna" and "forewing with large marginal cell and small elongate apical one." These characters may apply to a species of *Scobina*, all of which have sharp carinae on the head similar to the "elongated triangle" of Curtis.

Hylotoma (*Schizocera*) *ochrostigma* Curtis 1844: 255. M. No locality.
Ptilia ochrostigma: Kirby 1882: 45.— Dalla Torre 1894: 320 (Brazil).— Konow 1905a: 27.

The description is mostly color, but one character of the forewing is mentioned in the original description: "with one marginal cell terminated by a triangular one." This is possibly like the forewing of *Neurogymnia* (Fig. 144).

Gymniopterus singularis Ashmead 1898:213. No locality.

Gymnia tibialis Spinola 1851:7-8. F. "Para".–Kirby 1882: 42 (*Trailia compressicornis* Cameron a syn.).—Dala Torre 1894:318.
Sericoceros tibialis: Konow 1905a:28.

Nematoneura violaceipennis André 1881: 577. "Caucase".— Kirby 1882: 316 (Caucasus).— Konow 1890: 244 (listed; "Ca.").— Dalla Torre 1894: 316 (Caucasus).— Konow 1905a: 24 (Caucasus).— Malaise 1937a: 50 (S. Amer.; type probably labeled "R. Cauca", André possibly mistook for Rio Cauca, Colombia; type examined and appears to be South American).

Malaise stated that he examined the type at Leningrad; however, a search for the type by *A*. Zinovjev was unsuccessful (Zinovjev, personal correspondence).

ACKNOWLEDGMENTS

Acknowledgments are given in the first paper in this series (Smith, 1988) and several additional ones in the second part (Smith, 1990). I once again thank all who so kindly provided specimens. In addition, I extend my appreciation to Noel McFarland, Sierra Vista, Arizona, for providing host data and biological information on several species; D.H. Janzen, University of Pennsylvania, Philadelphia, for providing specimens from Santa Rosa National Park, Costa Rica, and for host data for a number of species occurring there; and the following for providing additional specimens and information: M.A. Ivie, Montana State University, Bozeman; J. E. Rawlins, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania; Diomedes Quintero, Museo de Invertebrados G.B. Fairchild, Universidad de Panama, Panama (Panama); Mario Elgueta D., Museo Nacional de Historia Natural, Santiago, Chile (Mus. Nac., Santiago); Jean-Michael Maes, Museo Entomologico, Leon, Nicaragua; and Paul Hanson, Universidad de Costa Rica, San José.

Linda Lawrence and Mary Lou Cooley, staff artists, Systematic Entomology Laboratory, U. S. Department of Agriculture, Washington, D.C., my wife, J. L. Smith, and Eleanor Holland, volunteer artist with the Systematic Entomology Laboratory, prepared many of the illustrations of female lancets.

I thank the following for their time and effort in reviewing this manuscript: Henri Goulet, Biosystematics Research Centre, Agriculture Canada, Ottawa; W.W. Middlekauff, University of California, Berkeley; and R.L. Smiley and E.E. Grissell, Systematic Entomology Laboratory, USDA, Beltsville, Maryland, and Washington, D.C.

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MEMOIRS
OF THE
AMERICAN ENTOMOLOGICAL SOCIETY
NUMBER 40

PHYLOGENY, TAXONOMY, AND BIOGEOGRAPHY OF EXTANT SILKY LACEWINGS (INSECTA: NEUROPTERA: PSYCHOPSIDAE)

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JOHN D. OSWALD

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Paul M. Marsh
Editor

Issued 30 September 1993

PRINTED BY BOOKCRAFTERS IN THE UNITED STATES OF AMERICA

Typesetting and Page Composition by ELYTRON
Swarthmore, Pennsylvania

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Phylogeny, Taxonomy, and Biogeography of Extant Silky Lacewings (Insecta: Neuroptera: Psychopsidae)

by

JOHN D. OSWALD

Department of Entomology
National Museum of Natural History, NHB 165
Smithsonian Institution
Washington, D.C. 20560

ABSTRACT. The world genera of the family Psychopsidae are revised based on a comparative morphological assessment of adults of 21 (of 26) extant silky lacewing species. Two subfamilies and five genera are recognized. The subfamily Zygophlebiinae contains three African genera, *Silveira*, *Cabralis*, and *Zygophlebius*; the subfamily Psychopsinae contains the genera *Balmes*, from southeast Asia, and *Psychopsis*, from Australia. A generic key and full taxonomic treatments of all supraspecific taxa are presented, together with a synonymical catalog of extant species. Three new species are noted. A novel male/female copulatory mechanism is described; and several hypotheses are advanced regarding the functional morphology of the male and female terminalia. A cladistic analysis of the 21 examined species using 60 adult morphological characters demonstrates the holophyly of all recognized supraspecific taxa. The five recognized genera are cladistically related as follows: ([*Silveira* + (*Cabralis* + *Zygophlebius*)] + [*Balmes* + *Psychopsis*]). Alternative classifications of the family are discussed, particularly with regard to the Australian species. The biogeography of extant psychopsids is discussed. The distribution and cladogeny of living silky lacewings is consistent with a Gondwanan origin of the extant members of the family. The present occurrence of *Balmes* species in southeast Asia is best explained by either (1) the northwesterly dispersal of an Australian, probably Tertiary, ancestor through the Malay Archipelago or (2) the northerly rafting of a Mesozoic ancestor on a rift fragment of northeastern Gondwanaland.

INTRODUCTION

The neuropterous family Psychopsidae, or "silky lacewings," contains 26 extant species (including three undescribed, see Appendix 1) and a variety of fossil forms ranging in age from Tertiary to Triassic (Table 5, page 48). This work treats the phylogeny, taxonomy, biogeography, and several aspects of the functional morphology of living psychopsids.

Because of the absence of silky lacewings from Europe and adjacent land areas, psychopsids came to the attention of western science at a relatively late date. The first described species, the attractive *Psychopsis mimica* from Australia, was initially characterized by Edward Newman in 1842, and more completely described the following year (Newman, 1843). Newman's implicit and appropriate comparison of *mimica* to a colorfully banded lepidopteran is memorialized in his generic name *Psychopsis*, derived from the Greek words *psyche*, butterfly, and *opsis*, appearance. In 1889, Friedrich Brauer described the first African psychopsid, *zebra*. Two years later Robert McLachlan (1891) recorded the first silky lacewing from southeastern Asia, *birmanus*, and established the presence of psychopsids in the last of the three disjunct geographies—Australia, sub-Saharan Africa, and southeast Asia—which currently comprise the tripartite distribution of the living members of this family.

Handlirsch (1906-1908) recognized the distinctiveness of the genus *Psychopsis* within the broad concept of the family Hemerobiidae then current and erected for it a new subfamily, the Psychopsinae, which was subsequently adopted by several contemporaries, e.g., Banks (1913) and Nakahara (1914). Navás (1910), apparently then unaware of all earlier work on this group, independently proposed two generic names, *Zygophlebius* and *Balmes*, to contain three new species (one each from Africa, Australia, and southeast Asia) that are now recognized as psychopsids. Navás placed his genera in a new hemerobiid tribe, the Zygophlebini.

In the years following his 1910 paper, Navás described several additional new psychopsids in a series of general papers (e.g., Navás, 1910, 1912a, 1912b) and one revisionary work, the "Ensayo monográfico de la familia de los Sicópsidos." Although the latter work was not published until 1917 (Navás, 1917), it was presented orally at the Valladolid Congress of the Asociación Española para el Progreso de las Ciencias in October, 1915. Several aspects of this work are significant: (1) it contained the first elevation of psychopsids to family rank—although, the family name "Psychopsidae" itself was first published independently by Tillyard (1916:271), (2) it represented the first comprehensive, worldwide, review of the family, recognizing eight genera, 13 species, and three varieties, and (3) it firmly established alar characters, principally venation and wing patterning, as the principal diagnostic and taxonomic traits used in the early differentiation of psychopsid taxa—an emphasis which was maintained throughout the subsequent revisions of Tillyard ([1919a]; Australia), Krüger (1922; world), and Kimmins (1939; world).

More recently, Tjeder's (1960) revision of the southern African psychopsid fauna conclusively demonstrated the taxonomic utility of male and female terminalic characters at all hierarchical levels within the family. Tjeder's expansion of the taxonomic character base in psychopsids to include terminalic traits was a major advance and paralleled concurrent trends in other neuropterous families. Subsequently, New ([1989a]) made extensive use of terminalic traits to diagnose Australian psychopsids.

The present work builds upon this 150-year history. The major new contribution contained here is the first detailed hypothesis of interspecific and intergeneric relationships within the family. This hypothesis is based upon a cladistic analysis of 60 characters (mostly terminalic) scored for 21 (of 26) living psychopsid species. The relative phylogenetic relationships inferred from this analysis are used (1) as the basis for a new generic and suprageneric classification of the family and (2) to interpret the biogeographic history of living silky lacewings and to account for their presently tripartite distribution. The descriptive aspects of this work are limited to taxa of generic and suprageneric rank. Consequently, full taxonomic treatments are provided only for the two subfamilies and five genera recognized here. A comprehensive synonymical catalog of extant psychopsid species, however, has been provided (Appendix 1), and synapomorphic characters supporting intrageneric clades among the examined species are included in the cladistic analysis. Readers are referred to the revisionary works of Tjeder (1960) and New ([1989a]) for species-level taxonomic treatments of African and Australian psychopsids respectively. The interspecific taxonomy of southeast Asian psychopsids requires additional study.

ACKNOWLEDGMENTS

I thank the following individuals for loaning material for this study: M. S. Moulds (AMS); Stephen Brooks (BMNH); Norman D. Penny (CAS); James K. Liebherr (CUIC); M. J. Fletcher (DANSW); G. Müller-Motzfeld (EMAU); Lionel A. Stange (FSCA); David G. Furth (MCZ); Les Minter (MINTER); Elaine De Coninck (MRAC); Mervyn W. Mansell (NCIP); Ulrike Aspöck (NHMW); R. Sithole (NMB); M. N. Mungai (NMK); Oliver S. Flint, Jr. (USNM); Andy E. Whittington (NMSA); E. C. Dahms (QMB); Jan van Tol (RNHL); E. G. Matthews (SAMA); M. A. Cochrane (SAMC); Martina Pusch (SMWW); M. A. Schneider (UQIC); Roy Danielsson (UZIL); Kurt K. Günther (ZMHB); and Ernst-Gerhard Burmeister (ZSM).

I gratefully acknowledge Oliver Flint, Jr. (USNM), Mervyn Mansell (NCIP), Wayne Mathis

(USNM), Timothy New (La Trobe University, Australia), and Lionel Stange (FSCA) for reviewing the manuscript and providing valuable comments. Les Minter generously shared some unpublished observations on several African species. George C. Steyskal provided helpful advice on a problematic nomenclatural question.

The research for this monograph was supported in part by a Smithsonian Postdoctoral Fellowship and was undertaken while the author was in residence in the Department of Entomology at the U.S. National Museum of Natural History (Smithsonian Institution), Washington, DC.

MATERIALS AND METHODS

Material.—This study was based on the examination of approximately 650 specimens representing 21 of the 26 known extant psychopsid species. The individuals and institutions who/which loaned this material are listed below under "Collection Acronyms."

Terminalia Preparation.—The following general sequence was used to prepare male and female terminalia: (1) remove abdomen from specimen [whole or only apical segments (ca. somites 6+)], (2) immerse overnight in cold 10% KOH to soften, digest, and hydrate, (3) rinse in 70% ethyl alcohol [EtOH], (4) [optional] stain in saturated solution of 70% EtOH and Chlorozol Black for approximately one minute, then rinse in 70% EtOH, (5) transfer to glycerin for dissection and examination.

Rinsing is facilitated by use of a syringe containing EtOH and a fine, bent-tipped needle. Removal of the gonarcus/mediuncus/9th gonocoxite complex from the abdominal apex of the male facilitates detailed examination and illustration of both this complex and the tergal and sternal elements which enclose it. Removal can be accomplished using a pair of jewelers' forceps and a fine probe to part the membranes joining these structures. Examination of female terminalic structures—particularly the bursa, spermatheca, posterior abdominal chamber, and various sternal structures—is greatly aided by cutting the abdominal body wall in a horizontal plane at approximately the level of the spiracles. To accomplish this, first trim the abdomen to contain approximately somites 6+. Then, with a fine pair of scissors, cut horizontally through the body wall from the pleural membrane to the distal apex of the ectoproct. With similar cuts made on both sides of the abdomen, the dorsal half of the abdomen can be bent back and the remaining connection severed. Careful cuts will avoid damage to the bursa, its glands, the spermatheca, and the posterior abdominal chamber.

Illustrations.—Terminalic drawings were prepared using a drawing tube attached to a dissecting microscope from structures either (1) completely embedded in glycerin jelly, or (2) partially embedded in petroleum jelly and covered with liquid glycerin. The excellent illustrations found in Tjeder (1960) are frequently cited herein to avoid excessive duplication of artwork. References to figures contained in Tjeder and other published works are cited as "fig." [lower case f]; figures contained in this work are cited as "Fig." [upper case F].

Terminology.—The morphological terminology used here generally follows that of Tjeder (1960) and New ([1989a]). A number of terminological differences, however, occur in (1) the male gonarcus/mediuncus/9th gonocoxite complex, and (2) the female ventral terminalia. A cross-reference guide to these differences is given below. Justifications of the terms used here are given in the text, particularly in the discussions of characters used in the cladistic analysis and under the heading "Functional Morphology of Male and Female Terminalia: Morphological Observations." Discussions of the terminology used for the gonarcus are given in Oswald (1988:396) and Oswald (1993: 155-157).

Cross-reference guide to terminalic terminology (Format: Tjederian term = Current term [(M)ale/(F)emale]): arcessus = mediuncus [M]; entoprocessus = extrahemigonarcal process [M]; glandulae accessoriae = bursal accessory glands [F]; gonapophysis lateralis = 9th gonocoxite [F]; paramere = 9th gonocoxite [M]; pregenitale = 8th sternite [F]; spermatheca = bursa (membranous portion) + spermatheca (sclerotized portion) [F].

Collection Acronyms.—**AMS**—Australian Museum, Sydney, NSW Australia; **BMNH**—The Natural History Museum, London, England; **CAS**—California Academy of Sciences, San Francisco, CA, USA; **CUIC**—Cornell University Insect Collection, Ithaca, NY, USA; **DANSW**—Agricultural Scientific Collections Trust (NSW Dept. Agric.), Rydalmere, NSW, Australia; **EMAU** - Zoologisches Museum, Ernst-Moritz-Arndt-Universität, Greifswald, Germany; **FSCA**—Florida State Collection of Arthropods, Gainsville, FL, USA; **MCZ**—Museum of Comparative Zoology, Cambridge, MA, USA; **MINTER**—Les Minter private collection, Pietersburg, South Africa; **MRAC**—Musée Royal de l'Afrique Centrale, Tervuren, Belgium; **NCIP**—National Collection of Insects, Pretoria, South Africa; **NHMW**—Naturhistorisches Museum, Wien, Austria; **NMB**—Natural History Museum, Bulawayo, Zimbabwe; **NMK**—National Museum of Kenya, Nairobi, Kenya; **USNM**—National Museum of Natural History, Washington, D.C., USA; **NMSA**—Natal Museum, Pietermaritzburg, South Africa; **QMB**—Queensland Museum, South Brisbane, Queensland, Australia; **RNHL**—Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands; **SAMA**— South Australian Museum, Adelaide, South Australia, Australia; **SAMC**—South African Museum, Cape Town, South Africa; **SMWW**—State Museum, Windhoek, Namibia; **UQIC**—University of Queensland, St. Lucia, Queensland, Australia; **UZIL**—Museum of Zoology and Entomology, Lund University, Lund, Sweden; **ZMHB**—Museum für Naturkunde der Humboldt-Universität, Berlin, Germany; **ZSM**—Zoologische Staats-sammlung, München, Germany.

TAXONOMIC TREATMENTS

Family PSYCHOPSIDAE Handlirsch

Psychopsinae Handlirsch [1906]:42 [As a subfamily of Hemerobiidae. Type genus: *Psychopsis* Newman, 1842.].—Banks, 1913:211 [nomenclature]; Nakahara, 1914:491 [nomenclature].

Psychopsini.—Navás, 1912b:194 [As a tribe of Hemerobiidae. Note: Navás's proposal of this name was apparently independent of Handlirsch's prior use of the name Psychopsinae. Navás proposed the name Psychopsini to replace his earlier tribal name Zygophlebini (based on *Zygophlebius* Navás, 1910), subsequent to his discovery of the existence of the older generic name *Psychopsis*.].

Psychopsidae.—Tillyard, 1916:271 [nomenclature]; Navás, 1917 [taxonomy]; Tillyard, [1919a] [taxonomy]; Krüger, 1922 [taxonomy]; Kimmins, 1939 [taxonomy]; Tjeder, 1960 [taxonomy]; New, [1989a] [taxonomy].

Balmesini Navás, 1917:207 [As a tribe of Psychopsidae. Type genus: *Balmes* Navás, 1910.].

Psychopsididae [sic].—Martynova, 1949:161 [nomenclature].

Diagnosis.—Medium-sized to large neuropterans (forewing length 10-35 mm) readily distinguished by the presence of a forewing and hind wing venational formation called the "vena triplica" (Fig. 32, vt). In this formation the subcostal and R1 spaces run parallel, and are subequal in width, from near the base of the wing to a common (or nearly common) distal point (the "anastomosis"; Fig. 32, ams) where each space is either constricted (by an interposed crossvein) or terminated (by brief vein fusion), and beyond (distal to) which point the parallel, subequal, nature of the spaces is not apparent. Other characteristic forewing traits include: (1) an unusually broad costal space, its width at least twice the width of the "vena triplica" near the "anastomosis," i.e., in the "pterostigmal region," (2) the presence of only one forewing nygma, located basally between veins R and M, (3) the complete absence of pterostigmata, and (4) the presence of at least four (usually >10) crossveins traversing the subcostal space between its base and the "anastomosis."

Description.—In the following treatment familial synapomorphies are indicated by bracketed character numbers (see Phylogenetic Analysis: Characters below). See also the discussions under the heading "Functional Morphology of Male and Female Terminalia." **Head**: compound eyes prominent; ocelli absent; 2 or 3 ocellar/cranial pulvinae usually present (all lost in *P. coelivaga*); antennae short, moniliform; toruli with one or two antennifers; maxillary palpi 5-segmented; labial palpi 3-segmented, ultimate labial palpomeres each bearing a palpimacula; mandibles well developed, slightly asymmetrical. **Thorax**: Pterothorax macropterous; wings generally broadly triangular; margins trichosorate; membrane fully microtrichose, but not macrotrichose; hind wing somewhat smaller than forewing. Forewing distinctly patterned, sometimes with brightly colored patches; humeral plate prominent, sometimes elongate; costal space very broad throughout, width in "pterostigmal region" >2 times the combined width of the adjacent Sc and R1 spaces [8]; pterostigma absent; costal gradate series present [6] (occasionally secondarily reduced or lost); proximal humeral trace recurrent and pectinately branched; subcostal space with more than four crossveins (but usually >10) [5]; longitudinal veins and costal veinlets densely macrotrichose. Legs cursorial; paired tibial spurs present; tarsi 5-segmented; pretarsus biclawed, arolium present, simple.

Male Terminalia (Figs. 1, 18).—**8th Somite**: tergite narrowed, hemiannular; sternite hemiannular to moderately produced posteriorly;

spiracles opening through ventrally prolonged margins of tergite [10] (secondarily free in several species). **9th Somite**: tergite arcuate, narrowed dorsally, expanded and elongated ventrally; tergal antecosta prominent, especially ventrolaterally, distal (ventral) ends articulated to anterolateral margins of 9th sternite [14]; sternite variously modified, usually somewhat reduced, composed principally of a pair of rigid lateral longitudinal costae [17], with various degrees of adjacent sclerotization, apex frequently emarginate, lateral costae articulated proximally to antecosta of 9th tergite [14], lateral costae continued internally as a pair of short apodemes [15]. **Ectoprocts**: free dorsomedially, doubly (two species; e.g., Fig. 21) or singly lobed distally, trichobothriate callus cercus always present. **Gonarcus** (Fig. 23): a prominent arcuate framework serving as the articulatory base of the mediuncus and 9th gonocoxites; extragonopons, extrahemigonarcus, and intrahemigonarcus prominent; intragonopons absent or poorly developed; extragonopons generally protruded beyond extrahemigonarcus in lateral view. **Mediuncus** (=arcessus of Tjeder and New): always present, proximal end articulated to posterior margin of extragonopons by means of a transverse flexion line; curvature variable; apex simple or bifid; apodeme of mediuncal adductor muscle always distinct [36]; proximoventral surface of mediuncus associated with a pair (sometimes fused sagittally) of accessory sclerites developed in adjacent gonosaccal membrane [37]. **9th Gonocoxites**: always present and paired; proximal ends articulated to posteroventral angles of extrahemigonarcus; distal ends fused at abdominal midline [23] (except in *P. coelivaga*) to form a more or less rigid arch joining the extrahemigonarcus. **Miscellaneous**: hypandrium internum and subanale always present.

Female Terminalia (Figs. 43-44).—**7th Somite**: tergite hemiannular, unmodified; sternite more or less hemiannular overall, posterior margin with a sagittal emargination and/or depression [40]; copulatory fovea present [42]. **8th Somite**: tergite narrowed, lateral extremities greatly prolonged ventrally, posterior margin fused for much of its length (especially laterally and ventrolaterally) to anterior margin of 9th tergite [46]; spiracles opening through ventrally prolonged margins of tergite; sternite always present, conformation variable (narrowly rectangular [44], triangular, trapezoidal, or compact and lobed), fused to 7th sternite in several species. **9th Somite**: tergite narrowed dorsally, greatly expanded ventrally, posteroventral expansion subtending ectoproct posteriorly; contralateral tergal margins adpressed ventrally; posteroventral tergal surfaces inwardly revolute and pilose [48]; tergal antecosta prominent for much of its length, particularly laterally and ventrolaterally, and giving rise to a pair of short broad apodemes (Fig. 43, ala) above spiracles of 8th somite [47]; a pair of slender inconspicuous apodemes (Fig. 43, da) issuing from near dorsal angles of posteroventral lobes of tergite [49]; subgenitale present, a subrectangular plate bearing a pair of small, free, lateral lobes. **Ectoprocts**: proximolateral margins more or less fused to 9th tergite, development of suture in this area variable, free on sagittal midline of abdomen, but parasagittal margins joined dorsally by a narrow membranous rift which severely restricts lateral ectoproctal motion. **9th Gonocoxites**: present, spathulate [50], each with a prominent longitudinal costa [51], at least some cochleariform suprastylar setae present [54]; 9th gonocoxal styli present, each bearing a field of short stout "digging" setae [55]. **Internal Structures**: bursa a large membranous sac, its ventral margins confluent with the adpressed dorsal edges of an elongate, sclerotized, slit-entry spermatheca; colleterial gland present, one pair of dorsodistal bursal accessory glands normally present (see Character 56 for variants); posterior abdominal chamber present [60]. **Miscellaneous**: subanale always present.

Natural History and Immature Stages.—See individual generic treatments below.

Distribution.—Range tripartly disjunct: southern half of Africa (predominantly south of the Equator), southeastern Asia (limits of distribution poorly known, reported from Burma, southern China, Laos, and Taiwan), and Australia (widespread, but records predominantly eastern).

Included Taxa.—Two subfamilies: Zygophlebiinae (three genera, nine species) and Psychopsinae (two genera, 17 species). For additional discussion of family classification see "Phylogenetic Analysis: Classification" below. All extant species are cataloged in Appendix 1.

KEY TO SUBFAMILIES AND GENERA OF PSYCHOPSIDAE

1 Distribution: Africa (Fig. 54); Male: apex of mediuncus simple (Fig. 4); Female: spermatheca bearing a pair of hollow ventrolateral lobes (Fig. 46, vll) .... (Zygophlebiinae) **2**
Distribution: Australia or southeastern Asia (Fig. 54); Male: apex of mediuncus emarginate or bifid (Fig. 27); Female: spermatheca lacking hollow ventrolateral lobes, but solid apodemal plates (Fig. 48, lap) may be present ventrolaterally .... (Psychopsinae) **4**

2(1) Head: vertex bearing 3 well-developed ocellar/cranial pulvinae (Tjeder, 1960:175, fig. 341); Female: hollow ventrolateral lobes of spermatheca slender (Tjeder, 1960:179, fig. 365) .... ***Silveira*** Navás
Head: vertex bearing 2 well-developed ocellar/cranial pulvinae [anteromedian pulvinus absent] (Tjeder, 1960:192, fig. 405); Female: ventrolateral lobes of spermatheca broad (Fig. 46) **3**

3(2) Forewing: bearing dark spots on a white ground (Tjeder, 1960:199, fig. 434A); Hind Wing: crossveins closing "vena triplica" distally not dark brown; Male: apex of mediuncus strongly decurved (Fig. 19); Female: bursa without corniform diverticulae (Tjeder, 1960:203, fig. 448) .... ***Cabralis*** Navás
Forewing: bearing transverse bars proximally on a yellowish or hyaline ground [wing lightly mottled in zns1, bars inconspicuus] (Tjeder, 1960:193, fig. 412); Hind Wing: crossveins closing "vena triplica" distally dark brown; Male: apex of mediuncus recurved (Fig. 14); Female: bursa with a pair of corniform diverticulae (Fig. 47, cd) .... ***Zygophlebius*** Navás

4(1) Hind Wing: bearing a prominent dark macula on, beyond, or below anastomosis of "vena triplica" [Australia] .... ***Psychopsis*** Newman
Hind Wing: dark distal macula lacking [Southeast Asia. The Australian species *gallardi*, regarded here as Psychopsinae incertae sedis, will also key here.] .... ***Balmes*** Navás

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Subfamily ZYGOPHLEBIINAE Navás

Zygophlebini Navás, 1910:82 [As a tribe of Hemerobiidae. Type genus: *Zygophlebius* Navás, 1910].—Navás, 1917 [taxonomy].

Diagnosis.—Cladistic analysis character numbers bracketed ([xx]), synapomorphies asterisked (*). **Head**: Vertex bearing 2 (*Cabralis* and *Zygophlebius*) or 3 (*Silveira*) well-developed ocellar/cranial pulvinae [1]; antennal toruli each with 2 antennifers, 1 medial and 1 lateral [2*, unique]. **Male Terminalia**: Anterolateral apodemes of 9th sternite continuing in line with proximal ends of lateral costae [15]; 9th Gonocoxites without true superprocesses [24]; apex of mediuncus simple [32]; apodeme of adductor muscle of mediuncus inserting proximoventrally on floor of mediuncus [36]. **Female Terminalia**: Suprastylar setae of 9th gonocoxite <50% (*Silveira*) or >50% (*Cabralis* and *Zygophlebius*) cochleariform [54]; spermatheca bearing a pair of ventrolateral lobes [58*, unique].

Distribution.—Southern half of Africa.

Included Taxa.—*Silveira* (four species), *Cabralis* (two species, including one undescribed), and *Zygophlebius* (three species, including one undescribed) [see Appendix 1].

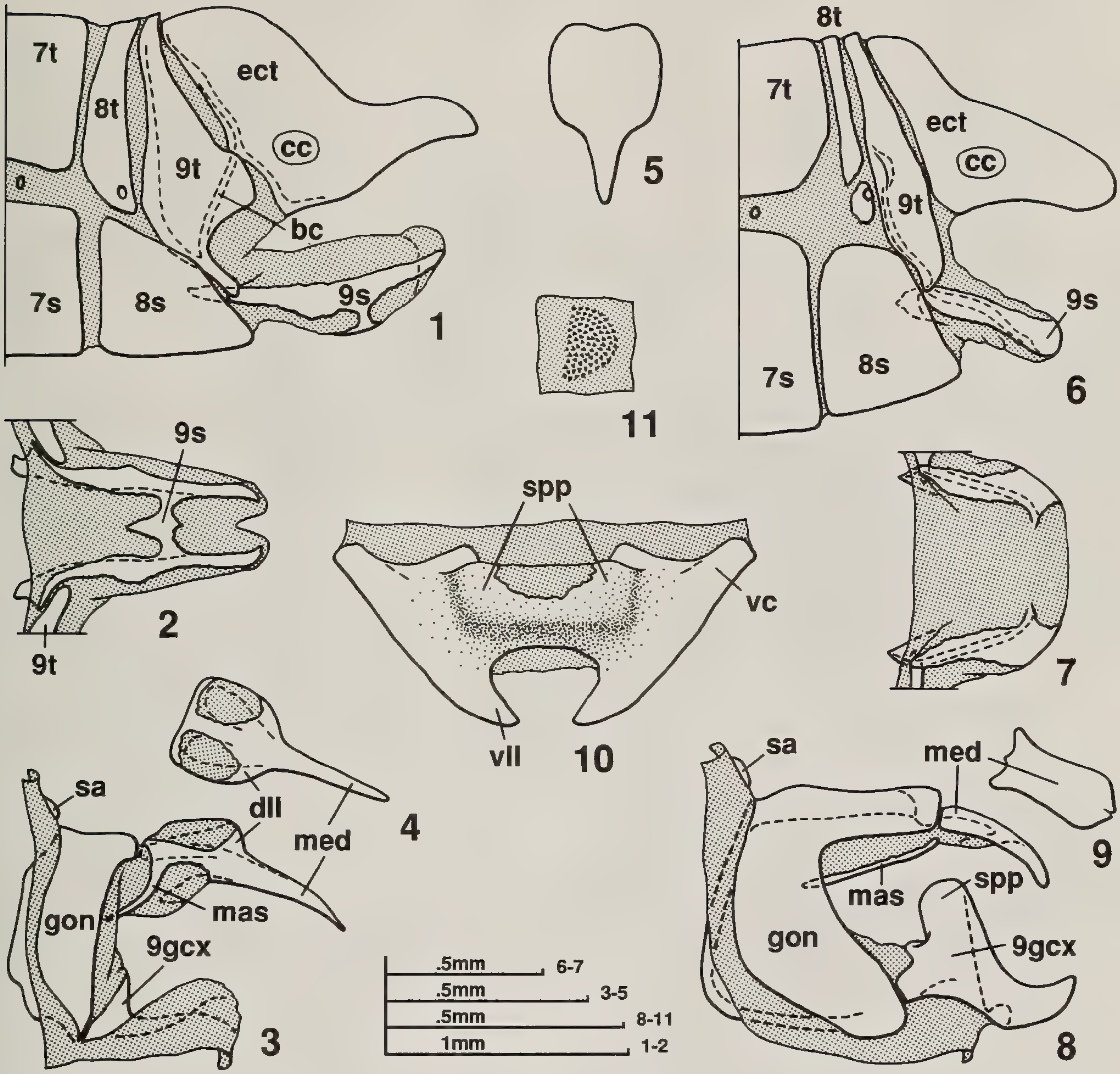
Genus SILVEIRA Navás

Figs. 1-5, 39, 41

Silveira Navás, 1912b:196 [Type species: *Silveira marmoratus* Navás, 1912b:196 (=*Psychopsis marshalli* McLachlan, 1902), by monotypy. Etymology: from the surname of Gonzalo Silveira, S. J., see Navás, 1912b:196. Gender: Masculine (implied from the original combination *Silveira marmoratus*, Art. 30d).].—Navás, 1917 [taxonomy]; Kimmins, 1939 [taxonomy]; Tjeder, 1960 [taxonomy].

Psychophasis Krüger, 1922:44 [Type species: *Psychopsis marshalli* McLachlan, 1902:234, by original designation. Etymology: unexplained, probably Psycho- (from Gr. *psyche*, butterfly) + -phasis (from Gr. *phasis* [fem.], appearance). Gender: Feminine.].—Kimmins, 1939 [synonymy].

Diagnosis.—Cladistic analysis character numbers bracketed ([xx]), synapomorphies asterisked (*). **Head**: Vertex bearing 3 well-developed ocellar/cranial pulvinae [1]. **Wings**: Forewing without light brown transverse bars [4]; forewing costal gradate series well developed [6]; hind wing without a dark distal macula [9]. **Male Terminalia**: 8th sternite without a posteromedian lobe [11]; 9th tergite without free posteroventral processes [12]; 9th sternite narrow and parallel sided in ventral view



Figs. 1-11. 1-4, *Silveira marshalli*, male. 1, abdominal apex, lateral. 2, 9th sternite, ventral. 3, gonarcus and 9th gonocoxites, lateral. 4, mediuncus, dorsal. 5, *Silveira rufus*, male mediuncus, dorsal outline. 6-11, *Balmes birmanus*, male. 6, abdominal apex, lateral. 7, 9th sternite, ventral. 8, gonarcus and 9th gonocoxites, lateral. 9, mediuncus, dorsal. 10. 9th gonocoxites, dorsal. 11, spiculate lobe of gonosaccal membrane, lateral. Abbreviations: **7s**, **8s**, **9s**, sternites; **7t**, **8t**, **9t**, tergites; **9gcx**, 9th gonocoxite; **bc**, brace costa; **cc**, cercal callus; **dll**, dorsolateral lobe; **ect**, ectoproct; **gon**, gonarcus; **mas**, mediuncal accessory sclerite; **med**, mediuncus; **sa**, subanale; **spp**, superprocessus; **vc**, ventral costa; **vll**, ventrolateral lobe.

[16*, unique], its apex shallowly emarginate [19*, homoplasious]; 9th Gonocoxites: ventral costae long and prominent [21], dorsolateral sclerotized plates not flared laterally [22], superprocesses absent [24]; mediuncus weakly decurved [33], not recurved [34]; gonosaccal membrane without spiculate lobes [39]. **Female Terminalia**: Posterior margin of 7th sternite medially depressed and emarginate [40]; 7th and 8th sternites unfused [43]; 8th sternite narrow and transverse [44]; 9th Gonocoxites: each gonocoxite bearing a single longitudinal row of stiff setae below the gonocoxal costa [52*, unique], without a compact aggregation of setae borne adjacent to insertion of stylus [53], suprastylar setae <50% cochleariform [54]; bursa without lateral corniform diverticulae [57]; hollow ventrolateral lobes of spermatheca narrow in lateral view [58*, unique].

Natural History and Immature Stages.—No published data. Larvae of *marshalli* have been reared to 2nd instar by L. Minter (pers. comm.).

Distribution.—Southern half of Africa (Angola, Botswana, Namibia, Republic of South Africa [Cape Prov., Transvaal], Zaire, Zimbabwe).

Species.—Four (see Appendix 1; Key: Tjeder, 1960:174-175).

Genus **CABRALIS** Navás

Figs. 17-20

Cabralis Navás, 1912a:109 [Type species: *Cabralis gloriosus* Navás, 1912a:110, by monotypy. Etymology: unexplained, unknown. Gender: Masculine (implied from the original combination *Cabralis gloriosus*, Art. 30d).].—Navás, 1917 [taxonomy]; Kimmins, 1939 [taxonomy]; Tjeder, 1960 [taxonomy].

Diagnosis.—Cladistic analysis character numbers bracketed ([xx]), synapomorphies asterisked (*). **Head**: Vertex bearing 2 well-developed ocellar/cranial pulvinae [1]. **Wings**: Forewing without light brown transverse bars [4]; forewing costal gradate series well developed [6]; hind wing without a dark distal macula [9]. **Male Terminalia**: 8th sternite with an inconspicuous posteromedian lobe [11]; 9th tergite margins produced posteroventrally as a pair of free processes [12*, unique]; 9th sternite not narrow and parallel sided in ventral view [16], its apex rounded, not emarginate [19]; 9th Gonocoxites: ventral costae long and prominent [21], dorsolateral sclerotized plates not flared laterally [22], superprocesses absent [24]; mediuncus strongly decurved [33*, unique], not recurved [34]; gonosaccal membrane without spiculate lobes [39]. **Female Terminalia**: Posterior margin of 7th sternite deeply depressed and emarginate medially [40]; 7th and 8th sternites not fused [43]; 8th sternite a compact median sclerite [44]; 9th Gonocoxites: without a longitudinal row of stiff setae below each gonocoxal costa [52], without a compact aggregation of setae borne adjacent to insertion of stylus [53], suprastylar setae >50% cochleariform [54]; bursa without lateral corniform diverticulae [57]; hollow ventrolateral lobes of spermatheca broad in lateral view [58].

Natural History and Immature Stages.—No published data. Larvae of *C. gloriosus* have been reared to 2nd instar by L. Minter (pers. comm.).

Distribution.—Southeastern Africa (Mozambique, Republic of South Africa [Transvaal], Zaire, Zimbabwe).

Species.—Two, including one undescribed [=cns1] (see Appendix 1).

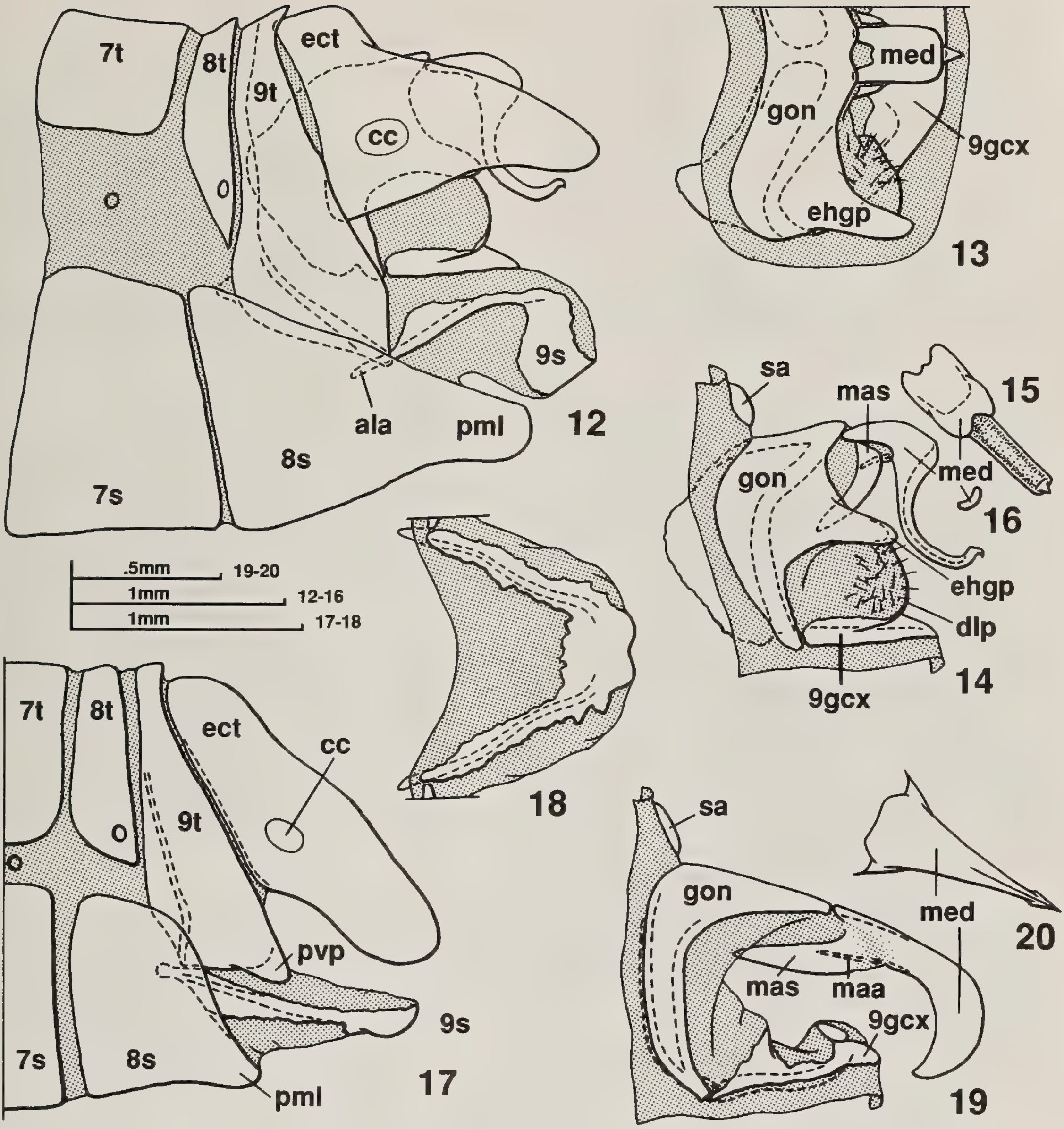
Genus **ZYGOPHLEBIUS** Navás

Figs. 12-16, 43-47

Zygophlebius Navás, 1910:82 [Type species: *Zygophlebius leoninus* Navás, 1910:83, by subsequent designation by Navás, 1917:200, who designated *Psychopsis zebra* Brauer, 1889:102, a name not originally included in *Zygophlebius*, but at the same time placed the originally included species *Z. leoninus* (as subspecies leonina [sic]) as a synonym of *P. zebra*, Art. 69a(v) (see discussion in Oswald, 1989). Incorrect Type Species Designation: *Zygophlebius verreauxinus* Navás, 1910:84, by Tillyard, [1919a]:760. Etymology: Zygo- (from Gr. zygon, yoke) + -phlebius (from Gr. *phleps* or *phlebos* [fem.], vein), see Navás, 1910:82. Gender: Masculine, Art. 30a(iii).].—Navás, 1917 [taxonomy]; Tillyard, [1919a]:759 [nomenclature]; Oswald, 1989 [nomenclature].

Notopsychops Tillyard, [1919a]:759 [Type species: *Psychopsis zebra* Brauer, 1889:102, by original designation. Etymology: unexplained, probably Noto- (from L. *noto*, to mark) + -psych- (from Gr. *psyche*, butterfly) + -ops (from Gr. *ops* [fem.], countenance). Gender: Masculine, Art. 30a(ii). Note: Proposed unnecessarily as a replacement name for *Zygophlebius* sensu Navás, 1917, see discussion in Oswald, 1989:139.].—Kimmins, 1939 [taxonomy]; Tjeder, 1960 [taxonomy]; Oswald, 1989 [synonymy].

Psychomorphe Krüger, 1922:44 [Type species: *Psychopsis zebra* Brauer, 1889:102, by original designation. Etymology: unexplained, probably Psycho- (from Gr. *psyche*, butterfly) + -morphe (from Gr. *morphe* [fem.], form). Gender: Feminine.].—Kimmins, 1939 [synonymy].



Figs. 12-20. 12-16, *Zygophlebius leoninus,* male. 12, abdominal apex, lateral. 13, gonarcus and 9th gonocoxites, dorsal. 14, same, lateral. 15, mediuncus, dorsal. 16, same, distal cross-section. 17-20, *Cabralis gloriosus,* male. 17, abdominal apex, lateral. 18, 9th sternite, ventral. 19, gonarcus and 9th gonocoxites, lateral. 20, mediuncus, dorsal. Abbreviations: **7s**, **8s**, **9s**, sternites; **7t**, **8t**, **9t**, tergites; **9gcx**, 9th gonocoxite; **cc**, cercal callus; **ala**, anterolateral apodeme; **dlp**, dorsolateral plate; **ect**, ectoproct; **ehgp**, extrahemigonarcal process; **gon**, gonarcus; **maa**, mediuncal adductor apodeme; **mas**, mediuncal accessory sclerite; **med**, mediuncus; **pml**, posteromedian lobe; **pvp**, posteroventral lobe; **sa**, subanale.

Nothopsychops.—Tjeder, 1960:173 and figure legends for "*Notopsychops zebra*" (=*leoninus*) [An incorrect subsequent spelling of *Notopsychops*].

Diagnosis.—Cladistic analysis character numbers bracketed ([xx]), synapomorphies asterisked (*). **Head**: Vertex bearing 2 well-developed ocellar/cranial pulvinae [1]. **Wings**: Forewing with light brown transverse bars [4*, unique]; forewing costal gradate series well developed (*zebra, leoninus*), or secondarily reduced (zns1) [6]; hind wing with a minute dark mark directly on the "anastomosis" [9*, unique]. **Male Terminalia**: 8th sternite with a posteromedian lobe [11]; 9th tergite without free posteroventral processes [12]; 9th sternite not narrow and parallel sided in ventral view [16], its apex shallowly emarginate (*zebra, leoninus*) or rounded (zns1) [19]; 9th Gonocoxites: ventral costae long and prominent [21], dorsolateral sclerotized plates flared laterally [22*, unique], superprocesses absent [24]; mediuncus distally recurved [34*, unique]; gonosaccal membrane without spiculate lobes [39]. **Female Terminalia**: Posterior margin of 7th sternite medially depressed and emarginate, and bearing a sagittal process (minute in zns1) [40*, unique]; 7th and 8th sternites not fused [43]; 8th sternite a compact median sclerite [44]; 9th Gonocoxites: without a longitudinal row of stiff setae below each gonocoxal costa [52], without a compact aggregation of setae borne adjacent to insertion of stylus [53], suprastylar setae >50% cochleariform [54]; bursa with lateral corniform diverticulae [57*, unique]; hollow ventrolateral lobes of spermatheca broad in lateral view [58].

Natural History and Immature Stages.—No published data. Larvae of *leoninus* and zns1 have been reared, respectively, to 2nd and 3rd instar by L. Minter (pers. comm.).

Distribution.—Southern half of Africa (Angola, Kenya, Malawi, Mozambique, Republic of South Africa [Transvaal], Swaziland, Tanzania, Uganda, Zaire, Zambia, Zimbabwe).

Species.—Three, including one undescribed [=zns1] (see Appendix 1; no recent authoritative species key exists).

Subfamily **PSYCHOPSINAE** Handlirsch

For synonymical listing see family treatment above.

Diagnosis.—Cladistic analysis character numbers bracketed ([xx]), synapomorphies asterisked (*). **Head**: Vertex bearing 2 ocellar/cranial pulvinae (the 3rd, medioventral, occasionally vestigial; all pulvinae absent in *P. coelivaga*) [1*, homoplasious]; antennal toruli each with a single lateral antennifer [2]. **Male Terminalia**: Anterolateral apodemes of 9th sternite deflected ventrad of a pair of imaginary lines continued anteriorly from proximal ends of lateral costae [15*, unique]; 9th Gonocoxites with true superprocesses [24*, unique]; apex of mediuncus emarginate or bifid [32*, unique]; apodeme of adductor muscle of mediuncus inserting at base of terminal mediuncal cleft (secondarily displaced ventrally in *P. barnardi*) [36*, unique]. **Female Terminalia**: Suprastylar setae of 9th gonocoxite >50% cochleariform [54*, homoplasious]; spermatheca not bearing a pair of ventrolateral lobes [58].

Distribution.—Southeastern Asia (*Balmes*) and Australia (*Psychopsis* and 1 incertae sedis species).

Included Taxa.—*Balmes* (four species, including one undescribed), *Psychopsis* (12 species), and one incertae sedis species [see Appendix 1].

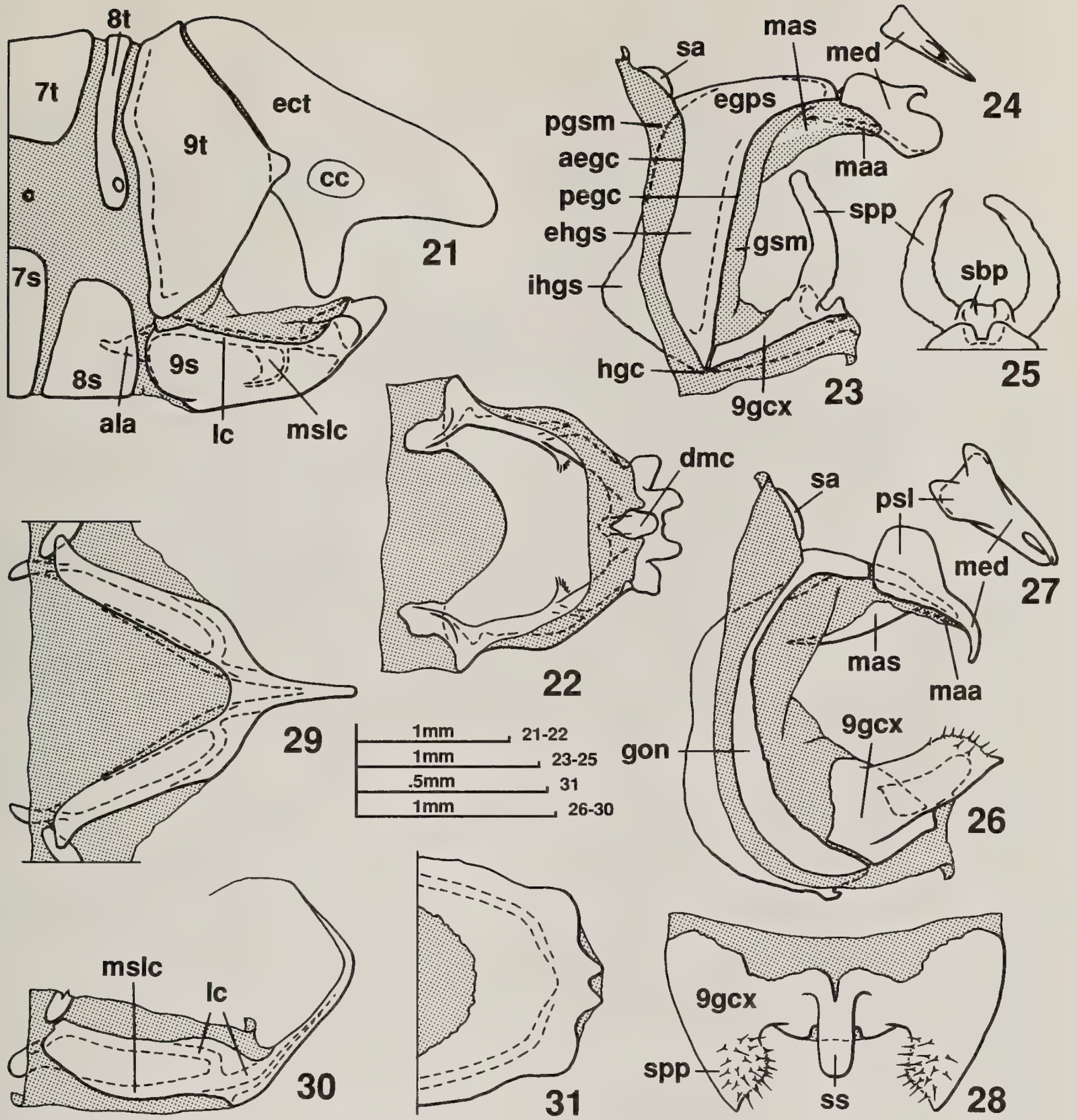
Genus **BALMES** Navás, revised status

Figs. 6-11, 40

Balmes Navás, 1910:85 [Type species: *Balmes terissinus* Navás, 1910:85, by monotypy. Etymology: from the surname of Catalan philosopher Jaime Luciano Balmes [1810-1848], see Navás, 1910:85. Gender: Masculine (implied from the original combination *Balmes terissinus*).].—Navás, 1917 [taxonomy]; Kimmins, 1939 [taxonomy]; New, [1989a] [nomenclature].

Nomenclatural Note.—*Balmes* is here resurrected from synonymy with *Psychopsis*. Justification for this action is given below under the heading "Phylogenetic Analysis: Classification."

Diagnosis.—Cladistic analysis character numbers bracketed ([xx]), synapomorphies asterisked (*). **Head**: Vertex bearing 2 well-developed ocellar/cranial pulvinae [1]. **Wings**: Forewing without light brown transverse bars [4]; forewing costal gradate series absent or reduced (i.e., <6 crossveins) [6*, homoplasious]; hind wing without a dark distal macula [9]. **Male Terminalia**: 8th sternite without a posteromedian lobe [11]; 9th tergite without free posteroventral processes [12]; 9th sternite not narrow and parallel sided in ventral view [16], its apex shallowly emarginate or rounded [19]; 9th Gonocoxites: ventral costae absent or reduced to short thickenings [21*, homoplasious], dorsolateral sclerotized plates not flared laterally [22],



Figs. 21-31, *Psychopsis* species, males. 21-25, *P. barnardi*. 21, abdominal apex, lateral. 22, 9th sternite, dorsal. 23, gonarcus and 9th gonocoxites, lateral. 24, mediuncus, dorsal. 25, apices of 9th gonocoxites, posterior. 26-30, *P. illidgei*. 26, gonarcus and 9th gonocoxites, lateral. 27, mediuncus, dorsal. 28, 9th gonocoxites, dorsal. 29, 9th sternite, ventral. 30, same, lateral. 31, *P. coelivaga*, 9th sternite, ventral. Abbreviations: **7s**, **8s**, **9s**, sternites; **7t**, **8t**, **9t**, tergites; **9gcx**, 9th gonocoxite; **aegc**, antextragonarcal commissure; **ala**, anterolateral apodeme; **cc**, cercal callus; **dmc**, dorsomedial cavity; **ect**, ectoproct; **egps**, extragonopons; **ehgs**, extrahemigonarcus; **gon**, gonarcus; **gsm**, gonosaccal membrane; **hgc**, hemigonarcal conjunction; **ihgs**, intrahemigonarcus; **lc**, lateral costa; **maa**, mediuncal adductor apodeme; **mas**, mediuncal accessory sclerite; **med**, mediuncus; **mslc**, mesal spur of lateral costa; **pegc**, postextragonarcal commissure; **pgsm**, paragonosaccal membrane; **psl**, parasagittal lobe; **sa**, subanale; **sbp**, subprocessus; **spp**, superprocessus; **ss**, sagittal spine.

superprocesses present but fused, represented by a transverse tumulus at the distal end of the conjoined gonocoxites [24*, unique]; mediuncus weakly decurved [33], not recurved [34]; gonosaccal membrane bearing spiculate lobes [39*, homoplasious]. **Female Terminalia**: Posterior margin of 7th sternite medially depressed and emarginate [40]; 7th and 8th sternites fused [43*, homoplasious]; 8th sternite narrow and transverse [44]; 9th Gonocoxites: without a longitudinal row of stiff setae below each gonocoxal costa [52], without a compact aggregation of setae borne adjacent to insertion of stylus [53], suprastylar setae >50% cochleariform [54]; bursa without lateral corniform diverticulae [57]; spermatheca lacking hollow ventrolateral lobes [58].

Natural History and Immature Stages.—No data.

Distribution.—Southeast Asia (southern China, Burma, Laos, Taiwan).

Species.—Four, including one undescribed [=bns1] (see Appendix 1; no recent authoritative species key exists). New's ([1989a]) treatment of *terissinus* as a junior synonym of *birmanus* appears to be faulty. I have examined males of three terminalically distinct *Balmes* species from mainland southeast Asia (i.e., excluding Taiwan); these are treated in Appendix 1 under the names *terissinus*, *birmanus*, and bns1. I have seen a long series of specimens (ca. 20 males, mostly in the USNM) that exhibit forewing maculation patterns closely matching Navás' original forewing illustration (1910:86, fig. 24) of *terissinus*. I have tentatively referred these specimens to *terissinus* based on their matching forewing maculations and their terminalic distinctness from specimens here attributed to *birmanus* and bns1, both of which lack the distinctly contrasting forewing maculae of *terissinus*. The specimens attributed here to *birmanus* closely correspond to New's ([1989a]:859) illustrations of the male terminalia of this species. The third species, here informally designated bns1, is clearly distinct terminalically from both *terissinus* and *birmanus*. Particularly diagnostic is the sagittal process arising from the distally fused male gonocoxites [character 26] in this species. It is at least possible that bns1 represents the unknown male of *formosa*; however, it is also possible that it represents an entirely new species. The discovery of still other *Balmes* species in the poorly collected areas of southeast Asia cannot be ruled out. A comprehensive review of material from this area is currently needed to definitively resolve these issues.

Genus **PSYCHOPSIS** Newman

Figs. 21-38, 42, 48-52

Psychopsis Newman, 1842:415 [Type species: *Psychopsis mimica* Newman, 1842:415, by monotypy. Etymology: unexplained, probably Psych- (from Gr. *psyche*, butterfly) + -opsis (from Gr. *opsis*, appearance). Gender: Feminine.].—Navás, 1917 [taxonomy]; Tillyard, [1919a] [taxonomy]; Krüger, 1922 [taxonomy]; Kimmins, 1939 [taxonomy]; New, [1989a] [taxonomy].

Artiopteryx Guérin-Ménéville, [1844]:389 [Type species: *Artiopteryx elegans* Guérin-Ménéville, [1844]:389, by monotypy. Etymology: unexplained, probably, Artio- (from Gr. *arteria*, artery) + -pteryx (from Gr. *pteryx* [fem.], wing). Gender: Feminine.].—Erichson, 1847 [note]; Hagen, 1866 [synonymy, as *Arteriopteryx* (sic)].

Arteriopteryx [sic] Hagen, 1866:380 [An incorrect subsequent spelling of *Artiopteryx*. Although probably intended as an emendation of *Artiopteryx* (see etymology above), Hagen's spelling does not meet the Code's emendation requirements because the original spelling was not explicitly cited, Art. 33b(i).].—Oswald & Penny, 1991 [nomenclature].

Magallanes Navás, 1912b:197 [Type species: *Psychopsis insolens* McLachlan, 1863:114, by original designation. Etymology: From the surname of Portuguese navigator Fernao de Magalhaes (=Ferdinand Magellan) [1480?-1521], see Navás, 1912b:197. Gender: No originally attributed or implied gender, here considered masculine, Art. 30.].—Navás, 1917 [taxonomy]; Tillyard, [1919a] [synonymy]; Kimmins, 1939 [taxonomy]; New, [1989a] [synonymy].

Wernzia Navás, 1912b:195 [Type species: *Hemerobius coelivagus* Walker, 1853:279, by original designation. Etymology: from the surname of M. R. P. Francisco Wernz, General de la Compañía de Jesús, see Navás, 1912b:195 and Navás, 1917:194. Gender: Feminine (implied from the original combination *Wernzia caelivaga* [sic]).].—Navás, 1917 [taxonomy]; Tillyard, [1919a] [synonymy]; Kimmins, 1939 [taxonomy]; New, [1989a] [synonymy].

Megapsychops Tillyard, [1919a]:771 [Type species: *Psychopsis illidgei* Froggatt, 1903:455, by original designation. Etymology: unexplained, probably Mega- (from Gr. *megas*, large) + -psych- (from Gr. *psyche*, butterfly) + -ops (from Gr. *ops* [fem.], countenance). Gender: Masculine, Art. 30a(ii).].—Kimmins, 1939 [taxonomy]; New, [1989a] [taxonomy]. NEW SYNONYM

Psychopsella Tillyard, [1919a]:780 [Type species: *Psychopsella gallardi* Tillyard, [1919a]:780, by original designation. Etymology: unexplained, probably

Psych- (from Gr. *psyche*, butterfly) + -ops- (from Gr. *ops*, countenance) + -ella (from L. diminutive suffix *-ella*). Gender: Feminine, Art. 30b.].—Kimmins, 1939 [synonymy].

Orientichopsis Kuwayama, 1927:125 [As a subgenus of *Psychopsis*. Type species: *Psychopsis* (*Orientichopsis*) *formosa* Kuwayama, 1927:123, by original designation. Etymology: unexplained, probably Orienti- (from L. *orientis*, east) + -chopsis (from the generic name [*Psy*]*chopsis* [fem.]). Gender: Feminine.].—Kimmins, 1939 [synonymy].

Nomenclatural Note.—*Megapsychops* is here reduced to a junior synonym of *Psychopsis*. Justification for this action is given below under the heading "Phylogenetic Analysis: Classification."

Diagnosis.—Cladistic analysis character numbers bracketed ([xx]), synapomorphies asterisked (*). **Head**: Vertex bearing 2 well-developed ocellar/cranial pulvinae, vestigial remnants of a third (ventromedial) pulvinus sometimes present (all pulvinae lost in *coelivaga*) [1]. **Wings**: Forewing without light brown transverse bars [4]; forewing costal gradate series well developed [6]; hind wing with a dark distal macula [9*, unique], but variable in position relative to the "anastomosis." **Male Terminalia**: 8th sternite without a posteromedian lobe [11]; 9th tergite without free posteroventral processes [12]; 9th sternite not narrow and parallel sided in ventral view [16], its apex of variable form [19]; 9th Gonocoxites: ventral costae generally long and prominent (reduced in *gracilis* and *illidgei*) [21], dorsolateral sclerotized plates not flared laterally when present [22], superprocesses present, their conformations variable [24]; mediuncus linear or weakly decurved [33], not recurved [34]; gonosaccal membrane without spiculate lobes (except in *insolens*) [39]. **Female Terminalia**: Posterior margin of 7th sternite medially depressed and emarginate [40]; 7th and 8th sternites not fused (except in *illidgei*) [43]; 8th sternite narrow and transverse to broadly triangular or trapezoidal [44]; 9th Gonocoxites: without a longitudinal row of stiff setae below each gonocoxal costa [52], with a compact aggregation of setae borne adjacent to insertion of stylus [53*, unique], suprastylar setae >50% cochleariform [54]; bursa without lateral corniform diverticulae [57]; spermatheca lacking hollow ventrolateral lobes [58].

Natural History and Immature Stages.—Larvae of *elegans*, *mimica*, and *coelivaga* have been mentioned in the literature (Froggatt, 1902 [*elegans* (as *mimica*), 1907 [*elegans*]; Tillyard, [1919b] [*elegans*, *coelivaga*]; Gallard, 1914 [*elegans* (as *newmani*)], 1922 [*mimica*], 1923 [*mimica*]; Withycombe, [1925] [*elegans*]; MacLeod, 1964 [*elegans*]). The most detailed life history account is that of Tillyard ([1919b]) for *elegans*. Larvae of *elegans* and *coelivaga* were field collected under the bark of healthy, rough-barked, Myrtaceous trees (primarily *Eucalyptus* species). Larvae appear to aggregate around sap flows where they are presumed to feed on small arthropods attracted to the exudates. Two-year life histories have been documented for both *elegans* (see Tillyard, [1919b]) and *mimica* (see Gallard, 1923). MacLeod (1964) presented a detailed treatment of the larval cephalic morphology of *elegans*.

Distribution.—Australia, reported from all states except Tasmania. Most species, however, are restricted to or primarily distributed within the tropical to mesic temperate mountainous areas of eastern Australia. Records from western, particularly northwestern, Australia are scarce (collection bias?).

Species.—Twelve, plus one incerta sedis species which may belong here (see Appendix 1; Key: New, [1989a]: 843-845).

FUNCTIONAL MORPHOLOGY OF MALE AND FEMALE TERMINALIA

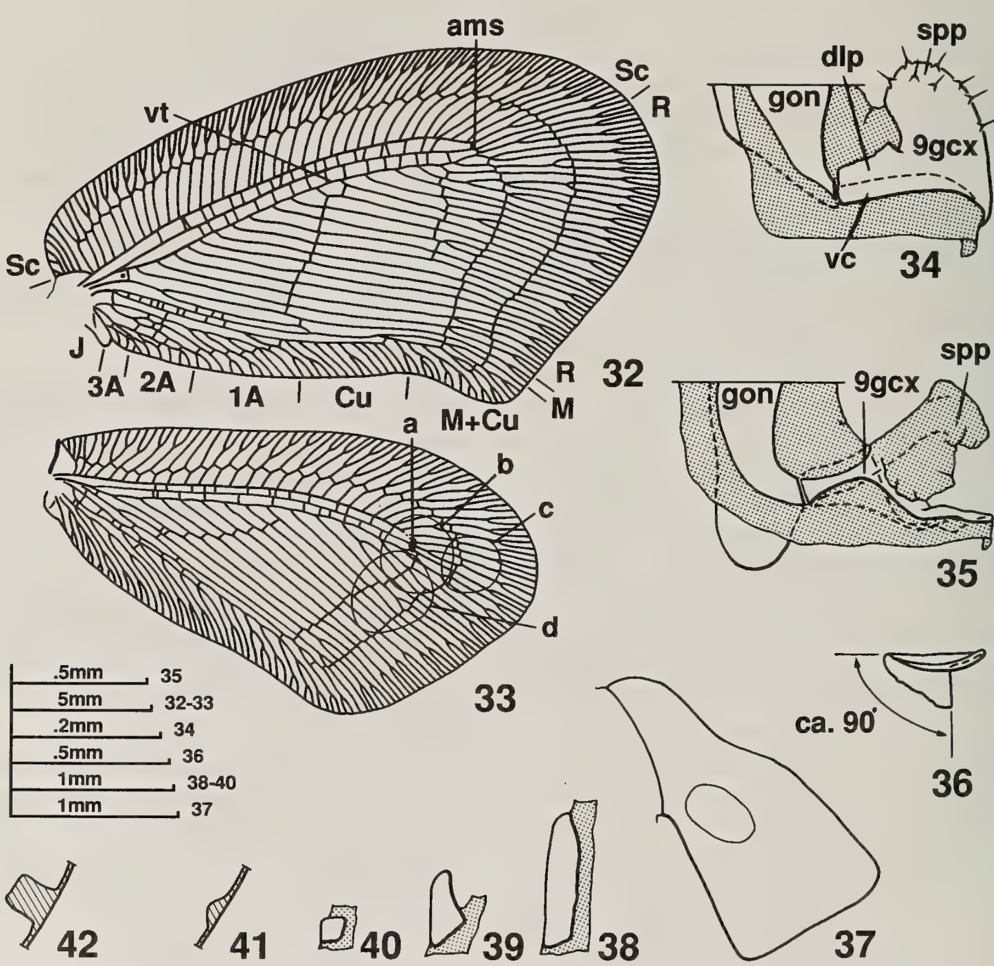
The functional morphology of male and female terminalic structures and the mechanics of copulation are poorly known for most neuropterous taxa, and no such information has been available for the family Psychopsidae. Research conducted for this work included detailed morphological examinations of both the male and female terminalia for nearly all species studied (five species were available in only one sex). The primary objective of these morphological studies was the individualization of characters and character states for the inference of phylogenetic relationships among extant psychopsids. The studies, however, also revealed something unexpected —the presence of a distinctive, and previously unnoticed, copulatory apparatus in the sclerotized components of both the male and female terminalia.

In the sections below I have drawn together numerous scattered observations on individual male and female terminalic components, and placed them together in a common context to provide a broad overview of psychopsid copulation and oviposition. This discussion is divided into two parts. First, I present a relatively detailed survey of the psychopsid male and female terminalia themselves. This section focuses on the morphology of the sclerites of the terminalic complex, including their modifications, fusions, articulations, apodemes, costae, and connecting membranes. Second, I discuss the mechanics of copulation and oviposition based on inferences derived from the morphological observations. The information and hypotheses presented here are based on observations of macerated and stained terminalic preparations from dried specimens.

MORPHOLOGICAL OBSERVATIONS

MALES

The sclerotized components of the male terminalia (Figs. 1, 3) can be divided into two systems: (1) an outer system comprised of the 8th tergite and sternite [8t, 8s], 9th tergite and sternite [9t, 9s], ectoprocts [ect] (=10th [+?11th] hemitergites +?cerci), and subanale [sa] (=?10th sternite remnant); and (2) an inner system comprised of the gonarcus [gon] (dorsomedially fused volsellae,



Figs. 32-42. 32-33, *Psychopsis barnardi*. 32, forewing. 33, hind wing. 34-35, Male 9th gonocoxites, lateral. 34, *P. coelivaga*. 35, *P. elegans*. 36, *P. barnardi*, hypandrium internum, lateral. 37, *P. elegans*, male ectoproct, lateral. 38-40, Forewing humeral plates, dorsal. 38, *P. barnardi*. 39, *Silveira marshalli*, 40, *Balmes birmanus*. 41-42, lateral costae of male 9th sternite, diagrammatic cross-sections. 41, *Silveira marshalli*. 42, *Psychopsis barnardi*. Abbreviations associated with the illustrations: **1A, 2A, 3A**, anal veins; **9gcx**, 9th gonocoxite; ams, anastomosis; **Cu**, cubitus; **dlp**, dorsolateral plate; **gon**, gonarcus; **J**, jugal vein; **M**, media; **M+Cu**, media + cubitus; **R**, radius; **Sc**, subcosta; **spp**, superprocessus; **vc**, ventral costa; **vt**, vena triplica.

sensu Adams, 1969), mediuncus [med] (a gonarcus fragment), mediuncal accessory sclerites [mas] (novel psychopsid sclerites), 9th Gonocoxites [9gcx] (sensu Adams, ="parameres" of many other authors), and hypandrium internum (a small sclerite associated with apex of eversible gonosaccal membrane).

Outer System (Male).—8th Tergite, free, hemiannular, very narrow, ventrolateral extremities enclosing spiracles of 8th somite in most species. **9th Tergite**, ± hemiannular; narrowed (particularly dorsally); antecosta prominent (at least ventrally); lateral extremities extended ventrally well below level of pleural membrane, their ventral apices articulating with anterolateral angles of 9th sternite. **Ectoprocts**, free, completely separated dorsally, membranously associated with posterior margin of 9th tergite; antecosta prominent to lacking; generally singly lobed posteriorly, bilobed in a few species (i.e., *Psychopsis illidgei* and *barnardi*, and *Silveira occultus*); cercal callus present, bearing trichobothria. **8th Sternite**, free, hemiannular, slightly narrowed dorsally, but largely unmodified in most species, with a small posteromedian bulge in some zygophlebiines. **9th Sternite**, free, anterolateral angles articulating with 9th tergite, each articulation braced by a lateral longitudinal costa, lateral costae occasionally with mesal spurs, but always continued internally as short apodemes beyond their articulations with 9th tergite; ventral surface of sclerite between lateral costae largely unsclerotized in many species; apical configurations highly varied, sometimes bearing prominent distal lobes, often sagittally emarginate; in a few *Psychopsis* species bearing a heavily-walled, sagittal pit, dorsodistally (Fig. 22, dmc); **Subanale**, always present, a small, setose, sclerite lying medially in the paragonosaccal membrane between the gonarcus and anus.

The 8th and 9th tergites, 8th sternite, and subanale appear to be largely immobile sclerites, disregarding the extension and compression motions of the abdomen. The ectoprocts articulate loosely on the ipsilateral posterior margins of the 9th tergite; and their motions are principally lateral/medial. The anterolateral angles of the 9th sternite articulate dicondylically with the ventrally elongate lateral extremities of the 9th tergite, which restricts 9th sternite motion to a dorsal/ventral arc around this articulation. The ectoprocts and 9th sternite, respectively, enclose the abdominal apex posterodorsally and posteroventrally, providing protection for the sclerites of the inner system. In some taxa the 9th sternite apex is modified to receive the apical portion of the mediuncus. For example, the mediuncal apex in several *Silveira* species has been observed resting in the apical emargination of the 9th sternite; and, the dorsomedial pit located near the apex of the 9th sternite in some *Psychopsis* species (e.g., *elegans*, *mimica*, and *barnardi*) appears to be a mediuncal receptacle.

Inner System (Male).—Gonarcus (Fig. 23), a well-developed, upright, sclerotized arch; comprised of an externally exposed *extragonarcus* (the *extrahemigonarcus* [ehgs] laterally, *extragonopons* [egps] dorsally), and an internal, apodemal, *intragonarcus* (the *intrahemigonarcus* [ihgs] laterally, *intragonopons* [absent or poorly developed in most psychopsids] dorsally); suspended between the ectoprocts by the *paragonosaccal membrane* [pgsm], which meets the gonarcus along a line, the *antextragonarcal commissure* [aegc], which separates the extra- and intragonarcus; posterior margin of extragonarcus confluent with *gonosaccal membrane* [gsm] along *postextragonarcal commissure* [pegc]; ant- and postextragonarcal commissures meeting (or nearly so) at a pair of points, the *hemigonarcal conjunctions* [hgc], at posteroventral angles of *hemigonarcus*; extragonopons generally prolonged posteriorly; extrahemigonarcus with a prominent posterior process (Fig. 13, ehgp) in *Zygophlebius zebra* and *leoninus*; intragonarcus variously developed, intragonopons frequently absent; mediuncus articulated along posterior margin of the extragonopons; paired 9th gonocoxites associated with posteroventral angles of hemigonarcus.

Although the gonarcus clearly serves as a rigid framework upon which the mediuncus and 9th gonocoxites articulate, the range of motion of this linked complex of three sclerites (taken as a unit) within the abdominal apex is difficult to ascertain. Based on its loose membranous association with the sclerites of the outer system, it would appear to be capable of a considerable range of motion during copulation, particularly protrusion posteriorly.

Mediuncus (Figs. 13-15, med), a small, secondarily disassociated, posteromedian fragment of the extragonarcus, now articulated with the posterior margin of the extragonopons at a transversely oriented joint; apex simple (Zygophlebiinae) or cleft/emarginate (Psychopsinae); bearing internally a discrete apodeme upon which the mediuncal adductor inserts.

Tjeder (1960) and New ([1989a]) used the term *arcessus* for this structure. I adopt "mediuncus" because it is consistent with Tjeder's original (1931:3, fig. 1) use of mediuncus for the dorsodistal portion of the "10th sternit [sic]" (i.e., gonarcus), and thus clearly connotes the homology of the articulated sclerite in psychopsids with the apex of the extragonarcus. The presence of an articulated mediuncus in psychopsids may or may not be homologous with one or more of the similar states found in other neuropterous families. Given the wide but sporadic distribution of both articulated and disarticulated mediunci within the Neuroptera, it is almost certain that functionally similar transverse articulations have developed in numerous neuropterous lineages independently. Because the articulation is ubiquitous, and therefore interpreted as plesiomorphic, within the Psychopsidae, its possible extrafamilial homologies have not been investigated in detail here. In psychopsids the mediuncus generally articulates with the extragonopons by means of a pair of sclerotized parasagittal lobes (sometimes poorly developed) borne on the proximodorsal margin of the mediuncus. This articulation restricts mediuncal motion to a vertical arc around the transverse posterior margin of the extragonopons.

Mediuncal Accessory Sclerites (Fig. 14, mas), a bilaterally symmetrical pair of narrowly elongate and weakly sclerotized straps originating in the gonosaccal membrane beneath the extragonopons and inserting posteriorly on (or at least closely associated with) the lateral or ventrolateral surfaces of the mediuncus. These structures appear to be a psychopsid novelty. Although their function is uncertain, their association with the mediuncus suggests that they may play a role in mediuncal adduction.

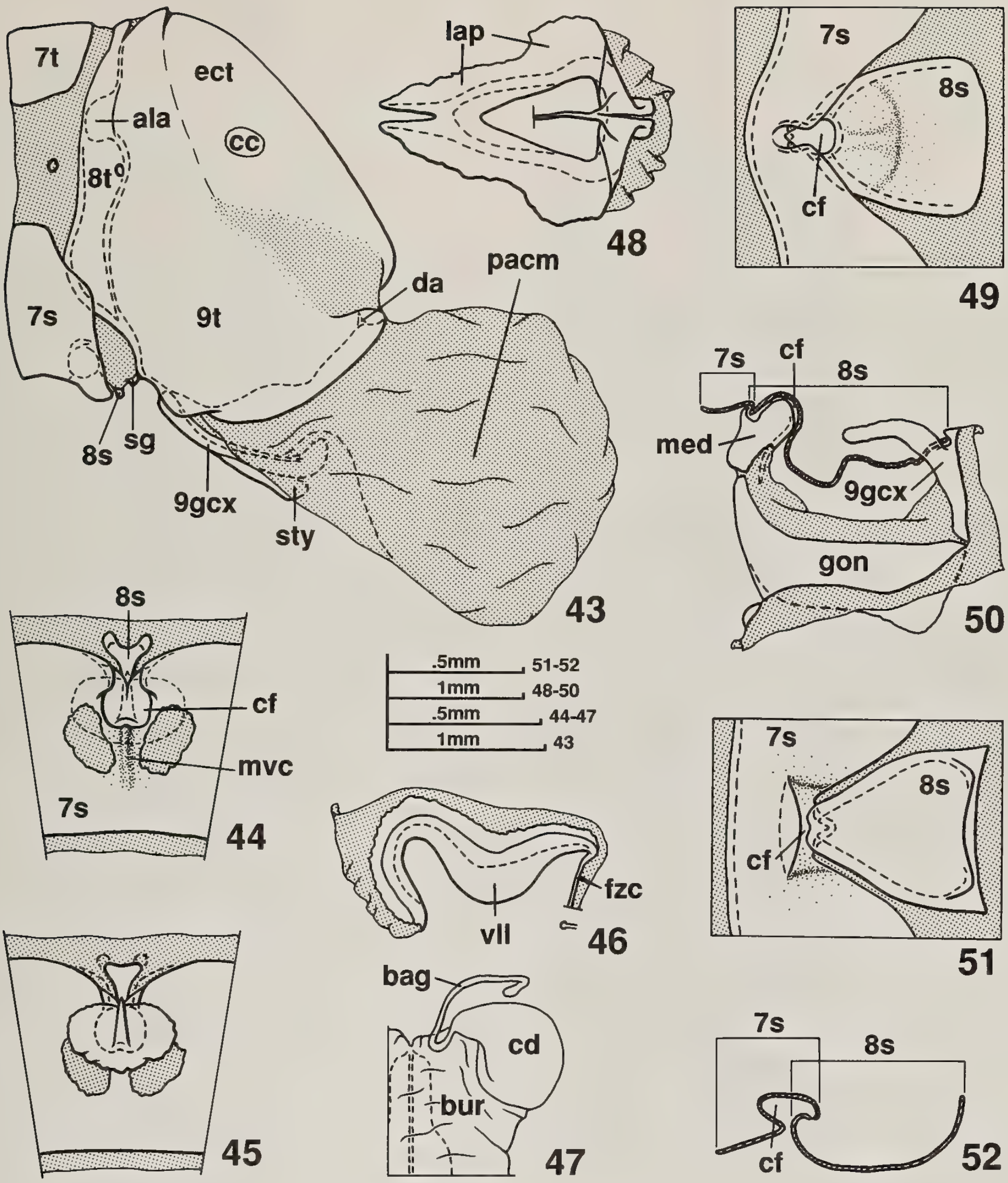
9th Gonocoxites (Fig. 23, 9gcx), a pair of partially setose, bilaterally symmetrical sclerites associated with the posteroventral angles of the hemigonarcus, and which are clearly fused sagittally (except in *Psychopsis coelivaga*, where the gonocoxite apices are closely associated, but not fused) to form an arcuate ventral bridge between the hemigonarcus; variously lobed distomedially, superprocesses present in all psychopsine species, absent in zygophlebiine species; each gonocoxite usually bears internally a ventrolongitudinal costa, sometimes also with distoventral apodemes. In nearly all psychopsid species, the motion of the 9th gonocoxites is a dorsal-ventral arc around their more or less dicondylic articulation with the posteroventral angles of the hemigonarcus. The only exception I have noted to this condition is found in *Psychopsis illidgei* (Fig. 26), where the gonocoxites overlie, and are joined for a considerable distance to, the posteroventral margins of the extrahemigonarcus. In this species, the 9th gonocoxites may be essentially fixed in position, although a clear suture separating the two sclerites is still present.

Hypandrium Internum (Fig. 36), a small sclerite of standard neuropterous form, i.e., triangular dorsal view, with a depressed median longitudinal keel and revolute lateral margins. This sclerite is associated with the apex of an eversible, membranous gonosaccus and may serve as an insertion site for gonosaccal adductor muscles.

FEMALES

Female terminalic structures (Fig. 43) can be divided into two systems: (1) an outer system of sclerites comprised of the 7th sternite [7s], 8th tergite [8t] and sternite [8s; =praegenitale, sensu Tjeder], 9th tergite [9t], subgenitale [sg], 9th gonocoxites [9gcx, sensu Adams; =gonapophyses laterales, sensu Tjeder), 9th gonocoxite styli [sty], ectoprocts [ect] (=10th [+?11th] hemitergites [+?cerci]), subanale (Tjeder, 1960:179, fig. 358, sap; =?10th sternite remnant), and postgenitalia (Tjeder, 1960:179, fig. 359, pop); and (2) an inner system of principally membranous components comprised of the posterior abdominal chamber [pacm; ="genital chamber" in part, sensu Tjeder], oviducts, bursa [Fig. 47, bur; ="spermatheca" in part, sensu Tjeder], and bursal appendages, i.e., the colleterial gland, colleterial accessory gland, bursal accessory gland(s) [Fig. 47, bag; = "glandulae accessoriae," sensu Tjeder], spermatheca [Fig. 46; ="spermatheca" in part, sensu Tjeder], and fertilization canal [Fig. 46, fzc].

Notes on Terminology and Homology.—Tjeder (1960) treated the ultimate and penultimate ventral sclerites of the female abdomen anterior to the ovipore under the names subgenitale and praegenitale. I interpret Tjeder's praegenitale as the female 8th sternite. The setiferousness of this sclerite (except in *Silveira*, where the loss of setae apparently facilitates insertion of the male 9th gonocoxites under the posterior margin of the female 7th sternite during copulation), together with its location immediately behind the 7th sternite



Figs. 43-52. 43-47, *Zygophlebius* new species (=zns1), female. 43, abdominal apex, lateral (membranous posterior abdominal chamber artificially everted to show its extent and proximal association with 9th tergite). 44-45, 7th and 8th sternites showing inflated copulatory fovea. 44, ventral. 45, dorsal. 46, spermatheca, lateral. 47, portion of bursa showing corniform diverticula and associated bursal accessory gland, dorsal. 48-50, *P. barnardi*, female. 48, spermatheca, ventral. 49, 7th and 8th sternites showing configuration of copulatory fovea, ventral. 50, same, with sternites in sagittal section and with male mediuncus/gonarcus/9th gonocoxite complex shown in its presumed copulatory position. 51-52. *P. elegans*, female. 51. 7th and 8th sternites showing configuration of copulatory fovea, ventral. 52, same, sternites in sagittal section. Abbreviations associated with the illustrations: **7s**, **8s**, sternites; **7t**, **8t**, **9t**, tergites; **9gcx**, 9th gonocoxite; **ala**, anterolateral apodeme; **bag**, bursal accessory gland; **bur**, bursa; **cc**, cercal callus; **cd**, corniform diverticula; **cf**, copulatory fovea; **da**, distal apodeme; **ect**, ectoproct; **fzc**, fertilization canal; **gon**, gonarcus; **lap**, lateral apodemal plate; **med**, mediuncus; **mvc**, midventral carina; **pacm**, posterior abdominal chamber membrane; **sg**, subgenitale; **sty**, stylus; **vll**, ventrolateral lobe.

and frequently transverse orientation corroborate its homology with the 8th sternite.

The homology of Tjeder's subgenitale is less certain. Its position between the 8th sternite and ovipore can be interpreted as (1) a pair of fused 8th gonocoxites [+?8th gonapophyses], (2) a 9th sternite, or (3) a novel secondarily developed sclerite. Since information available on this sclerite is currently inconclusive as to its homology, I have retained for it Tjeder's neutral term subgenitale. In psychopsids, the subgenitale is always small, asetose, and bears a pair of protrudent posterolateral lobes that insert into a pair of shallow depressions, one borne on the membranous anteromedian face of each female 9th gonocoxite. The weakly sclerotized portions of these depressions were designated postgenitalia by Tjeder (1960). They were interpreted as 9th gonapophyses by MacLeod and Adams ([1968]:248) in berothids, but are here regarded as simple secondary sclerotizations of the inner walls of the 9th gonocoxites, for which the name postgenitalia is retained. This system, i.e., a terminally bilobed subgenitale mating with a pair of impressed and weakly sclerotized "postgenitalia," is a common feature in many neuropterous families (e.g., Chrysopidae, Hemerobiidae, Psychopsidae, Nymphidae, Polystoechotidae). The system may have evolved as a mechanism to seal the posteroventral aspect of the abdomen—by linking the contralateral 9th gonocoxites, thus concealing the ovipore—and/or as a means of directing ova emerging from the ovipore into the sagittal canal between the female 9th gonocoxites (Bitsch, 1984:36). The wide distribution of this system within the Neuroptera suggests that it is either of considerable antiquity or has evolved parallelly in numerous lineages.

I adopt here the homologization by MacLeod and Adams ([1968]:248) of Tjeder's "gonapophyses laterales" with the female 9th gonocoxites; the later term is used here.

The exocrine gland appendages of the neuropterous bursa have yet to be adequately surveyed in a comparative manner across the families of the Neuropterida (Kristensen, 1981; = Neuroptera + Megaloptera + Raphidioptera). Thus, homologies among these glands must be regarded as tentative. This has lead to several terminological uncertainties. A particular problem is the simple appellation "bursal gland(s)," which has several distinct usages. This name has been used for apparently non-homologous paired and unpaired glands and might also be applied, collectively, to all glands opening on or near the bursa. In the interest of developing a more precise glandular terminology, I recommend that the simple, unmodified, phrase "bursal gland(s)" be reserved for the collective sense above and that other terms or modified phrases be adopted for presumably homologous glands or gland pairs. Accordingly, I use the designation bursal accessory glands (=glandulae accessoriae of Tjeder, 1960:203, fig. 448) for the plesiomorphic pair of glands inserted distally on the bursa in psychopsids. Similar, possibly homologous, paired glands are found in many other neuropterid families (e.g., Principi, 1949:332, fig. 14, "glandole della borsa copulatrice" [Chrysopidae]; Monserrat, 1990:71, figs. 11-12, 14 [Hemerobiidae]; Adams, 1969:7, fig. 6, "spermatheca" [Osmylidae]; Quartey and Kumar, 1973:94, fig. 8, "accessory glands" [Ascalaphidae]; Oswald, unpublished data, *Nymphes* [Nymphidae], *Agulla* [Raphidiidae], *Halter* [Nemopteridae], *Polystoechotes* [Polystoechotidae]). An additional, unpaired, gland is present in at least some raphidiids (e.g., *Agulla*) and osmylids (e.g., *Kempynus*).

Outer System (Female).—8th Tergite (Fig. 43), hemiannular, very narrow dorsally, wider ventrally; enclosing spiracles of 8th somite; posteroventral margins solidly fused to 9th tergite; posterodorsal fusion less complete, approximate path of 8t/9t suture generally well marked by 9th tergite antecosta. **9th Tergite**, narrow dorsally, greatly expanded posteroventrally; antecosta dorsal to spiracles of 8th somite produced as a pair of short, broad, apodemes; posteroventral margins pilose and inwardly revolute. **Ectoprocts**, subtriangular; apices attenuate, inwardly revolute, and pilose; anterior margins partially fused to 9th tergite, but the intervening suture lines are generally discernable; cercal callus present, bearing trichobothria. **Subanale**, prominent; setose. **7th Sternite**, ± hemiannular; posterior margin generally emarginate or undulate; posteromedial surface modified, generally as a distinct depression; antecosta generally prominent. **8th Sternite**, highly and variously modified in all species, narrow and transverse (e.g., *Silveira*, *Balmes*), to small and globular (e.g., *Cabralis*, *Zygophlebius*), or secondarily enlarged and triangular/trapezoidal (e.g., many *Psychopsis*); free or fused to posterior margin of 7th sternite; anteromedian surface sometimes depressed. **Subgenitale**, vestigial; a small, asetose, plate bearing a pair of small lateral protuberances. **9th Gonocoxites**, present; spathulate; each bears

(1) a dorsolongitudinal costa, (2) a subapical stylus, and (3) an apical-subapical aggregation of elongate, spathulate, setae. **9th Gonocoxite Stylus**, present; arising subapically from the ventral surface of the 9th gonocoxites; always bears a ventral field of highly modified "digging" setae. **Postgenitalia**, present; a pair of small, weakly sclerotized, invaginations located at the proximal ends of the membranous mesal walls of the 9th gonocoxites.

Inner System (Female).—Posterior Abdominal Chamber, present, a large internal space bounded by a membranous sac that fills the hollow created by the fused 8th and 9th tergites and ectoprocts; opens posterior to bursal opening and 9th gonocoxite insertions between pilose posteroventral margins of 9th tergite; lacks inserted exocrine glands. **Bursa**, a large membranous sac opening ventrally behind subgenitale and between bases of 9th gonocoxites; walls continuous ventrally with spermatheca; frequently containing amorphous spermatophore remnants; colleterial and colleterial accessory glands present, opening through membrane joining contralateral 9th gonocoxites, which is continuous with dorsal wall of bursa; one pair (2 pairs in some *Zygophlebius*) of bursal accessory glands present, each gland opening on dorsodistal surface of bursa through a separate duct (a single duct in *Balmes birmanus*; apparent points of insertion may vary depending upon degree of inflation of bursa). **Spermatheca**, a well-sclerotized, longitudinally oriented, structure attached to ventromedial aspect of bursa; slit-entry type, with narrow dorsal slit effectively dividing spermathecal (proximal) portion of insemination/fertilization canal from main bursal chamber; sometimes bearing prominent apodemes (e.g., some *Psychopsis* species, Fig. 48, lap) or lobes (i.e., Zygophlebiinae, Fig. 46, vll). **Insemination/Fertilization Canal**, proximal portion passing through spermatheca, constricted at proximal end of spermatheca and continued toward common oviduct as a thin duct.

HYPOTHESIZED MECHANICS OF COPULATION AND OVIPOSITION

COPULATION

Overview.—Copulation is the coupling of male and female terminalia preparatory to sperm transfer. In psychopsids, stable coupling is presumed to be accomplished by active confinement of the female 8th sternite between the opposable mediuncus and 9th gonocoxites of the male. The principal actions in the hypothesized copulatory sequence are listed in temporal order below. The numbered actions correspond to identically numbered sections given under the succeeding heading, "Evidence," where morphological evidence supporting each action is presented.

Copulatory Sequence.—(1) Copulation occurs venter to venter with the abdominal apices oriented in opposite directions. (2) The male mediuncus is inserted into the female copulatory fovea. Adduction of the mediuncus, by flexion of the mediuncal adductor muscle, partially links the abdomens together by rotating the apex of the mediuncus internally under the female 8th sternite or by solidifying its position within the fovea. While adducted, the proximodorsal surface of the mediuncus lies adjacent or adpressed to the posteromedian surface of the female 7th sternite. (3) Concurrent adduction of the male 9th gonocoxites, whose distal surfaces catch on or under the posterior margin(s) of the female 7th or 8th (or both) sternite(s), opposes the action of the mediuncus. The combined motions of the male mediuncus and 9th gonocoxites lock the male and female terminalia together by trapping the female 8th sternite between the mediuncus, anteriorly, and the 9th gonocoxites, posteriorly [except in *Silveira*, see Taxonomic Differences below]. (4) Following this linkage, access to the external opening of the female bursa—at rest concealed by the overlying 9th gonocoxites and ventrally extended lateral surfaces of the 9th tergite—is probably provided by lateral separation of the free, but sagittally adpressed, female 9th gonocoxites. This separation is most likely accomplished by the imposition between them of the apex of the male 9th sternite. (5) With the female 9th gonocoxites spread and the bursal opening exposed, the male gonosaccus is everted directly into the bursa, where the spermatophore is deposited.

Evidence.—(1) This orientation is the standard copulatory position in neuropterid insects (e.g., Megaloptera: Elliott, 1977:33, fig. 13 [Sialidae]; Neuroptera: Johnson and Morrison, [1980]:396 [Coniopterygidae]; Principi, 1949:353, fig. 29 [Chrysopidae]; Hennig, 1990:194, fig. 5 [Myrmeleontidae]), and is corroborated in psychopsids by the orientations and alignments of individual male and female terminalic components.

(2) The principle evidence supporting insertion

of the male mediuncus into the ventromedian fovea between female sternites 7 and 8 during copulation is the close correlation between male mediuncal shapes and female foveal configurations (including modifications to the adjacent portions of the female 7th and 8th sternites). This evidence seems incontrovertible. Summaries of the correspondence between the morphologies of the male mediuncus and female copulatory fovea and sternites in each psychopsid genus are given below.

Silveira. The copulatory fovea is a narrow chamber into which the slender male mediuncal apex is inserted. Adduction of the mediuncus rotates the mediuncus under the narrow, transverse, strap-like 8th sternite, and presses the proximodorsal surface of the mediuncus against the posteromedian surface of the female 7th sternite. In *Silveira rufus, occultus*, and *marshalli* the dorsal surface of the male mediuncus bears a pair of elevated proximolateral lobes. In females of these species the posteromedian depression of the 7th sternite is cordate, comprised of a pair of lateral depressions (which receive the mediuncal lobes) divided by a short anteromedian ridge (which receives the depression between the mediuncal lobes). In *jordani*, the male lacks dorsolateral mediuncal lobes, and the posteromedian depression of the female 7th sternite is simple, not cordate.

Cabralis. In both species the copulatory fovea is a posteriorly arched invagination that precisely mirrors the shape of the apically decurved male mediuncus. The female 8th sternite is a small rounded sclerite which forms an external reinforcing cap over the apex of the fovea. Except for its deep posteromedial emargination, which facilitates insertion of the large male mediuncus into the copulatory fovea, the posteromedian surface of the female 7th sternite is little modified.

Zygophlebius. The copulatory fovea in *zebra* and *leoninus* is a shallow pit bearing a narrow appendix into which the mediuncal apex inserts. In zns1 the fovea forms an inflated spheroid (also bearing an appendix). The shape in the latter species correlates with, and is likely a modification to accommodate, the distolateral setal tufts of the male mediuncus, which are present only in this species. The mediunci of all three species are recurved, and the degree of recurvature is positively correlated with the developmental state of the sagittal cusp on the posterior margin of the female 7th sternite (i.e., the larger the cusp the more recurved the mediuncus).

Balmes. In this genus the copulatory fovea is a shallow cavity protruded for a short distance under the anteromedian margin of the transverse 8th sternite. The fovea accommodates only the slightly curved apices of the male mediuncus.

Psychopsis. Copulatory foveae in this genus exhibit considerable interspecific variation, and include significant modifications to the female 7th and 8th sternites in most species. Mediuncus/(fovea+sternite) correspondence is most highly developed in the *illidgei* and *gracilis* species groups. For example: [1] in *illidgei*, the proximodorsal surface of the mediuncus bears a pair of erect lateral blades which fit into a symmetrical depression on the posteromedian surface of the female 7th sternite, and [2] in *barnardi* (Fig. 50), the enlarged (apomorphic) distoventral lobe of the mediuncus fits precisely into a deep, rounded, depression on the anteromedian face of the 8th sternite; sagittally, the anterior margin of this pit slightly overlaps the posterior margin of a smaller depression on the posteromedian surface of the 7th sternite; the emarginate distal surface of the plesiomorphic portion of the mediuncus (i.e., the small "hook" on the dorsal mediuncal surface) fits into the 7th sternite depression, with the plesiomorphic mediuncal apex catching on the overlapped 8th sternite margin; the mediuncus/(fovea+sternite) correlation in this species is especially striking.

(3) An active copulatory role for the male 9th gonocoxites is suggested by several aspects of their general morphology: [1] the presence of a ventral costa, which provides both stiffening for the narrow sclerites and reinforced sites for muscle insertion, [2] the presence of setae, suggesting a sensory role for these sclerites, and [3] the diversity of apical lobes on these sclerites. Given the position of their articulation with the gonarcus and their location ventral to the mediuncus, the most probable functional role of the 9th gonocoxites is to oppose the adduction of the mediuncus. This role is strongly supported by the automatic positioning of the 9th gonocoxites behind the posterior margins of the female 7th and 8th sternites when the mediuncus is inserted into the copulatory fovea. The copulatory positioning of the male 9th gonocoxites is discussed further under Taxonomic Differences below.

(4) At rest, the opening to the female bursa is concealed by the ventrally prolonged 9th tergites and the bases of the female 9th gonocoxites. Access to the bursal opening might be accomplished by either the posterior withdrawal of the 9th tergite/

gonocoxite complex or by lateral separation of the loosely adpressed gonocoxites. The latter mechanism seems simpler and is probably actually employed. Although spreading of the female 9th gonocoxites may be entirely under the voluntary control of the female, a number of morphological observations suggest that the male 9th sternite is structurally capable and positionally available to spread the female 9th gonocoxites after the male gonarcus/mediuncus/9th gonocoxite complex has firmly clasped the female.

First, it must be noted that the male 9th sternite articulates proximolaterally with the ventrolateral angles of the male 9th tergite. Distal to these points of articulation, the lateral margins of the 9th sternite bear strengthening longitudinal costae, which are also produced internally as a pair of short apodemes. The presence on the 9th tergite of well-sclerotized apodemes and articulations reinforced by thickened costae suggests that the motions of the 9th sternite are under active muscular control, and that abduction of the 9th sternite could exert significant pressure. Second, with the mediuncus and male 9th gonocoxites firmly grasping the female 8th sternite the ventral surface of the male 9th sternite lies directly against, or immediately adjacent to, the proximal ends of the female gonocoxites. This confirms that the 9th sternite, in copulatory position, occupies a position suitable to exert posterior pressure on the female 9th tergite and/or gonocoxites. Furthermore, the tightly linked male and female terminalia provide a solid foundation from which to exert such pressure. Third, since the adducted male 9th sternite closes the distoventral surface of the male abdomen, this sternite must be abducted at some time during copulation to allow eversion of the male gonosaccus. Fourth, in some taxa (e.g., *Z. leoninus* and *Silveira* species) the male 9th sternite appears longitudinally folded. One effect of such a fold could be to narrow the sternite along its midline, which could be an adaptation for easier penetration between the female 9th gonocoxites.

The alternative mechanism proposed for uncovering the opening to the bursa, i.e., posterior withdrawal of the female 9th tergite/gonocoxite complex, is also consistent with all of the above morphological observations. Under this mechanism, however, the ventral surface of the male 9th sternite is postulated to abut on the proximal ends of the female 9th gonocoxites and the anteroventral angles of the female 9th tergites; subsequent abduction of the male 9th sternite would then lever the entire female 9th tergite/gonocoxite complex posteriorly, rather than simply laterally displace the female 9th gonocoxites.

(5) Spermatophore transfer between the sexes is confirmed by the frequent presence of spermatophore remnants located deep within the bursa in macerated female specimens. The presence of an eversible male gonosaccus has been confirmed by artificial eversion of this structure in macerated male specimens. Eversion of the male gonosaccus directly into the female bursa is inferred from the adjacent alignment of these structures when the terminalia are linked as described above. This conclusion is further supported by [1] the typically deep observed insertion of the spermatophore within the bursa, [2] the presence in several species (i.e., all *Balmes* species and *P. insolens*) of one (or two) pairs of spiculate lobes located on the proximal surface of the everted gonosaccus (these lobes probably serve to anchor the everted gonosaccus within the bursa), and [3] the presence of a hypandrium internum associated with the apex of the gonosaccus (this sclerite probably serves as an insertion site for gonosaccal retractor muscles).

Taxonomic Differences.—Several copulatory features appear to be characteristic of all extant psychopsids. These include: (1) presence of a female copulatory fovea to receive the male mediuncus, (2) a means of "trapping" of the female 8th sternite by the male mediuncus and 9th gonocoxites to effect coupling, (3) probable use of the male 9th sternite to expose the female bursal opening, and (4) presence of an eversible male gonosaccus. However, clade-specific differentiation among several details of this generalized copulatory system have also been observed.

These differences may be divided into two classes. First, a "male mediuncus/female copulatory fovea" class, comprised of variations in the detailed configurations of the female copulatory fovea, including the adjacent portions of the 7th and 8th sternites, together with correlated changes in the morphology of the male mediuncus. Seve[ral] modifications falling into this class have been discussed above. Second, a "male 9th gonocoxite/female 7th or 8th sternite" class, comprised of variations in the details of contact between the male 9th gonocoxites and female sternites during coupling. Variations within this class are discussed below.

A major dichotomy exists between the

Zygophlebiinae and Psychopsinae with regard to the principle female sternite clasped by the male 9th gonocoxites during coupling. In the Psychopsinae, in which a prominent female 8th sternite is present, the male 9th gonocoxites insert under the posterior margin of this sternite; in the Zygophlebiinae, in which the female 8th sternite is reduced, the male 9th gonocoxites insert under the posterior margin of the female 7th sternite.

The zygophlebiine genera *Cabralis* and *Zygophlebius* appear to be transitional between the Psychopsinae and the zygophlebiine genus *Silveira* for this linkage trait. In the former genera a lobate, median, female 8th sternite is present, but, through the combination of a pair of parasagittally protruded female 7th sternite lobes and a pair of distolateral male 9th gonocoxite lobes, the female 7th sternite and male 9th gonocoxites are able to link laterally around the female 8th sternite. In *Silveira* the female 8th sternite is greatly reduced, being present as a narrow transverse bar which lacks setae or protruding lobes. In this genus the male 9th gonocoxites insert under the female 7th sternite, but over (with the female in ventral view) the female 8th sternite. Trapping of the 8th sternite in this case is accomplished by folding the apex of the mediuncus completely beneath 8th sternite, and, presumably, by pressing the sternite against the ventral (rather than dorsal) face of the male 9th gonocoxites. It is interesting to note that all *Silveira* species exhibit a broad, membranous emargination of the male 9th gonocoxites distomedially. This feature ensures that when the sclerotized male 9th gonocoxites are inserted beneath the female 7th sternite they do not interfere with the insertion of the mediuncus into the copulatory fovea, or the adduction of the mediuncus beneath the female 8th sternite. A similar apical male 9th gonocoxite notch is present in *Cabralis*, which allows the 9th gonocoxites to avoid interference with the large, arcuate, copulatory fovea found in that genus.

The linkage system in *Z. leoninus* has apparently diverged in another direction. This species bears a pair of transverse parasagittal scrobes on the posterior margins of the female 7th sternite. These grooves appear to receive during copulation the prominent pair of extrahemigonarcal processes located on the posterior margin of the male gonarcus. However, in *Z. zebra*, which also possess male extrahemigonarcal processes, female 7th sternite scrobes are lacking.

The posterior clasping mechanism in most psychopsine species is relatively homogeneous, but it has been modified somewhat in the *gracilis* group of *Psychopsis*. The plesiomorphic mechanism involves insertion of the small superprocesses of the male 9th gonocoxites under the posterior margin of the female 8th sternite during coupling. This pattern is found in *Balmes*, the *coelivaga, insolens*, and *illidgei* groups of *Psychopsis*, and possibly also *P. gracilis*. However, among the remaining species of the *gracilis* group with known males, i.e., *elegans, mimica*, and *barnardi* (males of *dumigani, margarita, maculipennis*, and *tillyardi* are unknown), the superprocesses appear to be too long to be effectively inserted under the 8th sternite. In these species the elongate superprocesses appear to lie adjacent to the external face of the 8th sternite during coupling, while the posterior margin of this sternite is caught by other smaller lobes near the apex of the gonocoxal arch. For example, in *barnardi* (Figs. 23, 25) and *mimica*, the catch probably consists of the paired structures designated below as the *subprocesses* [Character 25]. It is also possible that the female subgenitale may play a role in the posterior linkage mechanism in this species group.

Discussion.—In view of the varied and apparently species-specific nature of the interlocking copulatory elements of male and female psychopsids, it seems likely that these sclerites function as effective prezygotic barriers to interspecific hybridization. However, whether these structures evolved specifically as reproductive isolating mechanisms, or merely fulfill this role as a functional consequence of their gross morphological differentiation, cannot be critically resolved at present.

Although the individual morphological components of psychopsid terminalia had been described in some detail by previous workers, no reference to the copulatory mechanism described here has been found in any prior literature. At least in hindsight this seems surprizing given the simple elegance of the system. Determination of the generality of this or similar copulatory linkage systems within the order Neuroptera is hampered by our inadequate knowledge of copulatory mechanisms in most other families. However, detailed examination of the terminalic structures of the few outgroups used in this study suggests that what might be called "sternal confinement" coupling systems may be widespread within the Neuroptera. For example, in *Polystoechotes punctatus* the male mediuncus and 9th gonocoxites appear to create an enclosure suitable for confinement of the female subgenitale. In *Nymphes myrmeleonoides* the greatly enlarged posterodorsal process of the male mediuncus seems to insert into a voluminous membranous pouch located midventrally between the posterior margin of the female 6th sternite and the anterior margins of the 7th hemisternites, while the distally forked male 9th gonocoxites confine the posterior margins of the female 7th hemisternites. The largely unexplored character system of male/female coupling mechanisms may hold promise for the identification of characters phylogenetically informative at interfamilial levels of universality, and thus help to resolve the historically elusive phylogeny of neuropterous families.

OVIPOSITION

Overview.—Oviposition is interpreted broadly here to include the set of egg manipulative events occurring between the emergence of an ovum from the ovipore to its release [deposition] by the female. It is suggested here that normally laid psychopsid eggs are actively "powdered" prior to deposition with finely granulated plant and/or mineral material sequestered within the female posterior abdominal chamber. The hypothesized sequence of ovipositional events by which this occurs are given in temporal order below. The numbered events and/or actions correspond to identically numbered sections given under the succeeding heading, "Evidence," where morphological evidence supporting each event/action is presented.

Oviposition Sequence.—(1) Prior to the emergence of mature eggs from the ovipore, the female posterior abdominal chamber is actively filled with finely granulated plant and/or mineral material. (2) Eggs emerging from the ovipore are temporarily held at the proximal end of the female 9th gonocoxites, where they are coated with an adhesive secretion(s) derived from the colleterial and/or colleterial accessory glands. (3) "Adhesive" eggs pass to the distal end of the 9th gonocoxites, are inserted into the posterior abdominal chamber, and are powdered with the granulated material contained therein, which adheres to the colleterial gland secretion(s). (4) "Powdered" eggs are removed from the posterior abdominal chamber by the 9th gonocoxites and deposited.

Evidence.—(1) Tjeder (1960:172) was apparently the first author to comment on the general presence of large quantities of finely pulverized plant and/or mineral material contained within the abdominal apices of female psychopsids. Tjeder's general observations on African species were corroborated in New's ([1989a]:843) study of Australian psychopsids, and are further attested to here. Similar pulverized materials have been found inside the posterior abdominal chambers of nearly all female specimens of all species I have examined.

Tjeder accounted for the presence of this material by suggesting that it was passively acquired during the process of oviposition in bark crevices. However, several observations suggest that this hypothesis may be faulty. First, I am unaware of any reports of similar materials being held within the abdominal apices of other female neuropterans, even though many are known or strongly presumed to oviposit in similar sites; second, the inflated abdominal apex of psychopsid females does not seem well adapted to insertion in narrow crevices for the purpose of oviposition; third, the abdominal apex of female psychopsids appears to be capable of firm closure, suggesting that passive entry of extraneous materials during oviposition would be unlikely; fourth, the quantity of material typically observed within the abdominal apex would seem to be an acute irritant, if unintentionally acquired, and would probably be expelled before reaching the volumes normally observed; and, fifth, the morphological complexity of the organ within which the material is stored—i.e., a very large membranous sac enclosed within a distinctive bulbous chamber formed by the fusion of three posterior abdominal tergites—would seem to imply a functional connection between the organ and the material contained within it, suggesting a purposeful rather than accidental acquisition of the material. Each of these observations is consistent with the alternative hypothesis that the pulverized materials are actively acquired by the female for sequestration within the chamber, with the likely use of the material as a powdery coating for the eggs.

The hypothesis of active acquisition of the pulverized materials is further supported by other morphological features of the female abdominal apex. One obvious corollary of this hypothesis is the requirement of a mechanism by which such materials may be "internalized," i.e., the abdomen must possess morphological equipment suitable for filling the posterior abdominal chamber. Several observations implicate the 9th gonocoxites in this role. First, their general location—midventrally between the opposed ventral margins of the 9th tergite, with their posterior apices positioned at the opening of the chamber—is consistent with such a function. Second, their range of motion—a vertical arc around a pair of hinges which loosely join the anterior (proximal) ends of the gonocoxites to the adjacent ipsilateral margins of the 9th tergite—confers upon their posterior (distal) ends the ability to cross through the plane formed by the ventrally opposed 9th tergite margins, and renders them functionally capable of transporting externally gathered pulverized materials into the internal posterior abdominal chamber. Third, at least two ancillary gonocoxite structures further support this view: (1) the presence of "digging" setae on the ventral surface of the 9th gonocoxite stylus, and (2) the presence of a stiffening longitudinal costa running much of the length of each gonocoxite.

Digging Setae. All female psychopsids possess a field of strongly modified setae on the ventral surface of each gonocoxite stylus. Within these fields each seta is short, stout, flattened, and slightly concave. Attribution of a digging function to these setae is supported by their overall conformation, their invariable restriction to the ventral surfaces of the styli, and the consistently anterior alignment of their concave faces. While one function of these setae could be the preparation of cavities for egg deposition, another possible function is their use as rasps to dislodge and pulverize fragments of vegetable and/or mineral material from larger semisolid substrata in preparation for its uptake into the posterior abdominal chamber.

Longitudinal Costae. The presence of a prominent costa strengthening the longitudinal axis of each 9th gonocoxite is consistent with the use of these sclerites as load bearing organs. While serving as an attachment site for controlling musculature, these costae would also serve to stiffen the gonocoxites and oppose the bending forces associated with lifting (of material into the posterior abdominal chamber) and digging activities.

One final trait which should be mentioned is the dense pilosity associated with the opposed and incurvate posteroventral faces of the female 9th tergite. As suggested by Tjeder (1960:169), these pilose regions undoubtedly act in concert to seal the entry slit into the posterior abdominal chamber with a dense mat of overlapping setae. However, I suggest that their primary function is to prevent the accidental spillage of materials already contained within the chamber, rather than to prevent the unintentional uptake of such materials from the outside.

(2) The psychopsid ovipore opens midventrally between the female subgenitale and the bursal opening, and immediately adjacent to the anterior ends of the 9th gonocoxites. Consequently, eggs emerging from the ovipore pass directly into the anterior end of a sagittoventral canal, the *gonocoxal canal*, which is framed laterally by the symmetrically parasagittal 9th gonocoxites. When situated at the anterior end of the gonocoxal canal the ova lie adjacent to the orifice(s) of the colleterial and colleterial accessory glands, which open sagittally through the membrane forming the canal's roof. Coating an egg thus positioned with adhesive substances would be a simple matter of discharging glandular secretions into the canal, aided possibly by manipulation of the egg by the gonocoxites to spread the secretions. Because of their implication in the production of similar products in other neuropterous families (e.g., Chrysopidae), and the position of their opening(s) in the roof of gonocoxal canal, the origination of adhesive egg coating substances in the colleterial and/or colleterial accessory glands seems likely.

(3) Ova positioned proximally within the gonocoxal canal are separated from the posterior abdominal chamber by the membrane which forms the roof of the canal. However, this membrane is indented distally, resulting in the production of the apices of the gonocoxites as a pair of short free lobes. To enter the posterior abdominal chamber it seems likely that ova pass along the length of the canal until they reach the point where termination of the canal roof permits their insertion into the posterior abdominal chamber by the apices of the 9th gonocoxites. Active control of egg placement within the chamber by the gonocoxites is plausible given the range and direction of gonocoxal motions discussed above.

The primary function of the embowed, cochleariform, suprastylar setae located at the apices of the gonocoxites is uncertain. Two possibilities are: (1) they may facilitate manipulation and/or powdering of ova previously placed within the posterior abdominal chamber, or (2) they may play a role in aggregating materials destined for insertion into the chamber, i.e., they may act as a "broom" to consolidate materials loosened by the digging setae. The typically enlarged, concave, apices of the suprastylar setae and their location immediately behind the gonocoxal styli (which bear the digging setae) perhaps support the latter role better than the former.

(4) Removal of powdered eggs from the posterior abdominal chamber by the 9th gonocoxites is principally supported by the range of motion of these structures, which allows them to physically transport objects from within the chamber to outside the body.

Discussion.—The fact that the postulated final product of the oviposition sequence described above, i.e., eggs coated with pulverized plant and/or mineral materials, is indeed produced in at least some psychopsids is confirmed by Gepp's (1990:136) passing mention of several unpublished observations of the production of such eggs by three different workers (Gepp, Mansell, and Minter), in several African species of *Cabralis* and *Silveira*.

The only published information of which I am aware which might seriously discount the universality of the laying of powdered eggs is Tillyard's account of oviposition in *Psychopsis elegans*. Tillyard ([1919b]:789, 814-815) records the deposition of apparently unpowdered eggs from a captive female of this species. The eggs laid by this female were mostly cemented to an offered cotton-wool substrate. Tillyard's observations are difficult to reconcile with the current morphological finding in *elegans* of a well-developed posterior abdominal chamber filled, as in other psychopsids, with pulverized materials. Tillyard's observations might be explained in several ways. First, powdering of eggs could be under facultative control of the female, rather than obligatory. This might be supported by Gepp's (1990) comment that eggs laid in captivity by some *Silveira* species "*usually* have a sand covering" (italics mine). Second, the laying of unpowdered eggs could be an abnormal behavior induced by unnatural captive conditions. Or, third, Tillyard's female could have been a young lab-reared or wild-caught individual with an empty posterior abdominal chamber. Such a condition, perhaps due to the lack of exposure to a suitable powder source or an age dependency associated with the onset of chamber filling behavior, would necessarily result in unpowdered eggs. Unfortunately, Tillyard's limited comments do not allow confident discrimination among these alternatives.

However, the deposition of uncoated eggs under abnormal captive conditions by some antlion species which normally cover their eggs with a sand coating has been documented (e.g., *Creoleon plumbeus*; see Gepp, 1990: figs. 41 & 42), and this may be the simplest explanation of Tillyard's results.

The ovipositional habits of psychopsids may be unusual in other respects as well. In particular, all extant psychopsids probably oviposit while in flight. While yet unproven, morphological evidence and at least one behavioral observation can be marshalled in support of this hypothesis.

Morphological Evidence. The in-flight oviposition hypothesis presupposes the existence of morphological equipment in female psychopsids which is suitable for the manipulation, temporary retention, and subsequent deposition of eggs following their emergence from the ovipore. As argued above, the shape, position, linkage, and range of motion of the 9th gonocoxites implicate these structures as the primary dynamic components in the ovipositional process of psychopsids. Eggs emerging from the gonopore pass directly into the adjacent proximal end of the gonocoxal canal, which is framed laterally by the 9th gonocoxites. As each egg passes down the canal it is coated by secretions from the colleterial glands and, upon reaching the distal end of the canal, is inserted into the posterior abdominal chamber to be coated with granular materials. Following coating, each egg is removed from the chamber by the tips of the 9th gonocoxites, which subsequently release the eggs to effect deposition. This entire process appears to be completely independent of contact with any external surface; and there is little doubt that it could be easily accomplished by a flying female psychopsid.

However, perhaps the most compelling piece of morphological evidence supporting in-flight oviposition is the existence of the remarkable posterior abdominal chamber, which functions as the specialized internal receptacle for carrying egg coating materials. While the benefits of possessing such a chamber are obvious for animals which deposit granularly coated eggs in flight, comparable benefits are difficult to imagine for ground-standing egg depositors. (Psychopsids are here inferred to deposit their eggs on the ground surface because their granularly coated, non-adhesive, eggs appear particularly maladapted for deposition in the elevated sites utilized by many other neuropterous taxa, and because they lack obvious morphological adaptations for egg deposition in crevices [i.e., elongate ovipositors] or below the ground surface [i.e., long narrow abdomens and/or broad fields of digging setae on the abdominal apex].) Such ground-standing depositors would, presumably, have relatively ready access to granular ground-surface materials near their oviposition sites, and, thus, would appear to be unlikely candidates for the development a specialized internal chamber within which to sequester such materials.

In addition to holding egg-coating materials, the posterior abdominal chamber may also function as a short-term (seconds/minutes) storage site for eggs prior to deposition. However, it seems unlikely that psychopsids routinely use this chamber for longer-term (hours/days) egg storage. The latter assertion is supported by the observation that eggs have never been reported from the macerated posterior abdominal chambers of preserved specimens, even though the usual presence of granular materials within the chambers of these specimens strongly suggests that the vast majority of them were collected during their periods of active oviposition. This observations suggests that each psychopsid egg is individually coated and deposited before the next egg emerges from the ovipore.

Another interesting, but currently unanswerable, question about the precise method of egg deposition in psychopsids is whether the eggs are passively dropped or are actively thrown and/or directed when released. The slender form and proximal articulation of the 9th gonocoxites would appear to be compatible with either method.

Finally, the ubiquity of in-flight oviposition among extant silky lacewings is suggested by the strong similarity in the form of the distal abdominal structures of the females of all species (excluding sternites 7 and 8, and the copulatory fovea, which function as part of the species-specific copulatory apparatus). Intertaxon similarity is particularly striking in two character complexes which are apparently unique to female psychopsids; these are: [1] the presence of the posterior abdominal chamber and the highly fused tritergal framework (8t+9t+ectoprocts) which encloses it, and [2] the presence of a coordinated pair of slender 9th gonocoxites which articulate in a vertical plane around a pair of articulations located on the ventral margins of the 9th tergite. It is difficult to imagine these complex character traits as anything other than adaptations to a single distinctive ovipositional mechanism which is shared by all psychopsids.

Behavioral Observations. Probable in-flight egg-deposition behavior has been observed in the field by L. Minter, H. & U. Aspöck, and H. Hölzel, at Ingwe in the South African state of Transvaal. Minter (pers. comm.) reported that the observed behavior consisted of a distinctive jerky, dipping, flight pattern preformed by *Cabralis gloriosus* while flying low over leaf litter. Minter noted that this flight pattern was reminiscent of the in-flight ovipositional behaviors of some dragonflies and tipulids, except that the psychopsid abdomen was never touched to the ground. Although no eggs were recovered or definitely seen to be dropped, the consensus among the observers was that egg deposition was occurring.

Gepp (1990) briefly mentioned the possible existence of in-flight ovipositional behaviors in a few taxa scattered throughout the families Psychopsidae, Nemopteridae, and Myrmeleontidae. The data presented here go far toward demonstrating the existence of this behavior within the Psychopsidae from the standpoint of morphology. However, more detailed field studies of the aerial behavior of psychopsids are still needed to conclusively demonstrate in-flight oviposition in this family. I would encourage neuropterists and/or behaviorists with the capacity to undertake field work when and where psychopsids are present to further investigate this interesting behavioral possibility.

PHYLOGENETIC ANALYSIS

METHODS

Overview.—Relative phylogenetic relationships among extant psychopsids were estimated cladistically (Hennig, 1981; Wiley, 1981). Sixty characters (147 total character states) were numerically coded for: [1] 21 (of 26; Table 2) extant psychopsid species, [2] eight outgroup species (Table 1), and [3] one hypothetical ancestor. The resulting data set (Appendix 2) was analyzed with the computer program HENNIG86 (Version 1.5; Farris, 1988) to identify minimum length trees and to infer the cladogram mapping of synapomorphic traits. Characters were treated as ordered binary pairs (0 = plesiomorphic, 1 = apomorphic), except as follows (character #-# states-[o]rdered/[u]nordered): 1-5-u; 6-3-o; 8-3-o; 10-3-o; 14-3-o; 16-3-o; 17-3-o; 18-5-u; 22-5-u; 24-3-o; 36-3-o; 38-4-u; 40-3-o; 41-3-o; 45-3-o; 46-3-o; 50-3-o; 51-3-o; 56-3-o; 57-3-o.

Hypothetical Ancestor and Outgroups.—Eight outgroup species (Table 1) were initially included

Table 1. Outgroup taxa used in the initial cladistic analysis of the family Psychopsidae, and for the subsequent assignment of character states to the hypothetical ancestor. Species are grouped by superfamilies (sensu Withycombe, [1925]) and families.

Order / Superfamily / Family	Species
Neuroptera	
Hemerobioidea	
Hemerobiidae	*Nomerobius signatus*
Polystoechotidae	*Polystoechotes punctatus*
Osmyloidea	
Osmylidae	*Kempynus falcatus*
Osmylidae	*Osmylus fulvicephalus*
Myrmeleontoidea	
Nemopteridae	*Halter halterata*
Nymphidae	*Nymphes myrmeleonoides*
Nymphidae	*Osmylops armatus*
Raphidioptera	
Raphidiidae	*Agulla adnixa*

in the cladistic analysis as a means of polarizing psychopsid character states. These outgroups were selected as follows: (1) species within the families Hemerobiidae, Poly-stoechotidae, Nemopteridae, and Nymphidae were selected as representatives of the superfamilies "Hemerobioidea" and "Myrmeleontoidea," within which previous authors had placed the family Psychopsidae, (2) species of the family Osmylidae were selected because of their plesiomorphic ocellar configurations, and (3) *Agulla adnixa* was included as a root outgroup lying outside the order Neuroptera.

Hennig86 analyses using the 21 ingroup and 8 outgroup taxa resulted in a single ingroup topology (Fig. 53), but several divergent outgroup arrangements. Except for confamilial outgroup species, which always clustered together, the Nelson consensus tree of the outgroup topologies was completely unresolved. Because the character states used in the cladistic analysis were not explicitly selected with the aim of resolving interfamilial relationships, the different outgroup resolutions obtained in these analyses were judged too speculative for presentation here.

Because no single outgroup taxon was clearly established as the sister group of the Psychopsidae in these initial analyses, a ground-plan outgroup methodology using a single hypothetical ancestor derived from the eight initial outgroups was adopted for the final analysis. Character states were assigned to the hypothetical ancestor by applying the following rule: for each character assign to the hypothetical ancestor the character state with the broadest distribution among the initially employed outgroup families, i.e., the state found in the highest proportion of the outgroup families (not species). The only exception to this rule was character 1, the inferred polarity of which is discussed in detail under its character treatment below.

CHARACTERS

The 60 characters and 147 character states included in the cladistic analysis are treated below. Characters are grouped according to major body region, i.e., head, thorax, male terminalia, and female terminalia. Each character treatment is composed of four elements: (1) the character number and name, (2) a brief description of each character state, (3) a Comments section containing notes and discussion pertinent to the character and its states, and (4) a Change List outlining the mapping of the character on the final cladogram (Fig. 53). Change lists are given in the abbreviated format: node#-node#(state#-state#). For example, under Character 1, the notation "10-14(0-1)" is read: Character 1 changes from state 0 to state 1 between cladogram nodes 10 and 14. If a state change occurs on a terminal lineage, the second node# is replaced with the appropriate species name, e.g., "3-

coelivaga(1-2)." Whole-family synapomorphies are indicated by the notation "HypAnc-1(state#-state#)," where "HypAnc" represents the hypothetical ancestor used to root the cladogram. In cases where multiple equally parsimonious optimizations of a character are possible on the final cladogram (characters 1, 6, 19, 21, 24, 28, 36, 45, 54, and 56), separate change lists are given for each optimization, with the optimization plotted on the cladogram listed first.

HEAD (Characters 1-2)

1. Vertex, ocellar/cranial pulvinae.
(0) 3 well-developed ocellar/cranial pulvinae present, 2 dorsolaterals + 1 ventromedial (Tjeder, 1960:175, fig. 341);
(1) 2 distinct ocellar/cranial pulvinae present [dorsolaterals], ventromedial pulvinus either vestigial [its position marked by a few setae or an area of thinned cuticle, e.g., some *Psychopsis*] or absent [lost] (Tjeder, 1960:192, fig. 405; 198, fig. 433);
(2) 0 ocellar/cranial pulvinae present [all lost].

Comments: "Ocelli" have been cited as "vestigial" or "absent" in recent psychopsids (Tillyard, [1919a]; Kimmins, 1939; Tjeder, 1960); however, these works have used the term "ocelli" loosely. The pulvinate, setose, excrescences of the head capsule to which this name has been formerly applied are here called *ocellar/cranial pulvinae*. I suggest, as justified below, that these pulvinae are enlarged manifestations of the small *ocellar pulvinae* upon which neuropterid ocellar corneae are typically borne, rather than modifications of the "ocelli" (i.e., ocellar corneae) themselves.

In the orders Megaloptera and Raphidioptera, sister groups of the Neuroptera (Kristensen, 1981), three ocellar corneae are commonly present and are arranged in the normal pattern (i.e., in an anteriorly directed, bilaterally symmetrical, triangle situated on the cranial vertex above the antennal toruli). Each cornea is borne on the outer side of a small naked prominence, the *ocellar pulvinus*. Within the Neuroptera, distinct ocellar corneae persist only in some osmylids (Link, 1909), where they are borne on the outer sides of presumably homologous, but setose, pulvinae.

Ocellar corneae are absent in psychopsids, but their supporting pulvinae have apparently persisted in most species in the form of 2 or 3 cranial prominences (the ocellar/cranial pulvinae). The partial homology of these prominences with the ancestral ocellar pulvinae is supported by their (1) number [never more than three: 3, 2, or 0], (2) arrangement [an anteriorly directed triangle if 3, a bilaterally symmetrical pair if 2], (3) position on cranium [above and behind the antennal toruli], and (4) setiferousness [as in osmylid ocellar pulvinae]. The large size of psychopsid pulvinae relative to those of megalopterans, raphidiopterans, and osmylids seems best explained by secondary enlargement of the small ancestral pulvinae, whose precise conformation, position, and extent were no longer constrained by the presence of functional ocelli. Cranial pulvinae also occur in the families Dilaridae (e.g., Minter, 1986: fig. 1) and Berothidae (Tjeder, 1959:283, figs. 254-256). Whether these structures also represent partial homologues of ocellar pulvinae requires further study.

Given the broad distribution of ocelli in the Insecta, including the raphidiopterans and most megalopterans, it is reasonable to assume that the presence of ocelli represents a ground plan feature of the Neuropterida. However, their general absence in the Neuroptera, except for some osmylids, is striking and well documented (New, 1989b:54). Because of uncertainty about interfamilial relationships within the Neuroptera it is not currently possible to confidently infer the ocellar state likely to have existed in the immediate ancestor of the Psychopsidae. For the present analysis the hypothetical ancestor has been conservatively coded as state (0). This implies that the ancestor of the Psychopsidae lacked ocellar corneae but bore cranial pulvinae. Given the presence of corneae in some osmylids, however, the presence of corneae in the immediate ancestor of psychopsids cannot be entirely ruled out. The presence of three well-developed ocellar/cranial pulvinae is considered the most plesiomorphic state found within the Psychopsidae, followed by sequential loss of the single median, then the paired dorsolateral, pulvinae.

Change lists: [1] 1-2(0-1), 3-*coelivaga*(1-2), 10-14(0-1); [2] HypAnc-1(0-1), 3-*coelivaga*(1-2), 10-11(1-0).

2. Margin of torulus, medial antennifer.
(0) absent (e.g., Tjeder, 1959:283, fig. 256 [Berothidae]);
(1) present (Tjeder, 1960:175, fig. 341; 192, fig. 405; 198, fig. 433).

Comments: The presence of a single antennifer on the outer lateral rim of each torulus is apparently plesiomorphic within the Neuroptera. The development of a second antennifer on the medial rim of the torulus is a synapomorphy of the Zygophlebiinae.

Change list: 1-10(0-1).

THORAX (Characters 3-9)

3. Forewing, transverse bilineate fasciae.
(0) absent;
(1) present (New, [1989a]:864, figs. 59-62; 862, fig. 42).

Comments: Presence of these distinctive forewing fasciae has previously been used to distinguish either the genus *Psychopsis* (s.str.), or an informal species group within this genus (Kimmins, 1939; New, [1989a]). In the present analysis they are interpreted as a synapomorphy of the *gracilis* group of *Psychopsis*.

Change list: 5-6(0-1).

4. Forewing, light brown transverse bars.
(0) absent;
(1) present (Tjeder, 1960:193, fig. 412).

Comments: Presence of this barred forewing pattern is interpreted as a synapomorphy of *Zygophlebius*; although the condition found in zns1 differs somewhat from that found in *zebra* and *leoninus*. In zns1 the barring is often rather irregular proximally, and breaks up distally into a mottled pattern reminiscent of a *Silveira* species. In *zebra* and *leoninus* the bars remain approximately concentric and more or less discrete along the length of the wing, but diminish significantly in intensity toward the wing apex (in the distal half of the wing bars are often lacking). The pattern of barring is generally rather faint in all three species.

Change list: 14-15(0-1).

5. Forewing, number of Sc-R1 crossveins.
(0) 1 [but occasionally with 1 or 2 additional adventitious crossveins];
(1) >4 [but rarely <10] (Fig. 32).

Comments: Proliferation of subcostal crossveins (state 1) is tentatively interpreted here as synapomorphy of the Psychopsidae. It should, however, be noted that elevated numbers of subcostal crossveins are encountered sporadically in several other neuropterous families (e.g., Nymphidae, New, 1981; Hemerobiidae, Oswald [1993]). Although the numerous subcostal crossveins in these taxa appear to be the result of parallel increases within the different families, a higher level of universality of this character within the Neuropterida cannot yet be entirely ruled out. In scoring the present character, subcostal crossvein numbers were counted in psychopsids between the base of the subcostal space and the distal closure of the "vena triplica" (by crossvein or Sc-R1 anastomosis), and, in the outgroup species, to a similar distal region of the subcostal space.

Change list: HypAnc-1(0-1).

6. Forewing, crossveins of costal gradate series.
(0) absent or few [mean < or = 5 crossveins/wing] (e.g., New, [1989a]:858, fig. 6);
(1) numerous [mean > 5 crossveins/wing, usually >> 5] (Fig. 32).

Comments: Some psychopsid species exhibit considerable intraspecific variation in costal crossvein number. However, variation across the division number selected here, 5, appears to be rare. Evolution of a well-developed costal gradate series is interpreted here as a synapomorphy of the Psychopsidae, but one which has been secondarily lost independently in *Balmes* and *Zygophlebius* zns1. A second equally parsimonious optimization of this character would interpret the absence of a costal gradate series in the Psychopsidae as plesiomorphic, followed by independent evolution of costal gradate series in the Zygophlebiinae and *Psychopsis*, and its loss (reversal) in *Zygophlebius* zns1. Costal gradate series also occur sporadically in several other neuropterous families (e.g., Hemerobiidae, Myrmeleontidae, Rapismatidae), where they have certainly arisen independently.

Change lists: [1] HypAnc-1(0-1), 2-18(1-0), 15-zns1(1-0); [2] 1-10(0-1), 2-3(0-1), 15-zns1(1-0).

7. Forewing, shape of humeral plate.
(0) compact (Fig. 40);
(1) elongate [intermediate between states (0) and (2)] (Fig. 39);
(2) digitiform (Fig. 38).

Comments: Some species of *Zygophlebius* and *Psychopsis* are characterized by particularly long, digitiform, humeral plates (state 2). A small, compact, plate is here interpreted as the plesiomorphic state (0). Intermediate states (1) occur in *Silveira*, *Cabralis*, and *Zygophlebius* zns1.

Change list: 1-10(0-1), 3-4(0-1), 3-4(1-2), 15-16(1-2).

8. Forewing, width of costal space in pterostigmal region.
(0) narrow [<2 times combined width of adjacent Sc and R1 spaces];
(1) broad [>2 times combined width of adjacent Sc and R1 spaces] (Fig. 32).

Comments: Pterostigmata are absent in all psychopsids. For the purposes of this character the pterostigmal region is taken to be the costal space anterior to the distal portion of the "vena triplica." In all psychopsids the costal space in this region is especially broad. This trait is interpreted as a synapomorphy of the Psychopsidae.
Change list: HypAnc-1(0-1).

9. Hind wing, distal macula.
(0) absent;
(1) present, large, enclosing anastomosis (Fig. 33, b);
(2) present, large, posterior to anastomosis (Fig. 33, d);
(3) present, large, distal to anastomosis (Fig. 33, c);
(4) present, small, directly on anastomosis (Fig. 33, a).

Comments: The presence or absence of a distal hind wing macula has long been used to group species within the Psychopsidae (McLachlan, 1902; Tillyard, [1919a]; Kimmins, 1939). This character is divided here into one absence and four "presence" states, the latter based on the size and position of the macula relative to the "anastomosis" (the distal termination of the "vena triplica"). These states were analyzed as unordered in the cladistic analysis because of a priori uncertainty about their polarity within the family.

The small macula found in *Zygophlebius* species (state 4) is not homologous with the maculae found in *Psychopsis*, s.l. Among the other three presence states, a macula enclosing the anastomosis (state 1) was found to be a synapomorphy of *Psychopsis* (as here defined). States (2) [macula posterior to the anastomosis] and (3) [macula distal to the anastomosis] are interpreted as independent secondary shifts of the macula away from its plesiomorphic position encompassing the anastomosis. These states are synapomorphic of the *gracilis* [state (2)], and *insolens* [state (3)] groups of *Psychopsis*.
Change list: 2-3(0-1), 4-20(1-3), 5-6(1-2), 14-15(0-4).

MALE TERMINALIA (Characters 10-39)

7th and 8th somites (Characters 10-11)

10. Male 8th somite, spiracles.
(0) opening normally through membranous pleural membrane;
(1) opening through secondarily sclerotized regions of the pleural membrane which are dorsally seamlessly continuous with the ventrolateral margins of the 8th tergite (Fig. 1);
(2) opening in the pleural membrane associated with small, free, sclerotized plates (Fig. 6).

Comments: With few exceptions, the spiracles of the psychopsid male 8th somite open through the ventrally extended lateral surfaces of the 8th tergite. The absence of these tergal extensions in *Psychopsis coelivaga* is interpreted as a secondary reversal to the ancestral state (0); while in *Balmes birmanus*, the small sclerotized plates associated with the spiracles of the 8th somite appear to represent vestigial remnants of earlier tergal extensions which have become secondarily divided from the main body of the tergite.
Change list: HypAnc-1(0-1), 3-*coelivaga*(1-0), 19-*birmanus*(1-2).

11. Male 8th sternite, posteromedian lobe.
(0) absent;
(1) present (Fig. 12, pml).

Comments: This character refers to the distinct but inconspicuous, setiferous bulge located sagittally at the apex of the 8th sternite in *Cabralis* and *Zygophlebius*.
Change list: 10-14(0-1).

9th somite (Characters 12-27)

12. Male 9th tergite, free posteroventral process.
(0) absent;
(1) present (Fig. 17, pvp).

Comments: In *Cabralis gloriosus* and cns1, the posteroventral angles of the 9th tergite are produced as short angular processes. These processes are a synapomorphy of *Cabralis*.
Change list: 14-17(0-1).

13. Male 9th tergite, costa bracing point of ectoproct articulation.
(0) absent;
(1) present (Fig. 1, bc).

Comments: In all psychopsids the anterior margins of the ectoprocts are broadly hinged to, and loosely articulate with, the posterolateral margins of the 9th tergite. In *Silveira rufus, occultus,* and *marshalli,* the ventral articulation between the ectoproct and 9th tergite is braced by a costa on the inner surface of the 9th tergite. This costa is a synapomorphy of these three species of *Silveira.*
Change list: 11-12(0-1).

14. Male 9th tergite and sternite, articulation.
(0) poorly developed [i.e., tergal and sternal costae bracing articulation either both absent or only one (either) present], or entirely absent;
(1) well developed [i.e., articulation reinforced by both tergal and sternal brace costae] (Figs. 12, 17).

Comments: In the outgroups examined the 9th tergite and sternite are either unarticulated or only weakly articulated. In all psychopsids the anterolateral angles of the 9th sternite articulate directly on the elongate anteroventral angles of the 9th tergite, and both sclerites possess well-developed internal costae bracing the point of articulation. The derived state is interpreted as a synapomorphy of the Psychopsidae.
Change list: HypAnc-1(0-1).

15. Male 9th sternite, anterolateral apodemes.
(0) absent;
(1) present, lying entirely [or principally] in-line [or dorsal] to a line extended anteriorly from the midline of the proximal portion of the lateral costa of the 9th sternite in lateral view (Fig. 12, ala);
(2) present, lying entirely [or principally] ventral to a line extended anteriorly from the midline of the proximal portion of the lateral costa of the 9th sternite in lateral view (Figs. 21 [ala], 30).

Comments: In psychopsids the lateral costae of the 9th sternite are projected anteriorly beyond their points of articulation with the 9th tergite as a pair of short *anterolateral apodemes.* Similar apodemes were absent in the examined outgroups, even where the 9th tergite and sternite were articulated, and their presence in the Psychopsidae is interpreted as a family synapomorphy. The orientation of the anterolateral apodemes differs between the two psychopsid subfamilies. In the Zygophlebiinae the anterolateral apodemes are largely anterior linear extensions of the lateral apodemes; in the Psychopsinae, the anterolateral apodemes have been displaced ventrally (a synapomorphy of this subfamily).
Change list: HypAnc-1(0-1), 1-2(1-2).

16. Male 9th sternite, shape (ventral view).
(0) not parallel sided or particularly narrow;
(1) narrow and parallel sided (Fig. 2).

Comments: The shape of the 9th sternite exhibits considerable interspecific variation among psychopsids. In the four species of the genus *Silveira* the 9th sternite is especially narrow. In this genus, the anteroventral angles of the 9th tergite are narrowly elongated and inwardly curved. This has resulted in a narrowing of the proximal end of the 9th sternite, and a change in the course of its lateral apodemes from posteriorly convergent to approximately parallel. This correlated set of modifications is considered a synapomorphy of *Silveira.*
Change list: 10-11(0-1).

17. Male 9th sternite, thickness of lateral costa.
(0) lateral costa absent;
(1) thin to moderately thick (Fig. 41);
(2) extremely thick, massive (Fig. 42).

Comments: In all psychopsids the lateral, or sublateral, margins of the 9th sternite are reinforced by internal costae. Although similar costae were found in the outgroup *Polystoechotes punctatus,* most outgroups examined lacked such costae. The presence of these costae in psychopsids is here tentatively regarded as a synapomorphy of the family. In several species of the *gracilis* group of *Psychopsis* (e.g., *elegans, mimica,* and *barnardi*), these costae are greatly thickened (a synapomorphy of these species).
Change list: HypAnc-1(0-1), 6-7(1-2).

18. Male 9th sternite, mesal spurs of lateral costae.
(0) absent;
(1) present, distinct but not robust, aligned with distal portions of lateral costae (Fig. 30);
(2) present, very robust, not aligned with distal portions of lateral costae (Fig. 21).

Comments: In addition to the prominent lateral costae of the 9th sternite, members of the *illidgei* and *gracilis* species groups of *Psychopsis* possess a spur arising medially from each lateral costa (a synapomorphy of these groups). The form and position of these spurs exhibit some interspecific variation. In the plesiomorphic condition, found in *P. illidgei* and *gracilis*, the spurs are distinct but relatively weakly developed, run more or less longitudinally, are aligned with the distal portions of the lateral costae, and insert at a distinct bend in the lateral costae. In the derived condition, a synapomorphy of *P. elegans*, *mimica*, and *barnardi*, the spurs are short but very robust, run more transversely, are not aligned with the distal portions of the lateral costae, and do not insert at a distinct bend in the lateral costae.

Change list: 4-5(0-1), 6-7(1-2).

19. Male 9th sternite, configuration of apex.
(0) apex rounded or transverse, largely membranous, without a sagittal emargination (Fig. 7);
(1) apex with a shallow emargination setting off a pair of rounded parasagittal lobes (Fig. 2);
(2) apex robust, with 2-4 prominently protrudent rounded lobes (Fig. 22);
(3) apex elongate and attenuate, tapering to a long filiform process (Fig. 30);
(4) apex bearing a pair of small, angulate, parasagittal cusps separated by a shallow emargination (Fig. 31).

Comments: The conformation of the apex of the male 9th sternite varies extensively among psychopsids. Because no clear polarization was apparent among the observed states, the five states of this character were treated as unordered in the cladistic analysis. The following unambiguous synapomorphies were inferred for states (1) and (4): state (1) is independently derived from state (0) in *Silveira*, *Zygophlebius zebra* + *leoninus*, and bns1, and state (4) is derived from state (0) in *Psychopsis coelivaga*. Three equally parsimonious optimizations of states (2) and (3) are possible due to ambiguities in assigning an ancestral state to node 5. The optimization plotted on the cladogram arbitrarily posits the independent derivation of state (3) [in *illidgei*] and state (2) [in the *gracilis* group] from an ancestral state (0).

Change lists: [1] A + B; [2] A + C; [3] A + D; where A = 3-*coelivaga*(0-4), 10-11(0-1), 15-16(0-1), 19-bns1(0-1); B = 5-*illidgei*(0-3), 5-6(0-2); C = 4-5(0-2), 5-*illidgei*(2-3); D = 4-5(0-3), 5-6(3-2).

20. Male 9th sternite, subapical dorsomedial cavity.
(0) absent;
(1) present (Fig. 22, dmc).

Comments: *Psychopsis elegans*, *mimica*, and *barnardi* each bear a peculiar heavily-walled pit medially on the dorsodistal surface of the 9th sternite. In each of these species, the size and shape of the pit closely corresponds to the size and shape of the distal portion of the mediuncus. This fact, together with the observation that dorsad movement of the 9th sternite apex (resulting from vertical rotation of the 9th sternite around its proximolateral articulations with the 9th tergite) would bring it in close proximity to the mediuncus, strongly suggests that these cavities act as protective recesses for the mediunci. Among the examined species, these pits are restricted to, and constitute a synapomorphy of, *elegans*, *mimica*, and *barnardi*, although an incipient pit structure appears to be present in *gracilis*, the sister species of this clade. Tjeder (1960:167) casually noted the presence of this structure in mimica, and compared it to the "gonapsis" found in some chrysopids. The cladogram (Fig. 53) shows that this structure is clearly derived within the Psychopsidae and is not a homolog of chrysopid gonapses.

Change list: 6-7(0-1).

21. Male 9th gonocoxites, ventral costae.
(0) present, long and prominent, extended at least 1/2 the distance from the gonarcus/9th-gonocoxite articulation to the sagittal midline of the 9th gonocoxites (Fig. 34, vc);
(1) absent, or, at most, a short thickening bracing the gonarcus/9th gonocoxite articulation (Fig. 10, vc).

Comments: In most psychopsids the ventral, or near ventral, margin of each 9th gonocoxite is strengthened internally by longitudinal costa. These costae are reduced or absent (lost) in the three species of the genus *Balmes* and in *Psychopsis illidgei* and *gracilis*. Two equally parsimonious optimizations of this character are possible for the last two species. In the first (plotted on the cladogram), costae are independently lost in *illidgei* and *gracilis*; in the second, costae are lost between nodes 4 and 5, but regained between nodes 6 and 7. In both optimizations, costae are unambiguously lost in *Balmes*.

Change lists: [1] 2-18(0-1), 5-*illidgei*(0-1), 6-*gracilis*(0-1); [2] 2-18(0-1), 4-5(0-1), 6-7(1-0).

22. Male 9th gonocoxites, dorsolateral sclerotized plates.
(0) absent (Fig. 35);
(1) present, proximal portion not flared laterally [or 9th gonocoxite absent] (Fig. 34, dlp);
(2) present, proximal portion flared laterally (Fig. 14, dlp).

Comments: In the presumed plesiomorphic condition (state 1), the gonosaccal membrane inserts on the dorsal margins of the 9th gonocoxites along narrow sclerotized plates lying dorsad of the longitudinal ventral costae. In *Psychopsis elegans*, *mimica*, and *barnardi* these plates are absent (lost) and the gonosaccal membrane arises directly from the dorsal surfaces of the longitudinal costae (state 0). In *Zygophlebius* the sclerotized plates are enlarged, and flared dorsally and laterally (state 2).

Change list: 6-7(1-0), 14-15(1-2).

23. Male 9th gonocoxites.
(0) free, not fused, distally;
(1) fused distally.

Comments: Both free and distally fused 9th gonocoxites are widely distributed states in the Neuroptera. Among examined psychopsids, the 9th gonocoxites are fused distally in all species except *Psychopsis coelivaga*, where their sclerotized apices touch but are not solidly fused. Distally fused 9th gonocoxites are here tentatively regarded as a synapomorphy of the family, while the reversal to an unfused state is regarded as a autapomorphy of *P. coelivaga*.

Change list: HypAnc-1(0-1), 3-*coelivaga*(1-0).

24. Male 9th gonocoxites, superprocesses.
(0) absent or vestigial [or 9th gonocoxites absent] (Fig. 3 [absent]);
(1) present, a pair of short, stout, distal lobes (Fig. 34, spp);
(2) present, a pair of long, narrow, recurved processes (Fig. 23, spp);
(3) present, a pair of inflatable lobes braced by a stout anteromedial costa (Fig. 35, spp);
(4) present, fused, represented by a transverse tumulus crossing the fused 9th gonocoxites distally (Fig. 10, spp).

Comments: In the subfamily Psychopsinae, each 9th gonocoxite bears a erect dorsodistal process either in the form of a small rounded mound or an elongate lobe. Considerable interspecific diversity occurs in these lobes, but, because of their protrudent form, similar points of origination, and general bearing of setae, they are all treated here as homologous states of a common ancestral structure. I follow New ([1989a]) in calling these structures *superprocesses*. It should be noted that the structures to which Tjeder (1960) applied this term in the zygophlebiine genera *Zygophlebius* (figs. 415-416) and *Cabralis* (figs. 436-437) are only analogs; they are not homologs of psychopsine superprocesses, nor are they even homologous processes among the African genera. Tjeder's "superprocessus" in *Zygophlebius* is a modification of the proximodorsal margin of the 9th gonocoxite [Character 22, state 2], while his "superprocessus" in *Cabralis* is a lobe of the posteroventral margin of the gonocoxite.

Because of the lack of any clear polarity among the observed superprocessus states, the five states of this character recognized here were treated as unordered in the cladistic analysis. Nine equally parsimonious optimizations of this character are possible on the cladogram. These are due to ambiguity in the character states assigned to nodes 2 and 7. Because the states of this character were treated as unordered any of three possible states can be assigned to each of these two nodes without affecting the length of the cladogram. The optimization plotted on the cladogram hypothesizes origination of the superprocesses as a pair of stout distolateral lobes in the Psychopsinae [24(0-1)]. In *Balmes* the superprocesses are partially fused medially, and form a transverse tumulus across the apex of the gonocoxites [24(1-4)]. In *Psychopsis mimica* and *barnardi* the superprocesses are slender and extremely elongated [24(1-2)], while in *P. elegans* they are modified to form a pair of enlarged, partially inflatable, lobes braced by a stout costa [24(1-3)].

Change lists: [1] A + D; [2] A + E; [3] A + F; [4] B + D; [5] B + E; [6] B + F; [7] C + D; [8] C + E; [9] C + F; where A = 1-2(0-1), 2-18(1-4); B = 1-2(0-4), 2-3(4-1); C = 2-3(0-1), 2-18(0-4); D = 7-8(1-2), 7-*elegans*(1-3); E = 6-7(1-2), 7-*elegans*(2-3); and F = 6-7(1-3), 7-8(3-2).

25. Male 9th gonocoxites, subprocesses.
(0) absent [or 9th gonocoxites absent];
(1) present (Fig. 25, sbp).

Comments: I use the term *subprocesses* to designate the pair of small lobes adjacent to, but mesad of, the bases of the superprocesses in *Psychopsis mimica* and *barnardi*. Among the examined species, subprocesses were restricted to, and constitute a synapomorphy of, these species.

Change list: 7-8(0-1).

26. Male 9th gonocoxites, sagittal spines.
(0) absent [or 9th gonocoxites absent];
(1) present (Fig. 28, ss).

Comments: The distally fused 9th gonocoxites of *Balmes* bns1 and *Psychopsis illidgei* each bear a single spinose sagittal process dorsodistally. The process is emarginate apically in bns1, simple apically in *illidgei*. The processes in these species are clearly independently derived structures.

Change list: 5-*illidgei*(0-1), 19-bns1(0-1).

27. Male 9th gonocoxites, paired, projecting, ventrolateral lobes.
(0) absent [or 9th gonocoxites absent];
(1) present (Fig. 10, vll).

Comments: The fused 9th gonocoxite complexes of *Balmes birmanus* and bns1 bear distally a pair of ventrolateral lobes. These prominent structures are here interpreted as a synapomorphy of these two species.

Change list: 18-19(0-1).

10th [and 11th?] Somites (Characters 28-39)

28. Male ectoproct, posteroventral shape (lateral view).
(0) one apically rounded lobe (Fig. 12, ect);
(1) one apically truncate lobe (Fig. 37);
(2) two narrowed lobes (Fig. 21, ect).

Comments: Psychopsid male ectoprocts exhibit considerable interspecific variation, but generally bear a single rounded lobe posteroventrally (state 0). The ectoprocts of most members of the *gracilis* group of *Psychopsis* (e.g., *gracilis*, *elegans*, and *mimica*) are characterized by a squared, truncate, apex (state 1). Two species bear clearly bilobed ectoprocts, *Psychopsis illidgei* and *barnardi* (state 2). Transition to a truncate ectoproct form occurs as a synapomorphy of the *illidgei* + *gracilis* groups of *Psychopsis*. This hypothesis suggests that the bilobed ectoprocts of *illidgei* and *barnardi* may have been independently derived through the excavation of the flat distal surface of a truncate ectoproct, rather than by de novo outgrowth of a second marginal lobe. Because the male of *P. tillyardi* is unknown, two equally parsimonious optimizations of this character occur in the vicinity of *P. barnardi*/*tillyardi*, i.e., transition to a bilobed condition may be an autapomorphy of *barnardi* or a synapomorphy of *barnardi* + *tillyardi*. The former, more conservative, interpretation has been plotted on the cladogram.

Change lists: [1] 4-5(0-1), 5-*illidgei*(1-2), 9-*barnardi*(1-2); [2] 4-5(0-1), 5-*illidgei*(1-2), 8-9(1-2).

29. Male gonarcus, extrahemigonarcal processes.
(0) absent (Fig. 19);
(1) present (Fig. 14, ehgp).

Comments: In *Zygophlebius leoninus* and *Z. zebra*, each extrahemigonarcus bears a prominent posterior process. These processes are unique among extant psychopsids, and constitute a synapomorphy of these species. Tjeder (1960) used the term *entoprocesses* for these structures. I adopt the more general designation *extrahemigonarcal processes* because the cladogram clearly implies that these processes are not homologous with any of the other numerous processes denominated entoprocesses in other neuropterous families.

Change list: 15-16(0-1).

30. Male mediuncus, outline (dorsal view).
(0) not abruptly narrowed near mid-length [or mediuncus absent] (Figs. 24, 27);
(1) abruptly narrowed near mid-length; length of slender apex < length of broad base (Fig. 5);
(2) abruptly narrowed near mid-length; length of slender apex > length of broad base (Fig. 4).

Comments: Progressive narrowing and lengthening of the apical portion of the mediuncus is apparent in the genus *Silveira* (i.e., *jordani*, *rufus*, *occultus*, *marshalli* [least to most apomorphic]). State (1) is a synapomorphy of the species *rufus*, *occultus*, and *marshalli*, in which the apical portion of the mediuncus has become abruptly narrowed with respect to its broad base. State (2), in which the narrowed apical portion of the mediuncus has become elongated, and—at least in *marshalli*—further narrowed, is a synapomorphy of *occultus* and *marshalli*.

Change list: 11-12(0-1), 12-13(1-2).

31. Male mediuncus, proximodorsal lobes.
(0) one pair of small dorsolateral lobes present near midlength (Fig. 3, dll);
(1) lobes absent [or mediuncus absent] (Fig. 8);
(2) one pair of large parasagittal lobes present proximally (Fig. 26, psl).

Comments: One pair of symmetrically protruding lobes is present on the dorsal surface of the mediuncus in *Psychopsis illidgei* and *Silveira rufus, occultus*, and *marshalli*. Based on differences in the formation and insertion of these lobes, these lobes are here interpreted as independent developments in *Silveira* (state 0) and *Psychopsis* (state 2).

Change list: 5-*illidgei*(1-2), 11-12(1-0).

32. Male mediuncus, apex (dorsal view).
(0) simple [or mediuncus absent] (Figs. 4, 15);
(1) bifid or emarginate (Figs. 9, 27).

Comments: As noted by New ([1989a]:843), mediuncal apices of extant psychopsids are either simple [African species] or bifid [Australian and Asian species]. Both states occur widely in other neuropterous families. Based solely on the outgroups used for this study, a simple apex is tentatively assumed to be the plesiomorphic state within the Psychopsidae. Under this interpretation, a bifid apex constitutes a synapomorphy of the Psychopsinae.

Change list: 1-2(0-1).

33. Male mediuncus, apex (lateral view).
(0) linear, recurved, or weakly decurved relative to base [or mediuncus absent];
(1) strongly decurved relative to base, forming a long, stout, hook (Fig. 19, med).

Comments: The distal portions of the mediunci of *Cabralis gloriosus* and cns1 are compressed and strongly decurved, forming a flattened hook. This state is a synapomorphy of *Cabralis*.

Change list: 14-17(0-1).

34. Male mediuncus, distal end (lateral view).
(0) not recurved [or mediuncus absent];
(1) distinctly recurved (Fig. 14, med).

Comments: The presence of a subapically recurved mediuncus is a synapomorphy of the genus *Zygophlebius*. Progressively enhanced recurvature of the distal portion of the mediuncus is apparent within this genus (i.e., zns1, *zebra, leoninus* [least to most recurved]).

Change list: 14-15(0-1).

35. Male mediuncus, dorsodistal surface (transverse section).
(0) convex [or mediuncus absent or bifid];
(1) concave (Fig. 16).

Comments: In *Zygophlebius zebra* and *leoninus* the dorsal surface of the recurved mediuncal apex is distinctly impressed (i.e., concave in transverse section). This feature is a synapomorphy of these two species.

Change list: 15-16(0-1).

36. Male mediuncus, apodeme of mediuncal adductor muscle.
(0) absent [or mediuncus absent];
(1) present, inserting proximoventrally on floor of mediuncus (Figs. 19 and 23, ama);
(2) present, inserting at base of terminal mediuncal cleft (Fig. 26, ama).

Comments: In psychopsids, a mediuncal adductor muscle is postulated to insert on an apodeme arising from either the proximoventral floor of the mediuncus (African species and *Psychopsis barnardi*), or the base of the apical mediuncal cleft (Australian and Asian species, except *P. barnardi*). None of the outgroups examined possessed a distinct mediuncal adductor apodeme. The development of an adductor apodeme attached to the floor of the mediuncus (state 1) is interpreted a synapomorphy of the Psychopsidae; and the migration of this apodeme to the base of the terminal cleft (state 2) is interpreted as a synapomorphy of the subfamily Psychopsinae.

The condition found in *P. barnardi* is apomorphic (a reversal) with respect to other *Psychopsis* species. In this species a large rounded lobe has developed between the apodeme and its plesiomorphic insertion at the base of mediuncal cleft; this has resulted in secondary displacement of the adductor apodeme to the floor of the mediuncus. Because the male of *tillyardi* (sister species of *barnardi*) is unknown, the cladogram position of this reversal is ambiguous. It may represent an autapomorphy of *barnardi*, or a synapomorphy of *tillyardi* + *barnardi*. Although the deep median depression of the posterior margin of the female 7th sternite in both species strongly suggests that the male of *tillyardi*, when discovered, will possess a mediuncal configuration similar to that of *barnardi*, I have conservatively plotted this reversal on the cladogram as an autapomorphy of *barnardi*.

Change lists: [1] HypAnc-1(0-1), 1-2(1-2), 9-*barnardi*(2-1); [2] HypAnc-1(0-1), 1-2(1-2), 8-9(2-1).

37. Male mediuncal accessory sclerites.
(0) absent [or mediuncus absent];
(1) present (Figs. 14 and 26, mas).

Comments: The genitalic armature of all psychopsid males includes a pair of elongate mediuncal accessory sclerites. These sclerites are oriented longitudinally in the gonosaccal membrane, and are positioned bilaterally at the base of the mediuncus. The sclerites are generally weakly sclerotized and diffusely margined. Proximally, they are closely associated, or continuous, with the proximal end of the mediuncus; distally, they are either free or loosely fused below the extragonopons. These sclerites may provide additional sites for the insertion of muscles controlling the movement of the mediuncus. Their presence is interpreted a synapomorphy of the Psychopsidae.

Change list: HypAnc-1(0-1).

38. Male hypandrium internum, angle between dorsal margin and distal portion of "keel" (lateral view).
(0) << 90 degrees (Tjeder, 1960:195, fig. 418);
(1) approximately 90 degrees (Fig. 36);

Comments: The derived state is a synapomorphy of the *insolens*, *illidgei*, and *gracilis* groups of *Psychopsis*. No hypandrium internum was present in the nemopterid outgroup *Halter*.

Change list: 3-4(0-1).

39. Male gonosaccal membrane, rounded spiculate lobes.
(0) absent;
(1) present (Fig. 11).

Comments: The three species of the genus *Balmes*, and *Psychopsis insolens*, each bear a pair of small, but distinct, spiculate lobes ventrolaterally on the everted gonosaccus near its base. At rest, the lobes are withdrawn within the inverted gonosaccus. It seems likely that these lobes function as friction pads to grip the female and stabilize the base of the gonosaccus while it is everted during copulation and insemination. The lobes in *Balmes* and *Psychopsis* are interpreted here as parallel developments. In *Balmes terissinus*, a second smaller pair of lobes is present on the dorsal surface of the gonosaccus.

Change list: 2-18(0-1), 20-*insolens*(0-1).

FEMALE TERMINALIA (Characters 40-60)

7th and 8th somites (Characters 40-46)

40. Female 7th sternite, posterior margin.
(0) transverse and simple, without a sagittal emargination, process, or depression;
(1) with a medial emargination and/or depression (Figs. 49, 51);
(2) with a medial emargination and a sagittal process, the latter [sometimes small] representing the posterior termination of a short midventral carina (Fig. 44, mvc).

Comments: Derived state (1) is characteristic of all female psychopsids and is considered a family synapomorphy. Derived state (2) is a further synapomorphy of *Zygophlebius*.

Change list: HypAnc-1(0-1), 14-15(1-2).

41. Female 7th sternite, posterior margin.
(0) without a small sagittal cusp at the bottom of a deep depression;
(1) with a small sagittal cusp at the bottom of a deep depression (Fig. 49).

Comments: State (1) is a synapomorphy of *Psychopsis barnardi* + *tillyardi* (see also Comments under Character 45).

Change list: 8-9(0-1).

42. Copulatory fovea between female 7th and 8th sternites.
(0) absent;
(1) present (Figs. 44, 49, 51).

Comments: All female psychopsids possess a copulatory fovea located between (and sometimes extended onto) the 7th and 8th sternites. This depression/pit receives the distal portion of the male mediuncus during copulation and is a distinctive synapomorphy of the family Psychopsidae.

Change list: HypAnc-1(0-1).

43. Female 7th and 8th sternites.
(0) not fused [or 8th sternite absent (lost, not fused)] (Figs. 49, 51);
(1) fused.

Comments: State (1) is independently derived in *Balmes* and *Psychopsis illidgei*. In other psychopsids the adjacent margins of the female 7th and 8th sternites are membranously articulated, although often closely adpressed.

Change list: 2-18(0-1), 5-*illidgei*(0-1).

44. Female 8th sternite.
(0) present, hemiannular, unmodified;
(1) present, a small compact median sclerite with 1 or 2 distal lobes (Fig. 44);
(2) present, a narrow, transversely elongated sclerite (Tjeder, 1960:190, fig. 399);
(3) present, a bilaterally symmetrical, broadly triangular or trapezoidal sclerite with lateral margins marked by thickened internal costae (Figs. 49, 51).

Comments: The 8th sternites of the examined outgroups may be characterized as follows: [1] *Agulla*, homology uncertain, absent [presumed lost], or possibly homologous with a transverse, invaginated and sclerotized strip associated with the posterior margin of sternite 7, [2] *Nomerobius*, *Nymphes* and *Polystoechotes*, absent [presumed lost], [3] *Halter*, present, hemiannular, unmodified, [4] *Osmylops*, present, a pair of sagittally divided hemisternites, and [5] *Osmylus* and *Kempynus*, present, a transverse bar bearing posterolateral lobes. A distinct 8th sternite is present in all female psychopsids (Tjeder, 1960:174 incorrectly states that it is absent in *Silveira*, where it is present but reduced), but the outgroup states bear little resemblance to any psychopsid state. For the purpose of the cladistic analysis, the hypothetical ancestor has been assigned an unmodified, hemiannular, 8th sternite condition. This state is probably plesiomorphic within the Neuroptera. Among the outgroups, this state most closely resembles the condition found in the nemopterid *Halter*. The states of this character were treated as unordered in the cladistic analysis.

Under the assumptions above, modification of the 8th sternite to a narrowed, transverse, sclerite (state 2) is a psychopsid family synapomorphy, even though similar modifications have occurred in other families. Further modification of the 8th sternite into a compact median prominence (state 1) is a synapomorphy of *Cabralis* + *Zygophlebius*. Secondary enlargement of sternite 8 to form a triangular or trapezoidal structure is a synapomorphy of the *illidgei* + *gracilis* groups of *Psychopsis*.

Change list: HypAnc-1(0-2), 4-5(2-3), 10-14(2-1).

45. Female 8th sternite, small medial cusp of anterior margin.
(0) absent [or 8th sternite absent];
(1) present, apex directed dorsally [inwardly], anteromedian face of sternite without a deep rounded concavity (Figs. 51, 52);
(2) present, apex directed ventrally (outwardly) or anteriorly, anteromedian face of sternite with a deep rounded concavity (Figs. 49, 50).

Comments: In the *illidgei* and *gracilis* groups of *Psychopsis* the female copulatory fovea is comprised of a pit formed primarily from the adjacent depressed margins of the medial portions of the 7th and 8th sternites, rather than a membranous or secondarily sclerotized pit between these sclerites. Within the *gracilis* group there is an evident transformation in the location of the main depression of the fovea, from an intersternal, or 7th sternal, position to its location principally on the anteromedial face of sternite 8. This process appears to begin with the anteromedian attenuation of the 8th sternite, and, sagittally, its inward deflection as a narrow cusp (state 1), followed by the development of a secondary depression posterior to the cusp, which effectively alters the orientation of the cusp itself (state 2).

State (2) is a synapomorphy of *Psychopsis tillyardi* + *barnardi* in which the anteromedian 8th sternite cusp overlaps the posteromedian cusp of the 7th sternite. The secondary depression behind the 8th sternal cusp in females of *barnardi* correlates with, and is certainly an adaptation or coadaptation to, the presence of a large distoventral lobe of the mediuncus in males of this species (Figs. 49, 50). The presence of a similar depression in *tillyardi* strongly suggests that a similar mediuncal lobe will be found in the presently unknown male of *tillyardi*. Because no females of *gracilis* were available for examination, the universality of state (1) is uncertain. It may be a synapomorphy of the entire *gracilis* group, or of the *gracilis* group except *gracilis*. Lacking knowledge of the state in *gracilis*, the latter, more conservative, interpretation has been plotted on the cladogram.

Change lists: [1] 6-7(0-1), 8-9(1-2); [2] 5-6(0-1), 8-9(1-2).

46. Female 8th and 9th tergites.
(0) not fused;
(1) fused (Fig. 43).

Comments: In all female psychopsids tergites 8 and 9 are solidly fused along their adjacent lateral margins; this condition is synapomorphy of the family.
Change list: HypAnc-1(0-1).

9th and 10th [and 11th?] Somites (Characters 47-60)

47. Female 9th tergite, anterolateral apodemes.
(0) absent;
(1) present (Fig. 43, ala).

Comments: All female psychopsids possess a bilaterally symmetrical pair of short, broad, apodemes issuing from the 9th tergite antecosta dorsad of the 8th somite spiracles; this condition is synapomorphy of the Psychopsidae. Muscles attached to these apodemes are almost certainly responsible for adduction of the fused 8th tergite/ 9th tergite/ectoproct complex which terminates the female abdomen.
Change list: HypAnc-1(0-1).

48. Female 9th tergite, pilose posteroventral border.
(0) absent;
(1) present (Tjeder, 1960:203, fig. 441).

Comments: The posteroventral margins of tergite 9 in all female psychopsids are inwardly revolute, sagittally adpressed, and densely pilose. This condition is a family-level synapomorphy.
Change list: HypAnc-1(0-1).

49. Female 9th tergite, distal apodemes.
(0) absent;
(1) present (Fig. 43, da).

Comments: All female psychopsids possess a bilaterally symmetrical pair of slender apodemes issuing from near the dorsal angles of the posteroventral 9th tergal lobes; this condition is a synapomorphy of the Psychopsidae. Muscles presumed to attach to these apodemes probably help to control the position of the inwardly revolute posteroventral margins of the 9th tergite. These apodemes are sometimes difficult to locate, even in stained preparations.
Change list: HypAnc-1(0-1).

50. Female 9th gonocoxite, overall shape.
(0) more or less reniform;
(1) spathulate (Fig. 43, 9gcx).

Comments: The derived state is a distinctive synapomorphy of the family Psychopsidae.
Change list: HypAnc-1(0-1).

51. Female 9th gonocoxite, longitudinal costa.
(0) absent;
(1) present (Tjeder, 1960:179, fig. 361, ap).

Comments: This costa, found in all female psychopsids, stiffens the longitudinal axis of the 9th gonocoxite. The derived state is tentatively interpreted here as a family synapomorphy. Although the possibility of a higher level of universality for the derived state cannot be entirely dismissed (note its presence in some, but not all, outgroup taxa), its simple functional structure, scattered distribution among neuropterous family-level taxa, and the widely differing conformations of female 9th gonocoxites in these families suggest that longitudinal costae may have evolved independently in several different neuropterous families.
Change list: HypAnc-1(0-1).

52. Female 9th gonocoxite, longitudinal row of stiff setae.
(0) absent;
(1) present (Tjeder, 1960:179, fig. 361).

Comments: The 9th gonocoxites of *Silveira* species each bear a prominent longitudinal row of stiff setae lying ventral to, and following the course of, the longitudinal costa of the 9th gonocoxite. This row of setae is absent in other psychopsids.
Change list: 10-11(0-1).

53. Female 9th gonocoxite, aggregation of setae near insertion of stylus.
(0) absent;
(1) present (New, [1989a]:883, fig. 220, cs; 871, fig. 131).

Comments: The derived state is a synapomorphy of *Psychopsis*. Species of this genus bear a fairly tightly clustered aggregation of stiff setae adjacent to the insertion of the 9th gonocoxite stylus. This setal group is distinct from both the dense group of "suprastylar" setae [Character 54] at the apex of the 9th gonocoxites, and the more scattered proximal and ventral setae of this sclerite.

Change list: 2-3(0-1).

54. Female 9th gonocoxite, suprastylar setae.

(0) all apically unmodified acuminate setae;

(1) >50% apically unmodified acuminate setae, with at least a few elongate cochleariform setae ventrally (Tjeder, 1960:179, fig. 361);

(2) >50% cochleariform setae, generally with at least a few apically unmodified acuminate setae dorsally.

Comments: All female psychopsids bear a dense group of arched setae clustered at the distal (posterior) apex of the 9th gonocoxites. I refer to these as "suprastylar" setae (= "dorsal setae" + "ventral setae" of New, [1989a]:883, fig. 220), from their position above the gonocoxal stylus. These setae are of two forms: arched acuminate and arched cochleariform (i.e., spoon-shaped; see Tjeder, 1960:196, fig. 425). When both setal forms are present (most species) the transition between them is gradual, with the more ventral setae (i.e., closer to the gonocoxal stylus) more highly cochleariform.

Two equally parsimonious optimizations of this character are possible on the cladogram. Both optimizations interpret the evolution of cochleariform suprastylar seta (state 1) as a psychopsid synapomorphy; but, one optimization interprets the occurrence of state (2) in *Cabralis* + *Zygophlebius* and the Psychopsinae as two independent proliferations of cochleariform setae, while the second optimization accounts for the observed character distribution by postulating state (2) also as a family-level synapomorphy, followed by reduction in the numbers of cochleariform setae in *Silveira*. The former interpretation has been arbitrarily plotted on the cladogram.

Change lists: [1] HypAnc-1(0-1), 1-2(1-2), 10-14(1-2); [2] HypAnc-1(0-1), HypAnc-1(1-2), 10-11(2-1).

55. Female 9th gonocoxite stylus, short stout setae.

(0) absent [i.e., stylus setae acuminate, or stylus absent];

(1) present (Tjeder, 1960:179, fig. 361; 196, fig. 424).

Comments: All female psychopsids possess a field of stout, dished, "digging" setae, which are restricted to the ventral surfaces of the gonocoxal styli. This trait is here interpreted as a family synapomorphy. Somewhat similar terminalic setae have been reported in a few other neuropterous families (e.g., Stange, 1970:37, fig. 14, and Miller, 1990 [Myrmeleontidae]; Adams, 1967:235, figs. 20-21 [Chrysopidae]); however, they are not to my knowledge known from the gonocoxal styli of any other family. Although a specific function has not been demonstrated for these setae, their stout construction, concave and parallelly oriented anterior faces, distal location on the 9th gonocoxites, and insertions restricted to the venter of the gonocoxal styli, are all consistent with a function analogous to the teeth on a rasp, and are most likely used to loosen fine particulate matter for subsequent transfer to the posterior abdominal chamber [Character 60].

Change list: HypAnc-1(0-1).

56. Female bursa, number of inserted bursal accessory gland ducts.

(0) 1 unpaired duct;

(1) 1 pair of ducts (Tjeder, 1960:203, fig. 448, ag);

(2) 2 pairs of ducts (Tjeder, 1960:196, figs. 429 and 430, ag).

Comments: Bursal accessory glands have been reported in most families of Neuroptera, and were first elaborated upon in the Psychopsidae by Tjeder (1960), as "glandulae accessoriae." These exocrine glands insert on the distal end of the bursa by means of narrowed ducts, and are distinct from the proximomedian colleterial and colleterial accessory glands, which are also present in psychopsids. The apparent relative dorsal/ventral and lateral points of insertion of the bursal accessory gland ducts often vary with the degree of inflation of the bursa (e.g., whether spermatophore remnants are present or absent). These glands were found to be present in all examined psychopsids. They were incorrectly cited as absent in *Silveira* and *Psychopsis* by Tjeder (1960:174, 206) and in *Psychopsis* (including *Balmes*) by New ([1989a]:844]). In macerated specimens, careful preparation and staining are often necessary to detect these glands. A single pair of glands is probably plesiomorphic within the Neuroptera, and this state was found in all examined psychopsids, with the following two exceptions: (1) two pairs of glands and ducts are present in, and synapomorphic of, the clade *Zygophlebius zebra* + *leoninus*, and (2) in *Balmes birmanus* the bursal accessory gland ducts are partially fused, and reach the bursa as a single, common, median duct. The latter state is plotted on the cladogram as an autapomorphy of *B. birmanus*, but it may be a synapomorphy of the clade *birmanus* + bns1 (the female of the latter species is unknown). A character state apparently intermediate between the partially fused bursal ducts of *birmanus* and the more widely separated duct insertions of non-*Balmes* psychopsids occurs in *Balmes terissinus* (sister-species of the *birmanus* + bns1 clade), where two distinct, but very closely adjacent, duct insertions are present.

Change lists: [1] 15-16(1-2), 19-*birmanus*(1-0); [2] 15-16(1-2), 18-19(1-0).

57. Female bursa, lateral corniform diverticulae.
(0) absent;
(1) present (Fig. 47; Tjeder, 1960:196, fig. 430).

Comments: In most psychopsids the narrow ducts of the bursal accessory glands insert without enlargement onto the more or less planar surface of the bursa. In *Zygophlebius* each of the plesiomorphic pair of ducts inserts on a distinctly enlarged, attenuate, smooth-walled, distolateral lobe of the bursa. These structures, here called *corniform diverticulae* in reference to their shape, are clearly present in all three *Zygophlebius* species, but are particularly well developed in *leoninus*. Tjeder (1960:197) called these structures the "accessory structures . . . of the spermatheca." Corniform diverticulae are here considered a synapomorphy of *Zygophlebius*, but they may be incipient in *Cabralis*. In *Z. zebra* and *leoninus*, the ducts of the second pair of bursal accessory glands insert on the lateral walls of the corniform diverticulae.

Change list: 14-15(0-1).

58. Female spermatheca, ventrolateral lobes.
(0) absent;
(1) present, broad in lateral view (Fig. 46, vll);
(2) present, narrow in lateral view (Tjeder, 1960:179, figs. 363, 365).

Comments: All zygophlebiine species possess a pair of hollow ventrolateral lobes near the proximal end of the spermatheca. The presence of these lobes is here interpreted as a synapomorphy of this subfamily. It is further suggested that the narrow lobes of *Silveira* represent a secondarily constricted, and thus synapomorphic, form of the plesiomorphically broad lobes found in *Cabralis* and *Zygophlebius*. However, it should be noted that the absence of these spermathecal lobes in the Psychopsinae, and their observed distribution within the Zygophlebiinae, renders identification of the plesiomorphic zygophlebiine state somewhat arbitrary.

Change list: 1-10(0-1), 10-11(1-2).

59. Female spermatheca, lamellate apodemes extending from lateroventral margins.
(0) absent;
(1) present (Fig. 48, lap).

Comments: The derived state is interpreted as a synapomorphy of the *illidgei* and *gracilis* groups of *Psychopsis*. These plates probably function as surfaces for the insertion of muscles which consolidate the position of the spermatheca within the female abdomen. Enlarged lamellate plates extending from the sides of the spermatheca are absent in other psychopsids.

Change list: 4-5(0-1).

60. Female posterior abdominal chamber.
(0) absent;
(1) present (Fig. 43, pacm [artificially everted]).

Comments: The presence of a large membranous sac lining the hollow formed by the fused female 8th and 9th tergites and ectoprocts is a conspicuous synapomorphy of the family Psychopsidae. This sac encloses a large internal space, here called the *posterior abdominal chamber*, at the posterior end of the female abdomen. Tjeder (1960:168-169, 172) discussed this space under the name "genital chamber," and stated that it was confluent with the "spermatheca" (bursa + spermatheca as used here) by a wide membranous duct—the purported duct being shown in each of Tjeder's figures of the bursa-spermatheca complex of African psychopsids (i.e., Tjeder, 1960: figs. 363, 371, 387, 402, 427, 447) as a ductiform attenuation of the membranous bursa diverging from the proximal end of the sclerotized spermatheca. No such duct exists. In all psychopsids I have examined, the bursa simply opens through the ventral wall of the abdomen posterior to the subgenitale and between the bases of the ninth gonocoxites; it has no direct internal connection to the posterior abdominal chamber. Since the bursa and the chamber lack a connecting duct, it seems more appropriate to designate the chamber by the more generic phrase "posterior abdominal chamber," than the term "genital chamber."

Change list: HypAnc-1(0-1).

OMITTED CHARACTERS

Several characters used in earlier taxonomic works have been intentionally omitted from the suite of traits employed here to infer phylogenetic relationships within the Psychopsidae. A few of the more prominent of these characters are discussed below to document the reasons for their omission.

Vena Triplica (Fig. 32).—Tillyard ([1919a]) and subsequent authors have emphasized the presence of a venational configuration termed the "vena triplica" as a diagnostic feature of psychopsid neuropterans. According to Tillyard ([1919a]:754), this fore- and hind wing feature is formed by the "parallel" and "strengthened" basal two-thirds to three-quarters lengths of the three longitudinal veins "Sc, R [=anterior radial trace, =R1 of authors], and Rs [=anterior sectoral trace]," which are joined distally (at the "anastomosis") by crossveins or brief fusions of the longitudinal veins themselves.

After considerable reflection upon the nature of the vena triplica, I have at length concluded that it cannot be considered a psychopsid synapomorphy. Although this feature constitutes an important part of the psychopsid wing gestalt, the derived aspects of the psychopsid wing which might be associated with the vena triplica in fact seem to be due more to contrasts between the vena triplica and its surrounding venation than to the vena triplica itself. Specifically, two conditions—(1) the consistently broad forewing and hind wing costal spaces, and (2) the apparently abrupt termination, at the anastomosis, of the linearity of the longitudinal veins which comprise the vena triplica [due to localized vein fusion or constrictive crossvenation occurring at this point]—strongly enhance the visual perception of the vena triplica as a distinct entity, by acting to isolate it from the margins of the wing.

In other neuropterous families in which the proximal portions of the subcosta, anterior radial trace, and anterior sectoral trace are similarly parallel and robust (e.g., many osmylids, polystoechotids, ithonids, rapismatids, and dilarids), the visual impression of these veins is considerably different. This difference appears to be due to a visual perception of their continuation or association with the margin of the wing. This may be effected in a number of different ways, for example: (1) a consistently narrow costal space hinders visual differentiation of the three veins as an entity distinct from the anterior margin of the wing, (2) a basally wide but distally narrowed costal space presents a visual perception of the veins becoming confluent with the wing margin near the anterior aspect of its apex, and (3) a clear fusion of two or more of the veins distally often (e.g., many myrmeleontoid taxa) leads to the visual perception of a common fused vein continuing to near the wing apex. In each of these cases, unlike the condition found in psychopsids, potential isolation of the three veins is diminished by a visual tie to the wing margin.

Thus, psychopsid wings appear to differ from those of other neuropterans not in the possession of a vena triplica per se, but rather, in the possession of a consistently broad costal space and of branching patterns of the subcosta, anterior radial trace, and anterior sectoral trace which are distinctly different proximal and distal to the anastomosis.

Allometric Forewing Elements.—Froggatt (1903) and subsequent authors (e.g., Tillyard, [1919a]; Kimmins, 1939; New, [1989a]) have all noted the presence of a "raised" or "embossed" area at the apex of the forewing vena triplica in *Psychopsis illidgei*. These authors have employed this character consistently as a diagnostic feature of the genus *Megapsychops*. Rather than a "true" embossment (as found, for example, on the forewings of *Loyola croesus* [Chrysopidae] and *Gayomyia falcata* [Hemerobiidae]), this "raised" area appears to be simply part of an arcuate folding of the wing surface caused by localized allometry in forewing growth within the genus *Psychopsis*. This interpretation is consistent with the following observations. First, the four specimens of *illidgei* I have examined show a positive correlation between fold prominence and increasing forewing length. Second, similar but less developed folds occur at topographically homologous positions in the forewings of other moderate-sized *Psychopsis* species, e.g., *elegans*, *mimica*, *barnardi*, and *tillyardi*; and fold prominence in these species is typically more pronounced in larger individuals. Third, as the largest psychopsid species in terms of wing dimensions, *illidgei* would be expected (as observed) to exhibit fold development exceeding that of other species within the genus. Fourth, the smaller species of *Psychopsis*, e.g., *coelivaga*, *meyricki* and *insolens*, generally lack evidence of fold development.

The absence of evidence of fold development in African and Asian psychopsids, even within the genus *Silveira* where considerable interspecific variation in forewing size is apparent, suggests that the allometry has been derived only within *Psychopsis*.

A second forewing feature which appears to exhibit allometric variation within *Psychopsis* is the state of the tornus, which generally becomes more pronounced, i.e., angular, with increasing wing size (Tillyard, [1919a]). Both tornal and fold characters have been omitted from the phylogenetic analysis because their apparent allometry suggests that variation observed in these traits is not phylogenetically significant at interspecific levels of universality.

Forewing Venation.—Kimmins (1939) made extensive use of the arrangement of forewing veins M and Cu to diagnosing psychopsid genera. Character states employed by Kimmins included the presence or absence of fusion between these veins, and, in the former cases, the length of fusion. More recent workers (Tjeder, 1960; New, [1989a]) have de-emphasized this trait. Examinations of this character undertaken for the present work revealed considerable intraspecific variation in Kimmins' states of this character. Consequently, it has been omitted from the phylogenetic analysis. High levels of intraspecific variation in the "completeness" of the various fore- and hind wing gradate series has also lead to their deletion from the analysis.

RESULTS

The cladistic analysis of coded character data (Appendix 2) for the 21 psychopsid (ingroup) species and the hypothetical ancestor resulted in the single minimum length tree shown in Fig. 53 (length = 104 steps). This cladogram represents the first detailed hypothesis of intergeneric and intrageneric relationships within the family Psychopsidae. Cladogenetic relationships within the family are well resolved on this cladogram. Both its consistency index (.83) and retention index (.91) are relatively high; and the majority of superspecific clades are supported by two or more synapomorphies. The monophyly of the entire family is particularly well supported with 22 synapomorphies.

CLASSIFICATION

Given its small number of extant species, the intrafamilial classification of the Psychopsidae has been surprisingly controversial over the last 75 years, particularly at the generic level. In the sections below I propose a new family- and genus-group classification for the Psychopsidae and discuss its merits relative to earlier classifications.

New Classification.—The classification of extant psychopsids shown in Table 2 is newly proposed here. Except where otherwise noted, it is used herein as the basis of taxonomic discussions. The classification is fully "sequenced" (Wiley, 1981) for the 21 examined species. Sequencing allows a set of hypothesized branching relationships (in this case the cladogenetic relationships shown in Fig. 53) to be encoded in the form of a classification, with the encoded relationships being fully recoverable from the classification by the application of a few simple rules (see Wiley, 1981). Asterisked (*) species have not been seen. Consequently, their positions in the phylogenetic sequence are unsubstantiated. These species have been arbitrarily placed in the phylogenetic sequence at the end of the smallest taxonomic unit to which they can be inferred to belong based on character information available in the literature, as discussed below.

Placement of Unexamined Species.—*Balmes formosa*. This species is tentatively placed in *Balmes* on the basis of the: (1) reduced number of crossveins in the forewing costal gradate series (New, [1989a]:858, fig. 1) [Character 6], (2) absence an apical hind wing spot (Kuwayama, 1927:123, fig.) [Character 9], and (3) apparent absence of a compact aggregation of modified setae near the insertion of the stylus on the female 9th gonocoxites (New, [1989a]:860, fig. 30) [Character 53]. The *formosa* state of the first character is intermediate between the highly reduced number of costal crossveins found in the three examined *Balmes* species and the much greater number found in most *Psychopsis*. The *formosa* states of the last two characters are plesiomorphic within the Psychopsinae, but their derived states are synapomorphies of the examined species of *Psychopsis*. This species is known only from two specimens cited by Kuwayama (1927) as males, but both of which are probably females (New, [1989a]:846).

Psychopsis dumigani, maculipennis, and *margarita*. Each of these three species appears to be known only from a small number of female specimens (see their respective Appendix 1 entries). All three species are tentatively placed in the *gracilis* group of *Psychopsis* on the basis of their forewing maculae and fasciae (i.e., Tillyard, 1922a: plate 3 [*dumigani* and *margarita*]; Tillyard, 1925: plate 38, fig. 2 [*maculipennis*]). *Psychopsis maculipennis* clearly exhibits an apical hind wing macula lying posterior to the anastomosis, a synapomorphy of the *gracilis* group [Character 9]; but, in *margarita* the macula is distal to the anastomosis (as in the *insolens* group) and in *dumigani* the macula is diffuse. The large female 8th sternites of *margarita* and *dumigani* (New, [1989a]:870, figs. 116-117; 872, figs. 137-138) are also consistent with their placement in the *gracilis* group.

Psychopsis gallardi. The relationships of this species remain enigmatic. Although it clearly belongs within the Psychopsinae its relationships with *Balmes* and *Psychopsis* are sufficiently uncertain that I have chosen here not to place it in either genus. Kimmins (1939) placed *gallardi* in *Balmes* based principally on its lack of an apical hind wing macula [Character 9]. However, the absence of this macula is here interpreted as plesiomorphic within the Psychopsinae, and thus cannot support the monophyly of a clade *Balmes* (as interpreted here)

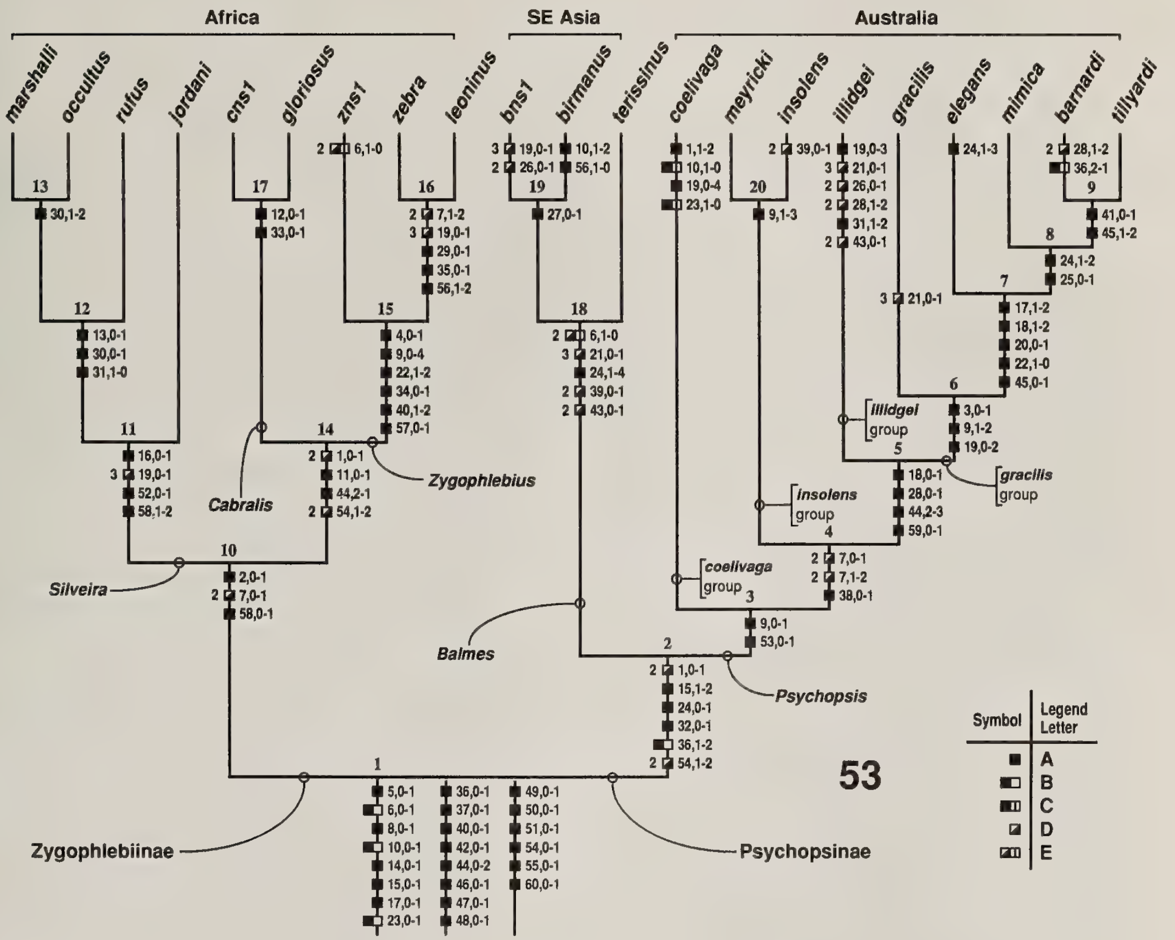


Fig. 53. Cladogram showing the relative relationships among 21 (of 26) living species of silky lacewings (Length = 104, CI = .83, RI = .91). Character state changes are mapped in the following format [left to right]: (1) number of occurrences on the cladogram of the indicated state transformation [if greater than one], (2) lineage symbol, see key below, (3) character number, (4) state numbers [ancestral state - derived state]. LINEAGE SYMBOLS: The relevant transformation is: [A] unique and unreversed, [B] unique but reversed in a distal lineage, [C] unique but a reversal of a basal transformation, [D] a parallelism occurring in two or more lineages, [E] a parallelism and a reversal.

Table 2. Classification of the extant species of the family Psychopsidae. Unexamined species are asterisked.

- Family Psychopsidae
  - Subfamily Zygophlebiinae
    - Genus *Silveira*
      - *S. jordani*
      - *S. rufus*
      - *S. occultus*
      - *S. marshalli*
    - Genus *Cabralis*
      - *C. gloriosus*
      - *C.* cns1
    - Genus *Zygophlebius*
      - *Z.* zns1
      - *Z. zebra*
      - *Z. leoninus*
  - Subfamily Psychopsinae
    - Genus *Balmes*
      - *B. terissinus*
      - *B. birmanus*
      - *B.* bns1
      - **B. formosa*
    - Genus *Psychopsis*
      - *coelivaga* species group
        - *P. coelivaga*
      - *insolens* species group
        - *P. insolens*
        - *P. meyricki*
      - *illidgei* species group
        - *P. illidgei*
      - *gracilis* species group
        - *P. gracilis*
        - *P. elegans*
        - *P. mimica*
        - *P. barnardi*
        - *P. tillyardi*
        - **P. dumigani*
        - **P. maculipennis*
        - **P. margarita*
    - Psychopsinae incertae sedis
      - *"*Psychopsis*"* gallardi (*Balmes* or *Psychopsis*)

+ *gallardi*. Although the reduced number of forewing costal crossveins [Character 6] (not veinlets) in *gallardi* is a possible *Balmes* synapomorphy, judging from New's ([1989a]:861, figs. 39-40) illustrations of the male terminalia of this species it appears to lack other *Balmes* synapomorphies, i.e., male 9th gonocoxite superprocesses modified into a transverse tumulus [Character 9], microspinose gonosaccus lobes [Character 39], and reduced ventral costae on the male 9th gonocoxites [Character 21]. It also lacks the only identified male synapomorphy which could link it with *Psychopsis*, i.e., an apical hind wing spot [Character 9]. Since females of *gallardi* are unknown, the only other synapomorphy of *Psychopsis* identified here, an aggregation of modified setae near the insertion of the stylus on the female 9th gonocoxites [Character 53], cannot yet be evaluated for this species. Thus, the position of *gallardi* is very uncertain; it may constitute the sister group of either *Balmes* or *Psychopsis*, or both genera. Until further study can be made of both sexes of this species, I believe it prudent to treat *gallardi* as an incertae sedis psychopsine.

Prior Classifications.—The six family- and genus-group classifications of extant psychopsids published since 1917 are shown in Tables 3 (worldwide classifications) and 4 (regional classifications).

Navás's (1917) "Ensayo monográfico de la familia de los Sicópsidos" was the first work to comprehensively treat the family Psychopsidae. Earlier works consisted principally of isolated descriptions, but sometimes contained lists of other described species. Navás's revision recognized three tribes with eight genera, 13 species, and three varieties. Taxon characterizations were based solely on venational traits and wing maculation patterns.

Tillyard ([1919a]) revised the Australian psychopsids. Citing overlapping variation in the venational traits used to characterize the four Australian genera recognized by Navás, Tillyard sunk three of Navás' genera, *Artiopteryx* (as *Arteriopteryx* [sic]), *Magallanes*, and *Wernzia*, as synonyms of *Psychopsis*. In the same paper Tillyard erected two new monotypic genera, *Megapsychops* and *Psychopsella* respectively, for the distinctive Australian species *illidgei* and *gallardi*, thus recognizing a total of three Australian genera.

Krüger (1922) reviewed the family based solely on venational characters. He recognized three genera but no subfamilial taxa. Apparently unaware of the works of both Navás (1917) and Tillyard ([1919a]), Krüger placed all southeast Asian and Australian species in a single genus, *Psychopsis*, and proposed two new genera, *Psychophasis* and *Psychomorphe*, to receive the African species. The latter two genera are, respectively, well-established junior synonyms of the Navásian genera *Silveira* and *Zygophlebius*.

Kimmins' (1939) classification is largely concordant with the earlier scheme of Navás (1917), with the following minor changes: (1) tribal taxa were dropped, (2) Tillyard's *Megapsychops* was recognized, and (3) Tillyard's synonymy of *Artiopteryx* with *Psychopsis* was retained. Again, diagnostic traits at the generic level were restricted to wing maculation and venational characters; however, some interspecific variation in male terminalic characters was noted.

Tjeder (1960) reviewed the African psychopsid fauna. He treated six species, placing them in the same three generic groupings recognized by Navás (1917). This work is also important for its conclusive demonstration of the utility of male and female terminalic characters as diagnostic traits at both the interspecific and intergeneric levels within this family.

New ([1989a]) reviewed the Australian and southeast Asian psychopsid fauna. He, like Tillyard ([1919a]), concluded that considerable intra- and interspecific variation in venational traits mitigated against formal recognition of the several small genera recognized by Navás (1917) in this fauna; however, at the same time he maintained the validity of *Megapsychops*, based primarily on its distinctive forewing venation and patterning. Significantly, New also placed *Balmes* as a synonym of *Psychopsis*, citing overall similarities among the male and female terminalia; however, he also noted the presence of considerable interspecific variation among terminalic structures within his concept of *Psychopsis*.

Two principal character trends are evident from this retrospective appraisal of psychopsid taxonomy. First, terminalic traits have gradually replaced venational traits as the principal source of characters upon which psychopsid classifications are based. This trend, which has paralleled similar shifts in other neuropterous families, is continued in the present work, where 51 of the 60 characters used in the cladistic analysis are male or female terminalic traits. Second, the character base upon which psychopsid classification is founded has diversified over time, and now includes characters from the head, wings (venation and maculation), male terminalia, and female terminalia.

In comparing these prior classifications, if the enigmatic treatment of Krüger is disregarded and the strictly nomenclatural problems caused by differential recognition of the synonymous names *Zygophlebius* and *Notopsychops* are ignored, it is clear that within the African fauna neither the genus-level classification nor the conceptual aggregation of species into genera has undergone much change since the publication of Navás' revision (1917; see Tables 3 and 4). Furthermore, the cladogram derived from the present research (Fig. 53), exhibits a convincing phylogenetic basis for a tripartite division of African psychopsids into the three genera *Silveira*, *Cabralis*, and *Zygophlebius*.

Thus, the principal taxonomic confusion in the family has revolved around the definition of generic limits within the southeast Asian and, particularly, Australian faunas. The opinions (see Tables 3 and 4) of Navás (1917) and Kimmins (1939) versus Tillyard ([1919a]) and New ([1989a]) differ considerably with regard to generic limits. However, surprisingly, both of these seemingly divergent viewpoints are reflected in the cladogenetic relationships inferred here among the species of these faunas.

Based on the cladogeny proposed here (Fig. 53), the genera *Balmes* (southeastern Asia) and *Psychopsis* (Australia) constitute sister-groups within the subfamily Psychopsinae. However, the three most basal lineages within *Psychopsis* correspond closely to the earlier genera *Wernzia* (type species: *coelivaga*), *Magallanes* (type species: *insolens*), and *Megapsychops* (type species: *illidgei*). Thus, an alternative fully sequenced classification based on this cladogram might recognize five genera within the Psychopsinae: *Balmes*, *Wernzia*, *Magallanes*, *Megapsychops*, and *Psychopsis* s.str. Such a classification would correspond closely to those proposed by Navás (1917) and Kimmins (1939).

However, I believe that a two-genus division of the Psychopsinae is preferable for three reasons: (1) the biogeographic cohesiveness of generic taxa, (2) concern about the proliferation of monotypic genera, and (3) the uncertain phylogenetic position of *gallardi*. First, the proposed bipartite division of the Psychopsinae has the advantage of restricting the apparent distribution of monophyletic psychopsid clades to discrete continents, i.e., the subfamily Zygophlebiinae to Africa, *Balmes* to southeastern Asia, and *Psychopsis* to Australia. Second, recognition of five, rather than two, psychopsine genera would require the recognition of two monotypic genera, *Wernzia* (for *coelivaga*) and *Megapsychops* (for *illidgei*), and a third genus, *Magallanes*, with

Table 3. Worldwide psychopsid classifications (1917-present). Spellings of names have been corrected where necessary. Synonymous generic names are placed collinearly.

Author & Year	Navás 1917	Krüger 1922	Kimmins 1939
African	Zygophlebini	—	—
Taxa	*Silveira*	*Psychophasis*	*Silveira*
	Cabralis	—	*Cabralis*
	Zygophlebius	*Psychomorphe*	*Notopsychops*
Australian	Balmesini	—	—
& Oriental	*Balmes*	—	*Balmes*
Taxa	Psychopsini	—	—
	Wernzia	—	*Wernzia*
	Magallanes	—	*Magallanes*
	—	—	*Megapsychops*
	Artiopteryx	—	—
	Psychopsis	*Psychopsis*	*Psychopsis*

Table 4. Regional psychopsid classifications (1919-present). Spellings of names have been corrected where necessary.

Author & Year	Tillyard [1919a]	Tjeder 1960	New [1989a]
African	—	*Silveira*	—
Taxa	—	*Cabralis*	—
	—	*Notopsychops*	—
Australian	*Psychopsella*	—	—
& Oriental	*Megapsychops*	—	*Megapsychops*
Taxa	*Psychopsis*	—	*Psychopsis*

only two species (*meyricki* and *insolens*). In my opinion, there is no compelling reason to encumber the literature with this arrangement. Third, as noted above, the species *gallardi* is currently known only from one sex (male), and its true phylogenetic position within the Psychopsinae is unknown. Under a two-genus division of the Psychopsinae this species (when its affinities become known) could easily be incorporated into either *Balmes* or *Psychopsis* as a sister lineage without requiring a nomenclatural change. However, if *gallardi* is found to constitute the sister-group of a clade (*Wernzia* + (*Magallanes* + (*Megapsychops* + *Psychopsis* s.str.))) under the five-genus system, yet another monotypic genus (*Psychopsella*, type species: *gallardi*) would be required to incorporate this species into a sequenced classification of the family.

Finally, it should be noted that if a broad concept of *Psychopsis* is to be adopted, the species *illidgei* cannot also be accorded generic rank (e.g., as proposed by New [1989a]) without compromising the monophyly of *Psychopsis*. According to the classificatory division of the cladogram adopted here, *illidge*i is simply a highly autapomorphic species of *Psychopsis*.

BIOGEOGRAPHIC ANALYSIS

INTRODUCTION

The distribution of extant psychopsids is distinctly tripartite (Fig. 54). The genus *Psychopsis* is endemic to Australia; *Balmes* is restricted to southeast Asia (mainland and Taiwan); and *Silveira*, *Cabralis*, and *Zygophlebius* are endemic to the southern half of Africa. All available distributional data suggest that the taxa occupying these three areas are completely disjunct. No living silky lacewings are known from any of the intervening and/or adjacent areas of northern Africa, Madagascar, the Middle East, India, the Malay Archipelago, or New Guinea.

The fossil genera currently attributed to the family Psychopsidae are listed in Table 5. The extinct families Kalligrammatidae, Brongniartiellidae, and Osmylopsychopsidae contain a number of additional taxa thought to be closely related to psychopsids. Unfortunately, the less than optimal preservation of most 'psychopsoid' fossils limits observations of some critical character suites, particularly terminalia; this, together with the inadequacy of revisionary and phylogenetic studies of fossil 'psychopsoids,' currently prohibits critical evaluation of relationships among extant and fossil 'psychopsoid' taxa. Consequently, it is premature to attempt to fully combine distributional data from recent and fossil psychopsids into a comprehensive hypothesis of silky lacewing biogeography. However, assuming that the genera in Table 5 are correctly placed in the family Psychopsidae, several preliminary conclusions appear justifiable. First, the presence of psychopsids on both Laurasia (e.g., Germany, Kazakhstan, China) and Gondwanaland (Australia) during the Mesozoic supports the idea that silky lacewings were widely distributed during this era. Second, the 11 described genera of fossil psychopsids (with ca. 15 species) suggest that silky lacewings were morphologically diverse as well as geographically widespread during the Mesozoic, with their principal radiation possibly occurring during the Jurassic. Third, the oldest fossils attributed to the

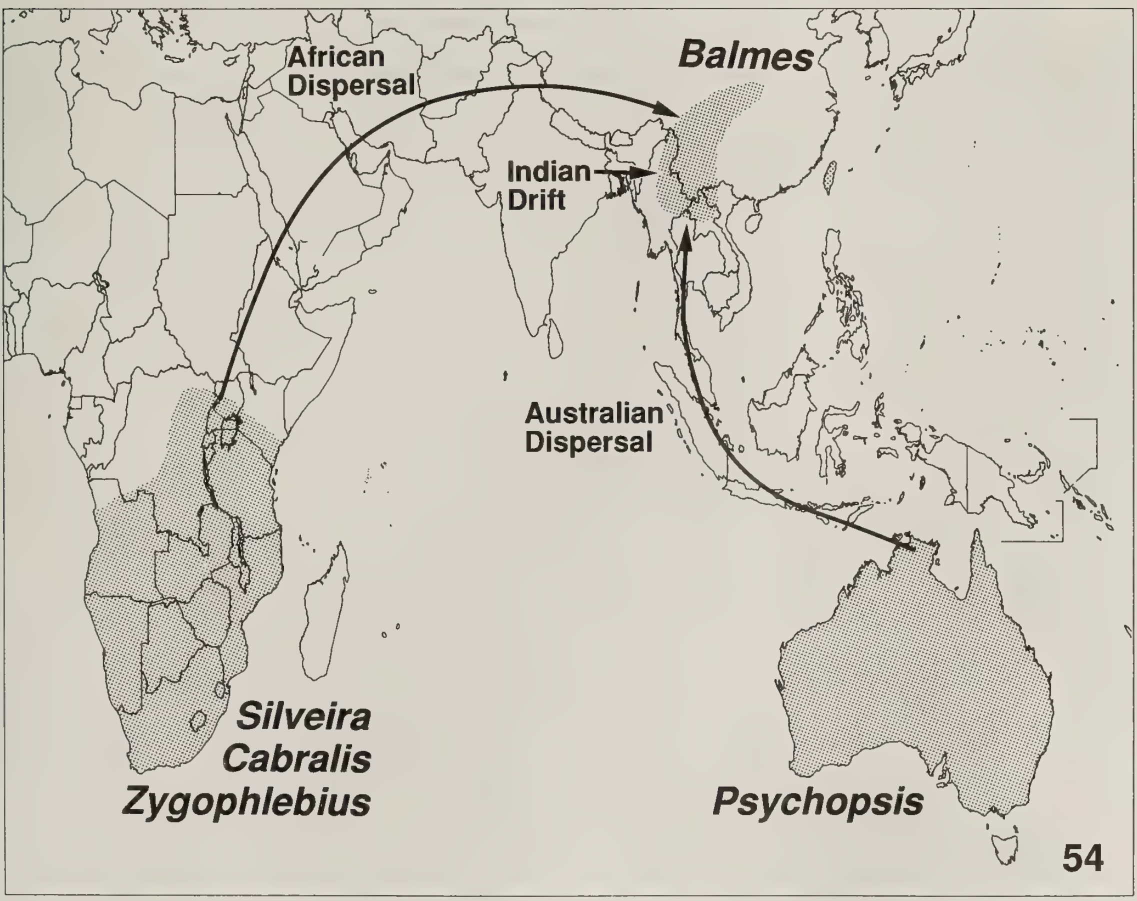


Fig. 54. World distribution of extant psychopsids (equal area map projection). The ranges of the south African genera *Silveira*, *Cabralis*, and *Zygophlebius* have been combined. *Psychopsis* records from western, particularly northwestern, Australia are sparse. The limits of the range of *Balmes* in southeastern Asia are imprecisely known.

Table 5. Fossil genera of the family Psychopsidae.

Genus	Temporal Distribution	Geographic Distribution
Miopsychopsis Makarkin, 1991	Miocene	USSR
Propsychopsis Krüger, 1923	Oligocene	Europe, N. Am.
Embaneura Zalessky, 1953	Cretaceous	USSR
Grammapsychops Martynova, 1954	Cretaceous	USSR
Angaropsychops Martynova, 1949	Upper Jurassic	USSR
Calopsychops Panfilov, 1980	Upper Jurassic	Kazakhstan
Propsychops Panfilov, 1980	Upper Jurassic	Kazakhstan
Beipiaopsychops Hong, 1983	Middle Jurassic	China
Sinopsychops Hong, 1982	Middle Jurassic	China
Apeirophlebia Handlirsch, [1906]	Upper Lias	Germany
Triassopsychops Tillyard, 1922b	Upper Triassic	Australia

Psychopsidae (Upper Triassic of Australia) date the origin of the family prior to the division of Pangea into Laurasia and Gondwanaland. Fourth, the presence of psychopsids on Laurasian land areas (North America: Florissant, CO; Europe: Baltic amber) during the Tertiary suggests that the disappearance of silky lacewings from much or most of ancient Laurasia is a relatively recent event.

Tillyard ([1919a]:764) suggested a Gondwanan origin for the family Psychopsidae based on his knowledge of (1) the tripartite distribution of living species and (2) apparently closely related fossil taxa in the families Kalligrammatidae and Prohemerobiidae, which were then known from Mesozoic strata in Australia and Europe. This view was reiterated without additional support by New ([1989a]:841). Neither Tillyard nor New commented specifically on the biogeographic significance of the occurrence of psychopsids on apparently Laurasian areas of southeast Asia, which is anomalous under the Gondwanan origin hypothesis. Presumably, both would have explained this occurrence by postulating the dispersal of a Gondwanan ancestor from Australia across the Malay Archipelago to mainland Asia. While such a proposal would be consistent with both their hypothesis and the observed distributions of extant psychopsids, several other plausible biogeographic hypotheses can be marshalled to explain the presence of silky lacewings in southeast Asia. Below, I outline four such hypotheses, develop a method for discriminating among them, and use the method to show that one hypotheses is better supported by the available data than the other three.

BIOGEOGRAPHIC HYPOTHESES

The four biogeographic hypotheses outlined below have been developed from a simple model of the tectonic fragmentation of Pangea, and the subsequent interactions of Laurasia with fragments of Gondwanaland. Rosen (1978:185, fig. 24) illustrated the relative relationships among most of the major tectonic fragments of Pangea. This illustration is reproduced in Fig. 55, and reduced to the land areas occupied by extant psychopsids in Fig. 56. Given the land area relationships shown in the latter figure, at least four different histories of landmass occupancy (Figs. 57, 59, 61, 63) are possible for an ancestral lineage leading to extant southeast Asian psychopsids. These histories constitute four different biogeographic explanations (hypotheses) that could account for the current presence of psychopsids in southeast Asia. Each of the hypotheses assumes that the stem ancestor of the Psychopsidae (1) occupied some portion of Pangea and (2) predated the division of Pangea into Laurasia and Gondwanaland. The validity of these assumptions is supported by the existence of the psychopsid fossil *Triassopsychops* from the Upper Triassic of Australia.

Laurasian Relic Hypothesis (Fig. 57): The Laurasian Relic hypothesis interprets southeast Asian psychopsids as the descendents of an ancient Laurasian (rather than Gondwanan) ancestor. Several psychopsid fossils have been reported from Laurasian land areas (i.e., Europe [Baltic Amber] and North America) during the Tertiary, far postdating the division of Laurasia and Gondwanaland.

Although not numerous, these fossils document a wide distribution of psychopsids on Laurasian land areas until relatively recent times, and confirm the plausibility of deriving southeast Asian psychopsids from Laurasian rather than Gondwanan ancestors.

Indian Drift Hypothesis (Fig. 59): The Indian Drift hypothesis interprets southeast Asian psychopsids as the descendents of Gondwanan ancestors that drifted northward on the Indian Plate and were introduced onto Eurasia as a consequence of the conjunction of India and Eurasia in the early Eocene (Brown & Gibson, 1983). Although no recent or fossil psychopsids are known from Indian Plate land areas, the plausibility of this hypothesis is suggested by the close proximity of the known western limit of the range of *Balmes* (i.e., Burma, south central China) to the eastern margin of this plate (Fig. 54).

Australian Dispersal Hypothesis (Fig. 61): The Australian Dispersal hypothesis interprets southeast Asian psychopsids as the descendents of ancestors that dispersed northwesterly from Australia through the Malay Archipelago to mainland Asia. The plausibility of this hypothesis derives primarily from the existence of a readily apparent dispersal route, i.e., the islands of Malesia, from Australia to southeast Asia. Detracting evidence includes the absence of any records of extant and/or fossil psychopsids from any land areas along this possible dispersal route.

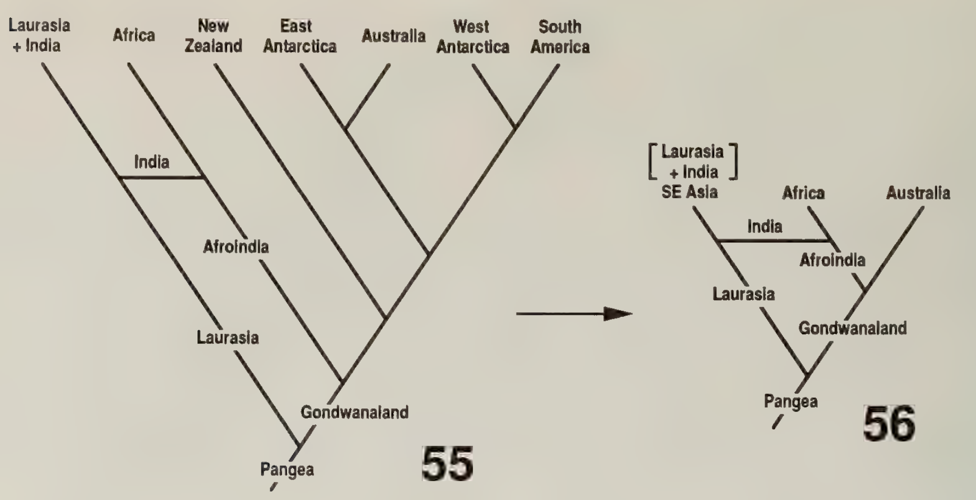
African Dispersal Hypothesis (Fig. 63): The African Dispersal hypothesis interprets southeast Asian psychopsids as the descendents of ancestors that dispersed to southeast Asia from Africa. Dispersal could have occurred by at least two routes: (1) direct transoceanic dispersal, which seems unlikely given the limited flight capabilities of psychopsids and the extreme distance separating southern Africa and southeast Asia throughout the Cenozoic and Mesozoic eras, or (2) transcontinental dispersal northward through Africa to the Middle East, then eastward to southeast Asia. The principal detracting evidence of the latter route is the absence of any known remnant populations of extant psychopsids along this path.

HYPOTHESIS TESTING

The conceptual development of area-cladograms and their application to biogeographic studies has been an important recent development in cladistic theory (Nelson & Platnick, 1981; Humphries & Parenti, 1986). Area-cladograms are cladograms depicting hypotheses of relationships among geographic areas and are generally produced by the substitution of the terminal taxa of a calculated taxon-cladogram by their respective distributions. However, given a set of known area relationships and a biogeographic hypothesis consistent with those relationships, it is also possible to predict the form of the area-cladogram corresponding to the biogeographic hypothesis. This characteristic can be exploited to divide a large set of plausible biogeographic hypotheses into several smaller sets, each of which predicts a different area-cladogram. By matching the actual area cladogram of a test taxon to one of the sets of predicted area-cladograms, a reduced field of biogeographic hypotheses can be identified that are consistent with (1) the test taxon cladogeny, (2) the test taxon geographic distribution, and (3) the underlying known area relationships.

In the present case, the area relationships between southeast Asia (assumed here to be part of Laurasia, but see below), Africa, and Australia (Fig. 56) are well supported by the known fragmentation sequence of Pangea and Gondwanaland (Rosen, 1978, Smith et al., 1981). The landmass occupancy histories required by the ancestors of southeast Asian psychopsids under each of the four biogeographic hypotheses listed above are given in Figs. 57, 59, 61, and 63 (narrow lines and underlined land areas), where they are mapped on replicas of Fig. 56 to show their consistency with the area relationships there depicted. The corresponding predicted area cladograms are shown in Figs. 58, 60, 62, and 64. Note that the first three hypotheses predict different area cladograms but that the Indian Drift and African Dispersal hypotheses predict the same area cladogram (and thus are not separable by this method). A finding of the latter area cladogram in the test taxon would, however, still contain information by excluding the Laurasian Relic and Australian Dispersal hypotheses.

The derivation of the area cladogram predicted by the Indian Drift hypothesis is explained below as an example of the logic of deriving predicted area cladograms from landmass occupancy histories. Note that under the Indian Drift hypothesis (Fig. 59) the ancestors of southeast Asian and African taxa are predicted to share a more recent common ancestor (on Afroindia) than either does with



Figs. 55-56. 55. Cladistic representation of the relative relationships between selected landmasses stemming from the tectonic fragmentation of Pangea (redrawn from Rosen 1978:185, fig. 24). 56. Cladistic representation of the relative relationships between the land areas occupied by living psychopsids (reduced from Fig. 55).

Australian taxa. This is reflected in the predicted area cladogram (Fig. 60) by assigning "SE Asia" and "Africa" to the terminal bifurcation of the area cladogram, and joining "Australia" basally.

RESULTS

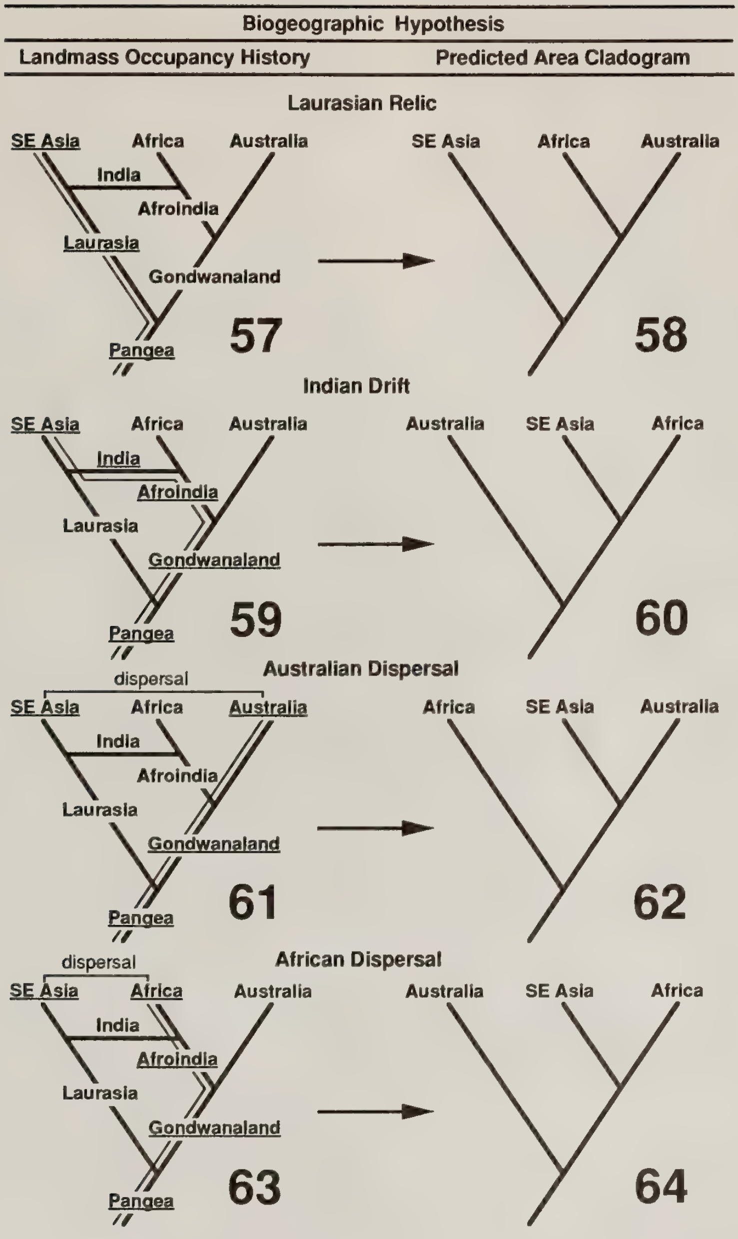
The actual area-cladogram found for extant psychopsids (Fig. 53) matches the area-cladogram predicted by the Australian Dispersal hypothesis (Fig. 62).

DISCUSSION

The results support the contention that southeast Asian psychopsids reached mainland Asia via dispersal from Australia through the Malay Archipelago, and are inconsistent with the alternative hypotheses that they (1) represent a relic of a long-endemic fauna of Laurasian ancestry [Laurasian Relic], (2) dispersed from Africa via the Middle East [African Dispersal], or (3) dispersed from Gondwanaland via the Indian Plate [Indian Drift]. The Australian Dispersal hypothesis is also consistent with the following overall biogeographic hypothesis for extant psychopsids: (1) the most recent common ancestor of extant psychopsids inhabited some portion of Gondwanaland, (2) extant psychopsid taxa occupying Australia and sub-Saharan Africa represent endemic elements which differentiated in-place subsequent to the rifting of Africa from the remainder of Gondwanaland [including Australia], and (3) the occupation of mainland Asia by ancestors of the genus *Balmes*, derived from an ancient Australian taxon, is a more recent event. This scenario also accords with Tillyard's ([1919a]) general suggestion of a Gondwanan origin for the family Psychopsidae.

The support found here for a dispersalist explanation of the occurrence of *Balmes* in southeast Asia depends importantly on the structure of the limited tectonic model of Gondwanan fragmentation employed here. This model, and the area-cladograms predicted by the four evaluated biogeographic hypotheses based on it, provides a means of assessing the relative plausibility of the different hypotheses. Alteration of the underlying model, however, could (1) shift support to an alternative hypotheses predicting a different area-cladogram, or (2) fail to produce unambiguous results where multiple biogeographic hypotheses predict identical area-cladograms.

The second possibility is apparent in the present model where the area-cladograms predicted by the Indian Drift and African Dispersal hypotheses are identical. A similar and more interesting result based on a slightly altered tectonic model is discussed below. Audley-Charles (1987) summarized geological evidence for the hypothesis that Burma, the Malay peninsula, and Sumatra (together with several other islands of the Malay Archipelago) represent terranes which rifted off the northern margin of Gondwanaland, adjacent to present-day



Figs. 57-64. Landmass occupancy histories and their corresponding predicted area cladograms for four biogeographic hypotheses which could account for the presence of living silky lacewings in southeast Asia. Each landmass occupancy history traces (narrow line) the inferred sequence of landmasses (underlined) which must have been occupied by the lineal ancestors of living southeast Asian psychopsids under a particular biogeographic hypothesis, given the relative relationships between land areas shown in Fig. 56. The corresponding predicted area cladograms show the areal relationships expected from a cladistic analysis of a higher taxon occupying each of the three terminal areas.

northern Australia, and subsequently accreted to Eurasia. These terranes, at least some of which were probably above water during the late Mesozoic and early Tertiary, provide another possible vehicle for the introduction of ancestral, Gondwanan, psychopsids into southeast Asia. On the area-cladogram shown in Fig. 56, such terranes would be represented by one or more lines arising from the Australian stem after its divergence from Afroindia. It should be noted that under this augmented model of Gondwanan fragmentation a simple comparison of actual to predicted psychopsid area-cladograms cannot differentiate between the Australian Dispersal hypothesis and the alternative hypothesis that the ancestors of southeast Asian psychopsids reached Eurasia vicariantly by drifting northward on such a terrane, because both hypotheses (1) predict the same area-cladogram (Fig. 62) and (2) match the actual area-cladogram (Fig. 53).

In conclusion, while the comparison of a calculated (actual) area-cladogram with area-cladograms predicted from a set of biogeographic hypotheses consistent with the known relationships among a suite of areas can be powerful tool for restricting the number of plausible biogeographic hypotheses, it does not guarantee identification of a unique "best" hypothesis. However, even with the latter shortcoming, this method has the potential to contribute significantly to our understanding of the biogeography of individual taxa occurring in the biotically complex region of southeast Asia because of its ability to discriminate between at least three important classes of relevant biotic elements: (1) ancient Laurasian endemics, (2) rafted or non-rafted Australian immigrants, and (3) African or rafted Indian immigrants.

SUGGESTIONS FOR FUTURE RESEARCH

Phylogeny.—Future work on psychopsid phylogeny should concentrate on (1) assessing the phylogenetic position of the Psychopsidae within the Neuroptera, i.e., its interfamilial relationships, and (2) testing the intrafamilial relationships proposed here by including in subsequent analyses both new taxa (i.e., fossil species and the five extant species not examined here) and new character data (e.g., from molecules, preimaginal morphology, and fossils). Investigations of phylogenetic relationships between living and fossil psychopsids would be of particular interest because of their relevance to the biogeography of the family. Among the extant species, the position of the incertae sedis species "*Psychopsis*" *gallardi* is of special interest.

Taxonomy.—Although few species of Recent psychopsids probably remain to be discovered, some additional taxonomic work is still needed. Two priorities in this area are (1) the completion of a revisionary study of the genus *Balmes* and (2) the discovery, description, and comparative analysis of the preimaginal stages of psychopsid species. In the latter area, the rearing of larvae should be emphasized to ensure positive species identifications. Comparative studies of heterospecific and/or heterogeneric larvae are especially needed to further the ends of taxonomic identification, phylogenetic inference, and the study of functional morphology.

Ecology and Natural History.—Studies of the ecology and natural history of all psychopsid species are needed. Little more than anecdotal information exists in either of these areas for any species. Field studies containing detailed information on topics such as microhabitat and feeding preferences, abundance, spatial distribution, movement patterns, behavior, longevity, etc. are conspicuously lacking in the literature. This statement applies equally to both larvae and adults. Of special interest would be the verification or refutation of the hypotheses advanced above for psychopsid copulation and oviposition, particularly those regarding in-flight egg deposition. Individuals who conduct field studies should be careful to deposit selected specimens, especially reared larvae, in an established public collection where they can be made available to future researchers for comparative study. The existence of such deposits should be published in some appropriate manner.

Fossils.—The number of fossil genera attributed to the Psychopsidae has nearly doubled during the last 15 years. A comprehensive comparative revision of these taxa is now needed. Such a work could contribute significantly to our knowledge of psychopsid phylogeny and biogeography.

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APPENDIX 1

Synonymical Catalog of Extant Psychopsids
APPENDIX 1

Synonymical Catalog of Extant Psychopsids and Material Examined

To augment the family- and genus-level taxonomic data contained in the main text, a synonymical catalog of extant psychopsid species is presented below. Each species treatment contains a concise distributional statement, a synonymical listing with annotated bibliographic citations, a flight period statement, and a listing of material examined. Distribution statements reflect geographic data associated with examined specimens and records cited in Tjeder (1960) and New ([1989a]). Binomina enclosed in brackets in the synonymical listings indicate incorrect determinations. "FLIGHT PERIOD" statements give extreme capture dates; except where otherwise indicated, cited data reflect only temporal data associated with examined specimens. "MATERIAL EXAMINED" statements present selected label data in the format: COUNTRY: POLITICAL SUBDIVISION: # males, # females, # sex undeterminable ["?"; e.g., abdominal apex missing], geographical collection data, temporal collection data, miscellaneous data, collector(s) surname(s) (REPOSITORY COLLECTION ACRONYM). Material in brackets has been added for clarity. Collection acronyms are expanded above under the heading "Materials and Methods: Collection Acronyms." An asterisk (*) following an annotation indicates a figure (e.g., forewing* = forewing figure). Taxa are listed in the order shown in Table 2.

Family PSYCHOPSIDAE Handlirsch
Subfamily ZYGOPHLEBIINAE Navás
Genus **SILVEIRA** Navás

jordani Kimmins, 1939: southwestern Africa

Silveira jordani Kimmins, 1939:148 [original description, male terminalia*, wing*].—Tjeder, 1960 [redescription, distribution, male terminalia*, female terminalia*, wing*, habitus*].

FLIGHT PERIOD: 21 September - 16 April [Outlier: June (day unrecorded), see Tjeder, 1960:191]. MATERIAL EXAMINED [12M, 3F, 1? = 16]: **NAMIBIA**: 3M, Homeb. Namib National Park, 23.i.1988, Miller & Stange (FSCA); 2M, 1F, Namib/Naukluft Park, Gobabeb, 23°34'S, 15°03'E, 18.ii-7.iii.1983, ex. Malaise trap, Mansell (NCIP); 1F, Namib/Naukluft Park, Kuiseb R. nr. Gobabeb, 23°34'S, 15°03'E, 18.ii-20.iii.1983, ex. light, Kuiseb Survey (NCIP); 1M, TSES, S[outh] W[est] A[frica], 1924, Brown (SAMC); 1?, 7 mi. S. Ombika, Etosha Pan, 27.x.1967, 1150m, Ross & Stephen (CAS); 1M, Gobabeb, Namib Desert Research Station, 12.x.1967, 407m, Ross & Stephen (CAS); 2M, Blässkranz 7, 24°06.5'S, 16°14.5'E, Maltahöhe Dist., 12-14.x.1984, Irish (SMWW); 1M, Orange River, 28°02'S, 17°04'E, Lüderitz District, 15-16.iv.1986, Irish (SMWW); 1M, Anikamkarab, 2.ii.[19]69 (SMWW). **SOUTH AFRICA: CAPE PROVINCE:** 1M, Clanwilliam, 30.i.1983, Stange & Miller (FSCA); 1F, Cape, Namaqualand, Worden[w?], 21.ix?.[18]86 (SAMC).

rufus Tjeder, 1960: southeastern Africa

Silveira rufa [sic] Tjeder, 1960:185 [original description, male terminalia*, female terminalia*, wing*, habitus*].

FLIGHT PERIOD: 4 November (see Tjeder, 1960:188) - 26 February [Outlier: 10 July, see Tjeder, 1960:188]. MATERIAL EXAMINED [2M]: **SOUTH AFRICA: TRANSVAAL:** 1M, D'Nyala Nat. Res., Ellisras District, 23°45'S, 27°49'E, 23-26.ii.1987, Mansell (NCIP); 1M, Potgi[l?]eters Rust, xii.1919, Malla (SAMC).

occultus Tjeder, 1960: southwestern Africa

Silveira occulta [sic] Tjeder, 1960:180 [original description, male terminalia*, female terminalia*, wing*, habitus*].

FLIGHT PERIOD: 22 February - 26 May. MATERIAL EXAMINED [9M, 39F, 3? = 51]: **ANGOLA:** 22F, 20km NE Sa da Bandeira, 4.iii.[19]70, 5600', Ross (CAS); 1F, 18 mi. N. Chicuma, 26.v.[19]58, 1200m, Ross & Leech (CAS). **ANGOLA or NAMIBIA:** 1?, Erikson's Drift, Kunene R[iver], iii.1923, S. W. Africa Mus. Exped. (SAMC). **NAMIBIA**: 3M, 1F, 1?, Deutsch SW. Afrika (ZMHB); 1M, 1F, D.SW. Afrika, Okahandya, 25.iv.[19]02?, Schultze (ZMHB); 1M, 2F, Elefantenberg, Farm Achalm, 9km S. Otavi, 19°44'S, 17°21'E, 12.iii.1987, Oberprieler (NCIP); 1F, Windhoek, SE 2217 Ca, 13.iii.1971 (SMWW); 1F, Damaraland, Sebraskop 410, 20°44'S, 15°09'E, 13.iv.1987, Irish & Marais (SMWW); 2F, Otjitambi, "1970," 29.iii.[19]51 (SMWW, UZIL); 1M, Windhuk [=Windhoek], Zobrys (UZIL); 3M, 2F, Okahandja, iii.1969, 18.ii.1958 [paratype, Gaerdes], 10.iii.1958 ["allotype," Gaerdes], 22.ii.[19]36 [paratype], 21.iii.[19]56 [paratype] (SMWW, UZIL); 6F, Okahandja, 2116DD, 13-14.iii.1969, Lamoral & Day (UZIL). **COUNTRY UNCERTAIN:** 1?, "Guinea," P. Andongo, 27.v.[18]75, Homeyer (ZMHB).

marshalli (McLachlan, 1902): southeastern Africa

Psychopsis marshalli McLachlan, 1902:234 [original description].

Psychopsis nebulosa Van der Weele, 1907:146 [original description, male terminalia*].

Silveira marmoratus Navás, 1912b:196 [original description].—Navás, 1917 [redescription]; Navás, 1928 [distribution].

Zygophlebius nebulosa [sic].—Navás, 1917 [redescription, distribution].

Psychophasis marshalli.—Krüger, 1922 [listed].

Silveira marshalli.—Kimmins, 1939 [listed, distribution, wing*]; Tjeder, 1960 [redescription, distribution, male terminalia*, female terminalia*, wing*, habitus*].

FLIGHT PERIOD: 3 November - 7 April [Outlier: July (day unrecorded), see Tjeder, 1960:180]. MATERIAL EXAMINED [27M, 39F, 6? = 72]: **BOTSWANA**: 1M, 1F, Serowe, i.1990, ex. Malaise trap, Forchhammer (CAS); 4M, 1F, Serowe, Farmer's Brigade, ii.1988, ex. Malaise trap, Forchhammer (USNM); 1M, Ngoma, 24.ii.1980, Owen (NMK). **SOUTH AFRICA: TRANSVAAL:** 1?, Ost-Transvaal, Karino, iii.1911, Cooke (ZMHB); 1F, 5mi. W Warmbad, 24-25.ii.1968, Krombein & Spangler (USNM); 1M, Kruger Nat. Park, Olifants Camp, 19.ii.1968, Krombein & Spangler (USNM); 5M, 2mi. N Messina, 24.iii.[19]58, 590m, Ross & Leech (CAS); 1F, Nylstroom, 24°42'S, 28°20'E, 30.xi.1970, Schalkwyk (NCIP); 1M, 5F, 12km N Nylsspruit, 16.ii.1983, Miller (FSCA, CUIC); 1M, Messina, 11.ii.1985, ex. light, Aspöck, Hölzel & Mansell (NCIP); 1M, 1F, Langjan Nature Res. 22°52'S, 29°14'E, 2.ii.1984, ex. light, Mansell (NCIP). **ZAIRE:** 1? (tentative identification), 150-200mi. W. Kambove [=?Kambove at 10°52'S, 26°38'E], 3.xi.[19]07, 3500-4500ft., Neave? (BMNH). **ZIMBABWE (=S. RHODESIA):** 9M, 18F, 5mi. S Lupani, 11.ii.1970, 3000ft, Ross (CAS); 3F, 41mi. S Umtali, 17.iii.[19]58, 640m, Ross & Leech (CAS); 1F, 3mi. E Matapo Mission (=? in Matopo Hills), 14.ii.1970, 5000ft, Ross (CAS); 1F, Bikita Mines, 19.iii.[19]58, 1200m, Ross & Leech (CAS); 1M, 10mi. NE Filabusi, 21.iii.[19]58, 1100m, Ross & Leech (CAS); 1F, 33mi. SE Chirundu, 8.iii.[19]58, 1170m, Ross & Leech (CAS); 1F, Khami Ruins, 14mi. W Bulawayo, 22.iii.[19]58, 1275m, Ross & Leech (CAS); 1F, Guelo, 7.iv.1917, Skaife (SAMC); 2M, 3F, 4?, Salisbury, 7.i.[19]15, 17.ii.[19]15, 7.i.[19]17, iii.[19]18, 22.ii.[19]19, 10.ii.[19]20, +3 without date, various coll. (SAMC, NMK, USNM).

Genus **CABRALIS** Navás

gloriosus Navás, 1912: southeastern Africa

Cabralis gloriosus Navás, 1912a:110 [original description, wing*].—Navás, 1917 [redescription, distribution]; Navás, 1931 [listed, distribution]; Kimmins, 1939 [listed, distribution]; Tjeder, 1960 [redescription, distribution, male terminalia*, female terminalia*, wing*, habitus*].

FLIGHT PERIOD: 19 November - 15 February. MATERIAL EXAMINED [13M, 6F = 19]: **SOUTH AFRICA: TRANSVAAL:** 1M, 2F, Ingwe, 10 km N. Louise Trichardt Hotel, 15.ii.1988, Miller (FSCA); 3M, Louis Trichardt district, 22°58'S, 29°56'E, 3.ii.1990, ex. dense brush along stream, Minter (MINTER); 2F, Louise Trichardt, Hanglip, Ingwe, 23°00'S, 29°57′E, 10.ii.1985, ex. forest, Minter (MINTER); 4M, 1F, Wylliespoort, Ingwe Motel, 22°58′S, 29°57′E, 19.xi/30-31.i.1984, Mansell (NCIP). **ZIMBABWE (=S. Rhodesia):** 3M, 1F, Burma Valley, Mutare district, 19°12′S, 32°42′E, 19.xi.1990, netted in forest, Minter (MINTER); 1M, Burmah Valley, Umtali, xi.1953, Pinhey (NMK); 1M, Umtali, 20.i.[19]48, Pinhey (NMK).

cns1 (=*Cabralis* new species #1; undescribed): west central Africa

FLIGHT PERIOD: 18 October - December (day unrecorded). MATERIAL EXAMINED [12M, 7F, 2? = 21]: **ZAIRE (=Belgian Congo):** 2M, 4F, 1?, Lulua: Kapanga [8°21′S, 22°35′E], 11.xi.1932, x.1933 (MRAC [papered]); 9M, 2F, 1?, Lulua: Riv. Luiza [ca. 7°35′S, 22°40′E], 18.x.1933, x.1933, Overlaet (MRAC [papered]); 1F, Sandoa [9°41′S, 22°52′E], xii.1931 (MRAC); 1M, Tshibaba [=?7°55′S, 22°24′E], 14.xi.193[2?] (MRAC [papered]).

Genus **ZYGOPHLEBIUS** Navás

zns1 (=*Zygophlebius* new species #1; undescribed): southeastern Africa

FLIGHT PERIOD: Unknown. MATERIAL EXAMINED [2M, 2F = 4]: **SOUTH AFRICA: TRANSVAAL:** 2M, 2F, Chuenespoort [=Chuniespoort, 24°16′S, 29°33′E] area, S of Pietersburg, no date, Minter (MINTER).

zebra (Brauer, 1889): southeastern Kenya and adjacent Tanzania [not Madagascar, see Tjeder, 1960:198] (Notes: Many early literature records for "*zebra*" actually pertain to "*leoninus*." The specific name "*zebra*" is treated here as a noun in apposition, Art. 31b(ii).).

Psychopsis zebra Brauer, 1889: 102 [original description].—Kolbe, 1897 [redescription, distribution]; Van der Weele, 1907 [distribution, male terminalia*]; Van der Weele, 1909 [listed, distribution]; Navás, 1914 [listed, distribution]; Fraser, 1951 [listed, distribution].

Zygophlebius zebra [var. *zebra*?].—Navás, 1917 [redescription, distribution].

Psychomorphe zebra.—Krüger, 1922 [listed, taxonomy].

Notopsychops zebra.—Tillyard, [1919a] [taxonomy]; Kimmins, 1939 [listed, distribution, wing*].

FLIGHT PERIOD: 29 October - 8 May. MATERIAL EXAMINED [4M, 14F, 1? = 19]: **KENYA:** 1M, 2 mi. E. Taveta [3°24′S, 37°41′E], 29.x.1957, 840m, Ross & Leech (CAS); 1F, Kenya coast, Sokoke forest [station = 3°29′S, 39°50′E], 8.v.[19]76, Bampton (MINTER); 1M, 3F, Kilifi [3°38′S, 39°51′E], Sokoke forest, iv.1958, iv.1960, iv.1962, Williams (NMK); 2F, Coast Prov., Kilifi, Sokoke forest, iv.1957, 200ft., Williams (NMK); 1F, Sokoke For[est], White Sand, 8 mi. S. Malindi [3°13′S, 40°07′E], iv.1969, Clifton (NMK); 1F, 1?, Kibwezi [2°25′S, 37°58′E], 22.xii.[19]24, 16.i.[19]26, Feather (BMNH); 1M, 2F, Kasigau [3°49′S, 38°40′E], xi.1938, ?van Someren (BMNH); 1F, nr. Teita [=?Taita Hills, 3°25′S, 38°20′E], i.1892, 2500-3000', Jackson (BMNH). **TANZANIA:** 3F, G[erman] E[ast] Africa, Rd to Kilossa [=Kilosa, 6°50′S, 36°59′E], Usagara Dist., 22-26.xii.1910, 1500-2500ft, Neave (BMNH); 1M, D[eutsch] O[st] Afrika, D[?]eymer (ZMHB).

leoninus Navás, 1910: south-central and southeastern Africa (Note: Many early records of "zebra" pertain to this species).

[*Psychopsis zebra*].—Gerstaecker, [1894] [redescription, distribution]; Navás, 1929 [listed, distribution]; Navás, 1931 [listed, distribution]; Esben-Petersen, 1936 [listed, distribution].

Zygophlebius leoninus Navás, 1910:83 [original description, forewing*].

Psychopsis felina Navás, 1912a:111 [original description, male terminalia*].

Zygophlebius zebra var. *felina* [sic].—Navás, 1917 [redescription, distribution].

Zygophlebius zebra var. *leonina* [sic].—Navás, 1917 [redescription, distribution].

Zygophlebius zebra var. *weelina* [sic] Navás, 1917:203 [original description].

[*Nothopsychops* (sic) *zebra*].—Tjeder, 1960.

[*Notopsychops zebra*].—Handschin & Markl, 1955 [listed, distribution]; Tjeder, 1960 [redescription, distribution, male terminalia*, female terminalia*, wing*, habitus*].

FLIGHT PERIOD: September (day unrecorded, see Handschin and Markl, 1955:67) - March (day unrecorded, see Tjeder, 1960:198). MATERIAL EXAMINED [73M, 81F, 27? = 181]: **ANGOLA:** 3F, Duque de Bragança [=Calandula, 9°06′S, 15°57′E], 29.x.1903, Hebel (RNHL); 1M, 1F, Bange Ngola [=?Bange Angola, 8°26′S, 16°40′E], 4.x.1903, Hebel (RNHL); 3M, 2F, 3?, Luacinga R[iver] [=?Luassing(u)a R., 15°44′S, 18°39′E], xi.[18]99, Penrice (RNHL, BMNH[1?], EMAU[1F]); 1F, 1?, Longa R[iver] [=?Luassingua

R.], xi.[18]99, Penrice (RNHL); 1M, Ndalla Ango, 12.x.1903, Hebel (RNHL); 1F, Gamba-Andulo, Bihé [=Kuito, 12°23′S, 16°56′E], xii.1934, Braun (BMNH); 2?, Angola S. or., Cacolo [10°09′S, 19°21′E] (westl. Saarimo), 23.xii.1957, 1400m, Heinrich (ZSM, identification based on photo & label data). **MALAWI:** 1F, Nkata Bay [=Nkhata Bay, 11°36′S, 34°18′E], Mkuwadzi Forest, 27.xi.1970 (NMB); 1F, Nyasaland, Mlanje [16°02′S, 35°30′E], 26.xi.[19]44, 2000ft., Wood (NMB); 3F, Nyasaland, Mlanje, 29.xi.1912, 29.i.1914, Neave (BMNH); 1?, Zomba [15°23′S, 35°20′E], ?Rendall (BMNH); 1F, Kasungu Nat. Park, Lifupa Camp [13°03′S, 33°09′E], 1333Aa, 9-10.xii.1980, 1000m, [ex.?] *Brachystegia*, Stuckenberg & Londt (NCIP); 1M, Kandoli [=?Kandoli Hill, 11°34′S, 34°16′E], lower slope, Nkata Bay Dist., Nyasaland, 16.xii.1960, ex. woodland, Eccles (NMB). **MOZAMBIQUE**: 1F, Rikatla [=?Lagoa Ricatla, 25°46′S, 32°37′E] (NHMW); 1M, 2F, Dondo Forest [Dondo, 19°36′S, 34°44′E], P[ortugese] E[ast] A[frica], xii.1960 (NMB); 2M, Beira [19°50′S, 34°52′E], 19.ii.[19]00 (BMNH); 1?, Delagoa Bay [=Baía de Lourenço Marques, 25°48′S, 32°51′E], Heyne (EMAU, no abdomen or original labels); 1F, Delagoabai [=Delagoa Bay], [pre-1894], Monteiro (ZMHB). **SOUTH AFRICA: TRANSVAAL:** 5M, 3F, Farm Murlebrook, nr. Tzaneen, 23°57′S, 30°10′E, 29.xii.1987, Scholtz or Minter (NCIP); 6M, 4F, Farm Murlebrook, Letsitele Valley, Tzaneen district, 4.xii.1988, densely wooded area near stream, Minter (MINTER); 5M, 3F, Hans Merensky Nat. Res., 23°40′S, 30°39′E, 27-30.xi.1981, Mansell or Oberprieler (NCIP, FSCA); 3M, 1F, Farm Glen Lyden, nr. Klaserie, 24°30′S, 30°57′E, 18.xii.1975, ex. forest along stream, Minter (MINTER); 1M, Farm Rietfontein, nr. Nelspruit, 25°24′S, 30°48′E, 14.xii.1975, ex. forest along stream, Minter (MINTER); 1M, Kruger Nat. Park, Skukuza, 24°59′S, 31°55′E, 13.xii.1985, Braack (NCIP); 1F, Trichardsdal, 24°10′S, 30°24′E, 9.i.1982, ex. light, Oberprieler (NCIP); 2F, Farm Weltevreden, Nelspruit Dst., 25°34′S, 31°10′E, 1.ii.1989, at light, Oberprieler (NCIP); 1M, 1F, Montrose Falls, 25°25′S, 30°44′E, 29.i.1989, Oberprieler (NCIP); 1M, 1F, Duiwelskloof [23°42′S, 30°08′E], 13.i.1987, Eardley (NCIP); 1M, 1F, 7km N Hazyview, Sabie River, 6.xii.1976, Miller (NCIP); 1F, White River [=?Wit Kei River, 32°09′S, 27°24′E], E. Transvaal, i.[19]07, ?Distant (BMNH); 1F, Mt. Chirinda[?], S. Africa, 14.xii.1908, 3800′, Swynnerton (BMNH); 1?, Ost Transvaal, Karino [=Carino, 25°28′S, 31°06′E], i.1911, Cooke (ZMHB). **SWAZILAND:** 1M, 1F, Mlawula, 26°11′S, 32°04′E, 16.xi.1989, stunted *Androstachys johnsonii* forest in Lebombo Mts. nr. Mbuluzi Riv., Minter (MINTER). **TANZANIA:** 3M, 4F, Mpanda district, Katuma-Mpanda road, ca. 6°10′S, 30°49′E, 25.xi.1971, ca. 1300m, Kielland (RNHL); 1F, Mpanda district, Mabu, Wanzizi [=Wansisi] Hills, ca. 6°26′S, 30°29′E, 22.xi.1966, 1200m, Kielland (RNHL); 2M, 1F, Mpanda district, Sibweza, ca. 6°27′S, 29°55′E, 6.i.1969, xii.1970, xii.1971, 1100m, Kielland (RNHL); 1M, Mpanda district, Utinta, ca. 6°21′S, 30°28′E, xii.1971, 1200m, Kielland (RNHL); 1M, Mpanda district, Kampisa River, 6°07′S, 30°36′E, 4.xii.1966, Kielland (RNHL); 1M, Mpanda [6°22′S, 31°02′E], 8.xii.1969, Kielland (RNHL); 1M, Kapanga [6°18′S, 30°35′E], 10.xii.1962, Kielland (RNHL); 1F, Mpanda, Kapanga, 10.xii.1962, Kielland (RNHL); 1F, Thelembi, 2.xii.1966, Kielland (RNHL); 3M, 3F, Songea [10°41′S, 35°39′E], Mawanga forest, xii.1969, Watulege (NMK); 3?, Tanganjika, Songea, Peramiho, 26.xi.1958, 1000m, Lindemann (ZSM, identification based on photo and label data); 1?, Kigonsera [10°48′S, 35°03′E], 1907 (ZSM, identification based on photo and label data); 1M, 1F, [German] East Africa, Tendaguru, 1.i.1925, Cutler (BMNH); 1M, 1F, D[eutsch] O[st] Afrika, Tendaguru, Janensch (ZMHB). **UGANDA:** 1F, Uganda, ex. McLachlan Coll. (BMNH). **ZAIRE (=Belgian Congo):** 1M, Muye [9°00′S, 26°43′E], Park Upemba, 17.i.[19]58, 1570m, Ross & Leech (CAS); 2F, 150-200mi. W. of Kambove [=?Kambove at 10°52′S, 26°38′E], 23.x.[19]07, 1.xi.[19]07, 3500-4500ft., Neave? (BMNH); 1F, S.E. Katanga, 4.xii.[19]07, 4000′, ?Neave (BMNH); 2M, 2F, 1?, Lulua: Kapanga [8°21′S, 22°35′E], 11.xi.1932, 21.xi.1932, x.1933, xii.1933, Overlaet (MRAC); 1M, 1F, 1?, Elisabethville [11°40′S, 27°28′E], x.1911, "Miss. Agric." (MRAC); 2M, 1F, Elisabethville-Lubumbashi, 9.xii.1923, xi.1926, Seydel (MRAC); 3F, 2?, Kafakumba [9°41′S, 23°44′E], x.1930, ii.1931, Overlaet (MRAC); 2M, 1F, 4?, Sandoa [9°41′S, 22°52′E], xi-xii.1930, Overlaet (MRAC); 1M, 1F, 1?, Lulua: Riv. Luiza [ca. 7°35′S, 22°40′E], x.1933, 18.x.1933, Overlaet (MRAC); 2M, 1F, Kalenge [or Lulua]: Tshibalaka [8°32′S, 23°13′E], 13.x.1933, x.1933, Overlaet (MRAC); 1F, Uelé:

Paulis [2°46'N, 27°37'E], 1946, Abbeloos (MRAC); 1M, Katanga: Sashila [ca. 9°40'S, 23°20'E], 26.x.[19]25, Overlaet (MRAC); 1F, Rutschuru [1°11'S, 29°27'E], i.1928, Seydel (MRAC); 1M, Mufungwa Sampwe [9°20'S, 27°26'E], 20.xi.1911, Bequaert (MRAC). **ZAMBIA (=N. Rhodesia):** 1M, Chisamba, nr. Lusaka, 14°58'S, 28°15'E, 5-24.xii.1989, ex. light trap, Reavell (NMSA); 2F, Kasanka Nat[ional] Game Res[erve], Lake Wasa Camp, 12°30'S, 30°15'E, 14-22.xii.1989, ex. light trap, Reavell (NMSA); 1M, Abercorn [=Mbala, 8°50'S, 31°22'E], i.1967 (NMK); 1F, Abercorn, 13.i.1964 (NMB); 2M, 2F, 1?, Kitwe [12°49'S, 28°13'E], xi.1961, xii.1961, 8.xii.1961 (NMB); 1F, Ikelenge [11°14'S, 24°16'E], Mwinilunga [11°44'S, 24°26'E], 18.i.1965 (NMB); 2F, Ndola [12°58'S, 28°38'E], 4.i.1954, Cottrell (UZIL); 1F, Kasempa [=? 13°27'S, 25°50'E], 7.xii.[19]59, Johnsen (NMB); 1?, N'Sombo [10°49'S, 29°56'E], N. of Lake Bangweulu, 11.xii.1946, ex. low forest (BMNH); 1?, Kipushi [12°48'S, 30°43'E], N. Rhodesia: Congo Border, 15.xii.1927, ex. light, Evans (BMNH). **ZIMBABWE (=S. Rhodesia):** 3M, 1F, Burma Valley, Mutare district, 19°12'S, 32°42'E, 19.xi.1990, forest, Minter (MINTER); 2F, Vumba Mts., Umtali [18°58'S, 32°40'E], i.1960 (NMB); 3M, 1F, Witchwood Valley, Vumba Mts., Umtali, i.1960 (NMB); 1F, Haroni River [20°01'S, 33°01'E], xi.1967, ?Melsetter (NMB); 1F, Mashonaland [=NE Zimbabwe], 13.i.[18]96, Marshall (BMNH); 1M, Umtali District, 8.xii.1931, Sheppard (NCIP); 1M, Umtali, Mashonal'd, 25.?.1900, Marshall (BMNH). **UNCERTAIN IDENTIFICATIONS** (terminalia lacking, associations based on collection localities): **SOUTH AFRICA: NATAL:** 1?, Pongola River, N. Zululand, 20.x.[19]38, Marly (SAMC). **ZIMBABWE:** 1?, S. Rhodesia, Vumba, Umtali, i.1946 (NMK).

Subfamily PSYCHOPSINAE Handlirsch
Genus **BALMES** Navás

terissinus Navás, 1910: southeast Asia **New Status**

Balmes terissinus Navás, 1910:85 [original description, forewing*].—Navás, 1917 [redescription].

TAXONOMIC NOTE: *Balmes terissinus* is here resurrected from synonymy with *birmanus* (e.g., New, [1989a]). Justification for this change is documented above in the taxonomic treatment of the genus *Balmes*.

FLIGHT PERIOD: April (day unrecorded) - 21 July. MATERIAL EXAMINED [18M, 3F, 5? = 26]: **CHINA: SZECHWAN PROVINCE:** 1?, Suifu, 30.v.1925, 2000ft., Graham (MCZ); 17M, 4?, Yunnan border S of Suifu, iv.[19]29, Graham (MCZ, USNM); 1F, Chengtu, 21.v.1929, Parish? (CUIC); 1M, 1F, Chengtu, v.1934, Graham (MCZ, USNM); 1F, Mt. Omei, 21.vii.[19]35, 4000ft., Graham (USNM).

birmanus (McLachlan, 1891): southeast Asia

Psychopsis birmana McLachlan, 1891: 320 [original description].—Krüger, 1922 [listed]; New, [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

Balmes notabilis Navás, 1912b:197 [original description].—Navás, 1917 [redescription].

Balmes birmanus (-a [sic]).—Navás, 1930 [listed, distribution]; Kimmins, 1939 [listed, distribution].

FLIGHT PERIOD: April (days unrecorded). MATERIAL EXAMINED [3M, 1F = 4]: **CHINA: YUNNAN PROVINCE:** 1M, bet. Tengyueh and Nan Tien, "1909-10," Brown (CUIC). **UNKNOWN PROVINCE**: 2M, Yun Hsien, iv.1942, Jellison (USNM); 1F, Loimwe [? Loirnwe], iv, 5-6000', Kingford (MCZ).

bns1 (=*Balmes* new species #1; undescribed): southern China

FLIGHT PERIOD: 2 June. NOTES: Females unknown; known only from the unique male below. MATERIAL EXAMINED [1M]: **CHINA:** 1M, Kunming, 2.vi.1941 (USNM).

formosa (Kuwayama, 1927): Taiwan (Note: The specific name "*formosa*" is treated here as a noun in apposition, Art. 31b(ii).).

Psychopsis (*Orientichopsis*) *formosa* Kuwayama, 1927:123 [original description, habitus*].

Balmes formosana [sic].—Kimmins, 1939 [listed, distribution].

Psychopsis formosa.—New, [1989a] [redescription, distribution, female terminalia*, wing*].

FLIGHT PERIOD: August (see Kuwayama, 1927:125). NOTES: Males unknown; known only from the two females (not males as stated by Kuwayama, see New, [1989a]:846) of the type series. MATERIAL EXAMINED: None.

Genus **PSYCHOPSIS** Newman

coelivaga species group

coelivaga (Walker, 1853): northeastern Australia [Queensland, ?Victoria]

Hemerobius coelivagus Walker, 1853:279 [original description].

Psychopsis coelivaga (-us [sic]).—McLachlan, 1863 [listed]; Hagen, 1866 [listed]; Brauer, 1889 [listed]; Froggatt, 1903 [redescription, distribution, habitus*]; Tillyard, [1919a] [listed, distribution]; Krüger, 1922 [listed]; New, [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

Wernzia caelivaga [sic].—Navás, 1912b [redescription, distribution, wing*]; Navás, 1917 [redescription].

Wernzia coelivaga (-us [sic]).—Kimmins, 1939 [listed, distribution].

FLIGHT PERIOD: 23 October - 28 February [Outlier: May (day unrecorded)]. MATERIAL EXAMINED [7M, 5F, 6? = 18]: **AUSTRALIA: QUEENSLAND:** 1F, Toowoomba, 5.i.[19]42, Common (UQIC); 4M, Killarney, 24.ii.[19]46, 6.i.[19]50, Dumigan (UQIC); 1?, Killarney, 28.ii.[19]50, Morris (UQIC); 1?, Kuranda, Dodd (SAMA); 1?, Range Hallanton?, 22.xii.[19]12, Beck (UQIC); 1?, Brisbane (SAMA); 1F, Brisbane, 23.x.[19]21, Hacker (QMB); 1F, Herberton, 15.i.1911, Dodd (MCZ). **VICTORIA:** 1F, Horsham [?adventitious, see New [1989a]: 853] (SAMA). **UNKNOWN STATE:** 1F, Masdore?, 2.xi.[19]13, Buialing? (UQIC); 3M, 1?, Towbu, 1.ii.[19]20, 4.xii.[19]21, Beck (QMB, UQIC); 1?, Mt. Nebo, v.[19]50, Edye (UQIC).

insolens species group

insolens McLachlan, 1863: eastern Australia [New South Wales, Queensland]

Psychopsis insolens McLachlan, 1863:114 [original description, habitus*].—Hagen, 1866 [listed]; Brauer, 1889 [listed]; Froggatt 1902 [listed]; Froggatt, 1903 [listed, distribution, habitus*]; Tillyard, [1919a] [listed, distribution]; Krüger, 1922 [listed]; New, [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

[*Psychopsis coelivagus* (sic)].—Froggatt, 1902 [listed].

Magallanes insolens.—Navás, 1917 [redescription, wing*]; Kimmins, 1939 [listed, distribution].

FLIGHT PERIOD: 16 November - March (day unrecorded). MATERIAL EXAMINED [37M, 23F, 10? = 70]: **AUSTRALIA: NEW SOUTH WALES:** 2F, 1?, Beecroft, 17.i.[19]63, 7.xii.1967, 22.i.1971, Williams (DANSW); 1F, Collaroy, 7.i.1962, Gaven (DANSW); 1F, Glenhaven, 8.ii.1988, Davison (DANSW); 1M, Erina Heights, 17.xii.1981, Holtkamp (DANSW); 1F, Ourimbah, iii.1986, Adamski (DANSW); 1F, Narara, 15.xii.1944, Riely (DANSW); 1F, Lindfield, ii.1911, Fry (AMS). **QUEENSLAND:** 14M, 1F, 5?, Killarney, 4.xii-27.i/1923-1952, mostly ex. Dumigan collection (UQIC, QMB); 5M, Toowoomba, 25.xi-25.xii/1919-1929, various coll. (UQIC); 2M, 1F, 1?, Brisbane, 16.xi-24.i/1920-1938, (UQIC, QMB); 1F, 1?, Stanthorpe, 19.i.[19]26 (UQIC); 1M, Burleigh [20°17′S, 143°05′E], 29.xi.[19]26 (UQIC); 1M, Glen Aplin, i.1963, at light, Elder (UQIC); 1F, Ferny Groove, 24.xi.[19]62, Lisle (UQIC); 13M, 11F, Canungra, xi.1965, 8-17.xii.1966, Curtis (UQIC). **UNKNOWN STATE:** 1F, "Nord Australia / 1864" (MCZ); 1?, no data (UQIC); 1?, Darlington, 1.xii.[19]46, Rosser (UQIC).

meyricki McLachlan, 1887: eastern Australia [New South Wales]

Psychopsis meyricki McLachlan, 1887:30 [original description].—Brauer, 1889 [listed]; Tillyard, [1919a] [listed, distribution]; Krüger, 1922 [listed]; New, [1989a] [redescription, distribution, male terminalia*, wing*].

Magallanes meyricki.—Navás, 1917 [redescription]; Kimmins, 1939 [listed, distribution].

FLIGHT PERIOD: 20 January. NOTES: Females unknown; known only from the seven males of the type series. MATERIAL EXAMINED [3M]: **AUSTRALIA: NEW SOUTH WALES:** 3M, "Mt. Kosciusko" [more specifically, Jindabyne, see Tillyard, [1919b]: 779], 20.i.1885, 2800ft., paratypes, [Meyrick, see orig. desc.] (BMNH).

illidgei species group

illidgei Froggatt, 1903: eastern Australia [New South Wales, Queensland]

Psychopsis illidgei Froggatt, 1903:455 [original description, distribution, habitus*].—Navás, 1917 [redescription, wing*]; Krüger, 1922 [listed].

Megapsychops illidgei.—Tillyard, [1919a] [redescription, distribution, ?female terminalia*, wing*, habitus*]; Tillyard, 1926 [habitus*]; Kimmins, 1939 [listed, distribution]; New, [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

FLIGHT PERIOD: 12 December - 3 January. MATERIAL EXAMINED [1M, 3F = 4]: **AUSTRALIA: QUEENSLAND:** 1F, Mt. Tambourine, Geissmann (AMS); 1F, Mt. Tambourine, 12.xii.1942, 1200', Tisdale (SAMA); 1F, Mt. Tambourine, xii.1944 (QMB); 1M, Bunya Mts., 3.i.1945 ["3-1-45"], Dumigan (UQIC).

gracilis species group

gracilis Tillyard, 1919: eastern Australia [New South Wales, Queensland]

Psychopsis gracilis Tillyard, [1919a]:776 [original description, ?female terminalia*, wing*, habitus*].—Kimmins, 1939 [listed, distribution]; New, [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

FLIGHT PERIOD: 26 October - 30 January. MATERIAL EXAMINED [3M, 1F = 4]: **AUSTRALIA: QUEENSLAND:** 1M, 15 mi. SW Burleigh Hds., 26.x.1962, 50m, Ross & Cavagnaro (CAS); 1M, Killarney, 30.i.[19]52, Morris (UQIC); 1?, Tambourine Mts., Pa[u?]ttinson (QMB). **QUEENSLAND or NEW SOUTH WALES**: 1M, Macpherson Ra[nge], 28.xii.[19]41, D[umigan] (UQIC).

elegans (Guérin-Méněville, [1844]): eastern Australia [New South Wales, Queensland]

Artiopteryx elegans Guérin-Méněville, [1844]:389 [original description].—Erichson, 1847 [redescription].

Psychopsis elegans.—Hagen, 1866 [listed]; Brauer, 1889 [listed]; Tillyard [1919a] [listed, distribution, wing*]; Tillyard [1919b] [biology, egg*, larval instars*, pupa*]; Krüger 1922 [listed]; Gallard 1923 [note]; Tillyard 1926 [habitus*]; Kimmins 1939 [listed, distribution]; New [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

[*Psychopsis mimica*].—Froggatt, 1902 [redescription, 1st instar larva].

Psychopsis newmani Froggatt, 1903:454 [original description, distribution, habitus*].—Gallard, 1914 [biology]; Navás, 1917 [redescription, distribution].

Zygophlebius verreauxinus Navás, 1910:84 [original description, wing*].

Arteriopteryx [sic] *elegans*.—Navás, 1917 [redescription].

FLIGHT PERIOD: 14 October - 24 January. MATERIAL EXAMINED [12M, 8F, 3? = 23]: **AUSTRALIA: QUEENSLAND:** 1M, Cairns dist., Dodd (SAMA); 1F, 1?, Toowoomba, Barnard (QMB); 1M, 1?, Brisbane, 20.x.[19]25, 12.xii.[19]39 (UQIC, QMB); 4M, Kuranda, Dodd (SAMA); 1M, Yeppoon, 14.x.[19]24 (QMB); 1M, no further locality, 1844, Thorey (MCZ); 1M, Bulimba, 28.x.[19]09 (USNM); 1F, Biloela [24°21′S, 150°30′E], 11.xii.[19]46, Bird (UQIC); 1M, Biloela, 24.i.[19]45, Rosser (UQIC); 1F, Bundaberg [24°50′S, 152°21′E], 25.x.[19]32 (UQIC); 1?, Wacol [27°35′S, 152°56′E], 18.xii.[19]51, Box? (UQIC). **NEW SOUTH WALES:** 1F, Sydney, Summe Hill, 2.i.[19]13, Downing (DANSW); 1M, Eppine, 24.xii.[19]15, reared, Tillyard (SAMC); 1M, Warialda district, xii.1949 (DANSW). **UNKNOWN STATE:** 2F, no locality data, 16-19.xii.[19]40, (UQIC); 1F, no data (USNM); 1F, Ft. Denison, N. Australien, 1847, Daemel (MCZ).

mimica Newman, 1842: eastern and southern Australia [New South Wales, s. Northern Territory, Queensland, South Australia, Victoria, Western Australia]

Psychopsis mimica Newman, 1842:415 [original description].—Newman, 1843 [redescription, habitus*]; McLachlan, 1863 [listed]; Hagen, 1866 [listed]; Brauer, 1889 [listed]; Froggatt, 1903 [redescription, distribution, habitus*]; Navás, 1917 [redescription]; Tillyard, [1919a] [listed, distribution]; Gallard, 1922 [biology]; Krüger, 1922 [listed]; Gallard, 1923 [biology]; Tillyard, 1926 [habitus*]; Kimmins, 1939 [listed, distribution]; New, [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

Hemerobius mimicus.—Walker, 1853 [redescription, distribution].

Hemerobius olim Brauer, 1889:103 [nomen nudum].

[*Psychopsis elegans*].—Kimmins, 1939 [wing*].

FLIGHT PERIOD: 14 October - 11 March. MATERIAL EXAMINED [9M, 57F, 8? = 74]: **AUSTRALIA: NEW SOUTH WALES:** 2M, 2F, Narrabri A.R.Stn., 24.xi.1966, 5-11.xi.1967, 1.xii.1967, some ex. light, Wright (DANSW); 1F, Narrabri, 24.i.1960, Lola (DANSW); 1F, Hay WWF, 20.i.1916 (DANSW); 1F, Tumut, 6.ii.1957, Nicholson (DANSW); 1F, Warren, i.1963, Grund (SAMA); 1F, Binnaway, 5.i.1934, Field (AMS); 1F, Deniliquin, 13.ii.1950 (DANSW); 1?, Coonabarabran [31°16′S, 149°18′E], 31.i.[19]47 (DANSW). **NORTHERN TERRITORY:** 1M, Alice Springs, Ernabella Mission, 7.xi.1961, Hilliard (SAMA). **QUEENSLAND:** 1F, Cunnamulla, xi.1943, Geary (QMB); 2F, Cunnamulla, i.1941, 14.xii.1944 (QMB); 1F, St. George, i.1944, Geary (AMS); 2F, 1?, Clermont [22°48′S, 147°40′E], 14.x.[19]23, 21.x.[19]24, 26.ii.[19]24 (QMB, UQIC). **SOUTH AUSTRALIA:** 2F, Windy Cr. below Aroona Dam, 10km SW Copley, 24.xi.1975, ex. light, Gross (SAMA); 1F, Berri (SAMA); 2F, Berri, xii.1920, Hoskin (SAMA); 1M, 3F, no further locality (SAMA); 1F, Waikerie, i.1971, Doyle (SAMA); 1F, Balcanoona Ck., 23.xi.1975, ex. light, Gross & Potezny (SAMA); 1F, Blackwoood, 11.iii.[19]69, ex. light, McFarland (SAMA); 2M, 6F, 2?, Adelaide, 1.ii.1893, 15.ii.[18]98, 7.i.[19]08, 26.x.[19]10, most no date, various coll. (MCZ, SAMA); 1?, Wentworth, 19.i.[18]91 (SAMA); 1F, Wentworth, 21.ii.[18]93, Cudmore (SAMA); 1?, Reed Beds, ii.1894, White (SAMA); 1F, Reed-Beds, i.1903, Smith (SAMA); 1F, Reed-Beds, ii.1903, Jones (SAMA); 1F, Flinders Range, Mt. Painter, Stokes (SAMA); 1M, Laura, ii.[19]67, Peck (SAMA); 1F, Manoora, Kelly (SAMA); 1F, Unley Park, 26.ii.1961, ex. light, Southcott (SAMA); 2F, Waterfall Gully, 29.i.1948 (SAMA); 1F, Melrose, Shields (SAMA); 3F, Holmfirth, Fulham, ii.1898, ii.1899, i.1904, Mellor (SAMA); 1F, College Town, iii.1956, Melrose (SAMA); 1F, Murray Bridge [35°10′S, 139°17′E], Mackintosh (SAMA); 1F, Mitcham, 21.xii.[19]06, (SAMA). **VICTORIA:** 1F, Loddon Riv., 13.i (USNM); 1M, Gunbower, 2.ii.[19]54, Harley (UQIC). **WESTERN AUSTRALIA:** 1?, Beverley (SAMA). **UNKNOWN STATE:** 1F, Grumbungee (UQIC); 1F, G[rum]bungee, 27.xii.[19]20, Beck (UQIC); 1M, 1F, Madowla Park, 21.i (SAMA); 1F, no data (MCZ); 1F, Mt. Larcom, xi.1928, Chapman (QMB); 1F, "Australia / Angus" (MCZ); 1F, Jrura?, 19.xii.[19]00, Lewis (SAMA); 1F, Umberatana?, 8.xii.[18]99, Greenwood (SAMA); 1F, Renworth?, 22.xii.[18]92, (SAMA); 1?, "Australia" (MCZ); 1F, no data (SAMA).

barnardi Tillyard, 1925: northeastern Australia [Queensland]

Psychopsis barnardi Tillyard, 1925:388 [original description, habitus*].—Kimmins, 1939 [listed, distribution]; New, [1989a] [redescription, distribution, male terminalia*, female terminalia*, wing*].

FLIGHT PERIOD: 4-8 December. MATERIAL EXAMINED [18M, 3F, 2? = 23]: **AUSTRALIA: QUEENSLAND:** 12M, 1?, "Carnavon" [=Carnarvon?] Range, xii, Geary (MCZ); 2M, 1?, Carnarvon Range, 4-6.xii.[19]41, Franzen (UQIC); 4M, 1F, Carnarvon Range, 5-8.xii.1941 (QMB); 1F, no data [Queensland?] (UQIC); 1F, Brisbane, [19]52, "RPK" (UQIC).

tillyardi New, [1989]: north central Australia [Northern Territory]

Psychopsis tillyardi New, [1989a]:851 [original description, distribution, female terminalia*, wing*].

FLIGHT PERIOD: 11 April (see New, [1989a]:851). NOTE: Males unknown; known only from the female holotype and the following specimen. MATERIAL EXAMINED [1F]: **AUSTRALIA: NORTHERN TERRITORY:** 1F, Bathurst Is. (SAMA).

dumigani Tillyard, 1922: northeastern Australia [Queensland]

Psychopsis dumigani Tillyard, 1922a:36 [original description, A*, habitus*].—Kimmins, 1939 [listed, distribution]; New, [1989a] [redescription, distribution, female terminalia*, wing*].

Psychopsis notha Navás, 1928:65 [original description, distribution, forewing*].

FLIGHT PERIOD: 1-11 November (see Tillyard, 1922a:36). NOTES: Males unknown; known only from ca. six female specimens. Males previously cited by Tillyard are actually females, see New, [1989a]:852. MATERIAL EXAMINED: None.

maculipennis Tillyard, 1925: western Australia [Western Australia]

Psychopsis maculipennis Tillyard, 1925:389 [original description, habitus*].—New, [1989a] [redescription, distribution, wing*].

Wernzia maculipennis.—Kimmins, 1939 [listed, distribution].

FLIGHT PERIOD: Unknown (unique holotype lacks temporal collection data). NOTES: Males unknown; known only from unique female (not male as stated by Tillyard, see New, [1989a]:852) holotype. MATERIAL EXAMINED: None.

margarita Tillyard, 1922: eastern Australia [New South Wales]

Psychopsis margarita Tillyard, 1922a:37 [original description, habitus*].—Kimmins, 1939 [listed, distribution]; New, [1989a] [redescription, distribution, female terminalia*, wing*].

FLIGHT PERIOD: 29 December (see Tillyard, 1922a:38). NOTES: Males unknown; known only from the two females (not males as stated by Tillyard, see New, [1989a]:850) of the type series. MATERIAL EXAMINED: None.

PSYCHOPSINAE *incerta sedis*

gallardi (Tillyard, 1919): eastern Australia [New South Wales, Queensland]

Psychopsella gallardi Tillyard, [1919a]:780 [original description, male terminalia*, wing*, habitus*].—Gallard, 1923 [listed, distribution].

Balmes gallardi.—Kimmins, 1939 [listed, distribution].

Psychopsis gallardi: New, [1989a] [redescription, distribution, male terminalia*, wing*].

FLIGHT PERIOD: 7 December - 14 January (see New, [1989a]:847). NOTES: Females unknown; known only from two male specimens. MATERIAL EXAMINED [1?]: **AUSTRALIA: QUEENSLAND:** 1?, Carnarvon Range, 7.xii.1941 (QMB). [This specimen is tentatively identified as gallardi. Its forewing markings are similar to those illustrated by Tillyard ([1919a]: plate 78, fig. 11), and it lacks a distal hind wing macula. However, the costal gradate series of the specimen are much more complete (18 crossveins in each wing) than is indicated by either Tillyard or New ([1989a]) for the other known specimens of this species. This specimen was not included in the cladistic analysis because it lacks an abdomen.]

APPENDIX 2

Character State Data Matrix

The coded character state data in the matrix below were used to infer cladistic relationships within the family Psychopsidae. The data shown for the ingroup taxa and the hypothetical ancestor were used to generate the cladogram shown in Fig. 53. The data shown for the outgroup taxa are presented only to document the assignment of ground plan character states to the hypothetical ancestor (see Phylogenetic Analysis: Methods above); these data were not included in the final cladistic analysis. Characters, character states, and outgroup taxa are discussed more fully in the text. Derived character states which were found to be restricted to outgroup taxa (matrix code "-") have been omitted from the textual character treatments. These omissions have been verified to have no affect on the character states assigned to the hypothetical ancestor. Symbols: 0-4, character state numbers; ?, missing ingroup data (i.e., relevant sex unknown or not seen and data not available in the literature); *, state uncoded due to uncertain ingroup/outgroup homology; -, derived state restricted to one or more outgroup taxa, individual states not treated in text.

Taxon	Character Number	
	00000000011111111112222222222	3333333333444444444455555555556
	12345678901234567890123456789	0123456789012345678901234567890
Outgroup Taxa		
Agulla	-000000000000-000000010000000	01-00000000000*00000-1000010000
Halter	20000000000000000-0001001000	01101000-000000000000000000000
Kempynus	-00000000-0000000000001000000*	********000000-000001000010000
Nomerobius	20000000000000000-0-1-000000	01000000000000-00000000010000
Nymphes	-0001000000000000000010000000	0-110000000000-000001000010000
Osmylops	20001000000000000-0000000000	0-000000002000-000001000010000
Osmylus	-00000000-000000000000000000*	********00-000-000001000010000
Polystoechotes	20000000000000010-0111000-00	01000000000000-00000000010000
Hypothetical Ancestor		
HypAnc	00000000000000000001000000	0100000000000000000000000010000
Ingroup Taxa		
P. barnardi	10101121210001202221001210020	0110001110111032111111012110011
B. birmanus	10001001020001201000111400100	0110002101101120111111002100001
P. coelivaga	20001101100001201040010100000	0110002100101020111111012110001
P. elegans	10101121210001202221001300010	0110002110101031111111012110011
C. gloriosus	11001111011101101000011000000	0101001100101010111111002110101
P. gracilis[1]	10101121210001201120111100010	01100021101?103?1???1101?1??0??
P. illidgei	10001121110001201130111101020	0210002110101130111111012110011
P. insolens	10001121310001201000011100000	0110002111101020111111012110001
S. jordani	01001111010001111010011000000	0100001100101020111111101110201
Z. leoninus	11011121411001101010021000001	0100111100201010111111002121101
S. marshalli	01001111010011111010011000000	2000001100101020111111101110201
P. meyricki[2]	10001121310001201000011100000	011000211 0?????????????????????
P. mimica	10101121210001202221001210010	0110002110101031111111012110011
S. occultus	01001111010011111010011000000	2000001100101020111111101110201
S. rufus[3]	01001111010011111010011000000	1000001100101020??1?111011??20?
B. terissinus	10001001010001201000111400000	0110002101101120111111002110001
P. tillyardi[4]	101011212????????????????????	??????????1110321111111012110011
Z. zebra	11011121411001101010021000001	0100111100201010111111002121101
bns1[5]	10001001010001201010111401100	011000210 1??????????????????????
cns1	11001111011101101000011000000	0101001100101010111111002110101
zns1	11011011411001101000021000000	0100101100201010111111002111101

[1] Female not seen, incomplete female terminalia data taken from New ([1989a]: figs. 75-79).
[2] Female unknown (New [1989a]:854).
[3] Female not seen, incomplete female terminalia data taken from Tjeder (1960:

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PHILADELPHIA

1993

Paul M. Marsh
Editor

Issued 1 December 1993

PRINTED IN THE UNITED STATES OF AMERICA

Typesetting and page composition by
ELYTRON
Swarthmore, Pennsylvania

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This study is respectfully dedicated to

Sven Nilsson

the father and friend of the first author,

who unfortunately passed away before the work was finished

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by

JAN A. NILSSON

and

CLARENCE DAN JOHNSON

Department of Biological Sciences
Northern Arizona University
P.O. Box 5640, Flagstaff, AZ 86011-5640, USA

ABSTRACT—The genera and species of the New World tribe Pachymerini (the palm bruchids) are revised, and the world genera of the Pachymerinae are described. The new genus *Speciomerus* Nilsson is established, the genus *Butiobruchus* Prevett is synonymized with *Pachymerus* Thunberg, and 3 new species are described: *Caryoborus gracilis* Nilsson, *Caryobruchus maya* Nilsson, and *Pachymerus sveni* Nilsson. New combinations are given to 5 species, while 1 genus name and 12 species names are synonymized. A neotype is designated for *Bruchus curvipes* Latreille. The following 20 species of New World Pachymerinae are considered to be valid: *Caryoborus chiriquensis* Sharp, *C. gracilis* Nilsson, new species, *C. serripes* (Sturm), *Caryobruchus curvipes* (Latreille), *C. gleditsiae* (Johansson and Linné), *C. marieae* Nilsson and Johnson, *C. maya* Nilsson, new species, *C. rubidus* (Chevrolat), *C. veseyi* (Horn), *Speciomerus giganteus* (Chevrolat), new combination, *S. revoili* (Pic), new combination, *S. rubrofemoralis* (Pic), new combination, *S. ruficornis* (Germar), new combination, *Pachymerus abruptestriatus* (Gyllenhal), *P. bactris* (Linné), *P. bridwelli* (Prevett), new combination, *P. cardo* (Fåhraeus), *P. nucleorum* (Fabricius), *P. sveni* Nilsson, new species, *P. thoracicus* Prevett. Keys to subfamilies, tribes, genera and species are presented, critical morphological characters are illustrated and Arecaceae host plants are reported. Distribution maps are presented for all species.

INTRODUCTION

Most Bruchidae are small and all feed in the seeds of plants. Less than 10% of these seed beetles are of economic importance. They are closely related to the Chrysomelidae, the leaf beetles. The body is often egg-shaped, that is broadest toward the rear or the middle. The head is frequently concealed from above, and prolonged into a short beak. The hind femur is usually enlarged dorso-ventrally (incrassate), often with spines or denticles on the ventral margin. The antennae are often club-shaped with 11 segments, often serrate or pectinate. The eyes are often notched (ocular sinus), the elytra are striate (each elytron has 10 striae), and the pygidium is often exposed (White 1983). All known Bruchidae spend their larval period in the seeds or fruits of plants, and are often specific to seeds of certain plant species or genera (Johnson and Slobodchikoff 1979). Females oviposit on a seed or a pod, the larvae then burrow into a seed, feed inside a seed or several seeds, usually pupate inside a seed, and the adults emerge through an exit hole.

The host plants of many bruchids are unknown, and the delimitation of plant families varies with different taxonomists. According to Johnson (1985) about 85% of the investigated host plants are in the legume family, Fabaceae, 4% are in the palm family, Arecaceae, 4% in the morning glory family, Convolvulaceae, and 2% in the mallow family, Malvaceae. The remaining 5% are in 29 other families (Borowiec 1987; Johnson 1981, 1985) (Table 1).

Bruchids in the subfamily Pachymerinae are medium to large size plant seed predators consisting mainly of so called primitive forms. They appear to be naturally distributed in the tropics and subtropics of all continents except Australia, and extend into temperate zones in some areas. The Old World pachymerines are only reliably reported to feed in Leguminosae and Combretaceae, while the tribe Pachymerini of New World origin almost exclusively uses palms as host plants and are therefore commonly called palm bruchids. The only known exception is *Pachymerus abruptestriatus* (Gyllenhal) which uses a non-palm, *Diospyros* sp. (Ebenaceae), as a host (Bondar 1941, 1943). Although palms are of economic importance, little is known about the insects that feed in their seeds, and only a few host associations are known.

Most of the studies on bruchids have been done on species in the largest subfamily Bruchinae, which feeds mostly in legumes. Patterns obtained from research on Bruchinae cannot be automatically extrapolated to the Pachymerinae, since the pachymerine bruchids are only distantly related to the Bruchinae.

Very little ecological research has been done on the Pachymerinae, even though relationships between bruchid beetles and their hosts usually are more readily studied than are many other insects and their host plants. Palms are, however, usually an exception to this, being much more difficult to collect because of the height of many palm trees. The limited knowledge we have about the biology of the palm bruchids has mostly been learned through studies of their palm hosts (Janzen 1971, 1972; Wilson and Janzen 1972; Smith 1975; Bradford and Smith 1977; Wright 1983; Smythe 1989). One reason for the lack of ecological research is the problem of identification. With this revision, identification problems are clarified for the New World species.

The palm bruchids appear to be nocturnal insects because they are often captured in ultraviolet light traps. Also, captive beetles in the laboratory hide during daylight hours inside hollow palm fruits and come out only at night or in a dark room. In the laboratory, palm bruchids also seem to have only one generation per year, and the developmental time for the larvae in the seeds, compared with other bruchids, seems to be much longer. The normal developmental time for *Stator beali* Johnson (Bruchinae) is about one month, while for *Caryobruchus gleditsiae* (Johansson and L.) (Pachymerinae) it is six months or longer. It is not known if any of the Old World pachymerines in the tribes Caryedini and Caryopemini also use palms as hosts, but some are pests of legumes such as peanut (Davey 1958; Prevett 1966b) and tamarind (Davey 1958; Johnson 1966, 1986; Nilsson and Johnson 1992; Vélez Angel 1972).

TAXONOMIC HISTORY

Studies of the pachymerines (Bridwell 1929; Prevett 1966b) are few and incomplete. Thirty-four species names of palm bruchids have been published. Linné (1762) described *Dermestes bactris* in a letter to N.J. Jacquin who subsequently published Linné's description in a footnote with his description of the host palm *Bactris minor* (Jacquin 1763). Another pachymerine species, *Dermestes gleditsiae*, was mentioned in Linné's letter and compared with *D. bactris* but a printed description of this species was not done until Johansson described it along with a redescription of *D. bactris* in his dissertation (Johansson 1763). A formal publication of these two species in the genus *Dermestes* was also published after the death of Linné (Johansson and Linné 1763, published 1789). The letter with the original description of *D. bactris* was later published together with Linné's other correspondence to Jacquin by Schreibers (1841). Prior to both these dates Linné proposed and published the genus *Bruchus* in which he placed both species (Linné 1767a, b).

Fabricius (1792) redescribed *Bruchus bactris* and also described the new species *Bruchus nucleorum* from specimens first misidentified by Herbst (1783) as *B. bactris*. Fabricius also described *Bruchus gonagra* (1798) and *Bruchus arthriticus* (1801), but ignored

Bruchus gleditsiae. Fabricius and the other students of Linné did not have Linné's collection on which to base new descriptions and redescriptions. After the death of Linné, the collection was first owned by Linné's son. In 1783 it was sold to a private collector in the United Kingdom and in 1828 to the Linnean Society in London (Usinger 1974). Since then the collection has been treated more as if the insects were expensive jewels rather than insects for scientific study.

Latreille (1802) added the category family to the hierarchial system implemented by Linné and placed *Bruchus* with *Anthribus* in a family he named Bruchèlae. The family name was corrected to Bruchidae by Leach (1814) and *Anthribus* was removed by Thunberg (1816).

After *Bruchus* was proposed (Linné 1767a), all seed beetles were placed in this genus until Thunberg (1805) transferred *B. bactris* (L.) to the new genus *Pachymerus*. This new genus name was ignored by other workers until Pic (1913) used it again. Thus, descriptions of *Bruchus curvipes* Latreille (1811), *B. ruficornis* Germar (1818a) and *B. serripes* Sturm (1826) were all described as *Bruchus*.

Latreille (1825) used the name Pachymere (vernacular name) and ignored *Pachymerus* Thunberg (1805). He named Pachymere as if it were a new genus and designated *Bruchus brasiliensis* Thunberg as type of the genus. Schönherr (1833) placed *Bruchus* in the family Curculionidum and divided the genus into several groups. He followed Latreille (1825) and placed some species in grex (subgenus) *Pachymerus* (Pachymere Latreille 1825, not *Pachymerus* Thunberg 1805) and some in the new subgenus *Caryoborus*. This name became the accepted name for all "palm bruchids" until Pic (1913) rediscovered *Pachymerus* Thunberg (1805). *Bruchus bactris*, the type of *Pachymerus* (Thunberg 1805) and *B. serripes* Sturm, the type of the genus *Caryoborus*, are distinct species so both genera are valid.

Fåhraeus (1839) described *Bruchus cardo* and Gyllenhal (1839) described *B. abruptestriatus*. Both were placed in the subgenus *Caryoborus* by Schönherr (1839). Horn (1873) described *Caryoborus veseyi*, separated *Caryoborus* from *Bruchus* and elevated it to the generic level.

Several descriptions of new taxa followed. Motschoulsky (1874) described *Caryaborus (sic) testaceus*, misspelling the genus name. Chevrolat (1877) described *Caryoborus giganteus*, *C. priocerus*, *C. lacerdae*, *C. luteomarginatus*, *C. rubidus*, and *C. recticollis*. Sharp (1885) described *C. chiriquensis*. Pic described *C. rubrofemoralis* and *C. donckieri* in 1899 and *C. revoili* and *C. sparsepunctatus* in 1902.

Pic (1913) transferred all "palm bruchids" described until then to *Pachymerus* Thunberg (1805) and invalidated the name *Pachymerus* Latreille (1825). The name *Pachymerus* Latreille was changed to *Pseudopachymerus*. Bridwell (1932) synonymized *Pseudopachymerus* Pic with *Caryedes* Hummel, and placed it in the subfamily Bruchinae.

In all, 22 species were described up to and including Pic (1913). Most of these descriptions appear to have been done without study of types and without comparing them with other species. Bridwell (1929) did the first modern study but his work was also done without the study of types and limited to comparing material at the U.S. National Museum with original descriptions. Bridwell established the new genus *Caryobruchus* and the subfamily Pachymerinae which he divided into the three new tribes Pachymerini (after *Pachymerus* Thunberg), Caryedini (after *Caryedon* Schönherr) and Caryopemini (after *Caryopemon* Jekel). These names follow the recommendations in the International Code of Zoological Nomenclature (ICZN 1985). Decelle (1966) changed two of the tribe names to Caryedontini and Caryopemontini. However, the correct stems of the Pachymerinae tribes are Pachymer-, Caryed-, and Caryopem-. To these stems should be added -ini (ICZN 1985). Therefore Caryedontini and Caryopemontini are unnecessary changes of the original names given by Bridwell. We follow Bridwell and use the original names.

Bridwell placed all species commonly called "palm bruchids", the genera *Pachymerus*, *Caryoborus* and *Caryobruchus*, in the Pachymerini. The distribution of these is limited to the New World. He discussed the Old World tribes but did not mention any species. He primarily studied beetles in the New World genus *Caryobruchus* and described the species *C. scheeleae*, *C. lipasmatus*, *C. buscki*, *C. acrocomiae*, *C. pararius*, and *C. pergandei*. Most of these new species were described from only one or two specimens.

Only a few new species have been described since Bridwell's (1929) paper. Bondar (1941) described *Pachymerus diospirosi*. Kingsolver (1965) described a new fossil genus *Oligobruchus* which he placed near *Pachymerus*. This fossil genus was not studied and is not included in the revision. Nilsson (1992) stated that based on a study of the original description, *Oligobruchus* is closer to *Caryopemon* Jekel than to *Pachymerus*. Decelle (1966) transferred *Bruchus fuscus* Goeze to *Caryobruchus* and preliminarily placed it with *Dermestes gleditsiae*. Prevett (1966a) proposed and described the new genus *Pachymeroides* and the species *P. bridwelli*.

The second modern study of the palm bruchids is Prevett's (1966b) systematic notes on the genus *Pachymerus*. This appears to be the first work where types were studied. He changed, in a footnote, the name *Pachymeroides*, preoccupied in the Hemiptera, to *Butiobruchus*. He also proposed a neotype for *Bruchus bactris* (although a neotype was needed, the name is incorrect because the correct type name is *Dermestes bactris*). He also described the new species *Pachymerus thoracicus*.

Silva (1979) discussed the distribution of the host plant of *Pachymerus thoracicus* Prevett. Borowiec (1987) discussed taxonomic characters of *Pachymerus*, *Caryoborus* and *Caryobruchus* in his worldwide treatment of bruchid genera. Udayagiri and Wadhi (1989) list all Bruchidae in their catalog, but much of the information about the Pachymerinae is outdated. Nilsson and Johnson (1990) redescribed *C. gleditsiae* and described *Caryobruchus marieae*.

Because of the confusion between *Pachymerus* Thunberg and *Pachymerus* Latreille, for many years both non-pachymerine and pachymerine bruchids were included in the genera *Caryoborus* or *Pachymerus*. Most of these were correctly placed by Pic (1913), but some still remain in *Caryoborus* or *Pachymerus* because they have not been studied since they were described.

The purpose of this study is to revise the New World tribe Pachymerini and to describe the world genera of the subfamily Pachymerinae. A revision is necessary to make possible the correct identification of species of palm bruchids. This is especially important for agricultural inspectors at ports of entry, ecologists working with palms and tropical agriculture and silviculture workers.

All new taxa in this revision are to be attributed to Jan A. Nilsson.

MATERIALS AND METHODS

During this study 4231 specimens of Pachymerini were examined from 51 museum, private, or university collections. The numbers of specimens studied are in the treatment of each species. Many were old museum specimens without host associations and other ecological data. In addition to specimens of Pachymerini, several specimens of Caryedini and Caryopemini were also studied.

Host records are in the Specific Records section. Most host records are from collection labels, but a few beetles were reared in the laboratory. These were reared from palm fruits contained in glass canning jars covered by paper towels treated with 0.5-1% Kelthane® in acetone solution to prevent mite infestations (Johnson 1970). The paper towels were secured to the jars with metal ring caps. The jars were examined weekly for any bruchids that may have emerged.

All descriptions follow the same basic format and all species are described or redescribed. A Diagnosis with a brief listing of characters used to differentiate a particular species from related species is included before the detailed description or redescription. All species in a genus are compared and contrasted in a section following the last included species. If a species is new, a Differential Diagnosis follows the Diagnosis of that species (however, it is only a statement referring to the section following the last included species). Some terminology used is new (see MORPHOLOGICAL TERMINOLOGY below) and some follows *in part* that of Prevett (1966b) and Johnson and Kingsolver (1973). Kingsolver (1970) is followed for terminology of the male genitalia but several new structures are defined. Species names, genera and tribes are indexed.

All drawings were made by the first author. The illustrations for each species vary, depending on which characters are of importance. The hind leg and male and female genitalia are always illustrated. Due to the great similarity between species, the habitus is only illustrated for some species, but at least one habitus from each genus is illustrated. For some species additional structures are figured. Almost all parts used in the keys are figured. The same body parts are placed together for each genus to facilitate comparisons rather than putting all parts of one species together.

The male and female genitalia have very useful characters in the genus *Caryobruchus* but are of no taxonomic value in the genus *Pachymerus*. Genitalia were studied and drawings made, however, for all species in all genera. All specimens were relaxed in hot 70-80% alcohol for 3-10 minutes, depending on the condition and size of the specimens. The genitalia were removed by placing the beetles upside-down under a dissecting microscope on a piece of Styrofoam®. The beetles were held in place with dissecting forceps, the apex of the pygidium was opened with another pair of forceps, and the genitalia removed. Extracted genitalia were cleared of tissue by treatment in hot 10% potassium hydroxide (KOH) for about 2-6 minutes. Care was taken to assure that the genitalia were not kept too long in the KOH because this makes the genitalia transparent and of no use for identification. After the KOH treatment the genitalia were washed in alcohol, the parts stored in microvials with glycerin, and attached to a specimen pin.

The geographical distributions for each species are in a list of countries and sometimes also as states or provinces in the Distribution section, and as distribution maps (Figs. 1-6). For species that are in need of collecting all known collecting records are in the Specific Records section to aid future collectors. For species extensively collected only specific records with host associations are noted. If a record is judged to be from a quarantine without a specific collection locality or other place away from its natural habitat, but not so noted on the labels, the record is not included on the distribution maps.

The sexes in palm bruchids are morphometrically similar, some sexual dimorphisms exist, e.g., much longer femur in the male *Pachymerus bactris* (Linné), and in some species the males sometimes have a much wider protarsus. Taxonomically important length/width ratio means are in Table 2.

Only the New World tribe Pachymerini are revised. Some species that have been introduced to the Old World are mentioned. The Old World species *Caryedon serratus* (Olivier) (tribe Caryedini) has been reported introduced to the New World (Johnson 1966, 1986; Nilsson and Johnson 1992; Vélez Angel 1972) but is not included here.

In addition to the revision of the New World tribe Pachymerini, the Old World genera of the subfamily are described.

STRUCTURES OF VALUE AS TAXONOMIC CHARACTERS

Total length of body. The heads of bruchids are often at more than a 90° angle to the meson (Figs. 53, 54). The heads articulate with varying lengths of the vertex (Fig. 55) and the occiput (Fig. 55) hidden under the pronotal disk. For these reasons the measurements of total body length in bruchid literature has traditionally been the combined lengths of the elytron and the pronotum only. Because the space between the pronotum and the elytron varies depending on the position of the beetle, and the pronotum and the elytron are not in a horizontal plane, the measurements are done separately and then added.

Total width of body. Measured as the maximum width across the elytra. Due to variation in the resting position of the elytra, only one elytron width was measured and then multiplied by two to give the body width.

Maximum thoracic depth. Measured in lateral view from the basal mesal part of the elytra, to the basal mesal part of the mesosternum. The measurement is not a very reliable character because the elytra are often not in a flat resting position making an accurate measurement impossible. This is often the case, particularly in teneral beetles with swollen abdomens. Even if the insect is softened in alcohol it is difficult to put the elytra into a reliable position for measurement. This measurement is included because it is of some value when comparing the different genera, but not when comparing different species.

Integument. The integument in the pachymerine bruchids is usually moderately hirsute with rather fine setae (Fig. 7). Sometimes the setae have been removed, probably due to accidental rubbing (Figs. 8, 9). Since the base of each seta is set in a minute puncture, the integument is minutely punctulate where the setae have been removed. Very few structures are glabrous (as defined by Torre-Bueno (1989) p. 305: smooth, devoid of pubescence; devoid of any sculpturing). The color of the integument in the Pachymerini is very similar for all species in the tribe but with much intraspecific variability and therefore of limited use as a taxonomic character. Some exceptions are in the descriptions. The color is usually dark brown to almost black, or a modification of these colors, together with the addition of yellow and red on some body parts, especially the legs and the antennae.

Vestiture. With the exception of *Diegobruchus* Pic and *Caryopemon* Jekel, pachymerine bruchids appear brownish or blackish because the setae are not dense or coarse enough to cover the brownish or blackish integument. However, colors of the setae, especially on the dorsum, were found to be valuable characters to distinguish many species, especially in *Pachymerus*. To a limited extent the texture (fine, medium, coarse) can also be of some taxonomic value. Density of setae is not of much value since most Pachymerinae (Pachymerini and Caryedini) are homogeneous and have sparse setation. The arrangement of the setae is of some importance in separating two species where the disposition of the setae on the elytra along the striae gives an effect of alternating color (*Speciomerus ruficornis* (Germar) and *Pachymerus bactris* (Linné)). This effect is strongest to the naked eye and often is not clearly visible under the microscope. Some species have very small, fine setae, e.g., *Speciomerus rubrofemoralis* (Pic), so that the integument appears not to have setae and is difficult to see under a microscope.

Head. The important characters on the head vary between genera. The size and shape of the antennal segments are two of the most important characters to separate the species of *Caryobruchus* (Figs. 89-94) and *Caryoborus* (Fig. 95). The following characters are usually important: the length, size and height of the carina between the eyes (Figs. 53-55); the distance between the eyes on the dorsal side (following Prevett 1966b, the term approximate is used for a short distance between the eyes (Fig. 55) and distant for a long distance between the eyes (Fig. 53)); the distance between the eyes on the ventral side (approximate (Fig. 61) or distant (Fig. 58)); the size of the ocular sinus (Figs. 20, 53); the postocular lobe (Figs. 19, 20); the length and width of the 3rd segment of the maxillary palp (Figs. 53, 55); the total length of the head; and the shape of the submentum (Fig. 56). Bridwell (1929) and Prevett (1966b) used the term "gula" for the submentum. We are confident that the structure is the submentum (for discussion see MORPHOLOGICAL TERMINOLOGY).

Prothorax. *Disk.* Several important taxonomic characters are on the disk (Figs. 55, 67) which usually is feebly convex with the sides of the anterior margin depressed. Sometimes it is sharply depressed so that the angles (Fig. 53) are not visible in dorsal view. The shape of the anterior margin is often a good character to separate species. The length compared to the width of the disk (length/width ratio) is sometimes important to separate species, especially in *Pachymerus*. Bridwell (1929) separated several species of *Speciomerus* Nilsson (he placed these beetles in *Caryobruchus*) on the amount and location of the punctations (foveolations) found on the disk. The amount of punctations varies intraspecifically, and Bridwell only had one or two specimens of each species to study. Therefore, punctations are generally not useful to separate species. *Prosternal process*. The apex of the prosternal process (Figs. 46, 47) in the Pachymerini always completely separates the procoxae and the width (wide, medium or narrow) is an important species character. *First leg*. Protarsus 1 (tarsal segment 1 on the 1st leg) (Fig. 20) is often much shorter and wider than the metatarsus 1 (tarsal segment 1 on the hind leg) (Fig. 20). In *Speciomerus* and *Caryobruchus* protarsus 1 is sexually dimorphic, swollen in males but not in females.

Mesothorax and metathorax. *Scutellum*. Size and shape are sometimes useful characters to delimit higher taxa but rarely useful for species (Fig. 50). *Elytron*. The size is of taxonomic importance for higher taxa. The humerus (Fig. 12) is sometimes scabrous (Fig. 67), and even though there can be some intraspecific variation, the absence or presence of scabrosites is a good species character. The striae (Fig. 11) are almost identical in the palm bruchids, always ten lines of punctations and therefore usually not much use as taxonomic characters. Prevett (1966b) stated that in *Pachymerus abruptestriatus* (Gyllenhal) "the elytral striae are marked by shallow elongate-oval irregularly spaced punctures". This description fits all species in the Pachymerini. However, in this species the setae are dense and coarse and the immediate area surrounding the punctations (and inside the punctations) are without setae, so because of the contrast between the darker integument and the pale setae, the punctations in the stria appear very clear and distinct. Fine punctations can also be seen on the lateral side of the metafemur. The explanation is the same as for the strial punctations. *Metafemur*. This leg segment possesses several important characters (Figs. 68-90). It is incrassate, has a pecten (Figs. 23, 24) on the ventral side with different numbers of denticles, varying length and shape (straight or curved), and a prepectenal ridge (Fig. 24) with or without spines. The location of the first denticle on the pecten (Figs. 24, 36-38), which is usually larger and acuminate, and the length of the pecten (length/width ratio) and prepectenal ridge are important characters for species, genera and higher taxa. The lateral side of the metafemur has, in many species, fine punctations which are especially visible in *Pachymerus abruptestriatus*. *Metatibia*. The hind tibia of the Pachymerinae has 3-7 carinae (Figs. 24, 35, 36). The character state with many carinae (usually 4-6) is more common in the subfamily. In the New World only some *Pachymerus* sp. have 7 carinae, and the 7th is present only as a short remnant outer ventral carina (Figs. 24b, 86, 87), and *Caryoborus, Caryobruchus,* and *Speciomerus* have only 3 carinae. Only *Caryopemon* and *Diegobruchus,* two Old World Pachymerinae, have a complete set of 7 full length carinae. The length of these carinae is indicated as a percentage range from either the basal end or the apical end of the segment. Some carinae are strong at the apical end and then taper toward the basal end, while other carinae are strong at the basal end and taper toward the apical end. A carina may extend the full length of the tibia, but be weak over all its length or covered by setae and therefore hard to see. The shape of the bend of the tibia and the length of the mucro can also be of use. The two apical calcaria (Figs. 68-70) in the metatibial corona (dorsal side of the mucro) are found only in *Caryoborus* in New World Pachymerinae. These calcaria, however, sometimes fall off dried specimens. There are fewer carinae in Bruchinae and in slightly different positions, so a modified terminology was adopted by Nilsson and Johnson (1990). The seven carinae in the Pachymerinae are (the assumed homologous carinae in Bruchinae are in parenthesis): 1) inner ventral carina (ventral carina); 2) middle ventral carina; 3) outer ventral carina (lateroventral carina); 4) lateral carina (lateral carina); 5) dorsolateral carina; 6) mesal carina; 7) dorsomesal carina (dorsomesal carina) (Figs. 24, 35, 36). The definitions in Torre-Bueno (1989) for lateral and mesal cannot be used and the terms are redefined (see MORPHOLOGICAL TERMINOLOGY). *Mesosternal process.* The process appears in more or less three different forms and is an important character to separate species in some genera. Most often the apex of the process is either (i) slanting (Fig. 42) or (ii) feebly or sharply curved back towards the plane of the metasternum (Fig. 41); but sometimes (iii) the apex is produced, not slanting or curved back towards the plane of the metasternum, but projecting at a 90° angle from the body plane (when this is the case the spinasternum is often enlarged, produced and the anterior end of the metasternum slightly swollen).

Abdomen. Only two characters were found to be useful, the size (length/width ratio) of the pygidium (Figs. 62-65) and the amount of the pygidium covered by the elytra. The pygidium cover is included in the description for some species as a percentage.

Genitalia. *Median lobe.* The male genitalia offer some of the most stable and useful characters for distinguishing genera and species in bruchid beetles. However, in the New World tribe Pachymerini, the characters of the median lobe are only useful for *Caryobruchus* and to a limited extent in *Caryoborus* and *Speciomerus*. *Caryobruchus* is the only genus in Pachymerini with both basal and median sclerites. The median lobe displays little intraspecific variation and is valuable for the recognition of closely related species. The terminology used for the median lobe (Figs. 97, 98, 99, 101, 102) is that of Kingsolver (1970). New terminology is gemma (pl. gemmae) (see MORPHOLOGICAL TERMINOLOGY below). *Tegmen.* The lateral lobes are also of some limited use as characters, and the terminology follows that of Kingsolver (1970) and Nilsson and Johnson (1992) or is new (see MORPHOLOGICAL TERMINOLOGY below). *Female genitalia.* The sclerites and the length of the apodeme of the spiculum gastrale (Figs. 110, 111, 112) are useful characters in *Caryobruchus* and also to a limited extent in *Speciomerus*.

Host plants. Because many bruchids are host specific, this is often used as a taxonomic character (Johnson and Kingsolver 1973, 1976; Johnson 1990). But the present status of the New World palm taxonomy is such that a comparison can at best only be performed on palm genera. Many collections of palm seeds are needed since most museum specimens are without host records. Most often the host is only identified as "palm". However, the recent revision of *Sabal* (Zona, 1990) makes it possible to use host records for comparison with the genus *Caryobruchus*, the palm bruchids using the fruits of *Sabal* palms for egg laying. The host records for each species in the present study are from collection labels and the plant names were not investigated.

MORPHOLOGICAL TERMINOLOGY

Monros (1959) worked with the Chrysomelidae and made detailed, labeled drawings of beetles in the subfamily Sagrinae. This group of beetles is believed to be very closely related to the Bruchidae (Monros 1959; Kingsolver, pers. comm.). To our knowledge labeled drawings have never been published on bruchid body parts, even though such drawings could be useful since bruchids are morphologically very different from most other families of beetles. For this reason attempts have been made to illustrate all body parts discussed in this work.

The parts of the head discussed below are defined somewhat differently than other authorities. The gula only exists in the prognathous head type, and it is defined the following way by different authors: sclerite on the ventral side of the head between the labium and the foramen magnum (Borror *et. al.* 1989). Torre-Bueno gives several definitions: in prognathous insects, the fused lower ends of the postocciput forming a ventral plate; the throat; that sclerite forming the central portion of the head beneath, extending from the submentum to the posterior margin, and laterally bounded by the genae (Torre-Bueno 1989).

None of the definitions are very precise. Imms (1964) did not have a glossary, but explained many terms in the general text. He stated that in the prognathous head type the foramen magnum is inclined, or it retains the vertical position by elongation of the ventral part of the head. In Coleoptera he stated that this is done as a median ventral sclerite, the gula, extending from the occipital foramen to the base of the submentum, occupying an area between the postoccipital sutures. These sutures have extended forward on the head capsule, as have the posterior tentorial pits, and where they bound the gula they are called gular sutures.

Torre-Bueno's definition of head capsule included the gula, but this is incorrect because a head capsule exists in all types of insects, not only prognathous insects, while the gula only exists in prognathous insects. The gula has not been used very often in bruchid taxonomy, but Bridwell (1929) and Prevett (1966b) used "gula" as one of several characters to delimit species of *Pachymerus*. The "gula" they used is actually the submentum. The gula as defined here (gu, Figs. 46, 56) is the area between the gular sutures and the posterior tentorial pits (ptp, Fig. 56). These sutures are the ventral extensions of the postoccipital suture (Imms 1964; Torre-Bueno 1989) and mark the division between the gena and the gula. Sometimes the sutures are fused on the ventral side to only one suture, and in such a case (e.g. Curculionidae) the gula is considered absent (Borror *et. al.* 1989). The gular sutures are usually very easy to find because the gula is usually glabrous and not hidden under setae or sculptured integument. Furthermore, the posterior tentorial pits are associated with the gular sutures, which makes the sutures even easier to observe because they are slightly enlarged at the pit location. Since the head is articulate, part of the sutures and the pits are sometimes covered by the ventral side of thorax.

The gula is redefined the following way: **gula** (Fig. 56), the postoccipital area on the ventral side of the head, delimited by the genae (and the gular sutures), the submentum and the foramen magnum (occipital foramen). The gula exists in opisthognathous insects only.

The definitions of the vertex and occiput as given by Torre-Bueno (1989) are followed. The frons is redefined, and the parts illustrated and labeled to avoid misunderstandings: **frons** (Fig. 51), the upper anterior portion of the head capsule, close to the antennae, between the clypeus and the vertex; **vertex** (Figs. 51, 55), the top of the head between the eyes, frons and occiput, anterior to the occipital suture; **occiput** (Figs. 51, 55), dorsal part of the head between the occipital sulcus and the postoccipital sulcus.

The metatibia of the Pachymerinae has several carinae which are good taxonomic characters. As defined in Torre-Bueno (1989), mesal (adj.) cannot be used to name a carina on the metafemur because a mesal carina must be situated on or near the meson, and lateral (adj.) may be used for a carina on both the outer and the inner side of the metatibia: mesal, pertaining to, situated on, or in the meson; meson, midline of the body; mesad, toward or in the direction of the meson of the insect body; lateral, relating, pertaining or attached to the side; laterad, toward the side and away from the median line. Laterad and mesad are adverbs and cannot be used.

Since these terms have been used in bruchid literature a change in terminology would be confusing. We are redefining lateral and mesal for use here: **lateral**, relating, pertaining or attached to the side away from the meson of the insect body; **mesal**, relating, pertaining or attached to the side toward the meson of the insect body.

Some terminology of the male genitalia is new: **caput** (Fig. 100), the headlike area apical to the cingulum of the lateral lobes including Kingsolver's band and cutis; **cingulum** (Figs. 99,100, 115,116), the light colored girdle-like band on the basal side of Kingsolver's band (dark) of the lateral lobes; **cutis** (Figs. 99, 100), the apical area of the lateral lobes located on both sides of nodus usually with setae; **gemma** (pl. gemmae) the swollen structure consisting of two equal semi-elliptical, budlike parts of the male genitalia attached to both the median lobe and the lateral lobes (Figs. 105, 106, 114); **nodus** (Figs.99, 100), the emargination on the apex of the lateral lobes, sometimes cleft (Figs. 115, 116), sometimes only a sinuated line indicating separation of the lobes (Figs. 99, 100).

TAXONOMY OF THE PACHYMERINAE

Tribe CARYEDINI Bridwell

Caryedini Bridwell 1929:143.
Caryedontini (sic) Decelle 1966:172; Udayagiri and Wadhi 1989:226.

Native to the Old World. Body elongate or oval, usually small (2-8 mm). Head short, often concealed from above, eye facets of medium size, extending to both dorsal and ventral sides of head, postocular lobe short, ocular sinus vague. Pronotum subrectangular, transverse, disk not lobed on basal margin, lateral carina variable, in some genera extending from base to apex, in some not; if incomplete usually strong at posterior end, tapering, obsolete at anterior end. Scutellum not minute. Elytron elongate, usually covering only the base of pygidium, striate, striae punctate. Metafemur incrassate, ventral ridge usually pectinate. Metatibia carinate. Median lobe and lateral lobes highly variable.

KEY TO SUBFAMILIES OF BRUCHIDAE

1 Body always metallic; metatrochanter very large (Fig. 31); scutellum triangular (Fig. 50A) ...... **Rhaebinae**
— Body usually non-metallic; metatrochanter small; scutellum variable (Figs. 50 B-L) **2**
2 (1) Metatibia without a mucro but with two long, sharp movable apical calcaria (Fig. 32); metacoxa twice as wide as metafemur (Fig. 32); metafemur usually without spines (Fig. 32) .... **Amblycerinae**
— Metatibia with mucro and fixed spines (Figs. 25-30) or without spines (*Caryoborus* (Pachymerinae) has two small apical calcaria much smaller than in Amblycerinae and ventrad to the mucro (Figs. 68-70)); metacoxa variable but not twice as wide as metafemur; metafemur with or without spines or denticles **3**
3 (2) Antennae never longer than body length, metacoxa about as wide as metafemur <u>and</u> metafemur often with one or more spines .... **Bruchinae**
— If antennae shorter than body length, then metacoxa not as wide (or at most about as wide) as metafemur <u>and</u> metafemur with or without a pecten or spines; if antennae longer than body length, then metacoxa wider than metafemur <u>and</u> metafemur without a pecten or spines **4**
4 (3) Metafemur with pecten and often also with spines (Fig. 23, 24); disk of pronotum with a surrounding (or almost so) impressed marginal line (Figs. 43 and 12) .... **Pachymerinae**
— Metafemur without pecten, with or without spines; disk of pronotum without a surrounding impressed marginal line **5**
5 (4) Metafemur with small spines (Fig. 29); metacoxa much shorter than metafemur; base of pygidium covered by elytra; scutellum triangular .... **Eubaptinae**
— Metafemur without spines (Fig. 30); metacoxa about the same length as metafemur; pygidium and one or two tergites not covered by elytra; scutellum elongate .... **Kytorhininae**

KEY TO TRIBES OF PACHYMERINAE

1 Deep (long) ocular sinus (Figs. 20, 22); eyes not coarsely facetted; postocular lobe long (Figs. 20, 22): vestiture variegated .... **Caryopemini**
— Ocular sinus vague (Figs. 10-16, 19); eyes coarsely facetted; postocular lobe short (Fig. 19); vestiture of uniform color **2**
2 (1) Prosternal process narrow if completely separating procoxae (Fig. 49), or acute if not completely separating procoxae (Fig. 48); protarsal and metatarsal segment 1 only feebly expanded triangularly at apex; body length usually 4 - 7 mm .... **Caryedini**
— Prosternal process wide or narrow and always completely separating procoxae, never acute (Figs. 46-47); protarsal and metatarsal segment 1 strongly expanded triangularly at apex; body length usually 8 - 20 mm .... **Pachymerini**

KEY TO GENERA OF TRIBE CARYEDINI

1 When hind leg flexed, tibia positioned on mesal side of pecten; pectenal denticle 1 on metafemur not large and acuminate (Fig. 38); two apical tubercles on apical side of pecten (Fig. 38); tibia with tubercle close to base (Fig. 38) . . . . **Exoctenophorus** Decelle

— When hind leg flexed, tibia positioned on lateral side of pecten (Fig. 36); pectenal denticle on metafemur large and acuminate (Fig. 36); no apical tubercles; tibia without tubercle near base (Fig. 36) **2**

2 (1) Prosternum completely separating procoxae (Fig. 49); apex of prosternal process narrow but not acute (Fig. 49); elytral stria 1 (stria closest to the meson) bending away from the meson posterior to the apex of the scutellum (Fig. 50C) (stria continuing past apex of scutellum near the basal margin of the elytron); stria 2 and 9, and stria 3 and 8 usually joining at the apex of elytron; lateral carina of pronotum complete **3**

— Prosternum not completely separating procoxae (Fig. 48); apex of prosternal process acute (Fig. 48); elytral stria 1 not bending away from the meson posterior to the apex of the scutellum (Fig. 50B) (stria only continuing to slightly posterior to scutellum apex); stria 2 and 9, and stria 3 and 8 not joining at the apex of elytron (often hard to see under setae); lateral carina of pronotum complete <u>or</u> incomplete **4**

3 (2) Body rounded (Fig. 19); length of abdominal sternum 1 about 1.5 times the combined length of sterna 2 - 5; females with a glabrous field ("miroir", Decelle 1965) between elytral stria 9 and 10 close to humerus (Fig. 19) . . . . ***Afroredon*** Decelle

— Body elongate (Fig. 17); length of abdominal sternum 1 about the same as the combined length of sterna 2 - 5; females without a glabrous field between elytral stria 9 and 10 close to humerus . . . . ***Mimocaryedon*** Decelle

4 (2) Lateral carina of pronotum incomplete (Fig. 44), strong at posterior end, tapering, obsolete at anterior end; body oval (Fig. 16) . . . . ***Caryedon*** Schönherr

— Lateral carina of pronotum complete, extending from head to elytron; body elongate (Fig. 18) . . . . ***Caryotrypes*** Decelle

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Genus **CARYEDON** Schönherr

Figs. 16, 40, 117, 189

Caryedon Schönherr 1823:1134.
Pachymerus Pic 1913:6.

Type species: *Bruchus serratus* Olivier 1790. Original designation.

Elongated or oval beetles. Integument usually medium to dark brown, usually with irregular, darker, almost black markings, setae often dense, uniformly brownish white or pale brown. Head short, constricted behind eye; vertex usually with sharp median carina, glabrous or partly covered by setae; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus almost nonexistent; submentum tapering, posterior part medium width, sides parallel. Antennal segments 5-10 serrate. Pronotum subrectangular, transverse, base slightly wider than apex; disk with surrounding impressed marginal line, line sometimes weak or obsolete along anterior margin; lateral carina incomplete, not extending from head to elytron, strong at posterior end, tapering, obsolete at anterior end. Prosternum with short process, not completely separating procoxae. Mesosternum with long process, not cleft. Elytron elongate, approximately three times longer than wide, females without a glabrous field between elytral stria 9 and 10 near humerus. Scutellum square, not truncate apically. Metafemur incrassate, elongate; dorsal side nongranulate; ventral side pectinate; pecten with denticles, denticle 1 usually acuminate, usually slightly larger than the other denticles, located after middle of femur; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge long, with spines, without protuberance. Metatibia arcuate; three strong ventral carinae, middle carina without tubercle and without sulcus; with lateral but without dorsolateral carinae; with mesal but without dorsomesal carinae; mucro at apex, without apical calcaria. Median lobe broad with basal hood broad, with both dorsal and ventral valve (dorsal valve absent in all other Pachymerinae genera), with median and basal sclerites. Lateral lobes confluent, not separated, without gemmae, with small cleft; Kingsolver's band absent, in some specimens present as faint, vague, undefined band.

Genus **CARYOTRYPES** Decelle

Fig. 18

Caryotrypes Decelle 1968:419.

Type species: *Pachymerus pandani* Blanchard 1845. Designation by monotypy.

Decelle (1968) incorrectly used the name *Caryotrypes pandani* (Blanchard) as the name of the type species.

This genus has not been studied. This description is translated and paraphrased from Decelle 1968. Elongated beetles. Antennal segments slender, segments 5-10 feebly serrate. Pronotum subrectangular, apical end wider than basal end, disk with surrounding impressed marginal line; lateral carina complete. Prosternum with short process, not completely separating procoxae. Elytron very elongate; without a glabrous field between elytral striae 9 and 10 near humerus; stria 1 originating posterior to apex of scutellum; striae 2 and 9, and striae 3 and 8 not united at apex, but at basal end striae 2 and 4 bend away from meson and striae 3 and 5 bend towards meson (so that striae 2 and 3 respectively striae 4 and 5 almost meet at the base). Process on metasternum narrow, acute. Metafemur pectinate on ventral side; when leg flexed, tibia positioned on lateral side of pecten. Metatibia with carinae, without tubercle. Genitalia unknown (not dissected).

Genus **MIMOCARYEDON** Decelle

Figs. 17

Mimocaryedon Decelle 1968:419.

Type species: *Mimocaryedon freyi* Decelle 1968. Original designation.

This genus has not been studied. Described by Decelle (1968) from one individual female (male unknown), found in the private collection of D. Frey (for whom the type species of this monotypic genus was named). Unfortunately, Decelle returned the specimen to D. Frey, instead of safely depositing it in a museum. D. Frey is now dead and his descendants are disputing the inheritance, including the insect collection, and the future of the collection is uncertain (Decelle, pers. comm.). This description is translated and paraphrased from Decelle 1968. Oval beetles. Antennal segments 4-10 serrate. Pronotum subrectangular, base wider than apex; lateral carina complete. Prosternum with long process, completely separating procoxae. Elytron elongate; without a glabrous field between elytral striae 9 and 10 close to humerus; stria 1 originating anterior to apex of scutellum, bending in a direction away from the meson; striae 2 and 9, and striae 3 and 8 united at apex. Process on metasternum wide, rounded. Metafemur pectinate on ventral side; pecten with denticles, denticle 1 slightly larger than the other denticles, located beyond middle (posterior 2/5th) of femur; when leg flexed, tibia positioned on lateral side of pecten. Metatibia with carinae, without tubercle. Genitalia unknown (dissected, but only spermatheca described and illustrated by Decelle 1968).

Genus **AFROREDON** Decelle

Figs. 19, 36, 185

Afroredon Decelle 1965:213.

Type species: *Afroredon africanus* Decelle 1965. Original designation.

Small, short, oval beetles. Integument usually light to medium brown, setae often dense uniformly white. Head short, constricted behind eye; vertex with sharp median, glabrous, carina; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus vague; submentum tapering, posterior part of medium width, sides parallel. Antennal segments 5-10 serrate. Pronotum subrectangular, transverse, base about the same width as apex; disk with surrounding impressed marginal line; lateral carina complete, extending from base to apex. Prosternum with short process, not completely separating procoxae. Mesosternum with long process, not cleft. Elytron oval, approximately two times longer than wide, females with a glabrous field between elytral striae 9 and 10 near humerus. Scutellum quadrate, not truncate apically. Metafemur incrassate, oval; dorsal side nongranulate; ventral side pectinate; pecten with denticles, denticle 1 usually acuminate, usually slightly larger than the other denticles, located after middle of femur; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge long, with spines, without protuberance. Metatibia arcuate; three strong ventral carinae, middle carina without a tubercle or sulcus; with lateral but without dorsolateral carinae; with mesal but without dorsomesal carinae; mucro at apex, without apical calcaria. Median lobe slender, basal hood slender, without dorsal valve, with ventral valve, without sclerites. Lateral lobes confluent, not separated, without gemmae, with small cleft; Kingsolver's band present.

Genus **EXOCTENOPHORUS** Decelle

Figs. 21, 38, 186-188

Exoctenophorus Decelle 1968:414.

Type species: *Exoctenophorus deflexicollis* Decelle 1968. Designation by monotypy.

Short, oval beetles, almost as wide as long. Integument light brown, setae sparse, uniformly whitish, area between the stria with pubescence of alternating fine and medium textured setae giving an effect of alternating color, making the elytron appear striped. Head short, constricted behind eye; vertex with diffuse median carina, sometimes partly covered by setae; eye large, feebly bulging, extending to both dorsal and ventral sides of head; ocular sinus vague; submentum tapering, posterior part wide, subtriangular, converging posteriorly between eye and gena. Antennal segments 4-10 serrate, sometimes 3rd segment feebly serrate. Pronotum subrectangular to almost subpentagonal, transverse, base and apex about the same width; disk with surrounding impressed marginal line; lateral carina complete, extending from base to apex. Prosternum with short, acute process, only separating procoxae to about 25% their length. Mesosternum with long, medium width process, not cleft. Elytron oval, approximately two times longer than wide. Scutellum trapezoid, wider basally. Metafemur incrassate, oval; dorsal side nongranulate; ventral side pectinate; pecten with denticles, denticle 1 acuminate, larger than the other denticles, located before middle of femur; when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge short, without spines, without a protuberance. Metatibia arcuate; three strong ventral carinae, middle carina with a tubercle, without sulcus; with lateral and mesal carinae; dorsolateral and dorsomesal carinae obsolete; mucro at apex, with apical calcaria. Median lobe very slender, without median sclerites, with one complex basal sclerite. Lateral lobes confluent, not separated, very slender, with small cleft; Kingsolver's band present.

Tribe CARYOPEMINI Bridwell

Caryopemini Bridwell 1929:143; Udayagiri and Wadhi 1989:236.
Caryopemontini (sic) Decelle 1968:413.

Native to the Old World. Body elongate or oval, size 4-15 mm. Head elongate, often concealed from above, eye finely facetted, barely extending to ventral side of head, postocular lobe long, ocular sinus prominent. Pronotum subconical, wider at base, disk lobed on basal margin, lateral carina complete or incomplete. Scutellum variable. Elytron elongate, usually covering more than the base of pygidium, striate, striae punctate. Metafemur incrassate, ventral ridge usually pectinate. Metatibia carinate. Male genitalia without sclerites or with median and basal sclerites. Lateral lobes without Kingsolver's band.

KEY TO GENERA OF TRIBE CARYOPEMINI

1 Metafemur elongated (Fig. 39); scutellum minute (Fig. 50E); dorsal side of metafemur granulate (Fig. 20); prosternal process acute and separating procoxae for about 90% of their length .... *Caryopemon* Jekel

– Metafemur oval (Fig. 37); scutellum not minute (Fig. 50D); dorsal side of metafemur not granulate; prosternal process acute and separating procoxa for about 60% of their length .... ***Diegobruchus*** Pic

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Genus **CARYOPEMON** Jekel

Figs. 20, 39, 50, 190, 191

Caryopemon Jekel 1855:25.
Protocaryopemon Borowiec 1987:53; Nilsson and Johnson 1991:349.

Type species: *Caryopemon hieroglyphicus* Jekel 1855. Designated by monotypy.

Elongated, oval beetles. Integument usually dark brown, setae dense, variegated, white, beige to light brown, in variable patterns. Head long, not constricted behind eye; vertex with sharp or diffuse median carina, sometimes covered by setae; eye large, feebly bulging, barely extending to ventral side of head; ocular sinus prominent; submentum not tapering, posterior part wide, subrectangular, not converging between eye and gena. Antennal segment 4 serrate, segments 5-10 pectinate. Pronotum subpentagonal, conical, wider at base; disk with surrounding impressed marginal line which is weak or sometimes obsolete along anterior margin; lateral carina complete, extending from base to apex (sometimes weak and often covered by setae at apex). Prosternum with long narrow process, separating procoxae for about 90% of their length. Mesosternum with long wide process extended to metasternum, not cleft. Metasternum sometimes angular in profile. Elytron elongate, approximately 2.5 times longer than wide. Scutellum elongate, minute. Metafemur incrassate, elongate; dorsal side granulate; ventral side pectinate; pecten with denticles, denticle 1 not acuminate, same size or smaller than other denticles, located beyond middle of femur; when leg flexed tibia positioned on mesal side of pecten; prepectenal ridge with spines and without protuberance. Metatibia arcuate; three strong ventral carinae, middle carina without tubercle and sulcus; with lateral and dorsolateral carinae; with mesal and dorsomesal carinae; mucro at apex, without apical calcaria. Median lobe slender, with spines, without sclerites. Lateral lobes confluent, not separated, wide, with small cleft and large groove surrounding the median lobe at all sides except ventral side; Kingsolver's band absent.

Genus **DIEGOBRUCHUS** Pic

Figs. 22, 37, 50, 192

Diegobruchus Pic 1913:110.

Type species: *Bruchus suarezicus* Pic. Designated by monotypy.

Short, oval beetles, almost as wide as long. Integument usually light brown to black, setae dense to sparse, variegated, with scattered spots of white, beige to light brown and yellow. Head long, not constricted behind eye; vertex with diffuse median carina, often partly covered by setae; eye medium size, feebly bulging, not extending to ventral side of head, or only feebly so; ocular sinus prominent; submentum tapering, posterior part wide, subtriangular, converging between eye and gena. Antennal segments variable, segments 3 and 4 usually serrate sometimes pectinate (segment 3 sometimes only feebly so), segments 5-10 serrated or pectinate. Pronotum subpentagonal, transverse, convex, wider at base; lateral sides of disk without impressed marginal line, basal and apical margin with an impressed marginal line, partly covered by setae; lateral carina incomplete, very short, not extending from base to apex. Prosternum with short acute process separating procoxae for about 60% of their length. Mesosternum with long wide process, not cleft. Elytron oval, approximately 1.8 times longer than wide. Scutellum elongate, quadrate, not minute. Metafemur incrassate, oval; dorsal side nongranulate; ventral side pectinate; pecten with denticles, denticle 1 acuminate, usually larger than other denticles, located beyond middle of femur; when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge long, with spines, without a protuberance. Metatibia arcuate; three strong ventral carinae, middle carina without tubercle and sulcus; with lateral and dorsolateral carinae; with mesal and dorsomesal carinae; mucro at apex, without apical calcaria. Median lobe semi-broad, with median and basal sclerites. Lateral lobes confluent, not separated, with small cleft; Kingsolver's band absent.

Tribe PACHYMERINI Bridwell

Pachymerini Bridwell 1929:143; Decelle 1965:214; Udayagiri and Wadhi 1989:234.

Native to the New World. Body elongate, usually large, 5-21 mm. Head short, prolonged into a short rostrum, often concealed from above, eye coarsely faceted, extending to both dorsal and ventral sides of head, postocular lobe short, ocular sinus almost nonexistent. Pronotum sub-rectangular, transverse, disk not lobed on basal margin, lateral carina complete, extending from head to elytron. Scutellum not minute. Elytron elongate, usually covering only base of pygidium, striate, stria punctate. Metafemur incrassate, ventral ridge usually pectinate. Metatibia carinate. Median lobe without sclerites or with only basal sclerites (*Caryobruchus* has both median and basal sclerites, variable in *Caryoborus*), lateral lobes with Kingsolver's band.

KEY TO GENERA OF TRIBE PACHYMERINI

1 When leg flexed, tibia positioned on mesal side of pecten (Figs. 23B, D); metafemur with a long (clearly longer than 1/2 length of metafemur) pecten usually not produced (Figs. 24B, C); metatibia with six or seven carinae, with a tubercle near the base; median lobe without sclerites (Figs. 163, 167); lateral lobes usually with gemmae (Figs. 102, 106, 161) (except *P. cardo*, Fig. 157) .... ***Pachymerus*** Thunberg

— When leg flexed, tibia positioned on lateral side of pecten (Figs. 23A, C); metafemur short (about 1/2 length of metafemur or shorter) or of medium length, usually with pecten produced (Fig. 24A); metatibia with three carinae, without a tubercle near the base; median lobe usually with sclerites (Figs. 120, 122, 128, 131, 140); lateral lobes without gemmae 2

2 (1) Metatibia with two small apical calcaria ventrad to mucro (Figs. 68-70); pecten of medium length with denticle 1 located slightly before middle of femur; prepectenal ridge shorter than pecten without spines but with a protuberance (Figs. 68-70) positioned on the lateral side of metatibia when leg flexed (protuberance not cristate, sometimes weak); median lobe with small, often very weak, median sclerites (Figs. 118, 120, 122) .... ***Caryoborus*** Schönherr

— Metatibia without apical calcaria; pecten short with denticle 1 located beyond middle of femur (except *Caryobruchus marieae* with denticle 1 located near middle of femur); prepectenal ridge longer than pecten with spines (Figs. 71-75, 77-80), and with or without protuberance (protuberance cristate); median lobe with median sclerites (Figs. 128, 131, 134, 137, 140, 143, 146, 149, 152, 155) (except *Speciomerus rubrofemoralis*, Fig. 134) 3

3 (2) Sides of submentum strongly converging triangularly between eyes (distance between eyes on ventral side usually distant) (Fig. 58); genae long; median lobe always with both basal and median sclerites (Figs. 140, 143, 146, 149, 152, 155) .... ***Caryobruchus*** Bridwell

— Sides of submentum parallel or almost so (distance between eyes on ventral side usually approximate) (Fig. 61); genae short; median lobe never with median sclerites (Figs. 128, 131, 134, 137) ..... ***Speciomerus*** Nilsson

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Genus **CARYOBORUS** Schönherr

Caryoborus Schönherr 1833:92.
Pachymerus: Pic 1913:6.

Type species: *Bruchus serripes* Sturm 1826. Original designation.

Elongated beetles. Integument usually dark brown to almost black, setae sparse, uniformly whitish. Head short, constricted behind eye; vertex with sharp or diffuse median carina, sometimes covered by setae; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus short but distinct; submentum tapering, posterior part wide, sides almost parallel, only feebly converging between eye and gena. Antennal segments 4-10 serrate, in many males and sometimes females of *Caryoborus serripes* the 3rd segment also feebly serrate. Pronotum subrectangular, transverse, base and apex about the same width; disk with surrounding impressed marginal line; lateral carina complete, extending from base to apex. Prosternum with long process, completely separating procoxae. Mesosternum with long process, cleft or not cleft. Elytron elongate, approximately 3 times longer than wide. Scutellum square, truncate apically. Metafemur incrassate, elongate; dorsal side smooth; ventral side pectinate; pecten produced, curved, with denticles, denticle 1 acuminate, longer than other denticles, located before middle of femur; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge shorter than pecten, without spines, when leg flexed, with protuberance positioned on the lateral side of metatibia. Metatibia arcuate; three strong ventral carinae, middle carina without tubercle and sulcus; lateral and dorsolateral carinae obsolete; mesal and dorsomesal carinae obsolete; mucro at apex, with apical calcaria. Median lobe slender, with median sclerites (sometimes very vague), with or without basal sclerites. Lateral lobes confluent, not separated, but with narrow, rather long cleft; without gemmae; Kingsolver's band present.

The following three species of *Caryoborus* are considered valid: *C. chiriquensis* Sharp, *C. gracilis* Nilsson, new species, and *C. serripes* (Sturm).

KEY TO SPECIES OF **CARYOBORUS**

1. Antennae longer than elytron; antennal segments long (Fig. 95 C); pecten with 15-24 denticles (Fig. 70); apex of mesosternal process usually sharply curved back towards plane of metasternum (Fig. 41) . . . . *C. serripes* (Sturm)
- Antennae shorter than elytron; antennal segments short (Fig. 95 A, B); pecten with 16 denticles or less; apex of mesosternal process usually slanting, not sharply curved back towards plane of metasternum (Fig. 42) 2

2 (1) Male genitalia with apical triangle as in Figs. 120 & 121; antennal segments slender (Fig. 95 B); pecten with 13-16 denticles; prosternal disk usually sparsely punctulate . . . . *C. gracilis* Nilsson
- Male genitalia with apical triangle not as in Fig.120 & 121; antennal segments wide (Fig. 95 A); pecten with 7-14 denticles; prosternal disk usually moderately punctulate . . . . *C. chiriquensis* Sharp

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Caryoborus chiriquensis Sharp

Figs. 1, 42, 69, 95, 118, 119, 124

Caryoborus chiriquensis Sharp 1885:504; Bridwell 1929:147.
Pachymerus chiriquensis: Pic 1913:7.
Caryobruchus chiriquensis: Udayagiri and Wadhi 1989:239.

Type Data.—Type locality: V. de Chiriqui, Panama. Holotype and one paratype deposited in The Natural History Museum, London (BMNH). Sharp (1885) mentioned four specimens in his original description, but the location of the other two is unknown. The holotype designation is uncertain; the Natural History Museum regards one of the specimens labelled "type" as the holotype, the others as paratypes (pers. comm. S.L. Shute, The Natural History Museum, London). Sharp's choice of words indicates clearly that he did not know that *B. serripes* Sturm was congeneric. The original description and Bridwell's treatment of *C. chiriquensis* and *B. serripes* is such that there is no question about the identity of *C. chiriquensis*.

Distribution .—(Fig. 1). Specimens examined, 58. Colombia, Ecuador (Carchi, Cotopaxi, Pinchincha).

Diagnosis.— Integument medium brown to dark brown, sometimes almost black; fine, white to yellowish-white pubescence partially cover integument color. Males 8.0-9.5 mm, females 7.5-9.7 mm in total length (pronotum-elytra); width of males 3.5-4.0 mm, females 3.8-6.0 mm, maximum thoracic depth of males 2.2-3.5 mm, females 2.3-4.2 mm. Eyes approximate. Antennal segments 4-10 serrate, in males segment 3 usually not feebly serrate, segments longer than wide, segment 4 not as wide as segment 9, segments 9-11 only slightly longer than wide. Pronotum disk wider than long (length/width ratio mean 0.79). Metafemur about twice as long as wide (length/width ratio mean 1.95); pecten with 7-14 rather large denticles. Pygidium slightly longer than wide (length/width ratio mean 1.16).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter glabrous. *Color.* Body and appendages uniform medium brown to dark brown, sometimes almost black.

Vestiture. Dorsal and ventral body surfaces with white to yellowish-white, fine, short, recumbent, regular, setae; antenna with minute white setae; surface of elytron moderately hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; ventral ridge of metafemur with sparse setae not covering pecten, in between each denticle a large, light golden seta; tarsomere 1 with moderately dense golden setae, ventral side of tarsomere 2 with a few coarse, golden setae, ventral side of tarsomere 3 with many very dense, coarse, golden setae; pygidium not as densely hirsute as elytron, setae longer.

Head. Shorter than pronotum; frons and vertex with usually hirsute carina, carina at vertex not interrupted by a weak depression; ocular sinus short, but distinct; on dorsal side eyes approximate; postocular lobe short; antenna shorter than elytron, segments 4-10 strongly serrate, longer than wide, segment 4 not as wide as segment 9, segment 9-11 only slightly longer than wide; gena medium length; sides of submentum almost parallel, only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.79); moderately to densely punctate, large punctations more or less evenly distributed;

all sides with strong, impressed, marginal line, anterior margin usually feebly emarginate; angles vaguely pointed, visible in dorsal view; dorsal surface medially flattened; sides depressed, more depressed toward apex, rounded, narrowed to apex from slightly more than middle of side; angles of lateral margin at base feebly produced, angle usually more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from head to elytron. Protarsus 1 shorter but only slightly wider than metatarsus 1 (only feebly wider than in females). Prosternum completely separating procoxae, apex of prosternal process narrow or mostly so.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface flattened between humerus and mesal margin, depressed laterally and apically; humerus non-scabrous (sometimes feebly scabrous); striae punctate. Metafemur incrassate, maximum width closer to base, constricted toward apex, slightly more than twice as long as wide (length/width ratio 1.95), ventral side with a pecten armed with 7-14 rather large denticles, produced, long, feebly curved; denticle 1 large, acuminate, closer to femoral base than to apex; following denticles smaller but only decreasing slightly in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge shorter than pecten, without spines, with a weak protuberance positioned on lateral side of metatibia when leg flexed; lateral side with small punctures, often hidden under setae. Metatibia evenly arcuate (angle >90°); three strong ventral carinae; lateral, dorsolateral, mesal and dorsomesal carinae obsolete; mucro long; tibial corona with two calcaria originating in depression on dorsal side of mucro; spur not visible in lateral view. Mesotarsus 1 slightly shorter, but about as wide as metatarsus 1. Apex of mesosternal process without cleft, slanting, projecting with less than 90° angle from body plane, apex not sharply curved back toward plane of metasternum; metaspinasternum feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, slightly longer than wide (length/width ratio mean 1.16), wider at base than apex, partly hidden by elytra, elytra cover 0-50% length of pygidium from base, in less than 90° angle to elytron, visible in dorsal view.

Genitalia. Median lobe (Fig. 118) slender. Ventral valve long with sides forming a triangle with an acute angle. Armature of internal sac with small, very weak median sclerites, without basal sclerites. Lateral lobes (Fig. 119) appear as one, with very large (for the subfamily) cleft, extending to 0.5 length of distance from apex to Kingsolver's band; cutis partly surrounding apex of median lobe on dorsal and lateral sides.

Females.— Similar to males, but maximum thoracic depth slightly larger. Armature of bursa copulatrix and apodeme of spiculum gastrale (Fig. 124).

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. Colombia: quarantine Miami, in palm, 14.IV.1966, (USNM). Ecuador: Carchi, elev. 1250m, 1-10.VIII.1983, J.E. Rawlins (CMNH); Cotopaxi, Las Pampas, ex *Phytelephas*, XI.86, VII.87, I.88, G. Onore (PUC); Cotopaxi, San Francisco de las Pampas, alt. 1200m, ex *Phytelephas aequatorialis* Spruce, 1991, H. Borgtoft Pedersen (BP); Loja, (AMNH); Pinchincha, Santo Domingo D.L.C., X.1983, Onore (CDJ); Pinchincha, Tinalandia, 700m elevation, 26-28.V.1976, Alluriquin (FDA); unknown quarantine, Baraganata, in Ivory nuts, (USNM). Panama: Canal Zone, Cristóbal, pier 7, 25.X.1918, H.F. Dietz (USNM); V. de Chiriqui, Champion, *holotype*, (BMNH).

Discussion.—Bridwell (1929) stated that many palm nuts originated in Ecuador but were shipped through Panama. Only the holotype and one specimen labeled "Cristóbal, pier 7" were collected in Panama (probably shipped from Ecuador through the Panama Canal where it was intercepted). It is therefore questionable if the insect exists in Panama. It is possible that this species only exists in Ecuador and southern Colombia. Thus, Panama is not included in the distribution.

Caryoborus gracilis Nilsson, **new species**

Figs. 1, 68, 95, 120, 125

Type Data.—Type locality: Maturín, Monagas, Venezuela. Holotype, Venezuela, Monagas, Maturín, ex *Mauritia flexulosa* L. seeds, 5.II.1973, D.H. Janzen; deposited in U.S. National Museum of Natural History, Washington, D.C. (USNM). Allotype, Venezuela, Monagas, Maturín, ex *Mauritia flexulosa* L. seeds, 5.II.1973, D.H. Janzen; deposited in USNM. Paratypes, 37. Bolivia: (1) Pando, Prov. Manuripi, Alta Gracia, 22.X.1989, ex. semilla de *Jessenia*, I. Vargas (FMNH); (1) Santa Cruz, Prov. Andrés Ibañez, S.C. de la Sierra, 21.V.89,

P. Bettella (FMNH). Brazil: (1) Bahia, Chapada, Oct. (CMNH); (1) Rondonia, Ouro Preto do Oeste, 29.X.1987, L. Elias (UFDP); (1) Rio Branco, Uranduique, VII.1960, Pereira & Machado (USNM); (2) in palm seeds Brazil, Hoboken 3333 (USNM); (3) CNHM 1955, Karl Brancsik coll. ex Eduard Knirsch, (FMNH). Colombia: (3) Meta, Villavicencio aviport, ex *Dictyocaryum fuscum* H. Wendl., VIII.2.41, D. Fairchild (USNM). Ecuador: (1) Pinchincha, Tinalandia, 15km E Santo Domingo, 27.VIII.83, reared seed palm, C.D. Johnson (CDJ). French Guiana: (1) Lansberg (UZMC); (2) Piste de St. Elie Pt.15, ex *Jessenia bataua* Burret, 14 Novembre 1986, Plinio Sist Leg (ORST). Peru: (2) Loreto, Jennaro-Herrera, ex *Oenocarpus*, Oct.1990, G. Couturier (ORST); (11) Loreto, Jennaro-Herrera, ex *Jessenia bataua* Burret, 11-X-91, G. Couturier (ORST); (3) Junín, Satipo, XI.1944, Paprzycki (AMNH); Nov. 48, Paprzycki (USNM); (1) Madre de Dios, Mouth of Rio la Torre, S bank of Rio Tambopata, alt. ca 100m, 11.VIII.1979, LJB (RIL); (1) quarantine Miami, 4.X.1977, (USNM); (1) quarantine Washington, D.C., Lima, ex *Jessenia* sp., (X-11-46) (USNM). Venezuela: (1) Monagas, Maturín, ex *Mauritia flexulosa* L. seeds, 5.II.1973, D.H. Janzen (USNM).

Etymology.— Named, as a noun in apposition to *Caryoborus*, because of the smaller size and more slender forms, especially the antenna, when compared to *C. chiriquensis* and *C. serripes*.

Distribution.— (Fig. 1). Specimens examined, 39. Bolivia (Pando, Santa Cruz), Brazil (Bahia, Rondonia), Colombia (Meta), Ecuador (Pinchincha), French Guiana, Peru (Junín, Loreto, Madre de Dios), Venezuela (Monagas).

Diagnosis.— Integument light brown to dark brown; fine, white to yellowish-white pubescence partially cover integument color. Males 7.0-9.2 mm, females 6.9-9.7 mm in total length (pronotum-elytra); width of males 3.4-4.4 mm, females 3.3-4.5 mm, maximum thoracic depth of males 2.4-3.6 mm, females 2.1-4.1 mm. Eyes approximate. Antennal segments 4-10 feebly serrate, in males segment 3 not feebly serrate, segments longer than wide, segment 4 not as wide as segment 9, segment 9-11 clearly longer than wide. Disk of pronotum wider than long (length/width ratio mean 0.81). Metafemur about twice as long as wide (length/width ratio mean 2.07); pecten with 13-16 medium-sized denticles. Pygidium much longer than wide (length/width ratio mean 1.32).

Differential Diagnosis.—See COMPARISONS OF SPECIES IN CARYOBORUS.

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter glabrous. *Color.* Body and appendages uniform light brown to dark brown.

Vestiture. Dorsal and ventral body surfaces with white to yellowish-white, fine, short, recumbent, regular setae; antenna with minute white setae; surface of elytron moderately hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; ventral ridge of metafemur with sparse setae, not covering pecten, in between each denticle a large, light golden seta; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 2 with a few, coarse, golden setae, ventral side of tarsomere 3 with many, very dense, coarse, golden setae; pygidium not as densely hirsute as elytron, setae longer.

Head. Shorter than pronotum; frons and vertex with carina partly glabrous, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus short, but distinct; on dorsal side eyes approximate; postocular lobe short; antenna shorter than elytron, segments 4-10 feebly serrate, longer than wide, segment 4 not as wide as segment 9, segment 9-11 clearly longer than wide; gena medium length; sides of submentum almost parallel, only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.81); sparsely punctate, large punctations unevenly distributed as four clusters; all sides with strong, impressed, marginal line, anterior margin usually feebly emarginate; angles vaguely pointed, visible in dorsal view; dorsal surface convex medially; sides depressed, more depressed toward apex, rounded, narrowed to apex from slightly more than middle of side; angles of lateral margin at base feebly produced, angle usually more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter but slightly wider than metatarsus 1 (feebly wider than in females). Prosternum completely separating procoxae, apex of prosternal process narrow.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface flattened between humerus and mesal margin, depressed laterally and apically; humerus scabrous; striae punctate. Metafemur incrassate, maximum width closer to base, constricted toward apex, slightly more than twice as long as wide (length/width ratio 2.07), ventral side with a pecten armed with 13-16 medium-sized denticles, produced, long, feebly curved; denticle 1 large, acuminate, closer to femoral base than to apex; following denticles smaller but only decreasing slightly in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge shorter than pecten, without spines, with a weak protuberance positioned on lateral side of metatibia when leg flexed; lateral side with small punctures, often hidden under setae. Metatibia evenly arcuate (angle >90°); 3 strong ventral carinae; lateral, dorsolateral, mesal and dorsomesal carinae obsolete; mucro long; tibial corona with 2 calcaria originating in the depression on dorsal side of mucro; spur not visible in lateral view. Mesotarsus 1 slightly shorter, slightly wider than metatarsus 1. Apex of mesosternal process with a cleft, slanting, projecting with less than 90° angle from body plane, at apex not sharply curved back towards plane of metasternum; metaspinasternum produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, much longer than wide (length/width ratio mean 1.32), wider at base than apex, partly hidden by elytra, elytra cover 10-70% length of pygidium from base, in less than 90° angle to elytron, visible in dorsal view.

Genitalia. Median lobe (Fig. 120) slender. Ventral valve very long with sides forming a triangle with a extremely acute angle. Armature of internal sac with small, rather strong median sclerites; without basal sclerites. Lateral lobes (Fig. 121) appear as one, with very large (for the subfamily) cleft, extending to 0.6 length of distance apex to Kingsolver's band; cutis partly surrounding apex on dorsal and lateral sides of median lobe.

Females.— Similar to males, but maximum thoracic depth slightly larger. Armature of bursa copulatrix and apodeme of spiculum gastrale (Fig. 125).

Specific Records.— (See list of paratypes.) Host records are from collection labels, spelled exactly as written, and should be verified.

Caryoborus serripes (Sturm)

Figs. 1, 7, 10, 23, 41, 70, 95, 97, 115, 116, 122, 123, 126

Bruchus serripes Sturm 1826:74; Boheman 1829:117.
Bruchus (*Caryoborus*) *serripes*: Schönherr 1833:93.
Pachymerus serripes: Pic 1913:8.
Caryoborus serripes: Bridwell 1929:147; Udayagiri and Wadhi 1989:238.
Caryoborus priocerus Chevrolat 1877:99. **New synonymy.**

Type Data.—Type locality: Para, Brazil. Holotype; depository unknown, but the original description, and Bridwell's treatment of *B. serripes* and of *C. chiriquensis*, is such that there is no question about the identity of *C. serripes*. Old publications sometimes give Boheman credit for this species. Perhaps the type was lost, or no type had been designated when Boheman redescribed this species three years after Sturm's original description. No paratypes. *Caryoborus priocerus*. Holotype, Cayenna, D. Gehin, Col. Chevrol.; deposited in Naturhistoriska Riksmuseet, Stockholm (NR).

Distribution .—(Fig. 1). Specimens examined, 77. Bolivia (Beni), Brazil (Acre, Amazonas, Espirito Santo, Maranão, Rio de Janeiro, Pará), Ecuador (Napo), French Guiana, Guyana, Peru (Loreto), Suriname.

Diagnosis.— Integument medium brown to dark brown, sometimes almost black; fine, white pubescence partially cover integument color. Males 7.4-10.8 mm, females 6.3-12.9 mm in total length (pronotum-elytra); width of males 3.4-4.2 mm, females 3.8-6.2 mm, maximum thoracic depth of males 2.1-3.6 mm, females 2.3-4.5 mm. Eyes approximate. Antennal segments 4-10 strongly serrate, in males segment 3 often feebly serrate (rarely so in females), segments longer than wide, segment 4 wider than segment 9, segment 9-11 much longer than wide. Disk of pronotum wider than long (length/width ratio mean 0.81). Metafemur slightly more than twice as long as wide (length/width ratio mean 2.02); pecten with 15-24 rather small denticles. Pygidium slightly longer than wide (length/width ratio mean 1.11).

Males.—*Integument*. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden or yellow setae lining the margin), metacoxa near trochanter glabrous.. *Color*. Body and appendages uniform medium brown to dark brown, sometimes almost black.

Vestiture. Dorsal and ventral body surfaces with white, fine, short, recumbent, regular, setae; antenna with minute white setae; elytron surface moderately hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; ventral ridge of metafemur with sparse setae not covering the pecten, in between each denticle a large, light golden seta; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 2 with a few, coarse, golden setae, ventral side of tarsomere 3 with many very dense, coarse, golden setae; pygidium not as densely hirsute as elytron, setae longer.

Head. Shorter than pronotum; frons and vertex with slightly glabrous carina, carina at vertex interrupted by a weak depression (Fig. 96); ocular sinus short, but distinct; on dorsal side eyes approximate; postocular lobe short; antenna usually longer than elytron, segments 4-10 strongly serrated, longer than wide, segment 4 wider than segment 9, segment 9-11 much longer than wide; gena medium length; sides of submentum almost parallel, only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.81); moderately to densely punctate, large punctations evenly distributed; all sides with strong, impressed, marginal line, anterior margin usually feebly emarginate; angles vaguely pointed, visible in dorsal view; dorsal surface medially flattened; sides depressed, more depressed toward apex, rounded, narrowed to apex from slightly more than middle of side; angles of lateral margin at base feebly produced, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter but only slightly wider than metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process medium width.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface flattened between humerus and mesal margin, depressed laterally and apically; humerus scabrous (rarely non-scabrous); striae punctate. Metafemur incrassate, maximum width closer to base, constricted toward apex, slightly more than twice as long as wide (length/width ratio 2.02), ventral side with a pecten armed with 15-24 rather small denticles, produced, long, curved; denticle 1 large, acuminate, closer to femoral base than to apex; following denticles smaller and decreasing in size; when leg flexed tibia positioned on lateral side of pecten; prepectenal ridge shorter than pecten, without spines, with a protuberance positioned on lateral side of metatibia when leg flexed; lateral side with small punctures, often hidden under setae. Metatibia evenly arcuate (angle >90°); three strong ventral carinae; lateral, dorsolateral carinae, mesal, and dorsomesal carinae obsolete; mucro long; tibial corona with two calcaria originating in the depression on dorsal side of mucro; spur not visible in lateral view. Mesotarsus 1 slightly shorter, but about as wide as metatarsus 1. Apex of mesosternal process without cleft, not slanting, initially projecting at 90° angle from body plane, at apex sharply curved back (with almost 90° angle) towards plane of metasternum; metaspinasternum feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, slightly longer than wide (length/width ratio mean 1.11), wider at base than apex, partly hidden by elytra, elytra cover 5-50% length of pygidium from base, in less than 90° angle to elytron, visible in dorsal view.

Genitalia. Median lobe (Fig. 122) slender. Ventral valve long with sides forming a triangle with an acute angle. Armature of internal sac with small, very weak median sclerites; with two short, elongate, basal sclerites, with numerous small denticles. Lateral lobes (Fig. 123) confluent, not separated, but with very large (for the subfamily) cleft, extending to 0.5 length of distance apex to Kingsolver's band; cutis partly surrounding apex on dorsal side of median lobe.

Females.— Similar to males, but maximum thoracic depth slightly larger. Antennal segments shorter (especially segments 9-11), segment 3 usually not even feebly serrate. Armature of bursa copulatrix and apodeme of spiculum gastrale (Fig. 126).

Specific Records.— Host records are from collection labels, spelled exactly as written, and should be verified. Bolivia: Beni, Ivon, 1921-1922, M.R. Lopez (USNM). Brazil: Acre, Guanabara, Rio Grande, X.1960, F.M. Oliveira (UFDP); Maranão, Imperatriz, 1.1973, (UFDP); Amazonas, INPA, 29.V.1976, Diaz (CDJ); Espirito Santo, Conceição da Barra, X.1972, M. Alvarenga (CMNH); Espirito Santo, Linhares, IX.1978, M. Alvarenga (CMNH); Espirito Santo, Linhares, 20.XI.1971, A.C. Domingos (UFDP); Espirito Santo, Linhares, 9-15.X.1975, C.

Elias (UFDP); Rio de Janeiro, (CMNH); Pará, Santarem, (CMNH); Pará, Tiriós, Alty Parú d'Oeste, I-II.1963, Machado & Pereira (USNM); Pará, Itaituba, Rio Tapajos, 9.10.63, (UFDP). Ecuador: Napo, Limoncocha, 41970, Hesp. (USNM); Napo, Limoncocha, 16.VII.1972, P.L. Kazan (FDA); Napo, Limoncocha, 15.VII.1977, W.E. Steiner (USNM); Napo, Rivers Napo & Aguarito, alt. 200m, (USNM). French Guiana: Cayen, D. Gehin, *paratype C. priocerus*, (NR); Cayenne (UZMC); Cayenne, Bot. Garden, 16.II.1959, A.M. Nadler (AMNH); Cayenne, I.1917, III.1917, (CMNH); Piste de St. Elie, pk 15, ex *Astrocaryum* seeds, 20.III.1986, Plinio (USNM); Maroni River, Schuns (USNM); Hwy D6 to Kaw, 33.5km SE of Rours, I.1986, G. Tavskilian (RIL). Guyana: Essequibo R., Moraballi Creek, 17.IX.1929, (BMNH); Tumatumari, Rio Potaro, IV.1912, (AMNH); quarantine Coral Gables, ex seed *Astrocaryum* (FDA). Peru: Loreto, Jennaro-Herrera, *Astrocaryum* sp., 28.VIII.90, Nov-Dec.1990, A. Delobel (ORST); Loreto, Jungle Amazon Inn, 30mi [50km] E. Iquitos on Amazon river, 30.III.1984-31985, P. Shelley (FDA); Reared palm seeds, 19-18-89 (Ad. III-90), Miami 086316, (USNM). Surinam: Brokopondo, 301969, L. & C.W. O'Brien (CDJ); quarantine New York, ex *Astrocaryum huicunga* Dammer ex Burret nuts, (USNM).

COMPARISONS OF SPECIES IN *CARYOBORUS*

Caryoborus gracilis has a very distinct median lobe, the apical triangle is extremely acute, not so in *C. chiriquensis* or *C. serripes*, and the internal sac has very distinct sclerites (Fig. 120). The male genitalia of *C. chiriquensis* and *C. serripes* are rather similar. The external characters of *C. gracilis* are often intermediate between the other two species. The antennae are much slenderer on *C. gracilis*, while the antennae are much longer (and the individual segments are much wider) on *C. serripes*. The number of denticles on the pecten is 14-16 in *C. gracilis*, 7-14 in *C. chiriquensis* and 14-24 in *C. serripes*. For morphometrical comparisons see Table 2; note the longer pygidium of *C. gracilis*.

Several specimens have been found with external and genitalic characters that are intermediate between *C. chiriquensis* and *C. gracilis*, and *C. chiriquensis* and *C. serripes*. The speciation process is probably rather recent, ongoing and hybrids therefore probably exist. The male genitalia are distinct, so they are considered to be distinct species, pending further study.

Genus **CARYOBRUCHUS** Bridwell

Caryobruchus Bridwell 1929:148.

Type species: *Dermestes gleditsiae* Johansson and Linné 1763. Original designation.

Elongated beetles. Integument usually dark brown, setae sparse with uniform whitish color. Head short, constricted behind eye; vertex with sharp or diffuse median carina, sometimes partly covered by setae; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus vague; submentum tapering, posterior part wide, subtriangular, converging between eye and gena. Antennal segments 4-10 serrate. Pronotum subrectangular, transverse, base and apex about the same width; disk with surrounding impressed marginal line; lateral carina complete, extending from base to apex. Prosternum with long process (Figs. 46, 47), completely separating procoxae. Mesosternum with long process (Figs. 41, 42), noncleft. Elytron elongate, approximately three times longer than wide. Scutellum square, truncate apically. Metafemur incrassate, elongate; dorsal side nongranulate; ventral side pectinate; pecten produced, straight, with denticles, denticle 1 acuminate, larger than the other denticles, located beyond middle of femur; when leg flexed tibia positioned on lateral side of pecten; prepectenal ridge with spines, without a protuberance. Metatibia arcuate; three strong ventral carinae, middle carina without tubercle and sulcus; lateral and dorsolateral carinae obsolete; mesal and dorsomesal carinae obsolete; mucro at apex, without apical calcaria. Median lobe usually broad, sometimes slender, with large median and basal sclerites. Lateral lobes confluent, not separated, without cleft, apex with vague median notch and a fine line- or fold-like sinus (Figs. 141, 144, 147, 150, 153, 156); without gemmae; Kingsolver's band present.

The following six species of *Caryobruchus* are considered valid: *C. curvipes* (Latreille), *C. gleditsiae* (Johansson and Linné), *C. marieae* Nilsson and Johnson, *C. maya* Nilsson, new species, *C. rubidus* (Chevrolat), and *C. veseyi* (Horn).

KEY TO SPECIES OF *CARYOBRUCHUS*

1 Inner ventral carina strongly elevated from middle of metatibia (Fig. 11, 76); large pecten (Fig. 76); pygidium as long as wide; antennal segments 4-10 wide (length = width) (Fig. 92); genitalia as in Figs. 142 & 143, apex of median lobe forming an acute angle; metafemur length/width ratio mean 1.79. . . . . **C. marieae** Nilsson and Johnson

— Inner ventral carina on metatibia not strongly elevated; pecten of normal size; pygidium wider than long (Fig. 65); genitalia not as above, apex of median lobe usually forming a obtuse angle (Fig. 140) (in *C. veseyi* (Fig. 146) the angle is acute but not as much as in *C. marieae*); metafemur length/width ratio mean 1.90 or more **2**

2 (1) Metafemur much longer than wide (length/width mean ratio 2.60); antennal segments 4-10 long, slender, non-serrate or mostly so (Fig. 90); genitalia as in Figs. 145 & 146 . . . . **C. veseyi** (Horn)

— Metafemur longer than wide (length/width ratio mean 1.90-1.94); antennal segments 4-10 serrate, longer than wide (Figs. 89, 91, 93, 94); genitalia not as above **3**

3 (2) Genitalia as in Figs. 151 & 152; segment 3 of maxillary palp long, slender; eyes on dorsal side of head approximate . . . . **C. maya** Nilsson

— Genitalia not as above; segment 3 of maxillary palp not slender; eyes on dorsal side of head distant **4**

4 (3) Genitalia as in Figs. 139 & 140; segment 3 of maxillary palp shorter, wide; setae on elytron and pronotum whitish, not dense . . . . **C. gleditsiae** (Johansson and Linné)

— Genitalia not as above; Segment 3 of maxillary palp intermediate; setae on elytron and pronotum usually dense **5**

5 (4) Genitalia as in Figs. 148 & 149; setae on elytron and pronotum light yellowish brown, very dense (often giving a smudged appearance to the beetle) . . . . **C. curvipes** (Latreille)

— Genitalia as in Figs. 154 & 155; setae on elytron and pronotum white, often dense . . . . **C. rubidus** (Chevrolat)

Caryobruchus curvipes (Latreille)

Figs. 4, 78, 89, 98, 148 - 150

Bruchus curvipes Latreille 1811:234. **Neotype designated.**
Caryaborus(sic) *testaceus* Motschoulsky 1874:246. **New synonymy.**
Pachymerus testaceus: Pic 1913:9.
Caryobruchus testaceus: Bridwell 1929:155.

Type Data.—Type locality: Michoacan, Mexico. Holotype, lost. Neotype female, near La Huacana, Michoacan, Mexico, 23.X.1987, ex seeds of *Sabal pumos* (H.B. & K.) Burret, S. Zona, *Bruchus curvipes* Latreille, neotype by Jan Arne Nilsson 1992; deposited in the U.S. National Museum of Natural History, Washington, D.C. Neoparatype female, same data as neotype. The name is a **nomen dubium** since two species have been referred to by this name in the literature (Germar 1818a, 1818b). A neotype is necessary in the interest of stability of nomenclature to separate the types of *Bruchus curvipes* Latreille 1811, and *Bruchus ruficornis* Germar 1818. The beetle collection of Latreille has disappeared, and so the holotype of *Bruchus curvipes* is lost. In 1929, Latreille's collection of Coleoptera was housed in Manchester, United Kingdom, but has since been sold to an unknown buyer (pers. comm. S.L. Shute, The Natural History Museum, London). The original description, host record, and collection locality make it very likely that *C. testaceus* is conspecific with *C. curvipes*. Two specimens collected from the type locality of *Bruchus curvipes* were studied. These were reared from fruits of *Sabal pumos* (H.B. & K.) Burret, the species of palm from which the original Latreille specimens of *Bruchus curvipes* were reared. The type locality of the host palm is the same as the type locality for the beetle, near the Jorullo Volcano and the town of La Huacana, in the state of Michoacan (Zona 1989). One of the specimens collected at the original type locality (Zona 1989) of both the insect and the palm host (Latreille 1811), a female, is here designated a neotype. *Caryoborus testaceus*. Holotype male, Am. cent. Mots.; deposited in the Moscow State University, Zoological Museum, Moscow (MOSC).

Distribution .—(Fig. 4). Specimens examined, 60. Guatemala (Petén), Mexico (Chiapas,Oaxaca, Sinaloa).

Diagnosis.— Integument medium to dark reddish-brown, medium texture, beige or light yellowish-brown pubescence. Males 6.0-11.9 mm, females 6.5-12.3 mm in length (pronotum-elytra); width of males 3.4-6.2 mm, females 3.8-6.6 mm, maximum thoracic depth of males 3.7-4.7 mm, females 3.9-4.4 mm. Eyes distant. Antennal segments 4-10 serrate, segments longer than wide. Disk of pronotum wider than long (length/width ratio mean 0.73). Metafemur almost twice as long as wide (length/width ratio mean 1.92); pecten short with 8-10 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 7-11 small, usually acute, spines. Metatibia with inner ventral carina not elevated. Pygidium wider than long (length/width ratio mean 0.70).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform medium brown to dark reddish-brown.

Vestiture. Setae often lost on parts of the body, possibly due to rubbing. Dorsal and ventral body surfaces with beige or light yellowish-brown, medium texture, short, recumbent, moderately dense, uniform setae, color strongest yellow on apical end of elytron and metafemur; antenna with minute white setae; elytron moderately hirsute; sparse setae on ventral ridge of metafemur not covering the pecten; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium as densely hirsute as elytron, but setae longer. Setae often very dense giving the beetle a smudged appearance.

Head. Usually shorter but sometimes almost as long as pronotum; frons and vertex with prominent median glabrous carina, carina at vertex not interrupted by a weak depression; ocular sinus vague; on dorsal side eyes distant; postocular lobe medium-sized; antenna shorter than elytron, segments 4-10 serrate longer than wide; maxillary palp segment 3 less than twice as long as segment 2 and somewhat narrow; gena long; sides of submentum only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.73); sparsely punctate; all sides with strong, impressed, marginal line, anterior margin straight or feebly emarginate; angles usually rounded, sometimes not visible in dorsal view; medial dorsal surface usually flattened, sides depressed, more depressed toward apex, either arcuate or angulate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle usually less than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from head to elytron. Protarsus 1 shorter and wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process of intermediate width.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface usually convex between humerus and mesal margin, depressed laterally and apically; humerus non-scabrous; striae punctate. Metafemur incrassate, maximum width slightly closer to base, constricted toward apex, almost twice as long as wide (length/width ratio mean 1.92), ventral side with a pecten armed with 8 - 10 denticles, produced, short, straight; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles smaller and decreasing in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 7-11 small, usually acute spines; lateral side with small punctures, usually hidden under setae. Metatibia evenly arcuate (angle >90°); three strong ventral carinae, inner carina very strong, wide tibial furrow between inner and middle carinae, middle carina strong, very close to and fusing with outer at mucro, outer carina very strong; lateral, dorsolateral, mesal and dorsomesal carinae obsolete; mucro medium size; tibial corona smooth, without spines; spur barely visible in lateral view, sparsely covered with setae. Mesotarsus 1 shorter and slightly wider than metatarsus 1. Mesosternal process not slanting, projecting to almost 90° angle from body plane, apex not curved back towards plane of metasternum; metaspinasternum only feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, feebly convex in lateral view, wider than long (length/width ratio mean 0.70), wider at base than apex, in almost 90 degrees angle to elytron, usually hidden by the elytra and not visible in dorsal view.

Genitalia. Median lobe (Fig. 149) broad. Ventral valve short with sides forming a triangle with an obtuse angle. Armature of internal sac with two median, long curved sclerites, one arm acute at apex, serrate at apex and near base; two large, wide, serrate basal sclerites. Lateral lobes (Fig. 150) confluent, not separated, without cleft, apex with median notch, line-like sinus extending from notch to 0.6 length of distance apex to Kingsolver's band.

Females.— Similar to males, maximum thoracic depth often slightly larger; protarsus 1 not as wide (sexual dimorphism). Armature of bursa copulatrix (Fig. 148) of two types: two curved, club shapes, apposed sclerites, wider at base; and one long, rodlike, wider at base, with a cleft on the dorsal side.

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. Guatemala: El Petén, 1922, H.F.Loomis (USNM); Uaxactum, ex Botan palm, 28.III.1922, H.L. Loomis (USNM); Uaxactum, El Petén, ex Botan palm 18.III.1922, H.F. Loomis (USNM). Mexico: Chiapas, ex palmetto, XII.1906, Collins & Doyle (USNM); Chiapas, Tuxtla Gutierrez, X.1987, D.B. Thomas (RIL); Michoacán, seeds of *Sabal pumos* (H.B. & K.) Burret, 23.X.87, S. Zona (ZONA); Oaxaca, Temascal, at light, 30.V.1964, D.H. Janzen (CDJ); Sinaloa; 14mi [22km] NW Rosario, reared from seeds of palm, VII.23.65, C.D. Johnson (CDJ).

Discussion.—Bonpland collected palm fruits from a new species of palm, given the name *Corypha pumos* by Kunth (Humboldt, Bonpland and Kunth 1815), later *Sabal pumos* (H.B. & K.) Burret (Zona 1990). The beetles which emerged from most of the fruits were named *Bruchus curvipes* by Latreille; (1811). The type has disappeared. However, two female specimens of *Caryobruchus* have been collected at the type locality of *Corypha pumos* (H.B. & K.) Burret. With the host record, collection locality and the original description it can be assumed that the beetles described by Latreille and these two specimens are conspecific. It is often preferable to designate male bruchids as types, but for species in *Caryobruchus* the female genitalia have been found to have excellent characters for use in identification to species. For this reason, one of the female specimens has been designated as the neotype.

Caryobruchus gleditsiae (Johansson and Linné)

Figs. 3, 56, 57, 75, 91, 97 - 100, 139, 140, 141

Dermestes gleditsiae Johansson and Linné 1763:9; Johansson and Linné 1789:392.
Bruchus gleditsiae: Linné 1767:605.
Pachymerus gleditsiae: Pic 1913:7.
Caryobruchus gleditsiae: Bridwell 1929:155; Udayagiri and Wadhi 1989:239; Nilsson and Johnson 1990:51.
Bruchus arthriticus Fabricius 1801:398.
Caryoborus arthriticus: Schönherr 1833:93.
Bruchus fuscus Goeze 1977:332; Decelle 1966:172 (synonym?).

Type Data.—Type locality: Amer. The holotype of *Dermestes gleditsiae* has disappeared. The insect at the Linnean Society in London is probably not the specimen used by Johansson and Linné for the original description and should not be considered the holotype. But there is no question about the identity of this species as it is the only species of palm bruchid occurring in the United States, and the name has been accepted for this species by bruchid researchers. No paratypes. *Bruchus arthriticus*. Holotype; deposited in Universitetets Zoologisk Museum, Copenhagen (UZMC). *Bruchus fuscus*. Holotype; deposited in Muséum National d'Histoire Naturelle, Paris (MNHP).

Distribution .—(Fig. 3). Specimens examined, 2480. Bahamas, Bermuda, Cuba, Dominica, Dominican Republic, El Salvador, Guatemala, Honduras, Jamaica, Mexico (Campeche, Chiapas, Guerrero, Hidalgo, Michoacan, Nayarit, Oaxaca, Puebla, San Luis Potosi, Sinaloa, Sonora, Tamaulipas, Veracruz), Panama, United States (Alabama, Florida, Georgia, Louisiana, Mississippi, Texas).

Diagnosis.— Integument dark brown, sometimes slightly reddish (this is usually the color of specimens collected on Cuba), sparse white or yellowish-white pubescence. Males 7.2-12.1 mm, females 4.3-11.0 mm in length (pronotum-elytra); width of males 3.6-6.2 mm, females 2.2-5.4 mm, maximum thoracic depth of males 2.3-3.7 mm, females 1.5-3.6 mm. Eyes distant. Antennal segments 4-10 serrate, longer than wide. Disk of pronotum disk wider than long (length/width ratio mean 0.69). Metafemur almost twice as long as wide (length/width ratio mean 1.94); pecten short with 7-12 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 7-13 small acute spines. Metatibia with inner ventral carina not elevated. Pygidium wider than long (length/width ratio mean 0.74).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed), some structures glabrous. Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform dark brown, sometimes slightly reddish.

Vestiture. Setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surfaces with white or yellowish-white, medium texture, recumbent, moderately dense, uniform setae; antenna with minute white setae; sparse setae on elytron; sparse setae on ventral ridge of metafemur not covering pecten; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron.

Head. Shorter or about as long as pronotum; frons and vertex with median glabrous carina; ocular sinus vague or lacking; on dorsal side eyes distant; postocular lobe short; antenna shorter than elytron, segments 4-10 serrate, clearly longer than wide; maxillary palp segment 3 less than twice as long as segment 2 and somewhat wide; gena long; sides of submentum only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.69); moderately punctate; all sides with strong, impressed, marginal line, anterior margin usually emarginate; angles produced, visible in dorsal view; medial dorsal surface usually flattened, sides depressed, sharply depressed toward apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base sharply produced, angle more than 90°; posterior margin arcuate, feebly produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter and wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process medium width.

Mesothorax and Metathorax. Scutellum small, subquadrate, often slightly longer than wide. Elytron with dorsal surface often slightly flattened between humerus and mesal margin, depressed towards sides and apex; humerus non-scabrous; striae punctate. Metafemur incrassate, maximum width closer to base, constricted toward apex, almost twice as long as wide (length/width ratio mean 1.94), ventral side with a pecten produced, short, straight, armed with 7-12 denticles; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles decreasing in size; when leg flexed tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 7-13 small acute spines; Metatibia arcuate, bending with an even arc (angle >90°); three strong ventral carinae, inner carina strong at base and mucro and moderately deep tibial furrow between inner and middle carinae, middle carina strong at base (weak at mucro in some specimens) and fusing with outer carina just before mucro, outer carina strong at base and mucro; lateral, dorsolateral, mesal and dorsomesal carinae obsolete; mucro medium size; tibial corona smooth, without spines; spur only slightly visible in lateral view. Mesotarsus 1 shorter, but only slightly wider than metatarsus 1. Mesosternal process vaguely slanting, projecting with less than 90° angle from body plane, apex usually feebly curved back towards plane of metasternum; metaspinasternum only feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, moderately convex in lateral view, wider than long (length/width ratio 0.74), wider at base than apex, at almost 90° angle to elytron, but most often not completely hidden by the elytra and thus partially visible in dorsal view.

Genitalia. Median lobe (Fig. 140) broad. Ventral valve long with sides forming a triangle with an obtuse angle. Armature of internal sac with two large, median, Y-shaped sclerites with one arm acute at apex and branched at less than right angle; two basal, straight or slightly curved serrated sclerites. Lateral lobes (Fig. 141) confluent, not separated, without cleft, apex with vague median notch, fold-like sinus (see Fig. 141) extending from notch to 0.5 length of distance apex to Kingsolver's band.

Females.— Similar to males, maximum thoracic depth usually slightly larger, protarsus 1 not as wide (sexual dimorphism). Armature of bursa copulatrix (Fig. 139) of two types: two apposed ventral sclerites, but widely separated at base, mushroom-shaped; and one dorsal sclerite, long, rodlike, wider at base, base of sac swollen, bulblike.

Specific Records.—Only records with host plant associations included. Host records are from collection labels, spelled exactly as written, and should be verified. Natural hosts probably *Sabal* palms. Bermuda: Nonsuch Island, ex *Sabal bermudana* L.H. Bailey, VI.1988, S. Zona (ZONA). Cuba: A da Costa Lima, ex *Copernicia ? hospita* Mart., VIII.49, (BMNH); Camaguey, ex *Copernicia hospita* Mart., 1948, B.F. Dahlgren (FMNH); Camaguey, 5mi [8km] N of

Cabeza de Vaca, ex *Copernicia torrans*, B.F. Dahlgren (FMNH); Camaguey, Nuevitas road between Minas and Nuevitas, ex *Copernicia hospita* Mart., 28.VIII.1949, (FMNH); El Coca, ex *Sabal florida*, 6.II.1948, B.F. Dahlgren (FMNH); Camaguey, Nuevitas road between Minas and Nuevitas, ex *Copernicia rigida* Britton & Wilson, 24.VIII.1949, B.F. Dahlgren (FMNH); Guanabacoa, Havana, ex *Copernicia inderoglossa*, X.1929, H. Leon (USNM); Habana, with seed of *Copernicia torreana* León, quarantine Washington, D.C., (USNM); ex *Copernicia* sp., B.E. Dahlgren (BMNH); Guanabaeva, ex palm yata, (AMNH); with seeds of *Copernicia rigida* Britton & Wilson, (USNM); with seeds of *Copernicia sueroana* León, (USNM). Dominican Republic: San Cristóbal Prov., 9.IX.1969, (TAM); ex *Inodes neglecta*, (USNM). El Salvador: quarantine from San Salvador, ex native palm, 3.VI.1929, (USNM); quarantine, San Salvador, ex *Sabal* sp., interc. 29.VII.77, (USNM). Haiti: ex *Sabal domingensis* (type *S. haltensis*), (ZONA). Honduras: quarantine Miami, ex *Chamaedorea seifrizii* Burret seed, (USNM). Jamaica: St. Thomas, Morant Point, ex dead *Thrinax* sp. fronds, 15.V.1965, T.H. Farr (USNM). Mexico: Chiapas, quarantine Laredo, on *Chamaedorea* seed, intercepted 8.IV.57, (USNM); Michoacan, La Gallina, 1.XI.80, 880 msnm S-144, ex *Sabal*, Atkinson & Equihua (JRN); Nayarit, 13mi [21km] SE of Acaponeta, ex palm, 12.VII.1968, C.D. Johnson (CDJ); Nayarit, San Blas turnoff, ex palm, 11.VII.1968, C.D. Johnson (CDJ); Sinaloa, 18mi [29km] SE of Escuinapa, ex palm, 26.VIII.1965, C.D. Johnson (CDJ); Sinaloa, ex *Sabal rosei* Becc., VIII.1988, S. Zona (ZONA); Sonora, San Carlos Bay, by the beach, 23.VII.1988, ex *Sabal uresana* Trel., J.A. Nilsson (JAN); Sonora, ex *Sabal uresana* Trel., S. Zona (ZONA); Veracruz, km 14, federal road 180 (Veracruz-Alvarado), Rancho Las 3M, fallen seeds *Sabal mexicana* Mart., 15.Jan.1978, Silvia Olvera (CDJ); Veracruz, 24km S of Veracruz, by hwy 180, seeds on ground, *Sabal mexicana* Mart., V.1990, J.A. Nilsson (JAN). St. Croix: ex seed *Coccothrinax argentata* (Jacq.) Bailey, (USNM). United States: Florida, Alachua County, 1.VII.1978, ex *Sabal palmetto* (Walt.) Lodd. ex Schult, T.H. Atkinson (FDA); Florida, Alachua County, Gainesville, ex *Sabal* sp., 11.IV.1934, L.J. Bottimer (CNC); Florida, Alachua County, Gainesville, ex *Phoenix sylvestris* (L.) Roxb., 11.VII.1960, L.J. Bottimer (CNC); Florida, Brevard County, ex palmetto, 8.IV.1937, Dyson & Setzer (FDA); Florida, Citrus County, in palmetto litter, 27.III.1965, R.E. Love (UGA); Florida, Dade County, Homestead, ex "Royal Palm", 21.VI.1965, C. O'Brien (CDJ); Florida, Dade County, Florida City, ex "Silver Palm", 11.III.1920, M. Hebard (ANSP); Florida, Dade County, Everglades national Park, ex *Coccothrinax argentata* (Jacq.) Bailey, IV.1960, F.C. Craighead (CNC); Florida, Dade County, Coral Gables, Fairchild Tropical garden, ex *Sabal longipedunculata*, 7.V.1960, Woodruff & McFarlin (FDA); Florida, Dade County, Coral Gables, Fairchild Tropical Garden, Coconut Grove, ex *Sabal parviflora* Becc., 22.VIII.1960, L.J. Bottimer (CNC); Florida, Dade County, Coral Gables, Fairchild Tropical Garden, Coconut Grove, ex *Sabal yapa* C. Wright ex Becc., 22.VIII.1960, L.J. Bottimer (CNC); Florida, Dade County, Coral Gables, Fairchild Tropical Garden, Coconut Grove, ex *Sabal causiarum* O.F. Cook, 24.VIII.1960, L.J. Bottimer (CNC); Florida, Dade County, Coral Gables, Fairchild Tropical Garden, Coconut Grove, ex *Coccothrinax*, 24.VIII.1960, L.J. Bottimer (CNC); Florida, Dade County, Coral Gables, Fairchild Tropical Garden, Coconut Grove, ex *Livistonia chinensis* R. Br., 24.VIII.1960, L.J. Bottimer (CNC); Florida, Dade County, Coral Gables, Fairchild Tropical Garden, Coconut Grove, ex *Thrinax*, 29.VIII.1960, L.J. Bottimer (CNC); Florida, Dade County, Coral Gables, Fairchild Tropical Garden, Coconut Grove, ex *Sabal parviflora* Becc., L.J. Bottimer (CNC); Florida, Highlands County, Childs, *Tillandsia fasciculata*, 23.V.1949, B. Patterson (FMNH); Florida, Highlands County, Lake Placid, ex *Sabal etonia* Swingle ex Nash, 6.II.1961, F.C. Craighead (CNC); Florida, Lee County, Koreshan State Park, ex palmetto, 7.V.1976, O'Brien & Marshall (CAS); Florida, Levy County, ex *Yucca smalliana*, 30.VI.1956, H.V. Weems Jr. (FDA); Florida, Marion County, Ocala National Forest, ex *Sabal etonia* Swingle ex Nash, VII.1974, (FDA); Florida, Monroe County, Marathon, ex *Thrinax microcarpa* Ruiz & Pav., 31.V.1960, L.J.Bottimer (CNC); Florida, Monroe County, Big Pine Key, ex *Thrinax microcarpa* Ruiz & Pav., 2.V.1960, L.J. Bottimer (CNC); Florida, Orange County, Orlando, ex palmetto, 28.II.1930, L.J. Bottimer (CNC); Florida, Osceola County, ex *Sabal palmetto* (Walt.) Lodd. ex Schult, XI.1988, S. Zona (ZONA); Florida, Polk County, Lake Martha, ex *Sabal palmetto* (Walt.) Lodd. ex Schult, 21.IV.1951, B.E. Dahlgren (FMNH); Florida, Polk County, Frostproof, ex *Sabal etonia* Swingle ex Nash, 22.V.1982, S. Zona (ZONA); Florida, Washington County, ex *Sabal palmetto* (Walt.) Lodd. ex Schult, (COR); Georgia, Fulton County, Atlanta, ex *Sabal* *minor* (Jacq.) Pers., (COR); Louisiana, Ascencion County, Gonzales, ex *Sabal glabra* Sargent, 5.XI.1927, C.A. Brown (LSU); Louisiana, East Baton Rouge County, Baton Rouge, ex palmetto, X.1927, C.A. Brown (LSU); Louisiana, Plaquemines County, ex *Sabal minor* (Jacq.) Pers., 20.X.1979, S. Doughty (LSU); Texas, Bowie County, Texarkana, ex palmetto, G.W. Blaydes (USNM); Texas, Cameron County, Sabal Palm Grove Sanctuary, Southmost, bl trap, 6-9.X.1981, R. Turnbow (TURN); Texas, Cameron County, SW Brownsville close to Audubon Palm Refuge, ex *Sabal mexicana* Mart., 17.V.1988, J.A. Nilsson (JAN); Texas, Cameron County, Brownsville, ex *Phoenix*, 13.IV.1961, L.J. Bottimer (CNC); Texas, Crosby County, 25.II (no year), ex *Sabal glabra* Sargent, L.J. Bottimer (UA); Texas, Crosby County, ex *Sabal* sp., 26.XI.1924, L. J. Bottimer (CNC); Texas, Hidalgo County, Edinburg, Pan American University campus, ex *Sabal mexicana* Mart., 18.V.1988, J.A. Nilsson (JAN); Texas, Hidalgo County, McAllen, ex *Sabal mexicana* Mart., 4.VI.1990 (emerged 11.VI.1990), J.A. Nilsson (JAN); Texas, Hidalgo County, N of Mission, by hwy 107, ex *Washingtonia robusta* Wendl., 16.V.1988, J.A. Nilsson (JAN); Texas, Hidalgo County, Pharr, by El Centro mall, seed on ground *Sabal mexicana* Mart., 22.XII.1988, J.A. Nilsson (JAN); Texas, Hidalgo County, Pharr, seeds on ground, 16.VII.1989 (emerged 5.X.1989), J.A. Nilsson (JAN); Texas, Kleberg County, Kingsville, Texas A&I University campus, ex *Sabal* sp.seeds on ground, 7.VII.1989, J.A. Nilsson (JAN); Texas, Kleberg County, Riviera Beach, 21.X.1984, R. Turnbow (TURN); Texas, Starr County, Rio Grande City, planted esplanade palms, ex *Sabal* sp. with black shiny seeds (not looking like *Sabal mexicana* Mart. seeds), VIII.1988, 18.VII.1989, J.A. Nilsson (JAN); Texas, Walker County, Lake Stubblefield, ex *Sabal minor* (Jacq.) Pers., 3.IX.1971, W.E.Clark (CDJ); Texas, Webb County, Laredo, TX Tourist Bureau, ex *Phoenix* sp., 23.VIII.1988, J.A. Nilsson (JAN).

Discussion.—Linné has incorrectly been designated as the only author of this species. Usinger (1964) stated: "According to the custom of the time, Linnaeus is cited as "author" of these [theses] and it would be quite impossible in any given case to determine which parts of a thesis were transcribed lecture notes and which represented original ideas or observations of the student. The theses were published separately and then collected theses of all his students were reprinted several times, the Schreiber edition (3rd) appearing in ten volumes under the title "Amoenitates Academicae." Linné might have been responsible for the name, since it is mentioned in a letter to N.J. Jacquin; (1762), but a description prior to Johanssons description (1763) does not exist. We give Johansson credit as first author and Linné as second author. The correct citation should be *Dermestes gleditsiae* Johansson and Linné 1763. The type in the collection of Linné in London is probably not the original type. The label on the specimen in the collection does not have the same data as indicated by the original description. This is not surprising since insects named by Linné were often not represented by a type specimen, and if a "type" existed it was often replaced by specimens in "better" condition after the death of Linné (Usinger 1964). Since Linné did not himself describe *C. gleditsiae*, a "type" was most likely placed in the collection after the death of Linné in 1783. We do not regard the insect in the Linnaean Collection as the holotype.

Caryobruchus marieae Nilsson and Johnson

Figs. 3, 11, 23, 24, 76, 92, 142 - 144

Caryobruchus marieae Nilsson and Johnson 1990:55.

Type Data.—Type locality: Habana, Cuba. Holotype male, Cuba, Habana, *Sabal parviflora* Becc., quarantine 28.11.1932; deposited in the U.S. National Museum of Natural History, Washington, D.C. (USNM). Allotype female, Cuba; deposited in USNM. Paratypes, 24.

Etymology.— Named in honor of Marie Simonsson.

Distribution .—(Fig. 3). Specimens examined, 26. Cuba.

Diagnosis.— Integument dark brown to almost black, sparse white pubescence. Males 7.2-8.3 mm, females 8.4-9.0 mm in length (pronotum-elytra); width of males 3.4-4.4 mm, females 4.4-4.8 mm, maximum thoracic depth of males 2.5-2.8 mm, females 3.0-3.2 mm. Eyes distant. Antennal segments 4-10 serrate, as wide as long. Disk of pronotum wider than long (length/width ratio mean 0.72). Metafemur less than twice as long as wide (length/width ratio mean 1.79). Pecten long, strongly produced with seven or eight denticles, denticle 1 acuminate and much longer; prepectenal ridge about as long as pecten, with 6-10 medium acute spines . Metatibia with inner ventral carina elevated at apical end creating a wide slanted tibial furrow at basal end of mucro. Pygidium about as wide as long (length/width ratio mean 1.00).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages varying from uniform dark brown to almost black.

Vestiture. Setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surfaces with white, fine, very short, recumbent, moderately dense, uniform; antenna with minute white setae; sparse setae on elytron; sparse setae on ventral ridge of metafemur not covering pecten; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron. Elytra and pronotum disk almost non-hirsute in some specimens, possibly due to rubbing.

Head. About as long as pronotum, sometimes slightly longer; frons and vertex with median glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus vague; on dorsal side eyes distant; postocular lobe short; antenna shorter than elytron, segments 4-10 serrate about as wide as long; maxillary palp segment 3 less than twice as long as segment 2 and of intermediate width; gena long; sides of submentum only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.72); moderately to densely punctate; all sides with strong, impressed, marginal line, anterior margin feebly emarginate; angles rounded, often not visible in dorsal view; medial dorsal surface usually feebly convex, sometimes flattened; sides depressed, sharply depressed toward apex, parallel, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced; angle more than 90°; posterior margin arcuate, feebly produced medially; strong lateral prothoracic carina complete, extending from head to elytron. Protarsus 1 shorter and slightly wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process narrow.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface usually slightly flattened between humerus and mesal margin, depressed towards sides and apex; humerus non-scabrous; striae punctate. Metafemur incrassate, maximum width closer to base, constricted towards apex, almost twice as long as wide (length/width ratio mean 1.78), ventral side with a pecten armed with seven or eight denticles, strongly produced, only slightly shorter than prepectenal ridge; denticle 1 very large, acuminate, closer to femoral apex than to base; following denticles decreasing in size; when leg flexed, tibia on lateral side of pecten; prepectenal ridge approximately as long as pecten, with 6-10 medium acute spines. Metatibia evenly arcuate (angle >90°); three strong ventral carinae, inner carina strong at base and very strong and elevated from middle of tibia to mucro and deep tibial furrow between inner and middle carinae (furrow wide from elevated carina to mucro), middle carina strong at base and weaker at mucro and very close to and fusing with outer carina just before mucro, outer carina weak at base and stronger at mucro; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro very large; tibial corona smooth, without spines; spur clearly visible in lateral view; mesotarsus 1 slightly shorter and slightly wider than metatarsus 1. Mesosternal process vaguely slanting, projecting to less than 90° angle from body plane, apex feebly curved back towards plane of metasternum; metaspinasternum only feeble produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, moderately convex in lateral view, about as wide as long (length/width ratio mean 1.00), wider at base than apex, at almost 90° angle to elytron, often hidden by elytra and thus not visible in dorsal view.

Genitalia. Median lobe (Fig. 143) slender. Ventral valve long with sides forming a triangle with an acute angle. Armature of internal sac with two median, V-shaped sclerites with one arm acute at apex and branched from base of sclerite at about right angle; two basal inverted U-shaped, serrated sclerites. Lateral lobes (Fig. 144) confluent, not separated, without cleft, apex with vague median notch, line-like sinus extending to 0.5 length of distance apex to Kingsolver's band.

Females.— Similar to males, maximum thoracic depth usually slightly larger; protarsus 1 not as wide (sexual dimorphism). Armature of bursa copulatrix (Fig. 142) of two types; two small, short ventral sclerites, slightly wider at base; and one dorsal sclerite, wider at base, base of sac swollen, bulblike.

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. Cuba: *allotype* , (USNM); 1929, (JAN); 1929, Bruner & Boucle (USNM); X.1929, Bruner (USNM); Camacho, 1929, ex *Sabal* sp., Leon (USNM); Cayamas, 14.I, 3.III, 5.III, 13.III, 16.III (year unknown), E.A. Schwarz (USNM); Guanimar, 1929, ex *Sabal* sp., Leon (USNM); Habana, *Sabal parviflora* Becc., quarantine 28.11.1932, *holotype* , (USNM); Habana, ex *Sabal parviflora* Becc., (USNM); Oriente, Rio de Imias, X.1929, ex *Sabal* sp., Leon (USNM).

Discussion.—This species needs to be collected extensively. The latest collection date of specimens examined is 1932.

Caryobruchus maya Nilsson, **new species**

Figs. 5, 79, 93, 151 - 153

Type Data.—Type locality: 15km S. of Morocoy, Quintana Roo, Mexico. Holotype, Quintana Roo, 15km S of Morocoy, 19.VI.1990, R. Turnbow; deposited in the American Museum of Natural History, New York (AMNH). Allotype, Mexico, Campeche, 28km E. Xpujil, on burned cabbage palm, 29.VI.1990, R.Turnbow; deposited in AMNH. 38 paratypes. Belize: (1) (JAN); (1) C.F. Baker 1906 (USNM). Guatemala: (1) Petén, Tikal, 28.II.1956, #74, I.J. Cantrell (MIC); (1) Petén, Tikal, 28.VI.1974, W.E. Steiner (USNM); (1) interc. 4-21-1967, Houston 10962, ex *Chamaedorea elegans* Mart., S.H. Pruitt Coll. (USNM). Mexico: (5) Campeche, 28km E. Xpujil, on burned cabbage palm, 29.VI.1990, 19.VI.1990, R.Turnbow, (TURN); (1) Campeche, 4 km Xpujil, 30.V.1984, R.Turnbow (TURN); (1) Chiapas, hwy 180, 31km E of Villahermosa, 28.VI.1990, R. Turnbow (TURN); (2) Quintana Roo, 13 km N. Obregon, V.31 1984, J.E. Wappes (WAPP); (5) Quintana Roo, 15km S of Morocoy, 29.VI.1990, 19.VI.1990, R. Turnbow (TURN); (1) Quintana Roo, Hwy. 307, 95 km N junction Hwy, 186, 31.V.1984 (TURN); (1) Quintana Roo, Allen Point, Ascencion Bay, 17.IV.1960, J.F.G. Clarke (USNM); (13) Quintana Roo, Ascen. Bay, Sulimans Pt, Sta 7, 19.IV.1960, J.F.G. Clarke (USNM); (1) Yucatan, Itzimna, IX.9.1964, collectors J.C. & D. Pallister (AMNH); (1) interc. Brownsville, *Sabal*, 1.X.85, (USNM); (1) interc. at Brownsville, Tex., Sudduth taken in palm seed from Fortin, Veracruz, (USNM); (1) interc. New Orl. 42610, 9/16/67, in plane cargo hold 67-24808, (USNM).

Etymology.—Named, as a noun in apposition to *Caryobruchus*, after the Maya Indians who inhabited the same area as the beetles.

Distribution (Fig. 5).—Specimens examined, 40. Belize, Guatemala (Petén), Mexico (Campeche, Chiapas, Quintana Roo, Yucatan).

Diagnosis.— Integument dark brown, sometimes slightly reddish, sparse yellowish-white pubescence. Males 6.4-8.5 mm, females 6.6-8.3 mm in length (pronotum-elytra); width of males 3.7-4.5 mm, females 3.8-4.4 mm, maximum thoracic depth of males 2.5-2.8 mm, females 3.0-3.3 mm. Eyes approximate. Antennal segments 4-10 serrate, longer than wide. Disk of pronotum wider than long (length/width ratio mean 0.68). Metafemur almost twice as long as wide (length/width ratio mean 1.90); pecten short with 8-13 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 7-12 small acute spines. Metatibia with inner ventral carina not elevated. Pygidium wider than long (length/width ratio mean 0.89).

Differential Diagnosis.—See COMPARISONS OF SPECIES IN CARYOBRUCHUS.

Males.—*Integument.* Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform dark brown, sometimes slightly reddish.

Vestiture. Setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surfaces with yellowish-white, medium texture, recumbent, moderately dense, uniform setae; antenna with minute white setae; sparse setae on elytron; sparse setae on ventral ridge of metafemur not covering the pecten: protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron.

Head. Longer or as long as pronotum; frons and vertex with median glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus vague or lacking; on dorsal side eyes approximate; postocular lobe medium length; antenna shorter than elytron, segments 4-10 serrate, longer than wide; maxillary palp segment 3 twice as long or longer than segment 2, and elongate; gena long; sides of submentum only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.68); moderately punctate; all sides with strong, impressed, marginal line, anterior margin feebly emarginate; angles produced, visible in dorsal view; medial dorsal surface usually flattened, sides depressed, sharply depressed toward apex, angulate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base sharply produced, angle more than 90°; posterior margin arcuate, feebly produced medially; strong lateral prothoracic carina complete, extending from head to elytron. Protarsus 1 shorter, but only slightly wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process of medium width.

Mesothorax and Metathorax. Scutellum small, subquadrate, often slightly longer than wide. Elytron with dorsal surface usually slightly flattened between humerus and mesal margin, depressed towards sides and apex; humerus nonscabrous; striae punctate. Metafemur incrassate, maximum width closer to base, constricted toward apex, almost twice as long as wide (length/width ratio mean 1.90), ventral side with a pecten armed with 8-13 denticles, produced, short, straight; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles decreasing in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 7-12 small acute spines;. Metatibia evenly arcuate (angle >90°); three strong ventral carinae, inner carina strong at base and mucro and moderately deep tibial furrow between inner and middle carinae, middle carina strong at base (weak at mucro in some specimens) and fusing with outer carina just before mucro, outer carina strong at base and mucro; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro medium size; tibial corona smooth, without spines; spur only slightly visible in lateral view. Mesotarsus 1 shorter, but not wider than metatarsus 1. Mesosternal process vaguely slanting, projecting to less than 90° angle from body plane, apex straight or feebly curved back towards plane of metasternum; metaspinasternum only feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, moderately convex in lateral view, wider than long (length/width ratio mean 0.89), wider at base than apex, at almost 90° angle to elytron, usually hidden by elytra and thus not visible in dorsal view.

Genitalia. Median lobe (Fig. 152) broad. Ventral valve long with sides forming a triangle with an obtuse angle. Armature of internal sac closely resembling that of *C. gleditsiae*, with two large, median, Y-shaped sclerites, branched slightly above base at about right angle, with one arm acute at apex and hooked; two long, narrow, straight basal serrated sclerites. Lateral lobes (Fig. 153) confluent, not separated, without cleft, apex with vague median notch, fold-like sinus extending from notch to 0.5 length of distance apex to Kingsolver's band.

Females.— Similar to males, maximum thoracic depth usually slightly larger; protarsus 1 not as wide (sexual dimorphism). Armature of bursa copulatrix of two types (Fig. 151): two apposed ventral sclerites, slightly separated at base, sickle-shaped and slightly wider at apex; one dorsal sclerite, very long, narrow, rodlike, slightly wider at apex, base of sac sharply bent (approximately 135° angle) back toward ovipositor, not swollen and bulblike.

Specific Records.—(See list of paratypes). Host records are from collection labels, spelled exactly as written, and should be verified.

Caryobruchus rubidus (Chevrolat)

Figs. 4, 65, 80, 94, 154 - 156

Caryoborus rubidus Chevrolat 1877:114.
Pachymerus rubidus: Pic 1913:8.
Caryobruchus rubidus : Bridwell 1929:155; Udayagiri and Wadhi 1989:240.

Type Data.—Type locality: Mexico, Tutla (probably Tuxtla as in Tuxtla Gutierrez, Chiapas). Holotype male; Mexico, Tutla, D. Boucard, Coll. Chevr.; deposited in Naturhistoriska Riksmuseet, Stockholm (NR). No paratypes.

Distribution.— (Fig. 4).—Specimens examined, 4. Mexico (Chiapas).

Diagnosis.— Integument light to dark reddish-brown, medium texture, white pubescence, partly cover integument color. Males 6.6-7.1 mm, females 6.7-7.3 mm in length (pronotum-elytra); width of males 3.8-3.9 mm, females 3.8-4.0 mm, maximum thoracic depth of males 2.3-2.5 mm, females 2.7-2.9 mm. Eyes distant. Antennal segments 4-10 serrate, segments longer than wide. Disk of pronotum wider than long (length/width ratio mean 0.72). Metafemur about twice as long as wide (length/width ratio mean 1.91); pecten short with 8-11 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 7-9 small usually acute spines. Metatibia with inner ventral carina not elevated. Pygidium wider than long (length/width ratio mean 0.70).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with white setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform light to dark reddish-brown.

Vestiture. Setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surfaces with white, medium texture, recumbent, moderately dense, uniform setae; antenna with minute white setae, and longer golden sparsely irregular setae; elytron moderately hirsute; sparse setae on ventral ridge of metafemur not covering pecten; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium about as densely hirsute as elytron, setae longer.

Head. About as long as pronotum; frons and vertex with weak median glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus vague; on dorsal side eyes distant; postocular lobe medium size; antenna shorter than elytron, segments 4-10 serrate, longer than wide; maxillary palp segment 3 about twice as long as segment 2, widest at middle of segment; gena long; sides of submentum only feebly converging triangularly between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.72); densely punctate, punctations distributed more or less evenly over the disk; all sides with strong, impressed, marginal line, anterior margin clearly emarginate; angles vaguely pointed, visible in dorsal view; medial dorsal surface usually feebly convex sometimes flattened, sides depressed, more depressed toward apex, feebly angulate or arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base sharply produced, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from head to elytron. Protarsus 1 shorter, but only slightly wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process narrow.

Mesothorax and Metathorax. Scutellum small, subquadrate, often slightly wider than long. Elytron with dorsal surface usually slightly flattened between humerus and mesal margin, depressed towards sides and apex; humerus scabrous (usually covered by setae); striae punctate. Metafemur incrassate, maximum width slightly closer to base, constricted toward apex, almost twice as long as wide (length/width ratio mean 1.91), ventral side with a pecten armed with 8-11 denticles, produced, short, straight; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles smaller and decreasing in size; when leg flexed tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 7-9 small, usually acute spines. Metatibia evenly arcuate (angle >90°), dorsal side partly granulate (covered by setae); three strong ventral carinae, inner carina very strong, wide tibial furrow between inner and middle carinae, middle carina very strong, very close to and fusing with outer carina at mucro, outer carina very strong; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro medium size; tibial corona smooth, without spines; spur clearly visible in lateral view, sparsely covered with setae. Mesotarsus 1 shorter, but not wider than metatarsus 1. Mesosternal process slanting, projecting to less than 90° angle from body plane, apex not curved back towards plane of metasternum, metaspinasternum only feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, wider than long (length/width ratio mean 0.89), wider at base than apex, at more than 90° angle to elytron, elytra usually hidden by elytra, and thus not visible in dorsal view.

Genitalia. Median lobe (Fig. 155) broad. Ventral valve short with sides forming a triangle with an obtuse angle. Armature of internal sac with four median, flattened, cone-shaped sclerites, the two upper sclerites with the produced arms opposing each other, the two lower with the produced arms in the same direction; and two basal sclerites, curved, wide, serrate with marginal denticles. Lateral lobes (Fig. 156) confluent, not separated, without cleft, cutis flat, apex with median notch, vague line-like sinus extending from notch to 0.25 length of distance apex to Kingsolver's band.

Females.— Similar to males, but maximum thoracic depth slightly larger, pygidium sometimes visible in dorsal view. Armature of bursa copulatrix (Fig. 154) of two types: two apposed ventral sclerites, narrowed at middle; one large, long, dorsal sclerite, wider at base; base of sac slightly swollen and bulblike.

Specific Records.— Host records are from collection labels, spelled exactly as written, and should be verified. Mexico: Tutla (probably Tuxtla, as in Tuxtla Gutierrez, Chiapas), D.Boucard, *holotype*, (NR); Morelos, ex *Brahea* palm, quarantine Laredo, (USNM) (Morelos might not be the original collecting area, since border interceptions often do not have information on the collection area, only the locality from where it was shipped).

Discussion.—This species needs to be collected extensively. Only four specimens with poor records were obtained for this study.

Caryobruchus veseyi (Horn)

Figs. 5, 77, 90, 145 - 147

Caryoborus veseyi Horn 1873:313.
Pachymerus veseyi: Pic 1913:9.
Caryobruchus veseyi: Bridwell 1929:157.

Type Data.—Type locality: Baja California, Mexico. Holotype female, LeConte coll.; deposited in Museum of Comparative Zoology, Harvard UniversityMuseum of Comparative Zoology, Cambridge (MCZ). No paratypes. Collector and collection locality not on the pin, but is noted in the original description: J.X. de Vesey, the peninsula of lower California.

Distribution.—Specimen examined, 64. Mexico (Baja California).

Diagnosis.— Integument dark reddish-brown, fine, white pubescence partly covers integument color. Males 8.2-9.3 mm, females 7.6-12.1 mm in length (pronotum-elytra); width of males 4.8-5.2 mm, females 4.2-6.6 mm, maximum thoracic depth of males 2.7-3.3 mm, females 2.4-4.1 mm. Eyes distant. Antennal segments feebly 4-10 serrate, segments markedly longer than wide. Disk of prosternum wider than long (length/width ratio mean 0.78). Metafemur much more than twice as long as wide (length/width ratio mean 2.60); pecten short with 8-11 denticles, denticle 1 acuminate and much longer; prepectenal ridge longer than pecten, with 10-14 small usually acute spines. Metatibia with inner ventral carina not elevated. Pygidium wider than long (length/width ratio mean 0.76).

Males.—*Integument.* Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with white setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform medium to dark reddish-brown.

Vestiture. Setae often lost on parts of the body, possibly due to rubbing. Dorsal and ventral body surfaces with white, fine, very short, recumbent, moderately dense, uniform setae; antenna with minute white setae; elytron moderately hirsute; sparse setae on ventral ridge of metafemur not covering pecten; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron, setae longer.

Head. Slightly shorter than pronotum; frons and vertex with prominent median glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus vague; on dorsal side eyes distant; postocular lobe prominent; antenna shorter than elytra, segment 4 often non-serrate, segments 5-10 feebly serrate or non-serrate, markedly longer than wide; gena long; sides of submentum only feebly converging between eyes; on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio mean 0.78); moderately to densely punctate; all sides with strong, impressed, marginal line, anterior margin clearly emarginate; angles vaguely pointed, visible in dorsal view; medial dorsal surface usually convex, sides depressed, more depressed toward apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle more than 90°; posterior margin arcuate, not produced or only feebly produced medially; strong lateral prothoracic carina complete, extending from head to elytron. Protarsus 1 shorter, but only slightly wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process narrow.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface usually slightly flattened between humerus and mesal margin, depressed towards sides and apex; humerus scabrous; striae punctate. Metafemur incrassate (much less so than any other species of *Caryobruchus*), maximum width slightly closer to apex, constricted toward apex, much more than twice as long as wide (length/width ratio mean 2.60), ventral side with a pecten armed with 8-11 denticles, produced; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles smaller and decreasing in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 10-14 small, usually acute spines; lateral side with small punctures, usually not visible under setae. Metatibia evenly arcuate (angle >90°), dorsal side granulate; three strong ventral carinae, inner carina very strong, wide tibial furrow between inner and middle carinae, middle very carina strong, very close to and fusing with outer carina at mucro, outer carina very strong; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro short; tibial corona smooth, without spines; spur clearly visible in lateral view, sparsely covered with setae. Mesotarsus 1 shorter, but not wider than metatarsus 1. Mesosternal process slanting, projecting to less than 90° angle from body plane, apex usually not curved back towards plane of metasternum; metaspinasternum only feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, feebly convex in lateral view, wider than long (length/width ratio mean 0.76), wider at base than apex, at almost 90° angle to elytron, usually hidden by the elytra and thus not visible in dorsal view.

Genitalia. Median lobe (Fig. 146) slender. Ventral valve long with sides forming a triangle with an angle. Armature of internal sac with two median, Y-shaped sclerites, one arm acute at apex, branch from slightly more than middle of the sclerite at about right angle; four large, basal sclerites, two large, blade-shaped, broad at base, acute at apex, two small, bulbous, denticulated, colorless (the sclerites in Pachymerinae are normally dark brown), with basal end open sclerites. Lateral lobes (Fig. 147) confluent, not separated, without cleft, apex with median notch, line-like sinus extending from notch to 0.7 length of distance apex to Kingsolver's band.

Females.— Similar to males, maximum thoracic depth often slightly larger; pygidium sometimes visible in dorsal view; protarsus 1 not as wide (sexual dimorphism). Armature of bursa copulatrix (Fig. 145) of two types: two ventral, very thin and slender, parallel, sclerites; and one dorsal sclerite, long, rodlike at base, wider at apex, base of sac not swollen and bulblike, small part of base usually bent back towards ovipositor.

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. Mexico: Baja California, (due to insufficient collection labels it could often not be determined if the collection locality was in B. Calif. Norte or B. Calif. Sur.) J.X. de Vesey, *holotype*, (MCZ); El Taste, Beyer (SDNHM) (AMNH) (ANSP); El Taste, 01.VIII, Beyer (USNM); Pozo Largo, Santa Rita drainage, Sierra Victoria, 13.IV.55, ex palm *E. brandegeei*, R.S. Ferris (CAS) (CNC); San Fernando, (SDNHM) (MCZ); Santa Rosa, VIII.(no year), G. Beyer (ANSP); Santa Rosa, VIII.(no year), (COR); Santa Rosa (MCZ); Sierra de La Laguna, ex *Erythea brandegeei* Purpus. Gartenfl., I.1906, J.N. Rose (USNM); Baja California Norte, Catavina, 5.VIII.86, *Erythea armata* S. Wats. on ground, F.C. Baptista (CDJ), Sonora, quarantine Nogales, intercepted 20.IV.1959; quarantine Nogales, ex *Sabal rosei* Becc., (USNM); quarantine from Baja California, Resaca, Los Angeles County, ex *Erythea brandegeei* Purpus. Gartenfl. seeds, 1.XII.1980, (CDFA); quarantine from Mexico, Los Angeles, Los Angeles County, ex *Erythea brandegeei* Purpus. Gartenfl., 271981, (CDFA).

Discussion.—With its long, slender antennal segments and metafemur much longer than wide, this species is easily distinguished from other species in *Caryobruchus*.

COMPARISONS OF SPECIES IN *CARYOBRUCHUS*

Species of this genus are very similar and characters overlap. The best and safest way to separate them by species is to use the male and female genitalia (Figs. 139 - 156). However, certain external characters are useful. The following are very distinctive and cannot be confused: large pecten in *C. marieae;* the elevated ventral carina in *C. marieae;* the slender, almost non-pectinate antennal segments in *C. veseyi;* the much longer than wide metafemur in *C. veseyi;* and the long, slender 3rd maxillary palp segment in *C. maya*. *C. maya* is the only species in *Caryobruchus* with the distance between the eyes on the dorsal side approximate, all other species have the eyes distant. Except for these species, and these characters, all other identifications should be verified by inspecting the male or female genitalia. *Caryobruchus maya* is hard to separate from *C. gleditsiae* by external characters only. *C. maya* has a long slender 3rd maxillary palm segment and the setae on the elytron are yellowish white, while *C. gleditsiae* has a short wide 3rd maxillary palp segment and the setae on the elytron are white. *C. maya* has a very distinct shape of bursa copulatrix and the sclerites are smaller and more slender than *C. gleditsiae* (Fig. 151). The sclerites of the median lobe are very similar to *C. gleditsiae* but the basal sclerites have distinctly larger denticles. For morphometrical comparisons see Table 2, note the longer pygidium of *C. marieae*, and the longer metafemur of *C. veseyi*.

Genus **SPECIOMERUS** Nilsson, **new genus**

Type species: *Caryoborus giganteus* Chevrolat, 1877. Present designation.

This genus is referable to the family Bruchidae, subfamily Pachymerinae Bridwell and tribe Pachymerini Bridwell, where it is intermediate between *Caryoborus* Schönherr and *Caryobruchus* Bridwell. It can be distinguished from these genera by the following characters.

Elongated beetles. Integument varying from light brown to almost black, with reddish and yellowish tint in some species, setae sparse with uniform whitish color, sometimes appear almost non-hirsute. Head short, constricted behind eye; vertex with sharp or diffuse median carina, sometimes partly covered by setae; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus almost nonexistent; submentum tapering, posterior part narrow to very narrow, sides parallel, not converging between eye and gena. Antennal segments 4-10 serrate. Pronotum subrectangular, transverse, base and apex about the same width; disk with surrounding impressed marginal line; lateral carina complete, extending from base to apex. Prosternum with long process, completely separating procoxae. Mesosternum with long process, cleft at apex. Elytron elongate, approximately three times longer than wide. Scutellum square, truncate apically. Metafemur incrassate, elongate; dorsal side smooth; ventral side pectinate; pecten produced, straight, with denticles, denticle 1 acuminate, larger than the other denticles, located beyond middle of femur; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge with spines, with or without a protuberance. Metatibia arcuate; three strong ventral carinae, middle carina without tubercle and sulcus; lateral and dorsolateral carinae obsolete; mesal and dorsomesal carinae obsolete; mucro at apex, without apical calcaria. Median lobe slender, without median sclerites, with or without large basal sclerites. Lateral lobes confluent, not separated, with small cleft, apex with vague, median notch and a fine line- or fold-like sinus (Figs. 129, 132, 135, 138); without gemmae; Kingsolver's band present.

Speciomerus is best separated from the other three genera in Pachymerini by studying the genitalia. *Pachymerus*, except *P. cardo*, has gemmae, *Caryobruchus* has median sclerites, and *Caryoborus* has lateral lobes partly surrounding the apex on the dorsal and lateral sides of the median lobe. *Speciomerus* lacks these structures. With external characters *Pachymerus* is best separated from the other genera in Pachymerini by the position of the metatibia on the lateral side of the pecten when the leg is flexed (Fig. 23). *Caryoborus*, *Caryobruchus* and *Speciomerus* have the leg on the mesal side of the pecten when flexed (Fig.23). The apical calcaria ventrad to the mucro on the metatibia (Fig. 70) separate *Caryoborus* from *Caryobruchus* and *Speciomerus* which lack these structures. *Speciomerus* is best separated from *Caryobruchus* by the shape of the submentum: in *Speciomerus* the sides of the submentum are parallel or nearly so (Fig. 61); in *Caryobruchus* the sides of the submentum are strongly converging triangularly (Fig. 56). Taxonomically important length/width ratio means are in Table 2.

The following four species of *Speciomerus* are considered valid: *S. giganteus* (Chevrolat), new combination; *S. revoili* (Pic), new combination; *S. rubrofemoralis* (Pic), new combination; and *S. ruficornis* (Germar), new combination.

KEY TO SPECIES OF *SPECIOMERUS*

1 Color of metafemur usually reddish brown to almost orange, distinctly different from dark elytron (epipleuron often same color as metafemur); color of elytron usually black with very fine white very vague setae (hard to see, may appear to be without setae); median lobe without sclerites (Fig. 134); female genitalia with three pairs of sclerites (Fig. 133) .... ***S. rubrofemoralis*** (Pic)

— Color of metafemur variable but more or less same color as the elytra (epipleuron always same color as rest of elytron); color of elytron variable with clearly apparent white setae; median lobe with sclerites (Figs. 128, 131, 137); female genitalia with two pairs of sclerites 2

2 (1) When leg flexed, prepectenal ridge with small or very small spines without protuberance or only feebly so (Figs. 73, 74); frons and vertex with medium median partly glabrous carina, carina continuous not interrupted by weak depression; color of integument usually dark brown or black .... ***S. revoili*** (Pic)

— When leg flexed, prepectenal ridge with large spines with a cristate protuberance positioned on lateral side of metatibia (Figs. 71, 72); frons and vertex with medium median partly glabrous carina, carina interrupted by weak depression (Fig. 96); color of integument usually light brown or yellowish brown 3

3 (2) Color of elytra variable with setae always forming longitudinal stripes (less apparent under the microscope); body elongate, wide; last maxillary palp slightly widened; apodeme of spiculum gastrale in female genitalia of normal length (Fig. 130) .... ***S. ruficornis*** (Germar)

— Color of elytra variable with setae never forming longitudinal stripes; body elongate, narrow; last maxillary palp narrow; apodeme of spiculum gastrale in female genitalia very long (Fig. 127) .... ***S. giganteus*** (Chevrolat)

Speciomerus giganteus (Chevrolat), new combination

Figs. 2, 15, 34, 61, 71, 96, 127 - 129

Caryoborus giganteus Chevrolat 1877:98.
Pachymerus giganteus: Pic 1913:7.
Caryobruchus giganteus Bridwell 1929:155; Udayagiri and Wadhi 1989:239.
Caryoborus donckieri Pic 1899:21. **New synonymy.**
Caryobruchus scheeleae Bridwell 1929:151. **New synonymy.**
Caryobruchus lipasmatus Bridwell 1929:152. **New synonymy.**
Caryobruchus buscki Bridwell 1929:152. **New synonymy.**
Caryobruchus pararius Bridwell 1929:153. **New synonymy.**

Type Data.—Type locality: Bahia, Brazil. Holotype female, Bahia, D. Mocquerys, prise vivante à Rouen, col. Chevrol.; deposited in Naturhistoriska Riksmuseet, Stockholm, (NR). No allotype and no other paratypes. *Caryoborus donckieri*. Jatahy, Prov. Goyas, Bresil, Sept. á Nov. 97; deposited in the Muséum National d'Histoire Naturelle, Paris (MNHP). *Caryobruchus buscki*: Panama, Canal Zone, Tabernilla, A. Busck; deposited in the U.S. National Museum, Washington, D.C. (USNM). *Caryobruchus lipasmatus* Brazil, Pará, reared from Babassu nut, quarantine New York; deposited in USNM. *Caryobruchus pararius*: Brazil, Pará, 19.IV.1919, ex nuts, quarantine Washington, D.C.; deposited in USNM. *Caryobruchus scheeleae*: Colombia, Bolivar, El Banco, ex *Attalea*, unknown quarantine; deposited in USNM.

Distribution .—(Fig. 2). Specimens examined, 132. Bolivia, Brazil (Amazonas, Bahia, Matto Grosso, Pará, Paraíba, Rio de Janeiro, Rondonia, Santa Catarina, São Paulo), Colombia (Bolivar, Meta), Costa Rica, Guayana, Panama, Peru, Venezuela (Barinas, Bolivar).

Diagnosis.— Integument medium to dark reddish-brown, leg 1 and 2 lighter contrasting color (especially in specimens with dark elytra), tibia and tarsus yellowish-brown, antennae yellowish brown, fine yellowish-white pubescence partly cover integument color. Males 12.0-17.1 mm, females 12.2-21.2 mm in length (pronotum-elytra); width of males 5.6-7.0 mm, females 4.8-8.6 mm, maximum thoracic depth of males 4.6-6.4 mm, females 4.6-8.4 mm. Eyes approximate. Antennal segments 4-10 feebly serrate, segments markedly longer than wide, segment 9 about as long as segment 4 but segment 4 usually wider. Disk of pronotum wider than long (length/width ratio mean 0.84). Metafemur more than twice as long as wide (length/width ratio mean 2.13); pecten short with 10-17 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 4-7 large acute or edged spines. Metatibia with inner ventral carina slightly elevated. Pygidium usually as long as wide or longer than long (length/width ratio mean 1.02).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform dark reddish-brown, leg 1 and 2 usually light reddish-brown to almost yellow, tibia and tarsus usually yellowish-brown to almost yellow, antennae yellowish brown to almost yellow.

Vestiture. Setae often lost on part of body, possibly due to rubbing. Dorsal and ventral body surfaces with white or yellowish-white, fine, recumbent, dense, uniform setae; antenna with minute yellowish-white setae; elytron surface sparsely hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; ventral ridge of metafemur with sparse setae not covering pecten; tarsomeres on all legs with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron.

Head. Slightly shorter than pronotum; frons and vertex with week to strong median glabrous carina, carina at vertex interrupted by a week depression (Fig. 96); ocular sinus short but distinct; on dorsal side eyes approximate; postocular lobe very short, with a weak glabrous carina continuing on gena; antenna often only slightly shorter than elytra, segments 4-10 serrate, markedly longer than wide, segment 9 about as long as segment 4, but segment 4 usually wider; gena short; sides of submentum parallel, not converging triangularly between eyes; on ventral side eyes approximate.

Prothorax. Disk wider than long (length/width ratio mean 0.84); all sides with strong, impressed, marginal line, anterior margin straight or feebly emarginate; angles pointed, visible in dorsal view; medially dorsal surface flattened, more flattened posteriorly; sparsely punctate, punctations unevenly distributed as four clusters, often with weak but distinct sulci towards sides; sides depressed, more depressed toward apex, usually strongly angulate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base sharply produced, angle more than or about 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 swollen, shorter and wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process medium width, sometimes wide.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface flattened or feebly convex between humerus and mesal margin, depressed laterally and apically; humerus usually non-scabrous, but some specimens feebly scabrous, scabrosites often covered by setae; striae punctate. Metafemur incrassate, maximum width slightly closer to base, constricted toward apex, more than twice as long as wide (length/width ratio mean 2.13) ventral side with a pecten armed with 10-17 denticles, produced, short, straight; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles smaller and decreasing in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 4-7 large acute or edged spines; lateral side without visible small punctures. Metatibia evenly arcuate (angle >90°); three strong ventral carinae; inner carina very strong and slightly elevated from before middle, wide tibial furrow between inner and middle carinae; middle carina very strong, very close to and fusing with outer carina before mucro; outer carina medium strength, slightly weaker before fusing with middle carinae; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro long; tibial corona smooth, without spines; spur visible in lateral view. Mesotarsus 1, slightly swollen, shorter and wider than metatarsus 1. Mesosternal process with cleft, usually not slanting, produced, projecting to 90° angle from body plane, apex sharply bent back towards plane of metasternum; metaspinasternum feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, feebly convex in lateral view, usually as long as wide or longer than wide (length/width ratio mean 1.02), wider at base than apex, only partly hidden by the elytra, elytra cover 0-40% of pygidium length from base, at much more than 90° angle to elytron, thus visible in dorsal view.

Genitalia. Median lobe (Fig. 128) slender. Ventral valve long with sides forming a triangle with an acute angle. Armature of internal sac without median sclerites; with a transparent, almost colorless, small, median structure, without a cleft but with numerous small denticles; and with two very long, slender, basal sclerites, with small denticles at both apical and basal ends. Lateral lobes (Fig. 129) confluent, not separated; Kingsolver's band present.

Females.— Similar to males, maximum thoracic depth slightly larger. Sexual dimorphism; pro- and mesotarsus 1 slightly wider than metatarsus 1, but not swollen as in males, pygidium almost straight in lateral view. Armature of bursa copulatrix (Fig. 127); one pair of ventral sclerites; one dorsal sclerite. Apodeme of spiculum gastrale longer than normal.

Specific Records.—Only records with host plant associations included. Host records are from collection labels, spelled exactly as written, and should be verified. Brazil: Pará, Carajas, em semente de Babacu, 24.VII.1987, M.V. de Macedo (UFDP); Pará, reared from Babassu nut, quarantine New York, *holotype, Caryobruchus lipasmatus* (USNM); Pará, reared from Babassu nut, quarantine New York, *allotype, Caryobruchus lipasmatus* (USNM); Pará, 19.IV.1919, ex nuts, quarantine Washington, D.C., *holotype, Caryobruchus pararius* (USNM). Colombia: Bolivar, El Banco, ex *Attalea*, unknown quarantine, *holotype, Caryobruchus scheeleae* (USNM); Bolivar, El Banco, ex *Attalea*, 24.VI.1916, unknown quarantine, *paratype, Caryobruchus scheeleae* (USNM). Costa Rica: Puntarenas, 10.2 mi N. Puntarenas, 15.II.1970, reared from *Scheelea liebmannii* Becc. (USNM). Panama: Canal Zone, Barro Colorado Island, ex *Scheelea zonensis* L.H. Bailey (=Corozo Palm), 27.VI.1933, J.D. & H. Hood (USNM); Canal Zone, Barro Colorado Island, seed *Scheelea zonensis* L.H. Bailey , III.1981, J. Wright (JAN); Canal Zone, Barro Colorado Island, Roosevelt Rdg. 197, 2.VI.1983 (USNM); II. no year, ex *Scheelea zonensis* L.H. Bailey , quarantine Washington, D.C. (USNM). Venezuela: Barinas, W. of Brainas, ex seed of *Scheelea rostrata* Burret, late.II.1974, 21.X.1973, D.H. Janzen (USNM); Cascaras, ex *Scheelea macrolepis* Burret, 181948, D.W. Jenkins (USNM); reared from seeds of *Englerophoenix* sp., quarantine New York, 10.VI.1937 (USNM).

Discussion.—This is the largest species of palm bruchid. Bridwell (1929) described four new species of *Caryobruchus*, but they are all conspecific with *C. giganteus*. He studied very few specimens (only one or two of each new species), did not study types, and used color and punctuation on the disk of the pronotum to separate species. These characters are highly variable within this species.

Speciomerus revoili (Pic), **new combination**

Figs. 2, 14, 73, 136, 138

Caryoborus revoili Pic 1902:172.
Pachymerus revoili: Pic 1913:8.
Caryobruchus revoili: Bridwell 1929:155; Udayagiri and Wadhi 1989:240.
Caryobruchus acrocomiae Bridwell 1929:153; Udayagiri and Wadhi 1989:238. **New synonymy.**

Type Data.—Type locality: Paraguay. Holotype female, Revoil; deposited in Muséum National d'Histoire Naturelle, Paris (MNHP). The type is badly insect damaged, a homotype was therefore deposited in MNHP together with the type. No allotype and no other paratypes. *Caryoborus acrocomiae*: Holotype, Uruguay, ex seed *Acrocomia* sp., quarantine Washington , D.C., 9.XII.1921; deposited in the U.S. National Museum, Washington, D.C. (USNM).

Distribution.— (Fig. 2). Specimens examined, 52. Argentina (Salta, Misiones), Bolivia (Santa Cruz), Brazil (Mato Grosso, Mato Grosso del Sul, Rio Grande do Sul), Paraguay (Alto Paraná, Cordillera, Paraguarí, San Pedro), Uruguay, Venezuela (Apure, Guarico, Barinas).

Diagnosis.— Integument dark reddish-brown, to almost black, some specimens more red than others, appendages and antennae with slightly lighter, more yellowish color, hind femur often with a darker area in the center, fine white to yellowish-white pubescence partly covers integument color. Males 10.3-17.2 mm, females 10.7-16.8 mm in length (pronotum-elytra); width of males 5.6-9.4 mm, females 6.0-8.8 mm, maximum thoracic depth of males 3.8-6.8 mm, females 4.1-7.0 mm. Eyes approximate. Antennal segments 4-10 feebly serrate, segments longer than wide, segment 9 usually longer than segment 4. Disk of pronotum wider than long (length/width ratio mean 0.74). Metafemur usually twice as long as wide (length/width ratio mean 2.05); pecten short with 8-13 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 4-9 usually large acute or edged spines. Metatibia with inner ventral carina not elevated. Pygidium wider than long (length/width ratio mean 0.79).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with white setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color*. Body dark reddish-brown, to almost black, some specimens more red than others, appendages and antennae usually with slightly lighter color, hind femur often with darker area in the center.

Vestiture. Setae often lost on parts of the body, possible due to rubbing. Dorsal and ventral body surfaces with white to yellowish-white, fine (very fine on elytra), recumbent, dense, setae; antenna with minute yellowish-white setae; elytron surface densely hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; ventral ridge of metafemur with sparse setae not covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 2 with a few coarse, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron, setae longer and coarser.

Head. Slightly shorter than pronotum; frons and vertex with weak to strong median usually glabrous but sometimes hirsute carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus vague; on dorsal side eyes approximate; postocular lobe short, with a glabrous carina continuing on gena; antenna clearly shorter than elytra, segments 4-10 serrated, longer than wide, segment 9 usually longer than segment 4, both segments about the same width, or segment 4 slightly wider; gena short; sides of submentum parallel, not converging triangularly between eyes; on ventral side eyes approximate.

Prothorax. Disk wider than long (length/width ratio mean 0.74); all sides with strong, impressed, marginal line, anterior margin emarginate; angles vaguely pointed, visible in dorsal view; medial dorsal surface flattened to convex, punctate, small punctations (different from the punctations due to loss of setae) evenly distributed over the disk, large punctae unevenly distributed as four clusters; sides depressed, more depressed toward apex, angulate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter and not very wide or swollen but wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process narrow or medium width.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface flattened, or sometimes feebly convex, between humerus and mesal margin, depressed laterally and apically; humerus non-scabrous, usually without setae; striae punctate. Metafemur incrassate, maximum width slightly closer to base, constricted toward apex, usually more than twice as long as wide (length/width ratio mean 2.05), ventral side with a pecten armed with 8-13 denticles, produced, short, straight; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles smaller and decreasing in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 4-9 usually large acute or edged spines; lateral side with visible small punctures, feebly visible under setae. Metatibia evenly arcuate (angle >90°); three strong ventral carinae, inner carina very strong usually not elevated, wide tibial furrow between inner and middle carinae, middle carina very strong, very close to and fusing with outer carina before mucro, outer carina medium strength, slightly weaker before fusing with middle carinae; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro long; tibial corona smooth, without spines; spur visible in lateral view, sparsely covered with setae. Mesotarsus 1 shorter, not very wide or swollen but wider than metatarsus 1. Mesosternal process often with a cleft at apex, slanting, projecting to much less than 90° angle from body plane, apex gradually or sharply curved back towards plane of metasternum; metaspinasternum not or only feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, wider than long (length/width ratio mean 0.79), wider at base than apex, partly hidden by the elytra, elytra cover 30-60% of pygidium length from base, at almost 90° angle to elytron, usually not visible in dorsal view.

Genitalia. Median lobe (Fig. 137) slender. Ventral valve long with sides forming a triangle with an acute angle. Armature of internal sac without median sclerites; with a transparent, almost colorless, small, median structure, with a cleft and numerous small denticles; and with two very long, slender, basal sclerites, with small denticles at basal end (often hard to see). Lateral lobes (Fig. 138) confluent, not separated, but with large (for the genus) cleft, apex at about the same level as cutis, with vague median notch, vague fold-like sinus extending from notch to 0.5 length of distance apex to Kingsolver's band.

Females.— Similar to males, but maximum thoracic depth slightly larger. Armature of bursa copulatrix (Fig. 136); one pair of ventral sclerites; one dorsal sclerite. Apodeme of spiculum gastrale normal length.

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. Argentina: Salta, C. Bruch (BR); Misiones, San Ignacio, B. & W. Bade (BR). Bolivia: Santa Cruz, Prov. Andréz Ibáñez, Sta. Cruz, Los Olives, 27.II.1989, P. Bettela (FMNH); Santa Cruz, Prov. Andréz Ibáñez, 6km S de SC, 10.XII.1989, 30.XII.1989, Bettela (FMNH); Santa Cruz, Province del Sara, II.1912, XI.1912, Steinbach (CMNH); Santa Cruz, Prov. del Sara, Buena Vista, alt. 1700 ft., II-IV.1925 (ANSP); Ichilo, Buena Vista, alt. 400 m, X.1962 (MSU); Prov. Ichilo, Buena Vista, 61990, P. Bettella (FMNH). Brazil: Mato Grosso, Diamantino, Facienda Sao Joao, alt. 450 m, 6.II.1981, Ekis & Young (CMNH); Mato Grosso del Sul, Corumba, Serra de Urucum, 25.XI.1960, K. Lenko (USNM); Rio Grande do Sul, Chapada (CMNH). Paraguay: Alto Paraná, Primavera, 17.VIII.1955, E.J. Phillips (BMNH); Cordillera, Emboscada, 15.X.1954 (CNC); Paraguarí, Sapucay, 1903, W. Foster (BMNH); San Pedro, Carumbe, 10-10.II.1973, R. Goldbach (FML); Revoil, *holotype* (MHNP); in *Acrocomia totai* Mart., 1951 (USNM). Uruguay: ex seed *Acrocomia* sp., quarantine Washington , D.C., 9.XII.1921, *holotype*, and 1 *paratype* of *Caryobruchus acrocomiae* (USNM). Venezuela: Apure, Madre Viejo, Rio Apure, en barbas de palma, 21.II.1979, J. Pulido (UCV); Guarico, 59 km E. of Santa Maria de Ipire, from seeds of palm, 15.III.1989 (emerged 30.III.1989), C.D. Johnson (CDJ); Barinas, 25 km S. of Barinas, from seed of palm, 19.III.1989, C.D. Johnson (CDJ).

Discussion.—This species needs to be sampled much more extensively to give a better picture of the geographical distribution. The area of distribution is now divided into two widely separated geographical locations. The color of this species is highly variable, probably depending on host plants, time of killing after emerging from palm fruits, and kind of museum storage. Specimens in the type series of *Caryobruchus acrocomiae* are much more red than any of the other specimens studied. The paratype is almost orange, but with a slightly swollen abdomen, a typical characteristic of teneral beetles. Pachymerine and other bruchids are often also much lighter in color just after they have emerged from seeds. Several parts on the paratype are deformed indicating damage before hardening of the integument. The setae on the elytra are very fine on some specimens, giving them an appearance of having no setae.

This species and *Caryobruchus gleditsiae* are the most variable species in size of the Pachymerini. Changes in size do not seem to be accompanied with any important allometric changes (the small individuals look like the large individuals). Some specimens appear slightly wider, and dorso-ventrally more flattened, but intermediates exist. This is partly an illusion depending on how the elytra are positioned (resting position), and depending on if the pronotum disk is flat or convex. This variation is usually accompanied with a slightly wider pronotal disk. However, the width and shape of the disk is highly variable in all species of Pachymerini.

Speciomerus rubrofemoralis (Pic), new combination

Figs. 2, 74, 133 - 135

Caryoborus rubrofemoralis Pic 1899:21.
Pachymerus rubrofemoratus: Pic 1913:8.
Caryobruchus rubrofemoralis: Prevett 1966b:181; Udayagiri and Wadhi 1989:240.

Type Data.—Type locality: Jatahy, Prov. Goyas, Brasil. Holotype, Goias, Jatahy, IX-XI.1897; deposited in Muséum National d'Histoire Naturelle, Paris (MNHP). No paratypes.

Distribution .—(Fig. 2).—Specimens examined, 8. Brazil (Mato Grosso, Goias).

Diagnosis.— Elytra and pronotum very dark reddish-brown to black in some specimens, antennae black, coxa, trochanter and femur on all legs, light reddish brown, metafemur almost orange in some specimens, with center often darker, appear almost non-pubescence with very fine, minute, irregular, white setae. Males 9.8-10.8 mm, females 9.7-11.9 mm in length (pronotum-elytra); width of males 5.6-5.8 mm, females 5.5-5.8 mm, maximum thoracic depth of males 3.7-4.0 mm, females 3.8-4.3 mm. Distance between eyes intermediate. Antennal segments 4-10 feebly serrate, segments longer than wide, segment 9 longer than segment 4, but segment 4 wider. Disk of pronotum wider than long (length/width ratio mean 0.80). Metafemur more than twice as long as wide (length/width ratio mean 2.05); pecten short with 8-10 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 5-7 very small, acute or obtuse spines. Metatibia with inner ventral carina not elevated. Pygidium slightly wider than long (length/width ratio mean 0.96).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Elytra and pronotum, vertex and antennae dark reddish-brown to black, head except vertex dark reddish-brown, coxa, trochanter and femur on all legs light reddish brown, metafemur almost orange in some specimens, epipleuron often light reddish-brown.

Vestiture. Appearance almost non-hirsute, setae minute on dorsal side, on ventral side slightly larger and coarser. Dorsal and ventral body surfaces with white, very short, minute (slightly larger and coarser on ventral side), recumbent, sparse, irregular setae; antenna with minute white setae; elytron surface moderately hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; ventral ridge of metafemur with sparse setae not covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium as hirsute as elytron, setae same length.

Head. About as long as pronotum; frons and vertex with medium median partly glabrous carina, carina at vertex interrupted by a weak depression (Fig. 96); ocular sinus vague; distance between eyes on dorsal side intermediate; postocular lobe very short, with a glabrous carina continuing on gena; antenna slightly shorter than elytra, segments 4-10 serrate, longer than wide, segment 4 slightly wider than segment 9; gena short; sides of submentum parallel, not converging triangularly between eyes; on ventral side eyes approximate.

Prothorax. Disk wider than long (length/width ratio mean 0.80); all sides with strong, impressed, marginal line, anterior margin feebly emarginate or straight; angles rounded, usually visible in dorsal view; medial dorsal surface usually feebly convex; sparsely punctate, large, but mostly weak punctations, unevenly distributed more or less as four clusters; sides depressed, more depressed toward apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter, swollen, wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process narrow.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface convex between humerus and mesal margin, depressed laterally and apically; humerus non-scabrous; striae punctate. Metafemur incrassate, maximum width closer to base, constricted toward apex, usually twice as long as wide (length/width ratio mean 2.05), ventral side with a pecten armed with 8-10 denticles, produced, short, straight; denticle 1 slightly larger, acuminate, closer to femoral apex than to base; following denticles smaller and decreasing in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge much longer than pecten, with 5-7 very small acute or obtuse spines; lateral side with small punctures, clearly visible as femur is almost non-hirsute. Metatibia evenly arcuate (angle >90°); three strong ventral carinae, inner carina very strong, narrow furrow between inner and middle carinae, middle carina very strong, fusing with outer carina at mucro, outer carina very strong; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro short; tibial corona smooth, without spines; spur clearly visible in lateral view, sparsely covered with setae. Mesotarsus 1 shorter, swollen in appearance, wider than metatarsus 1. Mesosternal process slanting, projecting to much less than 90° angle from body plane, not curved back towards plane of metasternum, or apex only slightly so; metaspinasternum not produced or only feebly so.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, sometimes hard to see under setae, convex in lateral view, only slightly wider than long (length/width ratio mean 0.96), wider at base than apex, partly hidden by the elytra, elytra cover 40-60% of pygidium length from base, at less than 90° angle to elytron, usually visible in dorsal view.

Genitalia. Median lobe (Fig. 134) slender. Ventral valve long with sides forming a triangle with an acute angle. Armature of internal sac without sclerites; with a transparent, almost colorless, small, median structure, without a cleft and without denticles. Lateral lobes (Fig. 135) confluent, not separated, with small cleft, strong protruding fold, apex often above cutis, with weak median notch, vague fold-like sinus extending from notch to 0.5 length of distance apex to Kingsolver's band.

Females.— Similar to males, but maximum thoracic depth slightly larger. Armature of bursa copulatrix (Fig. 133); two pairs of ventral sclerites; one dorsal sclerite. Apodeme of spiculum gastrale normal length.

Specific Records.—Host plants unknown. Brazil: Mato Grosso, Chapada dos Guimaraes, XI.1963, M. Alvarenga (USNM); Mato Grosso, Rondonopolis, XI.1963, M. Alvarenga (USNM); Cent. Brazil, Chapada, alt. 2600 ft., XI.1902, A.Robert (BMNH); Chapada, Chapada Campo, X, (CMNH); Chapada, X, (CMNH); Chapada, XI-XII, (USNM); Goias, Jatahy, *holotype*, IX-XI.1897 (MHNP).

Discussion.—This species needs to be collected extensively. Only eight specimens have been studied, and the host plants are unknown. The collection labels are somewhat unclear. The holotype location on the specimen label is possibly in French (by Pic?), and the few specimens collected more recently are from "Chapada". With the exception of one specimen, they are without state information. It is assumed that Chapada is the same as Chapada dos Guimaraes, Mato Grosso.

Speciomerus ruficornis (Germar), new combination

Figs. 2, 72, 130 - 132

Bruchus ruficornis Germar 1818:5.
Caryobruchus ruficornis: Bridwell 1929:154; Udayagiri and Wadhi 1989:240.
Bruchus curvipes: Germar 1818:463 (nec Latreille 1811).
Pachymerus curvipes: Pic 1913:7 (nec Latreille 1811).
Caryobruchus pergandei Bridwell 1929:151. **New synonymy.**

Type Data.—Type locality: "Westindißchen Inßeln" from the original description. This species is probably endemic to Brazil, but could have been shipped to one of the islands in the West Indies. Holotype; depository unknown, but the original description, in German, is very good and such that there is no question about the identity of this species. No paratypes. *Caryobruchus pergandei*: deposited in the U.S. National Museum of Natural History, Washington, D.C. (USNM)

Distribution .—(Fig. 2).—Specimens examined, 8. Brazil (Amazonas, Pará, Mato Grosso).

Diagnosis.— Integument light or dark reddish-brown to dark brown, antennae and tarsus often distinctly different color than the rest of the body, usually strongly reddish or yellowish brown, medium texture, yellowish-white, in some specimens slightly golden, pubescence almost completely cover integument color. Males 18.3-19.5 mm, females 15.0-18.8 mm in length (pronotum-elytra); width of males 8.4-10.2 mm, females 8.0-9.0 mm, maximum thoracic depth of males 7.3-7.7 mm, females 7.5-7.9 mm. Eyes approximate. Antennal segments 4-10 feebly serrate, segments longer than wide, segment 4 wider than segment 9, segment 9-10 much longer than wide. Disk of pronotum wider than long (length/width ratio mean 0.81). Metafemur more than twice as long as wide (length/width ratio mean 2.08); pecten short with 11-14 denticles, denticle 1 acuminate and longer; prepectenal ridge longer than pecten, with 3-6 usually large acute or edged spines. Metatibia with inner ventral carina slightly elevated, outer ventral carina tapering from about 70% distance from base, not reaching mucro. Pygidium slightly wider than long (length/width ratio mean 0.92).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with white setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform light or dark reddish brown to dark brown.

Vestiture. Setae often lost on parts of the body, possibly due to rubbing. Dorsal and ventral body surfaces with white, medium to fine texture, short, recumbent, dense, regular, setae; antenna with minute yellowish-white to golden setae; elytron surface densely hirsute, area between the stria with pubescence of alternating fine and medium textured setae giving an effect of alternating color, making the elytron appear striped; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae except a few golden setae inside apex of mucro; ventral ridge of metafemur with sparse setae not covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 2 with a few, very dense, coarse, golden setae, ventral side of tarsomere 3 with many very dense, coarse, golden setae; pygidium not as densely hirsute as elytron, setae longer.

Head. Shorter than pronotum; frons and vertex with median hirsute or slightly glabrous carina, carina at vertex interrupted by a weak depression (Fig. 96); ocular sinus vague; on dorsal side eyes approximate; postocular lobe short, with a glabrous carina, continuing on gena; antenna sometimes almost as long as elytron, segments 4-10 serrate, longer than wide, segment 4 wider than segment 9, segments 9-10 much longer than wide; gena short; sides of submentum parallel, not converging triangularly between eyes; on ventral side eyes approximate.

Prothorax. Disk wider than long (length/width ratio mean 0.81); all sides with strong, impressed, marginal line, anterior margin usually feebly emarginate; angles vaguely pointed, visible in dorsal view; medial dorsal surface flattened; sparsely punctate, large punctations unevenly distributed as four clusters, middle clusters located in a shallow sulcus; sides depressed, more depressed toward apex, angulate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base feebly produced to rounded, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter and often swollen in appearances much wider than metatarsus 1 (sexual dimorphism: not wider in females). Prosternum completely separating procoxae, apex of prosternal process medium width.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface flattened or slightly convex, between humerus and mesal margin, depressed laterally and apically; humerus non-scabrous; striae punctate. Metafemur incrassate, maximum width closer to base, constricted toward apex, more than twice as long as wide (length/width ratio 2.08), ventral side with a pecten armed with 11-14 denticles, produced, short, straight; denticle 1 large, acuminate, closer to femoral apex than to base; following denticles smaller and decreasing in size; when leg flexed, tibia positioned on lateral side of pecten; prepectenal ridge longer than pecten, with 3-6 large acute or edged spines, usually with a protuberance positioned on lateral side of metatibia when leg flexed; lateral side with small punctures, usually feebly visible under setae. Metatibia evenly arcuate (angle >90°); three strong ventral carinae, inner carina very strong, narrow tibial furrow between inner and middle carinae, middle carina very strong, not so strong at mucro, fusing with outer carina before mucro, outer carina very strong at base tapering from about 70% distance from base not reaching mucro; lateral, dorsolateral, mesal, and dorsomesal carinae obsolete; mucro long; tibial corona smooth, without spines; spur clearly visible in lateral view, but usually partly covered with setae. Mesotarsus 1 slightly shorter and often swollen in appearance, much wider than metatarsus 1. Apex of mesosternal process with cleft, not slanting, projecting to approximately 90° angle from body plane, at apex gradually or sharply curved back towards plane of metasternum; metaspinasternum feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, slightly wider than long (length/width ratio mean 0.92), wider at base than apex, partly hidden by the elytra, elytra cover 50-70% of pygidium length from base, at almost 90° angle to elytron, but usually visible in dorsal view.

Genitalia. Median lobe (Fig. 131) slender. Ventral valve long with sides forming a triangle with an acute angle. Armature of internal sac without median sclerites; with a transparent, almost colorless, median structure, with a cleft and numerous small denticles; and with two very long, slender, basal sclerites, with small denticles at basal end. Lateral lobes (Fig. 132) confluent, not separated, with large (for the genus) cleft, strong produced fold, apex below cutis, without visible median notch, vague fold-like sinus extending to 0.7 length of distance apex to Kingsolver's band.

Females.— Similar to males, but maximum thoracic depth slightly larger. Armature of bursa copulatrix (Fig. 130); one pair of ventral sclerites; one dorsal sclerite. Apodeme of spiculum gastrale normal length.

Specific Records.—Host plants unknown. The type of *Caryobruchus pergandei* is believed to have emerged from a fruit of an *Astrocaryum* palm from Brazil (Bridwell 1929). Intercepted in Europe from palm fruits of *Bactris* sp, "wahrßcheinlich (probably) *Bactris minor*" (Germar 1818a). Bridwell (1929) stated that this host plant identification probably was wrong. Due to confusion of this species with *B. curvipes* (Germar 1818b) this host record is uncertain. Brazil: Amazonas, Rio Tapajos, Caxiricatuba, 37, A.M. Olalla, (USNM); Pará, (BMNH); Pará, Logan (KZ); Mato Grosso, Chapada, Oct.(USNM); Mato Grosso, Chapada, Dec., (USNM); Vera., 55° 36' W., 12° 46' S., X.1973, M. Alvarenga (CDJ); (no data), *holotype Caryobruchus pergandei,* (USNM).

Discussion.—This species needs to be collected extensively. Only eight specimens have been studied . The collection labels are unclear, without information on states. It is assumed here that Chapada is the same as Chapada dos Guimaraes, Mato Grosso.

COMPARISONS OF SPECIES IN *SPECIOMERUS*

This genus is the most diverse in the tribe Pachymerini. *Speciomerus giganteus* and *S. rubrofemoralis* are slender beetles, and the latter can at first glance be confused with a *Caryoborus* sp. The reddish brown to almost orange color on metafemur on *S. rubrofemoralis* is very distinctive and cannot be confused. Note the absence of sclerites in the median lobe in *S. rubrofemoralis*. *Speciomerus ruficornis* and *S. revoili* are wider beetles, and a small specimen of the latter can be confused with a large *Caryobruchus* sp. The longitudinal stripes on the elytra formed by setae on *S. ruficornis* are very distinctive and cannot be confused. For morphometrical comparisons see Table 2, note the wider pygidium of *S. revoili.*

Genus **PACHYMERUS** Thunberg

Pachymerus Thunberg 1805:281.
Pachymeroides Prevett 1966b:81 (not *Pachymeroides* Signoret 1880)
Butiobruchus Prevett 1966b:183. **New synonymy.**

Type species: *Dermestes bactris* Linné 1763. Designation by monotypy.

Elongated beetles. Integument usually dark brown, setae sparse or dense with uniform whitish, yellow or golden color. Head short, constricted behind eye; vertex with sharp or diffuse median carina, sometimes partly covered by setae; eye large, bulging, extending to both dorsal and ventral sides of head; ocular sinus vague; submentum tapering, posterior part wide, subtriangular or sides parallel. Antennal segments 5-10 serrate. Pronotum subrectangular, transverse, base and apex about the same width; disk usually with surrounding impressed marginal line, line sometimes weak or obsolete along anterior margin; lateral carina complete, extending from base to apex. Prosternum with long process (Figs. 46, 47), completely separating procoxae. Mesosternum with long process (Figs. 41, 42), not cleft. Elytron elongate, approximately three times longer than wide. Scutellum square, truncate apically. Metafemur incrassate, oval or feebly elongate (very elongate in male *P. bactris*); dorsal side nongranulate; ventral side pectinate; pecten vaguely produced, long, with denticles, denticle 1 usually acuminate (except *P. bridwelli* where denticle 1 usually is smaller than other denticles), usually slightly larger than other denticles, located before middle of femur; one or two apical tubercles (Figs. 82-88) (sometimes three tubercles in *P. cardo*); when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge very short, without spines, or protuberance. Metatibia arcuate; two strong ventral carinae (outer ventral carina obsolete or weak, very short), middle carina with tubercle and sulcus; with lateral and dorsolateral carinae; with mesal and dorsomesal carinae; mucro at apex, without apical calcaria. Median lobe slender, with basal hood usually broad, without median and basal sclerites. Lateral lobes confluent, not separated, without cleft, apex with vague median notch and a fine line- or fold-like sinus (Figs. 160, 164, 168, 172, 176, 180, 184); with gemmae (except *P. cardo*); Kingsolver's band absent.

The following seven species of *Pachymerus* are considered valid: *P. abruptestriatus* (Gyllenhal); *P. bactris* (Linné); *P. bridwelli* (Prevett), new combination; *P. cardo* (Fåhraeus); *P. nucleorum* (Fabricius); *P. sveni* Nilsson, new species; and *P. thoracicus* Prevett.

KEY TO SPECIES OF *PACHYMERUS*

1 Male genitalia without gemmae (Fig. 157) . . . . **P. cardo** (Fåhraeus) (in part)
— Male genitalia with gemmae (Fig. 161), or females of all species 2
2 (1) Metafemur without a large acuminate first pectenal denticle (Fig. 81); metatibia without tibial sulcus (Figs. 24D, 81); sides of submentum between eyes almost parallel . . . . **P. bridwelli** (Prevett)
— Metafemur with a large acuminate first pectenal denticle (Figs 82-88); metatibia with tibial sulcus (Figs. 24B, 24C); sides of submentum strongly converging triangularly between eyes 3
3 (2) Metafemur with a distinct sinuated carina at basal end (Figs. 25, 27, 84, 88) 4
— Metafemur without a sinuated carina at basal end (Fig. 26) 5
4 (3) Metafemur elongate (males only) (Fig. 25); one apical denticle on metafemur (Figs. 25, 26, 84) . . . . **P. bactris** (Linné) (in part)
— Metafemur oval (both males and females) (Fig.27, 88); 2 apical tubercles on metafemur (Figs. 27, 88) . . . . **P. sveni** Nilsson (in part)
5 (3) Three apical tubercles on metafemur . . . . **P. cardo** (Fåhraeus) (in part)
— One or two apical tubercles on metafemur (Figs. 82 - 88) 6
6 (5) One apical denticle on metafemur (Figs. 82, 84, 87) 7
— Two apical tubercles on metafemur (Figs. 83, 85, 86, 88) 9
7 (6) Eyes approximate (close together) (Fig. 55); pubescence strongly golden, marginal and sutural interval of elytra often with more condensed pubescence appearing paler; hind femur in males elongate (Fig. 84) with sinuated carina, in females incrassate, without sinuated carina (Fig. 82); 3rd maxillary palp segment long and slender (Fig. 55, 60); mesal carina on metatibia extending from apex to only 60% of tibial length . . . . **P. bactris** (Linné) (in part)
— Eyes distant (far apart) (Fig. 53) or distance between eyes intermediate; pubescence whitish grey or yellow sometimes light golden; marginal and sutural intervals of elytra with uniform pubescence not as above; hind femur in both males and females incrassate, without sinuated carina (Fig. 87, 88); 3rd segment of maxillary palp short and wide (Fig. 53); mesal carina on metatibia extending 100% of tibial length 8
8 (7) Eyes distant (far apart) (Fig. 53); pubescence whitish grey; pecten with a shallow sulcus between last denticle and the other pectenal denticles (Fig. 87B) or a very large fused denticle (Fig. 87A) . . . . **P. nucleorum** (Fabricius)
— Distance between eyes intermediate; pubescence yellow sometimes light golden; pecten not as above . . . . **P. cardo** (Fåhraeus) (in part)
9 (6). Eyes distant (far apart) (fig. 53); pronotum disk distinctly wider than long (length/width ratio mean 0.66) . . . . **P. thoracicus** Prevett
— Eyes approximate (close together) (Fig. 55) or distance between eyes intermediate; pronotum disk wider than long but not as much as above (length/width ratio mean 0.69-0.71) 10
10 (9). Apex of prosternal process blunt, wide (Fig. 47); setae pale yellow, coarse . . . . **P. abruptestriatus** (Gyllenhal)
— Apex of prosternal process blunt, intermediate width; setae yellow or greyish-white, not coarse 11
11 (10). Metafemur with a sinuated carina at basal end (both males and females) (Fig. 88); setae usually greyish-white . . . . **P. sveni** Nilsson (in part)
— Metafemur without a sinuated carina at basal end; setae yellow . . . . **P. cardo** (Fåhraeus) (in part)

Pachymerus abruptestriatus (Gyllenhal)

Figs. 3, 85, 165 - 168

Bruchus abruptestriatus Gyllenhal *in* Schönherr 1839:128.
Pachymerus abruptestriatus: Pic 1913:6; Prevett 1966B:187; Udayagiri and Wadhi 1989:242; Kingsolver and Silva 1991:413.
Caryoborus sparsepunctatus Pic 1902:172; Kingsolver and Silva 1991:413.
Pachymerus diospiros Bondar 1941:387; Prevett 1966B:187; Kingsolver and Silva 1991:413.

Type Data.—Type locality: Brazil. Holotype, Brazil; deposited in Naturhistoriska Riksmuseet, Stockholm (NR). No paratypes. *Caryoborus sparsepunctatus*: Lectotype, Gounelle [?], Brazil [from original description], col. Pic, lectotype *sparsepunctatus* det. Kingsolver 1970; deposited in Muséum National d'Histoire Naturelle, Paris (MNHP). *Pachymerus diospirosi*: Many syntypes (usually with a co-type label) are deposited in the many different collections.

Distribution .—(Fig. 3). Specimens examined, 20. Brazil (Bahia, Minas Gerais).

Diagnosis.— Integument red brown to dark brown, coarse pale yellow pubescence often densely covering integument color.. Males 7.6-10.0 mm, females 7.1-10.5 mm in length (pronotum-elytra); width of males 2.0-5.0 mm, females 1.7-5.4 mm, maximum thoracic depth of males 2.3-3.7 mm, females 2.4-4.1 mm. Antennal segment 4 not serrate, segment 5-10 serrate, about as wide as long. Distance between eyes intermediate. Disk of pronotum wider than long (length/width ratio mean 0.69). Metafemur slightly less than twice as long as wide (length/width ratio mean 1.86); pecten, curved, with 11-16 denticles, denticle 1 acuminate and longer, two apical tubercles, the last usually the largest, the first sometimes larger and partly fused with preceding denticle or with the second small apical denticle; prepectenal ridge shorter than pecten, without spines. Metatibia with two strong ventral carinae, middle ventral carina uniform (not crooked), with a tubercle, outer ventral carina obsolete. Pygidium slightly wider than long (length/width ratio mean 0.74).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, part of ventral side of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body usually red brown, head usually dark brown, appendages red brown to yellowish brown.

Vestiture. Setae often lost on parts of the body, possibly due to rubbing. Dorsal and ventral body surfaces with pale yellow, very coarse texture, long, recumbent, dense, uniform setae; antenna with minute yellowish-white, uniform setae; part of ventral side of gena with sparse, fine, yellow setae; elytron surface densely hirsute, protibia and mesotibia with coarse, long, golden, moderately dense to dense setae apically; metatibia lacking golden setae, except a few golden setae inside apex of mucro; ventral ridge of metafemur with pale yellow setae covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium densely hirsute, setae longer than on elytron.

Head. Shorter than pronotum; frons and vertex with a usually prominent median, hirsute, partly glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus short; distance between eyes on dorsal side intermediate; postocular lobe short but distinct. Antenna shorter than elytra, antennal segment 4 not serrate, segments 5-10 serrate about as wide as long. Gena long; sides of submentum strongly converging triangularly between the eyes, distance between eyes on ventral side intermediate.

Prothorax. Disk wider than long (length/width ratio mean 0.69); sides and base with strong, impressed, marginal line; anterior margin feebly emarginate, marginal line tapering toward middle, medially line weak or absent (covered by setae); angles vaguely pointed, usually visible in dorsal view; medial dorsal surface flattened, more flattened posteriorly; densely punctate (punctations often hard to see covered by setae); sides depressed, sharply depressed towards apex, usually feebly angulate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle 90° or less; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter, but only slightly wider than metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process medium to wide.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface feebly convex between humerus and mesal margin, depressed laterally and apically; humerus scabrous, sometimes partly covered with setae; striae punctate. Metafemur incrassate, maximum width closer to base, constricted towards apex, slightly less than twice as long as wide (length/width ratio mean 1.86); ventral side with a pecten, covered with long, coarse, pale yellow setae especially on lateral side, armed with 11-16 denticles; denticle 1 long, acuminate, closer to femoral base than to apex; following denticles smaller in size, covered by setae, the last denticle larger than preceding, feebly tuberculate; two apical tubercles; 2-3 denticles before apical tubercles in a weak sulcus; when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge much shorter than pecten, covered with setae, without spines; lateral side with small punctures, clearly visible in some specimens as darker spots in between setae. Metatibia evenly arcuate (angle >90°), two very strong ventral carinae, inner carina strong fusing with middle carinae at apex of mucro, middle carina strong, uniform (not crooked), with a tubercle near base, and a short sulcus distal to tubercle, furrow between carinae, outer carina obsolete; lateral carina strong extending 100% of tibia, distance to dorsolateral carina measured at the base of mucro, about the same as if measured from 3/4 length of tibia (75% of distance from base of tibia); dorsolateral carinae medium strength at apex tapering slowly towards base only extending 85% of tibia; mesal carina strong extending 100% of tibia, dorsomesal carinae strong at apex tapering slowly towards base only extending 70% of tibia; all except ventral carinae partly covered by setae (but both lateral and mesal carinae usually clearly visible); mucro long; tibial corona smooth, without spines; spur small barely visible in lateral view, partly covered with setae; mesotarsus 1 shorter, but only slightly wider than metatarsus 1. Mesosternal process produced, projecting to 90° angle from body plane, apex not slanting, not curved back towards plane of metasternum; spinasternum posterior to the process strongly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, slightly wider than long (length/width ratio mean 0.74), wider at base than apex, partly hidden by the elytra, elytra cover 20-50% of pygidium length from base, but at more than 90° angle to elytra and usually slightly visible in dorsal view.

Genitalia. Median lobe (Fig. 167). Ventral valve long with sides forming a triangle with an acute angle. Internal sac without armature. Lateral lobes (Fig. 168) confluent, not separated, with gemmae, without cleft, apex with vague median notch and line-like sinus. Kingsolver's band absent.

Females.— Similar to males, but maximum thoracic depth slightly larger. Bursa copulatrix without armature (Fig. 166).

Specific Records.—This is the only species of Pachymerini, "the palm bruchids", that has been reported from a non-palm. The host record is from collection labels and should be verified. Brazil: Bahia, G. Bondar (AMNH); Bahia, Agua Preta, ex seeds of *Diospyros* sp., P. Silva (USNM); Minas Gerais, 1100m, 15.XI.83 (JAN); *holotype*, (NR); Gounelle, *holotype Caryoborus sparsepunctatus* (MNHN).

Pachymerus bactris (Linné)

Figs. 6, 24 - 26, 46, 55, 82, 84, 105 - 107, 173 - 176

Dermestes bactris Linné *in* Jacquin 1763:170; Johansson and Linné 1763:9; Johansson and Linné *in* Schreibers 1841:53.

Bruchus bactris: Linné 1767:605; Fabricius 1792:369; Fåhraeus *in* Schönherr 1839:126.

Dermestes bactridis (sic) Johansson and Linné 1789:392.

Pachymerus bactris: Thunberg 1805:282; Pic 1913:7; Prevett 1966b:182 (neotype designated); Udayagiri and Wadhi 1989:243.

Caryoborus luteomarginatus Chevrolat 1877:106; Prevett 1966:182.

Caryoborus recticollis Chevrolat 1877:115. **New Synonymy.**

Type Data.—Type locality: Carthagenœ [Colombia?; from original description of host palm], collector probably N.J. Jacquin. Holotype, cannot be found, and no paratypes exist. The insect in the collection of Linné in London is not the type (Prevett 1966). The author name for this species has traditionally been Linné (or modifications such as Linnaeus, Linn. or L.). This species is also stated as being originally described by Johansson in 1763, but because of tradition, credit is given to Linné. This is incorrect since the species was first described by Linné alone (*in* Jacquin 1763) in a footnote with *Bactris minor* Jacquin, 1763 (Arecales), collected in Carthagenae. The original type had according to the Johansson's (1763) redescription the label "Americes", no such label exists on the present 'type' in the Linnaean Collection; (slide photo courtesy S.L. Shute, The Natural History Museum, London). Neotype, Venezuela, Aragua, Maracae, collected from seeds of *Bactris* sp., circa 1934, F. Zacher, neotype by Prevett 1966; deposited in The Natural History Museum, London (BMNH). The "type" in the collection of Linné should no longer be considered the type (despite the label in the Linnaean Collection). *Caryoborus luteomarginatus*: deposited in Naturhistoriska Riksmuseet, Stockholm (NR). *Caryoborus recticollis*: The collection of Chevrolat is housed at the Naturhistoriska Riksmuseet in Stockholm (NR), but the type of *Caryoborus recticollis* is missing. The original description by Chevrolat, and the collection locality fits that of *Pachymerus bactris*. *Caryoborus recticollis* is synonymized with *Dermestes bactris*. A neotype of *C. recticollis* may eventually be needed to stabilize the taxonomy. Because all types are in the general collection at the Stockholm museum, the entire collection must be studied in order to discover a possible neotype, or a misplaced holotype.

Prevett 1966 incorrectly designated the neotype as *Bruchus bactris*. The correct neotype name should be *Dermestes bactris*.

Distribution .—(Fig. 6). Specimens examined, 57. Brazil (Amazonas), Colombia, Ecuador, French Guiana, Guyana, Panama, and Venezuela (Aragua).

Diagnosis.— Dark brown, golden pubescent almost totally covering integument color, setae very dense, coarse, contrasting with surrounding strial intervals along mesal margin of elytron , often appearing as a light colored band.. Males 7.4-11.8 mm, females 8.0-9.0 mm in length (pronotum-elytra); width of males 4.4-6.2 mm, females 4.8-5.7 mm, maximum thoracic depth of males 3.8-5.2 mm, females 4.5-5.0 mm. Antennal segments 4 not serrate, segment 5-10 serrate, longer than wide. Eyes approximate. Disk of pronotum wider than long (length/width ratio mean 0.70). Metafemur almost twice as long as wide in the male (length width ratio mean, male 1.97, female 1.66); pecten with sexual dimorphism, in males not produced, straight, in females vaguely produced, curved, with 14-17 denticles, denticle 1 acuminate and longer (in the males usually all denticles small, except denticle 1 and the last denticle, and sometimes hard to see), 1 apical tubercle; prepectenal ridge shorter than pecten, without spines. Metatibia with two strong ventral carinae, middle ventral carina not uniform (crooked), outer ventral carina obsolete. Pygidium as wide as long (length/width ratio mean 1.00).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa trochanter, and part of mesal side of metafemur glabrous. *Color*. Body and appendages uniform dark brown.

Vestiture. Setae often lost on parts of the body, possibly due to rubbing. Dorsal and ventral body surfaces with golden, medium texture, short, recumbent, moderately dense to sparse, uniform setae; antenna with minute yellowish-white uniform setae and longer sparsely irregular setae; elytron surface densely hirsute, along mesal margin of elytron setae very dense, coarse, contrasting with surrounding strial intervals, often appearing as a light colored band, protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae, except a few golden setae inside apex of mucro; ventral ridge of metafemur with long golden setae covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron.

Head. About as long as pronotum; frons and vertex with median glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus short; on dorsal side eyes approximate; postocular lobe short but distinct. Antenna shorter than elytra, antennal segment 4 not serrate, segments 5-10 serrate longer than wide. Gena long; sides of submentum converging triangularly between the eyes, distance between eyes on ventral side intermediate.

Prothorax. Disk wider than long (length/width ratio mean 0.70); sides and base with strong, impressed, marginal line; anterior margin straight, marginal line tapering toward middle, medially line weak or absent (covered by setae); angles vaguely pointed, usually visible in dorsal view; medial dorsal surface flattened, more flattened posteriorly, often with weak but clear sulci towards sides, moderately to densely punctate (punctations hard to see covered by setae); sides depressed, sharply depressed toward apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle about 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter and wider than metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process medium to wide.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface feebly convex between humerus and mesal margin, depressed laterally and apically; humerus weakly scabrous (covered by setae); striae punctate. Metafemur only feebly incrassate, elongate, almost twice as long as wide (length/width ratio mean 1.97), sharply expanded from base, with a sinuated carina near base (males only), interrupted with an abrupt bend, produced or strongly produced, margin after bend first emarginate, then arcuate, maximum width closer to base, constricted towards apex; ventral side with a very long, non-produced pecten, covered with long golden setae on both lateral and mesal side, armed with 14-17 denticles; denticle 1 long, acuminate, closer to femoral base than to apex; following denticles usually much smaller in size, mostly covered by setae, the last denticle usually larger than preceding, feebly tuberculate; one apical tubercle, 2-3 denticles before apical denticle in a weak sulcus; when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge much shorter than pecten, covered by golden setae, without spines; lateral side with small punctures, usually not visible under setae. Metatibia not evenly arcuate, distinct basal bend (angle 90°), two very strong ventral carinae, inner carina strong fusing with middle carinae at apex of mucro, middle carina strong, not uniform (crooked), with a tubercle near base, and a short sulcus distal to tubercle, furrow between carinae, outer carina obsolete; lateral carina strong extending 100% of tibia, closer to dorsolateral carina at 3/4 length of tibia from base; dorsolateral carinae medium strength at apex tapering towards base only extending 75% of tibia; mesal carina strong at apex tapering towards base only extending 60% of tibia, dorsomesal carinae strong at apex tapering towards base only extending 85% of tibia; all except ventral carinae partly covered by setae; mucro medium size; tibial corona smooth, without spines; spur clearly visible in lateral view, covered with setae; mesotarsus 1 shorter and wider than metatarsus 1. Mesosternal process vaguely slanting, projecting to almost 90° angle from body plane, apex feebly curved back toward plane of metasternum; spinasternum posterior to the process produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, moderately convex to flat in lateral view, as wide as long (length/width ratio mean 1.00), wider at base than apex, often not hidden by the elytra, elytra cover 0-40% of pygidium length from base, at almost 90° angle to elytra but usually slightly visible in dorsal view.

Genitalia. Median lobe (Fig. 175). Ventral valve long with sides forming a triangle with an acute angle. Internal sac without armature. Lateral lobes (Fig. 176) confluent, not separated, with gemmae, without cleft, apex with vague median notch and line-like sinus. Kingsolver's band absent.

Females.— Similar to males, but maximum thoracic depth slightly larger. Sexual dimorphism of metafemur, incrassate, not as elongate as in males (length/width ratio mean 1.66), without sinuate carina, and no abrupt bend, pecten vaguely produced, not as long, arcuate, denticles before apical tubercles not in a sulcus or only very vague sulcus, setae covering denticles not as dense on mesal side, and prepectenal ridge only weakly emarginate. Bursa copulatrix without armature.

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. It is uncertain if the original specimen is the same as the specimen designated as a neotype (Prevett 1966). Bruchids corresponding to the neotype have been collected from *Astrocaryum;* sp., *Astrocaryum standleyanum* L.H. Bailey (det. N. Smythe, Smithsonian Tropical Research Institute, pers. comm.). The original type was collected from *Bactris minor;* Jacq. (det. N.J. Jacquin, 1763). Brazil: Amazonas, Manaus, X.1944, F. Johnson (CDJ). Colombia: In palm seed, quarantine Miami, 13.VI.1977 (USNM). Ecuador: Cañar, Yanayacu, 17.IX.1982, G.V. Manley (CDJ). French Guiana: Cayenne, Kourou, 3.VI.1986, E.G. Riley & D.A. Rider (LSU). Guyana: Lansberg (UZMC); Piste de St. Elie, ex *Astrocaryum* seeds, 15.VIII.1986, (USNM). Panama: Arrajan, trap catch, I-X.1947, J. Zetek (USNM); Canal Zone, Barro Colorado Island, 3.XII.1930, F.E. Lutz (USNM); Canal Zone, Barro Colorado Island, VI-VIII.1942, J. Zetek (USNM); Canal Zone, Barro Colorado Island, at light, 7-13.IV.1959, (FMNH); Canal Zone, Barro Colorado Island, I-III.1944, (USNM); Canal Zone, Barro Colorado Island, beating dead palm leaves, 8.VII.1961, 3.VIII.1961, 15.VII.1961, J.M. Campbell (FDA & CNC); Canal Zone, Barro Colorado Island, at light, 9.VII.1961, (CNC); Canal Zone, Barro Colorado Island, 13.VII.1963, (CNC); Canal Zone, Barro Colorado Island, 10.V.1982, R.B. & L.S. Kimsey (UCD); Canal Zone, Barro Colorado Island, ex seeds *Astrocaryum standleyanum* L.H. Bailey, fruit collected from trees V.1988, fruit opened V.1989 and live adults not yet emerged was collected, N. Smythe (JAN); Canal Zone, Fort Kobbe, 10.VI.1976, E.G. Riley (RIL); Archipelago de las Perlas, San José Island, at light, 11.VII.1944, Morrison (USNM); Tabogilla, 21.II.1912, A. Busck (USNM). Venezuela: Aragua, Maracae, collected from seeds of *Bactris* sp., circa 1934, F. Zacher, *neotype*, (BMNH); Carret, Moroncoro, Rm 118, III.1979, (UCV); Rio Taguaza, alt. 200m, Edo. Miranda, P.N. Guatopo (BOR).

Discussion.—This species was first described in a 1762 letter to N.J. Jacquin and later published by Jacquin (1763) as a footnote together with the description of *Bactris minor*. Johansson and Linné redescribed the species (1763), and this work was considered the original description for many years (however, only Linné was given credit for the description). Schreibers (1841) published all of Linné's correspondence to N.J. Jacquin, including the 1762 letter with the description. Since the letter was not published until 1841, the 1763 footnote description in Jacquin's publication is used as the original description.

Prevett (1966) designated a neotype of *Bruchus bactris* (the correct name of the type is *Dermestes bactris*) and stated that the "type" at the collection of Linné in London is not the original type but a non-Pachymerinae bruchid. The neotype is deposited in The Natural History Museum,London, (BMNH). The specimen of the species designated as neotype does not appear to use *Bactris minor* Jacq. as a host plant, and might, for this reason, be a different species than described by Linné. But the designation was necessary to stabilize the classification and to separate this species from closely related species of *Pachymerus*.

Chevrolat's original description and the collection locality of *Caryoborus recticollis* fits *Pachymerus bactris*. At the time Chevrolat described this species, all palm bruchids were placed in *Caryoborus*, and the type (*Dermestes bactris*) has been lost since the time of Linné and his students. This might explain why Chevrolat named *C. luteomarginatus* and *C. recticollis*. The type of *C. luteomarginatus* is a specimen with the typical elytral setation found in *P. bactris*, a light colored band along the mesal margin of the elytron. In contrast *C. recticollis* is without this light colored band. Most specimens of *P. bactris* observed have this band, but it is missing in some. Hence, Chevrolat described these two varieties as two different species.

Pachymerus bridwelli (Prevett), **new combination.**

Figs. 12, 81, 181-184

Pachymeroides bridwelli Prevett 1966a:81.
Butiobruchus bridwelli: Prevett 1966b:183.

Type Data.—Type locality: Paraguay. Holotype female, Paraguay, 1938, M.J. Viana; deposited in The Natural History Museum, London (BMNH). Two paratypes, one deposited in The Natural History Museum, London (BMNH), one deposited in Muséum National d'Histoire Naturelle, Paris, (MNHP).

Distribution .—(Fig. 3). Specimens examined, 37. Argentina (Corrientes, Entre Rios, Formosa, Misiones), Paraguay and Uruguay.

Diagnosis.— Red brown to dark brown, white pubescence only partly cover integument color.. Males 7.7-12.3 mm, females 8.6-13.2 mm in length (pronotum-elytra); width of males 4.2-6.4 mm, females 4.2-6.2 mm, maximum thoracic depth of males 2.3-4.3 mm, females 3.3-4.7 mm. Antennal segments 4 not serrate, segment 5-10 serrate, slightly longer than wide. Eyes distant. Disk of pronotum wider than long (length/width ratio mean 0.78). Metafemur often twice as long as wide (length/width ratio mean 1.95); pecten vague, not produced, curved, with 13-16 denticles, denticle 1 acuminate and short, 3rd or 4th denticle usually the longest, two apical tubercles; prepectenal ridge very short almost nonexistent, without spines. Metatibia with two strong ventral carinae, outer ventral carina usually obsolete. Pygidium usually longer than wide (length/width ratio mean 1.1).

Males.—*Integument*. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with pale yellow setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color*. Body and appendages reddish brown to dark brown.

Vestiture. Setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surface with white, fine texture, short, recumbent, moderately dense, uniform setae; ventral body surface with white, fine texture, short, recumbent, moderately dense, uniform setae; antenna with minute, white, uniform, sparse setae and longer, pale golden, sparsely irregular setae; elytron surface moderately hirsute, protibia and mesotibia with long, coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae, except a few golden setae inside apex of mucro; ventral ridge of metafemur with slightly longer white setae partly covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium about as hirsute as elytron, setae slightly longer.

Head. Shorter than pronotum; frons and vertex with a weak glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus short; on dorsal side eyes distant; postocular lobe short but distinct. Antenna shorter than elytra, antennal segment 4 not serrate, segments 5-10 serrate, longer than wide. Gena short; sides of submentum between eyes almost parallel, on ventral side eyes approximate.

Prothorax. Disk wider than long (length/width ratio mean 0.78); sides and base with strong, impressed, marginal line; anterior margin straight, marginal line tapering toward middle, often no line medially; angles vaguely pointed, often not visible in dorsal view; medial dorsal surface convex, less convex posteriorly, densely punctate; sides depressed, sharply depressed toward apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle greater than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter and wider than metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process narrow.

Mesothorax and Metathorax. Scutellum small, quadrate. Elytron with dorsal surface feebly convex between humerus and mesal margin, depressed laterally and apically; humerus feebly scabrous (often covered by setae); striae punctate. Metafemur incrassate, often twice as long as wide (length/width ratio mean 1.95), maximum width closer to base, constricted towards apex; ventral side with a very weak pecten, partly covered with long white setae on lateral side, armed with 13-16 denticles; denticle 1 acuminate, short, very close to femoral base; denticles 2 and 3 increasing in size, denticles becoming more tuberculate towards apex; two apical tubercles; when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge very short almost nonexistent, moderately covered with setae, without spines; lateral side with small punctures, often not visible under setae. Metatibia evenly arcuate (angle > 90°), two very strong ventral carinae, inner carina strong fusing with middle carinae at apex of mucro, middle carina strong, usually uniform (not crooked), with a tubercle near base, without a sulcus distal to tubercle, furrow between carinae, outer carina usually obsolete or sometimes very weak and short, only feebly visible by the tubercle; lateral carina strong extending 100% of tibia, distance to dorsolateral carina, measured at the base of mucro, about the same, as if measured from 3/4 length of tibia (75% of distance from base of tibia); dorsolateral carinae strong at apex, tapering slowly towards base extending 60-80% of tibia; mesal carina strong extending 100% of tibia; dorsomesal carinae strong at apex tapering slowly towards base extending 60-90% of tibia; all carinae except ventral partly covered by setae; mucro medium size; tibial corona smooth, without spines; spur clearly visible in lateral view, covered with setae; mesotarsus 1 shorter and wider than metatarsus 1. Mesosternal process slanting, projecting to much less than 90° angle from body plane, apex gradually curved back towards the plane of metasternum; metaspinasternum feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, punctations often covered by setae, convex in lateral view, longer than wide, wider at base than apex, partly hidden by the elytra, elytra cover 20-40% of pygidium length from base, but at almost 90° angle to elytra and usually not visible in dorsal view.

Genitalia. Median lobe (Fig. 183) slender. Ventral valve long with sides forming a triangle with an acute angle. Internal sac without armature. Lateral lobes (Fig. 184) confluent, not separated, with gemmae, without cleft, apex with vague median notch and line-like. Kingsolver's band absent.

Females.— Similar to males, but maximum thoracic depth slightly larger. Bursa copulatrix without armature (Fig. 182).

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. Argentina: Corrientes, Bella Vista, (BR); Entre Rios, Concordia, (BR); Entre Rios, Primero de Mayo, ex. fruto de palmera "yatay", 1937, M.J. Viana, *paratype* (MNHN); Entre Rios, en palmeras "yatay", 22.XII.1958, XII.1958, XI.1959, XII.1959, 16.XII.1959, 211960, 22.X.64, L.A. Gontero (FML); Entre Rios, ex. *Cocos* (prob. yatay), 1973 (USNM); Formosa, XI.1950, J. Daguerre (USNM); Formosa, Laguna Blanca, X.48, Morel (FML); Misiones, Iguazú, 1950, W.H. Partridge (BR). Paraguay: 1938, M.J. Viana, *holotype* (BMNH); Sapucay (CNC). Uruguay: Montevideo, XII.35 (CNC); ex. seeds of *Butia capitata*, 25.II.57, Div. Plant Prot. Dept. Agr. Israel, *paratype*, (BMNH).

Discussion.—This species was first placed in the genus *Pachymeroides* (Prevett 1966a). The name Pachymeroides was preoccupied and changed to *Butiobruchus* (Prevett 1966b). Only one species of *Butiobruchus* has been described and Prevett's (1966a) description was based on only three female specimens. After study of male specimens *Butiobruchus bridwelli* is moved to *Pachymerus*.

Since the shape of the submentum is an important taxonomic character, it should be noted, to avoid confusion, that gula and submentum are not defined as Prevett (1966b). Also, the base of antennal segments 2 and 4, the primary characters used by Prevett (1966a) to separate *Butiobruchus* from *Pachymerus*, is not used. He stated that the base is impressed in species of *Pachymerus* but not in *Butiobruchus*. This character is highly variable (Prevett only studied three specimens) in both genera, and depends on the angles of the antennal segments to each other since the segments articulate.

If the classification is based on monophyletic groups, *Butiobruchus* can not be a valid genus. This becomes very clear when studying the gemmae on the lateral lobes of the male genitalia. All species in *Pachymerus*, including *P. bridwelli*, have gemmae, except *P. cardo*. So if *Butiobruchus* is considered a valid genus, *P. cardo* must also be considered a separate genus because of the absence of gemmae. There are external characters that could be used to separate *P. bridwelli* into a separate genus (shape of pecten, width of metafemur, absence of tibial sulcus and width of submentum). But both male and female genitalia indicate a very close relationship. Nilsson (1992) believed similarities in genitalic characters, especially the male gemmae and absence of sclerites in the internal sac, were more important than differences in external characters. The female genitalia in *Pachymerus* are distinctly different from the female genitalia of other Pachymerini genera. Females of *P. bridwelli* are typical *Pachymerus*. Furthermore, the external characters of *P. cardo* are also definitely *Pachymerus*. For these reasons *Butiobruchus* Prevett is synonymized with *Pachymerus* Thunberg.

Pachymerus cardo (Fåhraeus)

Figs. 6, 83,109, 157 - 160

Bruchus cardo Fåhraeus *in* Schönherr 1839:127.
Pachymerus cardo: Pic 1913:7; Prevett 1966b:185; Udayagiri and Wadhi 1989:242.

Type Data.—Type locality: Pará, Brazil. Holotype, Brazil, Para, Klug; deposited in Naturhistoriska Riksmuseet, Stockholm (NR). One paratype, Brazil, Pará, coll. Chevr.; deposited in NR.

Distribution.— Specimens examined, 745. *New World*. Argentina (San Juan), Belize, Bolivia (El Beni, Santa Cruz), Brazil (Amazonas, Bahia, Maranhao, Matto Grosso, Matto Grosso do Sul, Pará, Paraíba, Paraná, Rio de Janeiro, São Paulo), Colombia (Magdalena, Valle del Cauca), Costa Rica, French Guiana, Guatemala, Guyana, Mexico, Nicaragua, Panama, Paraguay (Cordillera), Peru (Loreto), Suriname, Trinidad, Venezuela (Amazonas, Aragua, Barinas, Bolivar, Carabobo, Guárico, Monagas, Zulia). *Old World*. Introduced into Congo, Ghana and Nigeria.

Diagnosis.— Dark brown, golden pubescence almost totally covers integument color. Males 7.2-14.0 mm, females 7.4-14.3 mm in length (pronotum-elytra); width of males 4.0-7.0 mm, females 4.2-7.2 mm, maximum thoracic depth of males 2.9-4.8 mm, females 3.0-5.1 mm. Antennal segments 4 not serrate, segment 5-10 serrate, longer than wide. Distance between eyes intermediate. Disk of pronotum wider than long (length/width ratio mean 0.72). Metafemur less than twice as long as wide (length/width ratio mean 1.65); pecten curved, with 10-14 denticles, denticle 1 acuminate and longer, two apical tubercles (the normal number of apical tubercles is two but it often has only one and sometimes three); prepectenal ridge shorter than pecten, without spines. Metatibia with two strong ventral carinae, middle ventral carina uniform (not crooked) with a tubercle, outer ventral carina obsolete. Pygidium about as wide as long (length/width ratio mean 1.00).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color*. Body and appendages dark brown.

Vestiture. setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surface with golden, fine texture, short, recumbent, moderately dense, uniform setae; ventral body surface with pale yellow, medium texture, short recumbent, dense, uniform setae; antenna with short, yellowish-white, uniform, sparse setae and longer, golden, sparsely irregular setae; elytron surface densely hirsute, protibia and mesotibia with long, coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae, except a few golden setae inside apex of mucro; ventral ridge of metafemur with long pale yellow setae covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium not as densely hirsute as elytron.

Head. Shorter than pronotum; frons and vertex with median hirsute carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus short; on dorsal side eyes approximate or intermediate distance; postocular lobe short but distinct. Antenna shorter than elytra, antennal segment 4 not serrate, segments 5-10 serrate longer than wide. Gena long; sides of submentum feebly converging triangularly between the eyes, on ventral side eyes distant.

Prothorax. Disk wider than long (length/width ratio 0.72); sides and base with strong, impressed, marginal line; anterior margin feebly emarginate, marginal line tapering toward middle, medially line weak or absent (covered by setae); angles vaguely pointed, often not visible in dorsal view; medial dorsal surface convex, less convex posteriorly densely punctate (punctae often hard to see covered by setae); sides depressed, sharply depressed toward apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter, but only slightly wider than metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process medium width.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface feebly convex between humerus and mesal margin, depressed laterally and apically; humerus scabrous; striae punctate. Metafemur incrassate, maximum width closer to base, constricted towards apex; ventral side with a pecten, covered with long pale yellow setae on lateral side, armed with 10-14 denticles; denticle 1 long, acuminate, closer to femoral base than to apex; following denticles smaller in size, mostly covered by setae; two apical tubercles (the normal number of apical tubercles is two but it often has only one and sometimes three); when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge much shorter than pecten, covered with setae, without spines; lateral side with small punctures, usually not visible under setae. Metatibia evenly arcuate (angle >90°), two very strong ventral carinae, inner carina strong fusing with middle carinae at apex of mucro, middle carina strong, uniform (not crooked), with a tubercle near base, and a short sulcus distal to tubercle, furrow between carinae, outer carina obsolete; lateral carina strong, lateral carina strong extending 100% of tibia, distance to dorsolateral carina measured at the base of mucro, about the same as if measured from 3/4 length of tibia (75% of distance from base of tibia); dorsolateral carinae weak tapering fast towards base only extending 80-90% of tibia (sometimes only 20-30%); mesal carina strong extending 100% of tibia; dorsomesal carinae strong at apex tapering slowly towards base only extending 70-80% of tibia; all except ventral carinae often partly covered by setae; mucro medium size; tibial corona smooth, without spines; spur clearly visible in lateral view, partly covered with setae; mesotarsus 1 shorter, but only slightly wider than metatarsus 1. Mesosternal process slanting, projecting to much less than 90° angle from body plane, gradually curved back towards the plane of metasternum; spinasternum posterior to the process feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, about as wide as long (length/width ratio mean 1.00), wider at base than apex, partly hidden by the elytra, elytra cover 20-50% of pygidium length from base, but at almost 90° angle to elytra and usually not visible in dorsal view.

Genitalia. Median lobe (Fig. 159) slender. Ventral valve long with sides forming a triangle with an acute angle. Internal sac without armature. Lateral lobes (Fig. 160) confluent, not separated, without gemmae, without cleft, apex with vague median notch and line-like sinus. Kingsolver's band absent.

Females.— Similar to males, but maximum thoracic depth slightly larger. Bursa copulatrix without armature (Fig. 158).

Specific Records.—Only records with host plant associations included. Host records are from collection labels, spelled exactly as written, and should be verified. *New World.* Bolivia: Huachi, Rio Beni, ex *Attalea*, VIII.1921, O.E. White (USNM). Brazil: Amazonas, from palm fruit (BMNH); Amazonas, from fruits of *Elaeis melanococca* Gaert. Fruct. (BMNH); Bahia, em palmeiros, G. Bondar (FMNH); Pará ex *Attalea speciosa* Mart., 7.VII.1928, B. Krukoff (USNM); Rio de Janeiro, Botanical Garden, ex *Areca friandra* L., 3.VIII.1921, R.D. Kennedy (USNM); on journey from Rio de Janeiro, ex seeds *Scheelea leandroana* Barb. Rodr., 10.IV.1926, (USNM); Rio de Janeiro, quarantine New York, *Scheelea leandroana* Barb. Rodr., (USNM); 251919, on *Orbignya graciosa*, quarantine Washington D.C.; 15.X.1973, in seed of *Maximiliana regia* Mart., quarantine Miami, (USNM); from seeds *Cocos romanzoffiana* Cham.(USNM); in seeds *Elaeis guineensis* Jacq., 14.III.1958, I & P (USNM). Colombia: Valle del

Cauca, Palmira, reared seeds *Elaeis guineensis* Jacq., 15.IX.1983, L.C. Pardo (CDJ); Valle del Cauca, Rio Frio, Salonica, alt. 1150m, reared seeds *Attalea victoriana* Dugand, II.1982, C. Varela (CDJ); Valle del Cauca, 36km N. Roldanillo, seeds reared *Elaeis guineensis* Jacq., 20.VIII.1983, C.D. Johnson (CDJ). Costa Rica: Guanacaste, Peñas Blancas, hiding in mature *Scheelea* nut bunch on tree, 11.IX.1970, (USNM); Guanacaste, in oil palm seeds, XI.1967, (USNM). French Guiana: Cayenne, Piste de St Elie Pk15, 15 Aout 1986, graine d'*A. paramaca*, Plinio SIST Leg (ORST). Guatemala: In *Acrocomia sclerocarpa* Drude, (USNM). Guyana: Georgetown, botanical garden, ex seed *Maximiliana regia* Mart., 28.VI.1920, L.C. Griffith (USNM); Demerara river, ex seed *Maximiliana regia* Mart., C.E. Griffith (USNM). Nicaragua: In *Scheelea zonensis* L.H. Bailey , S. Kevorkien, (USNM). Panama: Canal Zone, Barro Colorado Island, ex *Scheelea*, 25.III.1964, L.J. Bottimer (USNM); Canal Zone, Summit, in seeds of *Elaeis guineensis* Jacq., VI.1928, J. Zetek (USNM); Canal Zone, Summit, in seed of *Scheelea zonensis* L.H. Bailey , 211937, J. Zetek (USNM); Canal Zone, Summit 3, on oil palm seeds, *Elaeis melanococca* Gaertn. Fruct., 22.IX.1949, J. Zetek (USNM); Canal Zone, Paraiso, ex old sheath of flowers *Attalea* palm, 1.II.1911, 30.IV.1911, E.A. Schwarz (USNM); Canal Zone, ex *Manicaria* sp., IX.1932, T.P. Hilditch (BMNH); Taberville, bred *Elaeis melanococca* Gaertn. Fruct., Chittenden (USNM); from Panama reared in Riverside, ex seeds of *Guilielma utilis* Oerst. (CDJ); ex *Martinezia caryotaefolia* H.B. & K. seeds, quarantine Hawaii, 16.IV.1932, (USNM); ex *Attalea gomphococca* Mart., quarantine, 8.VIII.1932 (USNM). Peru: Loreto, Jennaro-Herrera, Estero Cocha, es semin *Scheelea brachyclada* Burret, 8.X.1991, G. Couturier (ORST); with *Orbignya spectabilis* Burret nuts, quarantine New York, 13.V.1940, (USNM); in pkg *Attalea tessemannii* Burret, (USNM). Trinidad: Port-of-Spain, on *Elaeis guineensis* Jacq., 18.VI.1928, (USNM); Wordbrook, ex *Bactris cuesa* seed, (USNM); 2.IX.1936, ex *Englerophoenix* sp., quarantine New York (USNM); 2.VII.1934, ex *Maximiliana caribaea* Griseb. & H. Wendl. ex Griseb., quarantine Washington, D.C., (USNM); ex *Elaeis guineensis* Jacq., H.L. Sanford (USNM). Venezuela: Amazonas, Cano Iguana, de frutos de palma de Cucurito, XI.1982, (BOR), La Esmeralda, Expedition Fco Alto Orinoco, VI.1951, (USNM); Aragua, Maracay, 9.II.1989 (emerged 30.III.1989), from palmseed on ground, C.D. Johnson (CDJ); Barinas, W. of Barinas, 21.X.1973 (emerged late Feb.1974), D. Janzen (USNM); Barinas, 52km S.of Barinas, 12.III.1989 (emerged 20.IV.1989), in *Scheelea* palm?, C.D. Johnson (CDJ); Carabobo, Palma Sola, ex *Scheelea*, 041948, D.W. Jenkins (USNM); Carabobo, Tucuyito, 9.VIII.1937, in seed of *Attalea speciosa* Mart., C.H. Ballou (USNM); D.F., Caracas, en semillas de palma, 24.X.1983, G. Yepes (UCV); Guárico, Calabozo, Est. Biol. de los Llanos, ex *Copernicia tectornya*, 18.XII.1982, (CDJ); Zulia, 19km S. El Guayabo, in seeds of palm, C.D. Johnson, 21.II.1989 (emerged 30.III.1989) (CDJ); Zulia, La Fria, ex *Scheelea*, D.W. Jenkins (USNM); Cascara, 181948, ex *Scheelea macrolepis* Burret, (USNM); 08.IV.1935, with palm seed, quarantine CE Prince, (USNM); 30.VII.1936, ex Cohune palm, quarantine New York, (USNM); 27.II.1950, ex *Scheelea maracaibensis* Burret, quarantine Miami, (USNM). *Old World*. Congo: Brazzaville, noix de palme, 28.XI.86, 20.III.87, A. Delobel (ORST). Nigeria: U.C. Ibadan, kernel of *Elaeis guineensis* Jacq., , 25.VI.1959, G.H. Caswell (BMNH).

Discussion.—It is possible that this species was originally described by Klug. However, Fåhraeus has been given credit for the name, and we have not been able to find a description of this species by Klug. The original description appears to be the one in Schönherr 1839, where Klug is written after the species name. Fåhraeus' name is given after the description, indicating that he described the species. Klug collected the holotype, and perhaps he suggested the name, and for this reason (since there were no consistent taxonomic rules in 1839) Klug's name was printed after the species name in this publication.

The specimens reported from Mexico and Belize were intercepted in U.S. quarantine. The true collection locality is uncertain.

Pachymerus nucleorum (Fabricius)

Figs. 4, 13, 50, 51, 58, 64, 67, 87, 108, 169 - 172

Bruchus bactris: Herbst 1783:28 (*nec* Linné 1762).
Bruchus nucleorum Fabricius 1792:369; Gyllenhal *in* Schönherr 1833:92.
Pachymerus nucleorum: Pic 1913:8; Bridwell 1929:159; Prevett 1966b:188; Udayagiri and Wadhi 1989:244.
Caryoborus lacerdae Chevrolat 1877:106. **New Synonymy.**
Pachymerus lacerdae: Prevett 1966b:160.
Pachymerus olearius Bridwell 1929:160. (Prevett 1966b:189 = *lacerdae* Chevrolat). **New Synonymy.**

Type Data.—Type locality: Unknown. Two syntypes of *Bruchus nucleorum* are deposited in

Universitetets Zoologisk Museum, Copenhagen (UZMC). Fabricius described this species from specimens misidentified by Herbst as *Bruchus bactris*. No type or collection labels were on the types. One of the two syntypes is designated lectotype here: Amer. Islands, lectotype by Nilsson 1992 (UZMC). The other syntype is considered a paralectotype. Both Herbst and Fabricius indicated that the beetles were from "Indiae Nucleis" (F. 1792) and "Oßtindien" (=East India). Since all Pachymerini are of New World origin this information is probably incorrect. It would not be likely that it could have been introduced and collected here, since world communication at this time was not very good. It is not uncommon for old material to possess erroneous locality data. *Caryoborus lacerdae*: Bahia, Brazil; deposited in Naturhistoriska Riksmuseet, Stockholm, Sweden. *Pachymerus olearius*: Brazil; deposited in the U.S. National Museum, Washington, D.C. (USNM).

Distribution .—(Fig. 4).—Specimens examined, 201. *New World*. Argentina, Bolivia (Beni, Pando, Santa Cruz), Brazil (Amazonas, Bahia, Espirito Santo, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Sul, Rondonia, São Paulo), Paraguay (Amambay). *Old World*. Introduced to São Tomé e Príncipes.

Diagnosis.— Red brown, dark brown to almost black, greyish-white pubescence only partly covers integument color. Males 8.5-15.5 mm, females 9.2-16.3 mm in length (pronotum-elytra); width of males 3.8-7.4 mm, females 2.3-7.5 mm, maximum thoracic depth of males 3.0-4.5 mm, females 3.5-6.4 mm. Antennal segments 4 not serrate, segment 5-10 serrate, longer than wide. Eyes distant. Disk of pronotum only slightly wider than long (length/width ratio mean 0.80). Metafemur slightly less than twice as long as wide (length/width ratio mean 1.81); pecten curved, with 7-12 denticles, denticle 1 acuminate and longer, last denticle large, tuberculate (followed by one apical tubercle), a shallow sulcus between last denticle and the other pectenal denticles, or a very large fused denticle (last pectenal denticle fused with one or two of the smaller basad pectenal denticles); one apical tubercle; prepectenal ridge shorter than pecten, without spines. Metatibia with two strong and one very weak ventral carinae, middle ventral carina not uniform (crooked), with a tubercle, outer ventral carina present, weak, usually short. Pygidium wider than long (length/width ratio mean 0.89).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, ventral part of gena, apical end of proepimeron (with usually white or pale yellow setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color*. Body and appendages uniform red brown, dark brown to almost black.

Vestiture. Setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surface with greyish-white, fine texture, short, recumbent, moderately dense, uniform setae; ventral body surface with greyish-white, medium texture (coarser and longer on ventral side, some may have pale yellowish-white setae, but never clear yellow or golden), short, recumbent, moderately dense to sparse, uniform setae; antenna with minute, white, uniform, setae; elytron surface densely to sparsely hirsute, protibia and mesotibia with long, coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae, except a few golden setae inside apex of mucro; ventral ridge of metafemur with greyish-white setae partly covering pecten; tarsomere 1 with moderately dense, golden setae, tarsomere 2 with sparse golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium usually not as densely hirsute as elytron.

Head. Shorter than pronotum; frons and vertex with median hirsute or vaguely glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus short; on dorsal side eyes distant; postocular lobe medium size. Antenna shorter than elytra, antennal segment 4 not serrate, segments 5-10 serrate, longer than wide. Gena long; sides of submentum strongly converging between the eyes, on ventral side eyes distant.

Prothorax. Disk slightly wider than long (sometimes appear as if quadrate, length/width ratio mean 0.80); sides and base with strong, impressed, marginal line; anterior margin arcuate, marginal line tapering toward middle, medially line weak or absent (usually covered by setae); angles rounded, not visible in dorsal view; medial dorsal surface convex, less convex posteriorly densely punctate; sides depressed, sharply depressed toward apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base feebly rounded, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter and wider than metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process usually narrow.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface feebly convex between humerus and mesal margin, depressed laterally and apically; humerus scabrous; sometimes covered with setae, striae punctate (stria 1 see Fig. 50). Metafemur incrassate, maximum width closer to base, constricted towards apex, slightly less than twice as long as wide (length/width ratio mean 1.81); ventral side with a pecten, partly covered with greyish-white setae, especially on lateral side, armed with 7-12 denticles; denticle 1 long, acuminate, closer to femoral base than to apex; following denticles smaller in size, mostly covered by setae, the last denticle large, tuberculate (followed by one much smaller apical denticle); the first large, often with a shallow sulcus between last denticle and the other pectenal denticles, or a very large fused denticle (last pectenal denticle fused with one or two of the smaller basal pectenal denticles); when leg flexed, tibia positioned on mesal side of pecten; one apical tubercle, prepectenal ridge much shorter than pecten, covered with setae, without spines; lateral side with small punctures, often not visible under setae. Metatibia not evenly arcuate, distinct basal bend (angle close to 90°), 2 very strong ventral carinae, inner carina strong fusing with middle carinae at apex of mucro, middle carina strong, not uniform (crooked), with a tubercle near base, and a short sulcus distal to tubercle, furrow between carinae, outer carina medium strength at base, tapering, extending from base to 40-50% of tibia (some only extending to distal end of sulcus); lateral carina strong extending 100% of tibia, distance to dorsolateral carina measured at the base of mucro, about the same as if measured from 3/4 length of tibia (75% of distance from base of tibia); dorsolateral carinae medium strength at apex tapering slowly towards base only extending 90-95% of tibia (sometimes 100%); mesal carina strong extending 100% of tibia; dorsomesal carinae strong at apex tapering slowly towards base only extending 85% of tibia; carinae usually not covered by setae; mucro medium size to short; tibial corona smooth, without spines; spur clearly visible in lateral view, not covered with setae; mesotarsus 1 shorter and wider than metatarsus 1. Mesosternal process slanting, gradually curved back towards the plane of metasternum, projecting to much less than 90° angle from body plane (in some specimens almost in plane of body); spinasternum posterior to the process only feebly produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, slightly wider than long (length/width ratio mean 0.89), wider at base than apex, partly hidden by the elytra, elytra cover 20-50% of pygidium length from base, but at almost 90° angle to elytra and usually not visible in dorsal view.

Genitalia. Median lobe (Fig. 171) slender. Ventral valve long with sides forming a triangle with an acute angle. Internal sac without armature. Lateral lobes (Fig. 172) confluent, not separated, with gemmae, without cleft, apex with vague median notch and line-like sinus. Kingsolver's band absent.

Females.— Similar to males, but maximum thoracic depth slightly larger. Bursa copulatrix without armature (Fig. 170).

Specific Records.—Only records with host plant associations included. Host records are from collection labels, spelled exactly as written, and should be verified. Argentina: ex *Acrocomia* seeds quarantine San Pedro, Los Angeles County, California, (CDFA). Brazil: Bahia, em palmeiros, G. Bondar (FMNH); Maranhão, coco palm nuts, E.C. Green (USNM); Mato Grosso do Sul, quarantine D.C., ex *Acrocomia sclerocarpa* Drude, Porto Murtinho (USNM); Pará, *Attalea speciosa* Mart. nuts, 7.7.28, B. Krukoff (USNM); quarantine New York, reared from Babassu nuts (USNM); *Acrocomia* sp., 31.VIII.43, (CNC); quarantine Houston, in *Acrocomia* sp. nut, 8.31.43; quarantine Miami, in seed of *Orbignya* sp., (USNM); quarantine New York, on nuts *Cocos coronata* Mart., (USNM), quarantine Nogales, Arizona, in Babassu nuts, (CDJ). Paraguay: in *Acrocomia totai* Mart., 1957, (USNM); in *Acrocomia totai* Mart., 1951, Bomhard (USNM).

Discussion.—This species has two distinct forms, but it appears as if the populations are mixed. No form is more common in certain areas. One form has a large fused denticle (apical tubercle 1 fused with one or two of the basal pectenal denticles), the other form has a large shallow sulcus in the place of this large fused denticle (the size of the first apical tubercle is rather large, even in specimens with a sulcus). The reason for this variation is unknown.

Prevett (1966b) synonymized *P. olearius* with *P. lacerdae*. However, he recognized both *P. lacerdae* and *P. nucleorum* as valid species.

Pachymerus sveni Nilsson, **new species**
Figs. 5, 9, 24, 27, 59, 62, 88, 101-104, 161-163

Type Data.—Type locality: Belém, Brazil. Holotype male, Belém, Goeldi Museum, 10.II.1959, A.M. Nadler; deposited in the American Museum of Natural History, New York (AMNH). Allotype female, same data as holotype; deposited in AMNH. 29 paratypes. Brazil: (2) Amazonas, Agronomia INPA, ex seeds *Euterpe oleacea* Mart. (Açai do Pará), VII.87, Clement, C.(UFDP); (1) Bahia, 1319 (USNM); (3) Ceará, 11km SSW Fortaleza; ex seed *Copernicia cerifera* (Arr. Cam.) Mart., D. da Roche (USNM); (2) Pará, (KZ); (1) Pará, Belém, at night, 251969, L. & C.W. O'Brien (USNM); (1) Pará, Belém, Goeldi Museum, 10.II.1959, A.M. Nadler (AMNH); (1) Rio de Janeiro, palm seeds, Washington D.C. at quarantine, March-10-1914, E R Sasscer coll. (USNM); (3) Rio de Janeiro, ex seeds *Euterpe oleaceae* Mart., 19.XI. 1974, J. Donatti (USNM); (2) Rio Grande do Sul, São Luis, 7.II.1959, A.M. Nadler (AMNH); (2) Bowring 63 47 (BMNH); W-6039, 3-13-58-4623, ex *Bactris masaja.*; (1) ex seed *Bactris caryotifolia* Drude, quarantine Washington D.C. (USNM); (1) ex. *Desmoncus* sp., 2.V.1935, (seed on pin), H.Y. Gouldman (USNM); (7) ex seed Brazil, quarantine Miami, Florida, 22.II.49, (USNM). Venezuela: (1) Dto. Federal, Caracas, ex seed palmas, 24.X.1983, G. Yepez (UCV); (1) ex palm seed, 9.2.59, quarantine Hoboken, New Jersey (USNM).

Etymology .—Named after the first author's father and friend Sven Nilsson.

Distribution .—(Fig.5). Specimens examined, 31. Brazil (Amazonas, Bahia, Ceará, Pará, Rio de Janeiro, Rio Grande do Sul), Venezuela.

Diagnosis.— Dark brown to red brown, greyish-white pubescence (sometimes slightly yellowish) only partly covers integument color. Males 5.6-10.2 mm, females 5.7-10.0 mm in length (pronotum-elytra); width of males 2.6-4.6 mm, females 2.6-4.8 mm, maximum thoracic depth of males 1.4-4.0 mm, females 2.3-4.1 mm. Antennal segments 4 not serrate, segment 5-10 serrate, as wide as long. Eyes approximate. Disk of pronotum wider than long (length/width ratio mean 0.71). Metafemur less than twice as long as wide (length/width ratio mean 1.74); pecten curved, with 13-15 denticles, denticle 1 acuminate and longer, two apical tubercles; prepectenal ridge shorter than pecten, without spines. Metatibia with two strong ventral carinae, middle ventral carina uniform (not crooked), outer ventral carina obsolete. Pygidium slightly wider than long (length/width ratio mean 0.83).

Differential Diagnosis.— See COMPARISONS OF SPECIES IN PACHYMERUS.

Males.—*Integument.* Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, part of ventral side of gena, apical end of proepimeron (with golden or pale yellow setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages uniform dark brown to red brown.

Vestiture. Setae often lost on parts of the body, possibly due to rubbing. Dorsal and ventral body surfaces with greyish-white (rarely yellowish-white), fine texture, short, recumbent, moderately dense to sparse, uniform setae; antenna with minute white, uniform setae and longer golden, sparse, irregular setae; elytron surface moderately hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae, except a few golden setae inside apex of mucro; ventral ridge of metafemur with long, golden setae covering pecten; tarsomere 1 with moderately dense, golden setae, tarsomere 2 with greyish-white, medium texture, dense setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium usually not as densely hirsute as elytron. Elytron and pronotum disk almost non-hirsute in some specimens due to loss of setae.

Head. Shorter or as long as pronotum; frons and vertex with a prominent median, hirsute carina, carina weak at vertex, not interrupted by a weak depression (Fig. 96); ocular sinus short; on dorsal side eyes approximate; postocular lobe short but distinct. Antenna shorter than elytra, antennal segment 4 not serrate, segments 5-10 serrate as wide as long. Gena long; sides of submentum converging triangularly between eyes, on ventral side eyes distant.

Prothorax. Disk wider than long (length width ratio mean 0.71); sides and base with strong, impressed, marginal line; anterior margin straight or emarginate, marginal line tapering toward middle, medially line weak or absent; angles rounded, often not visible in dorsal view; medial dorsal surface usually flattened, more flattened posteriorly, densely punctate; sides depressed, sharply depressed towards apex, arcuate, narrowed to apex from slightly more than middle of side; angles of lateral margin at base produced, angle slightly more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter and slightly wider than metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process medium width.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface feebly convex between humerus and mesal margin, depressed laterally and apically; humerus scabrous, usually covered with setae; striae punctate. Metafemur, incrassate, expanded from base, with a sinuated carina near base (this feature exists in both males and females), with a weakly to moderately produced bend, margin after bend not emarginate or only vaguely so, then arcuate, maximum width approximately at middle of femur or slightly closer to base, constricted towards apex, less than twice as long as wide (length/width ratio mean 1.74); ventral side with a long, vaguely produced pecten, covered with long, golden setae, armed with 13-15 denticles; denticle 1 long, acuminate, closer to femoral base than to apex; following denticles smaller in size, mostly covered by setae on lateral side, the last denticle usually much larger than preceding, tuberculate; two apical tubercles; when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge much shorter than pecten, covered with setae, without spines; lateral side with small punctures, usually feebly visible under setae. Metatibia not evenly arcuate, (angle at basal end slightly more than 90°); two very strong ventral carinae, inner ventral carina strong fusing with middle carinae at apex of mucro, middle ventral carina strong, uniform (not crooked), with a tubercle near base, and a very short sulcus distal to tubercle, furrow between carinae, outer carina obsolete; lateral carina strong extending 100% of tibia, distance to dorsolateral carina measured at the base of mucro, about the same as if measured from 3/4 length of tibia (75% of distance from base of tibia); dorsolateral carinae strong at apex tapering towards base only extending 75% of tibia; mesal carina strong extending 100% of tibia; dorsomesal carinae strong at apex tapering towards base but extending 100% of tibia; all except ventral carinae partly covered by setae; mucro medium size to long; tibial corona smooth, without spines; spur clearly visible in lateral view, sparsely covered with setae; mesotarsus 1 shorter and slightly wider than metatarsus 1. Mesosternal process produced, projecting to slightly less than 90° angle from body plane apex feebly curved back towards plane of metasternum; spinasternum posterior to the process produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, moderately convex to flat in lateral view, slightly wider than long (length/width ratio mean 0.83), wider at base than apex, not hidden by the elytra, elytra often only reaching pygidium base (elytra cover 0-10%), but at almost 90° angle to elytra and usually only slightly visible in dorsal view.

Genitalia. Median lobe (Fig. 163) slender. Ventral valve long with sides forming a triangle with an acute angle. Internal sac without armature. Lateral lobes (Fig. 164) confluent, not separated, with gemmae, without cleft, apex with vague median notch and line-like sinus. Kingsolver's band absent.

Females.— Similar to males, but maximum thoracic depth slightly larger. Bursa copulatrix without armature (Fig. 162).

Specific Records.—(See list of paratypes.) Host records are from collection labels, spelled exactly as written, and should be verified.

Discussion.—This is probably the "another species" mentioned by Bridwell (1929:159) with a leg similar to *P. bactris* but never described.

The two species most easily confused with *P. sveni* are: *P. thoracicus* which has the same number of apical tubercles (two), the same setae color and the same size, but a wider prothoracic disk compared to length and no sinuated carina on metafemur; and *P. bactris* which has a similar sinuated carina on the metafemur (but absent in females), but is usually larger and has one apical tubercle and golden setae (compared to two apical tubercles and usually greyish-white setae in *P. sveni*).

Pachymerus thoracicus Prevett

Figs. 6, 86, 177-180

Pachymerus thoracicus Prevett 1966b:190; Udayagiri and Wadhi 1989:245.

Pachymerus copernicae Bondar: *in* Zacher 1952:469. **Nomen nudum.**

Pachymerus copernicae Bondar: *in* Silva 1979:347. **Nomen nudum.**

Type Data.—Type locality: Asuncion, Paraguay. Holotype, Asuncion, Paraguay, 1905, Fry; deposited in The Natural History Museum, London (BMNH). No allotype designated.

Distribution .—(Fig. 6).—Specimens examined, 35. Argentina (Buenos Aires, Chaco, Entre Rios, Formosa, Misiones, Tucumán), Brazil (Bahia, Espirito Santo, Mato Grosso do Sul, Rio Grande do Sul), Paraguay (Central).

Diagnosis.—Red brown to dark brown, greyish-white to sometimes pale yellow pubescence only partly covers integument color. Males 8.0-9.5 mm, females 7.8-9.5 mm in length (pronotum-elytra); width of males 4.8-6.0 mm, females 4.4-6.0 mm, maximum thoracic depth of males 3.4-3.7 mm, females 3.3-3.7 mm. Antennal segments 4 not serrate, segment 5-10 serrate, slightly longer than wide. Eyes distant. Disk of pronotum clearly wider than long (length/width ratio mean 0.66). Metafemur less than twice as long as wide (length/width ratio mean 1.74); pecten curved, with 11-14 denticles, denticle 1 acuminate and longer, two apical tubercles; prepectenal ridge shorter than pecten, without spines. Metatibia with two strong ventral carinae, middle ventral carina uniform (not crooked), outer ventral carina obsolete. Pygidium wider than long (length/width ratio mean 0.75).

Males.—Integument. Hirsute, base of each seta in a minute puncture (therefore minutely punctulate where setae have been removed). Gula, part of ventral side of gena, apical end of proepimeron (with golden setae lining the margin), metacoxa near trochanter, and part of mesal side of metafemur glabrous. *Color.* Body and appendages red brown to dark brown.

Vestiture. Setae often lost on part of the body, possibly due to rubbing. Dorsal and ventral body surfaces with greyish-white to pale yellow, fine texture, short, recumbent, moderately dense to sparse, uniform setae; antenna with short greyish-white, uniform, sparse setae and longer golden, sparse, irregular setae; elytron surface moderately hirsute; protibia and mesotibia with coarse, golden, moderately dense to dense setae apically; metatibia lacking golden setae, except a few golden setae inside apex of mucro; ventral ridge of metafemur with long, greyish-white to pale yellow setae sparsely covering pecten; tarsomere 1 with moderately dense, golden setae, ventral side of tarsomere 3 with very dense, coarse, golden setae; pygidium about as hirsute as elytron, setae longer.

Head. Shorter than pronotum; frons and vertex with a median, often prominent, partly glabrous carina, carina at vertex not interrupted by a weak depression (Fig. 96); ocular sinus short; on dorsal side eyes distant; postocular lobe short but distinct. Antenna shorter than elytra, antennal segment 4 not serrate, segments 5-10 serrate longer than wide. Gena very long; sides of submentum strongly converging triangularly between eyes, on ventral side eyes distant.

Prothorax. Disk distinctly wider than long (length width ratio mean 0.66); sides and base with strong, impressed, marginal line, anterior margin emarginate, marginal line tapering toward middle, medially line weak or absent; angles rounded, visible in dorsal view; medial dorsal surface convex, flattened posteriorly, densely punctate; sides depressed, sharply depressed towards apex, arcuate, feebly narrowed to apex from slightly more than middle of side; angles of lateral margin at base feebly produced or rounded, angle more than 90°; posterior margin arcuate, produced medially; strong lateral prothoracic carina complete, extending from base to apex. Protarsus 1 shorter, about as wide as metatarsus 1. Prosternum completely separating procoxae, apex of prosternal process narrow.

Mesothorax and Metathorax. Scutellum small, subquadrate. Elytron with dorsal surface almost flat between humerus and mesal margin, depressed laterally and apically; humerus scabrous, partly covered with setae; striae punctate. Metafemur incrassate, slightly less than twice as long as wide (length/width ratio mean 1.74), expanded from base, maximum width closer to base; ventral side with a pecten, sparsely covered with long, greyish-white to pale yellow setae, armed with 11 or 14 denticles; denticle 1 long, acuminate, closer to femoral base than to apex; following denticles smaller in size, sparsely covered by setae on lateral side, the last denticle usually larger than preceding, tuberculate; two apical tubercles; when leg flexed, tibia positioned on mesal side of pecten; prepectenal ridge much shorter than pecten, covered with setae, without spines; lateral side with small punctures, usually feebly visible under setae. Metatibia evenly arcuate (angle >90°); two very strong ventral carinae, inner ventral carina strong fusing with middle carinae at apex of mucro, middle ventral carina strong, uniform (not crooked), with a tubercle near base, and a very short sulcus distal to tubercle, furrow between carinae, outer carina obsolete; lateral carina strong extending 100% of tibia, distance to dorsolateral carina measured at the base of mucro, about the same as if measured from 3/4 length of tibia (75% of distance from base of tibia); dorsolateral carinae strong at apex tapering fast towards base extending 90-95% of tibia; mesal carina strong extending 100% of tibia;

dorsomesal carinae strong at apex tapering slowly towards base but extending 100% of tibia; carinae usually not covered by setae; mucro medium size; tibial corona smooth, without spines; spur clearly visible in lateral view, usually not covered with setae; mesotarsus 1 shorter, about the same width as metatarsus 1. Mesosternal process slanting, projecting to less than 90° angle from body plane, apex feebly curved back towards plane of metasternum; spinasternum posterior to the process only vaguely produced.

Abdomen. Sternum 1 about as long as remaining sterna. Pygidium punctulate, convex in lateral view, wider than long (length width/ratio 0.75), wider at base than apex, partly hidden by the elytra, elytra cover 20-60% of pygidium length from base, but at almost 90° angle to elytra and usually not visible in dorsal view.

Genitalia. Median lobe (Fig. 179) slender. Ventral valve long with sides forming a triangle with an acute angle. Internal sac without armature. Lateral lobes (Fig. 180) confluent, not separated, with gemmae, without cleft, apex with vague median notch and line-like sinus. Kingsolver's band absent.

Females.— Similar to males, but maximum thoracic depth slightly larger. Bursa copulatrix without armature (Fig. 178).

Specific Records.—Host records are from collection labels, spelled exactly as written, and should be verified. Argentina: Buenos Aires, 10.?.1907, C. Bruch (BR); Chaco, El Zapallar, 9.VI.48, R. Golbach (FML); Entre Rios, Federal, Daguerre (BR); Formosa, Gran Guardia, J. Foerster (CNC), Misiones, Bemberg, 12-291945, Hayward, Willink & Goldbach (FML); Eldorado, XI.30.1964, A. Kovacs (AMNH); Tucumán, Las Puestos, ex seed *Copernicia australis* Becc., 8.IV.1967 (FML). Brazil: Bahia, Fruits of *Copernicia orientalis*, G. Bondar (BMNH); Espirito Santo, Colatina (BMNH); Mato Grosso do Sul, Corumbá, ex fruits *Copernicia* sp., XI.17 (USNM); Rio Grande do Sul, (USNM). Paraguay: Central, Asunción, 1905, Fry, *holotype*, (BMNH); Asunción, 1905, Fry, *paratype*, (BMNH); quarantine Miami, in palm seed, 6.X.53 (USNM); 28.III.1956, *paratype*, (USNM).

Discussion.—The two species most easily confused with *P. thoracicus* are: *P. sveni* which has the same number of apical tubercles (two), the same setae color and the same size, but a narrower prothoracic disk compared to length and a sinuated carina on metafemur; and small specimens of *P. nucleorum* which have two apical tubercles, eyes on the dorsal side distant, and greyish-white setae like *P. sveni*, but a large tooth or sulcus at the distal end of the pecten (absent in *P. thoracicus*), and a much longer prothoracic disk compared to width (much wider than long in *P. thoracicus*). Usually *P. nucleorum* is much larger in size and cannot be confused with the much smaller *P. thoracicus*.

Beetles collected in 1907 by C. Bruch were identified as *Pachymerus gleditsiae*. This identification was discussed by Bridwell (1929:156). Bridwell stated correctly that he did not believe these specimens were *Caryobruchus gleditsiae*. These beetles are specimens of *Pachymerus thoracicus*.

COMPARISONS OF SPECIES IN *PACHYMERUS*

Study of the external characters and especially the gemmae of the lateral lobes of the male genitalia of *Butiobruchus bridwelli* indicate that this species should be placed in *Pachymerus*. It is best separated from other species of *Pachymerus* by the weak almost non-apparent pecten, the absence of a large first pectenal denticle, the absence of a tibial sulcus, and the sides of the submentum between the eyes being almost parallel. The latter character is not always distinct and it is sometimes hard to distinguish the feebly triangular sides of some species of *Pachymerus*. However the gena is usually longer in other species of *Pachymerus* compared to *P. bridwelli*.

The best characters to separate species of *Pachymerus* are the apical tubercles on the metafemur and the distance between the eyes on the dorsal side. *Pachymerus bactris* and *P. nucleorum* have one apical denticle, and sometimes also *P. cardo*. All other species have two apical tubercles. Sometimes *P. cardo* has three apical tubercles. *Pachymerus bactris* and *P. sveni* have eyes approximate (close together), *P. bridwelli*, *P. nucleorum* and *P. thoracicus* have eyes distant (far apart), while the distance between the eyes are intermediate on *P. abruptestriatus* and on *P. cardo*. The color of the setae is also a good character to separate some species. The golden setae contrasting with surrounding strial intervals along mesal margin of elytron, often appearing as a light colored band, in *P. bactris* cannot be confused. The coarse pale yellow pubescence on *P. abruptestriatus* is also very distinctive. The best character to identify *P. sveni* is the produced bend and sinuated carina on the metafemur. A similar structure also exists on the metafemur of male *P. bactris*, but the length of the leg segment is shorter in *P. sveni*. For morphometrical comparisons see Table 2. Note the longer pygidium of *P. bridwelli* and the wider pronotal disk of *P. thoracicus*.

SYSTEMATIC RELATIONSHIPS

The Bruchidae are closely related to the Chrysomelidae. Some researchers, primarily those of the Chrysomelidae (e.g. Monros 1959; Lawrence and Newton 1982; Schmitt 1985; 1989, 1990), believe that the seed beetles should be included as a subfamily in the Chrysomelidae, and some even as a tribe in the subfamily Sagrinae (e.g. Monros 1959). Others believe that the Bruchidae is a valid family, but if so the large leaf beetle family should be split into smaller families (Lawrence and Newton 1982), to conform with the definition of a monophyletic group.

Schmitt (1989) stated that the Bruchidae should be included as a subfamily in the Chrysomelidae. However, the bruchids he studied and used to find both synapomorphies and symplesiomorphies were *Acanthoscelides obtectus*, *Callosobruchus maculatus*, *Gibbobruchus mimus*, and *Spermophagus sericeus*. We believe these bruchids are all so called advanced species. He used characters from these groups to separate bruchids and other groups from Monrós (1985) "Crioceriformes". He stated that "similarities between these groups [Megalopodinae, Orsodacninae, and Bruchidae] and certain "Crioceriformes" can be shown with, e.g., pronotum without side margin, emarginated eyes, and tegminal parameres," which he stated are plesiomorphies. We believe these are apomorphic character states and that Schmitt should have studied the Pachymerini, and possibly also *Amblycerus* Thunberg, to find better characters since they are primitive groups.

Beetles in the Sagrinae are usually considered to be the closest relatives of the Pachymerinae (Crowson 1960; Monros 1959; Lawrence and Newton 1982; Kingsolver, pers. comm.). The Sagrinae genera *Carpophagus* and *Duboulaya* are considered primitive beetles and could have had a possible common ancestor with a primitive bruchid ancestor, while *Sagra* is an advanced group and not closely related to the Bruchidae (Monros 1959). *Sagra* has bright metallic colors, usually green, while the primitive leaf beetles are usually colored brown and have a general elongated appearance similar to the most primitive pachymerine tribe, the Pachymerini. They also have characters in common such as lateral carinae (Figs. 43, 44) and a marginal line on the pronotum (Fig. 12). These do not occur in other Chrysomelid groups (Monros 1959).

Nilsson (1992) further discussed several aspects of systematic relationships, cladistics, biogeographical history, morphological terminology, nomenclature and problems with type material, not included here.

ACKNOWLEDGMENTS

The first author wishes to express special thanks to both his parents. Very special thanks are expressed to the first author's wife Judith Lee Nilsson for editing early drafts of the manuscript, and for assisting with interlibrary loans. Our gratitude is also extended to J.M. Kingsolver, Systematic Entomology Laboratory, U.S. Department of Agriculture, for comments on the manuscript and help with special problems, and to S.L. Shute, The Natural History Museum, London, for help with specimens at the Linnaean Collection. Thanks also to our colleagues at the Department of Biological Sciences, Northern Arizona University, for invaluable discussions. We express appreciation to T. Ayers, C. Slobodchikoff, and M. Wagner, Northern Arizona University, P. M. Marsh, Systematic Entomology Laboratory, U.S. Department of Agriculture, and two anonymous reviewers, for reviewing early drafts of the manuscript. The study was partially funded by two grants from Sigma Xi and by a Summer Research Fellowship at Northern Arizona University.

Our thanks also to the following 51 institutions or private collections (curators and acronyms used in this study are in parenthesis) that kindly loaned specimens for study (several curators and collectors assisted more than merely sending specimens): (**ABS**) Archbold Biological Station, Lake Placid, FL, U.S.A. (Mark A. Deyrup); (**ANSP**) Academy of Natural Sciences, Philadelphia, PA, U.S.A. (Donald Azuma); (**AMNH**) American Museum of Natural History, New York, NY, U.S.A. (Lee H. Herman); (**BM**) Bishop Museum, Honolulu, HI, U.S.A. (G.A. Samuelson); (**BMNH**) The Natural History Museum, London, United Kingdom (S.L. Shute); (**BOR**) Bordon Collection, Maracay, Venezuela; (**BP**) Borgtoft Pedersen Collection, Institute of Biological Sciences, University of Aarhus, Denmark; (**BR**) Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina (Axel. O. Bachmann); (**CAS**) California Academy of Sciences,

San Francisco, CA, U.S.A. (David H. Kavanaugh); (**CDFA**) California Department of Food and Agriculture, Sacramento, CA, U.S.A. (Terry N. Seeno); (**CDJ**) C.D. Johnson Collection, Flagstaff, AZ, U.S.A.; (**CMNH**) Carnegie Museum of Natural History, Pittsburgh, PA, U.S.A. (John E. Rawlins); (**CNC**) Canadian National Collection, Ottawa, Canada (Jean McNamara); (**COR**) Cornell University, Ithaca, N.Y. U.S.A. (James K. Liebherr); (**CWO**) Charles W. O'Brien, Florida A&M University, Tallahassee, FL, U.S.A.; (**FDA**) Florida Department of Agriculture, Gainesville, FL, U.S.A. (M.C. Thomas); (**FML**) Fundación Miguel Lillo, Tucumán, Argentina (Arturo L. Terán); (**FMNH**) Field Museum of Natural History, Chicago, IL, U.S.A. (Philip P. Parrillo); (**IDA**) College of Idaho, Caldwell, ID, U.S.A. (William H. Clark); (**JAN**) Jan A. Nilsson Collection, first author's personal collection; (**JRN**) Jesus Romero-Napoles Collection, Chapingo, Mexico; (**KZ**) Katedra Zoologii, Cybulskiego, Wroclaw, Poland (Lech Borowiec); (**LBS**) California State University, Long Beach, Long Beach, CA, U.S.A.; (**LSU**) Louisiana State University, Baton Rouge, LA, U.S.A. (Cheryl B. Barr, Joan B. Chapin and Vicky L. Moseley); (**MCZ**) Museum of Comparative Zoology, Harvard University, Cambridge, MA, U.S.A. (Cleone T. Graham); (**MIC**) University of Michigan, Ann Arbor, MI, U.S.A.; (**MNHP**) Muséum National d'Histoire Naturelle, Paris, France (Nicole Berti); (**MOSC**) Moscow State University, Moscow, Russia (N.B. Nikitsky); (**MRAC**) Musée Royal de l'Afrique Centrale, Tervuren, Belgium (Jean Decelle); (**MSU**) Michigan State University, MI, U.S.A.; (**MVNH**) Museum of Victoria Natural History, Abbotsford, Victoria, Australia (A. Neboiss, C. McPhee, Ken Walker); (**NHMLA**) Natural History Museum of Los Angeles County, Los Angeles, CA, U.S.A. (Roy R. Snelling); (**NR**) Naturhistoriska Riksmuseet, Stockholm, Sweden (Per Lindskog); (**ORST**) Muséum National d'Histoire Naturelle, ORSTOM, Paris, France (Alex Delobel); (**PUC**) Pontificia Universidad Católica del Ecuador, Quito, Ecuador (Giovanni Onore); (**RIL**) E.G. Riley Collection, Texas A&M, College Station, TX, U.S.A.; (**SDNHM**) San Diego Natural History Museum, San Diego, CA, U.S.A. (David K. Faulkner); (**STRI**) Smithsonian Tropical Research Institute, Balboa, Panama (Nick Smythe and Joe Wright); (**TAM**) Texas A & M University, College Station, TX, U.S.A. (Edward G. Riley); (**TURN**) R.H. Turnbow Jr. Collection, Ft. Rucker, AL, U.S.A.; (**UA**) University of Arizona, Tucson, AZ, U.S.A. (Floyd G. Werner and Carl A. Olson); (**UCD**) University of California at Davis, Davis, CA, U.S.A. (Robert Schuster); (**UCV**) Universidad Central de Venezuela, Maracay, Venezuela; (**UFDP**) Universidade Federal do Paraná, Curitiba, Brazil (Cibele Stramare Ribeiro Costa); (**UGA**) University of Georgia, Athens, GA, U.S.A. (Cecil L. Smith); (**UL**) University of Lund, Lund, Sweden (Roy Danielsson); (**USNM**) U.S. National Museum of Natural History, Washington, D.C., U.S.A. (J. M. Kingsolver); (**UU**) University of Uppsala, Uppsala, Sweden (Sten Jonsson); (**UZMC**) Universitetets Zoologisk Museum, Copenhagen, Denmark (Ole Martin); (**WAPP**) J. Wappes Collection, Chadds Ford, PA, U.S.A.; (**ZONA**) S. Zona Collection, University of Florida at Gainesville, FL, U.S.A.

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Only the New World tribe Pachymerini is revised. *Caryedon serratus* (Olivier) and its synonyms, in the Old World tribe Caryedini, are excluded from the list, even though this species now is established in the New World. The fossil genus *Oligobruchus* Kingsolver is also excluded from the list, but it is mentioned briefly in the text (see TAXONOMIC HISTORY). It is also included in the distribution map (Fig. 1).

INDEX TO NAMES OF TAXA
(Valid names are in boldface)

Table 1. Plant families fed upon by bruchid larvae.

Acanthaceae	Combretaceae	Nyctaginaceae
Anacardiaceae	Convolvulaceae	Nymphaceae
Apiacea	Dioscoreaceae	Ochnaceae
Arecaceae	Ebenaceae	Onagraceae
Asteraceae	Euphorbiaceae	Pandanaceae
Bignoniaceae	Fabaceae	Rhamnaceae
Bixaceae	Lauraceae	Sterculiaceae
Bombacaceae	Lythraceae	Tiliaceae
Boraginaceae	Malpighiaceae	Verbenaceae
Cistaceae	Malvaceae	Vitaceae
Cochlospermaceae	Myrtaceae	Zygophyllaceae

Table 2. Taxonomically important length/width ratio means of Pachymerini species, males (n=10). 1, pronotum disk; 2, metafemur; 3, pygidium.

Genus Species	1	2	3
Caryoborus			
chiriquensis	0.79	1.95	1.16
gracilis	0.81	2.07	1.32
serripes	0.81	2.02	1.11
Caryobruchus			
curvipes	0.73	1.92	0.70
gleditsiae	0.69	1.94	0.74
marieae	0.72	1.79	1.00
maya	0.68	1.90	0.89
ubidus	0.72	1.91	0.70
veseyi	0.78	2.60	0.76
Speciomerus			
giganteus	0.84	2.13	1.02
revoili	0.74	2.05	0.79
rubrofemoralis	0.80	2.05	0.96
ruficornis	0.81	2.08	0.92
Pachymerus			
abruptestriatus	0.69	1.86	0.74
bactris	0.70	1.97	1.00
bridwelli	0.78	1.95	1.10
cardo	0.72	1.65	1.00
nucleorum	0.80	1.81	0.89
sveni	0.71	1.74	0.83
thoracicus	0.66	1.74	0.75

1

2

Figs. 1-2. 1, Geographical distribution of (**1**) *Caryoborus chiriquensis* Sharp, (**2**) *C. gracilis* Nilsson, (**3**) *C. serripes* (Sturm), and (**4**) *Oligobruchus* Kingsolver, fossil (Florissant formation, Oligocene). 2, Geographical distribution of (**1**) *Speciomerus giganteus* (Chevrolat), (**2**) *S. revoili* (Pic), (**3**) *S. rubrofemoralis* (Pic), and (**4**) *S. ruficornis* (Germar).

3

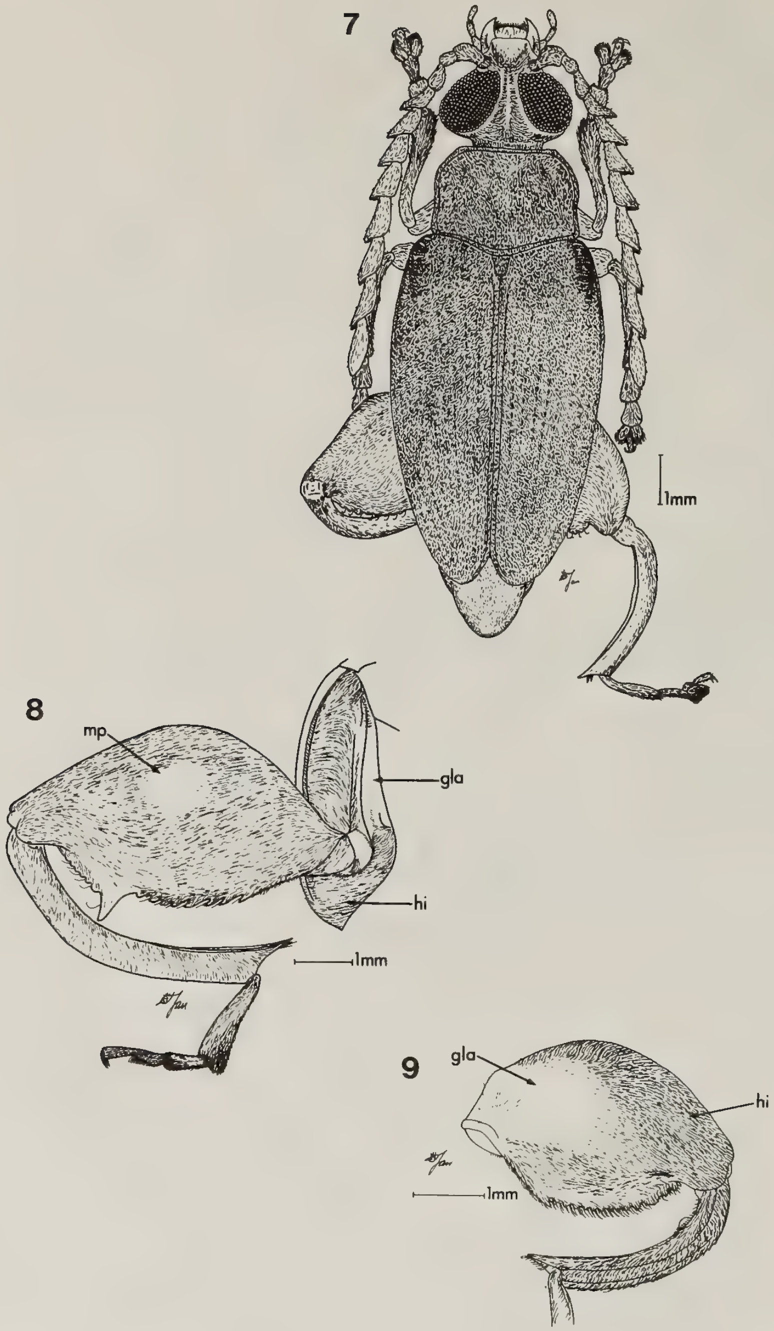
4

Figs. 3-4. 3, Geographical distribution of (**1**) *Caryobruchus gleditsiae* (Johansson and Linné), (**2**) *C. marieae* Nilsson and Johnson, (**3**) *Pachymerus abruptestriatus* (Gyllenhal *in* Schönherr), and (**4**) *P. bridwelli* (Prevett). 4, Geographical distribution of (**1**) *Caryobruchus curvipes* (Latreille), (**2**) *C. rubidus* (Chevrolat), and (**3**) *Pachymerus nucleorum* (Fabricius).

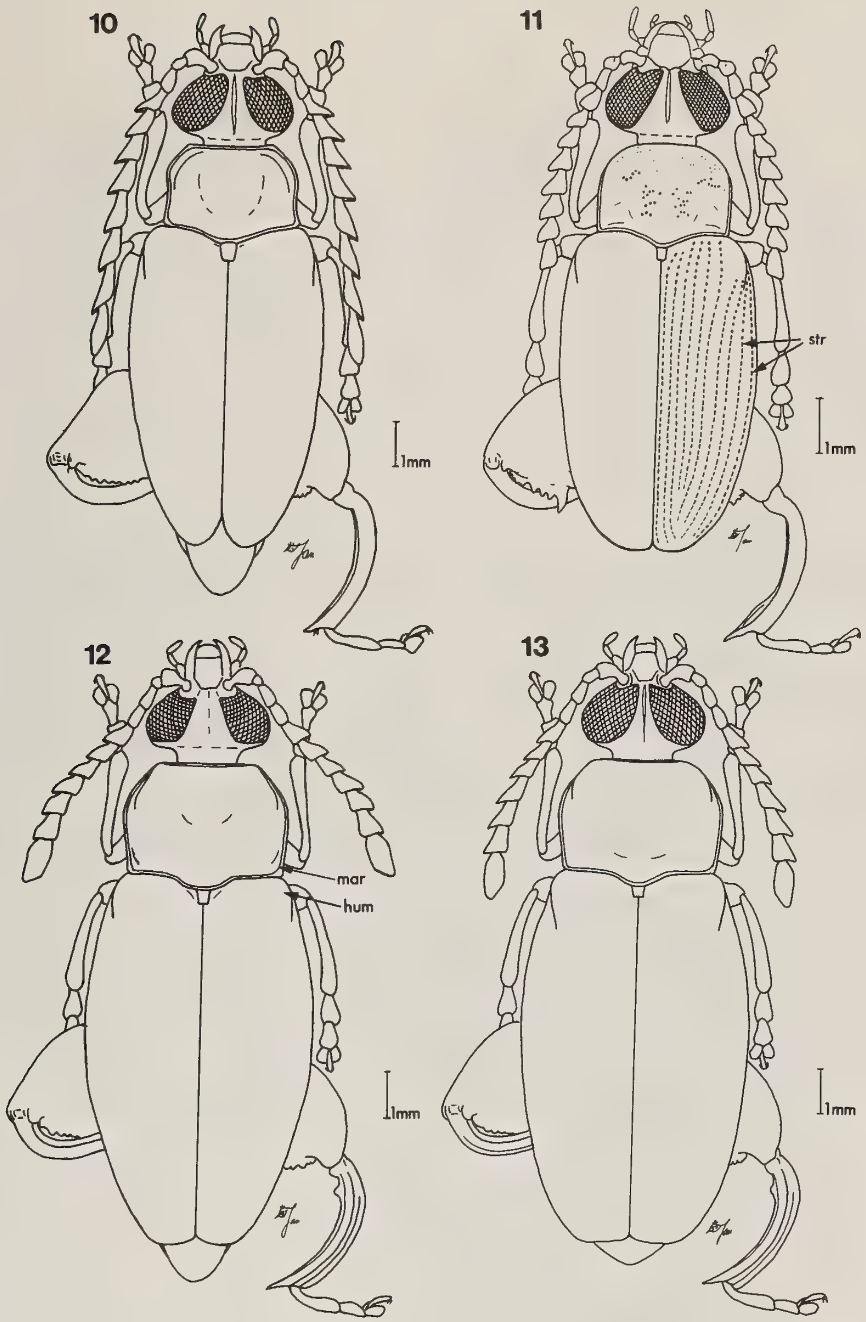
5

6

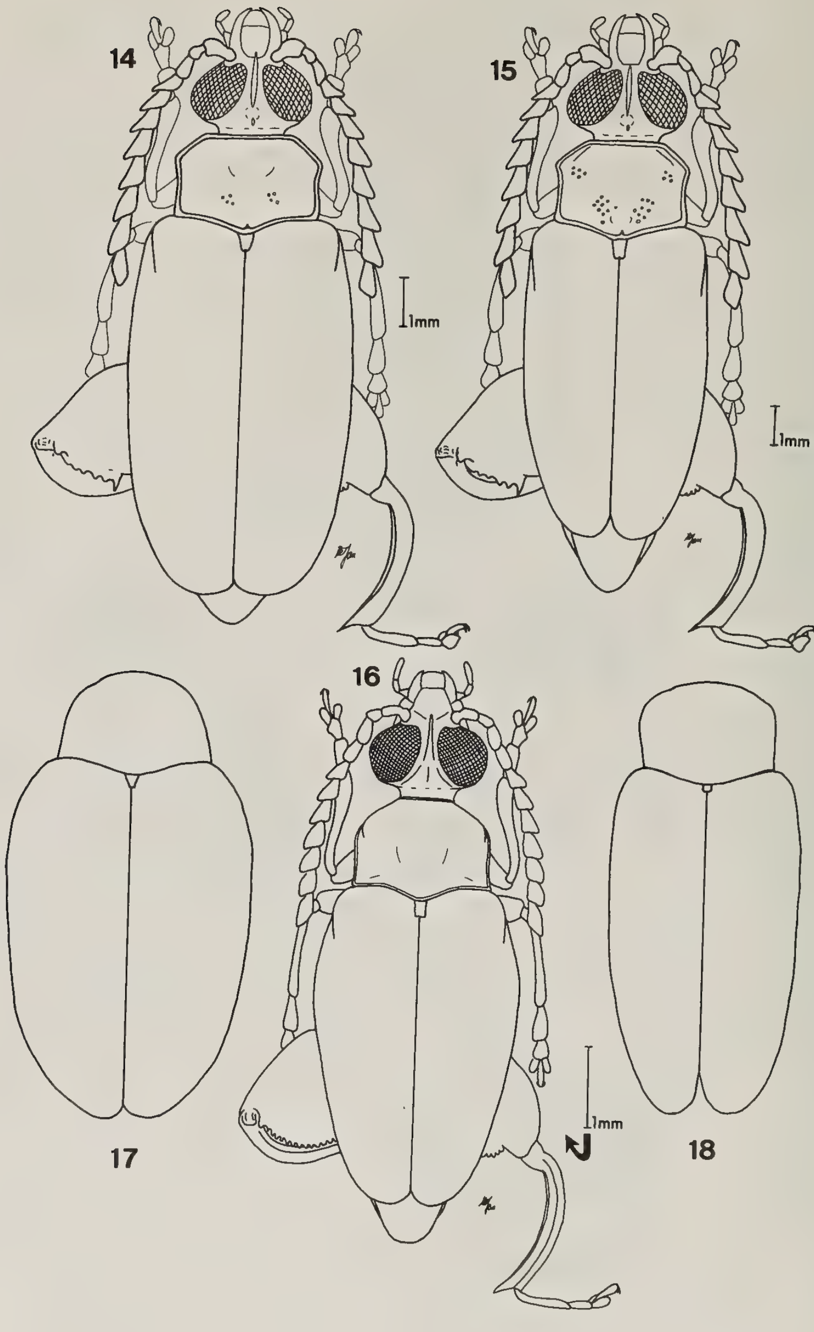
Figs. 5-6. 5, Geographical distribution of (1) *Caryobruchus veseyi* (Horn), (2) *C. maya* Nilsson, and (3) *Pachymerus sveni* Nilsson. 6, Geographical distribution of (1) *P. thoracicus* Prevett, (2) *P. bactris* (Linné *in* Jacquin), and (3) *P. cardo* (Fåhraeus *in* Schönherr).



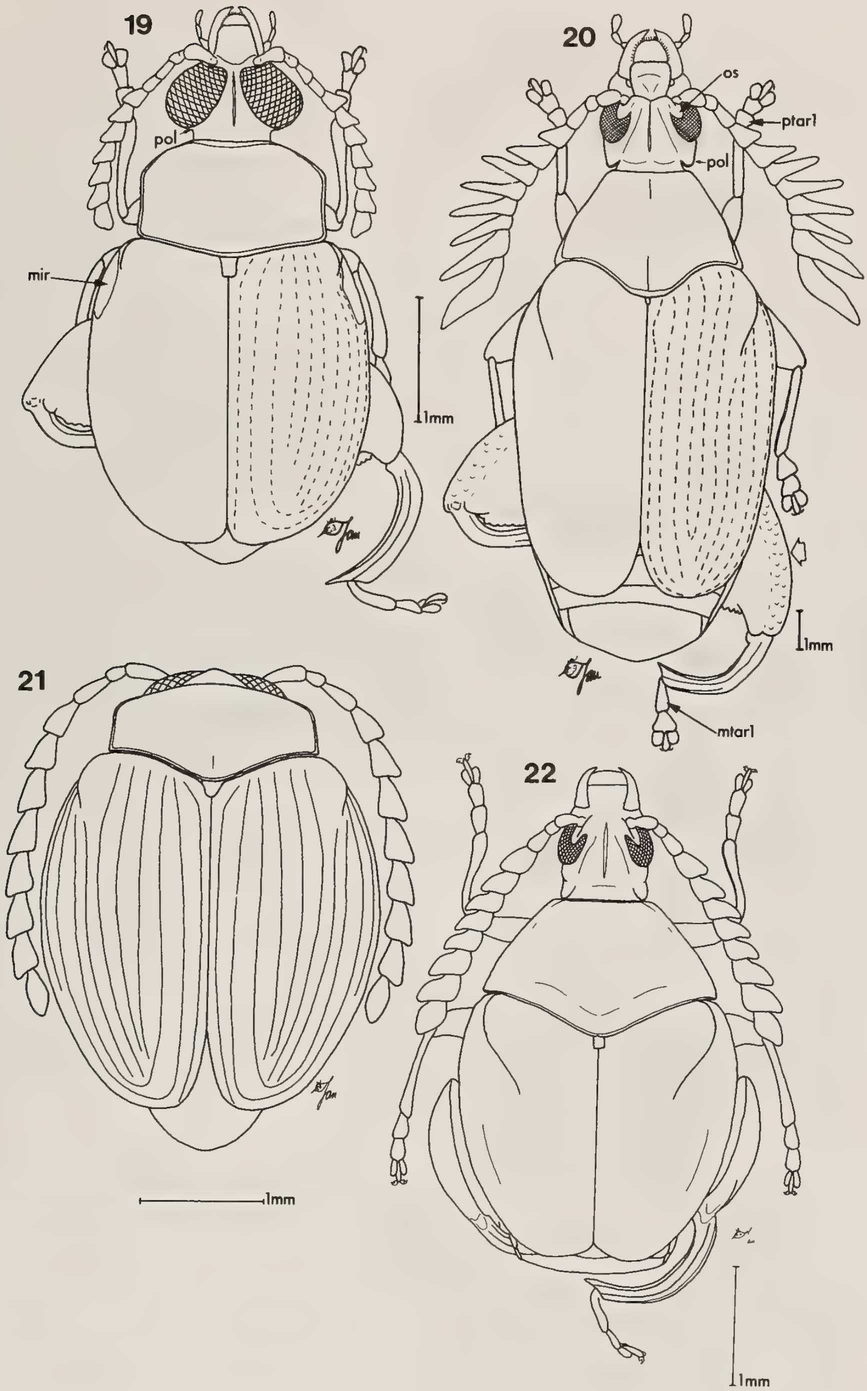
Figs. 7-9. 7, *Caryoborus serripes* (Sturm), habitus with setae, dorsal view. 8, *Speciomerus giganteus* (Chevrolat), hind leg with setae, lateral view. 9, *Pachymerus sveni* Nilsson, hind leg with setae, mesal view. Abbreviations: gla = glabrous, mp = micropunctulate (due to loss of setae), hi = hirsute.



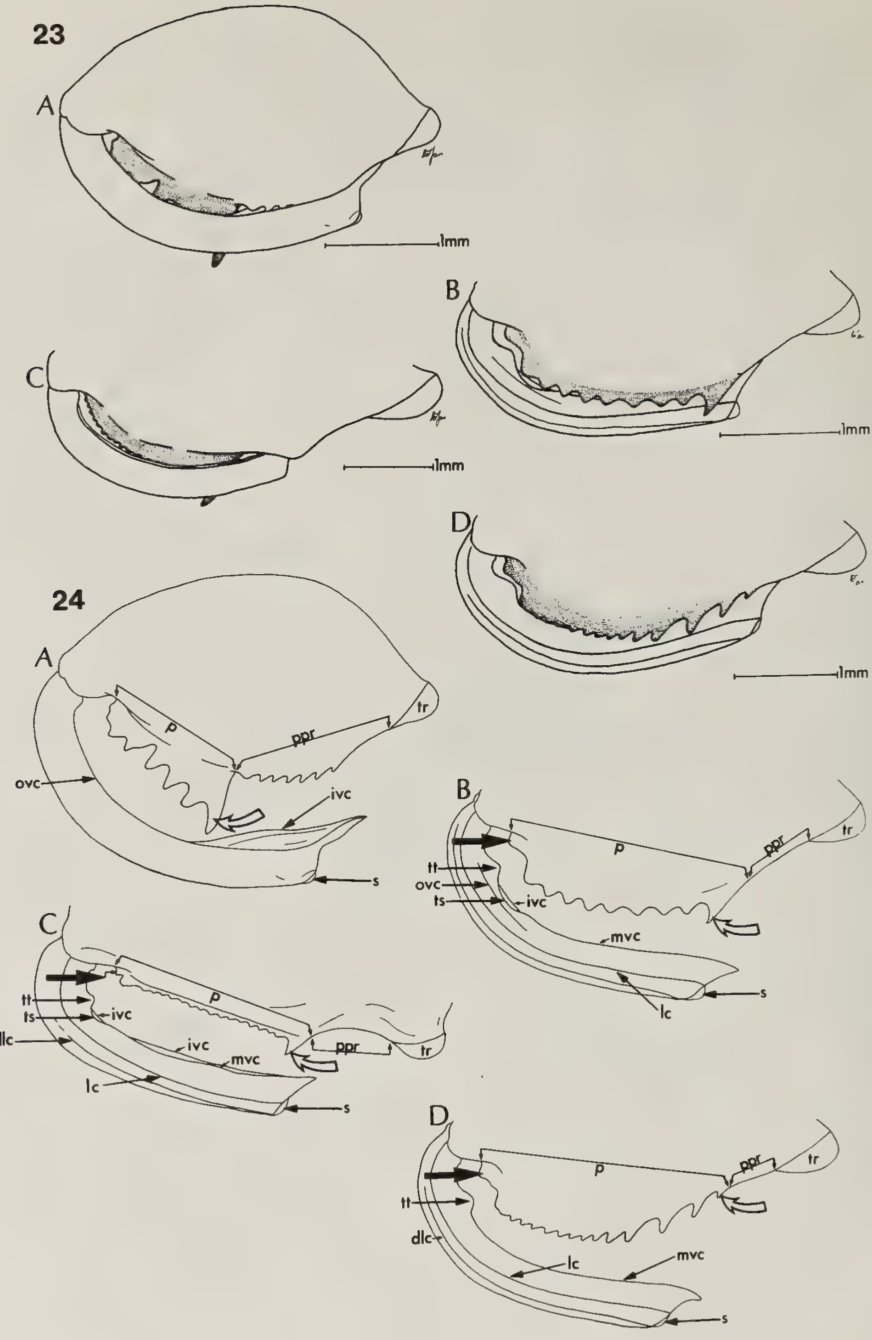
Figs. 10-13. Adult pachymerine bruchids, dorsal view. 10, *Caryoborus serripes* (Sturm). 11, *Caryobruchus marieae* Nilsson and Johnson. 12, *Pachymerus bridwelli* (Prevett). 13, *P. nucleorum* (Fabricius). Abbreviations: mar = marginal line on pronotum disk.



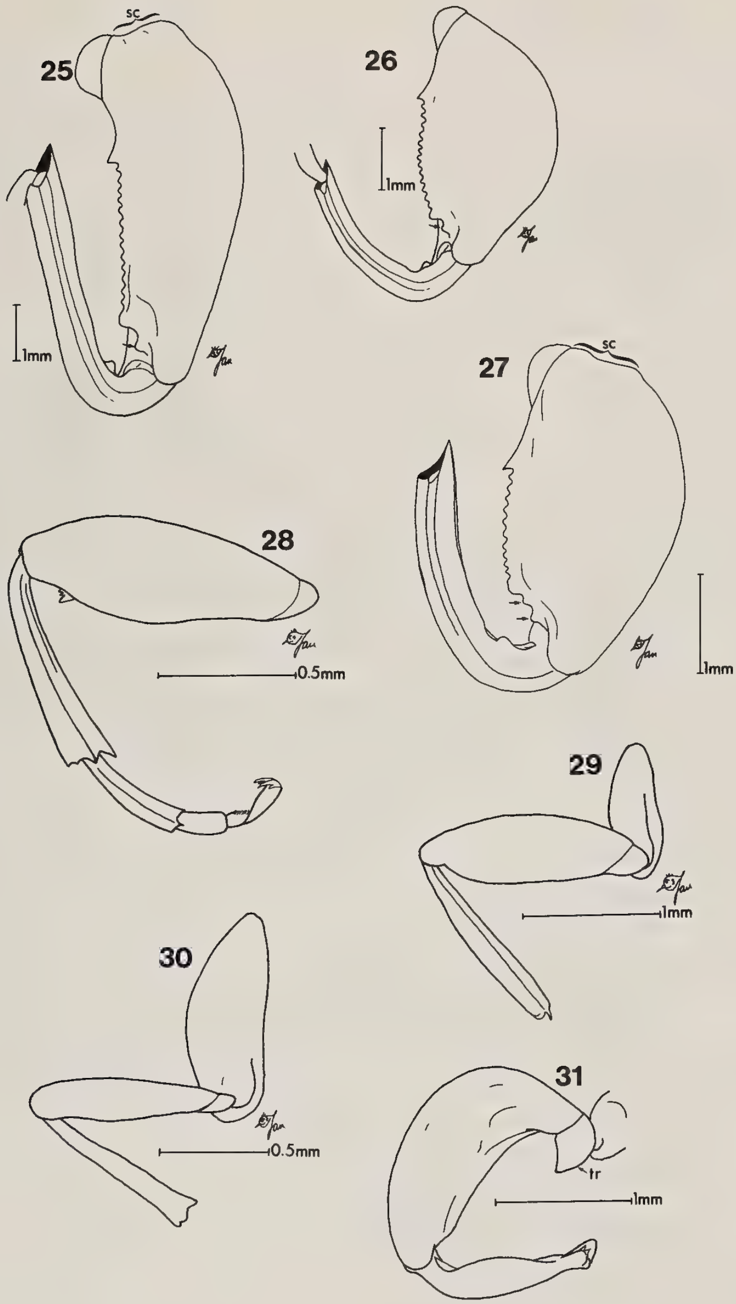
Figs. 14-18. Adult pachymerine bruchids, dorsal view. 14, *Speciomerus revoili* (Pic). 15, *S. giganteus* (Chevrolat). 16, *Caryedon serratus* (Olivier). 17, *Mimocaryedon freyi* Decelle. 18, *Caryotrypes pandani* (Blanchard).



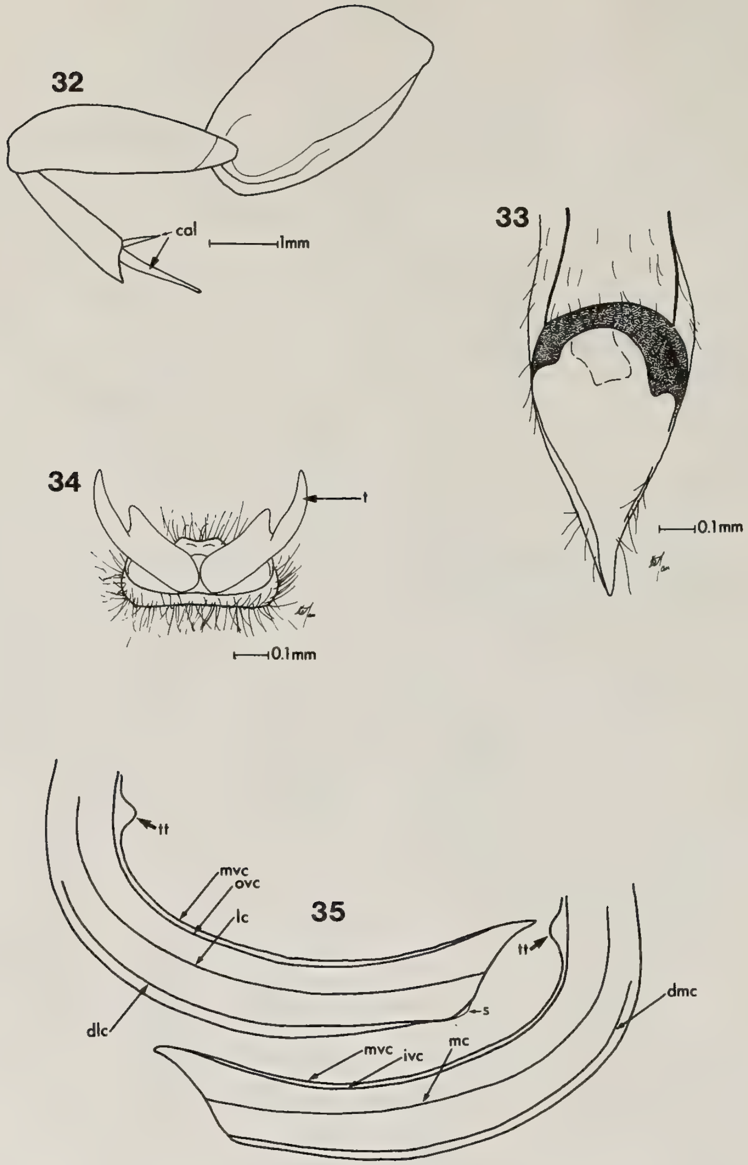
Figs. 19-22. Adult pachymerine bruchids, dorsal view. 19, *Afroredon africanus* Decelle. 20, *Caryopemon giganteus* Pic. 21. *Exoctenophorus deflexicollis* Decelle. 22. *Diegobruchus rubroguttatus* (Fairmaire). Abbreviations: mir = miroir (glabrous field; only in females), oc = ocular sinus, pol = post ocular lobe, ptar1 = protarsus segment 1. Large open arrow = granulated dorsal side of metafemur on *Caryopemon*.



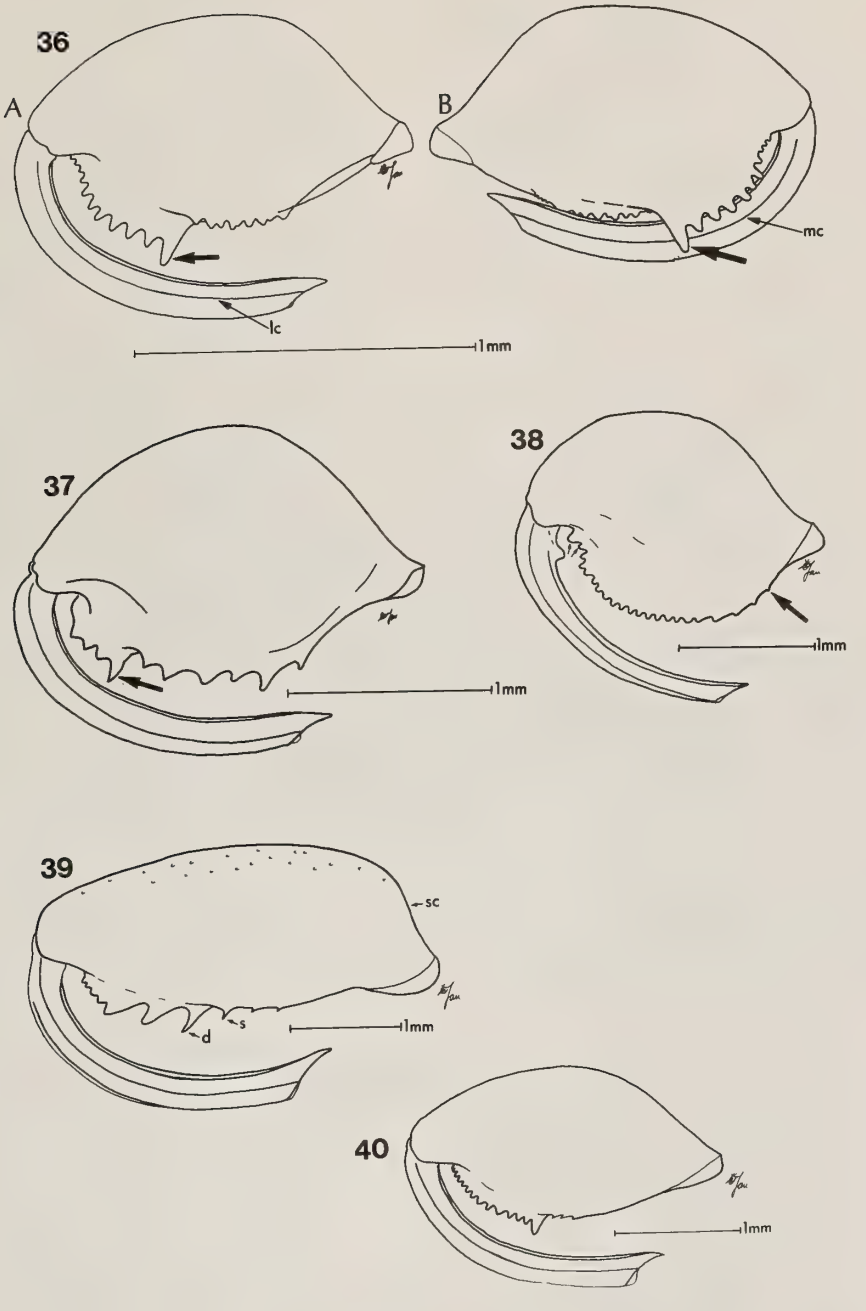
Figs. 23-24. 23, Hindleg, completely flexed: A, *Caryobruchus marieae* Nilsson and Johnson; B, *Pachymerus sveni* Nilsson; C, *Caryoborus serripes* (Sturm); D, *Pachymerus bridwelli* (Prevett). Shaded area = pecten. 24, Hindleg, partly extended: A, *C. marieae*; B, *P. sveni*; C, *P. bactris* (Linné), male; D, *P. bridwelli*. Abbreviations: dlc = dorsolateral carina, ivc = inner ventral carina, lc = lateral carina, mvc = middle ventral carina, ovc = outer ventral carina, p = pecten, ppr = prepectenal ridge, s = spur, tr = trochanter, ts = tibial sulcus, tt = tibial tubercle, large black arrow = apical tubercles on pecten. Large white arrow = denticle 1 on pecten.



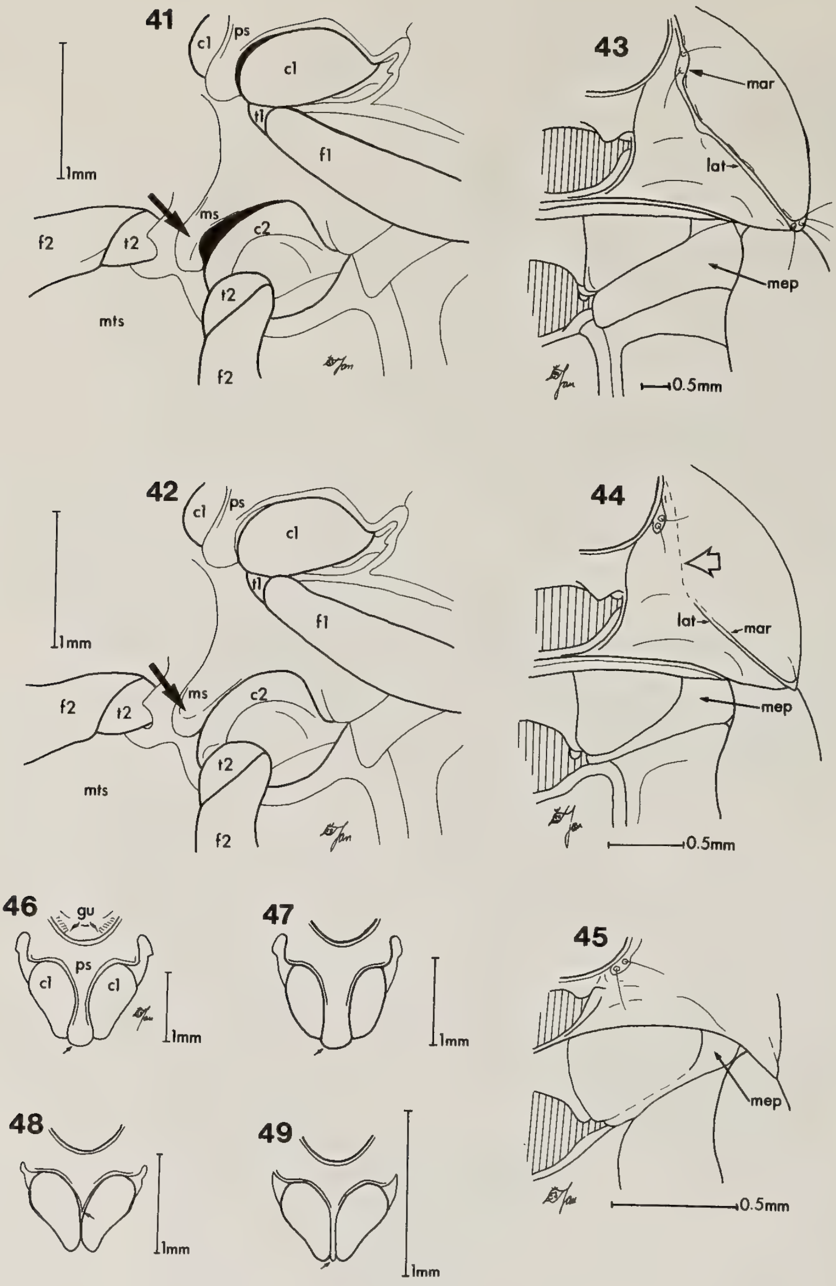
Figs. 25-31. Hind legs of Bruchidae. 25, *Pachymerus bactris* (Linné), male. 26, *P. bactris,* female. 27, *P. sveni* Nilsson. 28, *Acanthoscelides siemensi* Johnson. 29, *Eubaptus semiruber* (Pic). 30, *Kytorhinus prolixus* (Fall). 31, *Rhaebus* Fischer. Abbreviations: sc = sinuated carina, tr = trochanter. Small arrows = apical tubercles.



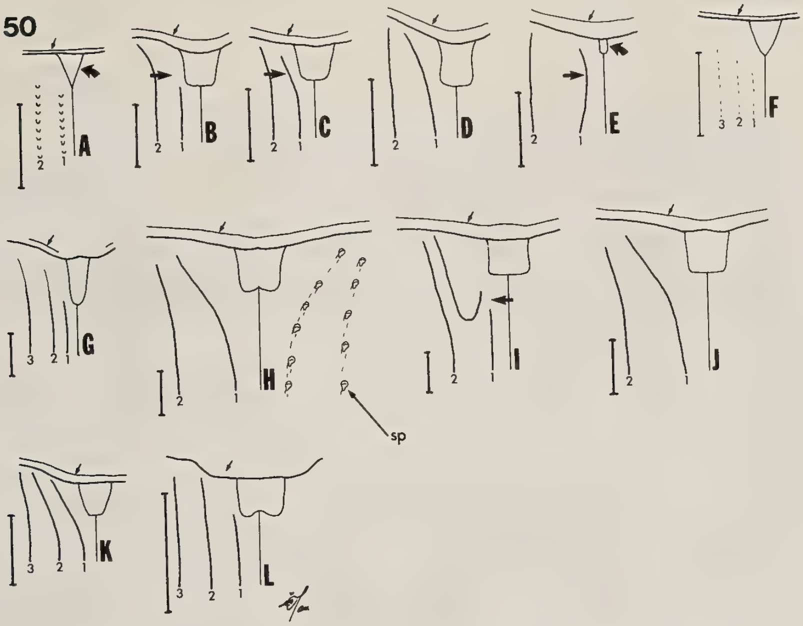
Figs. 32-35. 32, Hind leg of *Amblycerus* Thunberg. 33, Mucro of right tibia of *Pachymerus bactris* (Linné), dorsal view with spur (shaded area). 34, Last tarsomere of 1st leg, front view, of *Speciomerus giganteus* (Chevrolat). 35, Tibial carinae of an imaginary primitive Pachymerinae. Abbreviation: cal = calcaria, dlc = dorsolateral carina, dmc = dorsomesal carina, ivc = inner ventral carina, lc = lateral carina, mc = mesal carina, mvc = middle ventral carina, ovc = outer ventral carina, s = spur, t = tarsal claw, tt = tibial tubercle.

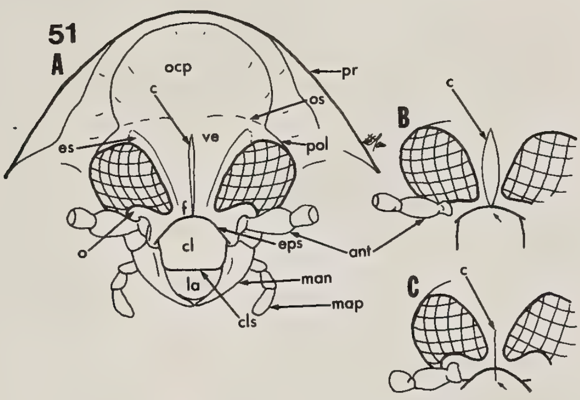


Figs. 36-40. Hind legs of Old World Pachymerinae: 36, *Afroredon africanus* Decelle: A, lateral view; B, mesal view; 37, *Diegobruchus rubroguttatus* (Fairmaire); 38, *Exoctenophorus deflexicollis* Decelle; 39, *Caryopemon giganteus* Pic; 40, *Caryedon serratus* (Olivier). Abbreviations: d = denticle (on pecten), lc = lateral carina, mc = mesal carina, s = spine (on prepectenal ridge), si = sinuated carina. Large arrow = denticle 1 on pecten, small arrows = apical tubercles.

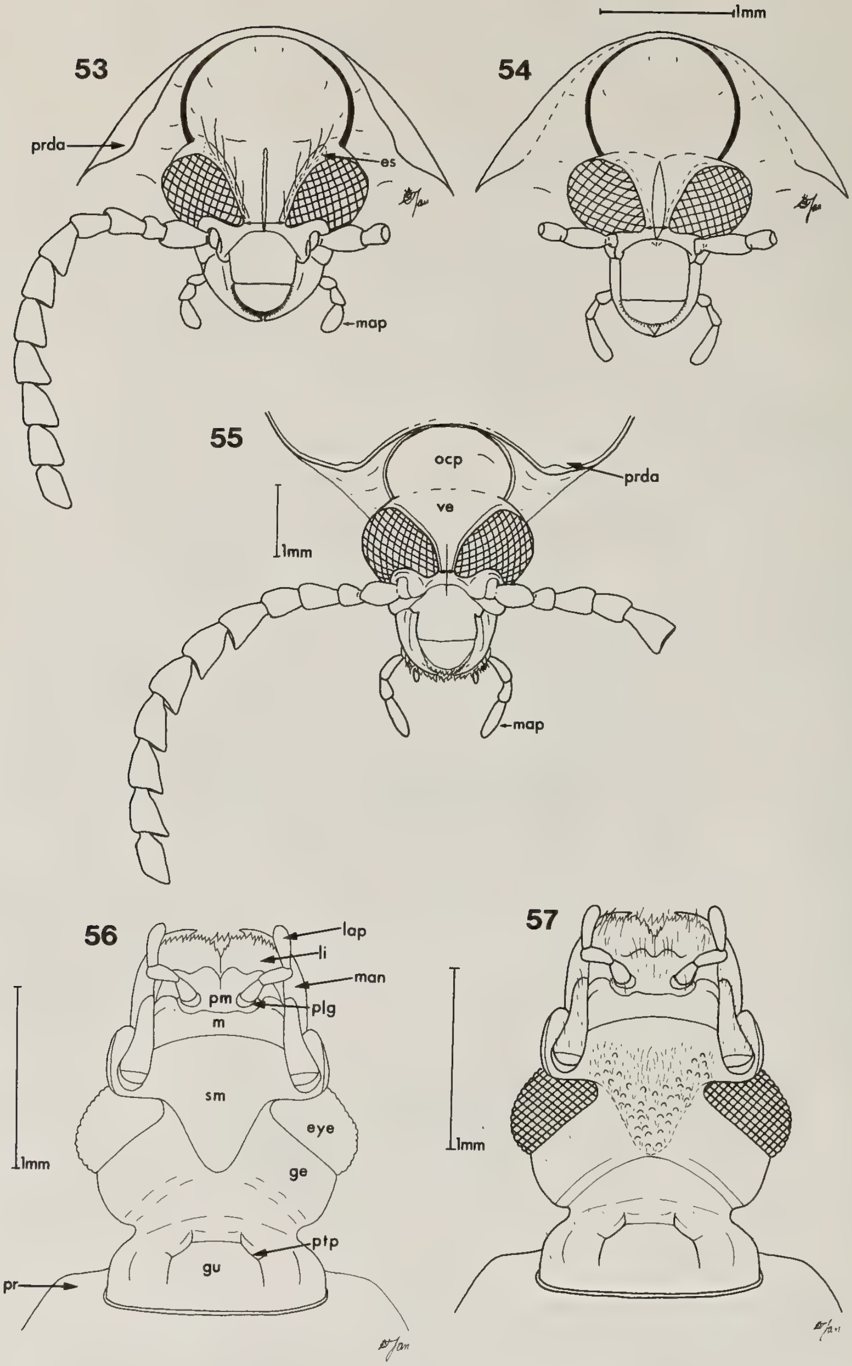


Figs. 41-49. 41, *Caryoborus serripes* (Sturm), ventral side showing mesosternal process. 42, *C. chiriquensis* Sharp, ventral side showing mesosternal process. 43, *Speciomerus revoili* (Pic), ventral and lateral side showing mesoepimeral plate and lateral carina on pronotum. 44, *Caryedon serratus* (Olivier), mesoepimeral plate and lateral carina on pronotum. 45, *Acanthoscelides macrophthalmus* (Schaeffer), mesoepimeral plate and lateral carina on pronotum. 46, *Pachymerus bactris* (Linné), prosternal process. 47, *P. abruptestriatus* (Gyllenhal), prosternal process. 48, *C. serratus*, prosternal process. 49, *Afroredon africanus* Decelle, prosternal process. Abbreviations: c1 = coxae legpair 1, c2 = coxae legpair 2, f1 = femur legpair 1, f2 = femur legpair 2, gu = gula, lat = lateral prothoracic carina, mar = marginal line, mep = mesoepimeral plate, ms = mesosternum, mts = metasternum, ps = prosternum, t1 = trochanter legpair 1, t2 = trochanter legpair 2. Large filled arrow = mesosternal process, large open arrow = incomplete carina on pronotum of *C. serratus*, small arrow = prosternal process.

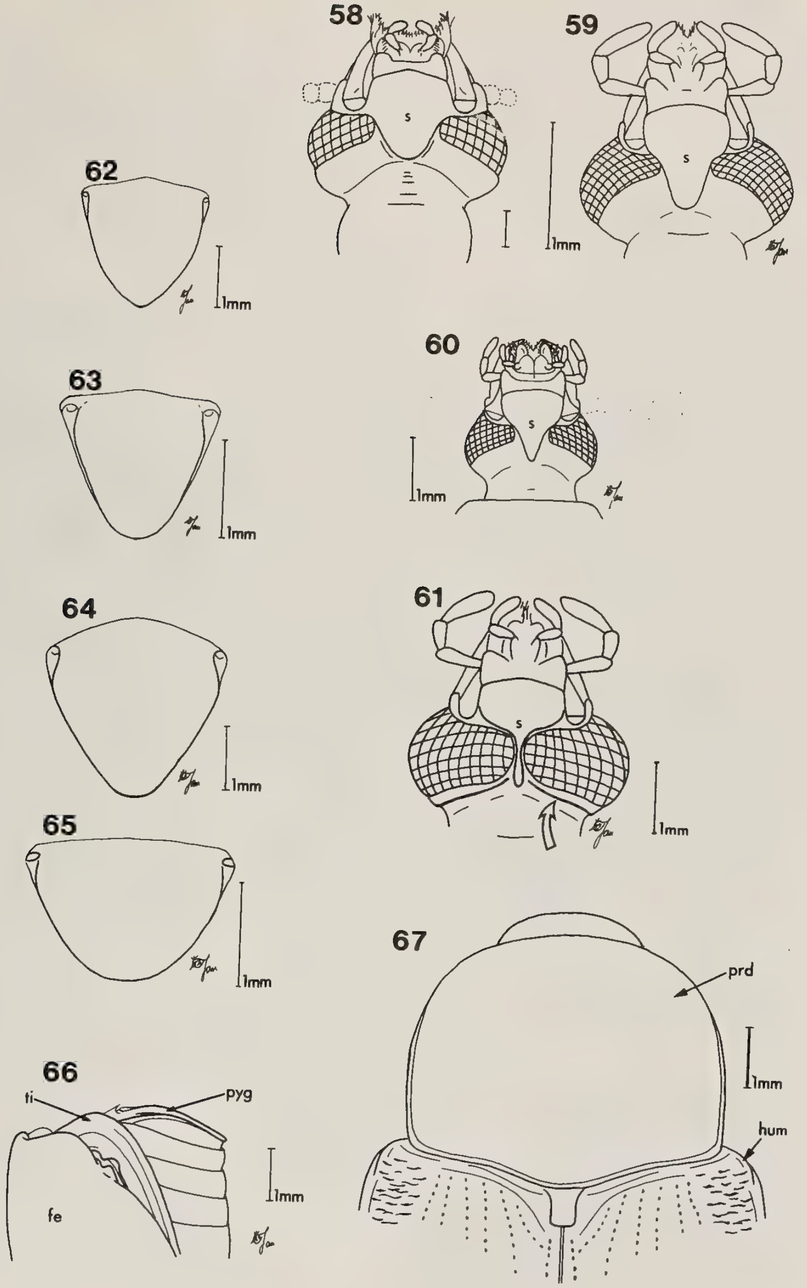




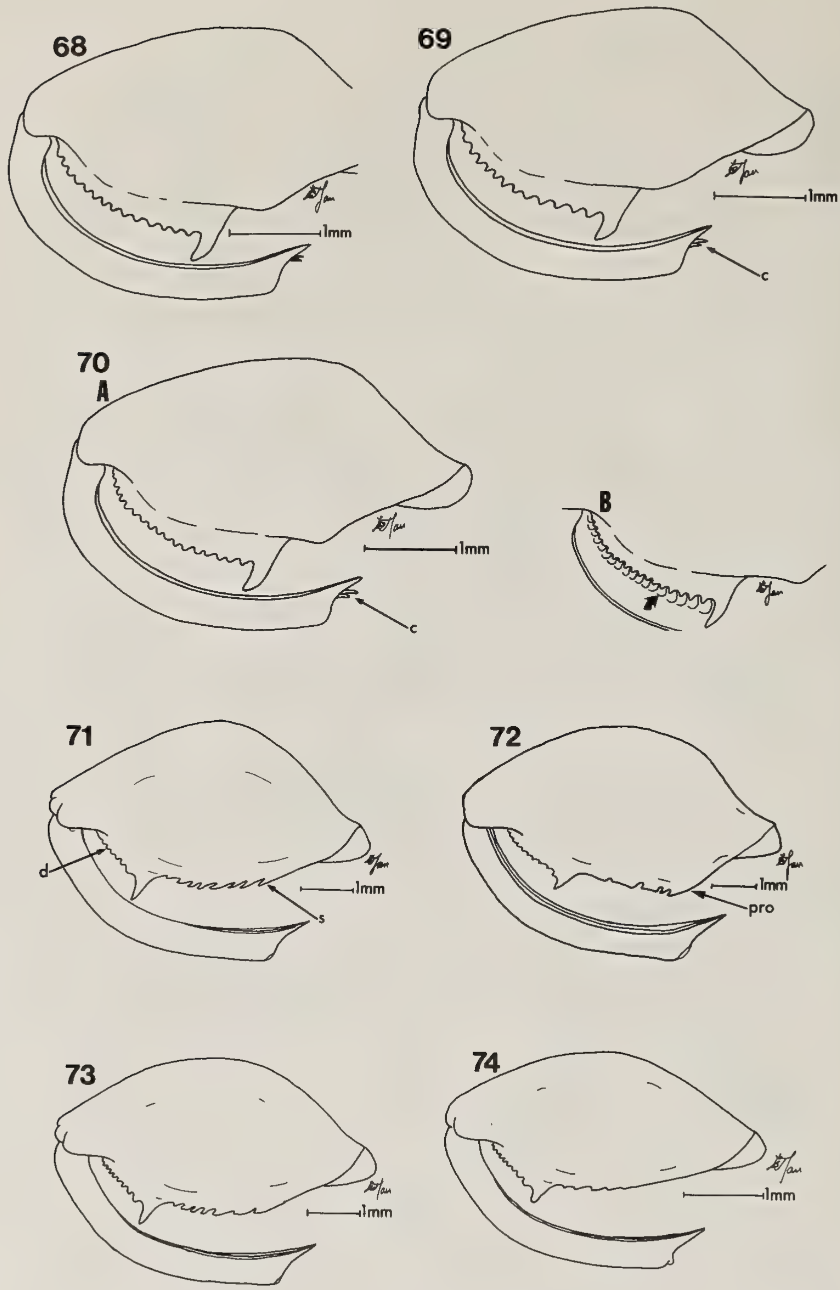
Figs. 50-52. 50, Scutellum and strial patterns at base of the elytra: A, *Rhaebus* Fischer sp.; B, *Caryedon serratus* (Olivier); C, *Afroredon africanus* Decelle; D, *Diegobruchus rubroguttatus* (Fairmaire); E, *Caryopemon giganteus* Pic; F, *Eubaptus semiruber* (Pic); G, *Amblycerus acapulcensis* Kingsolver; H, *Speciomerus revoili* (Pic); I, *Pachymerus nucleorum* (Fabricius); J, *Caryobruchus gleditsiae* (Johansson and Linné); K, *Exoctenophorus deflexicollis* Decelle; L, *Stator beali* Johnson. All scale lines = 0.5mm. Numbers indicate striae. Small arrow = presence or absence of marginal line (note remnant lines on *Amblycerus acapulcensis*), large straight arrow = special stria character, large bent arrow = special scutellum character, sp = strial puncture. 51, Head of Pachymerinae beetles: A, *P. nucleorum*; B, *C. serratus*; C, *P. bactris* (Linné). Note size difference between species of the carina on frons and vertex. 52, Left wing of *P. bactris*. Abbreviations: ant = antenna, c = carina on frons and vertex (interocular carina), cl = clypeus, cls = clypeolabral suture, eps = epistomal suture, es = eye supercilium, f = frons, la = labrum, man = mandible, map = maxillary palp, o = ocular sinus, ocp = occiput, os = occipital sulcus, pol = postocular lobe, pr = pronotum, ve = vertex.



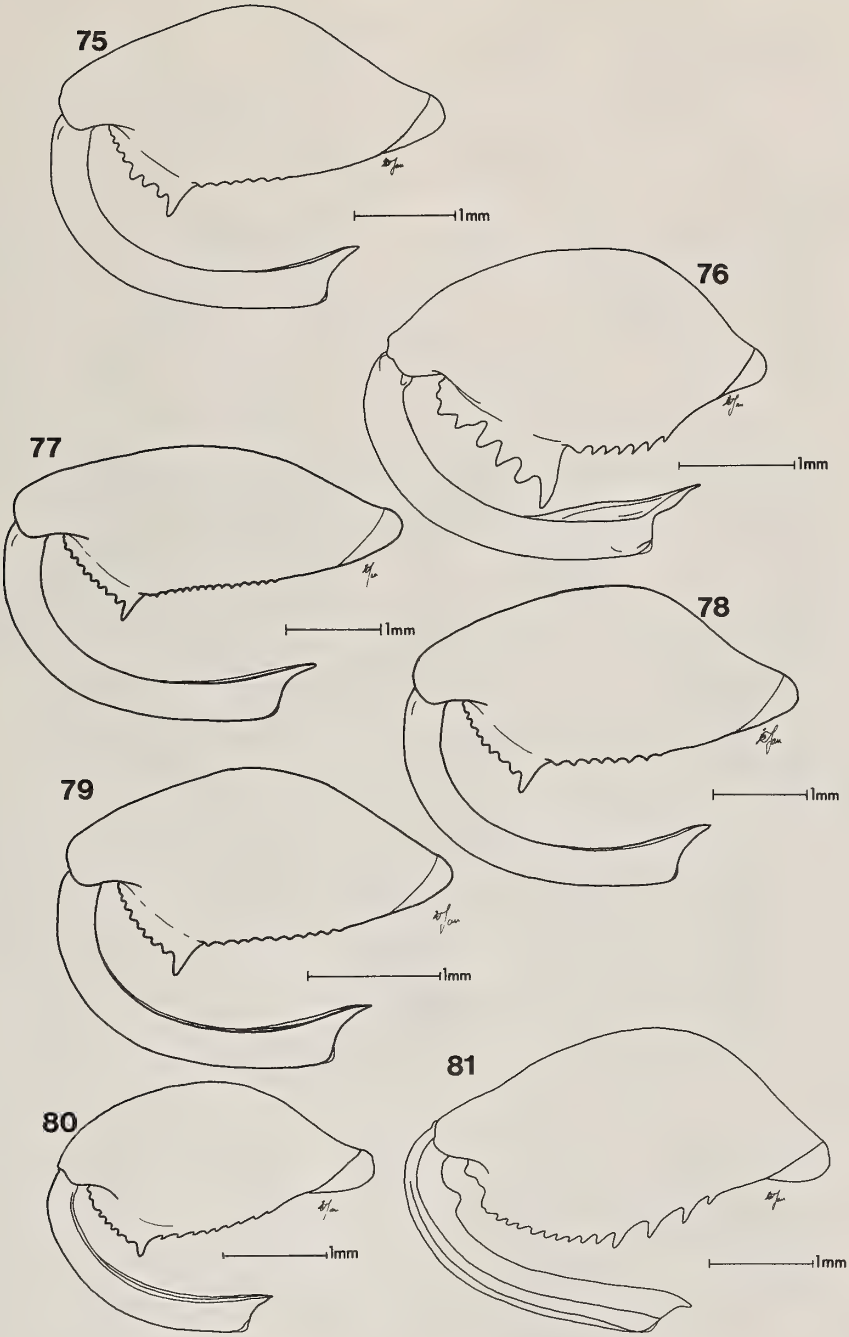
Figs. 53-57. 53-55, Frontal view of head (Figs. 53 and 54 at 90° angle to pronotum, Fig. 55 at 45° angle to pronotum): 53, *Pachymerus nucleorum* (Fabricius), with eyes distant; 54, *Caryedon serratus* (Olivier), with intermediate distance between eyes; 55, *P. bactris* (Linné), with eyes approximate. 56 - 57, Ventral side of head of *Caryobruchus gleditsiae* (Johansson and Linné). Abbreviations: es = eye supercilium, eye = compound eye, ge = gena, gu = gula, lap = labial palp, li = ligula, m = mentum, man = mandible, map = maxillary palp, ocp = occiput, plg = palpiger, pm = prementum, pr = pronotum, prda = anterior part of the pronotum disk, ptp = posterior tentorial pit, sm = submentum, ve = vertex.



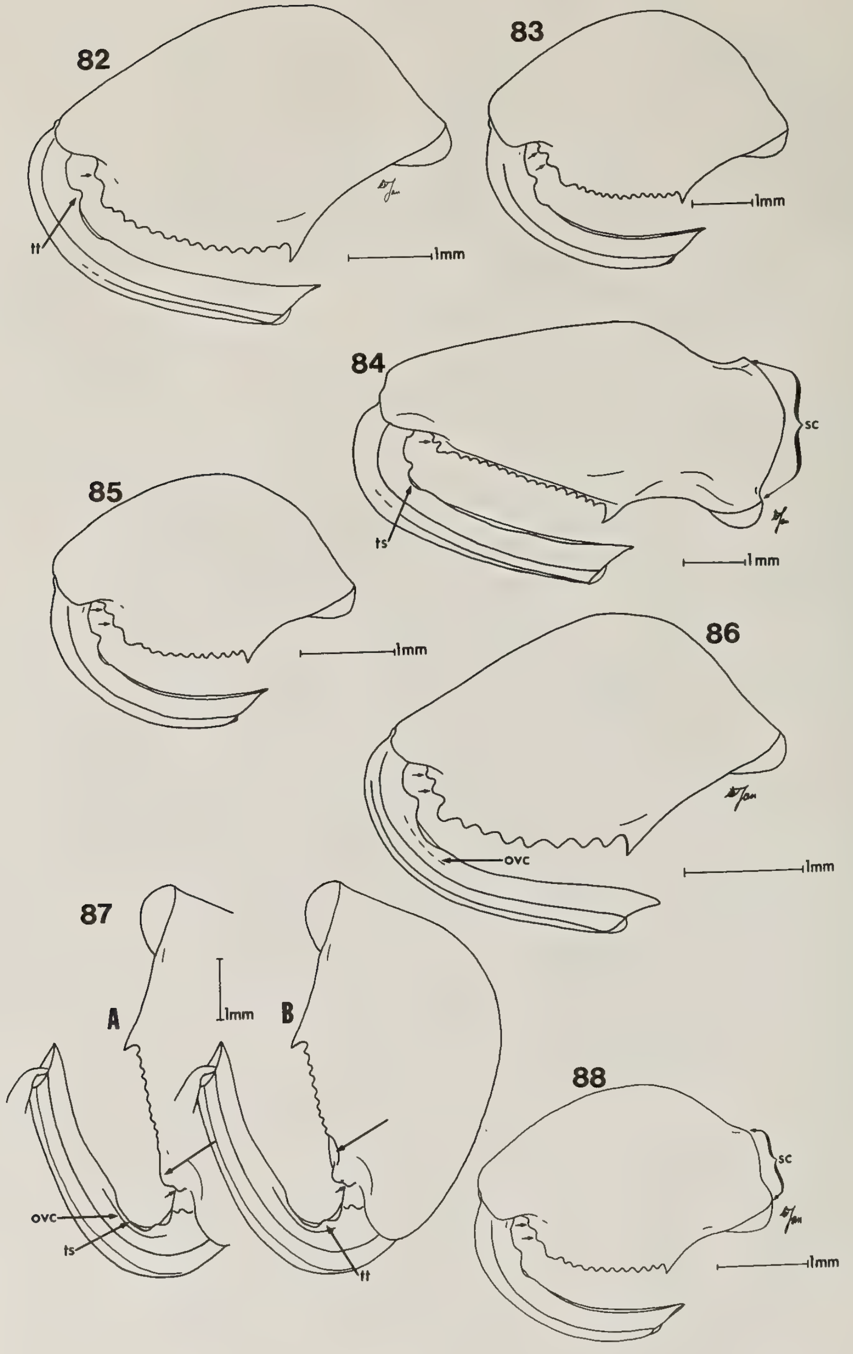
Figs. 58-67. 58-61, Ventral side of head showing variation in width of submentum: 58, *Pachymerus nucleorum* (Fabricius); 59, *P. sveni* Nilsson; 60, *P. bactris* (Linné); 61, *Speciomerus giganteus* (Chevrolat), note carina on the gena (arrow). 62-65, Pygidium of some species of Pachymerini: 62, *P. bactris*; 63, *P. sveni*; 64, *P. nucleorum*; 65, *Caryobruchus rubidus* (Chevrolat). 66, Lateral view of pygidium, *P. bactris*, male. 67, Pronotum and basal end of elytra of *P. nucleorum*. Abbreviations: fe = metafemur, hum = humerus, prd = pronotum disk, pyg = pygidium, s = submentum, ti = metatibia.



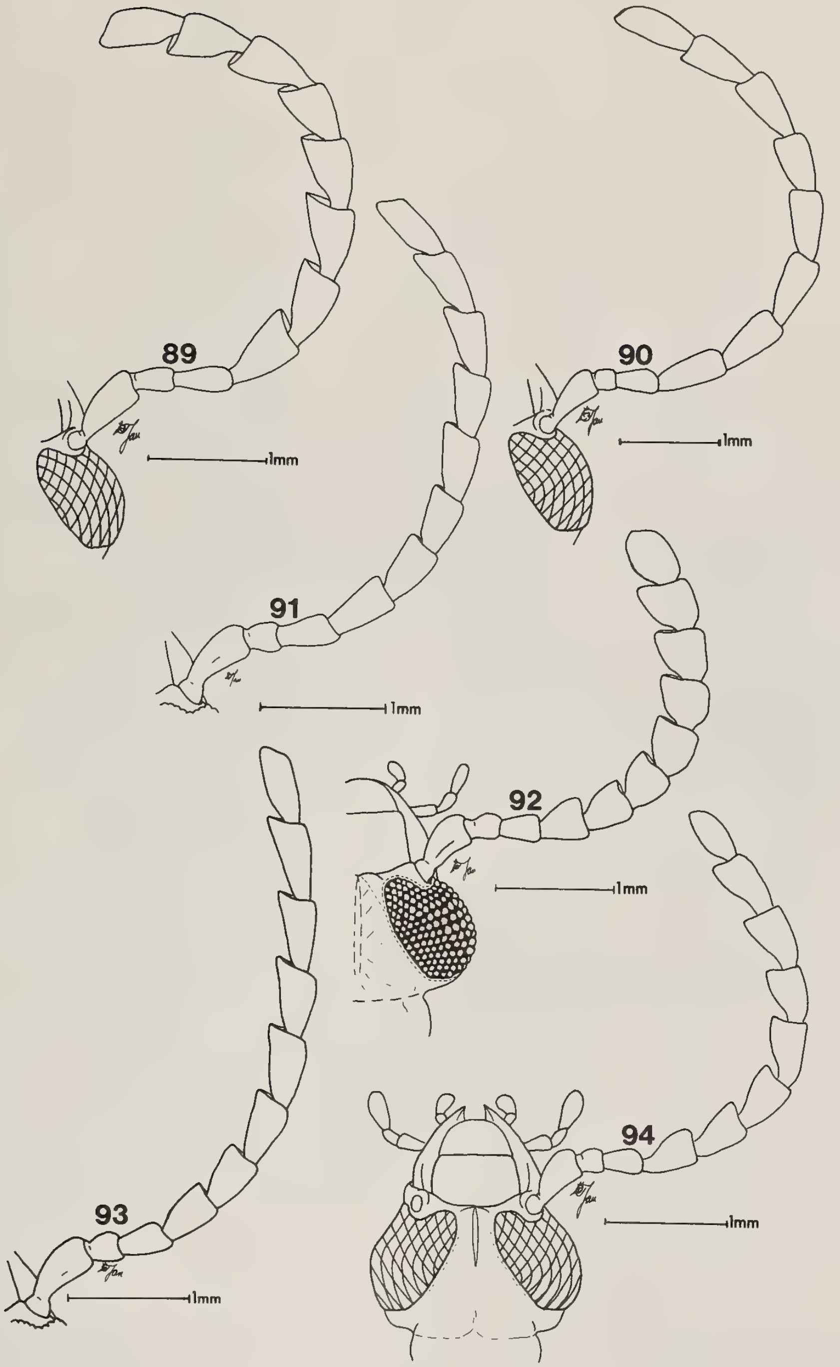
Figs. 68-74. Hind legs of Pachymerinae. 68, *Caryoborus gracilis* Nilsson. 69, *C. chiriquensis* Sharp. 70, A, *C. serripes* (Sturm); B. Detail of pecten with setae between denticles (arrow). Most pachymerine bruchids have these setae, but they are usually very short, fine and therefore hard to see (the setae have been removed from Figs. 68, - 70A). 71, *Speciomerus giganteus* (Chevrolat). 72, *S. ruficornis* (Germar). 73, *S. revoili* (Pic). 74, *S. rubrofemoralis* (Pic). Abbreviations: c = calcaria, d = denticle (on pecten), pro = protuberance, s = spine (on prepectenal ridge).



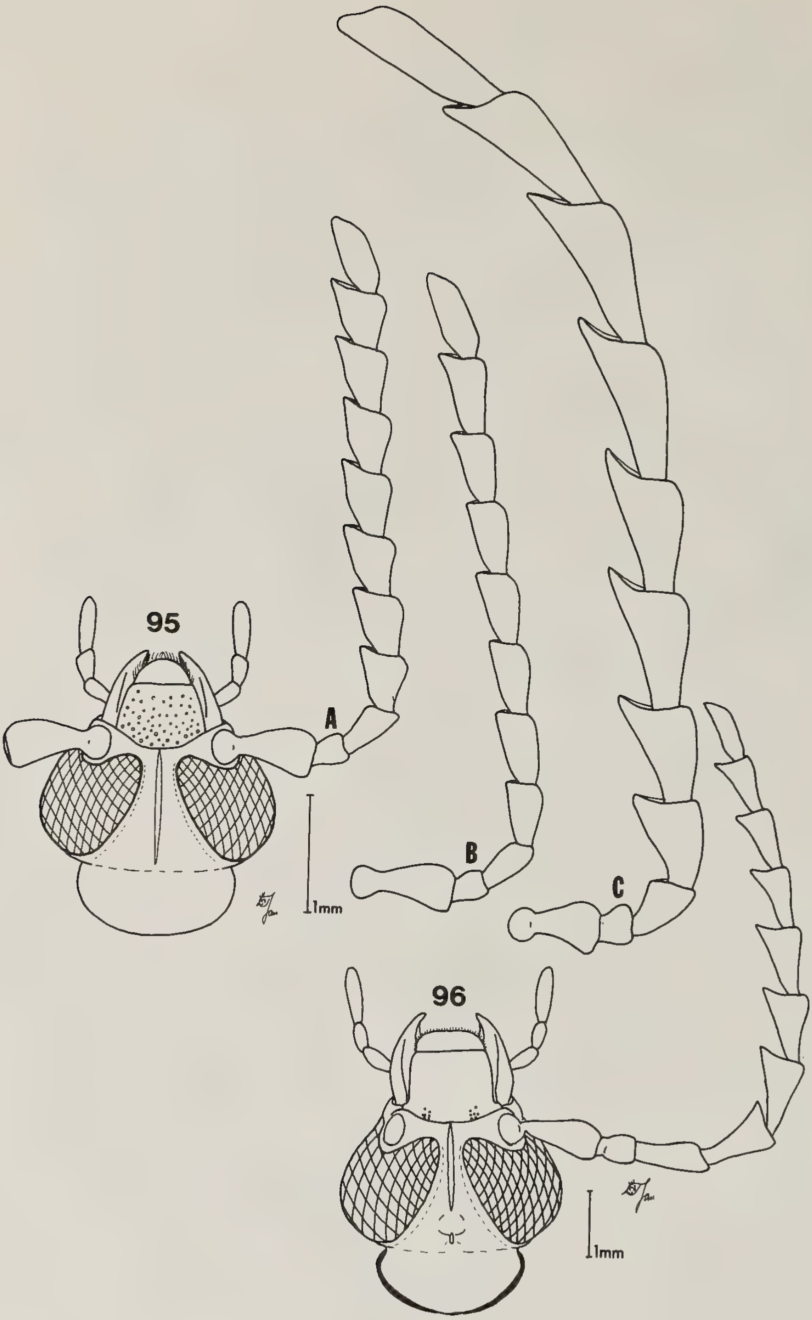
Figs. 75-81. Hind legs of Pachymerinae. 75, *Caryobruchus gleditsiae* (Johansson and Linné). 76, *C. marieae* (Nilsson and Johnson). 77, *C. veseyi* (Horn). 78, *C. curvipes* (Latreille). 79, *C. maya* Nilsson. 80, *C. rubidus* (Chevrolat). 81, *Pachymerus bridwelli* (Prevett).



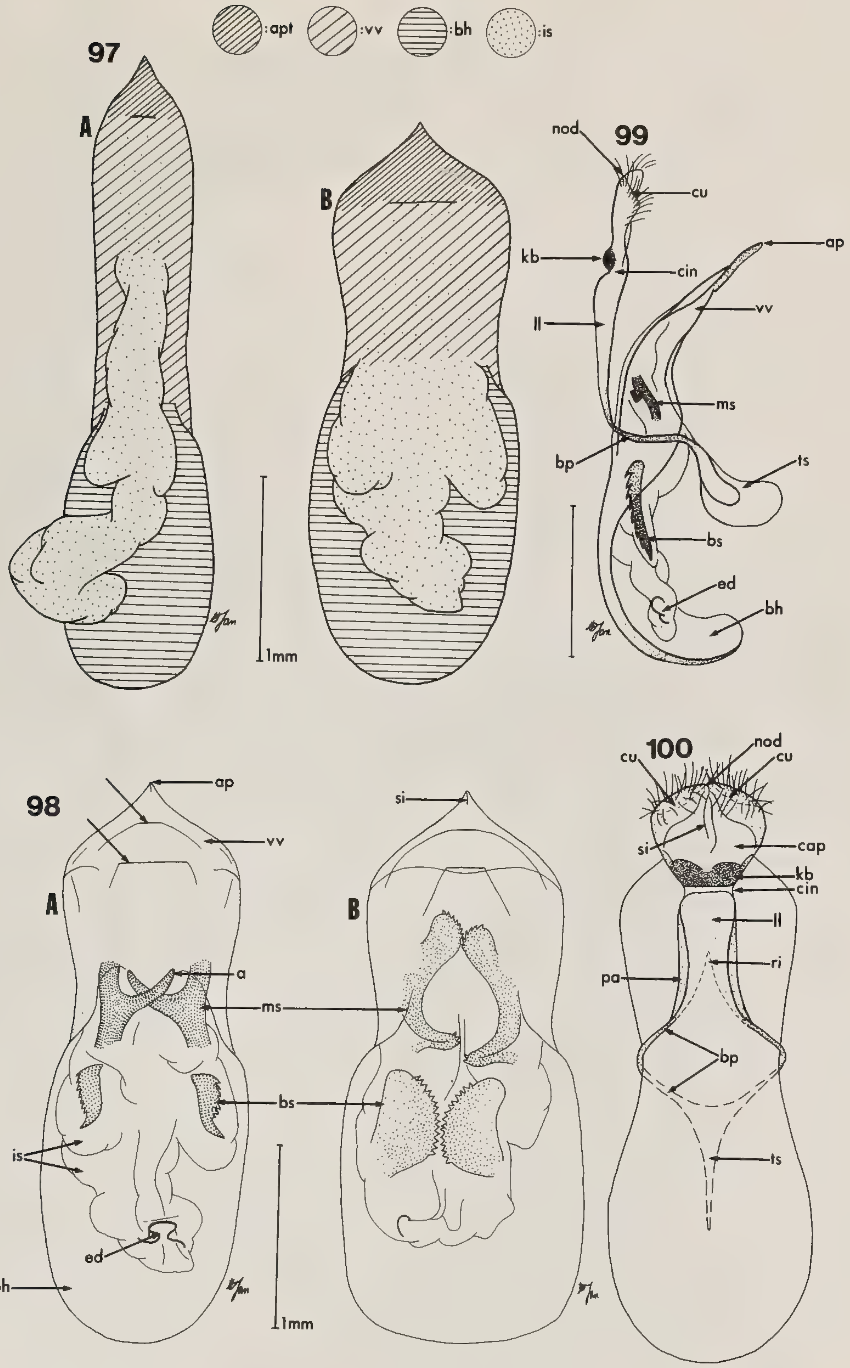
Figs. 82-88. Hind legs of Pachymerinae. 82, *Pachymerus bactris* (Linné), female (arrow = apical tubercle, tt = tibial tubercle). 83, *P. cardo* (Fåhraeus) (arrows = apical tubercles; this species has variable number of tubercles, 1-3 tubercles, but 2 tubercles appear to be more common). 84, *P. bactris*, male (arrow = apical tubercle, sc = sinuated carina, ts = tibial sulcus). 85, *P. abruptestriatus* (Gyllenhal) (arrows = apical tubercles). 86, *P. thoracicus* Prevett (small arrows = apical tubercles, ovc = outer ventral carina). 87, *P. nucleorum* (Fabricius): A. variation with large fused denticle (large arrow); B, variation with sulcus (large arrow, small arrow = apical tubercle, ovc = outer ventral carina, ts = tibial sulcus, tt = tibial tubercle). 88, *P. sveni* Nilsson (arrows = apical tubercles, sc = sinuated carina).



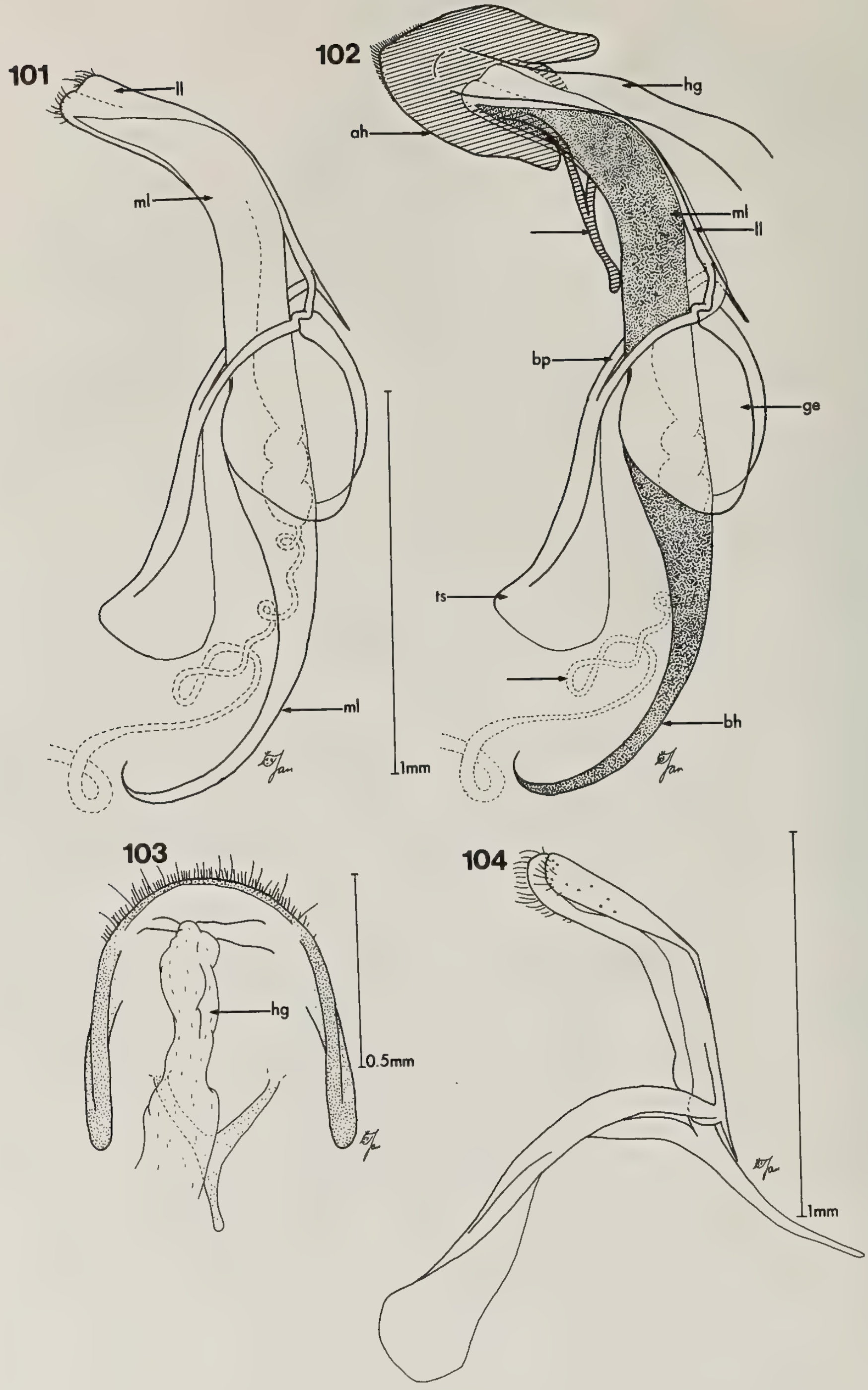
Figs. 89-94. Antennae of *Caryobruchus* Schönherr. 89, *C. curvipes* (Latreille). 90, *C. veseyi.* (Horn) 91, *C. gleditsiae* (Johansson and Linné). 92, *C. marieae* Nilsson and Johnson. 93, *C. maya* Nilsson. 94, *C. rubidus* (Chevrolat).



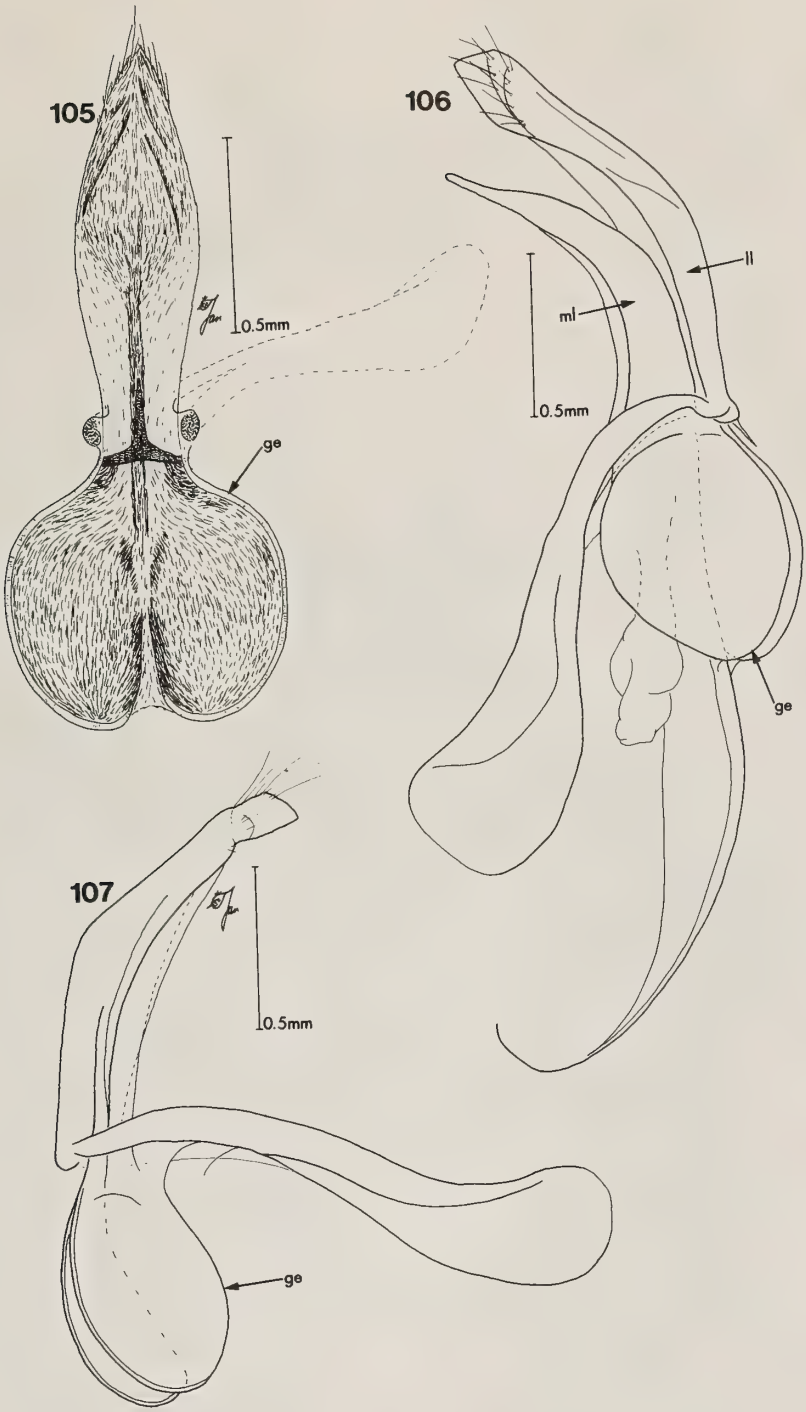
Figs. 95-96. 95, Antennae of *Caryoborus* Schönherr: A, *C. chiriquensis* Sharp; B, *C. gracilis* Nilsson; C, *C. serripes* (Sturm). 96, Antennae of *Speciomerus giganteus* (Chevrolat).



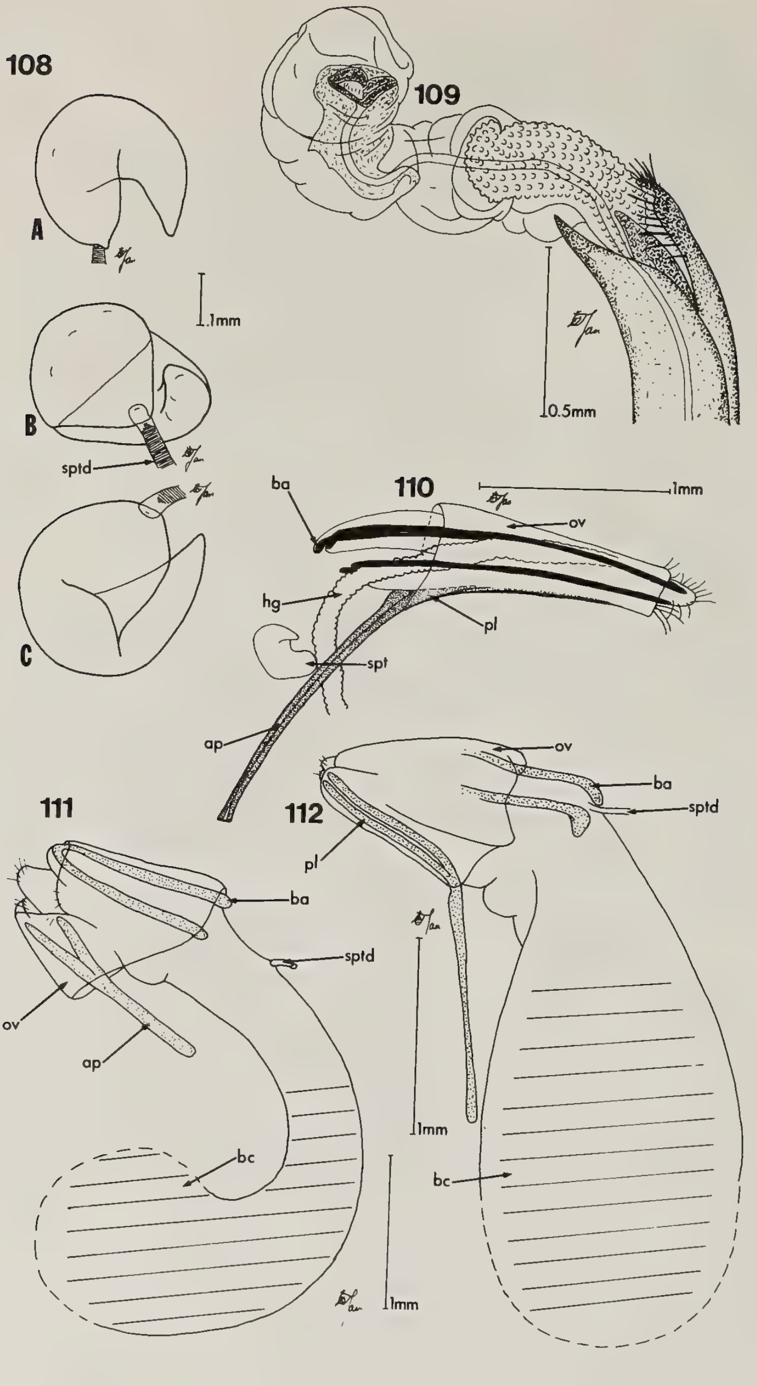
Figs. 97-100. 97, Sections of median lobe of male genitalia: A, *Caryoborus serripes* (Sturm); B, *Caryobruchus gleditsiae* (Johansson and Linné). 98, Parts of median lobe of male genitalia; A, *C. gleditsiae*; B, *C. curvipes* (Latreille): 99, Lateral view of median lobe and tegmen of *C. gleditsiae*. 100, Dorsal view of tegmen of *C. gleditsiae*: Abbreviations: a = apex of sclerite, ap = apex of median lobe, apt = apical triangle of the ventral valve, bh = basal hood, bs = basal sclerite, bp = basal piece, cap = caput, cin = cingulum, cu = cutis, ed = ejaculatory duct, is = internal sac, kb = Kingsolver's band, ll = lateral lobes, ms = median sclerite, nod = nodus, pa = pallium, ri = rima, si = sinus, ts = tegminal strut, vv = ventral valve.



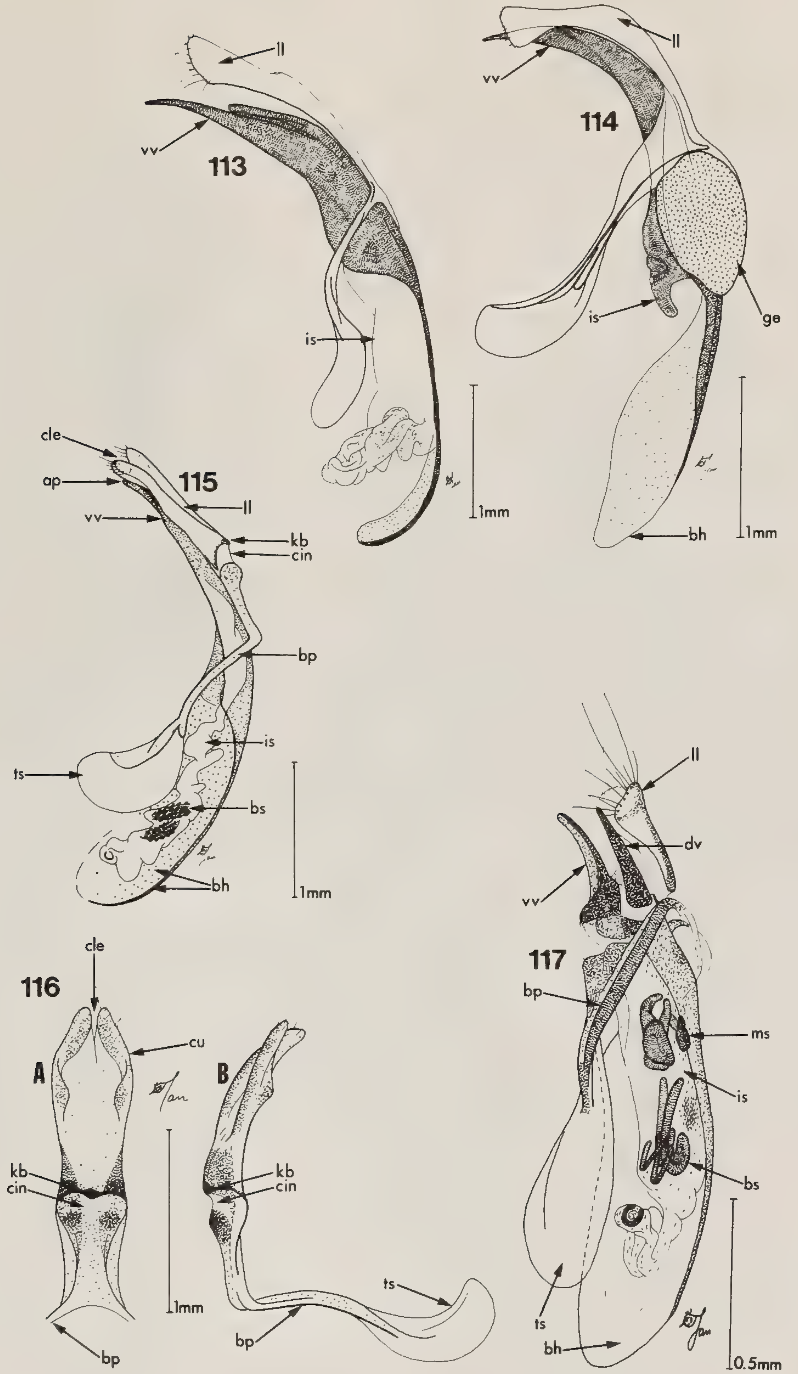
Figs. 101-104. 101, Male genitalia of *Pachymerus sveni* Nilsson, lateral view, without apical hood. 102, Same genitalia as in Fig. 101, with apical hood. 103, Apical hood of male genitalia of *P. sveni*, dorsal view. 104, Tegmen of *P. sveni*, lateral view, gemmae removed. Abbreviations: ah = apical hood, bh = basal hood, bp = basal piece, ge = gemma (pl. gemmae), hg = hind gut, ll = lateral lobes, ml = median lobe, ts = tegminal strut.



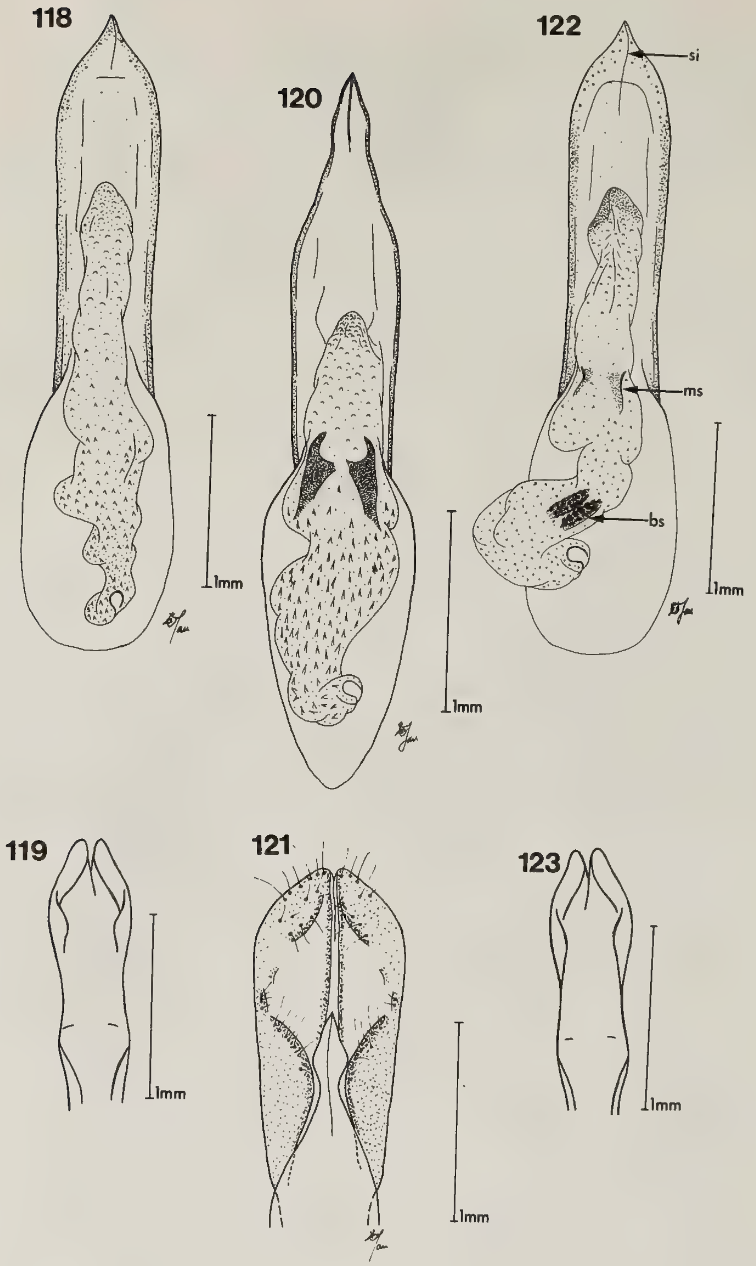
Figs. 105-107. Male genitalia of *Pachymerus bactris* (Linné). 105, Tegmen, gemmae removed (setae shown), dorsal view. 106, Median lobe and tegmen, with gemmae (setae not shown), lateral view. 107, Tegmen, with gemmae (setae not shown), lateral view. Abbreviations: ge = gemma (pl. gemmae), ml = median lobe, ll = lateral lobes.



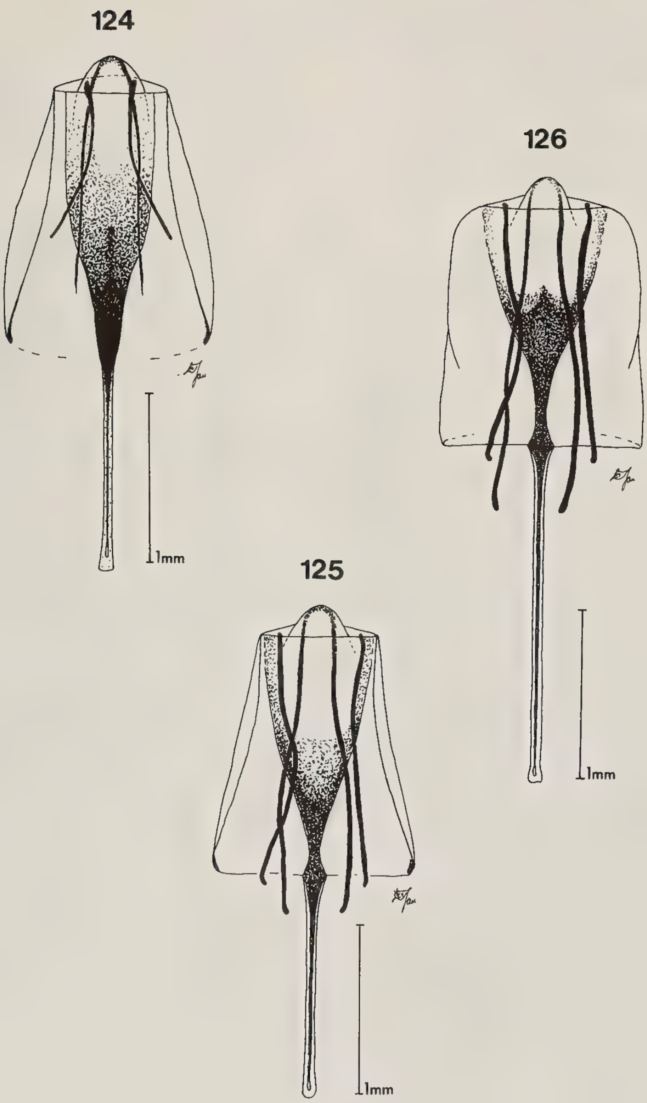
Figs. 108-112. 108, A - C, Spermatheca of *Pachymerus sveni* Nilsson, in different angles. 109, Median lobe of *P. cardo* (Fåhraeus) (everted). 110, Female genitalia of *P. sveni*, lateral view. 111, Female genitalia of *Caryobruchus* Bridwell, lateral view, area of sclerite location in the bursa copulatrix striped. 112, Female genitalia of *Speciomerus* Nilsson, lateral view, area of sclerite location in the bursa copulatrix striped. Abbreviations: ap = apodeme of spiculum gastrale (8th stenite), ba = baculum of 8th tergite, bc = bursa copulatrix, hg = hindgut, ov = ovipositor, pl = plate of spiculum gastrale (8th sternite), spt = spermatheca, sptd = spermathecal duct.



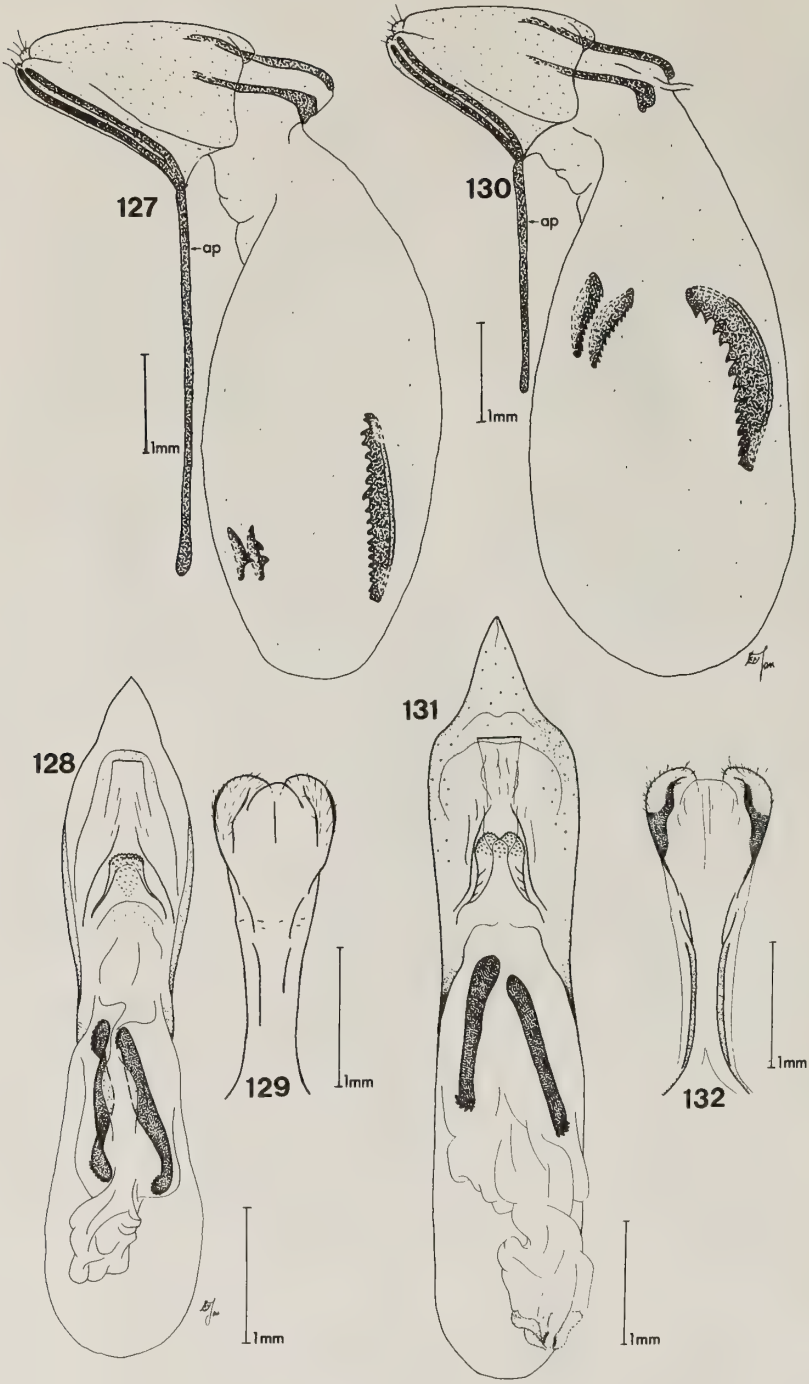
Figs. 113-117. Male genitalia. 113, Median lobe and tegmen of *Speciomerus rubrofemoralis* (Pic), lateral view (note absence of sclerites in the internal sac; dotted area = median lobe, white area = tegmen). 114, Median lobe and tegmen of *Pachymerus bridwelli* (Prevett), lateral view (note absence of sclerites in the internal sac; dotted area = median lobe, white area = tegmen). 115, *Caryoborus serripes* (Sturm), median lobe and tegmen, lateral view. 116, *Caryoborus serripes*: A, Lateral lobes (basal piece and tegminal strut removed), dorsal view; B, Tegmen (basal piece and tegminal strut included), lateral view. 117, Median lobe and tegmen of *Caryedon serratus* (Olivier) (note dorsal valve; also see Fig. 189). Abbreviations: ap = apex of median lobe, bh = basal hood, bp = basal piece, bs = basal sclerite, cin = cingulum, cle = cleft, cu = cutis, dv = dorsal valve, ge = gemma, is = internal sac, kb = Kingsolver's band, ll = lateral lobes, ms = median sclerites, ts = tegminal strut, vv = ventral valve.



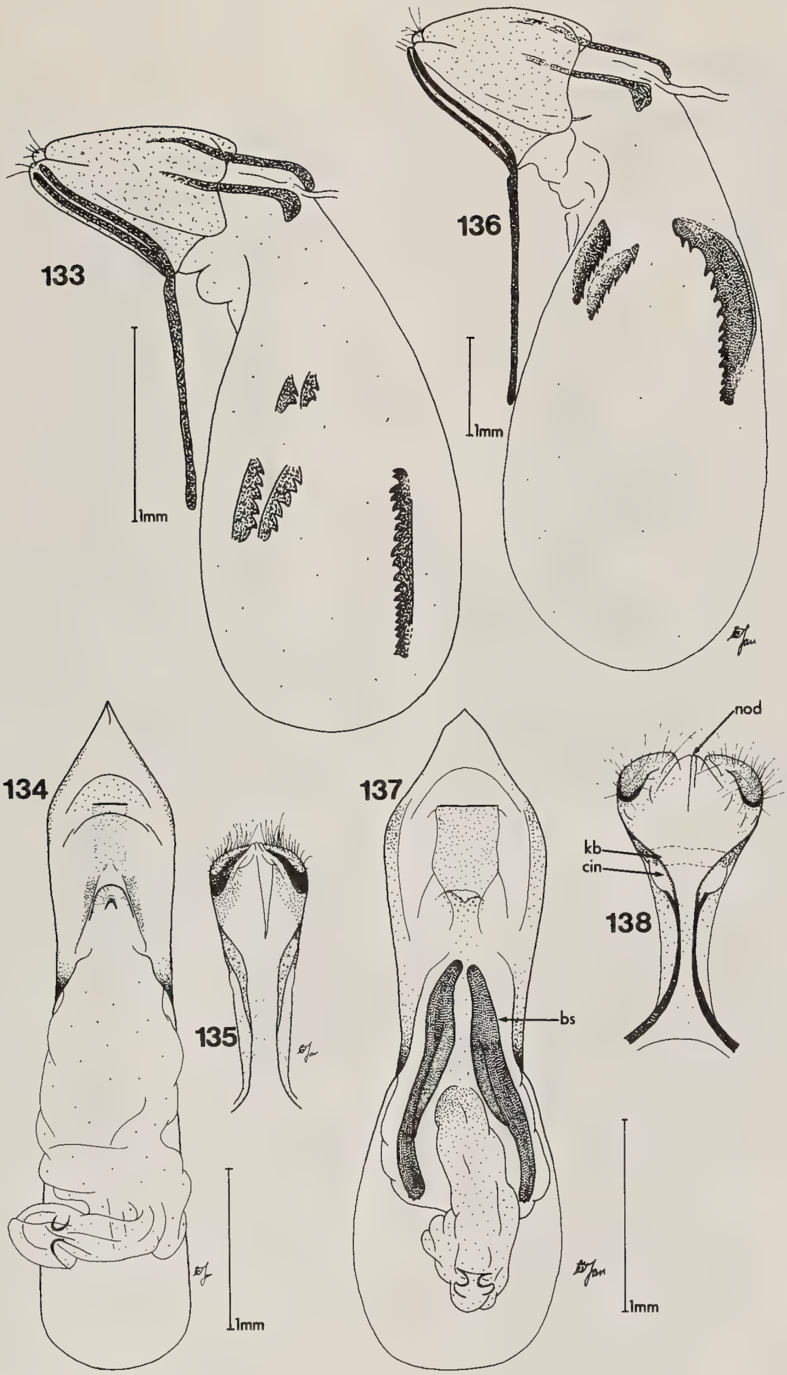
Figs. 118-123. Male genitalia of *Caryoborus* Schönherr. 118, *C. chiriquensis* Sharp, median lobe. 119, *C. chiriquensis*, lateral lobes. 120, *C. gracilis* Nilsson, median lobe. 121, *C. gracilis*, lateral lobes. 122, *C. serripes* (Sturm), median lobe. 123, *C. serripes*, lateral lobes. Abbreviations: bs = basal sclerites, ms = median sclerites, si = sinus.



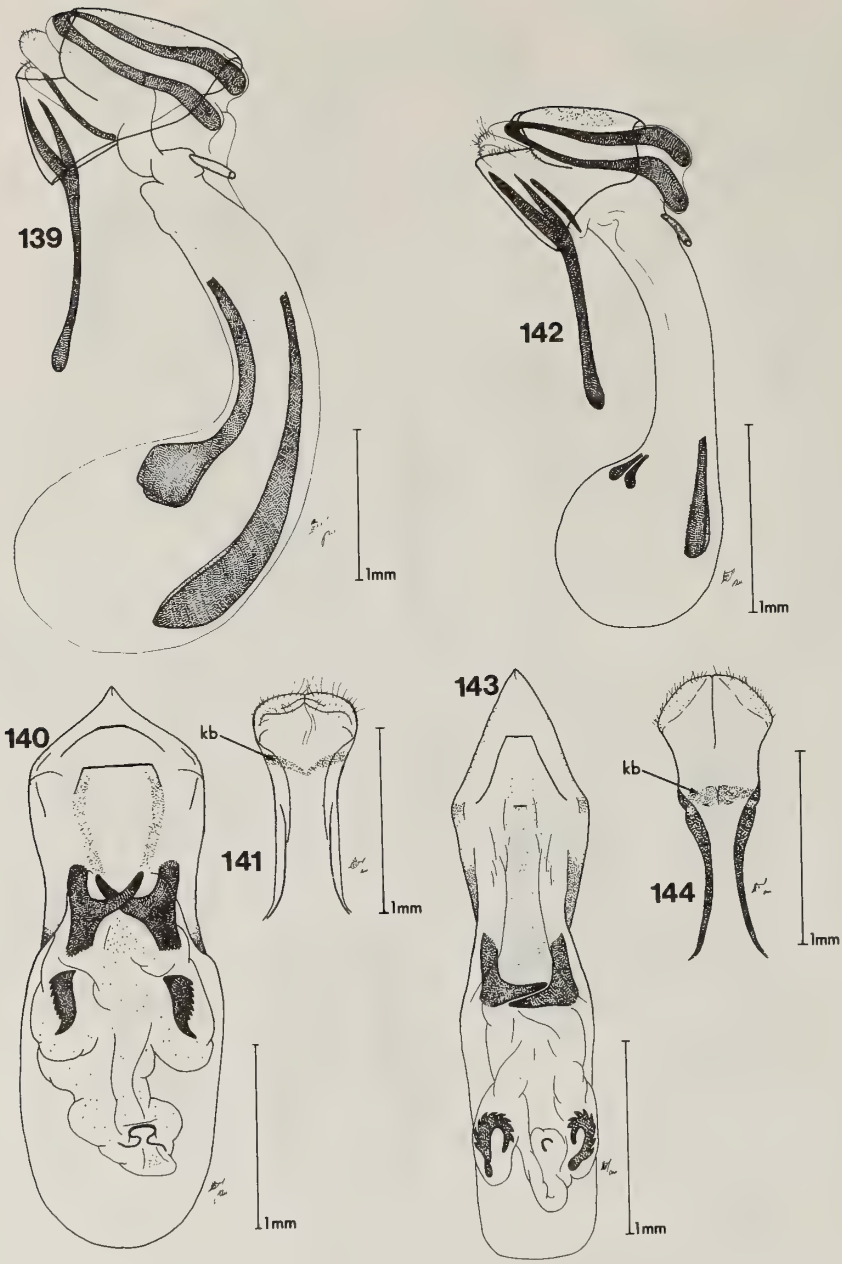
Figs. 124-126. Female genitalia of *Caryoborus* Schönherr. 124, *C. chiriquensis* Sharp. 125, *C. gracilis* Nilsson. 126, *C. serripes* (Sturm).



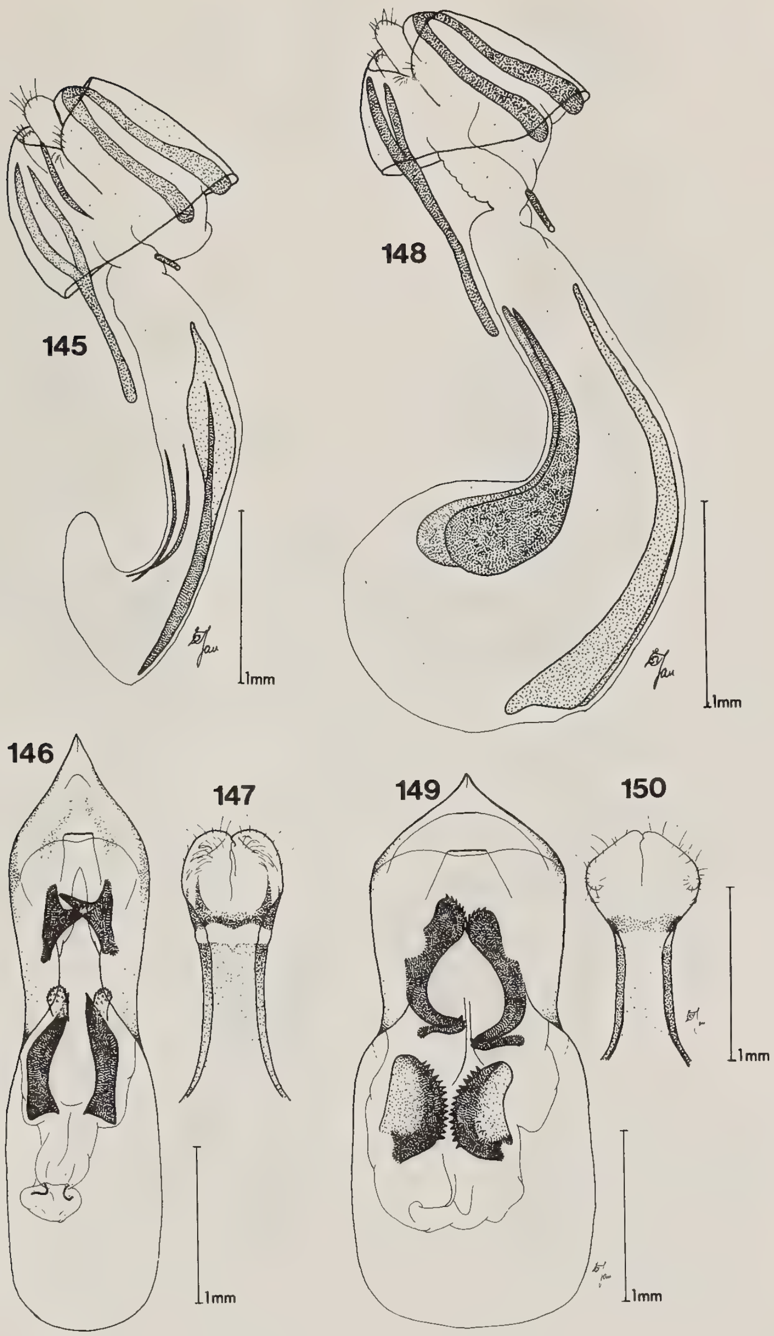
Figs. 127-132. Genitalia of *Speciomerus* Nilsson. 127, *S. giganteus* (Chevrolat), female. 128, *S. giganteus*, median lobe. 129, *S. giganteus*, lateral lobes. 130, *S. ruficornis* (Germar), female. 131, *S. ruficornis*, median lobe. 132, *S. ruficornis*, lateral lobes. Abbreviation: ap = apodeme of spiculum gastrale.



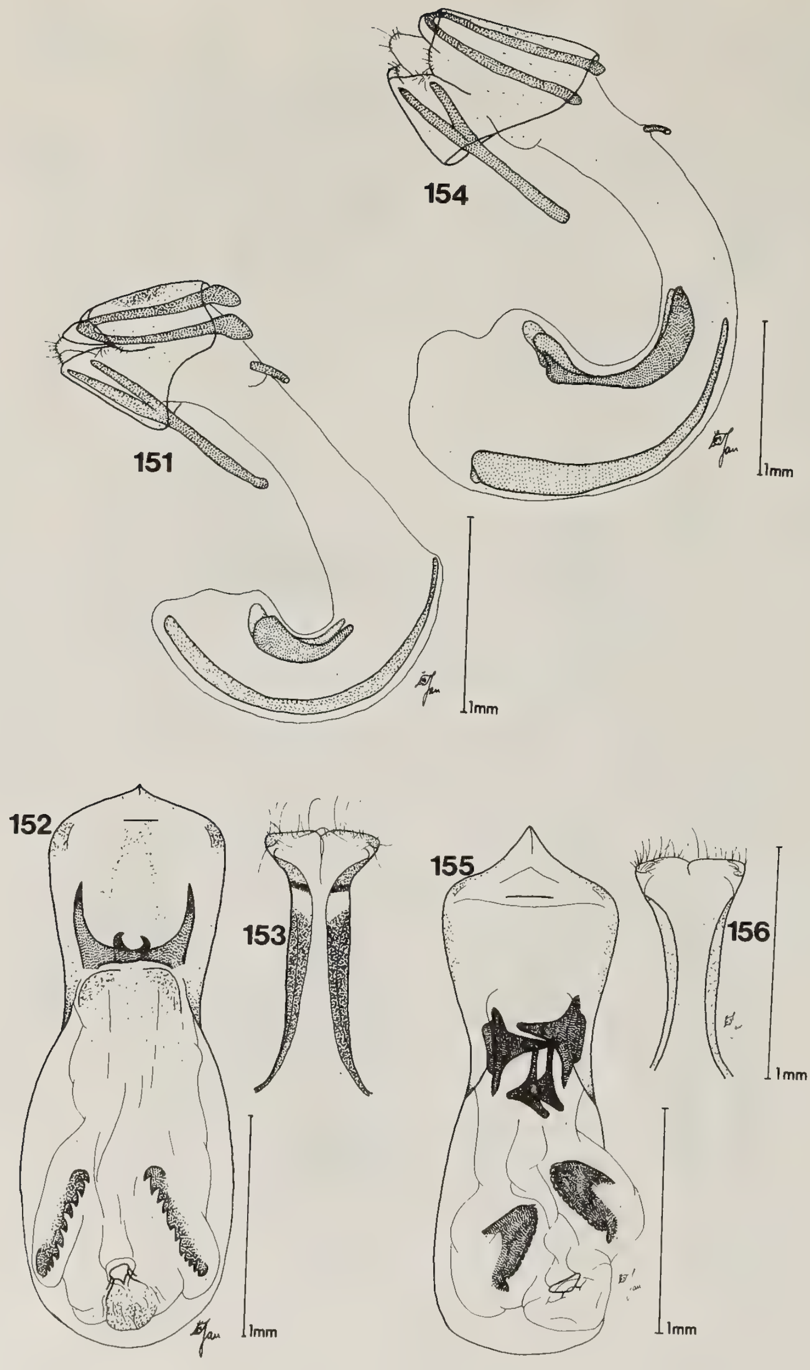
Figs. 133-138. Genitalia of *Speciomerus* Nilsson. 133, *S. rubrofemoralis* (Pic), female. 134, *S. rubrofemoralis*, median lobe. 135, *S. rubrofemoralis*, lateral lobes. 136, *S. revoili* (Pic), female. 137, *S. revoili*, median lobe. 138, *S. revoili*, lateral lobes. Abbreviations: bs = basal sclerite, cin = cingulum, kb = Kingsolver's band, nod = nodus.



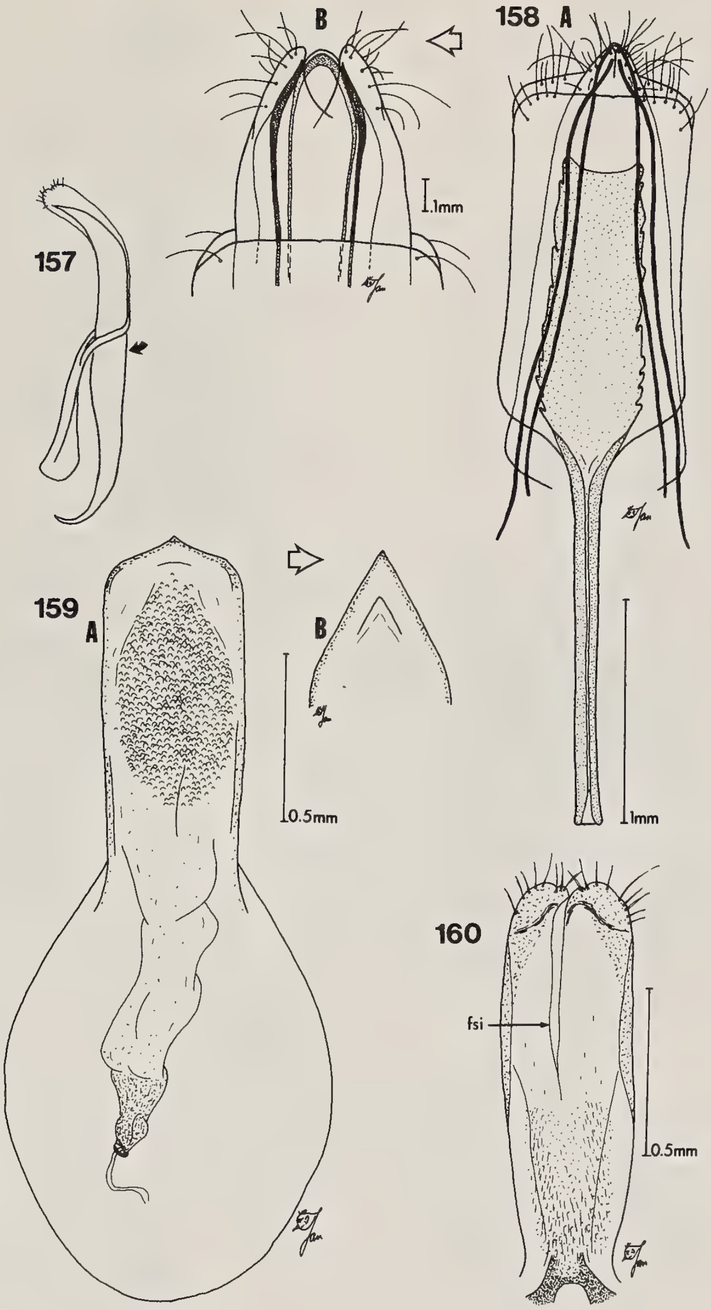
Figs. 139-144. Genitalia of *Caryobruchus* Bridwell. 139, *C. gleditsiae* (Johansson and Linné), female. 140, *C. gleditsiae*, median lobe. 141, *C. gleditsiae*, lateral lobes. 142, *C. marieae* Nilsson and Johnson, female. 143, *C. marieae*, median lobe. 144, *C. marieae*, lateral lobes. Abbreviation: kb = Kingsolver's band.



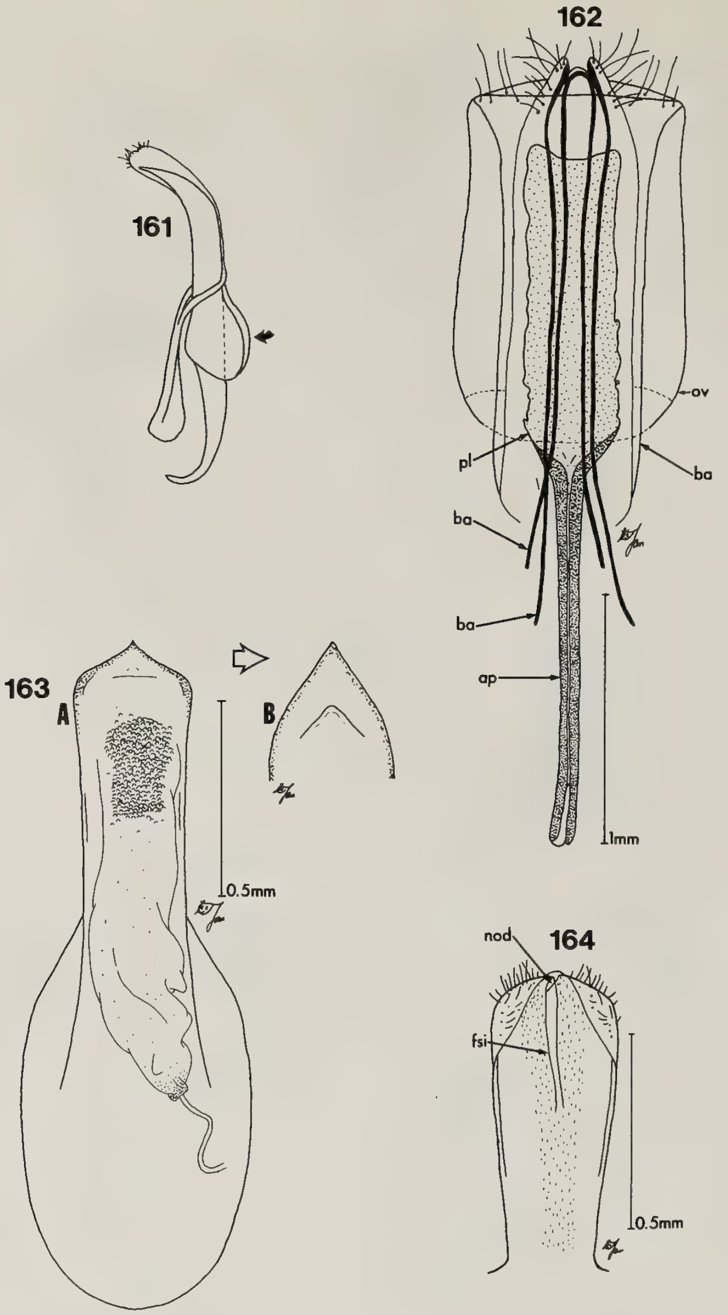
Figs. 145-150. Genitalia of *Caryobruchus* Bridwell. 145, *C. veseyi* (Horn), female. 146, *C. veseyi*, median lobe. 147, *C. veseyi*, lateral lobes. 148, *C. curvipes* (Latreille), female. 149, *C. curvipes*, median lobe. 150, *C. curvipes*, lateral lobes.



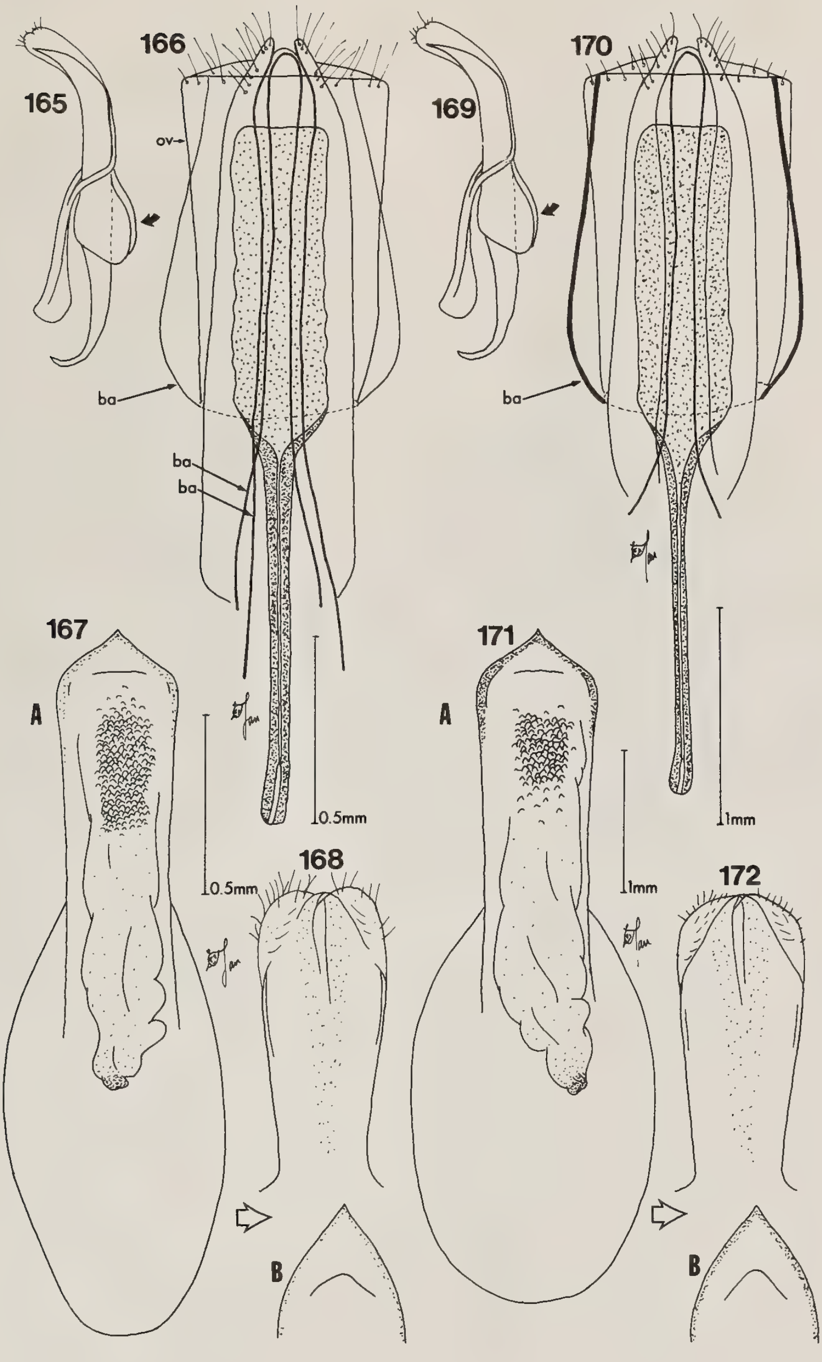
Figs. 151-156. Genitalia of *Caryobruchus* Bridwell. 151, *C. maya* Nilsson, female. 152, *C. maya*, median lobe. 153, *C. maya*, lateral lobes. 154, *C. rubidus* (Chevrolat), female. 155, *C. rubidus*, median lobe. 156, *C. rubidus*, lateral lobes.



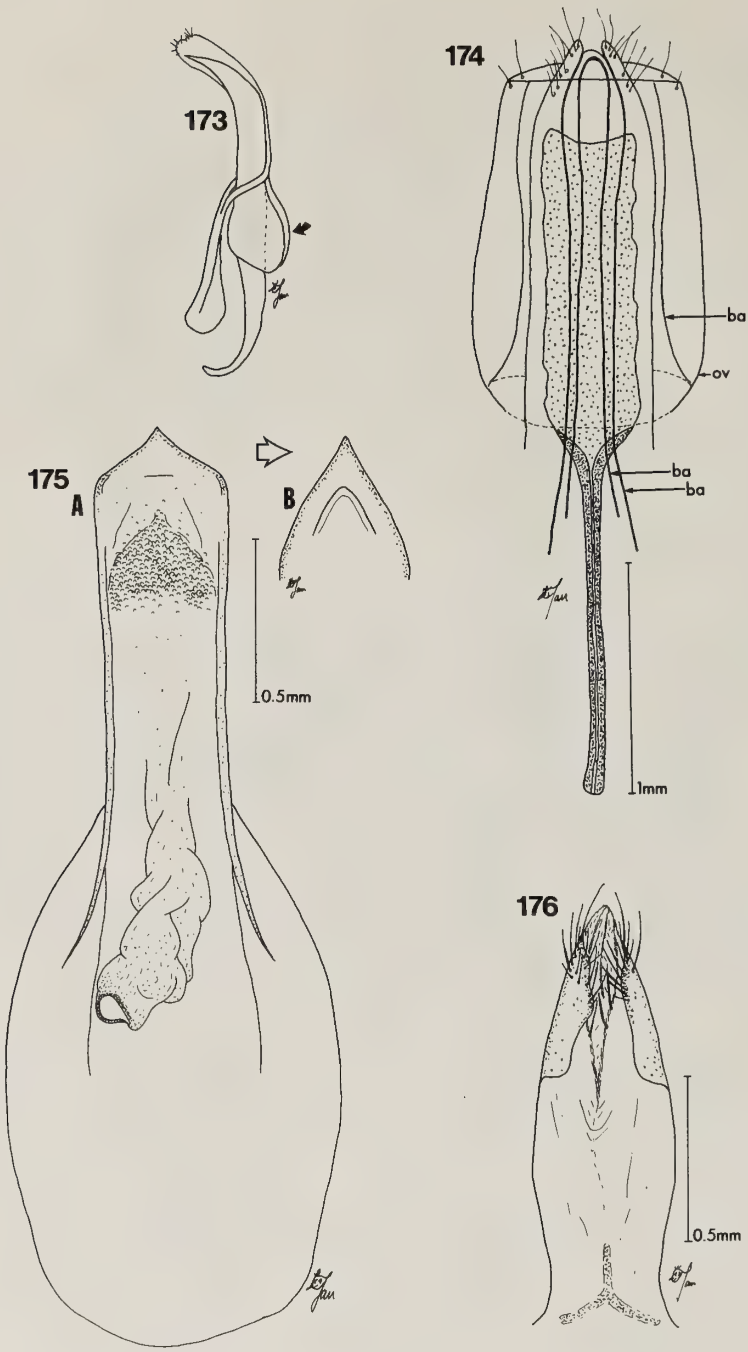
Figs. 157-160. Genitalia of *Pachymerus cardo* (Fåhraeus). 157, Profile of male genitalia, note absence of gemmae (arrow). 158, A, Female genitalia; B, Detail of ovipositor apex. 159, A, Median lobe of male; B, Detail of median lobe apex. 160, Lateral lobes. Abbreviation: fsi = foldlike sinus.



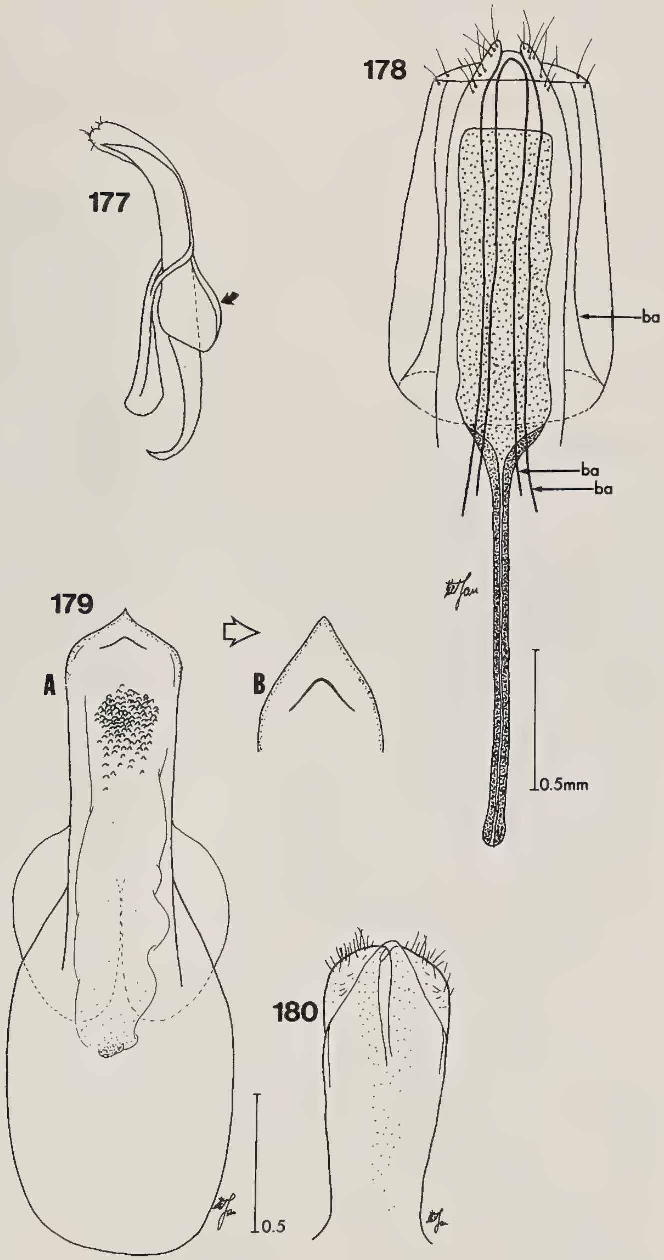
Figs. 161-164. Genitalia of *Pachymerus sveni* Nilsson. 161, Profile of male genitalia, note gemmae (arrow). 162, Female genitalia. 163, A, Median lobe; B, Detail of median lobe apex. 164, Lateral lobes. Abbreviations: ap = apodeme of spiculum gastrale, ba = baculum, fsi = foldlike sinus, nod = nodus, ov = ovipositor, pl = plate of spiculum gastrale.



Figs. 165-172. Genitalia of *Pachymerus* Thunberg. 165, *P. abruptestriatus* (Gyllenhal), profile of male genitalia, note gemmae (arrow). 166, *P. abruptestriatus*, female genitalia. 167, A, *P. abruptestriatus*, median lobe; B, Detail of apex. 168, *P. abruptestriatus*, lateral lobes. 169, *P. nucleorum* (Fabricius), profile of male genitalia, note gemmae (arrow). 170, *P. nucleorum*, female genitalia. 171, A, *Pachymerus nucleorum*, median lobe. B, Detail of apex. 172, *P. nucleorum*, lateral lobes. Abbreviations: ba = baculum, ov = ovipositor.



Figs. 173-176. Genitalia of *Pachymerus bactris* (Linné). 173, Profile of male genitalia, note gemmae (arrow). 174, Female genitalia. 175, A, Median lobe; B, Detail of apex. 176, Lateral lobes. Abbreviations: ba = baculum, ov = ovipositor.



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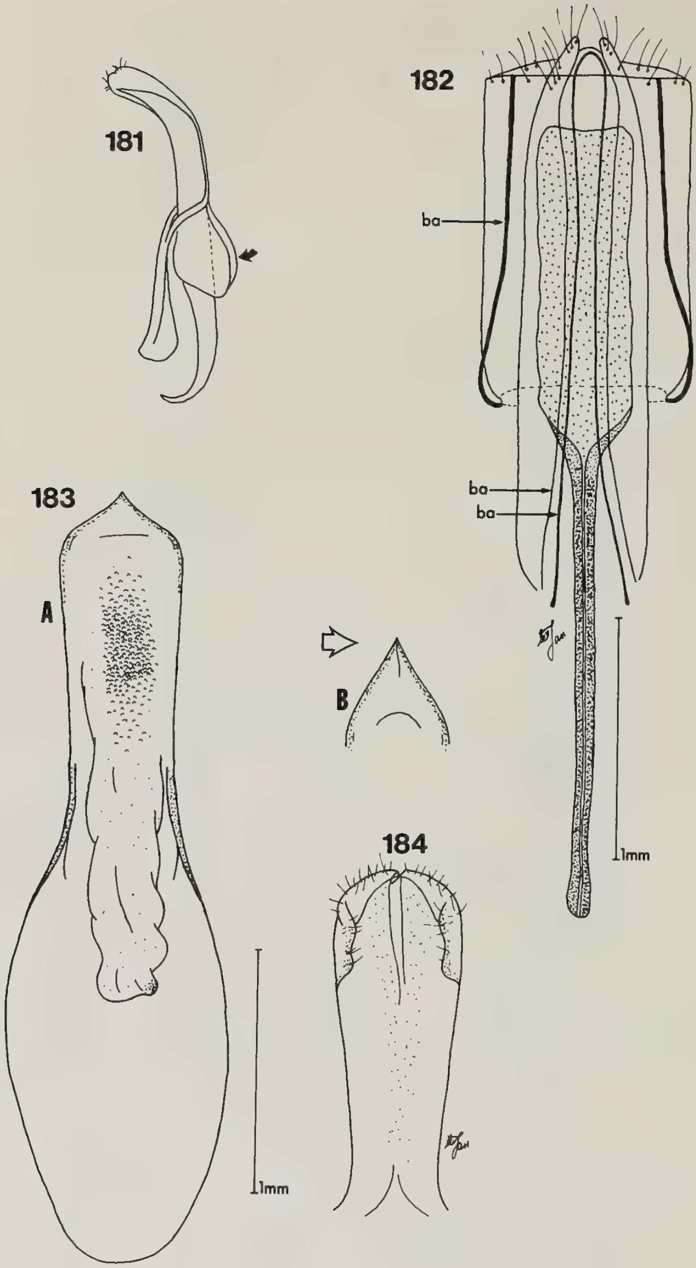

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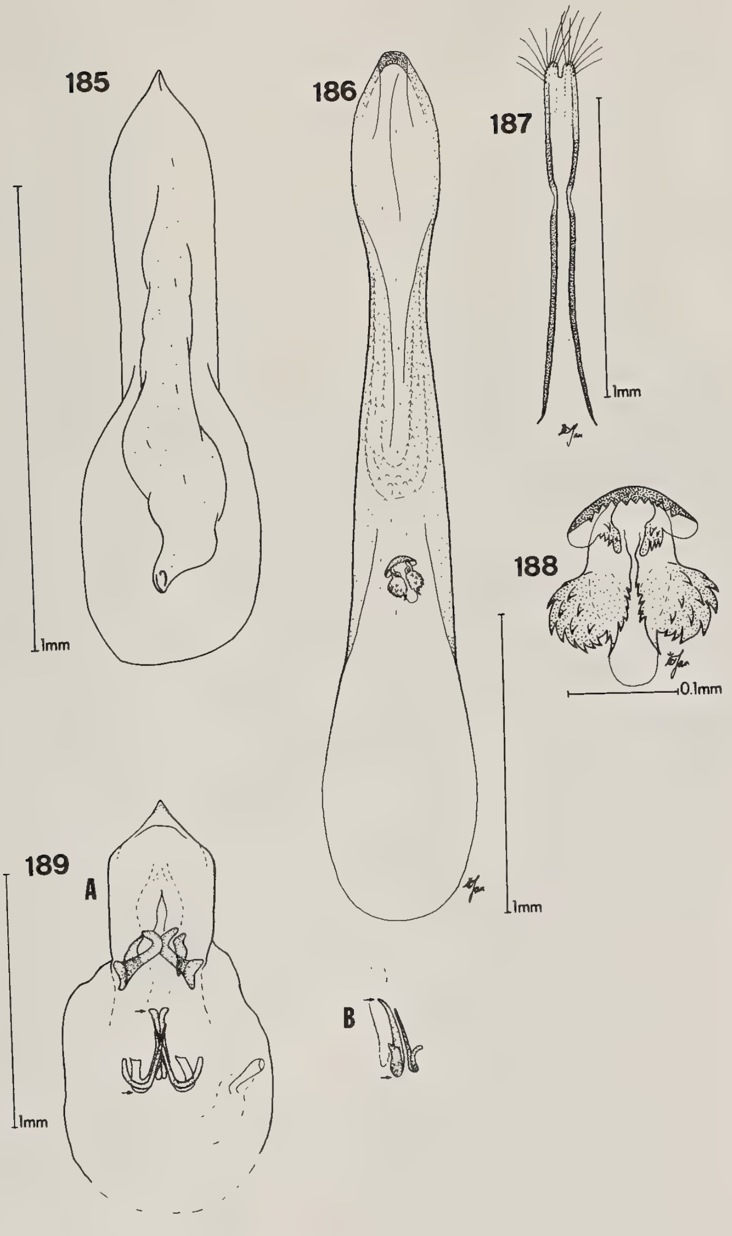

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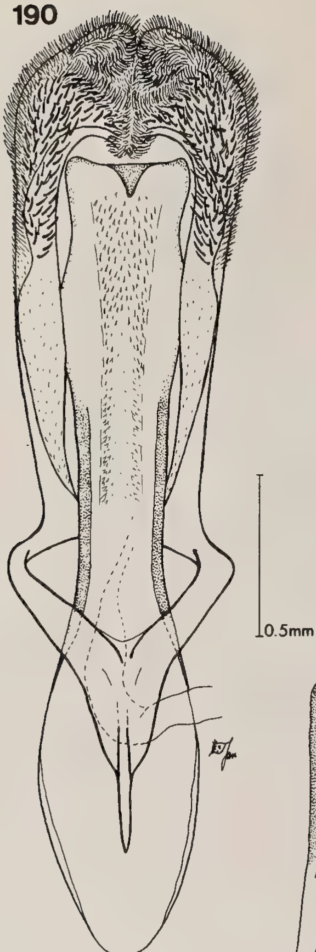

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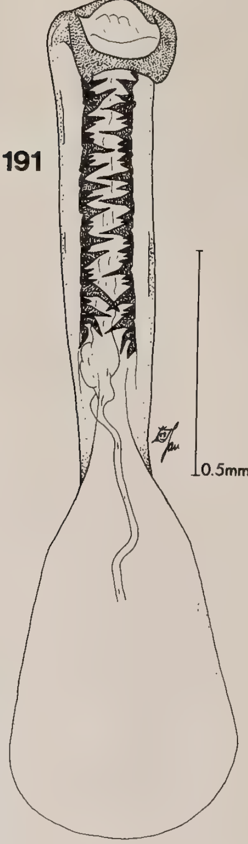

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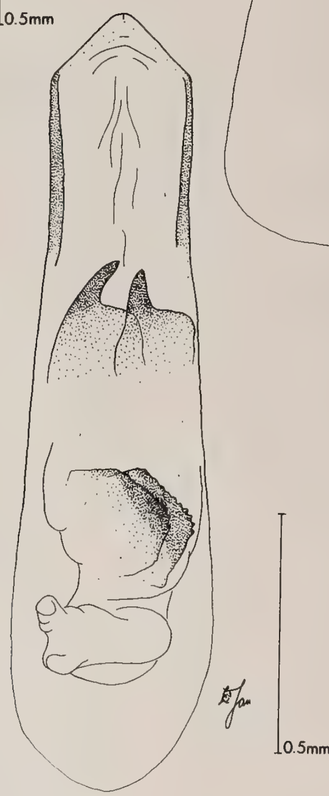

Figs. 190-192. 190, Male genitalia of *Caryopemon giganteus* Pic. 191, Median lobe *Caryopemon luteonotatus* Pic. 192, Median lobe of *Diegobruchus multinotatus* Pic.

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