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A New Species of *Merostachys* (Poaceae, Bambusoideae, Bambuseae) and Synopsis of the Genus in Argentina and Neighboring Regions

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Abstract—A new species of *Merostachys* from the Bolivian Yungas, ***Merostachys yungasensis***, is described and illustrated. ***Merostachys yungasensis*** is compared to other taxa distributed in Argentina, Bolivia, Paraguay, and Peru, in a table based on morphological characters. Additional micromorphological characters of foliage leaf blade and cauline epidermis are included. In Argentina two species are confirmed: *M. claussenii* and *M. multiramea*; the latter species constitutes a new report for this country and is excluded from Paraguay. The specific epithet of *M. claussenii* is emended, and a lectotype is here designated. Two new synonyms are recognized for *M. claussenii* and its presence is confirmed from Paraguay after an analysis of previous reports based on misidentifications. The taxa are illustrated. A key for the identification of the species, based on vegetative and reproductive characters, is also provided.

Resumen—Se describe e ilustra ***Merostachys yungasensis***, una nueva especie propia de los Yungas de Bolivia. ***Merostachys yungasensis*** se compara con otros taxones, distribuidos en Argentina, Bolivia, Paraguay, y Perú, en una tabla basada en caracteres morfológicos. Se incluyen estudios micromorfológicos de la epidermis caulinar y foliar. En la Argentina se reconocen dos especies: *M. claussenii* y *M. multiramea*; ésta última constituye una nueva cita para el país y se excluye de Paraguay. El epíteto específico de *M. claussenii* ha sido enmendado y se designa aquí el lectotipo. Dos nuevos sinónimos son reconocidos para *M. claussenii* y se confirma su presencia en Paraguay luego del análisis de registros previos basados en identificaciones erróneas. Los taxones se ilustran. Se provee una clave, basada en caracteres vegetativos y reproductivos, para la identificación de las especies.

Keywords—Argentina, Bambusoideae, Bolivia, *Merostachys*, Paraguay, taxonomy.

Bamboos, both woody and herbaceous, are forest grasses that comprise at least 90 genera and 1,200 species worldwide (McClure 1966; Clark 1995). The New World is represented by ca. 20 woody bamboos (Judziewicz et al. 1999; Londoño and Clark 2002; Guala 2003; Fisher et al. 2009). Brazil, the northern and central Andes, and Mexico, are the areas of highest bamboo diversity and endemism, to which may be added the still poorly known Guayana Highlands (Soderstrom et al. 1988; Clark 1990, 1995).

Merostachys Spreng. is a genus of woody bamboos, the largest of the subtribe Arthrostylidiinae Soderstr. and R. P. Ellis. Analysis of *ndhF* sequence data supported a sister relationship between this subtribe with Guaduinae Soderstr. & R. P. Ellis. Recent studies based on morphology and *rpl16* intron sequence data showed that Guaduinae may be derived from within Arthrostylidiinae (Judziewicz and Clark 2007; Ruiz-Sanchez et al. 2008). *Merostachys* has been related to *Chusquea* Kunth (Hackel 1909), *Arthrostylidium* Rupr. (Sendulsky 1997), and *Rhipidocladum* McClure (McClure 1973; Soderstrom 1981; Gentry 1993; Sendulsky 1997; Judziewicz et al. 1999; Judziewicz and Clark 2007). *Rhipidocladum* is the most similar morphologically because of the presence of apsidate vegetative branching. Nevertheless the two genera differ in the following characters: *Merostachys* has culm leaves with blades lanceolate and reflexed, constricted at the base, narrower than the sheath summit, and deciduous; spikelets provided with one or two functional florets; culms often robust and strong-walled, frequently with scabrous and mottled internodes. *Rhipidocladum* has culm leaves with blades triangular and erect, confluent with the sheath summit and persistent; spikelets with several functional florets; culms usually weak and thin walled, with smooth, generally unmottled internodes.

Merostachys comprises ca. 46 species (Takeda 1988; Judziewicz et al. 1999, 2000) distributed from southern Mexico and Belize to Peru, Bolivia, Paraguay, northeastern Argentina, and southern Brazil. It is widespread in forests and forest margins from sea level to 2,300 m (Judziewicz and Clark 2007). Central and Southern Brazil constitute centers of diversity for this genus (Ohrnberger and Goerrings 1984; Judziewicz et al. 1999, 2000) with 39 endemic taxa from a total of 41 present in Brazil (Judziewicz et al. 1999). Filgueiras and Santos Gonçalves (2004) listed 53 species endemic to Brazil, including nine undescribed taxa. In Argentina two species have been reported: *M. claussenii* Munro and *M. multiramea* Hack. (Nicora and Rúgolo de Agrasar 1987; Zuloaga et al. 1994, 2008; Lizarazu in press). Several authors cited *M. multiramea* (Smith et al. 1981; Renvoize 1988; Zuloaga et al. 1994, 2008; Jimenez et al. 2000) and *M. claussenii* as occurring in Paraguay (Bertoni 1918; Parodi 1936; Zuloaga et al. 1994; Judziewicz et al. 1999, 2000), however, the presence of both species in this country has been poorly documented. Regarding the last species, it was cited as *M. claussenii* (Munro 1868; Bertoni 1918; Parodi 1936; Dutra 1937; McClure 1973; Nicora and Rúgolo de Agrasar 1987; Sendulsky 1995; Zuloaga et al. 1994, 2008; Judziewicz et al. 2000; Schmidt and Longhi-Wagner 2009) or *M. clausenii* (Renvoize 1988; Sendulsky 1995; Judziewicz et al. 1999; Filgueiras and Santos Gonçalves 2004); the correct spelling of the specific epithet is clarified in the present paper.

Taxonomic identification of *Merostachys* species has been problematic due to their long periods of vegetative development, ca. 25–30 yr according to several authors (Soderstrom and Calderón 1979; Sendulsky 1992, 1995; Judziewicz et al. 1999; Guilherme and Ressel 2001). A monographic revision of the genus is lacking, nevertheless, partial treatments have been carried out for Mesoamerica (Davidse 1992), and South America, particularly in Brazil (Smith et al. 1981; Renvoize 1988; Sendulsky 1992, 1995, 1997, 2001; Clayton et al. 2006; Schwarzbach et al. 2008; Schmidt and Longhi-Wagner 2009) and northwestern South America (Hitchcock 1927; Judziewicz

1990, 2004; Gentry 1993; Londoño and Clark 1998; Renvoize 1998; Olivier 2008).

Leaf anatomical characters are useful in delimiting tribes and subtribes (Soderstrom and Ellis 1987). In this respect, several authors contributed anatomical data about Bambusoideae (Brandis 1907; Prat 1932, 1936; Page 1947; Metcalfe 1956, 1960; Calderón and Soderstrom 1973; Soderstrom et al. 1987; Soderstrom and Ellis 1988). Leaf anatomical studies on South American species of the woody bamboos are scarce (Metcalfe 1956, 1960; Renvoize 1987). In Argentina, Freier (1941) studied the leaf anatomy of some genera of native bamboos, and culm anatomy by Rúgolo de Agrasar and Rodriguez (2002, 2003). Regarding *Merostachys*, Metcalfe (1960) studied leaf micromorphology and leaf anatomy in transverse section in only one species from Brazil (*M. riedeliana* Rupr. ex Döll). Saiter Gomes and Neves (2009) analyzed the leaf surface of several Brazilian species of *Merostachys*, but only *M. latifolia* R. W. Pohl from Central America showed variation in shape and size of some epidermal cells on both surfaces. Specifically, foliage leaf abaxial surface has more diagnostic characters which are based on microhairs, papillae, stomatal complexes, and prickle-hair cells than does the adaxial surface. Anatomical description of *M. yungasensis* contributes to the knowledge of the genus to find infrageneric micromorphological characters.

The main objectives of the present paper are to describe a new species of *Merostachys*, *M. yungasensis*, known from only one locality of the Bolivian Yungas and to update the distributions for Argentina (*M. clausenii* and *M. multiramea)* and for Paraguay (*M. clausenii*). A complete description of *Merostachys clausenii* is here provided, its specific epithet is emended, two new synonyms are recognized, and the lectotype is here designated. The vegetative and reproductive characters of *M. multiramea* are here described in detail. Taxa are illustrated and a key for the identification of the species in Argentina, Bolivia, Paraguay, and Peru is included. A table comparing *M. brevispica* Munro (endemic to Peru), *M. clausenii*, *M. multiramea*, and *M. yungasensis* based on morphological characters is also provided. Micromorphological characters of leaf-blade and culms of *M. yungasensis* are also included. This paper includes a list of additional material examined, iconography, geographical distribution, habitat, phenology and uses for each species as appropriate.

Materials and Methods

Morphology—Morphological characters (vegetative and reproductive) were recorded from herbarium material. Specimens belonging to the following herbaria were examined: BA, BAA, BAB, CTES, LPB, and SI (acronyms after Holmgren et al. 1990). Type images were seen from BR, G, K, NY, P, S, TCD, US, and W.

Micromorphology—Micromorphological observations were based on herbarium material. Segments of the middle portion of the penultimate foliage leaf blade of a fertile innovation and the middle portion of internodes were selected and cleaned in xylene for 1.5 hr with an ultrasonic cleaner (Cleanson, model CS 1106, Argentina). The material was air dried, mounted and coated with a gold-palladium (40% - 60%) alloy by a Thermo VGScientific and then observed using a Phillips XL 30 (Phillips, The Netherlands) Scanning Electron Microscope (SEM) at the Museo Bernardino Rivadavia, Argentina.

Taxonomic Treatment

Merostachys Spreng., Syst. Veg. 1: 132. 1824.—TYPE: *Merostachys speciosa* Spreng. Brasilia, *Sellow s. n.* (lectotype: LE; isotypes: G Photo SI!, K-000307813 Photo SI!, K-000307814 Photo SI!, TCD-0008361 Photo SI!). Lectotype designated by Sendulsky, Kew Bull. 56: 630. 2001.

Key to the Species of *Merostachys* in Argentina, Bolivia, Paraguay, and Peru

1. Racemes (5-)6.5–11 cm long; spikelets 1(-2)-flowered, (10-)13–21 mm long; leaves of the branches with blades broadly lanceolate, abruptly attenuate toward the apex, midnerve centric or eccentric, 14–21-nerved; anthers 6–11 mm long; caryopsis stramineous 2
1. Racemes 3–6.1(-9) cm long; spikelets (1-)2-flowered, 9–14 mm long; leaves of the branches with blades narrowly lanceolate, slightly attenuate toward the apex, midnerve centric, 8–14-nerved; anthers 3–5 mm long; caryopsis blackish 3
   2. Foliage leaves with blades (6-)8–13 × 1.2–2.8 cm, midnerve centric, pilose at the base; racemes with 18–29 spikelets, straight or subfalcate; lower glume with apex abruptly acuminate; upper glume 9–14 mm long, as long as the spikelet, pubescent toward the apex, glabrous toward the base; fertile lemma subglabrous or pilose; palea pilose or subglabrous toward the apex; lodicules cuneiform, margin ciliate; anthers (6.5-)9–11 mm long; style base cylindrical ..... 2. *M. clausenii*
   2. Foliage leaves with blades 14–23 × 3.5–5.1 cm, midnerve eccentric, glabrous; racemes with 37–40 spikelets, notoriously falcate; lower glume with apex mucronate; upper glume 8–8.5 mm long, ½ the length of the spikelet, glabrous; fertile lemma glabrous; palea glabrous; lodicules lanceolate, margin smooth; anthers 6–6.5 mm long; style base globose ..... 4. *M. yungasensis*
      3. Foliage leaf sheath hirsute; spikelets 11–14 × 2–2.5 mm; upper glume ⅓ to ½ the length of the spikelet; stigmas plumose .... 1. *M. brevispica*
      3. Foliage leaf sheath scaberulous; spikelets 9–11 × 3–4 mm; upper glume ⅔ the length of the spikelet; stigmas bearded ..... 3. *M. multiramea*

1. Merostachys brevispica Munro, Trans. Linn. Soc. London 26 (1): 49. 1868.—TYPE: PERU. In Peruvia prope Tarapoto, 1855–1856, *R. Spruce s. n.* (holotype: K-307800 Photo SI!, K-307801 Photo SI!; isotypes: BR-68235 Photo SI!, NY-00658474 Photo SI!, P-625532 Photo SI!, P-625533 Photo SI!, P-625534 Photo SI!, S-05/5148 Photo S!, S-05/10802 Photo S!, TCD-0008362 Photo SI!, US-00026365 Photo SI!).

Iconography—Tovar (1993: 35, Fig. 2. d-f).

Vernacular Name—"Pacalita" (Peru; Olivier 2008).

Geographic Distribution and Ecology—Only known from type locality. Inhabits perennial tropical forests.

2. Merostachys clausenii Munro, Trans. Linn. Soc. London 26 (1): 48. 1868.—TYPE: BRAZIL. Minas Gerais, 1838, *P. Clausen 997* (erroneously under *P. Claussen 997)* (Lectotype here designated: P-625535! Photo SI; isolectotypes: BAA!, BR-686300 Photo BR!, G-00099736 Photo SI!, G-00099737 Photo SI!, K-307816 Photo SI!, P-625536 Photo SI!, P-625537 Photo SI!, S-05–5149 Photo SI!, US-00134235 Photo SI!, US-00479181 Photo SI!).

Merostachys burchellii Munro, Trans. Linn. Soc. London 26 (1): 51. 1868. Syn. nov.—TYPE: BRAZIL. Hab. In Brasilia australi, pr. Santos, Mar 1865, *Burchell 3243* (holotype: K-307809 Photo SI!; isotype: US-134257 Photo SI!).

Merostachys clausenii var *mollior* Döll, Fl. Bras. 2 (3): 214. 1880. Syn. nov.—TYPE: BRAZIL. Hab. ad Caldas, prov. Minarum, *Regnell III 1425* (holotype: K-307808 Photo SI!; isotype: BR-686271 Photo BR!; S-07/8548 Photo SI!, S-07/8549 Photo SI!, S-07/8550 1513Photo SI!, US-01021513! Photo SI!, US-0079091 Photo SI!).

Perennial, rhizome pachymorph. Culms 4–10 m tall, 0.7–5 cm in diameter, erect or pendulous, fistulous, terete, hollow, scabrous, 2.5–3 mm thick walled; nodes pubescent, with whitish hairs. Culm leaves with sheaths 27–29 cm long, adaxially shiny and glabrous; abaxially opaque and pilose; inner ligule ca. 1 mm long, membranous; outer ligule a salient rim; blades lanceolate, deciduous; oral setae 5–7 mm long, branching up to 26–34 cm long, with 16–42 branches per node, fan shaped. Branch internodes 1.5–3 mm in diameter, longitudinally furrowed, subglabrous, nodes prominent, stramineous or brown. Foliage leaves: sheaths longitudinally furrowed, slightly scabrous, margin fimbriate; oral setae (4–)6–12 mm long, deciduous, circinate, whitish, smooth; inner ligule truncate, membranaceous; outer ligule reduced to a rim of cilia; pseudopetiole (1–)2–5 × 1–1.5 mm, stramineous, rarely dark, subglabrous; pulvinii present at the joint between the blade and pseudopetiole, rarely absent; blades (6–) 8–13 × 1.2–2.8 cm, scaberulous, broadly lanceolate, abruptly attenuate, asymmetrical, midnerve centric, base obtuse, (8–)14–16-nerved, abaxially pilose at the base and adaxially hispid, glabrous in the remaining zones, margin scabrous. Flowering branch complement 26–43 cm long. Inflorescence a one-sided raceme (5.5–)7–11 × 1.4–1.8 cm, with 18–29 spikelets, straight, occasionally subfalcate, pectinate; rachis pilose, hairs whitish; pedicels 2–3 mm long, pilose, with whitish hairs. Spikelets (10–)13–21 × 3–6.5 mm, 1(–2)-flowered, subsessile, subpatent; glumes 2, unequal; lower glume 2–6 × 0.75–1.5 mm, 1-nerved, ovate, apex abruptly acuminate, pubescent; upper glume 9–14 × 3–5 mm, as long as the spikelet, (8–)10–13-nerved, ovate, mucronate, adaxially dark-spotted, pubescent toward the apex, glabrous on the rest; fertile lemma (8–)11–15 mm long, 14–18-nerved, lanceolate, acute, coriaceous, dark-spotted, pilose, rarely subglabrous, hairs whitish; fertile palea 10–15 mm long, 8–10-nerved, 2-keeled, ellipsoid, subglabrous or glabrous; rachilla 7.5–13 mm long, excurrent, ending in a reduced floret, pilose; lodicules 3, 3-nerved, cuneiform, membranaceous, unequal in length, margin ciliate, the anterior pair 3–3.2 × 1.4–1.5 mm, and the posterior one 1.8–2 × ca. 1 mm; stamens 3; anthers (6.5–)9–11 mm long; ovary 1–2.5 mm long; style base 1–2 mm long, cylindrical; stigmas 2, (1–)3–6 mm long, densely plumose; caryopsis 6–7 × 3–4 mm, ovoid, rostrate, stramineous. Figure 1.

Observations—When Munro (1868) described *Merostachys claussenii,* he cited two specimens: *Claussen s. n.* and *Wilkes 4238*, deposited at P and BM, respectively. The label of the first syntype indicates that it was collected by *M. Claussen*. According to Stafleu and Cowan (1976), it was Peter Clausen who collected in Minas Gerais, Brazil, from 1834–1843, and not Peter Claussen (1877–1959). For this reason, the specific epithet is here emended to reflect the proper spelling of the collector's name. Syntypes distributed in BR, G, K, P, and S, also repeat the mistake in the collector's name with the exception of the specimen deposited in BAA.

According to Döll (1880), *Merostachys clausenii* var. *mollior* is only characterized by the indument of the foliage leaf blade. This character is also observed in specimens previously identified under *M. clausenii* var. *clausenii*, so *M. clausenii* var. *mollior* is here synonymized under *M. clausenii*. Previously *M. burchellii* was synonymized under *M. clausenii var. mollior* (Judziewicz et al. 2000).

Iconography—Nicora and Rúgolo de Agrasar (1987: 104; Fig. 18. A, a-e, and g).

Phenology—On the basis of the analysis of herbarium specimens we suggest a life cycle of 30 yr whose flowering is extended for five years.

Geographic Distribution and Ecology—*Merostachys clausenii* is distributed from northeastern Brazil and Argentina, and eastern Paraguay. It grows in tropical forests with annual precipitation ranging 1,500–2,000 mm, mid temperatures 16–22°C (Zuloaga et al. 2008), and altitudes from 95–570 m in Argentina and Paraguay, and 917–1,403 m in Brazil.

Uses—According to Parodi (1936) leaf blades of *M. clausenii* constitute a mediocre forage, but its culms are useful to roof houses. Culms are also employed in wall construction and in crafting baskets and sieves.

Culm uses vary according to the tribes that inhabit the Parque Estatal de Serra do Tabulerio (Santa Catarina), tribe Xucuru give it little relevance (Schwarzbach and Negrelle 2007), but the tribe Guaraníes Mbya of Brazil and Argentina consider it is an important species in the manufacture of baskets, fuel, medicine, rituals, and different crafts (Keller 2007; Schwarzbach and Negrelle 2007; Schwarzbach et al. 2008). Guaraníes consider that it takes eight years between germination and culm maturation until it can be used (Keller 2008).

Vernacular names—Argentina: "Tacuapi" (*Keller 317*, CTES), "Pagnara mansa" (*Ekman 733*, BAA); Brazil: "Tacuara mansa," "Tacuara lixa" (Dutra 1937), "Taquari" (Döll 1880); Paraguay: "Tacuapi" (*Fiebrig 5418*, SI), "Jatevo" (*Caballero 3864,* CTES).

Additional Specimens Examined—ARGENTINA. Misiones: Dpto. Cainguás, Aristóbulo del Valle, Reserva Universidad Nacional de La Plata, 27°6′17″S, 54°59′19″W, 10 Jan 2005 fl!, *Biganzoli and Márquez 1773* (SI). Dpto. Candelaria, Bonpland, in silva primaevae frecuens, Jan 1908 fl!, *Ekman 733* (BAA); Loreto, Jul 1940 fl!, *Mutinelli s.n* (BA, BAA, BAF, CTES, SI). Dpto. Gral. Manuel Belgrano, Ruta 101 de Bdo. de Irigoyen a San Antonio, Salto Andresito, 26°12′S, 53°40′S, 1 Mar 1995 veg!, *Zuloaga et al. 5139* (SI); San Antonio C. E. B. S., 26°8′S, 53°45′W, 19 Oct 1972 fl!, *Eskuche 2013–5* (CTES, SI); 15 Oct 1975 fl!, *Zuloaga and Deginani 488* (CTES, SI); Reserva de Vida Silvestre Urugua-í, sendero "los pozones", 25°58′S, 54°7′W, 18 Feb 2005 fl!, *Belgrano et al. 368* (SI, WIS); Reserva de Vida Silvestre Urugua-í, sendero de Los Pozones, 25°58′5″S, 54°7′W, 22 Sep 2004 fl!, *Múlgura de Romero et al. 3869* (MNES, SI). Dpto. Gral. San Martín, Municipalidad El Alcázar, Propiedad Alto Paraná SA, 23 Sep 2000 fl!, *Keller 317* (CTES). Dpto. Guaraní, Predio Guaraní, Sector CIFOR, 26°54′59″S, 54°12′18″W, 21 Oct 1999 fl!, *Keller 89* (CTES); Predio Guaraní, Sector CIFOR 26°54′59″S, 54°12′18″W, 11 Jan 2006 fl!, *Keller 3306* (CTES); Ruta 15, límite del Predio Guaraní con el Instituto de Prev. Soc. en borde de ruta, 7 Sep 1994 veg! *Schinini 28726* (CTES); Predio Guaraní, Faja de enriquecimiento "Loro blanco", ca. 500 m de vivienda de huéspedes, 2 Nov 1999 fl!, *Tressens 6433* (CTES). Dpto. Iguazú, Salto Iguazú, 11 Oct 1910 fl!, *Rodríguez 408* (BA, BAA, SI); Reserva Forestal Parque Nacional Iguazú, 3 km al S del cruce con Ruta 101, próximo a la casa del guardaparques, 25°44′S, 4°26′W, 1 Feb 1976 fl!, *Romanczuk 644* (BAB, SI); Salto Uruguay, 25°54′S, 54°37′W, 10 Nov 1973 fl!, *Correa 5416* (BAA, BAB, CTES, SI); Parque Nacional Iguazú, Arroyo Ñandú, Ruta 101, 11 Jan 1972 fl!, *Mroginsky et al. 307* (BAA, CTES); Parque Nacional Iguazú, 26 Jun 1993 fl!, *Chediak 264* (CTES); Paraje Aguaray, Lote P (APSA) entre rodal 5–7 Sep 2001 fl!, *Keller 1210* (CTES); Puerto Bosetti, forestaciones de Pérez Companc S. A., a unos 35 km al Oeste de Ruta Nac. 12, 18 Jul 2002 fl!, *Keller 1917* (CTES); s. d. fl!, *Schulz s. n.* (CTES). Dpto. Moconá, 1 Jan 1975 fl!, *Carnevali 3471* (CTES). Dpto. Montecarlo, s. l., 17 Nov 1941, fl!, *Matus s. n.* (BAA). Dpto. San Ignacio, Pto. Presidente Irigoyen, 23 Oct 1922 veg!, *Rojas 4450* (BAA); Arroyo Ñacanguazú, Jul 1942 fl!, *Pérez Moreau s. n.* (BA, BAF, CTES). Dpto. San Pedro, Ruta Prov. 17, 80 km E de Eldorado,

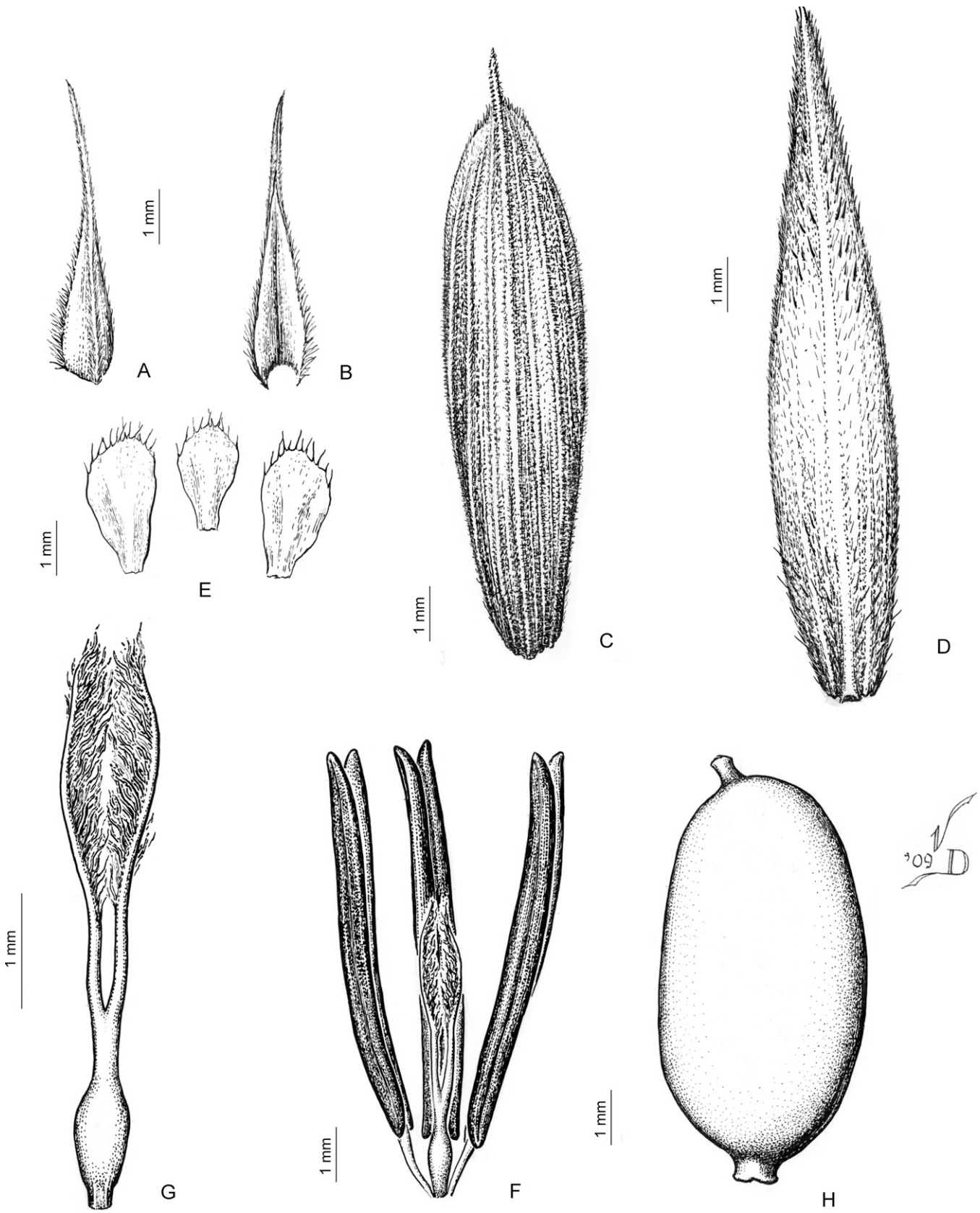

FIG. 1. *Merostachys clausenii*. A. Lower glume, dorsal view. B. Lower glume, ventral view. C. Upper glume, dorsal view. D. Lemma, dorsal view. E. Lodicules, detail. F. Androecium and gynoecium. G. Gynoecium. H. Caryopsis, lateral view. [A-G from *Keller 2828* (CTES); H from *Schinini and Fernández 5989* (CTES)].

22 Jan 1973 fl!, *Schinini and Fernández 5989* (BAA, CTES); San Pedro, colonia Paraíso, 1 km hacia Moconá, 17 Dec 1980 veg!, *Rúgolo de Agrasar 874* (SI); Reserva de Biósfera Yabotí, Reserva estricta Esmeralda, Estación Biológica, sotobosque de plantación de pino, 27 Sep 2004 fl!, *Múlgura de Romero 4038* (MNES, SI); Reserva de Biósfera Yabotí, al norte del Parque Prov. Esmeralda, camino a aldea aborigen Yabotí miní, 15 Oct 2004 fl!, *Keller 2828* (CTES).

BRAZIL. Minas Gerais: Poços de Caldas, camino al Cristo redentor, 14 Jan 1980 fl!, *Krapovickas and Cristóbal 35310* (BAA, CTES). Paraná: Valinhos, 11 Nov 1910 fl!, *Dusén 10761* (BAA, SI). Santa Catarina: Ponte Alta, Ponte Alta do Sul, Km 315, ruta BR 116, 30 Jan 1973 fl!, *Kraprovickas et al. 23064* (BAA, CTES, SI). Rio de Janeiro: "Organ Mts.", 1838–42 fl!, *Wilkes s. n.* (NY); Jan 1839 fl!, *Wilkes 4238* (BM); 1838–42 fl!, *Wilkes s. n.* (US-0002352).

PARAGUAY. Alto Paraná: Hernandarias, 20 km de Hernandarias, 10 Jan 1974 fl!, *Schinini 8050* (CTES); in regione fluminis, Oct 1909 fl!, *Fiebrig 5418* (BAA, CTES, SI); S.l. Oct 2000 fl!, *Caballero 3864* (CTES). Caazapá: Tapytá, Estancia Tapytá of Shell Forestry, 16 Dec 1999 fl!, *Zardini and Britez 53135* (AS, MO, SI). Guaira: Villa Rica, 25°47′S 56°27′W, 1874–77 fl!, *Balansa 136* (BAA). Amambay: Punta Para, Aug 1907 fl!, *Rojas 10910* (BAA); Puerto Bertoni, 9 Jan 1918 veg!, *Hauman s. n.* (BA 40574), Dic 1907 fl!, *Bertoni 3589* (BA).

3. Merostachys multiramea Hack., Repert. Spec. Nov. Regni Veg. 7 (149–151): 326. 1909.—TYPE: BRAZIL. Rio Grande do Sul: Municipio Rio Pardo, Fazenda Itacolamy, 70 m, Apr 1906 (fl), *C. Juergens 308* (holotype: W Photo W!; isotypes: 1518BAA! ex US-1021518!, US-79088 1518Photo SI!, US-1021518! Photo SI!).

Merostachys anomala Dutra, Revista Sudamer. Bot. 5 (5–6): 151, f. 3. 1938.—TYPE: BRAZIL. Rio Grande do Sul: habitat in silva primaeva ad mediam altitudinem, in Serra Geral, Oct 1906, *J. Dutra 518* (holotype: US-1723528 fragm. Photo SI!). Syn. designated by Sendulsky, Novon 5: 88. 1995.

Foliage leaves with oral setae 5–6(–14) mm long, deciduous, circinate, whitish, scabrous; pseudopetiole 2.5–4 × 1–1.5 mm, subglabrous, blackish; pulvinii absent. Flowering branch complement 14.5–45 cm long. Inflorescence a one-sided raceme, 3–5(–9) × 1–1.1 cm, with 11–20 spikelets, exserted or subexserted, subfalcate; rachis canaliculate, villous, hairs whitish. Spikelets 9–11 × 3–4 mm, (1–)2-flowered, subssesile, subpatent; lower glume 3–4 × 0.5–1 mm, 1-nerved, oblong, mucronate, villous; upper glume 7–9.5(–12) × 3–4 mm, 9–13-nerved, ovate, apex obtuse with acumen, pubescent toward the apex, margin ciliate; fertile lemma (8.5–)10–13 mm long, 16-nerved, lanceolate, apex acute, coriaceous, adaxially slightly dark-spotted, villous, hairs whitish or reddish; fertile palea 8–12.5 mm long, 2-keeled, ellipsoid, 8-nerved, ending in a reduced floret; lodicules 3, lanceolate, membranaceous, 3-nerved, apex acute, margin ciliate, the anterior pair 2.5–3 × 0.7–1.5 mm, the posterior one 1.5–2 × 0.5–1.25 mm; stamens 3; anthers 3–5 mm long; ovary 1–1.5 mm long, oblong; style base 0.5–1 mm long, cylindrical; stigmas plumose with long and scattered hairs, (1.5–)3–4.5 mm long; caryopsis 5.5–7 × 3–3.5 mm, ovoid, rostrate, dark brown or blackish. Figure 2.

Phenology—This species grows vegetatively for ca. 30 yr, and flowers for five years (Soderstrom and Calderón 1979; Sendulsky 1995; Judziewicz et al. 1999).

Geographic Distribution and Ecology—*Merostachys multiramea* is distributed from southeastern Brazil to northeastern Argentina (Zuloaga et al. 2008). Previous reports in Paraguay were based on misidentifications. It grows in tropical forests with altitudes from 174–874 m.

Uses—The culms are used for baskets, crafts, and fodder for livestock (Smith et al. 1981; Schwarzbach and Negrelle 2007).

Vernacular Names—Argentina: "Tacuapi," "Caña tacuara" (*Múlgura de Romero et al. 2713*, *2553*, SI), "Tacuara mansa" (*Jörgensen 106*, BAA, BAB); Brazil: "Taquara mansa," "Taquara lisa," "Taquara poca" (Smith et al. 1981).

Additional Specimens Examined—ARGENTINA. Misiones: Dpto. Candelaria, Bonpland, 7 Sep 1909 fl!, *Jörgensen 106* (BAA, BAB). Dpto. Cainguás, Cuña Pirú, Camping Municipal, picada, 27°5′11″S, 54°57′12″W, 24 Nov 2004 fl!, *Zuloaga and Belgrano 8147* (SI). Dpto. Gral. Belgrano, Refugio de vida silvestre Urugua-í, FVSA, Camino de entrada a la casa y sendero hacia Arroyo Sauer, 25°58′S, 57°07′W, 15 Nov 2000 fl!, *Múlgura de Romero et al. 2713* (CTES, SI). Dpto. Guaraní, límite entre predio UNAM y predio Papel Misionero, hacia Arroyo Paraíso, 26°57′S, 54°12′W, 10 Nov 2000 fl!, *Múlgura de Romero et al. 2553* (SI). Dpto. Iguazú, Paraje Aguaray, Lote P (APSA) entre rodal 5 y 6, 7 Sep 2001 fl!, *Keller 1198* (CTES). Dpto. Montecarlo, Colonia Monte Carlo, 2 May 1943 fl!, *Porta 33* (SI). S. loc. 17 Nov 1941 fl!, *Parodi 14403* (BAA); Colonia Guatambú, 15 Sep 1989 fl!, *Keller 46* (CTES). Parque nacional Iguazú, toma de agua, arroyo Mbocay, 20 May 1958 veg!, *Correa 2265* (BA). S. loc., *van de Venne 47* fl!, (BA). Dpto. Libertador Gral. San Martín, Municipio Ruiz de Montoya, Aldea aborigen Takuapi, 26°58′52″S, 55°5′70″W, 27 Jan 2005 fl!, *Keller 2935*(CTES).

BRAZIL. Paraná: Ipiranga, in silva primaeva, 15 Jan1915 fl!, *Dusén 14367* (BAA, SI); Guaratuba, Rio Itararé, 23 Nov 1973 fl!, *Kummrow 154* (SI); Horizonte. BR 153, 27 Nov 1985 fl!, *Krapovickas 39674* (CTES). Rio Grande do Sul**:** Montenegro, fl!, *Rambo 3097* (BAA); Vila Inconfidência, 8 Sep 1939 fl!, *Araujo 426* (BAA); São Leopoldo, in silva primaeva ast, Jan 1906 fl!, *Dutra 770* (SI). Santa Catarina: Nova Trento, Jun 1938 fl!, *Rambo 3229* (BAA).

4. **Merostachys yungasensis** Lizarazu sp. nov.—TYPE: BOLIVIA. La Paz, Dpto. Nor Yungas, 40 km before Caranavi, from rio Alto Beni, roadside through forest, 1500 m, 9 Mar 1987 fl!, *S. Renvoize 4732* (holotype: LPB!; isotypes: SI!, K).

Ad *Merostachydi clauseno* similis, sed foliis ramorum laminis glabris, 14–16.5 cm longis, 3.5 cm latis, 19–21 nervatis, nervo medio excentrico; racemis 37–40 spiculis, notabilissimus falcatis; gluma infera apice mucronato; gluma supera glabra, ca. 8.5 mm longa, dimidia spicula longiora; flosculo fertili glabro; lodiculis lanceolatis, marginibus laevibus; antheras 6–6.5 mm longis; basi styli globosa, bene differt.

Perennial; rhizome sympodial, pachymorph. Culms 10–15 m tall, ca 1.5 cm in diameter, scabrous; internodes ca 50 cm long, terete, hollow, 1.5–2 mm thick-walled, scabrous; prickles retrorse, nodes ca 1.5 cm long, protuberant, with short whitish hairs below. Culm leaves not seen. Foliage leaves: sheaths longitudinally furrowed, slightly scabrous; oral setae 2–3.25 mm long, 20–22 in each side of the sheath, whitish, scabrous; inner ligule ca 1 mm long, membranaceous, entire, puberulous or glabrous; outer ligule ca. 0.3 mm long, a rim minutely ciliate at the margin; pseudopetiole 4–6 × 2–2.2 mm, oblong, stramineous, glabrous; pulvinii on the adaxial surface of pseudopetiole; blades 14–23 × 3.5–5.1 cm, abaxial surface glaucous, oblong, broadly lanceolate, abruptly attenuate toward the apex, the base asymmetric, subrounded, midnerve eccentric, 19–21-nerved, 3 marginal scabrous nerves at both sides of midnerve, margin scabrous. Flowering branch complement 46–51 cm long, with ca. 26 branches, the internodes 8.5–10.5 cm long, 2–4 mm wide, stramineous, pilose, with whitish hairs, nodes brown, puberulous, scabrous. Inflorescence a one-sided raceme, 6.5–7 × 1.5–1.6 cm, falcate, terminal, with 37–40 spikelets; rachis grooved, densely strigose, hairs white; pedicels ca. 2 mm long, globose, pubescent; spikelets 14–15 × 3–3.5 mm, 1-flowered, subsessile, subpatent; glumes 2, unequal; lower glume 3.5–4 × 1.8–2 mm, 1-nerved, ovate, apex mucronate, asymmetric, glabrous; upper glume 8–8.5 × 3–3.5 mm, ½ the length of the spikelet,

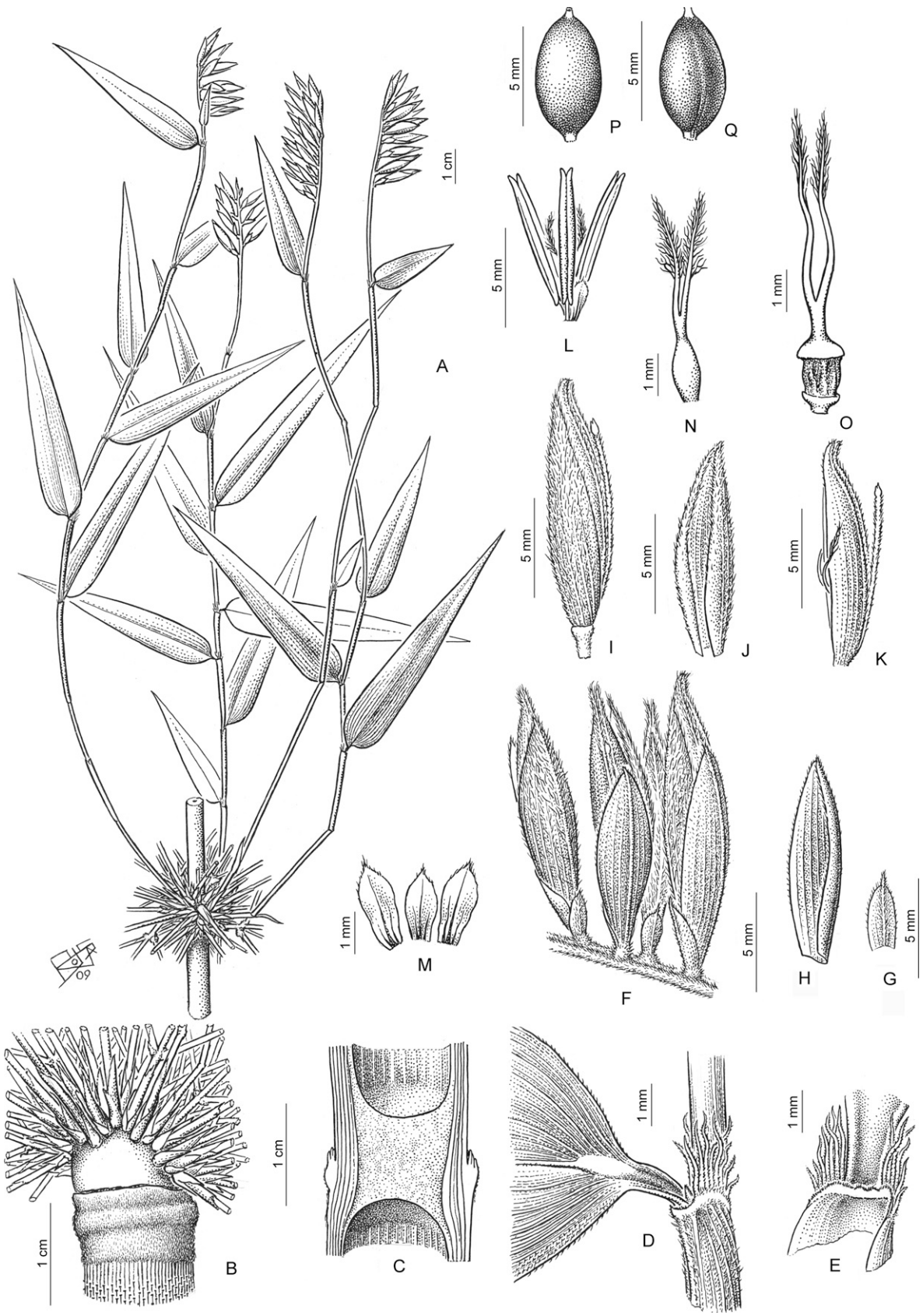

FIG. 2. *Merostachys multiramea.* A. Flowering branches and part of branch complement. B. Base of the branch complement. C. Node in longitudinal section, internal view. D. Upper portion of the branch foliage leaf sheath, ligule, oral setae, pseudopetiole, and blade (adaxial surface). E. Inner ligule and oral setae, ventral view. F. Rachis fragment provided with spikelets. G. Lower glume, ventral view. H. Upper glume, dorsal view. I. Spikelet, glumes removed. J. Lemma, ventral view. K. Palea and rachilla prolonged in a reduced floret, lateral view. L. Lodicule, androecium, and gynoecium. M. Lodicules, detail. N. Gynoecium. O. Immature caryopsis. P. Caryopsis, dorsal view. Q. Caryopsis, hilar view. [A, D-K, O-Q from *Múlgura de Romero et al. 2713* (SI); B-C, L-N from *Porta 33* (SI)].

FIG. 3. *Merostachys yungasensis.* A. Branch complement. B. Inflorescence. C. Mature bud complement. D. Inner ligule, oral setae, and pulvinii, ventral view. E. Foliage leaf sheath, pseudopetiole, and foliage leaf blade, showing oral setae. F. Rachis fragment provided with spikelets and upper glume, ventral view. G. Lower glume, dorsal view. H. Upper glume, dorsal view. I. Lemma, ventral view. J. Palea and rachilla prolonged in an aborted floret, lateral view. K. Lodicules, androecium, and gynoecium. L. Lodicules, detail. M. Gynoecium with stigmas rarely bearded. N. Gynoecium with plumose stigmas. O. Immature caryopsis. [A-B, D-O from *Renvoize 4732* (SI); C from *Solomon 12702* (LPB)].

ovate-triangular, apex mucronate, glabrous; upper floret perfect; fertile lemma 11–12 mm long, ovate, coriaceous, apex acute, 14–16-nerved, glabrous; fertile palea 11–12 mm long, glabrous, ellipsoid, acuminate, 2-keeled, keels scabrous, lemma and palea with transverse veins; rachilla prolonged in 10–12 mm long, ending in a reduced floret; lodicules 3, lanceolate, margin smooth, unequal in length, the posterior one 1.8–2 × 1.5–1.6 mm, and the anterior pair 2.5–3 × 1.7–1.75 mm, 3-nerved, membranaceous; stamens 3, anthers 6–6.5 mm long; ovary 3–3.5 mm long; style base 0.5–1 mm long, globose; stigmas 2, ca. 2 mm long, plumose, rarely bearded; caryopsis immature. Figure 3.

Iconography—Renvoize (1998: 30, Fig. 2: D) under *Merostachys* spp.

Etymology—The epithet *yungasensis* refers to the phytogeographic region where this species occurs, located in the province of Nor Yungas in the department of La Paz, Bolivia.

Geographic Distribution and Ecology—In Bolivia it has been collected at the Yungas, a stretch of forest along the eastern slope of the Andes Mountains from southeastern Peru through central Bolivia. The region is temperate, humid, and with a constant fog (Beck 1998).

Additional Material Examined—BOLIVIA. La Paz: Nor Yungas, Serranía de Bella Vista, 16 km N of Carrasco (37 Km N of Caranavi) on road to Palos Blancos, montane wet forest, 15°35'S, 67°34'W, 31 Oct 1984, veg!, *J. C. Solomon 12702* (MO, LPB).

Observations—The morphological characters of *M. yungasensis* are compared with those of other species of *Merostachys* from Argentina, Bolivia, Paraguay, and Peru (Table 1).

Micromorphology of Merostachys yungasensis—Culm epidermis**:** Ribs inconspicuous (Fig. 4 A). Long cells without simple papillae. Large prickles 104–110 × 41–50 µm, 3.9–5 times the stomatal length, barb apex retrorse. Small prickles 17.8–19.6 × 10.7–12.5 µm, base shorter than stomata, barb apex introrse. Stomatal complex 20.8–26.8 × 8.3–8.9 µm, slightly sunken, parallel-sided. Microhairs abundant, basal cell 10.7–16.7 µm long, apical cell 19.6–25 µm long, subsidiary cells, rectangular in outline. Macrohairs absent (Fig. 4 A-B).

Abaxial leaf-epidermis**:** Long-cells 110–164 × 9.4–11 µm, variable in length, with thin sinuous walls, papillae in two rows, branched, 2–3-lobed, some of them overarching the individual stomata. Short cells 31.8–38.6 × 9.5–11 µm, with thin sinuous walls, between stomata. Silica bodies vertically elongated, irregular crenate outline, Macrohairs absent. Microhairs absent or occasionally present over the veins, with basal cell 30–31 µm long and distal one frequently collapsed. Prickle hairs (Fig. 4 E) ca. 58.6 × 12.4 µm, infrequent, barb length at least twice as long as the stomata. Stomata 20–23.6 × 9.6–14 µm, subsidiary cells papillae, papillae 4–6 furcated (Fig. 4 C-E).

TABLE 1. Comparative diagnostic characters among species of *Merostachys.* [1]Characteristics of *M. brevispica* are based on the original diagnosis (Munro 1868) and phototypes. [2] According to Sendulsky et al. (1987).

Characters	*M. brevispica*[1]	*M. clausenii*	*M. multiramea*	*M. yungasensis*
Flowering branch complement, length (cm)	27–45	26–34	14.5–45	46–51
Raceme, shape	subfalcate	straight or subfalcate	subfalcate	falcate
Raceme, length (cm)	4–6.1	(5–)7–11	3–5(–9)	6.5–7
Raceme, number of spikelets	10–18	18–29	11–20	37–40
Spikelets, length (mm)	11–14	(10–)13–21	9–12	14–15
Foliage leaf sheath, indument	hirsute	scaberulous	scaberulous	scaberulous
Foliage leaf blade, shape (Ratio: Length/Width)	narrowly lanceolate (6.6–7)	broadly lanceolate (4.5–5.8)	narrowly lanceolate (5.5–7.5)	broadly lanceolate (4–4.5)
Foliage leaf blade, length (cm)	7–11	(6–)8–13	7.5–8.7	14–23
Foliage leaf blade, wide (cm)	1–1.5	1.2–2.8	1–2.1	3.5–5.1
Foliage leaf blade, number of nerves	11–12	(8–)14–16	8–14	19–21
Foliage leaf blade, midnerve	centric	centric	centric	eccentric
Pulvini	absent	present, rarely absent	absent	present
Pseudopetiole, length (mm)	3–5	2–5	2.5–4	4–6
Oral setae, length (mm)	(2.5–)3.5–4	(2–)3–6	2.5–3	2–3.25
Ratio upper glume/spikelet length	1/3-1/2	1	2/3	1/2
Lower glume, apex	cuspidate	abruptly acuminate	mucronate	mucronate
Lower glume, length (mm)	3.5–4	2–6	3–4	3.5–4
Upper glume, length (mm)	6–7	9–14	7–9.5(-12)	8–8.5
Lemma, indument	pubescent	subglabrous or pilose	villous	glabrous
Lemma, length (mm)	11–12	(8–)11–15	(8.5-)10–13	11–12
Lemma, nerves number	not seen	14–18	12–16	14–16
Palea, indument	pilose	pilose, occasionally subglabrous	subglabrous	glabrous
Palea, length (mm)	11–12	10–15	8–12.5	11–12
Lodicules, margin and shape	margin not seen, oblong-obtuse	ciliate, cuneiform	ciliate, lanceolate	smooth, lanceolate
Anther, length (mm)	not seen	(6.5–)9–11	3–5	6–6.5
Style base, length (mm)	not seen	1–2	0.5–1	0.5–1
Style base, shape	not seen	cylindrical	cylindrical	globose
Stigma	plumose	plumose	bearded	plumose, rarely bearded
Stigma, length (mm)	not seen	(1–)3–6	3–4.5	2–3
Caryopsis[2], color	not seen	stramineous	blackish	immature
Caryopsis[2], length (mm)	not seen	6–7	5.5–7	immature

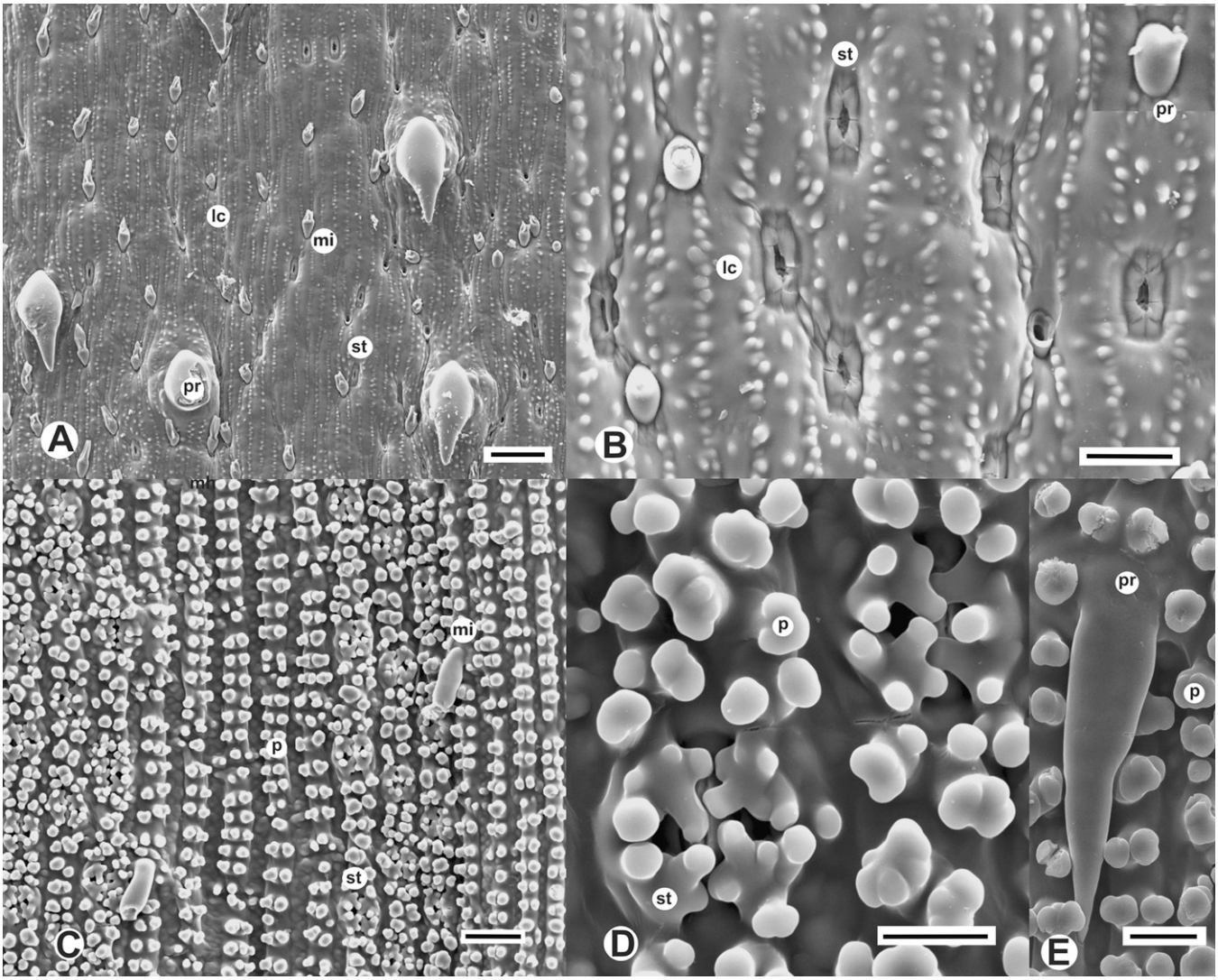

Fig. 4. SEM photographs of *Merostachys yungasensis*. A-B. Cauline epidermis. A. General view. B. Detail. C-E. Foliage leaf blade epidermis, abaxial surface. C. General view. D. Stomatal complexes, detail. E. Prickle hair, detail. [A-C, E from *Solomon 12702* (LPB); C-D from *Solomon 12702* (LPB), E from *Renvoize 4732* (SI)]. A, bar = 50 µm; B, bar = 20 µm; C, bar = 25 µm; D-E, bar = 10 µm; Abbreviations: bc. Bulliform cells, lc. Long cells, mh. Microhairs, p. papillae, pr. Prickles, sc. short cells, st. stomatal complexes.

Notes—Characters of cauline epidermis are valuable for taxa identification (Rúgolo de Agrasar and Rodríguez 2002). According to the authors, *Merostachys clausenii* and *M. multiramea* differ in rib prominence (not prominent vs. prominent), microhair distribution (isolated vs. abundant), and presence of small prickle hairs (present vs. absent). Saiter Gomes and Neves (2009) studied leaf epidermal characters in 12 species of *Merostachys* from Brazil and one species from Mesoamerica without the inclusion of *M. clausenii* and *M. multiramea.*

Other useful micromorphological characters were detected (Lizarazu et al. in prep.), some of them are included in comparative tables between *M. clausenii, M. multiramea,* and *M. yungasensis* (Tables 2, 3).

Table 2. Comparative micromorphological characters of cauline epidermis among species of *Merostachys*

Characters	*M. clausenii*	*M. multiramea*	*M. yungasensis*
Papillae	abundant, simple, alternating or irregularly placed	abundant, simple, alternating or irregularly placed	isolated or absent
Small prickle hairs	absent	absent	present
Large prickle hairs, length (µm)	86.2–87.5	86.2–100	104–110
Microhairs	isolated or absent	abundant	abundant
Prickle hairs, apex	acuminate	obtuse	acuminate

Table 3. Comparative micromorphological characters of foliage leaf blade epidermis among species of *Merostachys*

Characters	*M. clausenii*	*M. multiramea*	*M. yungasensis*
Papillae, number in long cells	6–7	6–7	4–5
Papillae, arrangement	in one row	in two rows	in two rows
Papillae, type	bilobed	bilobed	2–3-lobed.
Prickle hairs, abundance	abundant	scattered	absent, rarely present
Silica bodies, outline	dumb-bell	not seen	smooth, regular

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