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**The description of a new genus and twenty-three new species of Metarbelidae  
(Lepidoptera: Cossioidea) from the lowland tropical rain forests of the  
Guineo-Congolian Region with notes on habitats and biogeography**

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**Abstract**

*Haberlandia* **gen. nov.** is described. Currently, it comprises twenty-four species from Sierra Leone, Côte d'Ivoire, Ghana and Togo (West Africa); Cameroon, Central African Republic, Democratic Republic of Congo, Republic of the Congo and Gabon (Central Africa) with a single record from the Lake Victoria basin (Uganda, East Africa). Based on its distribution, *Haberlandia* **gen. nov.** is classified as endemic to the lowland tropical rain forests of the Guineo-Congolian Region. The new genus is therefore treated as a potential indicator of Pleistocene tropical rain forest refuges. Due to a strong link to that habitat and additional primitive morphological characteristics, the new genus appears to be of Cretaceous origin. Twenty-three new species are described, along with photographs of adult specimens, illustrations of their wing venation and genitalia as well as information on the floristic composition of their habitats. *Lebedodes hintzi* Grünberg (1911) has been transferred from the genus *Lebedodes* Holland (1893) into *Haberlandia* **gen. nov.**. The type species of the new genus is *Haberlandia odzalaensis* **spec. nov.**.

**Keywords:** Afrotropical Region, lowland tropical rain forest, Guineo-Congolian Region, Lake Victoria basin, Pleistocene refuge areas, potential indicator species, *Haberlandia* **gen. nov.**, new species, taxonomy, endemism.

**Introduction**

There has not been a comprehensive treatment of the Metarbelidae of the Afrotropical Region since the monograph of Janse (1925) for South Africa and the publication by Gaede (1929). Between 1930 and 1977 less than ten new species were described, and the diversity of the family has only recently come back under focus, when twenty-two new species from the Afrotropical Region were described by Lehmann (1997, 2007, 2008a, b) and one species by Mey (2005). Subsequently, the new genus *Kroonia* from the Afrotropical Region has been described (Lehmann 2010a), including seven new species. The genus *Arbelodes* Karsch (1896) from southeast-central and southern Africa has recently been revised, including the description of thirteen new species (Lehmann 2010b). The description of the new genus *Shimonia* Lehmann, De Prins & Wägele (in prep.) from Central and East Africa will include three new species. The characteristics which define the Metarbelidae, their distribution in the Afrotropical and Oriental regions, their immature stages and habitats were described by Lehmann (2008a, b). De Prins & De Prins (2011) list 176 species of Metarbelidae recorded from the Afrotropical Region belonging to 15 genera. This number of species will certainly rise to more than 300 in the next five years, and include an increase in the number of genera. In this paper another new genus is presented as fully as possible, taking into consideration the lack or inavailability of field research in several areas of West and Central Africa at present.

A number of collecting localities are located in Pleistocene refuge areas. The new genus appears together with some morphological ancient characteristics that might indicate links to these Pleistocene forest refuges and to the older Cossidae.

The refuge concept proposes that modern biotas in the tropics originate partly from ecological islands resulting from past cycles of forest fragmentation and subsequent expansion. It was also emphasized that African forest-adapted species evolved in isolation in these islands because these areas remained permanently forested during cool and dry climatic periods of the Pleistocene. The refuge concept includes the assumption that from the mid-Cretaceous to mid-Tertiary there is no evidence of major tectonic disturbances in Africa. Instead, the most important determinants of African biogeography were the northward drift of the continent and the central African uplift in mid-Tertiary times as well as periods of aridity alternating between wetter periods in the Pleistocene and Holocene (*e.g.* Hooker 1864, 1874; Lönnberg 1929; van Zinderen Bakker & Clark 1962; Hamilton 1976; Diamond & Hamilton 1980; Grubb 1982; Maley 1991).

The Guineo-Congolian Region was first recognized as “*Région guinéenne*” by Lebrun (1947). Monod (1957) renamed Lebrun’s area as the “*Région guinéo-congolaise*,” and White (1965) anglicized the term to the “*Guineo-Congolian Region*.” White (1979) presented three “*subdivisions*” of that region based on the size of the flora and its specific endemism. These subdivisions are “*Upper Guinea*” from Guinea Republic to south-central Ghana (14°-0°W, 11°-5°N), “*Lower Guinea*” from southern Benin to Cabinda and eastwards to the Congo River (2°-17°30’E, 8°N-6°50’S), and “*Congolia*” from the Congo River in the west to the Kivu centre and the western shore of Lake Victoria in the east (17°50’-32°E, 3°N-6°S). These subdivisions are separated by two areas with few endemic forest species. The first two subdivisions are separated by the savannas of the “*Dahomey interval*” (0°3’W-2°5’E) and the latter two by the “*Sangha River interval*” (14°-18°E) that includes large swamps with areas of swamp forest.

Lepidoptera species are often associated with certain vegetation types or biotopes (Van Dyck 2011). A particular association of Metarbelidae to legume-dominated tropical forests has been emphasized by Lehmann (2008a) based on 14 years of field research in southeast coastal Kenya (Lehmann & Kioko 2005). With regard to Central Africa, Lehmann, De Prins & Wägele (in prep.) stated that the records on ecology, bionomics and habitats are scanty and often separated from the taxonomic data, thus requiring integration. Hence, detailed habitat information is presented here for the relatively large area of the *Haberlandia* **gen. nov.**, gathered from habitat descriptions scattered over many small and obscure publications. Furthermore, no, or extremely little taxonomic or biodiversity work had been done for various large areas, with particularly large gaps in the forests of West Africa and the Congo Basin. Therefore, it can be assumed that the number of species of *Haberlandia* **gen. nov.** will increase in the future.

Many species of *Haberlandia* **gen. nov.** might never be discovered due to the increasing severity of the problem of deforestation of lowland tropical rain forests. The decline continues most notably in West Africa, which has lost the majority of its forest cover since the beginning of the 20<sup>th</sup> century (Chatelain *et al.* 2004).

### **Material and methods**

The discrimination of the following twenty-four species is based on specimens from the collections of the Natural History Museum, Paris, France (MNHN); the private collection

Witt, Munich, Germany (MWM); the National Museums of Kenya, Nairobi (NMK); the Royal Museum for Central Africa, Tervuren, Belgium (RMCA); the Zoological Museum Amsterdam, The Netherlands (ZMA); the Natural History Museum, Humboldt-University, Berlin, Germany (ZMHB); the Zoological State Collection Munich, Germany (ZSM), including privately-owned specimens from Dr Albert Legrain (Hermalle-sous-Argenteau, Belgium). A photograph of each species was taken prior to dissection. Colours of each specimen (*e.g.* of the head, thorax, abdomen, wings) were recorded before dissection in daylight and are based on Ridgway (1912). The nomenclature for parts of the head, antennae, thorax, abdomen, legs and venation follows Scoble (1995) and Edwards *et al.* (1998) and for internal features, mainly the genitalia, Sibatani *et al.* (1954) and Klots (1970). The terminology of the external and internal features at generic level is in accordance with Janse (1925).

The term “*geometric design*” is defined here and is based on several discussions with Dr Jeremy Holloway (London). According to this, a geometric design should comprise the following three characteristics:

- i) anything more complex than a wing pattern as, for example, typical separated fasciae;
- ii) any pattern that converges to form angles with each other or with other markings in a prominent geometric manner;
- iii) the geometric manner should in some way be regular with angles, squares, circles, letter-like or leaf-like patches, or even reticulation.

The hypothesis is that a geometric design designates a younger age than a wing pattern without any geometric design.

The meaning of the term “*tropical rain forest*” depends on its definition. It will be used here, in regard to West and Central Africa, for two main types of closed forest, namely: first, tropical evergreen seasonal forest and secondly, for the more deciduous types such as tropical semi-deciduous forest. The evergreen type typically features are high species diversity and a dominance of trees of the Caesalpinioideae. In contrast, the semi-deciduous rain forests have a larger proportion of taller trees that lose their leaves at least briefly during the dry season, but smaller trees are almost all evergreen; Caesalpinioideae are rarely dominant. The semi-deciduous type was not defined as “*tropical rain forest*” by the Unesco (1973) and by Hall & Swaine (1981) for Ghana. Other authors, such as Keay (1959) for Nigeria and White (1983) for the Guineo-Congolian Region, defined all closed forests as “*lowland rain forest*,” separating only “*wetter*” and “*drier*” types. This is followed here. It takes into consideration that, particularly in West Africa, the wet evergreen forests along the coast change gradually to semi-deciduous forests further inland largely due to a rainfall gradient and the extent of fire. It is assumed that the distribution of *Haberlandia* **gen. nov.** also gradually decreases with a lower amount of rainfall and hence, also occurs in the drier semi-deciduous rain forests that are sometimes surrounded or separated by savanna today. In these drier forest types it seems to be a relict because they were wetter rain forest types during the interglacial periods.

The term “*lowland forest*” was defined for tropical Africa by Keay (1959). They are confined to areas below 1300 m. This is followed here.

The biogeographical names in this paper follow White (1983), Sayer *et al.* (1992), Burgess *et al.* (2004) as well as Poorter *et al.* (2004).

## Taxonomic review

### ***Haberlandia* gen. nov.**

Type species: *Haberlandia odzalaensis* **spec. nov.**

*Haberlandia* **gen. nov.** has the typical characters that define the Metarbelidae. These were summarized by Lehmann (2008a) and are therefore not repeated here. The definition of the new genus is apomorphy-based.

### **Apomorphies of *Haberlandia* gen. nov.:**

- i) The uncus has a heavy, strong appearance, it is broad, at least half the size of the valva in a lateral view, its dorsal surface is usually flat, its lateral surface is straight and with or without setae. The shape of the uncus is unique among the Metarbelidae since it resembles a head with a short neck of certain dinosaurs (*e.g.* genus *Yamaceratops*) or the head of a golf club.
- ii) The dorsal surface of two gnathi is of a tabular shape.
- iii) Abdominal segment 8 in the female has a narrow, gap-like structure dorsally, at least half of the width of the dorsal surface.
- iv) The tegulae have a peculiar colour, often Hay's russet or xanthine orange, with a glinting shine. These triangular-shaped colour patches occur in the male as well as the female. They are very similar in colour and shape to the patch of hairs on the forehead, and hence above the eyes, of the De Brazza's monkey (*Cercopithecus neglectus* Schlegel). The tarsi have usually the same colour and glinting shine as the tegulae.
- v) A V-shaped simple geometric design in the subterminal and postmedial area on the forewing as well as on the hindwing occurs in both sexes.

A pair of small pits on the lower part of the frontoclypeus occurs also in a few other genera of Metarbelidae, and hence, pits are not treated here as an apomorphy. However, the occurrence of a pair of pits in *Haberlandia* **gen. nov.** (Figures 33-34) is treated herein preliminarily as a plesiomorphic character that indicates a relationship to the Cossidae. This assumption is based on Edwards *et al.* (1998) who mentioned such pits as an important character for the Cossidae (also J. Minet pers. comm.). It is noteworthy that all species have an extremely similar wing pattern combined with a similar venation. This is unusual among the Metarbelidae for a comparatively large genus and indicates a species complex.

### **Generic comparisons**

A generic comparison cannot be presented as no genus among the Metarbelidae is similar to *Haberlandia* **gen. nov.**. Its putative combination of characteristics and its position within the Metarbelidae demand the creation of a new genus.

### **Description (adult)**

**Head:** Rough-scaled; a pair of small pits on the lower part of the frontoclypeus is always present in both sexes (Figures 33-34), a pair of small pimples is absent; a pair of deep, oval-shaped pits occur behind the labial palpi, the latter consist of two segments, a short basal one and an upper segment that is at least twice as long; male antennae bipectinate, female antennae bipectinate (Figures 35-36), flagellum scaled dorsally, branches are not scaled in both sexes; antenna-wing ratio usually below or equal to 0.35:1.

**Thorax:** Densely covered with hair-like scales; the tegulae have a peculiar colour, often of Hay's russet or xanthine orange, with a glinting shine in the male as well as female. A short crest of hair-like scales occurs on metathorax.



**Wings:** The whole upperside as well as underside of the fore- and hindwing is densely rough-scaled in both sexes. The large size of the forewing and hindwing in males as well as females is outstanding. Both, *Haberlandia* **gen. nov.** and the new genus *Shimonia* Lehmann, De Prins & Wägele (in prep.) have currently the largest wings of the Metarbelidae on the African mainland. The Upper Guinean species of *Haberlandia* **gen. nov.** generally appear to be of a smaller wingsize if compared to the Central African species. The female is always larger than the male. The usually short-stalked V-shaped design of both sexes is the only geometric design and an easily recognized characteristic. A narrow patch of sepia from near the base of the forewing and below 1A+2A to half of an inner margin occurs in both sexes. A colourful pattern does not exist on the fore- and hindwing. The retinaculum and frenulum are absent.

**Venation:** Similar in both sexes. *Forewing:* The cell is slightly longer than half the length of the wing, 1A+2A forked at base, CuP obsolete, CuA<sub>2</sub> initiating from posterior angle of posterior cell, CuA<sub>1</sub>, M<sub>3</sub> and M<sub>2</sub> separated and initiating from apical angle of posterior cell, M<sub>1</sub> initiating from apical angle of median cell; R<sub>3</sub> long stalked and initiating from apical angle of median cell; R<sub>5</sub> and R<sub>4</sub> on a long stalk from about one-fourth of R<sub>3</sub>; R<sub>1</sub> initiating from anterior branch of median cell; Sc more or less parallel to R<sub>1</sub>; discocellular angled inward, lower angle slightly longer than upper one, a small vein present in discocellular cell. An areole and vein R<sub>2</sub> are always absent in both sexes. *Hindwing:* The cell is usually less than half the length of the wing; 3A present, 1A+2A present, CuP usually obsolete; CuA<sub>2</sub>, CuA<sub>1</sub>, M<sub>3</sub> and M<sub>2</sub> as for the forewing; M<sub>1</sub> and Rs initiating from apical angle of anterior cell, separated; Sc+R<sub>1</sub> usually without a bar to Rs and the median cell, discocellular cell angled inward, lower angle longer than upper angle, a small vein is present in the discocellular cell.

**Legs:** Epiphyses present from one-third of foretibiae. Hindfemora, -tibiae and -tarsi are covered with dense, long hair-like scales, tarsi often with a patch of xanthine orange, with a glinting shine. Hindlegs are with two pairs of tibial spurs in both sexes (usually shorter in the male but often longer than 1.3 mm in the female). *Haberlandia entebbeensis* **spec. nov.** from Uganda and *H. rohdei* **spec. nov.** from Ghana have only one pair of tibial spurs (apical spurs).

**Abdomen:** Densely covered with hair-like scales, abdominal tuft present, but remarkably short and rarely longer than one-fourth of abdomen length.

**Male genitalia:** Saccus broad, tip rounded; uncus currently the strongest among the Metarbelidae with a heavy appearance and at least half the size of the valva, strongly bent towards the valvae. Its dorsal surface is flat and its lateral surface is straight. The uncus is never bifid. The tegumen is broader than the vinculum and appears to consist of two or three overlapping plates (tergites 9 and 10?). Occurrence of two large gnathi at least half the size of the valvae, not separated ventrally. The gnathi appear to originate from the ventral margin of the tegumen and are connected by a membrane-like structure to the knee-like, anterior end of the costa of the valvae. The dorsal surface of the gnathi is usually of a tabular shape, but more or less foliaceous below and towards the ventral side. The valvae are simple and have a prominent sacculus. Costae elongated, extending in a broad (50% of the width of valva), knee-like shape to the ventral part of the tegumen and beyond the gnathi; a broad belt-like structure covers the base of the valva, sometimes as broad as 70% of the width of valva. The juxta has often one long emargination (longer than 35% of the length of the juxta). The aedeagus is simple but very large, usually longer than width of saccus, vinculum and valve; the distal end is spoon-like, vesica without cornuti.

**Female postabdominal structure:** Papillae anales obliquely 8-shaped and covered with long and/or short setae. Segment 8 sometimes has a wave-like dorsal surface (lateral view) that is always divided by a prominent narrow gap (viewed dorsally). This dorsal gap is at least as long as half of the width of the dorsal surface, but often longer. Posterior edge of segment 8 has long setae ventrally that often extend beyond the papillae anales. The lateral surface of segment 8 has sometimes prominent slits. The posterior apophyses are slightly longer than the anterior apophyses, the latter are more narrow.

**Species diversity:** Currently, *Haberlandia* **gen. nov.** comprises twenty-four species: *H. hintzi* (Grünberg 1911) has been transferred from the genus *Lebedodes* Holland (1893) into the new genus because it possesses the defining characters mentioned above; twenty-three new species are described: *H. odzalaensis* **spec. nov.**, *H. lindacammae* **spec. nov.**, *H. legraini* **spec. nov.**, *H. shimonii* **spec. nov.**, *H. annetteae* **spec. nov.**, *H. hilaryae* **spec. nov.**, *H. lusamboensis* **spec. nov.**, *H. entebbeensis* **spec. nov.**, *H. isakaensis* **spec. nov.**, *H. rudolphi* **spec. nov.**, *H. isiroensis* **spec. nov.**, *H. ueleensis* **spec. nov.**, *H. clenchi* **spec. nov.**, *H. josephi* **spec. nov.**, *H. ofriedi* **spec. nov.**, *H. rohdei* **spec. nov.**, *H. togoensis* **spec. nov.**, *H. hollowayi* **spec. nov.**, *H. janzi* **spec. nov.**, *H. tempeli* **spec. nov.**, *H. taiensis* **spec. nov.**, *H. rabiusi* **spec. nov.**, *H. hulstaerti* **spec. nov.** (Figures 1a-29a, 1b-29b; 1-36).

**Selection of the type species:** The species from the Odzala National Park (henceforth ‘Odzala NP’) has been selected for the type species of the new genus based on two reasons: Firstly, Odzala NP represents the habitats characteristic for the whole genus. These habitats include: i) various diverse, legume-dominated, mixed semi-evergreen open rain forest types on dryland including Marantaceae forests that have not yet reached its climax stage of primary forest; ii) closed primary swamp or riparian forest; iii) evergreen forest and/or thicket clumps currently expanding into savannas. The second reason is that the riparian forests of Odzala NP most probably represent minor Pleistocene refuges that were linked to the plateau of eastern Gabon. Although this plateau is partly located in the Sangha River interval it represents a major refuge area that is only 15 to 35 km west from Odzala NP (Sosef 1994).

**Etymology:** *Haberlandia* **gen. nov.** is named in honour of my grandparents, Eduard Willi Haberland, who passed away on 10<sup>th</sup> June 1982 and to his wife Charlotte Marie Johanna, nee Quitter, who died on 26<sup>th</sup> December 2010. Both accompanied me almost daily into the forests around Finsterwalde (Niederlausitz) to collect and record Lepidoptera during 1971 to 1982. The gender of the new genus is feminine.

**Ecology:** *Haberlandia* **gen. nov.** is classified as rain forest-dependent genus. The average annual rainfall for its lowland habitats is high and ranges from 1300 mm to more than 4000 mm (with one exception in the Dahomey interval). A link has been found to the following forest types: i) “Guineo-Congolian swamp forest and riparian forest;” ii) “Mixed moist semi-evergreen Guineo-Congolian rain forest;” iii) “Single-dominant moist evergreen and semi-evergreen Guineo-Congolian rain forest;” iv) “Drier peripheral semi-evergreen Guineo-Congolian rain forest” *sensu* White (1983). Despite the different plant community compositions, the biotopes share a common feature: woody legumes are dominant or co-dominant.

**Bionomics:** The author assumes that the caterpillars feed on the bark and/or in the wood of tree species, particularly on species of Caesalpinioideae. However, the biology of *Haberlandia* **gen. nov.** is unknown at present.

**Distribution:** *Haberlandia* **gen. nov.** is classified here as endemic to the lowland tropical rain forests of the Guineo-Congolian Region. Its present range extends from Sierra Leone, Côte d’Ivoire, Ghana and Togo eastwards via forest patches of the Dahomey interval to coastal forests of Cameroon and further east through southern Cameroon into the Central African Republic, south to the Republic of the Congo, the Democratic Republic of Congo (henceforth ‘DRC’) and to Gabon. The Guineo-Congolian lowland rain forest and swamp forest remnants around Entebbe and near Lake Victoria (south-central Uganda, East Africa) represent a relict distribution. Within this large range the new genus follows the distribution of the African lowland tropical rain forest. Kenema (southeastern Sierra Leone, West Africa) is currently the northwestern distribution limit; Voka (southeast Republic of the Congo) the southwestern limit; Lusambo (south-central DRC) the southeastern limit and Isiro (northeast DRC) the northeastern limit. The record from Entebbe represents the eastern most limit in Africa and a disjunct distribution (Figure 37). Of particular note is that no known record exists from the

Rwenzori Mountains, stretching east from the Congo Basin and west from Entebbe in a north-southerly direction. The new genus is unknown on the Arabian Peninsula and on Madagascar.

Note: *Haberlandia* **gen. nov.** is treated here as a potential indicator for Pleistocene forest refuges due to the following facts: i) its distribution in lowland tropical rain forests of the Guineo-Congolian Region; ii) at least 60% of the type localities are located within or close to Pleistocene forest refuges; iii) the occurrence of a pair of small pits on the lower frontoclypeus that indicates a relationship to the older Cossidae.

### A key to the species of *Haberlandia* **gen. nov.**

The key is based exclusively on morphological characters. As for all twenty-four species only one or a few specimens are available, identifications obtained with this key should be cross-checked carefully with the description, distribution and the figures presented in this paper. For the same reason external features alone cannot be used for a determination.

1a.	Male .....	2
1b.	Female .....	9
2a.	Males unknown.....	3
2b.	1 pair of tibial spurs on hindlegs.....	4
2c.	2 pairs of tibial spurs on hindlegs .....	5
3.	<i>rudolphi</i> spec. nov.; <i>clenchi</i> spec. nov.; <i>hintzi</i> ; <i>josephi</i> spec. nov.; <i>tempeli</i> spec. nov.; <i>rabiusi</i> spec. nov.	
4a.	2 processes on gnathos.....	<i>entebbeensis</i> spec. nov.
4b.	Process on gnathos absent.....	<i>rohdei</i> spec. nov.
5a.	Process on gnathos present .....	6
5b.	Process on gnathos absent .....	7
5c.	Unknown (gnathos missing) .....	8
6a.	Gnathos bearing 3 processes .....	<i>isakaensis</i> spec. nov.
6b.	Gnathos bearing 2 processes .....	6d
6c.	Gnathos bearing 1 process .....	6h
6d.	Uncus largely covered with setae, emargination in juxta 30-40% of its length .....	<i>odzalaensis</i> spec. nov.
6e.	Uncus with lateral setae, emargination in juxta 60%.....	<i>lusamboensis</i> spec. nov.
6f.	Uncus with only few lateral setae, emargination in juxta 15%, juxta with 2 ridges.....	<i>isiroensis</i> spec. nov.
6g.	Processes rudimentary, uncus largely with setae, emargination in juxta 60% .....	<i>otfriedi</i> spec. nov.
6h.	Uncus largely covered with setae, emargination in juxta 30%.....	<i>lindacammae</i> spec. nov.
6i.	Uncus largely covered with setae, juxta with 2 ridges, emargination 10% .....	<i>shimonii</i> spec. nov.
6j.	Gnathos 70% of valva, uncus with lateral setae, emargination in juxta 40% .....	<i>ueleensis</i> spec. nov.
6k.	Gnathos 40% of valva, uncus with lateral setae, emargination in juxta 40%.....	<i>legraini</i> spec. nov.
7a.	Gnathos 40% of valva, uncus largely without setae, saccus large, 25% of gnathos	<i>annetteae</i> spec. nov.
7b.	Gnathos 60% of valva, uncus bearing dorsal setae, emargination in juxta 10% .....	<i>hilaryae</i> spec. nov.
7c.	Gnathos 50% of valva, uncus bearing lateral setae, emargination in juxta 40% .....	<i>togoensis</i> spec. nov.
7d.	Gnathos large, 65% of valva, whole uncus bearing setae, emargination in juxta 30%	<i>hollowayi</i> spec. nov.
7e.	Gnathos 60% of valva, uncus with lateral setae, 2 ridges on juxta, emargination 20%	<i>janzi</i> spec. nov.
7f.	Largest belt-like structure covering 70% of valva, uncus with setae, emargination 50%	<i>taiensis</i> spec. nov.
8.	Uncus very narrow and densely covered with setae .....	<i>hulstaerti</i> spec. nov.

- 9a. Females unknown ..... 10  
 9b. 1 pair of tibial spurs on hindlegs ..... 10b  
 9c. 2 pairs of tibial spurs on hindlegs ..... 11
- 10a. *legraini* spec. nov., *shimonii* spec. nov., *hilarityae* spec. nov., *isakaensis* spec. nov., *isiroensis* spec. nov.,  
*ueleensis* spec. nov., *togoensis* spec. nov., *hollowayi* spec. nov., *janzi* spec. nov., *taiensis* spec. nov.,  
*hulstaerti* spec. nov..  
 10b. 1 pair of tibial spurs on hindlegs ..... *entebbeensis* spec. nov. & *rohdei* spec. nov.
- 11a. Segment 8 bearing slits ..... 12  
 11b. Segment 8 without slits ..... 13  
 11c. Segment 8 bearing 2 structures that appear like slits but are not open ..... *tempeli* spec. nov.
- 12a. Segment 8 bearing 2 slits ..... 12c  
 12b. Segment 8 bearing 1 slit ..... 12e  
 12c. Segment 8 bearing 2 sable-like and long slits, hook-like process near base of anterior apophyses ..... *hintzi*  
 12d. Segment 8 bearing 2 lanceolate and long slits, tiny hook-like process at base of anterior apophyses  
 ..... *josephi* spec. nov.  
 12e. Segment 8 bearing 1 S-shaped and long slit, tiny hook-like process near base of anterior apophyses .....  
*annetteae* spec. nov.  
 12f. Segment 8 bearing 1 lanceolate, broad but short slit, no hook-like process at base of anterior apophyses  
 ..... *rudolphi* spec. nov.
- 13a. Segment 8 bearing a bridge-like structure at anterior end of dorsal gap, small hook-like process at base of  
 anterior apophyses ..... *lindacammae* spec. nov.  
 13b. Segment 8 bearing no bridge-like structure at anterior end of dorsal gap, no hook-like process at base of  
 anterior apophyses ..... *odzalaensis* spec. nov.  
 13c. Segment 8 bearing no bridge-like structure at anterior end of dorsal gap, no hook-like process at base of  
 anterior apophyses, the latter are strongly bent towards ventral side ..... *lusamboensis* spec. nov.  
 13d. Segment 8 bearing no bridge-like structure at anterior end of dorsal gap, no hook-like process at base of  
 anterior apophyses that are not bent, narrower and shorter than posterior apophyses .... *rabiusi* spec. nov.  
 13e. Segment 8 bearing a small spot in the middle of its ventral edge, no bridge-like  
 structure at anterior end of dorsal gap, no hook-like process at base of anterior apophyses that are not  
 bent and as narrow as posterior apophyses ..... *clenchi* spec. nov.  
 13f. Segment 8 bearing a bridge-like structure at posterior end of dorsal gap, hook-like process at base of  
 anterior apophyses present, posterior apophyses broad ..... *otfriedi* spec. nov..

### 1. *Haberlandia odzalaensis* spec. nov.

Figures 1a, b, 2a, b; 1-3; 33-36.

#### Material examined:

Holotype male, Republic of the Congo, Western Cuvette department, Odzala NP, 400-500 m, 29.January-03.March.1997, V. Siniaev & S. Murzin leg., genitalia slide number 02/082009 I. Lehmann (in MWM).

Paratypes: male, same locality, date and collectors, genitalia slide number 03/082009 I. Lehmann (in MWM); male, same locality, date and collectors, genitalia broken (in MWM); male, same locality, date and collectors, no genitalia dissection done (in MWM); female, Odzala NP, 400-500 m, same date and collectors, ex coll. A. Schintlmeister, genitalia slide number 09/082009 I. Lehmann (in MWM); female, Central African Republic, economic prefecture Sangha-Mbaéré, Bayanga-Kongana, 20.-23.July.2009, T. Bouyer-Vanaerschodt leg., ex coll. Dr A. Legrain, genitalia slide number 15/012011 I. Lehmann (in RMCA); male, same locality and date, genitalia slide number 24/042011 I. Lehmann (in RMCA).

**Diagnosis:** The uncus has many short lateral and dorsal setae. The foliaceous structure of the gnathos has two thorn-like processes. The dorsal gap of segment 8 of the female is at least



two-thirds as long as the width of the dorsal surface. The posterior edge of segment 8 has long ventral setae that extend beyond the papillae anales. The latter is densely covered with long and short setae. Forewing and hindwing usually have a dark ground-colour which is mainly ecru-olive or Isabella colour in both sexes.

**Variation:** The paratypes from Kongana differ in the following characteristics:

- i) Female forewing length 24.5 mm; ground-colour dark, similar to the paratypes from Odzala NP, mainly ecru-olive mixed with light brownish olive in the forewing and buffy olive in the hindwing. The difference between the two female paratypes is remarkable in regard to the antenna-wing ratio: 0.28:1 (Kongana); 0.19:1 (Odzala).
- ii) Male forewing length 20.0 mm; antenna-wing ratio 0.35:1; ground-colour as in female. The antenna-wing ratio of the paratypes from Odzala NP is 0.31:1 and 0.35:1. Hence, the male antenna-wing ratio is variable ranging from 0.29:1 to 0.35:1. This might explain the variability of the antenna-wing ratio in the females. However, it is also possible that the specimens from Kongana represent a new species.

#### **Description (holotype)**

Male forewing length 22.0 mm; antenna-wing ratio 0.29:1. **Head:** Deep colonial buff, eyes ecru-olive; antennae deep colonial buff, short, branches of antennae 3.5x width of shaft, narrow, distance between branches 1.5x width of branch; labial palpi narrow, more than half of the diameter of the eye, colonial buff, sepia dorsally. **Thorax:** Patagia deep colonial buff; tegulae xanthine orange. **Abdomen:** Deep colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also capucine orange; medial spurs 0.8 mm, apical spurs 0.9 mm. **Forewing:** Upperside is deep colonial buff, several lines of buffy olive from costa to the dorsum; subterminal line buffy olive, forked near apex and coalescent with the postmedial line at CuA<sub>1</sub>, 'V' shortly stalked; CuA<sub>2</sub> ecru-olive; cilia short, 0.7 mm, colonial buff, glossy. The underside is deep colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside is deep colonial buff with a large triangular patch of buffy olive from half of inner margin to CuA<sub>2</sub>; cilia and underside as for the forewing. **Venation:** As described for the genus, but a small vein in the discocellular cell is forked towards the discocellular angle. **Genitalia:** See diagnosis.

#### **Description (paratype)**

Female forewing length 26.0 mm; antenna-wing ratio 0.19:1. **Head:** Ecru-olive, eyes black; antennae short, branches two times the width of the shaft; labial palpi longer than half of the eye diameter, ecru-olive. **Thorax:** Patagia ecru-olive with a narrow band of sepia; tegulae xanthine orange. **Abdomen:** Ecru-olive. **Legs:** Hindfemora, -tibiae and -tarsi ecru-olive; two pairs of tibial spurs, medial spurs 1.0 mm, apical spurs 1.2 mm. **Forewing:** Upperside is deep colonial buff; a small patch of buffy olive in the discocellular cell; many lines of buffy olive from the costal margin to the dorsum; subterminal line as in the male; cilia longer than for the male, deep colonial buff, glossy, 1.3 mm. The underside is as for the male. **Venation:** As for the male, except R<sub>3</sub> less long stalked and R<sub>5</sub> and R<sub>4</sub> on a long stalk but from about one-fifth of R<sub>3</sub>. **Hindwing:** Upperside ecru-olive, glossy; a faded subterminal line is present; cilia and underside as for the forewing. **Venation:** As for the male, but the small vein in the discocellular cell is not forked. **Genitalia:** See diagnosis.

**Etymology:** The species is named from the type locality Odzala NP.

**Habitat of type localities:** There are two key localities, firstly, Odzala NP (0°23'-1°10'N; 14°39'-15°11'E; altitude 300 to 570 m, mean annual rainfall 1600-2000 mm, the rainfall is higher on the western edge of the park at Mbandza and further to the north around Sembé) is located in the northwestern Republic of the Congo and in the Sangha River interval, *ca.* 35 km east of the border to Gabon and *ca.* 100 km south of the border to Cameroon. The area belongs to the "*Guineo-Congolian regional centre of endemism*" *sensu* White (1983) and to



the Dja-Minkébé-Odzala Tri-National Landscape that represents one of the largest blocks of intact lowland rain forest in the Congo Basin. A total of 1141 plant species were recorded from Odzala NP including 806 species from the forests that cover 71% of the park (3.000 km<sup>2</sup>). The southern part of the park consists of a mosaic of forest and evergreen thickets in savannas with *Hymenocardia acida* Tul.. The forest fringes and thickets are expanding into the savanna at present with species such as *Gaertnera paniculata* Benth., *Pentaclethra eetveldiana* De Wild. & T.Durand, *Xylopia aethiopica* (Dunal) A.Rich. and emergents of *Piptadeniastrum africanum* (Hook.f.) Brenan. The northern half of the park has a continuous forest cover and 90% of the forests belong to the “Mixed moist semi-evergreen Guineo-Congolian rain forest” *sensu* White (1983). These forests are the most diverse and occur on dryland. They harbour dense formations of Zingiberaceae and Marantaceae (henceforth ‘Marantaceae forest’) with the most frequent species being *Haumania liebrechtsiana* J. Léonard. The Marantaceae forest is an important forest type in Central and West Africa in which Marantaceae herbs grow up to 2 m tall and forming, sometimes dense, vine towers on trees. They cover hundreds of thousands of square kilometers (Letouzey 1968). Marantaceae forest occurs particularly around islands of savanna and represents a stage in the natural succession from savanna to mature forest where this progression is not blocked by regular fires. The openness of the canopy gradually increases with Marantaceae density. Species characteristic of the mixed forest type include: *Albizia adianthifolia* (Schum.) W.Wight (indicates an old secondary succession stage), *Blighia welwitschii* (Hiern) Radlk., *Canarium schweinfurthii* Engl., *Celtis tessmannii* Rendle, *Diospyros whitei* Dowsett-Lemaire & Pannell, *Entandrophragma candollei* Harms, *E. suaveolens* (Guill. & Perr.) Brenan, *Ficus macrosperma* Mildbr. & Burret, *F. wildemaniana* Warb., *F. burretiana* Mildbr. & Hutch., *Guarea cedrata* (A. Chev.) Pellegr., *Lophira alata* Banks (in the canopy of single-dominant Marantaceae forest), *Klainedoxa gabonensis* Pierre (in secondary forest and sometimes single-dominant), *Parinari excelsa* Sabine, *Petersianthus macrocarpus* (P. Beauv.) Liben, *Pycnanthus angolensis* (Welw.) Warb. (indicates a secondary succession stage) and *Staudtia gabonensis* Warb.. This forest type has not yet reached the climax stage of primary rain forest with a closed canopy, even as far as 50 km from the nearest savanna, leading to the conclusion that they must be of relatively recent origin. By contrast, swamp forests have a closed canopy with species such as *Xylopia rubescens* Oliv., *Entandrophragma palustre* Staner, *Mitragyna ciliata* Aubrév. & Pellegr., *Baphia laurifolia* Baill., *Klaineanthus gaboniae* Pierre and *Gilbertiodendron ogoouense* (Pellegr.) J. Léonard. Riparian forests include *Irvingia smithii* Hook.f., *Nauclea pobeguini* (Pobéguin) Petit, *Berlinia congolensis* (Baker f.) Keay, *Guibourtia demeusei* (Harms) J. Léonard, *Uapaca heudelotii* Baill., *Trichilia retusa* Oliv. and *Homalium africanum* (Hook.f.) Benth.. The predominance of the Guineo-Congolian element in the forests where human influence is less demonstrates the stability of these habitats (Dowsett-Lemaire 1996; Dowsett-Lemaire & Pannell 1996; Kouka 2001).

Secondly, Kongana (ca. 02°47’N, 16°20’E; altitude 430 m; average annual rainfall 1400-1700 mm; southwestern Central African Republic) is a small village located in the Sangha River interval, ca. 300 km northeast of Odzala NP and ca. 14 km southeast of the small town Bayanga. Kongana is part of the Dzanga Sangha Protected Area Complex (DSPAC), comprising a special reserve and the Dzanga-Ndoki National Park established in 1990. The DSPAC borders Cameroon in the west and the Republic of the Congo in the south. The forests are situated at the fringe of the Congo Basin. Commercial logging was carried out around Bayanga during 1972 to 1986 and 1993 to 1997. The terrestrial herbaceous vegetation is usually dense and characterized by Commelinaceae, Marantaceae and Zingiberaceae. The Ba Aka Pygmies live in these forests and have used species such as *Landolphia owariensis* P. Beauv. (wild rubber), *Gnetum buchholzianum* Engl. (koko leaves) and *Irvingia excelsa* Mildbr. (payo nuts) for thousands of years. Three forest types *sensu* White (1983) are present: i) “Mixed moist semi-evergreen Guineo-Congolian rain forest” with *Entandrophragma* spp.,

*Diospyros canaliculata* De Wild. and *Oncoba mannii* Oliv.; ii) “Single dominant moist evergreen and semi-evergreen rain forest” with *Gilbertiodendron dewevrei* (De Wild.) J. Léonard mainly occurring as a primary mature forest type in the neighborhood of streams, although avoiding permanently swampy sites; iii) “Guineo-Congolian swamp forest and riparian forest.” The richness of tree species in the DSPAC is high (208 species in 48 families). This high species richness as well as the presence of the Ba Aka Pygmies indicates the occurrence of Pleistocene forest refuges in the DSPAC. The forests of Kongana were studied by Balinga *et al.* (2006). Dominant species include *Dasylepis* spp., *Manilkara letouzei* Aubrév., *Diospyros iturensis* (Gürke) F. White, *Annonidium mannii* Engl. & Diels, *Strombosia pustulata* Oliv., *Greenwayodendron suaveolens* (Engl. & Diels) Verdc., *Gambeya boukokoensis* Aubrév. & Pellegr., *Dichostema glaucescens* Pierre and *Diospyros bipindensis* Gürke. This species composition indicates a “Mixed moist semi-evergreen Guineo-Congolian rain forest” of a mature type at the collecting site.

**Ecology of type specimens:** All specimens occurred in areas with high mean annual rainfall of at least 1400 mm and a short dry season (three months). The forest habitat comprises a mosaic of: i) Primary swamp and/or riparian forest; ii) Intact or old secondary “Mixed moist semi-evergreen Guineo-Congolian rain forest” including Marantaceae forest of different natural succession stages extending into savannas. Species characteristic of these forest types belong to the Euphorbiaceae, Rubiaceae and Caesalpinoideae in mature forest or to Burseraceae and Ochnaceae in Marantaceae forest.

**Distribution:** *Haberlandia odzalaensis* **spec. nov.** is known from Odzala NP (Republic of the Congo) and Kongana (Central African Republic). The new species probably extends into adjacent forest areas of southeastern Cameroon and northwestern DRC. *Haberlandia odzalaensis* **spec. nov.** is preliminarily classified as endemic to Lower Guinea.

## 2. *Haberlandia lindacammae* **spec. nov.**

Figures 3a, b; 4a, b; 4-6.

### Material examined:

Holotype male, Gabon, Ogooué-Ivindo province, northern Lopé Reserve, Mboko Forest, 27. September. 1993, Ph. Oremans leg., genitalia slide number 25/012011 I. Lehmann (in ZMA).

Paratypes: male, same locality, 30. September. 1993, same collector, genitalia slide number 01/052011 I. Lehmann (in ZMA); male, Gabon, Ogooué-Lolo province, Bambidie logging camp, 300 m, 13. October. 1994, J.J. Wieringa leg., genitalia slide number 02/052011 I. Lehmann (in ZMA); female, same locality, 15. October. 1994, same collector, genitalia slide number 29/012011 I. Lehmann (in ZMA).

**Diagnosis:** The foliaceous structure of the gnathos has only one short thorn-like process. The valvae have an ovate shape and are small if compared to the uncus that is half the size of the valva. The uncus is strongly bent towards the valvae and covered with minute setae. The ventral side of the valva is three times longer than the broad saccus. Segment 8 of the female genitalia has a narrow gap on the dorsal surface that has a bridge-like structure towards the anterior end.

### Description (holotype)

Male forewing length 23.0 mm; antenna-wing ratio 0.28:1. **Head:** Deep colonial buff, eyes sepia mixed with yellowish olive; branches of antennae 3.5x width of shaft; labial palpi longer than half of the eye diameter, narrow, ecru-olive. **Thorax:** Patagia deep colonial buff with a narrow band of xanthine orange; tegulae Hay's russet. **Abdomen:** Deep colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also with light orange-yellow; tibial spurs slightly bent, both pairs 1.2 mm long. **Forewing:** Upperside is deep colonial buff; many

lines of buffy olive from the costal margin to the dorsum; an oblique subterminal line is present from near apex to the end of CuA<sub>1</sub>, forked near apex and coalescent with an oblique postmedial line, resulting in an 'V' that is slightly bent inwards on R<sub>4</sub>; cilia deep colonial buff, glossy, 1.0 mm. The underside is deep colonial buff. **Venation:** As described for the genus, except R<sub>5</sub> and R<sub>4</sub> on a long stalk from about one-third of R<sub>3</sub>. **Hindwing:** Upperside is deep colonial buff with a reticulated pattern of light brownish olive; cilia and underside as for the forewing. **Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Description** (paratype)

Female forewing length 27.0 mm; antenna-wing ratio 0.30:1. **Head:** Deep colonial buff, eyes ecru-olive; branches of antennae three times the width of the shaft, distance between the branches at base two times the width of the branch; labial palpi half of the eye diameter, narrow, sepia. **Thorax:** Patagia deep colonial buff; tegulae Prout's brown. **Abdomen:** Deep colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff; two pairs of tibial spurs, medial spurs 0.7 mm, apical spurs 1.0 mm. **Forewing:** Upperside deep colonial buff; several lines of sepia from the costal margin to the dorsum; an oblique subterminal line of Prout's brown from near apex to CuA<sub>1</sub>, forked near apex and coalescent with an almost straight postmedial line, resulting in a shortly stalked 'V'; cilia longer than for the male, deep colonial buff, glossy, 1.1 mm. Underside mainly Prout's brown mixed with deep colonial buff. **Venation:** As described for the genus, except CuP present but obsolete towards the tornus, unusually large distance to CuA<sub>1</sub>; R<sub>5</sub> and R<sub>4</sub> on a long stalk from about one-fourth of R<sub>3</sub>. **Hindwing:** Upperside Prout's brown, glossy; cilia and underside as for the forewing. **Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Etymology:** The species is named for Linda Lorna Camm born in Nyeri (Kenya). Linda has been an honest friend for many years. She built up, largely on her own, a shop in Nairobi and Loitokitok (Kenya) not only through hard work but also through fascinating trips to remote places in Africa and Arabia. She employes more than 200 Maasai and Kikuyu today that work in womens' groups, giving them an opportunity to promote their fine art using beads for adornment on leather.

**Habitat of type localities:** There are two key localities, firstly, Lopé Faunal Reserve (0°10'-0°35'S, 11°30'-11°80'E; average annual rainfall 1503 mm) is located in central Gabon. It comprises a range of hills with an altitude between 400 and 700 m ("upland") and deep valleys as well as undulating "lowland" with an altitude of 100 to 399 m. The area belongs to the "*Guineo-Congolian regional centre of endemism*" *sensu* White (1983). A savanna and forest mosaic occurs in particular towards the northern and eastern boundaries of the reserve. The savannas, maintained by annual natural or human-induced fires, are completely enclosed by the large forest block and were dated to about 9000 years B.P. (Oslisly 2001). These so-called "*Ogooué savannas*" are a relict of the Leopoldvillian climatic phase (30,000 to 12,000 B.P.) when equatorial Africa suffered a severe drought (Aubréville 1967; Maley 1991; Oslisly *et al.* 1996). The largest savannas are restricted to low altitudes (below 250 m) with shrubs of *Crossopteryx febrifuga* (Afzel.) Benth., *Nauclea latifolia* Smith (both fire resistant) and *Bridelia ferruginea* Benth.. Adjacent to these savannas there is a colonizing forest dominated by *Aucoumea klaineana* Pierre (known as okoumé and by far Gabon's most important timber tree). Co-dominant species comprise *Lophira alata* Banks, *Swartzia fistuloides* (Harms) J.H. Kirkbr. & Wiersema, *Uapaca guineensis* Müll.Arg., *Sacoglottis gabonensis* (Baill.) Urb., *Staudtia gabonensis* Warb., *Klainedoxa gabonensis* Pierre including shrubs of *Psychotria vogeliana* Benth. and *Antidesma vogelianum* Müll.Arg.. Older and less open Marantaceae forest covers large areas in the northern half of the reserve including *Aucoumea klaineana* Pierre, *Lophira alata* Banks and *Haumania liebrechtsiana* J. Léonard. About half of the reserve is covered by mature forest. Characteristic species include *Dacryodes buettneri* (Engl.) Lam., *Cola lizae* N.Hallé - an endemic tree at Lopé that depends entirely on *Gorilla*

*g. gorilla* (Savage & Wyman) for dispersal (Tutin *et al.* 1991) - *Celtis tessmannii* Rendle, *Lophira alata* Banks, *Diospyros dendo* Hiern, *Xylopia quintasii* Engl. & Diels, *Pentaclethra macrophylla* Benth. and *Barteria fistulosa* Mast.. The forests in the “uplands” are very distinct. Common trees comprise *Augouardia letestui* Pellegrin and *Brachystegia mildbraedii* Harms, but on the lower half of deep valleys occur *Gilbertiodendron grandistipulatum* (De Wild.) J. Léonard, *Julbernardia brieyi* (De Wild.) Troupin and *Neochevalierodendron stephanii* J. Léonard. The Lopé and Ogooué rivers have riparian forest dominated by *Guibourtia demeusei* (Harms) J. Léonard, *Cryptosepalum staudtii* Harms, *Aphanocalyx djumaensis* (De Wild.) J. Léonard and *Hylodendron gabunense* Taub.. *Berlinia bracteosa* Benth. is only present along the Lopé River. The families Burseraceae, Ochnaceae, Sterculiaceae and Ulmaceae are more dominant near savannas, while the Caesalpinioideae are more dominant along rivers, on slopes and on the bottom of deep valleys (White 2001; Leal 2004).

Secondly, Bambidie logging camp (*ca.* 0°82'S, 12°92'E) is located *ca.* 130 km east from the Lopé Faunal Reserve and *ca.* 30 km east from Lastoursville (altitude 485 m, average annual rainfall 1680 mm) as well as near the Ogooué River. The forests that surround this large settlement of *ca.* 300 forest workers and their *ca.* 1200 family members are mature “Mixed moist semi-evergreen Guineo-Congolian rain forest” with a high conservation value. Old forest stands, represented by trees with at least 50 cm diameter at chest height, comprise three mixed mature types: i) *Scyphocephalum ochocoa* Warb. and *Aucooumea klaineana* Pierre, representing 14-40% and up to 20% of the stems per hectare, with *Lophira alata* Banks and *Paraberlinia bifoliolata* Pellegr.; ii) Dominant species of the second type include *Dialium pachyphyllum* Harms, *D. lopense* Breteler and *Gilbertiodendron pierreanum* J.Léonard; iii) *Scyphocephalum ochocoa* Warb. is dominant mixed with *Pycnanthus angolensis* (Welw.) Warb. and *Pentaclethra eetveldeana* De Wild. & T. Durand. In very young forest, *Aucooumea klaineana* Pierre constitutes 40% of the forest and is mixed with *Distemonanthus benthamianus* Baill., *Scyphocephalum ochocoa* Warb. and *Pterocarpus soyauxii* Taub.. The latter was strongly favored by all Iron Age people in the region for smelting ore (White 2001; Grandjean 2008). The mixed mature forest composition is typical for the eastern plateau of Gabon where *Scyphocephalum ochocoa* Warb. (Myristaceae) and *Paraberlinia bifoliolata* Pellegr. (Caesalpinioideae) are abundant (Sayer *et al.* 1992). *Haberlandia lindacammae* **spec. nov.** is currently under pressure from logging and its habitat may be destroyed in the near future. For example, the Ogooué-Lolo and Ogooué-Ivindo provinces count for half of the 1.5 million cubic metre of okoumé that was logged in 1997 (Collomb *et al.* 2000).

**Ecology of type specimens:** *Haberlandia lindacammae* **spec. nov.** was recorded in areas with high mean annual rainfall of at least 1500 mm. Its forest habitat comprises a mosaic of “Mixed moist semi-evergreen Guineo-Congolian rain forest” *sensu* White (1983) including Marantaceae forests in different natural stages of succession. The extent of savanna is patchy, but noteworthy, as the Ogooué savannas represent paleoclimatic relicts. *Gorilla g. gorilla* (Savage & Wyman) plays an important ecological role within the habitats by maintaining forest structure and species composition through the dispersal of various seeds.

**Distribution:** *Haberlandia lindacammae* **spec. nov.** is currently known from Lopé Faunal Reserve and Bambidie logging camp (Gabon). The new species is preliminarily classified as endemic to Lower Guinea. Its distribution is affected by increasing logging, resulting in habitat destruction.



### 3. *Haberlandia legraini* spec. nov.

Figures 5a, b; 7.

#### Material examined:

Holotype male, Republic of the Congo, Cuvette department, Owando, no day, November.2009, Eric Vingerhoedt leg., ex coll. Dr A. Legrain, genitalia slide number 08/012011 I. Lehmann (in RMCA).

**Diagnosis:** The foliaceous structure of the gnathos has one thorn-like process that has a rather bat-eared shape. The valvae are elongated and larger if compared to the small uncus that has less than half the size of the valva. The uncus is relatively narrow, less strongly bent towards the valvae and has only minute setae along its ventral end. The ventral side of the valva is five times longer than the saccus. The aedeagus is slightly S-shaped.

#### Description (holotype)

Male forewing length 21.0 mm; antenna-wing ratio 0.30:1. **Head:** Isabella colour, below the eyes buffy olive, eyes black; antennae short, branches three times the width of the shaft, distance between branches at base only 1.5x width of branch; labial palpi half of eye diameter, narrow. **Thorax:** Patagia of Isabella colour with a narrow band of xanthine orange; tegulae xanthine orange mixed with Hay's russet. **Abdomen:** Isabella colour. **Legs:** Hindfemora, -tibiae and -tarsi of Isabella colour with tips of warm buff, tarsi also cadmium yellow; hindlegs with two pairs of tibial spurs, medial and apical spurs 1.0 mm long. **Forewing:** Upperside Isabella colour; from the costal margin fine lines and striae of Dresden brown towards the dorsum; cilia Isabella colour, glossy, short, 0.6 mm. Underside Isabella colour. **Venation:** As described for the genus, except  $R_5$  and  $R_4$  on a long stalk from about one-third of  $R_3$ . **Hindwing:** Upperside buffy olive with no reticulated pattern; cilia and underside Isabella colour with many striae along the costal margin. **Venation:** As described for the genus, except with an unusually large distance between  $CuA_1$  and  $M_3$  as well as a small vein to the costa resulting in a forked appearance of  $Sc+R_1$ . **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Dr Albert Legrain (Hermalle-sous-Argenteau, Belgium) who contributed several new species described herein from his private collection. These species are from remote and extremely poorly known areas in the Congo Basin.

**Habitat of type locality:** Owando (0°29'S, 15°52'E; altitude 345 m; average annual rainfall 1681 mm) is located in the central part of the Republic of the Congo and in the Sangha River interval. The small town lies at the Kouyou River and is surrounded by a mosaic comprising patches of swamp and riparian forest as well as flooded grasslands with stagnant, but not marshy ponds. The area belongs to the "Guineo-Congolian regional centre of endemism" and the forest type is the "Guineo-Congolian swamp forest and riparian forest" sensu White (1983). Species richness and endemism are probably lower than in the forests west and east of the interval, although this might change in the future since the Sangha River interval is currently one of the least well-collected parts of Africa. However, many plant species occur in the interval and are widely distributed in the Guineo-Congolian Region. The swamp and riparian forests along the Kouyou are characterized by an abundance of *Entandrophragma palustre* Staner, *Symphonia globulifera* Linn.f., *Alstonia congensis* Engl. (in permanently flooded places); *Uapaca heudelotii* Baill., *Diospyros gillettii* De Wild., *Guibourtia demeusei* (Harms) J. Léonard, *Lasiodiscus mannii* Hook.f., *Garcinia* spp. and *Sterculia subviolacea* K. Schum. (White 1979; Sayer *et al.* 1992; Blom & Schipper 2004). Hence, dominants belong to the Meliaceae, Apocynaceae, Caesalpinoideae, Ebenaceae and Sterculiaceae.

**Ecology of holotype:** *Haberlandia legraini* spec. nov. was recorded in an area with high mean annual rainfall of at least 1600 mm. Its forest habitat comprises largely intact "Guineo-Congolian swamp forest and riparian forest."



**Distribution:** *Haberlandia legraini* **spec. nov.** is known from Owando (Republic of the Congo). Its distribution probably extends via swamp as well as riparian forests into eastern Gabon. The new species is preliminarily classified as endemic to Lower Guinea and Congolia.

#### 4. *Haberlandia shimonii* **spec. nov.**

Figures 6a, b; 8.

##### **Material examined:**

Holotype male, Gabon, Ogooué-Ivindo province, Ipassa (also called M'Passa), 10.May.1973, no collector, number RCP 317, genitalia slide number 12/022011 I. Lehmann (in MNHN).

**Diagnosis:** The gnathos has one short and triangular process on its anterior surface; the posterior edge is wave-like. Valvae with a deep notch at half of the costa. The costa of valvae is knee-like, short and not elongated towards the gnathos. The uncus is bent towards the valvae and has short setae on its entire lateral surface. The saccus is short, slightly broader than the vinculum, which has an ovate shape (ventral view). The juxta is large with two prominent ridges, but only with a very short emargination, less than 10% of the length of the juxta. The pattern of the forewing upperside has two characteristics: i) the subterminal line has a long, broad fork, extending from  $R_5$  to the apex; ii) the subterminal line and the postmedial line are coalescent between  $CuA_1$  and  $CuA_2$  forming an 'o' shaped patch above them.

##### **Description** (holotype)

Male forewing length 23.0 mm; antenna-wing ratio 0.33:1. **Head:** Deep colonial buff around eyes as well as base of antennae, eyes ecru-olive with black patches; antennae short, branches 4.5x width of shaft, distance between branches at base equal to the width of branch; labial palpi missing. **Thorax:** Patagia deep colonial buff; tegulae Hay's russet. **Abdomen:** Deep colonial buff. **Legs:** Femora, tibiae and tarsi deep colonial buff, tarsi also orange, glossy; hindlegs missing. **Forewing:** Upperside deep colonial buff; from the costal margin many lines of Isabella colour to the dorsum; a subterminal line from near apex towards  $CuA_1$ , long forked towards apex; cilia deep olive buff, glossy, short, 0.8 mm. Underside deep colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside deep colonial buff with a reticulated pattern of light brownish olive, the 'V' has a similar size and shape as for the forewing with a long forked subterminal band; cilia and underside as for the forewing. **Venation:** As described for the genus, except  $1A+2A$  obsolete,  $CuP$  absent. **Genitalia:** See diagnosis. The aedeagus is missing.

**Etymology:** The species is named for my son Shimoni Lehmann (Hamburg) who substantially encourages my studies on the Metarbelidae.

**Habitat of type locality:** Ipassa is located in northeastern Gabon and part of the Ipassa Makokou Strict Nature Reserve (ca.  $0^{\circ}45'-0^{\circ}50'N$ ,  $12^{\circ}85'-12^{\circ}90'E$ ; altitude 430-500 m; average annual rainfall 1755 mm at Makokou 10 km north of Ipassa; major dry season June, July, August with almost no direct sunshine). The area was classified a Man and Biosphere Reserve in 1983 and included into the Ivindo National Park in 2002. It belongs to White's (1983) "*Guineo-Congolian regional centre of endemism*" and large parts of the reserve are covered by intact "*Mixed moist semi-evergreen Guineo-Congolian rain forest.*" Due to regularly strong winds forest gaps are often created resulting in abundant Marantaceae and lianas in the understorey. By contrast, the high canopy forests have an open understorey. Since Ipassa borders the Ivindo River in the south and east there are also riparian as well as periodically flooded forests, covering often extensive areas, where *Uapaca* spp., *Alstonia congensis* Engl., *Guibourtia demeusei* (Harms) J. Léonard and *Raphia* palms are dominant. The "*Guineo-Congolian swamp forest and riparian forest*" *sensu* White (1983) as well as the mixed moist semi-evergreen forests were identified as part of a Pleistocene refuge area,

including in particular forests located north of the Ivindo River (Robbrecht 1996). The moist semi-evergreen forests are characterized by emergents of *Piptadeniastrum africanum* (Hook.f.) Brenan (up to 45 m tall), *Gambeya beguei* Aubrév. & Pellegr. and *Ficus* spp.. Two types of forest occur under these large trees: Firstly, a mixture of *Beilschmiedia* sp. with *Scorodophloeus zenkeri* Harms and *Fagara macrophylla* Engl. and secondly, a mixture of *Markhamia sessilis* Sprague, *Coula edulis* Baill., *Polyalthia suaveolens* Engl. & Diels with *Panda oleosa* Pierre, *Afrostryax lepidophyllus* Mildbr., *Annonidium mannii* (Oliv.) Engl. & Diels, *Berlinia bracteosa* Benth., *Cola rostrata* K. Schum., *Diospyros hoyleana* F.White, *Distemonanthus benthamianus* Baill., *Ficus macrosperma* Mildbr. & Burret and *Sorindeia nitidula* Engl.. The predominance of leguminous forest types with many lianas such as *Tetracera alnifolia* Willd., *Dalhousiea africana* S.Moore as well as the high diversity and endemism are characteristic features of the Ipassa forests (Hladik 1978).

**Ecology of holotype:** *Haberlandia shimonii* **spec. nov.** was recorded in an area with high mean annual rainfall of at least 1700 mm. Its forest habitat comprises largely intact swamp, riparian as well as mixed leguminous forest types with many Marantaceae and lianas.

**Distribution:** *Haberlandia shimonii* **spec. nov.** is known from Ipassa, a Pleistocene refuge area in northeastern Gabon. The new species is preliminary classified as endemic to Lower Guinea.

### 5. *Haberlandia annetteae* **spec. nov.**

Figures 7a, b, 8a, b; 9-10.

#### Material examined:

Holotype male, Central African Republic, economic prefecture of Sangha-Mbaéré, Mambélé-Mbaéré, 27. and 28. July.2009, T. Bouyer-Vanaerschodt leg., ex coll. Dr A. Legrain, genitalia slide number 09/012011 I. Lehmann (in RMCA);

Paratype female, same locality, same date and collector, genitalia slide number 26/042011 I. Lehmann (in RMCA).

**Diagnosis:** The foliaceous structure of the gnathos is without any process on its anterior surface; the posterior edge is not wave-like. The costa below the gnathos is similar to the half of an elongated 'o.' The uncus is bent towards the valvae, but setae are largely absent. The saccus is broadly ovate and very large (almost one-third of the size of the gnathos). The ventral view of the vinculum is almost rectangular. Most striking is segment 8 of the paratype: it has a narrow, long S-shaped slit. Below this slit occurs an oblique row of dots with and without long setae towards the posterior edge of segment 8. Posterior edge with long setae ventrally that do not extend beyond the papillae anales. The posterior apophyses are slightly longer and broader than the anterior apophyses. Papillae anales covered with long and short setae.

#### Description (holotype)

Male forewing length 22.0 mm; antenna-wing ratio 0.32:1. **Head:** Colonial buff, below the eyes sepia, eyes black; antennae short, branches 3.5x width of shaft, distance between branches at base equal to the width of branch; labial palpi narrow, slightly longer than half of diameter of eye. **Thorax:** Patagia colonial buff; tegulae xanthine orange with patches of Hay's russet and cadmium orange, glossy. **Abdomen:** Colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi colonial buff, tarsi also with cadmium yellow; hindlegs with two pairs of narrow tibial spurs, 1.0 mm long. **Forewing:** Upperside colonial buff, from the costal margin many lines of Prout's brown to the dorsum; subterminal line from near apex towards CuA<sub>1</sub>, postmedial line bent towards termen at the base of R<sub>4</sub> resulting in an oblique 'V.' The subterminal line has a short fork extending from R<sub>4</sub> to the apex. Cilia Isabella colour, short, 0.9 mm, glossy. The underside is colonial buff. **Venation:** As described for the genus, except

R<sub>5</sub> and R<sub>4</sub> on a long stalk from about one-third of R<sub>3</sub>. **Hindwing:** The upperside is colonial buff with a reticulated pattern of Prout's brown; the 'V' has a similar size and shape as for the forewing but the subterminal line is not forked; cilia and underside as for the forewing. **Venation:** As described for the genus, except both hindwings have a strong, rudimentary bar from Sc+R<sub>1</sub> towards Rs but it is not coalescent with the latter. **Genitalia:** See diagnosis. Juxta missing.

**Description** (paratype)

Female forewing length 27.0 mm; antenna-wing ratio 0.25:1. **Head:** As in male, but eyes ecru-olive with small black spots; antennae short, branches three times the width of the shaft, distance between branches at base 2.0 times the width of the branch; labial palpi Isabella colour, narrow, longer than half of diameter of eye. **Thorax:** Patagia deep colonial buff; tegulae Hay's russet with antique brown and marguerite yellow. **Abdomen:** Deep colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi ecru-olive, tarsi also with orange-buff; hindlegs with two pairs of tibial spurs, 1.2 mm long. **Forewing:** As in male, but from the costal margin many discontinuous lines of brownish olive to the dorsum; subterminal line coalescent with the postmedial line in between CuA<sub>1</sub> and CuA<sub>2</sub>, resulting in a short stalked 'V'; from one-third of CuA<sub>2</sub> a straight line to the dorsum; cilia deep colonial buff, glossy, long, 1.5 mm. Underside as in male. **Venation:** As in male, but CuP obsolete. **Hindwing:** Upperside ecru-olive, glossy; the 'V' has a similar size and shape as for the forewing; cilia and underside as for the forewing. **Venation:** As for the male, but CuP obsolete; Rs is S-shaped towards the upper half of the cell on both hindwings; a bar from Sc+R<sub>1</sub> towards Rs is absent. **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Annette Groß (Kluis, Germany) who has been a good friend since October, 2007. Her commitment to, and involvement on the Isle of Rugia has helped to maintain its avenues and historical gardens. The project we initiated in collaboration with farmers to protect avenues has resulted in various plantings of avenues in agricultural areas in 2009 and 2011. Annette's talent in highlighting hitherto unrecognised features of this complex world is much appreciated.

**Habitat of type locality:** Mambélé (3°49'N, 16°26'E; altitude 590 m) is a village located near the Loka River as well as at the road RR 26 to Bounguélé, ca. 25 km southwest of the small town Mbaéré and the Mbaéré River valley, respectively (southwestern Central African Republic). The Ngotto (also Ngoto) Forest Reserve (altitude 500-660 m; average annual rainfall 1692 mm) is located ca. 35 km east of Mambélé. The latter is entirely surrounded by forests of the "*Guineo-Congolian regional centre of endemism*" sensu White (1983). The forests surrounding Mambélé belong to the northwestern edge of the Congo Basin and have generally a high species diversity and endemism (Underwood & Olson 2004). Three forest types sensu White (1983) occur: i) "*Mixed moist semi-evergreen Guineo-Congolian rain forest*" with *Entandrophragma* spp., particularly *E. cylindricum* (Sprague) Sprague, mixed with *Diospyros* spp. and large quantities of herbaceous undergrowth (Marantaceae) indicated by the presence of various groups of *Gorilla g. gorilla* (Savage & Wyman); ii) "*Single dominant moist evergreen and semi-evergreen rain forest*" comprising *Gilbertiodendron dewevrei* (De Wild.) J. Léonard; iii) "*Guineo-Congolian swamp forest and riparian forest*" with a permanently flooded floor along streams or temporarily flooded forest along the Loka and Mbaéré rivers, inundated for six months per year, with *Raphia* spp. and *Mitragyna ciliata* Aubrév. & Pellegr.. Logging has been carried out in these forest types in the Sangha-Lobaye areas, including Mambélé-Mbaéré, since 1945. Towards Mbaéré and near the Mbaéré River valley (ca. 3°45'-4°N, 16°55'-17°25'E) there are forests with *Heisteria parvifolia* Smith and *Uapaca guineensis* Müll.Arg. mixed with large trees of *Amphimas pterocarpoides* Harms (the genus is endemic to the Guineo-Congolian Region) and *Pentaclethra macrophylla* Benth.. To the east of the Ngotto Forest area a forest-savanna mosaic begins with "*Drier peripheral*

*semi-evergreen Guineo-Congolian rain forest*” sensu White (1983). Meliaceae, in particular *Entandrophragma cylindricum* (Sprague) Sprague and Sapotaceae are abundant, but Sterculiaceae scarce. These drier forests still include patches of moist semi-evergreen forest with *Diospyros crassiflora* Hiern (White 1978; Sayer *et al.* 1992; Brugiére *et al.* 2005). The Mbaéré River valley represents one of the fluvial refuges in the northernmost Congo Basin (Colyn *et al.* 1991).

**Ecology of holotype:** *Haberlandia annetteae* **spec. nov.** occurs in rain forests with high mean annual rainfall of at least 1700 mm.

**Distribution:** Only known from Mambélé that is close to a Pleistocene fluvial refuge. *Haberlandia annetteae* **spec. nov.** probably extends into southeastern Cameroon. It is preliminarily classified as endemic to Lower Guinea.

### 6. *Haberlandia hilaryae* **spec. nov.**

Figures 9a, b; 11.

#### Material examined:

Holotype male, Cameroon, Centre Region, east of Mbalmayo, Obout, 700 m, no date, 2004-2005, Jean Mbida leg., ex coll. Dr A. Legrain, genitalia slide number 36/012011 I. Lehmann (in RMCA).

**Diagnosis:** This is the smallest species of *Haberlandia* **gen. nov.** in Central Africa at present. The position of the gnathos is striking, as it is well above the costa of the valvae (lateral view). Its size is larger than half of the valva. The uncus is small and short, less than half the size of the valva, setae are largely absent. The saccus is ovate, relatively small (one-fifth of the length of the sacculus) but three times broader than the vinculum.

#### Description (holotype)

Male forewing length 16.0 mm; antenna-wing ratio 0.31:1. **Head:** Deep olive-buff, sepia below the eyes, eyes black with a reticulated pattern; antennae short, branches 3.5x width of shaft, distance between branches at base 1.5x width of branch; labial palpi shorter than half of diameter of eye. **Thorax:** Patagia deep olive-buff, tegulae xanthine orange. **Abdomen:** Deep olive-buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also orange, glossy; hindlegs with two pairs of short tibial spurs, 0.8 mm long. **Forewing:** Upperside deep colonial buff, from the costal margin many lines of light brownish olive to the dorsum; a subterminal line from near apex towards CuA<sub>1</sub>, forked near apex and coalescent with a postmedial line at one-third of CuA<sub>1</sub>; postmedial line bent towards termen at base of R<sub>5</sub> and R<sub>4</sub>; cilia deep colonial buff, glossy, short, 0.8 mm. Underside deep colonial buff. **Venation:** As described for the genus. **Hindwing:** The upperside is deep colonial buff with a reticulated pattern of light brownish olive, glossy on all veins; subterminal line and postmedial line coalescent near end of CuA<sub>2</sub>; the postmedial line is forked at half of M<sub>2</sub> towards costa; cilia and underside as for the forewing. **Venation:** As described for the genus except, 1A+2A obsolete, Sc+R<sub>1</sub> almost coalescent with Rs near its base. **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Hilary Sommerlatte nee Camm (Naro Moru, Kenya) who has always encouraged me to come to Kenya to study its Lepidoptera in the field. I shall always remember how often I was humbled by listening to her fascinating stories of life in areas of hardship and poverty. The first field guide to the “*Trees and Shrubs of the Imatong Mountains*” is mainly based on her fieldwork that was undertaken during her stay in Juba (southern Sudan) during 1980 to 1985. With Hilary’s light-hearted gallantry, generosity and patience she showed me a Kenyan lifestyle that I had always dreamed of since I was 13 years old.

**Habitat of type locality:** Obout (3°28’N, 11°44’E; altitude 658 m) is a village located a few kilometers south of the Nyonga River and *ca.* 25 km east of the Mbalmayo Forest Reserve



(altitude 650 m, average annual rainfall 1600 mm) in south-central Cameroon. The area belongs to the “*Guineo-Congolian regional centre of endemism*” *sensu* White (1983). Species diversity and endemism are generally high, particularly towards Mbalmayo (Underwood & Olson 2004). Around Obout occurs a type of the “*semi-deciduous humid forest*” *sensu* Letouzey (1968) or “*Drier peripheral semi-evergreen Guineo-Congolian rain forest*” *sensu* White (1983). In contrast to other areas, these semi-deciduous forests of southern Cameroon are very old, developing during the last two million years. They are probably the consequence of long-term climatic changes with a major disturbance 2500 years BP due to a dry-out period (Maley 2001). The forests near Obout have an open canopy with a dense shrub layer comprising Marantaceae as *Haumania danckelmaniana* (Braun & Schum.) Milne-Redh.. The tree species belong mainly to the Apocynaceae, Sterculiaceae and Ulmaceae, with rare occurrences of the Caesalpinoideae, including: *Albizia ferruginea* (Guill. & Perr.) Benth., *Alstonia boonei* De Wild. (an indicator of secondary forest), *Antiaris africana* Engl., *Triplochiton scleroxylon* K.Schum., *Celtis adolfi-friderici* Engl., *C. mildbraedii* Engl., *C. tessmannii* Rendle, *Diospyros suaveolens* Gürke and *Xylopia aethiopica* (Dunal) A.Rich.. West as well as south of Obout occur larger forests dominated by *Gilbertiodendron dewevrei* (De Wild.) J.Léonard. The “*Atlantic biafran forest*” *sensu* Letouzey (1968), that is very rich in Caesalpinoideae and is considered as climax forest vegetation covering several Pleistocene forest refuge areas, occurs 50 km west of Obout. Riparian forest along the Nyonga River comprises *Raphia* spp., *Uapaca* spp. *Aphanocalyx hedinii* (A.Chev.) Wieringa and *Diospyros gillettii* De Wild. (Letouzey 1983; Tchonto Mbatchou 2004).

**Ecology of holotype:** *Haberlandia hilaryae* **spec. nov.** occurs in drier types of lowland tropical rain forest located in an area with a high mean annual rainfall of at least 1600 mm. Its forest habitat comprises largely ancient forests that developed through forest colonization on former savannas during the last two million years.

**Distribution:** Only known from Obout close to major Pleistocene forest refuges in southern Cameroon. The new species is preliminarily treated as endemic to Lower Guinea.

### 7. *Haberlandia lusamboensis* **spec. nov.**

Figures 10a, b, 11a, b; 12-13.

#### **Material examined:**

Holotype male, Belgian Congo, Lusambo (today in Sankuru province, DRC), 16.October.1950, number 87, Dr M.Fontaine leg., genitalia slide number 22/012011 I. Lehmann (in RMCA).

Paratypes: male, same locality, 04.November.1951, Dr M. Fontaine leg., genitalia slide number 09/022011 I. Lehmann (in RMCA); male, Republic of the Congo, Pool department, Boko district, Voka, no date, October and November.2009, Eric Vingerhoedt leg., ex coll. Dr A. Legrain, genitalia slide number 23/012011 I. Lehmann (in RMCA); female, Belgian Congo, Sankuru, Katako-Kombe, 02.January.1952, Dr M. Fontaine leg., genitalia slide number 02/022011 I. Lehmann (in RMCA).

**Diagnosis:** The foliaceous structure of the gnathos has two short processes, but only the upper one is thorn-like and 25% of the width of the gnathos. The gnathos is half the size of the valva. The juxta is elongated with a very long emargination at centre (more than 60% of the length of the juxta) with two tips that are almost acuminate. The saccus is one of the largest in *Haberlandia* **gen. nov.** and has 35% of the size of the gnathos. The tegumen is twice as broad as the vinculum. The female postabdominal structure has very long and narrow anterior apophyses that are bent towards the ventral side. The forewing and hindwing have a subterminal line and a postmedial line that are not coalescent, but connected by a bar above CuA<sub>1</sub> in both sexes.



**Variation:** The paratype from Voka differs in that the saccus is smaller, and the juxta has two rather rounded tips in between the very long emargination. The paratype from Lusambo has a very unusual feature since vein Rs is long stalked and forked on both hindwings, indicating that venation of this species is variable or that one additional new species might be involved.

**Description** (holotype)

Male forewing length 23.5 mm; antenna-wing ratio 0.36:1. **Head:** Isabella colour, eyes black; antennae long (7.0-8.0 mm, including paratypes), branches 2.5x width of shaft; labial palpi half of diameter of eye. **Thorax:** Patagia Isabella colour; tegulae Hay's russet. **Abdomen:** Warm buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also Hay's russet, glossy; hindlegs with two pairs of narrow spurs, medial spurs 1.2 mm, apical spurs 0.9 mm. **Forewing:** Upperside deep colonial buff; from the costal margin to dorsum many fine lines of Isabella colour; several long striae crossing the subterminal line; postmedial line is bent towards the apex at one-fourth of M<sub>1</sub>; cilia Isabella colour, glossy, 0.9 mm. Underside deep colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside light yellowish olive with a reticulated pattern of Isabella colour; cilia and underside as for the forewing. **Venation:** As described for the genus, except 1A+2A obsolete. **Genitalia:** See diagnosis.

**Description** (paratype)

Female forewing length 27.5 mm; antenna-wing ratio 0.28:1. **Head:** As for the holotype, but distance between the branches of the antennae greater, two times the width of the shaft. **Thorax:** As for the male. **Abdomen:** As for the male. **Legs:** Hindfemora and -tibiae as for the male, but tarsi orange buff; hindlegs with two pairs of spurs, 1.4 mm long. **Forewing:** Upperside as for the holotype but cilia longer, 1.3 mm, not glossy. **Venation:** As for the male, but R<sub>3</sub> on a shorter stalk; R<sub>5</sub> and R<sub>4</sub> on a stalk from about one-sixth of R<sub>3</sub>. **Hindwing:** Upperside as for the holotype but inner half of wing pure Isabella colour. **Venation:** As for the male, but Sc+R<sub>1</sub> with a very short bar to the anterior branch of the median cell. **Genitalia:** See diagnosis. Of particular note are scattered long setae that occur on segment 8 towards the ventral edge; long setae extend beyond the papillae anales. Papillae anales long, *ca.* 45% of length of segment 8, densely covered with short setae. The posterior apophyses are shorter and broader than the anterior apophyses.

**Etymology:** The species is named from the type locality Lusambo that was the capital of Kasai province until 1950.

**Habitat of type localities:** There are three key localities, firstly, Lusambo (4°57'S, 23°26'E; altitude 430 m, average annual rainfall 1600-1700 mm, rainy season September to April) is located just north of the confluence of the Sankuru River and the Lubi River (eastern Kasai region, south-central DRC). It belongs to the "*Guineo-Congolian regional centre of endemism*" but is only some kilometers north of the "*Guinea-Congolia/Zambezia regional transition zone*" *sensu* White (1983). Species diversity and endemism are generally high (Underwood & Olson 2004). The landscape around Lusambo comprises mainly forest with patches of savanna, interspersed with main crops as rice, maize, cassava, peanuts and oil palms. Data on flora and fauna is very scarce. The occurrence of single-dominant forests of *Gilbertiodendron dewevrei* (De Wild.) J.Léonard and *Brachystegia laurentii* (De Wild.) Louis were mentioned for Lusambo by Richards (1998). Riparian and floodplain forests occur along the Sankuru and Lubi rivers including *Uapaca heudelotii* Baill., *Diospyros deltoidea* F. White, *D. gillettii* De Wild., *Parinari congensis* Dirr., *Guibourtia demeusei* (Harms) J.Léonard and *Raphia* spp.. The single-dominant forests as well as the floodplain forests are surrounded by large areas of "*Mixed moist semi-evergreen Guineo-Congolian rain forest*" with *Allanblackia floribunda* Oliv., *Isolona pilosa* Diels, *Scorodophloeus zenkeri* Harms and *Parinari glabra* Oliv..

Secondly, Katako-Kombe (03°24'S, 24°25'E; altitude 570 m; average annual rainfall 1700–1900 mm) is a small town located *ca.* 1 km east from the Lukenie River and *ca.* 200 km

northeast from Lusambo (Kasaï-Oriental province, east-central DRC). The area belongs to the “Guineo-Congolian regional centre of endemism” *sensu* White (1983). Katako-Kombe is located within the lowland rain forest-savanna boundary and *ca.* 20 km northeast from the “Tshuapa-Lomami-Lualaba Landscape” (Hart & Thompson 2008). The forests in this landscape have a high plant endemism and are of global significance for the long-term survival of *Pan paniscus* Schwarz (bonobo). The occurrence of the bonobo indicates that forest cover persisted during the dry periods of the ice age (Colyn *et al.* 1991; Blom & Schipper 2004). Hence, the “South Central region” *sensu* Grubb (1982), including Katako-Kombe, is not a derivative minor centre of endemism harbouring an impoverished flora and fauna with a few endemics. The forests belong to the following types *sensu* White (1983): i) “Mixed moist semi-evergreen Guineo-Congolian rain forest” comprising *Anonidium mannii* (Oliv.) Engl. & Diels, *Scorodophloeus zenkeri* Harms, *Staudtia stipitata* Warb., *Greenwayodendron suaveolens* (Engl. & Diels) Verdc.; ii) “Drier peripheral semi-evergreen Guineo-Congolian rain forest” with *Scorodophloeus zenkeri* Harms; iii) “Single-dominant moist evergreen and semi-evergreen Guineo-Congolian rain forest” with *Brachystegia laurentii* (De Wild.) Louis. Riparian and swamp forests contain *Uapaca heudelotii* Baill., *Entandrophragma palustre* Staner and *Symphonia globulifera* L.f. (Steel 2008).

Thirdly, Voka (*ca.* 04°31’S, 14°45’E; altitude 480 m) is a village located *ca.* 82 km southwest from Brazzaville and *ca.* 36 km south of Kinkala (average annual rainfall 1366 mm). Voka is surrounded by the forest-savanna mosaic of the Pool region (southeast Republic of the Congo) and belongs to White’s (1983) “Guineo-Congolian regional centre of endemism.” Voka is located on outliers of the Batéké Hills; the Kinkala Hills are just north of Voka. These sandy hills are separated by large and slightly sloping valleys. The rivers in these valleys are laterally enlarged and hence, often create swampy valley floors with *Uapaca* and *Mitragyna* spp.. Most of the sandy area is covered by shrubby savanna with *Hymenocardia acida* Tul., *Loudetia demeusei* (De Wild.) C.E.Hubb., *Annona senegalensis* Pers. and *A. arenaria* Thonn.. Semi-deciduous forests occur as minor extensions of gallery forests on steeper slopes including *Hymenocardia ulmoides* Oliv., *Sapium cornutum* Pax, *Pentaclethra eetveldeana* De Wild. & T.Durand with Marantaceae undergrowth (Bernier 1999). Kelman (2004) stated that the forests of the broad valleys extend many kilometers into savanna and that their species composition is similar to the Congolian rain forests. Deforestation rates in the Pool region are high (*e.g.* 6000 ha were cut in 2007/2008). Kinkala and its environment have also been affected by several humanitarian crises since at least 1998, resulting in, for example, fifty thousand people hiding in the forests in March 2002 (Amnesty International 2003). Hence, untouched primary forest does probably not exist around Voka today.

**Ecology of type specimens:** *Haberlandia lusamboensis spec. nov.* occurs in moist and drier types of lowland rain forest that are located in the periphery of the large forest block and in an area with high mean annual rainfall of at least 1350 mm.

**Distribution:** *Haberlandia lusamboensis spec. nov.* is known from Lusambo and Katako-Kombe (DRC) that are close to fluvial Pleistocene forest refuges. Its distribution extends westwards along the forest-savanna mosaic into the southeastern Republic of the Congo. The new species is preliminarily classified as endemic to Congolia and Lower Guinea.

### 8. *Haberlandia entebbeensis spec. nov.*

Figures 12a, b; 14.

Holotype male, Uganda, Central region, Wakiso district, Entebbe, November.1962, E.S. Brown leg., genitalia slide number 27/122007 I. Lehmann (in NMK).

**Diagnosis:** *Haberlandia entebbeensis spec. nov.* is the largest species with only one pair of tibial spurs on the hindlegs. This feature also occurs in *H. rohdei spec. nov.*. The foliaceous

structure of the gnathos has two processes and the upper one is thorn-like, long, and 35% of the width of the gnathos. The gnathos is 60% of the size of the valva. The juxta is not elongated but has an emargination at centre (40% of the length of the juxta) with two rounded tips. The saccus is smaller than the juxta and has only 15% of the size of the gnathos. The tegumen is three times broader than the vinculum.

**Description** (holotype)

Male forewing length 23.0 mm; antenna-wing ratio 0.30:1. **Head:** Deep colonial buff, eyes wood brown; branches of antennae long, four times the width of the shaft; labial palpi less than diameter of eye. **Thorax:** Patagia deep colonial buff; tegulae deep chrome. **Abdomen:** Deep colonial-buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also deep chrome, glossy; hindlegs with one pair of apical spurs, short, 0.8 mm. **Forewing:** Broad with a rounded apex; upperside pale orange-yellow; many fine lines and striae of buckthorn brown from the costal margin to dorsum; cilia deep colonial buff, glossy, 0.7 mm. Underside deep colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside deep colonial buff, a reticulated pattern of buckthorn brown is present; cilia and underside as for the forewing. **Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Etymology:** The species is named from the type locality Entebbe (East Africa), the capital of the British Uganda Protectorate from 1894 to Independence in 1962.

**Habitat of type locality:** Entebbe (0°03'N, 32°27'E; altitude 1134-1182 m, average annual rainfall 1505-1623 mm) is located at the northwestern shore of Lake Victoria's Entebbe Bay, ca. 28 km south of Kampala. It belongs to "*The Lake Victoria regional mosaic*" sensu White (1983). Remnants of White's "*Drier peripheral semi-evergreen Guineo-Congolian rain forest*" still occur around Entebbe with the majority of species widespread in the Guineo-Congolian Region. The whole area was once covered by this type of forest, up to ca. 80 km wide, stretching inland from the shore of Lake Victoria. Forest vegetation around Entebbe in 1950 was dominated by *Piptadeniastrum africanum* (Hook.f.) Brenan, *Albizia* spp., *Celtis* spp. and *Maesopsis eminii* Engl. mixed with swamp forest elements towards the shore line featuring *Uapaca* spp., *Raphia farinifera* (Gaertn.) Hyl. and *Musanga cecropioides* R.Br.. Swamp forest remnants are dominated by *Piptadeniastrum africanum* (Hook.f.) Brenan and *Musanga cecropioides* R.Br. could still be found in 1982 around Entebbe, as reported by Hamilton (1984), who stated that the areas around Entebbe "*would once have carried forest of the Piptadeniastrum Zone type*" and that the grassland onto which the forest spread today resulted from forest clearance. He also presented a picture taken in 1967 of *Loudetia* grassland with forest thickets of *Maesopsis eminii* Engl. at Entebbe. This "*Piptadeniastrum Zone*" is only found in Uganda close to Lake Victoria, replacing the "*Celtis-Chrysopyllum Zone*" within ca. 15 km of the lake shore.

**Ecology of holotype:** *Haberlandia entebbeensis* spec. nov. was recorded in a lowland rain forest dominated by Caesalpinioideae and in an area with high mean annual rainfall of at least 1500 mm.

Note: *Piptadeniastrum africanum* (Hook.f.) Brenan is one of the dominant species in other type localities of *Haberlandia* gen. nov. as in Odzala NP, around Ipasa and Bingerville.

**Distribution:** *Haberlandia entebbeensis* spec. nov. is known from Entebbe (Uganda). Its occurrence around Entebbe indicates a disjunct distribution that is probably a relict as related species occur in Congolia, Lower Guinea as well as Upper Guinea.

### 9. *Haberlandia isakaensis* spec. nov.

Figures 13a, b; 15.

#### Material examined:

Holotype male, Belgian Congo, Isaka (today in Équateur province, DRC), 23.June.1953, Dr M. Fontaine leg., genitalia slide number 25/052009 I. Lehmann (in RMCA).

**Diagnosis:** This is a similar but smaller species if compared with the two previous ones. Additionally, the following differences exist: i) the foliaceous part of the gnathos has three thorn-like processes (35% of the width of the gnathos) at the centre of the posterior edge (ventral view); ii) the gnathos has only 40% of the size of the valva; iii) the saccus is small and only 20% of the size of the gnathos; iv) the sacculus is long and covers the whole ventral edge of the valva.

#### Description (holotype)

Male forewing length 21.0 mm; antenna-wing ratio 0.29:1. **Head:** Warm buff, eyes wood brown with small black patches; branches of antennae 3.5x width of shaft; labial palpi longer than half of diameter of eye. **Thorax:** Patagia marguerite yellow; tegulae Hay's russet. **Abdomen:** Warm buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also xanthine orange, glossy; hindlegs with two pairs of narrow spurs, medial spurs 1.1 mm, apical spurs 0.7 mm. **Forewing:** Upperside ecru-olive, from the costal margin to the dorsum many fine lines of buffy olive; the postmedial line is not bent towards the apex; cilia warm buff, glossy, 0.5 mm. Underside ecru-olive. **Venation:** As described for the genus. **Hindwing:** Upperside ecru-olive with many fine striae, reticulated pattern absent; cilia and underside as for the forewing. **Venation:** As described for the genus but 1A+2A present. **Genitalia:** See diagnosis.

**Etymology:** The species is named from the type locality Isaka.

**Habitat of type locality:** Isaka (1°29'S, 23°50'E; altitude 490 m, average annual rainfall 1700-2000 mm) is located *ca.* 190 km northwest from Katako-Kombe, *ca.* 410 km north of Lusambo and 10 km west from the Tshuapa River (southeastern Équateur province, central DRC). It belongs to the "Guineo-Congolian regional centre of endemism" *sensu* White (1983). Isaka is entirely surrounded by lowland rain forest and swamp forest (Sayer *et al.* 1992). The forests around Isaka were included into the "Tshuapa-Lomami-Lualaba Landscape" by Hart & Thompson (2008). They stated that the area is "little known with little human occupation," but contains "exceptionally high densities of bonobos and a major conservation potential." Species diversity and endemism are generally high (Underwood & Olson 2004). The forests are dominated by Caesalpinioideae with single-dominant forests of *Gilbertiodendron dewevrei* (De Wild.) J. Léonard and *Brachystegia laurentii* (De Wild.) Louis. Riparian and swamp forests comprise *Uapaca heudelotii* Baill., *Parinari congensis* Didr., *Entandrophragma palustre* Staner, *Coelocaryon botryoides* Vermoesen and *Symphonia globulifera* L.f.. The high densities of the bonobo indicate that forest cover persisted during dry periods of the ice age (Richards 1998; Blom & Schipper 2004; Steel 2008).

**Ecology of holotype:** *Haberlandia isakaensis* spec. nov. occurs in moist types of lowland rain forest that are located in the centre of the large forest block and in an area with high mean annual rainfall of at least 1700 mm.

**Distribution:** *Haberlandia isakaensis* spec. nov. is known from Isaka (DRC). It belongs to the "South-Central region" *sensu* Grubb (1982) that includes several fluvial Pleistocene forest refuges (Colyn *et al.* 1991). It is preliminarily classified as endemic to Congolia.



### 10. *Haberlandia rudolphi* spec. nov.

Figures 14a, b; 16.

Holotype female, Belgian Congo, Bena Dibebe (today in Sankuru province, DRC), 01.November.1921, L. Verlaine leg., genitalia slide number 16/012011 I. Lehmann (in RMCA).

**Diagnosis:** A pattern is almost absent on the forewing. Only a few lines are present from the costal margin to the dorsum. CuA<sub>2</sub> is not distinctly marked. The subterminal line is not bent; the postmedial line is bent below M<sub>1</sub> towards the tip of CuA<sub>2</sub>. The hindwing has only a few lines. The subterminal line and the postmedial line are coalescent on both wings. Segment 8 has very long and narrow anterior apophyses that are not bent towards the ventral side. A narrow slit is present below the base of the anterior apophyses. The papillae anales has long setae towards its ventral part.

#### **Description** (holotype)

Female forewing length 27.5 mm; antennae broken but at least 5.5 mm long. **Head:** Deep colonial buff; branches of antennae 2.5x width of shaft with few hairs. **Thorax:** Patagia deep colonial buff, tegulae ochraceous-orange. **Abdomen:** Deep colonial buff. **Legs:** Hindfemora deep colonial buff, hindtibiae and -tarsi also ochraceous-orange; hindlegs with two pairs of spurs, medial spurs 1.5 mm, apical spurs 1.3 mm. **Forewing:** Upperside deep colonial buff; cilia long, 1.5 mm. **Venation:** As described for the genus, but R<sub>5</sub> and R<sub>4</sub> on a long stalk from about one-fifth of R<sub>3</sub>. **Hindwing:** Upperside deep colonial buff. **Venation:** As described for the genus. **Genitalia:** Segment 8 has a wave-like dorsal surface that is divided by a prominent gap on the whole dorsal surface. The long setae of segment 8 do not extend beyond the papillae anales. The posterior apophyses are narrow and as long as the anterior apophyses. The papillae anales is short (only 35% of the length of segment 8) and densely covered with setae.

**Etymology:** The species is named in honour of dentist Werner Rudolph (Bovenden, Germany) for his honest friendship and generosity since 1987.

**Habitat of type locality:** Bena Dibebe (4°06'S, 22°49'E; altitude 460 m, average annual rainfall 1550-1650 mm) is a small town just north of the Sankuru River in the eastern Kasai region (south-central DRC). The area belongs to the "Guineo-Congolian regional centre of endemism" *sensu* White (1983). Species diversity as well as endemism is generally high (Underwood & Olson 2004). The landscape around Bena Dibebe is largely forest with no patches of savanna but interspersed with main crops as rice, maize and cassava. Information on the local indigenous flora is not available. However, Bena Dibebe is only 110 km northwest from Lusambo that is also located on the Sankuru River. Hence, there is a strong possibility that the forests have a similar species composition with riparian and floodplain forests including *Uapaca heudelotii* Baill., *Diospyros deltoidea* F. White, *D. dendo* Welw., *D. gillettii* De Wild., *Guibourtia demeusei* (Harms) J. Léonard, *Oubanguia africana* Baill., *Raphia* spp. and *Scytopetalum pierreanum* (De Wild.) Tiegh.. These floodplain forests are surrounded by large areas of "Mixed moist semi-evergreen Guineo-Congolian rain forest" dominated by Caesalpinioideae. The latter are probably similar at the species level to those around Mweka and Bena Longo (ca. 150 km southwest of Bena Dibebe) where Lebacq & Dechamps (1967) found dominant species on dryland as *Scorodophloeus zenkeri* Harms, *Plagiostyles africana* (Müll.Arg.) Prain, *Sorindeia claessensii* De Wild. and *Trichilia prieureana* A. Juss.. The riparian forests comprise *Eriocoelum microspermum* Gilg., *Uapaca* spp., *Cleistanthus mildbraedii* Jabl., Caesalpinioideae as *Cynometra lujae* De Wild., *Anthonotha macrophylla* P. Beauv. and *Baikiaea robynsii* Ghesq..

**Ecology of holotype:** *Haberlandia rudolphi* spec. nov. was recorded in a lowland rain forest area with high mean annual rainfall of at least 1550 mm.



**Distribution:** *Haberlandia rudolphi* **spec. nov.** is known from Bena Dibebe (DRC). The new species is preliminarily treated as endemic to Congolia.

### 11. *Haberlandia isiroensis* **spec. nov.**

Figures 15a, b; 17-18.

#### **Material examined:**

Holotype male, Belgian Congo, Paulis (today Isiro in Haut-Uele province, DRC), 11.April.1957, Dr M. Fontaine leg., genitalia slide number 25/042011 I. Lehmann (in RMCA).

Paratypes: male, same locality, 25.July.1958, Dr M. Fontaine leg., genitalia slide number 08/072011 I. Lehmann (in RMCA); male, same locality, 28.December.1957, Dr M. Fontaine leg., genitalia slide number 09/072011 I. Lehmann (in RMCA).

**Diagnosis:** The gnathos has two thorn-like processes that are slightly bent; the process at the centre of the posterior edge is shorter than the one above. The valvae have an obliquely ovate shape with a notch at the costa. The juxta has a short emargination at centre, 30% of the length of the juxta, with two rounded tips and two ridge-like structures. The saccus is small, ovate, less than one-fourth of the size of the gnathos. The postmedial line of the forewing is not bent towards the apex but towards the base of the wing in between  $M_2$  and  $M_3$ .

The paratypes differ not to any major degree.

#### **Description** (holotype)

Male forewing length 24.5 mm; antenna-wing ratio 0.31:1. **Head:** Cream-buff, eyes wood brown with small patches of ecru-olive; branches 3.5x width of shaft; labial palpi half of diameter of eye. **Thorax:** Patagia cream-buff; tegulae Hay's russet. **Abdomen:** Cream-buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also with Hay's russet, glossy; hindlegs with two pairs of narrow spurs, medial spurs 1.2 mm, apical spurs 0.9 mm. **Forewing:** Upperside colonial buff with many narrow lines and striae of Isabella colour; cilia short, 0.9 mm, colonial buff. The underside is colonial buff. **Venation:** As described for the genus, except  $R_5$  and  $R_4$  on a long stalk from about one-sixth of  $R_3$ . **Hindwing:** Upperside light yellowish olive with a reticulated pattern of Isabella colour; cilia and underside as for the forewing. **Venation:** As described for the genus but discocellular cell less than half the length of the wing. **Genitalia:** See diagnosis.

**Etymology:** The species is named from the type locality Isiro (formerly called Paulis).

**Habitat of type locality:** Isiro (02°46'N, 27°36'E; altitude 750 m; average annual rainfall 1530-1600 mm) is located *ca.* 50 km north of the large Ituri Forest (Haut-Uele province, northeastern DRC) and belongs to the "Guineo-Congolian regional centre of endemism" *sensu* White (1983). The small town (built since 1934) has been intensively settled since the early 1940's and is located at the lowland rain forest-savanna boundary. Three of White's (1983) forest types occur: i) "Mixed moist semi-evergreen Guineo-Congolian rain forest" dominated by *Brachystegia laurentii* (De Wild) Louis, *Cleistanthus michelsonii* J. Léonard, *Cynometra alexandri* C.H. Wright, *Irvingia gabonensis* (Aubry-LeComte) Baill., *Donella pruniformis* (Pierre) Aubrév. & Pellegr. and *Dialium corbisieri* Staner; ii) "Drier peripheral semi-evergreen rain forest" with *Alstonia boonei* De Wild., *Ricinodendron heudelotii* (Baill.) Pierre and *Canarium schweinfurthii* Engl.; iii) "Single-dominant moist evergreen and semi-evergreen Guineo-Congolian rain forest" comprising *Julbernardia seretii* (De Wild.) Troupin (often on shallow soils) and *Gilbertiodendron dewevrei* (De Wild.) J. Léonard (Hart 1985). Isiro belongs to the "East Central region" *sensu* Grubb (1982). This is a large Pleistocene refuge area with a very diverse flora and fauna, including lowland as well as montane species (Misonne 1963; Hamilton 1988; Colyn *et al.* 1991). About 75 km southeast from Isiro is the

“Ituri-Epulu-Aru Landscape” which is one of Central Africa’s most biologically diverse regions (CARPE 2005).

**Ecology of type specimens:** *Haberlandia isiroensis* **spec. nov.** was recorded in the periphery of the large forest block and in an area with high mean annual rainfall of at least 1500 mm.

**Distribution:** *Haberlandia isiroensis* **spec. nov.** is known from Isiro that is part of a Pleistocene forest refuge. The new species is preliminarily classified as endemic to Congolia.

## 12. *Haberlandia ueleensis* **spec. nov.**

Figures 16a, b; 19.

### Material examined:

Holotype male, Belgian Congo, Paulis (today Isiro in Haut-Uele province, DRC), 16.September.1959, Dr M. Fontaine leg., genitalia slide number 02/052009 I. Lehmann (in RMCA).

**Diagnosis:** *Haberlandia ueleensis* **spec. nov.** is one of the smallest species of the new genus in Central Africa. The uncus is small and only half of the length of the gnathos. The gnathos is as large as 70% of the valva and has a rounded process below the short tabular dorsal surface. The valvae are triangular-shaped with a strong fold at their tips. The valvae are short in comparison to the length of the rectangular-shaped saccus that has 40% of the length of the valvae. The juxta has a short emargination at centre, 30% of the length of the juxta, with two acuminate tips.

### Description (holotype)

Male forewing length 16.5 mm; antenna-wing ratio 0.33:1. **Head:** Warm buff, eyes black; branches four times the width of the shaft; labial palpi half of diameter of eye. **Thorax:** Patagia warm buff; tegulae xanthine orange. **Abdomen:** Warm buff. **Legs:** Hindfemora, -tibiae and -tarsi warm buff, tarsi also with raw sienna, glossy; hindlegs with two pairs of narrow spurs, medial spurs 1.2 mm, apical spurs 1.0 mm. **Forewing:** Upperside warm buff with many narrow lines and striae of buffy olive; subterminal line twice forked near apex, cilia short, 0.9 mm, warm buff. The underside is warm buff. **Venation:** As described for the genus. **Hindwing:** Upperside warm buff with a reticulated pattern of ecru-olive; cilia and underside as for the forewing. **Venation:** As described for the genus except discocellular cell less than half length of the wing. **Genitalia:** See diagnosis.

**Etymology:** The species is named from the Uele provinces Bas-Uele and Haut-Uele (DRC).

**Habitat of type locality:** See *Haberlandia isiroensis* **spec. nov.**.

**Ecology of holotype:** *Haberlandia ueleensis* **spec. nov.** was recorded in the periphery of the large forest block and in an area with high mean annual rainfall of at least 1500 mm.

**Distribution:** *Haberlandia ueleensis* **spec. nov.** is known from Isiro that is part of a Pleistocene forest refuge. The new species is preliminarily classified as endemic to Congolia.

## 13. *Haberlandia clenchi* **spec. nov.**

Figures 17a, b; 20.

### Material examined:

Holotype female, Belgian Congo, Eala (today in Équateur province, DRC), no date, October.1935, J. Ghesquière leg., genitalia slide number 17/012011 I. Lehmann (in RMCA).

Paratypes: female, Belgian Congo, Tshuapa-Bamania (today in Équateur province, DRC), 27.October.1954, E.P.G. Hulstaert leg., no genitalia dissection done; female, same locality, 06.October 1964 or 1968, E.P.G. Hulstaert leg., genitalia slide number 07/052011 I. Lehmann (in RMCA).

**Diagnosis:** The posterior apophyses as narrow as anterior apophyses. The long setae of segment 8 do not extend beyond the papillae anales. A characteristic feature is a small dark spot (best visible after dissection) near the middle of the ventral edge of segment 8. The papillae anales is covered with long and short setae. The labial palpi consist of two segments; the distal segment is very long but the basal segment very short.

The paratypes from Bamania do not differ to any major degree if compared with the holotype. Of particular note is a third line in between the subterminal line and postmedial line that is forked near costa. Since the other two lines are also forked there are three forks along the costal margin of the forewing. The hindwing is largely ecru-olive, the termen colonial buff.

**Description** (holotype)

Female forewing length 25.0 mm; antennae broken; in the paratypes the antenna-wing ratio is 0.23:1. **Head:** Colonial buff, eyes ecru-olive with tiny black spots; branches of antennae two times the width of the shaft, distance between branches at base very narrow, less than the width of branch; labial palpi narrow, half of diameter of eye, colonial buff. **Thorax:** Patagia colonial buff; tegulae amber brown. **Abdomen:** Colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi colonial buff; hindlegs with two pairs of narrow, very long spurs, medial spurs 1.9 mm, apical spurs 1.3 mm. **Forewing:** Damaged; upperside colonial buff; from the costal margin few lines of buffy olive towards the discocellular cell; subterminal line and postmedial line narrow, buffy olive; cilia short, 1.0 mm. Underside colonial buff. **Venation:** As described for the genus. **Hindwing:** Damaged; upperside glossy, colonial buff with a few scattered short lines of buffy olive; cilia and underside as for the forewing. **Venation:** As described for the genus except 1A+2A obsolete and CuP present; Sc+R<sub>1</sub> with a bar towards the base of the discocellular cell. **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Harry Kendon Clench (1925-1979) who was one of the most interactive lepidopterists' in the last century. He not only published 129 relevant taxonomic papers but also initiated, edited and circulated FRASS, *An Occasional Journal of Paralepidopterology*. He founded, together with Charles Lee Remington (1922-2007), "The Lepidopterists' Union" in 1947 later called the "Lepidopterists' Society."

**Habitat of type localities:** There are two key localities, firstly, Eala (0°03'N, 18°18'E; altitude 310-328 m) is a village *ca.* 10 km east of Mbandaka (average annual rainfall 2066 mm) and *ca.* 5 km north of the Equator. Generally, there is no dry season close to the Equator. The Ikelemba and Ruki rivers border Eala to the north and south, respectively. It belongs to the "Guineo-Congolian regional centre of endemism" *sensu* White (1983) and to the alluvial plain of the Central Basin region of the Congo River with indeterminate watersheds separating the poorly-defined drainage basins. A large part of the landscape is flooded permanently or during the flood period. Eala is surrounded by swamp forest and numerous small islands of grassy vegetation, known as "ésôbé" that are maintained by fire (Germain 1965; Sayer *et al.* 1992; Richards 1998). White (1983) defined the forests as "Guineo-Congolian swamp forest and riparian forest." The swamp forests near Eala are characterized by the presence of *Raphia* spp. and numerous Annonaceae as *Isolona hexaloba* (Pierre) Engl., Euphorbiaceae as *Alchornea floribunda* Müll. Arg., *A. hirtella* Benth., *A. cordifolia* Müll.Arg., *Uapaca guineensis* Müll.Arg.; Ebenaceae as *Diospyros gillettii* De Wild., *D. bipindensis* Gürke, *D. iturensis* (Gürke) Letouzey & F. White; Myristicaceae as *Pycnanthus marchalianus* Ghesq.; Olacaceae as *Strombosiopsis tetrandra* Engl.; Meliaceae as *Entandrophragma palustre* Staner and Caesalpinioidae as *Guibourtia demeusei* (Harms) J. Léonard. The latter was once common in swamp and riparian forest near Eala but is becoming increasingly rare due to rapid deforestation towards Mbandaka (Burgess *et al.* 2004; Njomo 2008). The Ikelemba and Ruki rivers form numerous alluvial islands with wet evergreen levee forests dominated by *Gilbertiodendron dewevrei* (De Wild.) J. Léonard and *Daniellia pynaertii* De Wild..

One of the two main botanic gardens of the DRC is located in Eala and was created in 1900. The garden has an area of 372 ha with special collections (125 ha), a forest reserve (*ca.* 190 ha), marshland (50 ha) and savanna “*ésôbé*” (7 ha). It is noteworthy, and probably a contrast to other botanic gardens, that of its estimated 5000 plant species only 1% are introduced, as in the case of *Hevea brasiliensis* (Willd.) Müll. Arg., *Psidium guajava* L., *Inga* spp. and *Cecropia* spp., and the remaining 99% represent indigenous Central African and local species (Kembelo 1996). It is therefore unlikely that the caterpillars of *H. clenchi* **spec. nov.** feed on bark or in wood of introduced species.

Secondly, Bamanía (also called Bamanya; 0°00'41.N, 18°19'E; altitude 312 m) is a mission station *ca.* 12 km south of Eala, *ca.* 4 km south of the Equator and west of the Ruki River. The habitat is the same as described for Eala.

**Ecology of the type specimens:** *Haberlandia clenchi* **spec. nov.** was recorded in an area with high annual rainfall of *ca.* 2000 mm and no dry season. Its habitat comprises a mosaic of open water, marshland, swamp forest, seasonally flooded forest and levee forest. The extent of seasonally inundated savanna is small. *Haberlandia clenchi* **spec. nov.** is a lowland forest species occurring in swamp forest as well as wet evergreen rain forest.

**Distribution:** *Haberlandia clenchi* **spec. nov.** is known from Eala and Bamanía. The new species is preliminarily classified as endemic to Congolia.

#### 14. *Haberlandia hintzi* **comb. nov.**

Original combination: *Lebedodes hintzi* Grünberg 1911

Figures 18a, b; 21.

#### **Material examined:**

Holotype female, Cameroon, Sud-Quest region, Victoria, 29.September.1910 (a second label on the holotype bears the dates 28.September-02.October.1910), E. Hintz S.G. leg., genitalia slide number 11/042009 I. Lehmann (in ZMHB).

**Diagnosis:** Segment 8 has two long slits: i) an oblique slit from the base of the anterior apophyses towards the ventral side; ii) a second slit near the anterior edge towards the ventral side. At the base of the anterior as well as posterior apophyses occur small hook-like processes. The posterior edge of segment 8 is bent inwards but extends ventrally towards the papillae anales. Near the ventral edge of segment 8 occur long setae that extend beyond the papillae anales. The latter has many long as well as short setae.

#### **Re-description of the holotype**

Female forewing length 24.0 mm; antennae broken. **Head:** Deep olive-buff around eyes as well as base of antennae, eyes wood brown; branches of antennae four times width of the shaft; labial palpi narrow and shorter than diameter of eye, deep olive-buff. **Thorax:** Patagia deep olive-buff; tegulae xanthine-orange. **Abdomen:** Deep olive-buff. **Legs:** Hindfemora, -tibiae and -tarsi deep olive-buff, tarsi also xanthine orange; hindlegs with two pairs of narrow spurs, medial spurs 1.0 mm, apical spurs 0.8 mm. **Forewing:** Upperside deep colonial buff; fine lines of Isabella colour from costal margin towards the dorsum; subterminal line and postmedial line brownish olive; cilia short, 1.0 mm. Underside chamois. **Venation:** As described for the genus. **Hindwing:** Upperside deep colonial buff with few faded lines of Isabella colour; cilia and underside as for the forewing. **Venation:** As described for the genus, but Sc+R<sub>1</sub> with a rudimentary bar towards the discocellular cell.

**Genitalia:** See diagnosis.

**Habitat of type locality:** Victoria (4°00'N, 9°12'E, altitude 3-14 m, average annual rainfall 4028 mm) is a small town at the coast of the Atlantic Ocean *ca.* 2.5 km southeast of Limbe (southwest Cameroon). It belongs to the “*Guineo-Congolian regional centre of endemism*” *sensu* White (1983). The botanists Preuss and Schlechter collected intensively around Victoria



before many plantations have been established after 1906. Among their records were many rain forest species e.g. *Rinorea preussii* Engl. (an indicator for Pleistocene forest refuges) and *Oxygyne triandra* Schltr.. Both species have become extinct at Victoria following the destruction of their habitats (Hall 1973). White (1978) mentioned the occurrence of *Diospyros physocalycina* Gürke in Victoria and stated that it indicates a “wet evergreen forest.” Today, the Mabeta-Moliwe forest reserve lies only 3 km east of Victoria and is recognized as the last surviving piece of “coastal lowland rain forest” between Limbe and Douala. It has been overlooked for a long time but an inventory undertaken by Cheek (1992) shows that it harbours 67 rare, strictly endemic or new plant species. Common species include *Strombosia scheffleri* Engl., *Tapura fischeri* Oliv., *Desbordesia glaucescens* (Engl.) Van Tiegh, *Lophira alata* Banks and *Ceiba pentandra* L. with common shrubs of *Heckeldora staudtii* (Harms), *Psychotria* spp. and *Cola flavo-velutina* K. Schum.. At altitudes below 200 m “Littoral Atlantic forest” sensu Letouzey (1968) occurs. Dominant tree species include *Lophira alata* Banks and *Sacoglottis gabonensis* (Baill.) Urb. indicating an old secondary forest type. Letouzey (1968) stated that this forest type results from clearing due to human occupation in the eighteenth century. The whole area that surrounds Mount Cameroon, including Victoria and Mabeta-Moliwe, is an important Pleistocene forest refuge (Cheek *et al.* 1996).

**Ecology of holotype:** *Haberlandia hintzi* occurs in an area with an extremely high annual rainfall of more than 4000 mm. *Haberlandia hintzi* is classified as a lowland species that is dependent on wet evergreen coastal rain forest.

**Distribution:** Only known from Victoria (Cameroon) that is located in an important Pleistocene refuge area. The habitat of the holotype was probably destroyed due to the establishment of plantations more than 90 years ago. *Haberlandia hintzi* is preliminary classified as endemic to Lower Guinea.

### 15. *Haberlandia josephi* spec. nov.

Figures 19a, b; 22.

#### Material examined:

Holotype female, Belgian Congo, Yangambi (today in Orientale province, DRC), 30.October.1957, P. Dessart leg., genitalia slide number 19/042009 I. Lehmann (in RMCA).

**Diagnosis:** This is currently the largest species of *Haberlandia* **gen. nov.** and one of the largest species of Metarbelidae on the African mainland. Segment 8 is peculiar since it has an elongated, triangular-shaped dorsal surface with two rounded tips. The gap-like structure is deep, *ca.* one-fifth of the width of segment 8. The anterior end of this gap has a long membrane pointing towards the apophyses. Below the base of the anterior apophyses and close to the anterior edge of segment 8 occur two long and lanceolate-shaped slits. Near the base of the anterior and posterior apophyses are small hook-like processes. The posterior edge of segment 8 is bent inwards but ventrally it extends slightly towards the papillae anales. The latter is covered with long as well as short setae. The posterior edge of segment 8 has ventrally long setae that do not extend beyond the papillae anales.

#### Description (holotype)

Female forewing length 28.5 mm; antenna-wing ratio 0.32:1. **Head:** Colonial buff, eyes wood brown; branches of antennae three times the width of the shaft; labial palpi narrow and slightly shorter than diameter of eye, colonial buff. **Thorax:** Patagia colonial buff and amber brown; tegulae amber brown. **Abdomen:** Colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi colonial buff, tarsi also raw sienna; hindlegs with two pairs of narrow spurs, medial spurs 1.0 mm, apical spurs 0.9 mm. **Forewing:** Broad and elongated, upperside colonial buff; from the costal margin several lines of Isabella colour towards the dorsum; subterminal line and postmedial line of Isabella colour; a broad S-shaped band of colonial buff is prominent. It is

edged Isabella colour and is forked near the end of CuA<sub>2</sub>. A spot of Isabella colour is present in the centre of the discocellular cell; cilia colonial buff, 1.2 mm long. The underside is colonial buff. **Venation:** As described for the genus, but R<sub>5</sub> and R<sub>4</sub> on a long stalk from about one-sixth of R<sub>3</sub>. **Hindwing:** Upperside colonial buff. The cilia and underside are as for the forewing. **Venation:** As described for the genus.

**Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Joseph Mugambi Ruthiiri (Nairobi), for his important help in the NMK during my studies on Lepidoptera in five coastal forests of southeast Kenya (1994-2007) as well as in Ololua Forest (near Nairobi) in 2008.

**Habitat of type locality:** Yangambi (0°45'N, 24°26'E, altitude 420-487 m, 1828 mm average annual rainfall) is located at the Congo River, ca. 90 km west of Kisangani (Orientale province, northeastern DRC). It belongs to the "Guineo-Congolian regional centre of endemism" *sensu* White (1983) and to the "East Central region" *sensu* Grubb (1982) that is an important Pleistocene refuge area. Yangambi is surrounded by extensive and diverse forests which in most cases have undergone not very far-reaching modifications (Unesco 1977). The semi-deciduous forest type has the highest diversity, dominated by *Scorodophloeus zenkeri* Harms with *Diospyros chrysocarpa* F. White as well as the *Gilbertiodendron dewevrei* (De Wild.) J. Léonard association with *Tieghemella heckelii* (A.Chev.) Pierre and *Oxystigma oxyphyllum* J. Léonard occurring on slopes and on valley bottoms. Less diverse is the *Brachystegia laurentii* (De Wild.) Louis association with *Annonidium mannii* Engl. & Diels, *Diospyros bipindensis* Gürke and *Polyalthia suaveolens* Engl. & Diels on low plateau regions. In the shrub layer of the latter association, *Cola griseiflora* De Wild., *Scaphopetalum thonneri* De Wild. & T.Durand and Marantaceae as *Haumania liebrechtsiana* J. Léonard can be found (Germain & Evrard 1956). Close to the river and on its many sandbanks near Yangambi are four main pioneer associations: i) a shrub community with *Dichaetanthera corymbosa* (Cogn.) Jacq.-Fél. and *Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg.; ii) seasonally flooded forest with *Ficus mucoso* Welw., *Bridelia micrantha* Hochst. Baill. and *Chrysobalanus atacorensis* A.Chev.; iii) flooded forests on older sites characterized by *Mimusops andongensis* Hiern, *Diospyros gilletii* De Wild and *Trichilia heudelotii* Planch; iv) forests along river banks with *Raphia laurentii* De Wild., *Uapaca heudelotii* Baill., *Diospyros boala* De Wild., *Parinari congensis* Didr. mixed with *Diospyros deltoidea* F. White and *Isolona hexaloba* (Pierre) Engl. (Louis 1947; White 1978).

**Ecology of holotype:** *Haberlandia josephi* **spec. nov.** occurs in rain forests that are dominated by Caesalpinioideae located in an area with a high species diversity and high endemism in valleys, on slopes and on plateau areas. The annual rainfall is high with more than 1800 mm. *Haberlandia josephi* **spec. nov.** is classified as dependent on lowland tropical rain forests.

**Distribution:** *Haberlandia josephi* **spec. nov.** is known from Yangambi that belongs to an important Pleistocene refuge area. It is preliminary classified as endemic to Congolia.

## 16. *Haberlandia ofriedi* **spec. nov.**

Figures 20a, b, 21a, b; 23-24.

### Material examined:

Holotype male, Ghana, Eastern Region, Bunso, Arboretum, 22.-30.October.2009, Sáfían Szabolcs leg., genitalia slide number 20/022011 I. Lehmann (in RMCA).

Paratype: female, same locality, same date, S. Szabolcs, A. Walker, S. Davey & R. Onstein leg., genitalia slide number 30/012011 I. Lehmann (in RMCA).

**Diagnosis:** This is one of the smallest species of the new genus but the antennae are among the longest in *Haberlandia* **gen. nov.** (male: 7.2 mm; female: 6.7 mm). In the male genitalia is

the upper half of the tegumen square-shaped (ventral view). The uncus is entirely covered with short setae and almost as long as the gnathos. The foliaceous gnathos is 40% of the size of the valva with two rudimentary thorn-like processes; towards its ventral edge it becomes almost acuminate (ventral view). The valva has a pronounced sacculus that extends from its base to its end. The juxta has an emargination at the centre that is long, namely 50% of the length of the juxta, with two rounded tips. The female has long tibial spurs, medial spurs 1.7 mm, apical spurs 1.5 mm. Segment 8 is equally broad and only slightly dorsally elongated. The anterior apophyses have a hook-like process at their base. The papillae anales is covered by long setae.

**Description** (holotype)

Male forewing length 17.0 mm; antenna-wing ratio 0.41:1. **Head:** Ecrú-olive, eyes sepia; branches of antennae three times the width of the shaft; labial palpi narrow, slightly longer than half of diameter of eye. **Thorax:** Patagia colonial buff; tegulae Hay's russet. **Abdomen:** Colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi colonial buff, tarsi also orange; hindlegs with two pairs of short spurs, medial spurs 0.8 mm, apical spurs 0.9 mm. **Forewing:** Upperside colonial buff with narrow lines of buffy olive; cilia short, 0.7 mm, colonial buff. The underside is colonial buff. **Venation:** As described for the genus except that  $R_3$  has only a short stalk. **Hindwing:** Upperside colonial buff with a reticulated pattern of buffy olive; a large rounded spot above the tornus; cilia and underside as in the forewing. **Venation:** As described for the genus except that  $1A+2A$  is obsolete towards the termen and  $CuP$  is absent. Of particular note is a short rudimentary vein towards the costa at half of the length of  $Sc+R_1$ . **Genitalia:** See diagnosis.

**Description** (paratype)

Female forewing length 20.0 mm; antenna-wing ratio 0.33:1. **Head:** Cream-buff, eyes wood brown; branches of antennae 2.5x width of the shaft; labial palpi narrow, half of diameter of eye. **Thorax:** Patagia cream-buff; tegulae ochraceous-orange. **Abdomen:** Cream-buff. **Legs:** Hindfemora, -tibiae and -tarsi cream-buff, tarsi also with orange; hindlegs with two pairs of spurs, both as long as in the holotype. **Forewing:** Upperside deep colonial buff with narrow lines of Isabella colour; cilia long, 1.2 mm, colonial buff. The underside is colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside deep colonial buff with a reticulated pattern of Isabella colour; a large rounded spot above the tornus; cilia and underside as for the forewing. **Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Dr Otfried Lange who passed away in Münster on 26<sup>th</sup> April 1990 (North Rhine-Westphalia, Germany). Otfried Lange was born in Saxony in 1927 but fled the GDR for political reasons in 1959. He received his PhD in forestry from the University of Freiburg (Baden-Württemberg) in 1960. I first met him in Münster in 1984 when I was 19 years old, and just a few weeks after two years of political imprisonment by the Government of the GDR. Otfried Lange was a straight-line and honest man. His strong belief in God, generosity and knowledge of human nature helped me to find continuity between my past, present and future. He was one of a handful of people that had a profound influence on my life until he died.

**Habitat of type locality:** Bunso (6°16'N, 0°27'W, altitude 225 m, average annual rainfall 1734 mm) is a settlement located ca. 90 km northwest of Accra (south-central Ghana). The area is still located in the "*Guineo-Congolian egiional centre of endemism*" but is very close to the Dahomey interval. It is noteworthy that Bunso lies in between two hotspots of biodiversity, namely 5-7 km east from the Atewa Range (775 m) and 3-5 km south of the Southern Scarp (788 m). The Atewa Range and in a lesser extent the Southern Scarp are a far-reaching exclave of a "montane" belt with a high rare and endemic species richness that begins further west on Mount Nimba (Liberia) with extensions to Mount Ziama (Guinea) and

to the montane area around Man (Côte d'Ivoire) (Wieringa & Poorter 2004). The Bunso Arboretum was founded in 1905. It is a forest reserve with a size of 16.5 ha. Half of this area is covered by indigenous trees and the other half by forest. The forest of the Bunso Arboretum belongs to the "South-east subtype of Moist Semi-deciduous forest" *sensu* Hall & Swaine (1981). Due to the long history of settlement in southern Ghana there are only 13% of forest reserves that include patches of this subtype. *Khaya ivorensis* A. Chev., a moist evergreen forest tree species, and *Terminalia ivorensis* A. Chev. achieve their greatest density here; *Cola nitida* (Vent.) A.Chev. is the edible kola, but grows wild in this subtype. Characteristic species at Bunso include the trees *Daniella ogea* (Harms) Rolfe, *Turraeanthus africanus* (Welw.) Pellegr. and *Chytranthus macrobotrys* (Gilg) Exell & Mendonça, the climber *Illigera pentaphylla* Welw. and the fern *Pteris togoensis* Heiron.

**Ecology of type specimens:** *Haberlandia ofriedi* **spec. nov.** was recorded in a rain forest dominated by Meliaceae, Combretaceae and Caesalpinioideae, located in an area with high mean annual rainfall of more than 1700 mm. The high rates of endemism in various groups of animals and plants in forests close to Bunso suggest old forest sites, perhaps a Pleistocene forest refuge.

**Distribution:** *Haberlandia ofriedi* **spec. nov.** is known from Bunso (Ghana). It is preliminary classified as endemic to Upper Guinea.

### 17. *Haberlandia rohdei* **spec. nov.**

Figures 22a, b; 25.

#### **Material examined:**

Holotype male, Ghana, Greater Accra Region, Accra, Achimoto Forest, 14.September.1988, F. Diemer leg., genitalia slide number 28/072009 I. Lehmann (in MWM).

**Diagnosis:** This is one of the smallest species of *Haberlandia* **gen. nov.**. The most striking difference to the remaining smaller species is the occurrence of only one pair of tibial spurs. The venation has two remarkable features: i) in the forewing is  $M_1$  slightly S-shaped at base; ii) the small vein in the discocellular cell of the hindwing is forked. In the male genitalia is the upper half of the tegumen triangular-shaped (ventral view). The structure below the tabular dorsal surface of the gnathos is not foliaceous. The valvae are small and broad. They do not extend beyond the tegumen and possess two broad costal plates that have an almost triangular shape and cover 50% of the base of the valva. The sacculus is long and broad (20% of the width of valva).

#### **Description** (holotype)

Male forewing length 17.0 mm; antenna-wing ratio 0.29:1. **Head:** Ecu-olive, eyes sepia; the branches of antennae three times the width of the shaft; labial palpi narrow, half of diameter of eye. **Thorax:** Patagia colonial buff; tegulae liver brown mixed with Hay's russet. **Abdomen:** Ecu-olive. **Legs:** Hindfemora, -tibiae and -tarsi colonial buff, tarsi also with xanthine orange; hindlegs without a pair of medial spurs, apical spurs 0.8 mm. **Forewing:** Upperside colonial buff with many narrow lines of buffy olive; cilia short, 0.8 mm, colonial buff. The underside is colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside ecru-olive with a reticulated pattern of buffy olive; cilia and underside as for the forewing. **Venation:** As described for the genus except that the small vein is forked in the discocellular cell of the hindwing. **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Professor Dr Michael Rohde (Berlin) for his honest friendship over almost ten years. We worked together as editors for three years and finally published the first book on "Avenues in Germany - their importance, care and development" [translated from German] in 2006. The book includes contributions from 43



authors of different scientific disciplines. This collaboration was a privileged experience in my life.

**Habitat of type locality:** Achimota Forest Reserve (also called Achimoto) is *ca.* 250 to 320 ha in size and located in the north-central part of Accra town, bordered by the Accra-Tema-Motorway in the south and by the University of Ghana in the northeast (5°37'N, 0°12'W, altitude 42-55 m, average annual rainfall 733 mm). Accra is located at the coast of the Atlantic Ocean and on the Accra Plains that belong to the Dahomey interval (White 1979). Hence, Accra is part of the “*Guinea-Congolia/Sudania regional transition zone*” *sensu* White (1983). Achimota Forest was gazetted in 1930 to create a green buffer between Achimota School and the city of Accra. The forest included a scrub forest in the 1930's and belongs to the “*South-east Outlier type*” *sensu* Hall & Swaine (1981). This is the least extensive and most vulnerable forest type in Ghana. Canopy trees of Achimota Forest are short (10-15 m) with emergents of *Hildegardia barteri* (Mast.) Kosterm. and *Adansonia digitata* L.; trees as *Cola millenii* K.Schum., *Blighia sapida* Konig, *Millettia thonningii* (Schum. & Thonn.) Baker, *Diospyros abyssinica* (Hiern) F.White, *Drypetes parvifolia* (Müll.Arg.) Pax & K.Hoffm. and *D. floribunda* (Müll.Arg.) Hutch. occur; *Vepris heterophylla* Engl. is locally abundant. Achimota Forest is largely degraded today and includes thickets and/or plantings of *Cassia occidentalis* Linn, *Elaeophorbium drupifera* (Thonn.) Stapf, *Flacourtia flavescens* Willd. and *Azadirachta indica* Juss.. The latter species was introduced to Ghana in 1916 and has spread extensively from firewood plantations into disturbed forest and thicket clumps on the Accra Plains. Some of these species are characteristic species of intact forest-thicket clumps on the Accra Plains including large specimens of *Elaeophorbium drupifera* (Thonn.) Stapf, *Flacourtia flavescens* Willd., *Diospyros mespiliformis* Hochst., *Uvaria chamae* P.Beauv., *Grewia carpinifolia* Juss. with rain forest elements as *Antiaris africana* Engl., *Baphia nitida* Lodd. and *Monodora tenuifolia* Benth. (Jeník & Hall 1976; Ern 1988).

**Ecology of holotype:** *Haberlandia rohdei* **spec. nov.** is classified as rain forest species although the forest is at its driest extreme in Ghana dominated by Euphorbiaceae, Caesalpinoideae, Ebenaceae and Meliaceae. The habitat has the lowest mean annual rainfall for *Haberlandia* **gen. nov.**.

**Distribution:** *Haberlandia rohdei* **spec. nov.** is known from Achimota Forest (Ghana). Its occurrence in the Dahomey interval is treated here as a relict distribution.

### 18. *Haberlandia togoensis* **spec. nov.**

Figures 23a, b; 26.

#### **Material examined:**

Holotype male, Togo, region Centrale, no locality mentioned on label, 12.May.1973, no collector mentioned, genitalia slide number 23/042009 I. Lehmann (in RMCA).

**Diagnosis:** The base of the uncus is triangular-shaped and only two times as broad as the width of the uncus (ventral view). The valvae are rather narrow and long (1.5x length of the gnathos). Half of the valva extends beyond the tegumen (viewed ventrally). The sacculus is long and broad (30% of the width of the valva).

#### **Description** (holotype)

Male forewing length 18.0 mm; antenna-wing ratio 0.30:1. **Head:** Warm buff, eyes wood brown; the branches of antennae 3.5x width of the shaft; labial palpi narrow, slightly longer than half of diameter of eye. **Thorax:** Patagia warm buff; tegulae xanthine orange. **Abdomen:** Warm buff mixed with ecru-olive. **Legs:** Hindfemora, -tibiae and -tarsi warm buff, tarsi also with xanthine orange; hindlegs with two pairs of tibial spurs, medial spurs 1.2 mm, apical spurs 0.9 mm. **Forewing:** Upperside warm buff with many narrow lines of ecru-olive towards the dorsum; subterminal line twice forked near apex; cilia short, 0.7 mm, warm buff. The

underside is warm buff. **Venation:** As described for the genus. **Hindwing:** Upperside deep colonial buff with a reticulated pattern of buffy olive; cilia and underside as for the forewing.

**Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Etymology:** The species is named from its type locality, the country Togo (West Africa).

**Habitat of type locality:** Unknown.

**Ecology of holotype:** Unknown.

**Distribution:** *Haberlandia togoensis* **spec. nov.** is known from central Togo.

### 19. *Haberlandia hollowayi* **spec. nov.**

Figures 24a, b; 27.

#### **Material examined:**

Holotype male, Côte d'Ivoire, Lagunes région, Bingerville, 13. September. 1961, J. Decelle leg., genitalia slide number 18/042011 I. Lehmann (in RMCA).

**Diagnosis:** The posterior cell of the discocellular cell is longer than half of the width of the hindwing. The tabular dorsal surface of the gnathos appears to be absent but is wave-like and laterally less visible; the foliaceous structure is unusually broad (broader than the tabular dorsal surface) and towards its ventral edge it is rounded (ventral view). The gnathos is 50% of the size of the valva. The sacculus is long and broad (15% of the width of valva).

#### **Description** (holotype)

Male Forewing length 17.5 mm; antenna-wing ratio 0.29:1. **Head:** Cream-buff, eyes ecru-olive; branches of antennae four times the width of the shaft; labial palpi narrow, slightly longer than half of diameter of eye. **Thorax:** Patagia cream-buff; tegulae Hay's russet.

**Abdomen:** Deep colonial buff mixed with cream-buff. **Legs:** Hindfemora, -tibiae and -tarsi cream-buff, tarsi also orange-buff; hindlegs with two pairs of tibial spurs, both are only 0.7 mm long. **Forewing:** Rather narrow with an acuminate apex. The upperside is deep colonial buff with many narrow lines of buffy olive; postmedial line and subterminal line are forked near the costa; cilia short, 0.5 mm, colonial buff. The underside is deep colonial buff.

**Venation:** As described for the genus except that  $M_1$  is slightly S-shaped at base. **Hindwing:** Upperside ecru-olive with a reticulated pattern of buffy olive; cilia and underside as for the forewing. **Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Dr Jeremy Holloway (London). He has just brought to completion his 18-part series of volumes on "*The Moths of Borneo.*" I am very grateful for the several opportunities I had to discuss various issues of the Metarbelidae with him.

**Habitat of type locality:** Bingerville (5°21'N, 3°53'W; altitude 7-21 m, average annual rainfall 2012 mm) is located near the coast of the Atlantic Ocean and 12 km east of Abidjan. The area belongs to White's (1983) "*Guineo-Congolian regional centre of endemism*" and is located in a mosaic of agricultural land, degraded forests and savanna. The forests near Abidjan as well as Bingerville are part of the "*evergreen forest belt*" of the Côte d'Ivoire and belong to a group of coastal forests characterized by their occurrence on tertiary sandy soils (Kouamé *et al.* 2004). Holmgren *et al.* (2004) stated that rare and/or endemic Ivorian plant species are frequently found in two locations of Côte d'Ivoire, with one of these locations around Abidjan. Forests around Abidjan and Bingerville belong to "*Hygrophilous coastal evergreen Guineo-Congolian rain forest*" and "*Guineo-Congolian swamp forest and riparian forest*" *sensu* White (1983). Coastal forests include trees as *Anisophyllea meniaudi* Aubrév. & Pellegr., *Gilbertiodendron splendidum* (A.Chev.) J.Léonard, *Strephonema pseudocola* A.Chev., *Trichilia ornithothera* J.J.de Wilde, woody legumes as *Berlinia tomentella* Keay, *Copaifera salikounda* Heckel, *Cynometra ananta* Hutch. & Dalziel, *Anthonotha vignei* Hoyle and *Piptadeniastrum africanum* (Hook.f.) Brenan. Swamp forests occur close to riverbanks

and lagoons. They comprise *Uapaca paludosa* Aubrév. & Léandri, *Heritiera utilis* Sprague, *Parinari robusta* Oliv., *Carapa procera* DC., *Scytopetalum tieghemii* Hutch. & Dalziel, *Rhaptopetalum beguei* Mangenot and *Neostenanthera hamata* (Benth.) Exell. (Poorter *et al.* 2004). The Botanical Garden of Bingerville (55 ha) created in 1904 is of significance. It has 228 plant species including 57 indigenous woody species (Séguéna *et al.* 2010).

**Ecology of holotype:** *Haberlandia hollowayi* **spec. nov.** has been recorded in an area with coastal forests as well as swamp forests dominated by Caesalpinioideae, Araliaceae, Sterculiaceae, Euphorbiaceae and Scytopetalaceae. The habitat is located in an area with very high mean annual rainfall of more than 2000 mm. The high diversity and endemism in forests around Abidjan/Bingerville suggest old forest sites. *Haberlandia hollowayi* **spec. nov.** is classified as lowland rain forest species.

**Distribution:** *Haberlandia hollowayi* **spec. nov.** is known from Bingerville (Côte d'Ivoire). It is preliminarily classified as endemic to Upper Guinea.

## 20. *Haberlandia janzi* **spec. nov.**

Figures 25a, b; 28.

### Material examined:

Holotype male, Côte d'Ivoire, Marahoué région, 15 km east of Bouaflé, Bouïtha [note: Bouïtha is close to the village Degbézéré that is south and not east of Bouaflé], 09.December.1983, R.T.A. Schouten & J.R.M. Buijsen leg., genitalia slide number 29/042011 I. Lehmann (in ZMA).

**Diagnosis:** The most striking difference to the previous species is the rounded apex of the broader forewings. The gnathos has a prominent tabular dorsal surface. The foliaceous structure of the gnathos is not broader than the tabular dorsal surface. The gnathos has 50% of the size of the valva. The juxta has two prominent ridge-like structures from top to the ventral part; its emargination is 30% of the length of the juxta, the two tips are rounded.

### Description (holotype)

Male forewing length 18.0 mm; antenna-wing ratio 0.30:1. **Head:** Deep colonial buff, eyes ecru-olive with small black spots; branches of antennae 2.5x width of the shaft; labial palpi narrow, half of diameter of eye. **Thorax:** Patagia deep colonial buff; tegulae xanthine orange. **Abdomen:** Deep colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi deep colonial buff, tarsi also orange; hindlegs with two pairs of tibial spurs, medial spurs 1.2 mm, apical spurs 0.9 mm. **Forewing:** Upperside deep colonial buff with many narrow lines of buffy olive; in between the postmedial line and subterminal line occurs a third faded line; cilia 0.9 mm, colonial buff. The underside is colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside as for the forewing. A reticulated pattern is absent. The subterminal line ends at CuA<sub>1</sub>, the other two lines are coalescent at CuA<sub>2</sub>; cilia and underside as for the forewing. **Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of André Janz (Ahrensburg, Germany). He kindly supports my work on the Metarbelidae and has resolved all computer issues for me since 2001.

**Habitat of type locality:** Bouïtha (ca. 6°40'N, 5°42'W; altitude 250 m, average annual rainfall 1350 mm) is a village located ca. 15 km south of Bouaflé, ca. 3 km from the village Degbézéré (south-central Côte d'Ivoire), and ca. 230 km northwest of Abidjan. The area is at a border line between the "Guineo-Congolian regional centre of endemism" and the "Guinea-Congolia/Sudania regional transition zone" *sensu* White (1983). Bouïtha belongs also to an area where Guinean savanna penetrates the Upper Guinea rain forest zone in a region called "V-Baoulé." Despite this, Bouïtha is surrounded by semi-deciduous forests located in a forest-agricultural land mosaic. Characteristic species of those semi-deciduous

forests that represent the northern limit of the forest zone in Côte d'Ivoire are *Aubrevillea kerstingii* (Harms) Pellegr. and *Khaya grandifoliola* C.DC.. The former genus is endemic to the Guineo-Congolian Region, the latter species is an Upper Guinea endemic that represents a link from these semi-deciduous forests to the rain forest block of Upper Guinea. Additional species around Bouïtha include *Diospyros abyssinica* (Hiern) F.White, *Ricinodendron heudelotii* (Baill.) Pierre, *Chrysophyllum giganteum* A.Chev., *Celtis mildbraedii* Engl., *Triplochiton scleroxylon* K.Schum. and *Nesogordonia papaverifera* (A.Chev.) Capuron (Kouamé *et al.* 2004).

**Ecology of holotype:** *Haberlandia janzi spec. nov.* occurs in semi-deciduous forests dominated by Caesalpinioideae, Meliaceae, Sterculiaceae and Ulmaceae. The habitat is located in an area with a high mean annual rainfall of more than 1300 mm. The new species is classified as dependent on lowland tropical rain forest.

**Distribution:** *Haberlandia janzi spec. nov.* is known from Bouïtha (Côte d'Ivoire). Its occurrence in forests west and east of the V-Baoulé is likely. It is preliminarily classified as endemic to Upper Guinea.

## 21. *Haberlandia tempeli spec. nov.*

Figures 26a, b; 29.

### Material examined:

Holotype female, Côte d'Ivoire, Lagunes région, ORSTOM-Adiopodoumé, April.1964, Piart & Griveaud leg., genitalia slide number 06/022011 I. Lehmann (in MNHN).

**Diagnosis:** This is the largest female of the new genus known from Upper Guinea. Due to this difference in the size it is not treated as the female of *H. hollowayi spec. nov.* that occurs east of Abidjan but is one of the smaller species. Other differences to the previous species from Côte d'Ivoire comprise: i) *Haberlandia tempeli spec. nov.* has broad forewings and a rounded apex; ii) the subterminal line is unique and has an oblique, very long fork extending from the apex almost to vein R<sub>5</sub>; iii) the postmedial line is bent inwards at M<sub>1</sub>; iv) the discocellular cell of the hindwing is large and less elongated. The dorsal gap on segment 8 is deep (25% of the length of segment 8). The posterior apophyses are almost twice as broad as the anterior apophyses. The setae on the ventral side of segment 8 extend beyond the papillae anales. The latter is elongated with long and short setae that are rather scattered. Slits are absent on segment 8 although two structures occur that appear to be shaped like slits, but are not open.

### Description (holotype)

Female forewing length 25.5 mm; antenna-wing ratio 0.30:1. **Head:** Colonial buff, eyes ecru-olive; branches of antennae 2.5x width of shaft; labial palpi narrow, half of diameter of eye.

**Thorax:** Patagia colonial buff; tegulae orange. **Abdomen:** Colonial buff. **Legs:** Hindfemora, -tibiae and -tarsi colonial buff, tarsi also orange; hindlegs with two pairs of long spurs, medial and apical pair 1.6 mm.

**Forewing:** Upperside colonial buff with few narrow lines of tawny-olive; cilia 1.2 mm long, colonial buff. The underside is colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside ecru-olive with a faded reticulated pattern of buffy olive; cilia and underside as for the forewing. **Venation:** As described for the genus.

**Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Karl Georg Tempel (Berlin) who works as the head of the Public Relations Division in the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety since 1990. Karl supported the campaign “*Germany’s tree-lined avenues - nothing can take their place*” for nine years (2002-2010). His work and excellent cooperation helped to greatly increase public awareness and value of avenues and resulted in various local avenue preservation projects in nine federal states of Germany.



**Habitat of type locality:** Adiopodoumé (5°20'N, 4°07'W; altitude 45 m, average annual rainfall 2100 mm) is located 17 km west of Abidjan in the “*Guineo-Congolian regional centre of endemism*” *sensu* White (1983). The type locality belongs to the area of the former French overseas research institute ORSTOM (Office de la Recherche Scientifique et Technique Outre-Mer; today IRD = Institute de Recherche pour le Développement), established in 1946. It is located *ca.* 1 km south of the village Adiopodoumé and the road A3 (Route de Dabou). The environment south of Adiopodoumé is a mosaic of houses, agricultural land with multi-cropping *e.g.* cassava, maize, groundnut, tomatoes, rice and, cacao mixed with trees that provide shade and fruit, such as banana, *Cola nitida* (Vent.) Schott & Endl., *Symphonia globulifera* Linn.f. and various palms. There are moist savanna patches that include swampy areas covered by *Scleria vogelii* C.B.Cl. (Cyperaceae) or secondary land with *Salacia oliveriana* N.Hallé, *Hugonia platysepala* Welw., *Tephrosia flexuosa* G.Don.. Forest grows to the north, east and south of the ORSTOM buildings and research fields, that is *ca.* 70-140 ha in size and is part of the “*evergreen forest belt*” of Côte d’Ivoire. The author assumes that little forest degradation occurred since 1946, particularly due to the swampy ground towards the Ebrié Lagoon and due to the permanent presence of people in scattered research stations. Tree species characteristic of the swamp forests around Adiopodoumé and Abidjan include *Carapa procera* DC., *Parinari robusta* Oliv., *Uapaca paludosa* Aubrév. & Léandri, *Raphia palma-pinus* (Gaertn. & Hutch.) and *Uapaca guineensis* Müll.Arg.. Based on older pictures taken in the 1950’s, coastal forest probably occurred behind the research fields on tertiary sands further inland (*cf.* Roose 1973). Coastal forest might be still present including species typical for the Adiopodoumé-Abidjan area, such as *Anisophyllea meniaudi* Aubrév. & Pellegr., *Anthonotha fragrans* (Bak.f.) Exell & Hillcoat, *Sacoglottis gabonensis* (Baill.) Urb., *Cussonia bancoensis* Aubrév. & Pellegr., *Strephonema pseudocola* A.Chev., *Monodora crispata* Engl., *Isolona campanulata* Engl. & Diels, *Trichilia ornithothera* J.J.deWilde; shrubs as *Icacina mannii* Oliv., *Epinetrum cordifolium* Mangenot & Miège, *Chassalia afzelli* (Hiern) K.Schum., woody lianas as *Lycopodium microphyllum* (Cav.) R.Br. and *Anthocleista nobilis* G. Don. (in secondary forest) (*cf.* Poorter *et al.* 2004).

**Ecology of holotype:** *Haberlandia tempeli spec. nov.* occurs in coastal forests as well as swamp forests located in an area with very high mean annual rainfall of 2100 mm. The high diversity and high rates of endemism in forests around Adiopodoumé-Abidjan-Bingerville suggest old forest sites. *Haberlandia tempeli spec. nov.* is classified as dependent on lowland tropical rain forests and in particular to “*Hygrophilous coastal evergreen Guineo-Congolian rain forest*” and “*Guineo-Congolian swamp forest and riparian forest*” *sensu* White (1983).

**Distribution:** *Haberlandia tempeli spec. nov.* is known from the ORSTOM area in Adiopodoumé. It is classified as endemic to Upper Guinea.

## 22. *Haberlandia taiensis spec. nov.*

Figures 27a, b; 30.

### Material examined:

Holotype male, Côte d’Ivoire, Bas-Sassandra région, Taï National Park, 12.November.1983, Dr K. Politzar leg., genitalia slide number 08/082009 I. Lehmann (in MWM).

**Diagnosis:** Most striking is the postmedial line that is zigzagged. The subterminal line and postmedial line are forked at the costa and coalescent below CuA<sub>1</sub>. The tabular dorsal surface of the gnathos is 30% of the gnathos; the foliaceous structure is not broader than the tabular dorsal surface and only 25% of the size of the valva. The valvae are large, rectangular in shape and covered by a very broad belt-like structure at their base (70% of the width of valva). The juxta is not elongated, large, 35% of the gnathos, its emargination at centre is 60%

of the length of the juxta, the two tips are rounded, ridge like structures are absent. The aedeagus is bent upwards distally.

**Description** (holotype)

Male forewing length 19.5 mm; antennae broken. **Head:** Ecu-olive around eyes and antennae, eyes buffy-olive with black spots; branches of antennae three times the width of the shaft; labial palpi narrow, more than half of diameter of eye. **Thorax:** Patagia ecru-olive; tegulae Hay's russet. **Abdomen:** Deep colonial buff. **Legs:** Femora, tibiae and tarsi ecru-olive, tarsi also xanthine-orange; hindlegs missing. **Forewing:** Upperside deep colonial buff with many narrow lines of buffy olive; in between the postmedial line and subterminal line occurs a very narrow third line; cilia 0.8 mm, colonial buff. The underside is colonial buff. **Venation:** As described for the genus. **Hindwing:** Upperside as for the forewing but with a faded reticulated pattern; cilia and underside as for the forewing. **Venation:** As described for the genus. **Genitalia:** See diagnosis.

**Etymology:** The species is named from the type locality, the Taï National Park (southwest Côte d'Ivoire), that comprises one of the most diverse forests in the country.

**Habitat of type locality:** Taï NP (457.261 ha; 5°10'-6°10'N, 6°70'-7°40'W; altitude 150-475 m, average annual rainfall 1800-2200 mm and decreasing from south to north) is located *ca.* 320 km west of Abidjan in White's (1983) "*Guineo-Congolian regional centre of endemism.*" The entire environment outside of the Taï NP was once covered by natural rain forests that have almost become extinct in the years since 1970. Only few patches remain along its eastern border on rock outcrops and inland valleys. The rain forests were replaced by large intensive cash-crop plantations as cocoa, coffee, rice (in inland-valleys) and *Hevea brasiliensis* (Willd.) Müll.Arg.. This effectively renders the Taï NP similar to a forested island today. Its forests fall entirely into the "*evergreen forest belt*" with the highest plant diversity in Côte d'Ivoire comprising 1231 plant species, dominated by the Caesalpinioideae, Rubiaceae and Euphorbiaceae. The maximum diversity is found on upper and middle slopes with *Entandrophragma* spp. and *Tieghemella heckelii* (A.Chev.) Pierre, while at lower elevations, *Pycnanthus angolensis* (Welw.) Warb. is abundant. The diversity of Taï NP is higher than in the forest of Haute Dodo, once thought to be the most diverse forest of Côte d'Ivoire with 906 plant species (*cf.* Kouamé *et al.* 2004). Endemism is high, there are 175 endemic species among the 908 species found in the southern half of Taï NP alone. These are dominated by *Hymenostegia afzelii* (Oliv.) Harms, *Strombosia pustulata* Oliv., *Diospyros sanza-minika* A. Chev., *Calpocalyx brevibracteatus* Harms and *Ceiba pentandra* (L.) Gaertn.. Where secondary forests occur, they are dominated by *Funtumia africana* (Benth.) Stapf.. Swamp forests also exist, and are dominated by *Mitragyna ciliata* Aubrév. & Pellegr., *Uapaca paludosa* Aubrév. & Léandri, *U. esculenta* A.Chev., *Gilbertiodendron splendidum* (A.Chev.) J.Léonard, *G. preussii* (Harms) J.Léonard, *Heritiera utilis* (Sprague) Sprague and *Sacoglottis gabonensis* (Baill.) Urb. (Adou Yao *et al.* 2005). *Raphia hookeri* Mann & Wendl., *Symphonia globulifera* L.f., *Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg. and *Cyrtosperma senegalense* Engl. are found along rivers (Mund 1999). Hypothetical Pleistocene forest refugia were mentioned by van Rompaey (1993) for hill ridges around Grabo *ca.* 40 km southwest of Taï NP.

**Ecology of holotype:** *Haberlandia taiensis* **spec. nov.** occurs in an area with high mean annual rainfall of at least 1800 mm. The very high diversity and high rates of endemism in its forest habitat suggest old forest sites, perhaps Pleistocene refuges on hilltops and along rivers. *Haberlandia taiensis* **spec. nov.** is classified as dependent on lowland tropical rain forest.

**Distribution:** *Haberlandia taiensis* **spec. nov.** is known from Taï NP (Côte d'Ivoire). It is classified as endemic to Upper Guinea.

### 23. *Haberlandia rabiusi* spec. nov.

Figures 28a, b; 31.

#### Material examined:

Holotype female, Sierra Leone, Eastern province, Kenema, no day, October.1974, Don A. Allaer leg., genitalia slide number 18/052009 I. Lehmann (in RMCA).

**Diagnosis:** Three characteristics stand out if compared to the other species described herein: i) the subterminal line of the forewing is not forked near apex; ii) the postmedial line has at its centre an elongated oval shaped spot; iii) segment 8 has a gap-like structure on its dorsal surface that ends just before the posterior edge. The posterior edge of segment 8 is bent inwards but ventrally it extends only slightly towards the papillae anales. The latter is attached to a large membrane that is as broad as segment 8. The posterior edge of segment 8 has ventrally long setae that do not extend beyond the papillae anales. The latter has long setae.

#### Description (holotype)

Female forewing length 21.5 mm; antenna-wing ratio 0.30:1. **Head:** Colonial buff around eyes as well as base of antennae, eyes wood brown with black spots; branches of antennae three times the width of shaft and covered with relatively few tiny hairs projecting mainly inwards; labial palpi narrow and longer than half of diameter of eye, Isabella colour. **Thorax:** Patagia colonial buff and amber brown; tegulae amber brown. **Abdomen:** Ecu-olive. **Legs:** Hindfemora, -tibiae and -tarsi colonial buff, tarsi also raw sienna; hindlegs with two pairs of narrow tibial spurs, medial spurs 1.1 mm, apical spurs 1.0 mm. **Forewing:** Elongated, upperside ecru-olive; from the costal margin several lines of buffy olive towards the dorsum; subterminal line and postmedial line of Isabella colour; near the postmedial line occur lines that have a vinaceous glint; cilia ecru-olive, 1.2 mm long. The underside is ecru-olive but colonial buff on the veins. **Venation:** As described for the genus. **Hindwing:** Upperside ecru-olive; cilia and underside as for the forewing. **Venation:** As described for the genus.

**Genitalia:** See diagnosis.

**Etymology:** The species is named in honour of Ernst-Wilhelm Rabijs (Preetz, Germany) who is the Permanent Secretary in the Ministry of Agriculture, Environment and Rural Areas of the federal state of Schleswig-Holstein. Ernst-Wilhelm Rabijs played an important role in my life when he was the Head of the Department of Nature Conservation in the Ministry of Environment of Mecklenburg-West Pomerania in 1991 to 1992. During these exciting years after the German unification he gave me the unique chance to build up the Land Park Programme and the legal protection of avenues in Mecklenburg-West Pomerania. I am very grateful for the opportunity to work with him for two years, for his integrity, honesty and his efforts to protect our environment for future generations.

**Habitat of type locality:** Kenema (7°52'N, 11°11'W; altitude 185 m; southeast Sierra Leone) is located only 2 km east of the Kambui Hills Forest Reserve (that includes the highest peak of 645 m in southern Sierra Leone) and 25 km northwest of Gola Forest Reserve (average annual rainfall 2539 mm). The latter is the largest of lowland rain forest (750 km<sup>2</sup>) in Sierra Leone that is covered by less than 5% of rain forests (Sayer *et al.* 1992). The Kambui Hills forest is also one of the largest in the country but separated by the main highway leading to Kenema town. Kambui North (20.348 ha) and Kambui South (880 ha) have been extensively logged in the past. They represent, as does Gola, a patchwork of primary rain forest with old re-growth on former farm sites. Kambui and Gola belong to the “*wet evergreen type*” of lowland tropical rain forest and to a sub-coastal forest band stretching from southeastern Sierra Leone to the Liberia-Côte d’Ivoire border. This band is a “*centre of diversity and endemism*” with high rare species richness within the Upper Guinean forest block (Wieringa & Poorter 2004). Characteristic species of the Kambui Hills comprise *Aubrevillea platycarpa* Pellegr., *Anisophyllea meniaudi* Aubrév. & Pellegr., *Belonophora hypoglauca* (Welw.) A.Chev., *Calpocalyx brevibracteatus* Harms., *Cassipourea afzelii* (Oliv.) Alston, *Cynometra*

*leonensis* Hutch. & Dalziel (at riverbanks), *Dialium aubrevillei* Pellegr. with understorey shrubs as *Bertiera breviflora* Hiern and *Alchornea cordifolia* (Schum. & Thonn.) Müll.Arg. (Poorter *et al.* 2004).

**Ecology of holotype:** *Haberlandia rabiusi spec. nov.* occurs in an area with high mean annual rainfall of at least 2500 mm. The very high diversity and endemism in its forest habitat suggest old forest sites, perhaps Pleistocene refuges on hilltops and along rivers. *Haberlandia rabiusi spec. nov.* is classified as dependent on lowland tropical rain forest.

**Distribution:** *Haberlandia rabiusi spec. nov.* is known from Kenema (Sierra Leone). It is classified as endemic to Upper Guinea. Its distribution is affected by the very high rate of deforestation in Sierra Leone.

#### 24. *Haberlandia hulstaerti spec. nov.*

Figures 29a, b; 32.

Note: The last new species in this paper has been described based on two characteristics of the uncus as the gnathos, saccus and the valvae are largely absent.

#### Material examined:

Holotype male, Belgian Congo (today Équateur province, DRC), Flandria (today Boteka), 20.June.1947, R.P.G. Hulstaert leg., genitalia slide number 21/042011 I. Lehmann (in RMCA).

**Diagnosis:** Two characteristics stand out: i) the uncus is unusual among *Haberlandia gen. nov.* since it is only slightly broader than the belt-like structure at the base of the valvae; ii) the uncus is densely covered with long setae. The width of the tegumen is narrow and almost equal to the vinculum.

#### Description (holotype)

Male forewing length 21.0 mm; antennae broken. **Head:** Warm buff, eyes ecru-olive; shaft of antennae densely scaled, branches three times the width of the shaft and densely covered with hairs projecting mainly inwards; labial palpi narrow and longer than half of diameter of eye, deep colonial buff. **Thorax:** Patagia cream buff; tegulae Hay's russet. **Abdomen:** Cream-buff. **Legs:** Hindfemora, -tibiae and -tarsi warm buff, tarsi also orange-buff; hindlegs with two pairs of narrow tibial spurs, medial spurs 0.7 mm, apical spurs 0.6 mm. **Forewing:** Upperside warm-buff; from the costal margin many lines of Isabella colour towards the dorsum; subterminal line and postmedial line of Isabella colour and forked near the costal margin and apex; cilia warm buff, 0.9 mm. The underside is cream-buff. **Venation:** As described for the genus but the vein in the discocellular cell is forked towards the termen. **Hindwing:** Upperside ecru-olive; cilia and underside as for the forewing. **Venation:** As described for the genus but with several differences: i) veins 3A, 1A+2A and CuP are present; ii) Rs has an unusual rudimentary vein towards the costal margin; iii) Sc+R<sub>1</sub> is forked at base.

**Genitalia:** See diagnosis. Note: The gnathos and the valvae are broken. The saccus is broken at the tip. The length of the saccus is longer than the width of the vinculum ventrally.

**Etymology:** The species is named in honour of the collector, the Flemish Father Gustaaf Hulstaert (1900-1990). His Catholic mission was located in Flandria. Gustaaf Hulstaert's legacy comprises his scholarly writings on the Mongo history, and his research into the Lomongo dialect, as well as his botanical and zoological notes written for the emerging Centre Aequatoria at Bamania (DRC), established in 1937, mainly due to his efforts. He made the largest contribution to the Aequatoria Archives, creating a collection of more than 600 schoolbooks and religious textbooks in 35 Congolese languages.

**Habitat of type locality:** Boteka (formerly Flandria, 0°18'S, 19°04'E; altitude 325 m; average annual rainfall 2000-2100 mm, no dry season) is a village located at the Momboyo



River. It is surrounded by largely intact lowland tropical rain forests of the “*Guineo-Congolian regional centre of endemism*” *sensu* White (1983). Single-dominant forests of *Gilbertiodendron dewevrei* (De Wild.) J. Léonard occur around Boteka. Mixed forest comprises Zingiberaceae as *Aframomum singulariflorum* Dhetchuvi and shrubs as *Tabernanthe iboga* Baill. in the understory, with trees such as *Diospyros iturensis* (Gürke) Letouzey & F.White and *Monodora angolensis* Welw. in the canopy (White 1978; Tonye *et al.* 2000; Blom & Schipper 2004). *Parkia bicolor* A. Chev. grows on the river banks; while swamp forests contain *Coelocaryon botryoides* Vermeesen, *Guibourtia demeusei* (Harms) J. Léonard, *Oubanguia africana* Baill. and *Symphonia globulifera* L.f. (Steel 2008). Industrial oil palm plantations as well as family plantations date back to 1927-1935 and comprise *ca.* 3.000 ha today (Carrere 2010).

**Ecology of holotype:** *Haberlandia hulstaerti spec. nov.* occurs in an area with high mean annual rainfall of *ca.* 2000 mm.

**Distribution:** *Haberlandia hulstaerti spec. nov.* is known from Boteka (formerly Flandria, DRC). It is preliminarily classified as endemic to Congolia.

## Discussion

The species of *Haberlandia gen. nov.* have only small morphological differences that are sometimes difficult to recognize. The species from the lowland rain forests of Upper Guinea are smaller in wing size if compared to the majority of species from lowland rain forests of Lower Guinea and Congolia. The swamp and riparian forests as well as the rain forests on dryland of the Congo Basin harbour the largest *Haberlandia* spp. representing the largest species among the Metarbelidae currently known from the African mainland. The low level of morphological differences between all species of *Haberlandia gen. nov.* in wing pattern, venation and genitalia is remarkable. It may reflect limited diversity in morphological potential, possibly as a result of extinction events caused by a widespread loss of lowland rain forest habitats. This loss may be due to past cycles of rain forest fragmentation and subsequent expansion due to climatic changes. A similar hypothesis was presented by Mitter *et al.* (2010) for the butterfly subfamily Pseudopontiinae (Pieridae) which also occurs in tropical forests of West and Central Africa.

Lehmann & Kioko (2005) and Lehmann (2008a) found that the Metarbelidae comprise mainly slow dispersing species in Pleistocene forest refuges dominated by Caesalpinioideae of southeast coastal Kenya based on 14 years of field research. Similarly, an accumulation of slow dispersing species, resulting in high diversity and endemism of *Haberlandia gen. nov.*, can be expected in Pleistocene forest refuges of West and Central Africa.

The conservation of the forests of Upper Guinea will be more and more at risk if an effective management strategy is not put into place. Of the primary rain forests that still covered small parts of Sierra Leone, half of Liberia, half of Côte d’Ivoire, a little under half of Ghana and a little part of west-central Togo at the turn of the last century, very few large forests remain, being found today only in Côte d’Ivoire (Taï NP only), Liberia and Ghana (Chatelain *et al.* 2004). Aside from the National Parks and other protected areas, forest patches are often degraded, as seen around Kenema (habitat of *Haberlandia rabiusi spec. nov.*), or have disappeared during the last 40 years, as seen close to the “*V-Baoulé*” and around Abidjan/Bingerville. This results in complete habitat loss, or in leaving a few tiny at risk forest habitats, in particular for *Haberlandia tempeli spec. nov.*, *H. hollowayi spec. nov.* and *H. janzi spec. nov.* *Haberlandia togoensis spec. nov.* might be already extinct in central Togo due to habitat loss (*cf.* Poorter *et al.* 2004).

Although rain forest did not always exist in the whole of tropical West and Central Africa due to a natural cycle of forest regression and progression, it is obvious that Upper Guinea lost the majority of its rain forests in the 20<sup>th</sup> century due to cash crop cultivation and exploitation of wood. The remaining forests are fragmented and “*critically threatened*.” The conservation of *Haberlandia gen. nov.* in Lower Guinea and Congolia is less of a problem as still large relatively stable or intact rain forest blocks remain (*cf.* Burgess *et al.* 2004).

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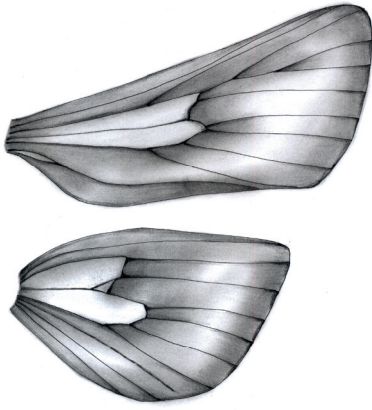


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1a



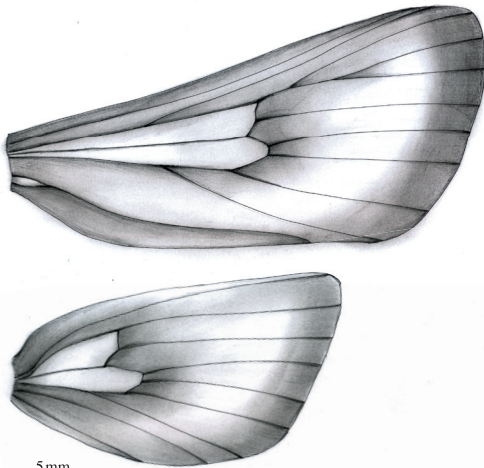
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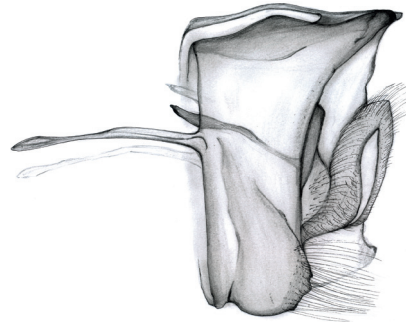
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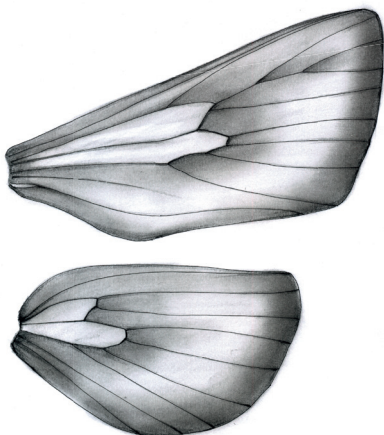
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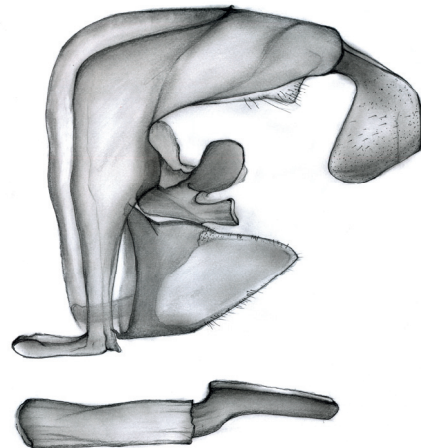
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Figure 1a. Wing venation of: *Haberlandia odzalaensis* **spec. nov.**, male, holotype. 2a. *Haberlandia odzalaensis* **spec. nov.**, female, paratype. 3a. *Haberlandia lindacammae* **spec. nov.**, male, holotype.

Figure 1b. Genitalia of: *Haberlandia odzalaensis* **spec. nov.**, male, holotype. 2b. *Haberlandia odzalaensis* **spec. nov.**, female, paratype. 3b. *Haberlandia lindacammae* **spec. nov.**, male, holotype.



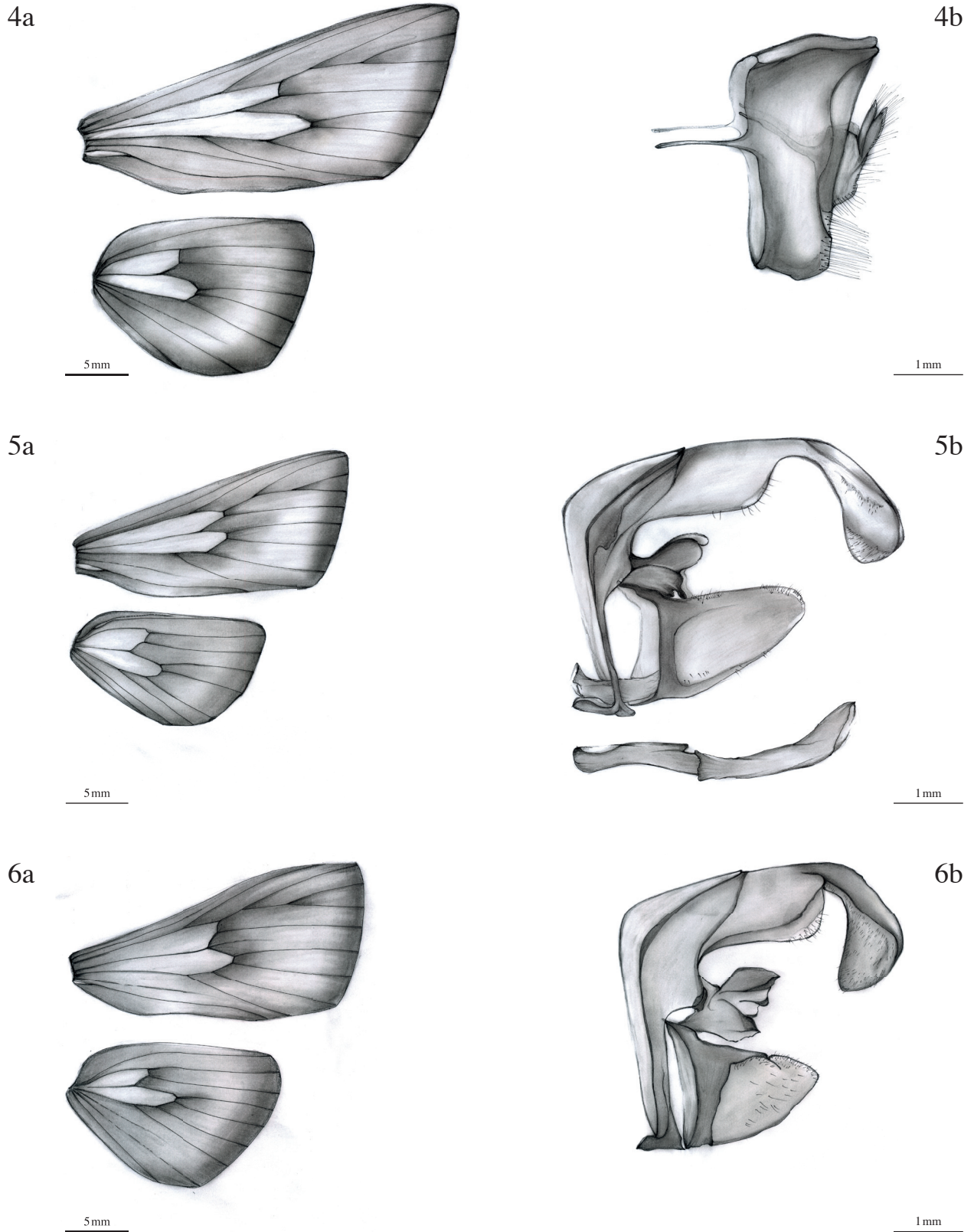
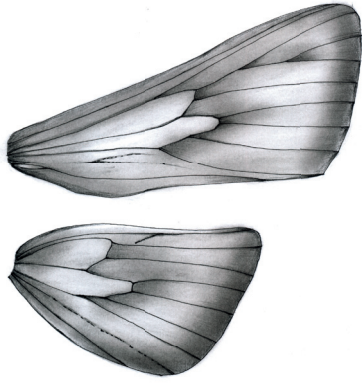


Figure 4a. Wing venation of: *Haberlandia lindacammae* **spec. nov.**, female, paratype. 5a. *Haberlandia legraini* **spec. nov.**, male, holotype. 6a. *Haberlandia shimonii* **spec. nov.**, male, holotype.

Figure 4b. Genitalia of: *Haberlandia lindacammae* **spec. nov.**, female, paratype. 5b. *Haberlandia legraini* **spec. nov.**, male, holotype. 6b. *Haberlandia shimonii* **spec. nov.**, male, holotype.

7a



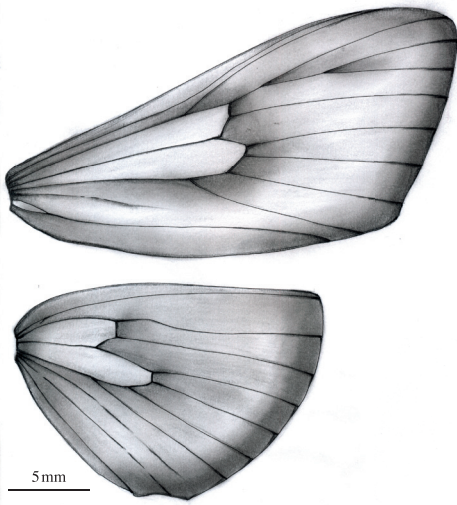
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7b



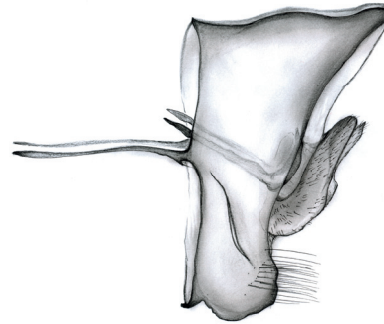
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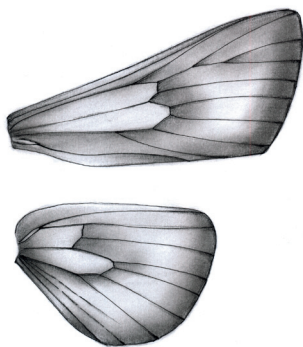
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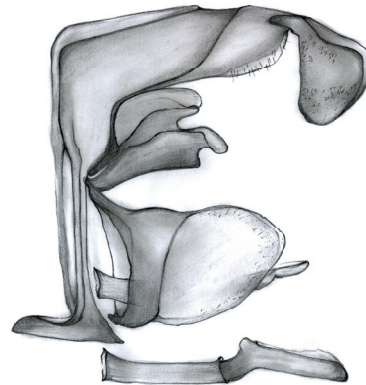
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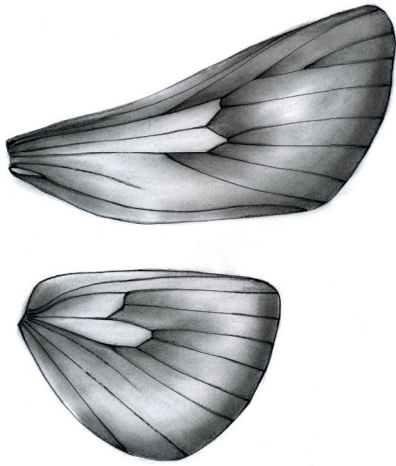


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Figure 7a. Wing venation of: *Haberlandia annetteae* **spec. nov.**, male, holotype. 8a. *Haberlandia annetteae* **spec. nov.**, female, paratype. 9a. *Haberlandia hilaryae* **spec. nov.**, male, holotype.

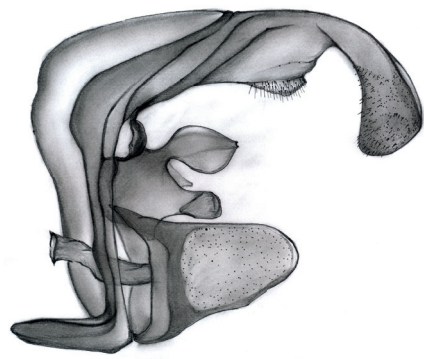
Figure 7b. Genitalia of: *Haberlandia annetteae* **spec. nov.**, male, holotype. 8b. *Haberlandia annetteae* **spec. nov.**, female, paratype. 9b. *Haberlandia hilaryae* **spec. nov.**, male, holotype.

10a



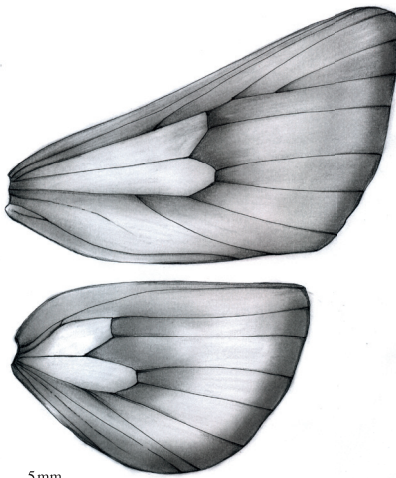
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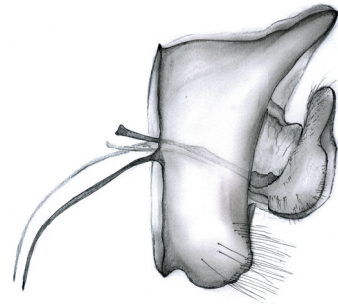
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11a



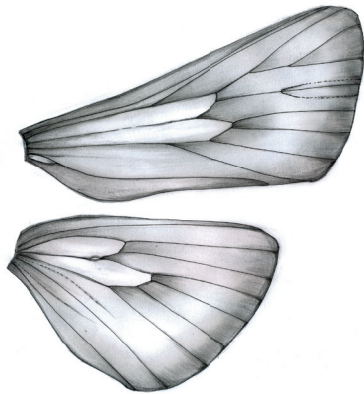
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12a



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12b



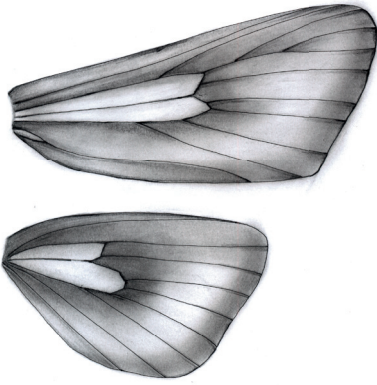
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Figure 10a. Wing venation of: *Haberlandia lusamboensis* **spec. nov.**, male, holotype. 11a. *Haberlandia lusamboensis* **spec. nov.**, female, paratype. 12a. *Haberlandia entebbeensis* **spec. nov.**, male, holotype.

Figure 10b. Genitalia of: *Haberlandia lusamboensis* **spec. nov.**, male, holotype. 11b. *Haberlandia lusamboensis* **spec. nov.**, female, paratype. 12b. *Haberlandia entebbeensis* **spec. nov.**, male, holotype.

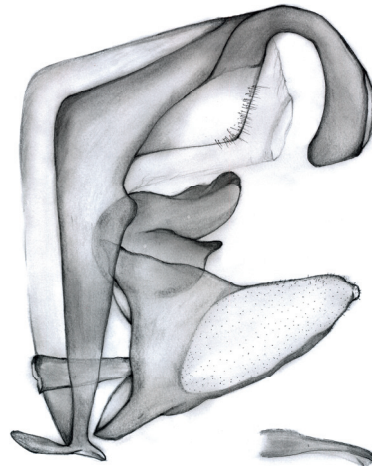


13a



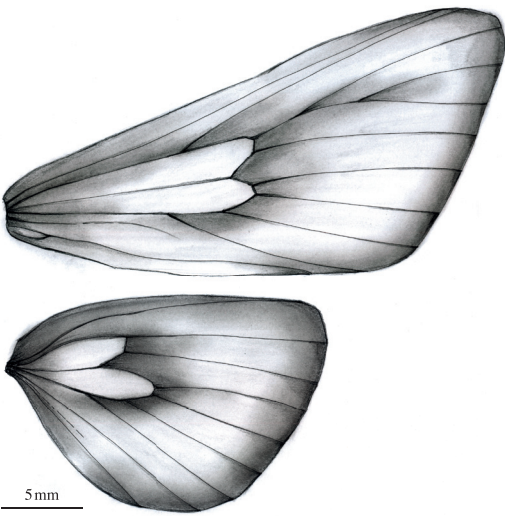
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13b



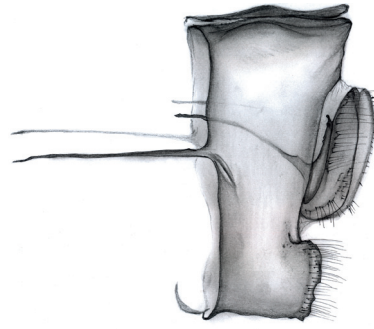
1 mm

14a



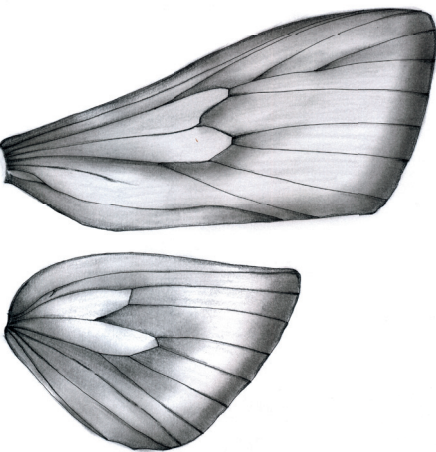
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14b



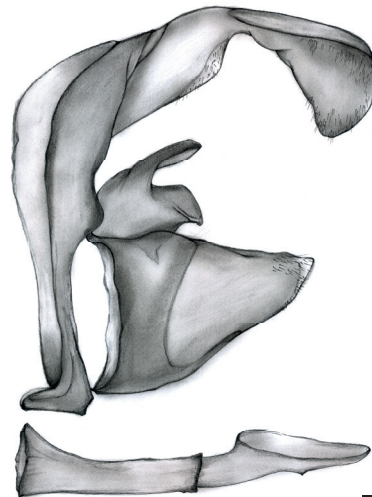
1 mm

15a



5 mm

15b



1 mm

Figure 13a. Wing venation of: *Haberlandia isakaensis* **spec. nov.**, male, holotype. 14a. *Haberlandia rudolphi* **spec. nov.**, female, holotype. 15a. *Haberlandia isiroensis* **spec. nov.**, male, holotype.

Figure 13b. Genitalia of: *Haberlandia isakaensis* **spec. nov.**, male, holotype. 14b. *Haberlandia rudolphi* **spec. nov.**, female, holotype. 15b. *Haberlandia isiroensis* **spec. nov.**, male, holotype.



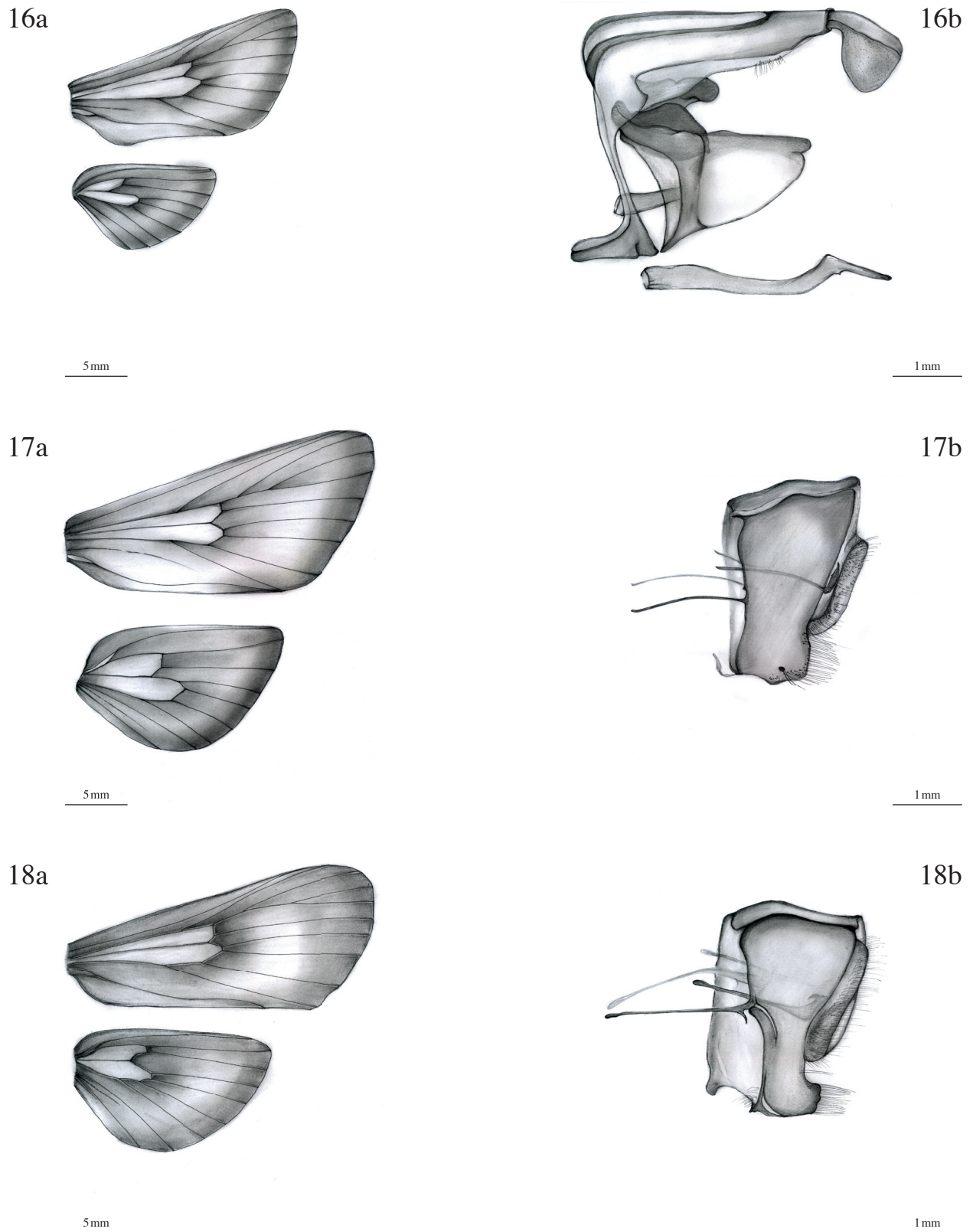


Figure 16a. Wing venation of: *Haberlandia ueleensis* **spec. nov.**, male, holotype. 17a. *Haberlandia clenchi* **spec. nov.**, female, holotype. 18a. *Haberlandia hintzi* (Grünberg 1911) **comb. nov.**, female, holotype.

Figure 16b. Genitalia of: *Haberlandia ueleensis* **spec. nov.**, male, holotype. 17b. *Haberlandia clenchi* **spec. nov.**, female, holotype. 18b. *Haberlandia hintzi* (Grünberg 1911) **comb. nov.**, female, holotype.

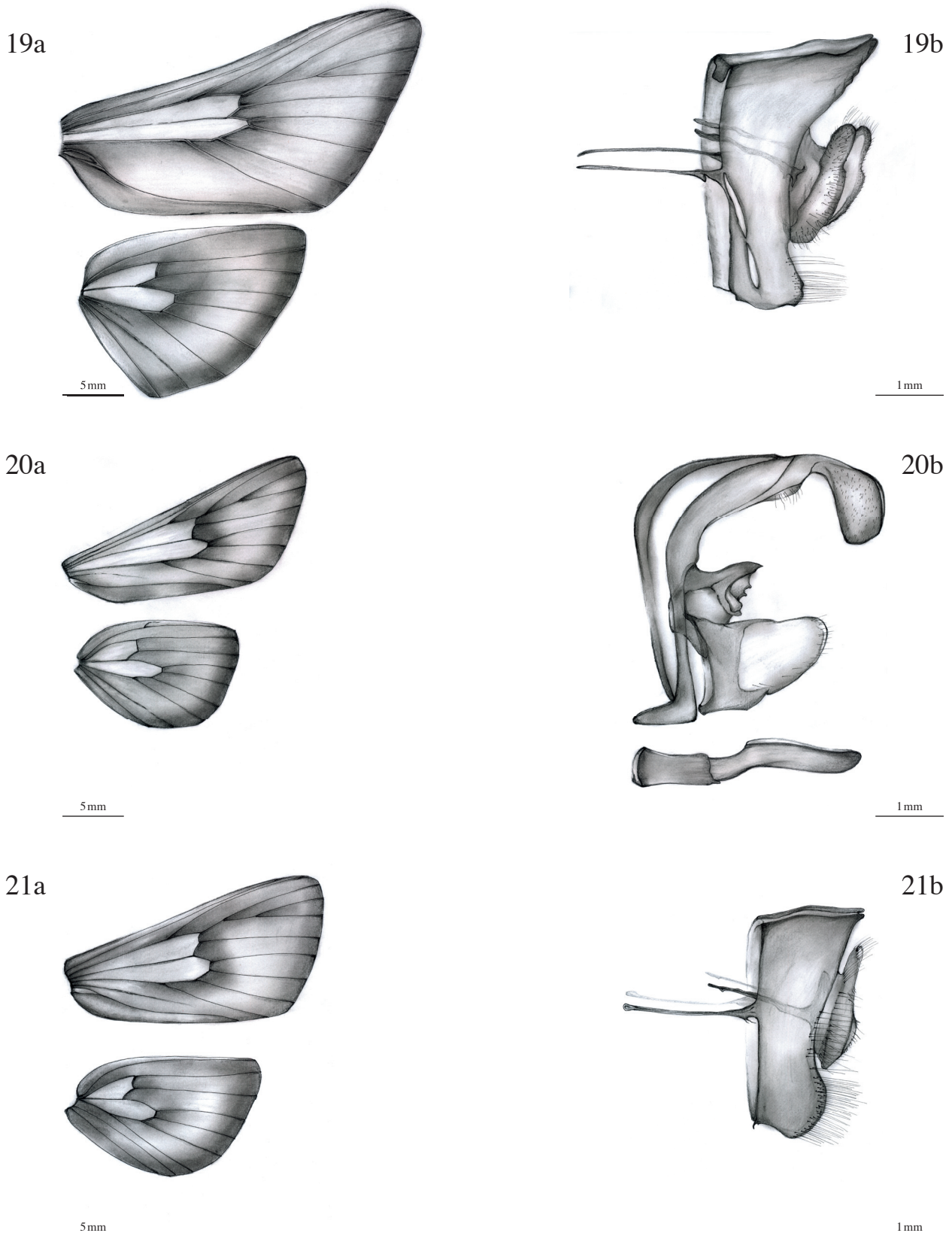
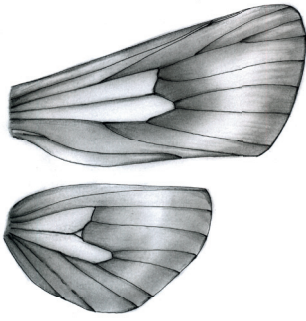


Figure 19a. Wing venation of: *Haberlandia josephi* **spec. nov.**, female, holotype. 20a. *Haberlandia ofriedi* **spec. nov.**, male, holotype. 21a. *Haberlandia ofriedi* **spec. nov.**, female, paratype.

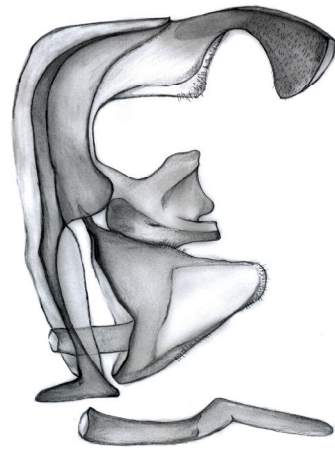
Figure 19b. Genitalia of: *Haberlandia josephi* **spec. nov.**, female, holotype. 20b. *Haberlandia ofriedi* **spec. nov.**, male, holotype. 21b. *Haberlandia ofriedi* **spec. nov.**, female, paratype.

22a



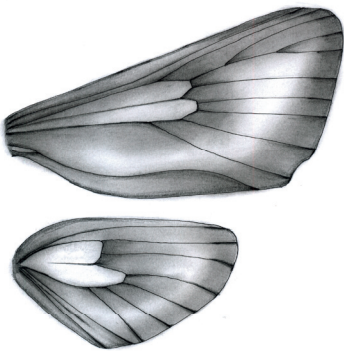
5 mm

22b



1 mm

23a



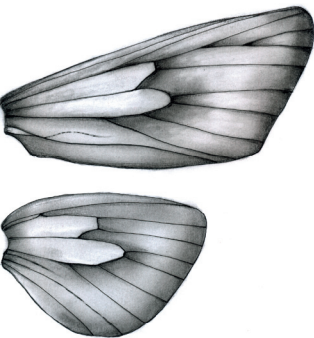
5 mm

23b



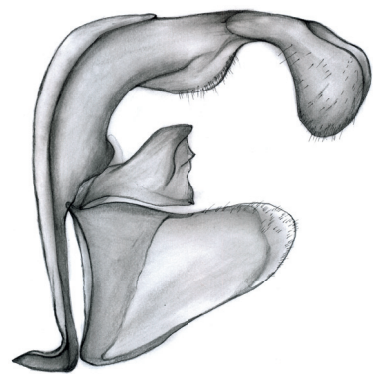
1 mm

24a



5 mm

24b



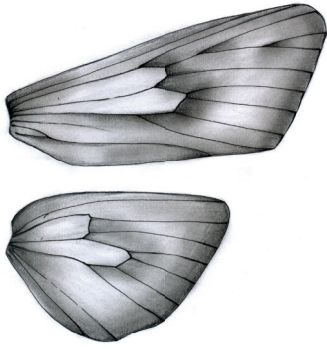
1 mm

Figure 22a. Wing venation of: *Haberlandia rohdei* **spec. nov.**, male, holotype. 23a. *Haberlandia togoensis* **spec. nov.**, male, holotype. 24a. *Haberlandia hollowayi* **spec. nov.**, male, holotype.

Figure 22b. Genitalia of: *Haberlandia rohdei* **spec. nov.**, male, holotype. 23b. *Haberlandia togoensis* **spec. nov.**, male, holotype. 24b. *Haberlandia hollowayi* **spec. nov.**, male, holotype.

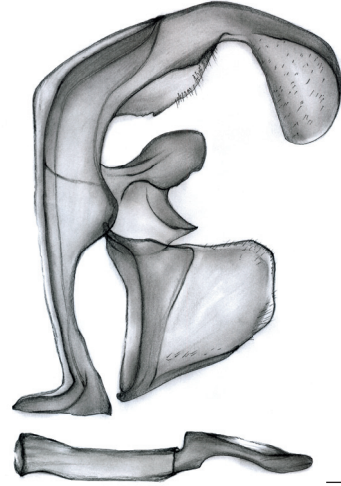


25a



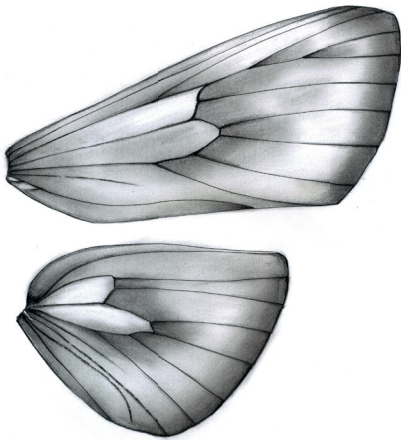
5 mm

25b



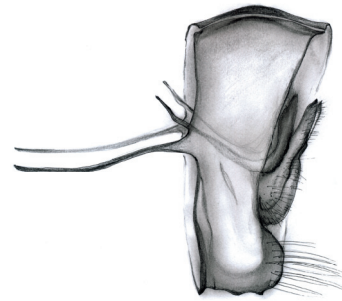
1 mm

26a



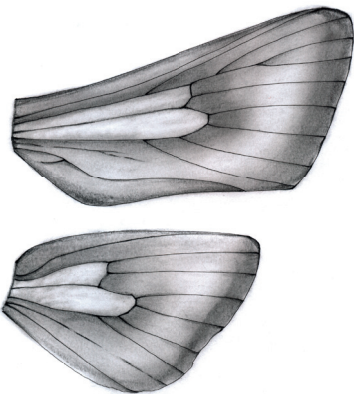
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26b



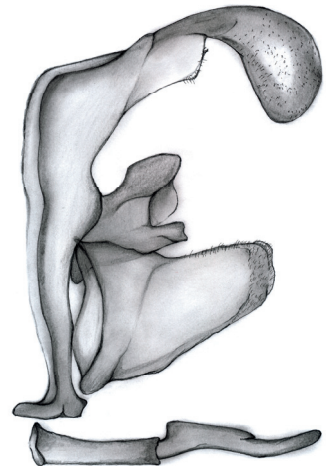
1 mm

27a



5 mm

27b



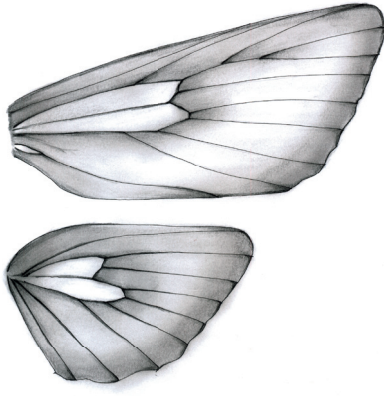
1 mm

Figure 25a. Wing venation of: *Haberlandia janzi* **spec. nov.**, male, holotype. 26a. *Haberlandia tempeli* **spec. nov.**, female, holotype. 27a. *Haberlandia taiensis* **spec. nov.**, male, holotype.

Figure 25b. Genitalia of: *Haberlandia janzi* **spec. nov.**, male, holotype. 26b. *Haberlandia tempeli* **spec. nov.**, female, holotype. 27b. *Haberlandia taiensis* **spec. nov.**, male, holotype.

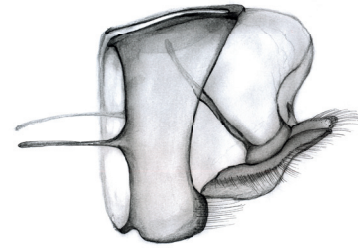


28a



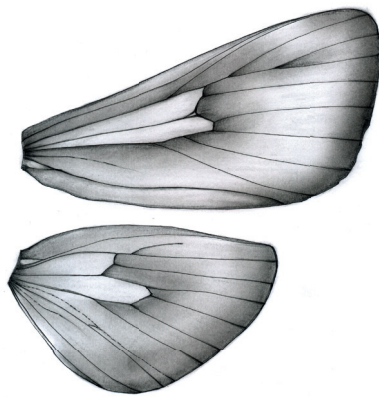
5 mm

28b



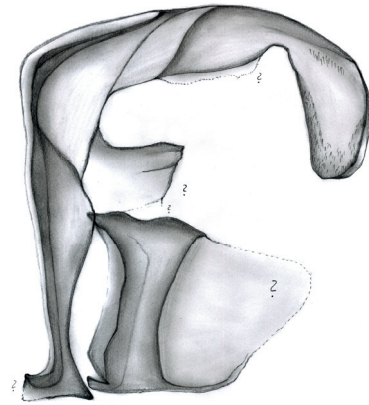
1 mm

29a



5 mm

29b



1 mm

Figure 28a. Wing venation of: *Haberlandia rabiusi* **spec. nov.**, female, holotype.

29a. *Haberlandia hulstaerti* **spec. nov.**, male, holotype.

Figure 28b. Genitalia of: *Haberlandia rabiusi* **spec. nov.**, female, holotype. 29b. *Haberlandia hulstaerti* **spec. nov.**, male, holotype.



**PLATE**  
**1 – 6**

1



2



3



4



5



6



- Figure 1.** *Haberlandia odzalaensis* spec. nov., male, holotype, Republic of the Congo, Western Cuvette department, Odzala National Park.
- Figure 2.** *Haberlandia odzalaensis* spec. nov., female, paratype, Republic of the Congo, Western Cuvette department, Odzala National Park.
- Figure 3.** *Haberlandia odzalaensis* spec. nov., female, paratype, Central African Republic, economic prefecture Sangha-Mbaéré, Kongana.
- Figure 4.** *Haberlandia lindacammae* spec. nov., male, holotype, Gabon, Ogooué-Ivindo province, Lopé Faunal Reserve.
- Figure 5.** *Haberlandia lindacammae* spec. nov., male, paratype, Gabon, Ogooué-Lolo province, Bambidie logging camp.
- Figure 6.** *Haberlandia lindacammae* spec. nov., female, paratype, Gabon, Ogooué-Lolo province, Bambidie logging camp.



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8



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10



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12



**Figure 7.** *Haberlandia legraini* spec. nov., male, holotype, Republic of the Congo, Cuvette department, Owando.

**Figure 8.** *Haberlandia shimonii* spec. nov., male, holotype, Gabon, Ogooué-Ivindo province, Ipassa.

**Figure 9.** *Haberlandia annetteae* spec. nov., male, holotype, Central African Republic, economic prefecture Sangha-Mbaéré, Mambélé.

**Figure 10.** *Haberlandia annetteae* spec. nov., female, paratype, Central African Republic, economic prefecture Sangha-Mbaéré, Mambélé.

**Figure 11.** *Haberlandia hilaryae* spec. nov., male, holotype, Cameroon, Centre Region, Obout.

**Figure 12.** *Haberlandia lusamboensis* spec. nov., male, holotype, Democratic Republic of Congo, Sankuru province, Lusambo.

13



14



15



16



17



18



- Figure 13.** *Haberlandia lusamboensis* spec. nov., female, paratype, Democratic Republic of Congo, Kasai-Oriental province, Katako-Kombe.
- Figure 14.** *Haberlandia entebbeensis* spec. nov., male, holotype, Uganda, Wakiso district, Entebbe.
- Figure 15.** *Haberlandia isakaensis* spec. nov., male, holotype, Democratic Republic of Congo, Èquateur province, Isaka.
- Figure 16.** *Haberlandia rudolphi* spec. nov., female, holotype, Democratic Republic of Congo, Sankuru province, Bena Dibebe.
- Figure 17.** *Haberlandia isiroensis* spec. nov., male, holotype, Democratic Republic of Congo, Haut-Uele province, Isiro (Paulis).
- Figure 18.** *Haberlandia isiroensis* spec. nov., male, paratype, Democratic Republic of Congo, Haut-Uele province, Isiro (Paulis).



19



20



21



22



23



24



- Figure 19.** *Haberlandia ueleensis* spec. nov., male, holotype, Democratic Republic of Congo, Haut-Uele province, Isiro (Paulis).
- Figure 20.** *Haberlandia clenchi* spec. nov., female, holotype, Democratic Republic of Congo, Équateur province, Eala.
- Figure 21.** *Haberlandia hintzi* (Grünberg 1911), female, holotype, Cameroon, Sud-Quest region, Victoria.
- Figure 22.** *Haberlandia josephi* spec. nov., female, holotype, Democratic Republic of Congo, Orientale province, Yangambi.
- Figure 23.** *Haberlandia ofriedi* spec. nov., male, holotype, Ghana, Eastern Region, Bunso Arboretum.
- Figure 24.** *Haberlandia ofriedi* spec. nov., female, paratype, Ghana, Eastern Region, Bunso Arboretum.

25



26



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30



- Figure 25.** *Haberlandia rohdei* spec. nov., male, holotype, Ghana, Accra, Achimota Forest Reserve.
- Figure 26.** *Haberlandia togoensis* spec. nov., male, holotype, Togo, region Centrale.
- Figure 27.** *Haberlandia hollowayi* spec. nov., male, holotype, Côte d'Ivoire, Lagunes région, Bingerville.
- Figure 28.** *Haberlandia janzi* spec. nov., male, holotype, Côte d'Ivoire, Marahoué région, Bouïtha.
- Figure 29.** *Haberlandia tempeli* spec. nov., female, holotype, Côte d'Ivoire, Lagunes région, Adiopodoumé, ORSTOM research institute.
- Figure 30.** *Haberlandia taiensis* spec. nov., male, holotype, Côte d'Ivoire, Bas-Sassandra région, Taï National Park.



31



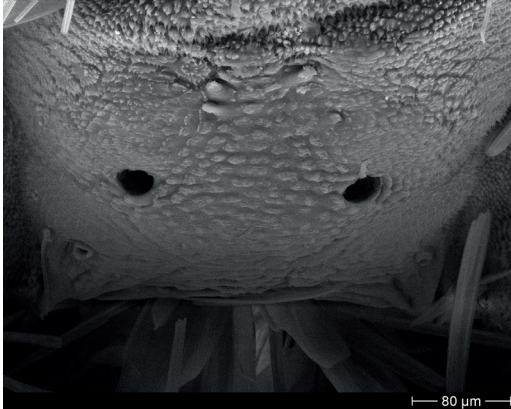
32



**Figure 31.** *Haberlandia rabiusi* spec. nov., female, holotype, Sierra Leone, Eastern province, Kenema.

**Figure 32.** *Haberlandia hulstaerti* spec. nov., male, holotype, Democratic Republic of Congo, Équateur province, Boteka (Flandria).

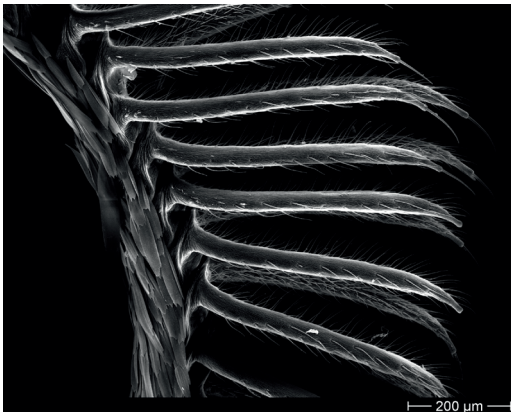
33



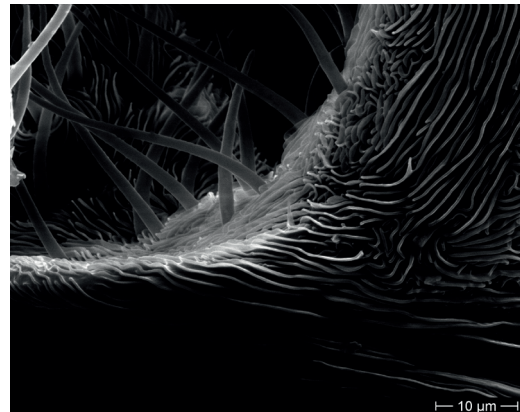
34



35



36



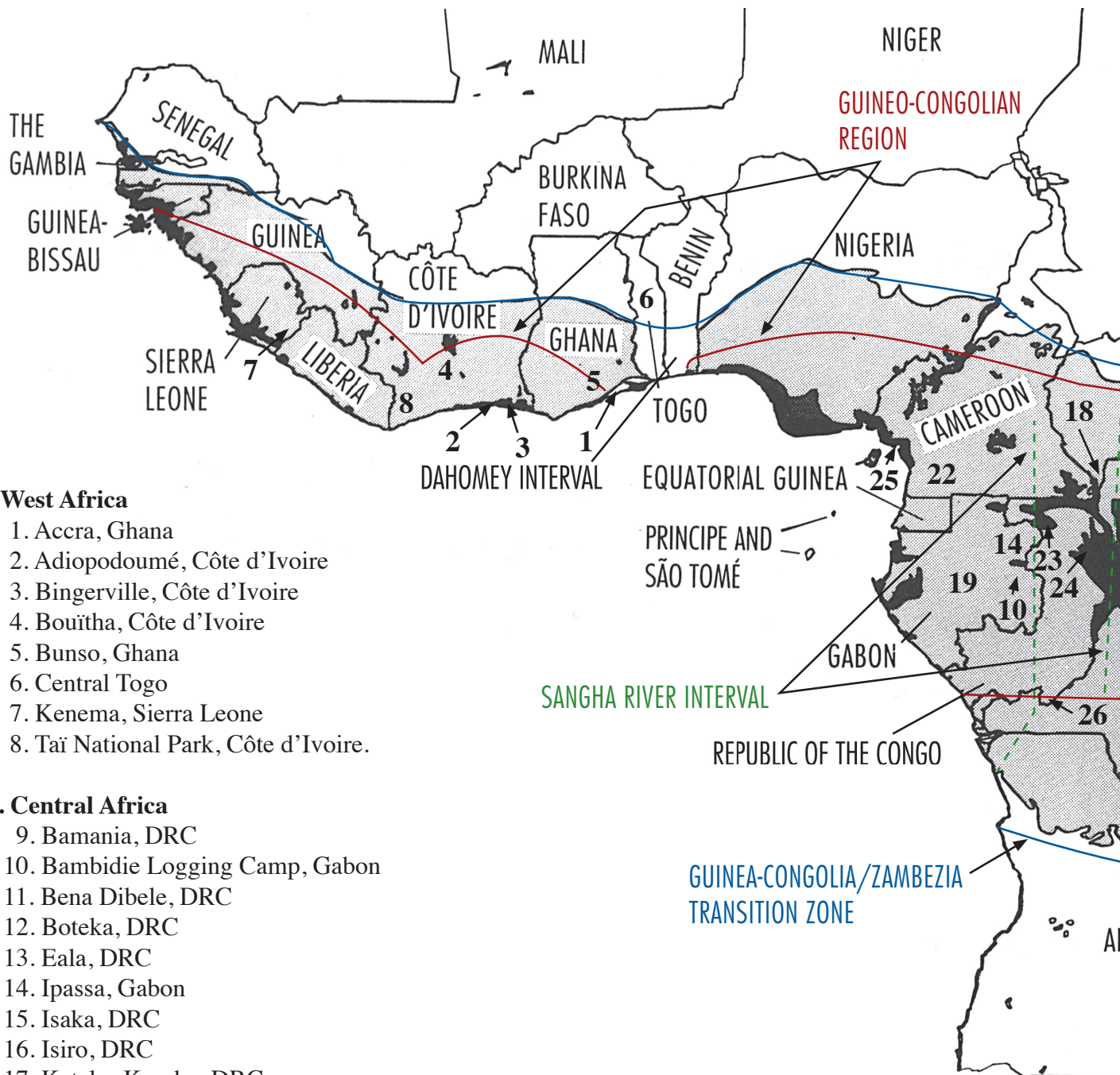
**Figures 33-36.** Details of *Haberlandia odzalaensis* spec. nov., female, paratype (*cf.* figure 3).

33. Head of ♀, a pair of frontoclypeus pits (ventral view).

34. Head of ♀, the frontoclypeus pit (ventral view).

35. Head of ♀, antenna.

36. Head of ♀, surface structure of antenna shaft.



### I. West Africa

1. Accra, Ghana
2. Adiopodoumé, Côte d'Ivoire
3. Bingerville, Côte d'Ivoire
4. Bouïtha, Côte d'Ivoire
5. Bunso, Ghana
6. Central Togo
7. Kenema, Sierra Leone
8. Taï National Park, Côte d'Ivoire.

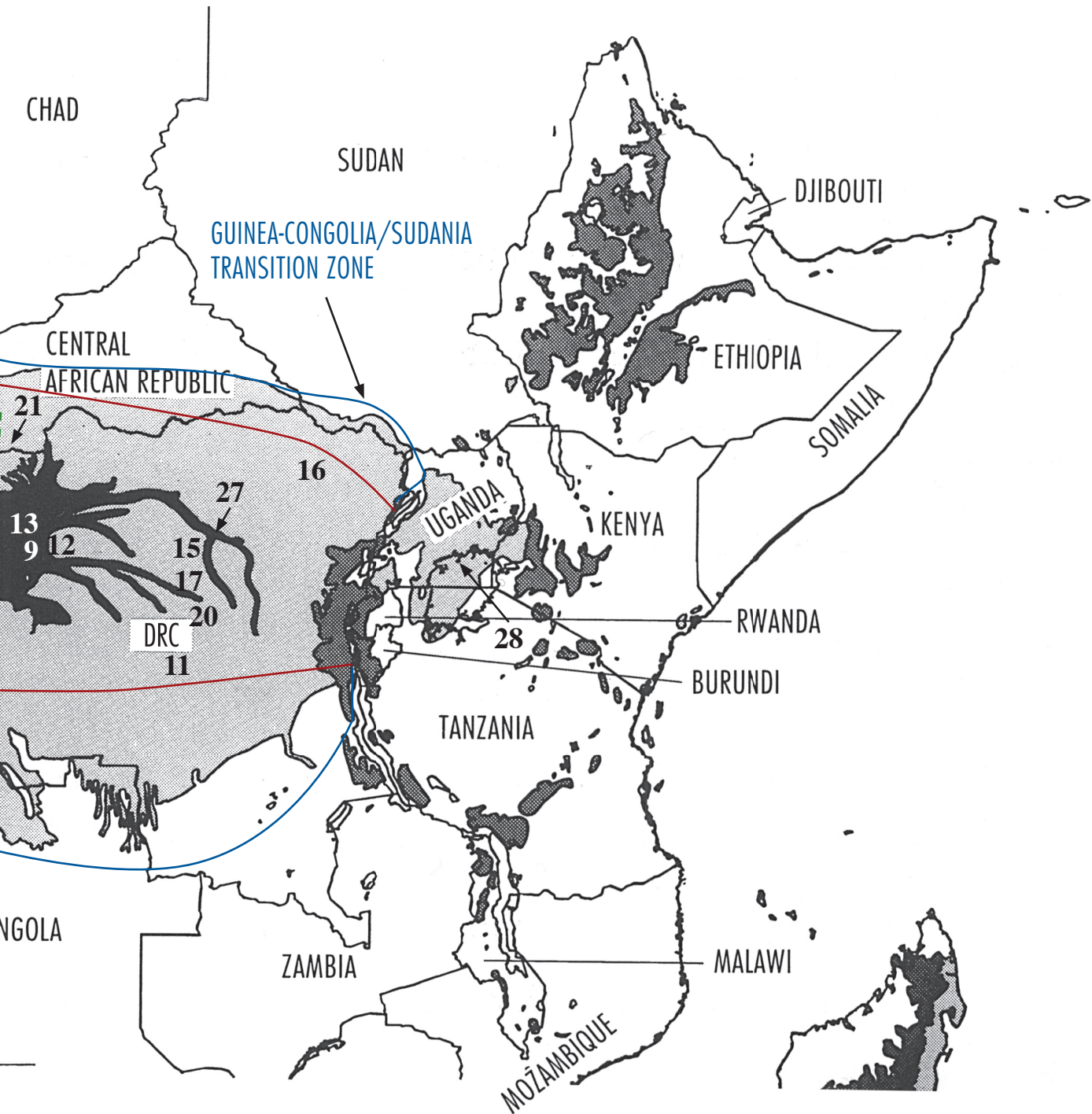
### II. Central Africa

9. Bamanja, DRC
10. Bambidie Logging Camp, Gabon
11. Bena Dibebe, DRC
12. Boteka, DRC
13. Eala, DRC
14. Ipassa, Gabon
15. Isaka, DRC
16. Isiro, DRC
17. Katako-Kombe, DRC
18. Kongana, Central African Republic
19. Lopé Faunal Reserve, Gabon
20. Lusambo, DRC
21. Mambélé, Central African Republic
22. Obout, Cameroon
23. Odzala National Park, Republic of the Congo
24. Owando, Republic of the Congo
25. Victoria, Cameroon
26. Voka, Republic of the Congo
27. Yangambi, DRC.

### III. East Africa

28. Entebbe, Uganda.





**Figure 37.** Distribution of lowland rain forest (light grey) of the Guineo-Congolian Region including the Sudania and Zambezia transition zones (from White 1979 and Sayer *et al.* 1992). The numbers indicate the collecting sites of *Haberlandia* **gen. nov.**

