

Life on leaves: leaf-dwelling pholcids of Guinea, with emphasis on *Crossopriza cylindrogaster* Simon, a spider with inverted resting position, pseudo-eyes, lampshade web, and tetrahedral egg-sac (Araneae: Pholcidae)

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Many tropical pholcid spider species are morphologically and behaviourally adapted to life on the underside of green leaves. The taxonomy of these cryptic spiders is mostly poorly known, and almost nothing is known about their biology. The present paper deals with seven West African leaf-dwelling pholcid species. Two of them are new to science: *Pholcus kakum* n. sp. and *Spermophora dieke* n. sp.; of three further species, the males are newly described: *Crossopriza cylindrogaster* Simon, 1907, *Leptopholcus tipula* (Simon, 1907), and *L. guineensis* Millot, 1941. *Crossopriza cylindrogaster* is remarkable for its inverted resting position (dorsal side pressed against the leaf), modifications of the lateral eyes that appear like additional lenses, lampshade webs with or without “ornaments” (puffs of silk), and tetrahedral egg-sacs. Finally, new morphological data and records are provided for *Pehrforsskalia conopyga* Deeleman-Reinhold and van Harten, 2001; *Nyikoa limbe* Huber, 2007 is newly recorded from Guinea.

Keywords: Pholcidae; leaf-dwelling; West Africa; taxonomy; natural history

Introduction

Leaf-dwelling pholcids (i.e. those that live on alive, green leaves) are a fascinating example of multiple convergent morphological and ethological adaptations to a specific microhabitat. Even though the phylogenetic relationships of several genera consisting mostly or entirely of leaf-dwellers remain largely unresolved, the scattered occurrence of leaf-dwelling representatives in largely non-leaf-dwelling genera strongly suggests multiple convergent origins. For example, leaf-dwelling species occur in the genera *Modisimus* (Huber et al, forthcoming), *Mesabolivar* and *Tupigea* (*M. luteus* and an undescribed *Tupigea* species from Brazil; see http://www.uni-bonn.de/~bhuber1/pholcidae_photos.html), *Pholcus*, *Spermophora*, and *Crossopriza* (Deeleman-Reinhold and Deeleman 1983; herein). Leaf-dwellers are usually pale greenish and more delicate than their non-leaf-dwelling congeners, and such species occur in several additional genera (e.g. *Buitinga safura*, *Paramicromerys rabeariveloi*, *Pomboia pallida*, *Quamtana oku*; see figures in Huber 2000, 2003a, 2003b, 2003c). Even though the biology of these species remains entirely unknown, their morphology suggests that they might represent additional independent origins of leaf-dwelling. Genera that comprise mostly or entirely leaf-dwellers include *Nyikoa* and *Pehrforsskalia* in

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Africa (Deeleman-Reinhold and van Harten 2001; Huber 2007); *Metagonia* and New World “*Leptopholcus*” in the Neotropics (Huber 1997, 2000; Huber and Wunderlich 2006); *Panjange*, *Calapnita*, and *Belisana* in SE Asia (Deeleman-Reinhold and Deeleman 1983; Deeleman-Reinhold 1986a, 1986b; Huber 2005); *Micromerys* in Australia (Huber 2001); and true *Leptopholcus* in the Old World tropics. Preliminary cladistic analyses indicate that even though these genera are closely related (they are all pholcines), they probably represent several convergent routes towards leaf-dwelling.

Several adaptations in addition to the pale greenish colour (that is usually quickly lost in ethanol) and the delicate bodies, legs, and sometimes even palps combine to make these spiders almost invisible to visual predators (and collectors) (cf. Deeleman-Reinhold 1986a, 1986b). The larger, long-legged leaf-dwellers seem to spend most of the day in a resting position with their bodies and legs tightly pressed against the leaf surface rather than hanging from silk lines like most other pholcids. To accomplish this, the legs are bent either to the front and then outwards and backwards (apparently all leaf-dwelling pholcines), or they are bent back and then outwards and forwards (e.g., leaf-dwelling *Modisimus*, Huber et al. (forthcoming)). *Crossopriza cylindrogaster* documents a third possible solution: bending the legs up as usual but at the same time positioning the prosoma at a right angle towards the leaf (see later). Other adaptations include the morphology of the egg-sacs that are often elongated, presumably to further enhance the similarity to a leaf vein (figure 5.7 in Murphy and Murphy (2000) shows the extreme case of a *Calapnita* sp. with all eggs aligned in a single string; see also http://www.uni-bonn.de/~bhuber1/pholcidae_photos.html), and the reliance on cryptic appearance as the major tactic to avoid predation rather than on whirling and dropping from the web.

However, this set of characters applies only to relatively large (>3 mm body length) long-legged leaf-dwellers. Others are so tiny that pressing their bodies against the leaf may not be necessary (e.g., *Nyikoa limbe* and *Spermophora dieke* below). Their only evident morphological adaptation is their greenish coloration. Another set of adaptation that occurs in both long- and short-legged species concerns the web (cf. Deeleman-Reinhold 1986a, 1986b). Some leaf-dwellers still build domed webs or sheets like their non-leaf-dwelling relatives, but with the apex of the dome (where the spider rests) closely attached to the leaf (e.g., *Modisimus*, *Belisana*, *Tupigea*). Others have reduced their web to a flimsy platform tightly attached to the leaf. Without recourse to powder or special lighting conditions, these sheets are often invisible to the naked human eye.

Unfortunately, our knowledge about the biology of leaf-dwelling pholcids is extremely rudimentary, based almost entirely on casual observations during collecting trips (Brignoli 1980; Deeleman-Reinhold 1986a; B.A. Huber, unpublished data). The only exception is on two species of *Metagonia* in a Costa Rican rainforest (Huber and Schütte, forthcoming). *Metagonia osa* and *M. uvita* were found to occur on a wide variety of plant species, but preferably on monocots; the two species seem to prefer different plants; leaf size does not seem to be crucial as long as it permits construction of the web; while *M. uvita* builds a single sheet and tends to run away when disturbed, *M. osa* constructs an additional tarpaulin-like sheet under which it remains even when disturbed; at least *M. osa* tends to align with major leaf veins. Interestingly, Pholcidae, represented by the two *Metagonia* species, were the dominant spider family on the underside of the studied leaves (105 specimens), followed by Theridiidae and Salticidae (23 and 22 specimens respectively).

The species in the present paper represent the opposite range of knowledge and thus the majority of species: they are either undescribed (*Pholcus kakum* n. sp. and

Spermophora dieke n. sp. below) or extremely poorly known. All that was previously known about *C. cylindrogaster* and *L. tipula* is in Simon's (1907) Latin descriptions of the lost female types; no illustrations have ever been published. There has been no further mention in the literature of *C. cylindrogaster* for over 100 years, and *L. tipula* was only briefly mentioned twice (Brignoli 1980; Deeleman-Reinhold 1986b), without any new data. In the case of *L. guineensis*, a good description of the female (including drawings) has been available (Milot 1941), and the two female type specimens are available for study, but in this genus most species are difficult to distinguish based on female morphology alone. Nevertheless, the new material below can be fairly confidently assigned to these old names either because of the distinctive colour pattern (*C. cylindrogaster*) or because specimens have been collected at or near the type localities and no congeners have been collected nearby (*L. tipula* and *L. guineensis*). The good original description of *Pehrforsskalia conopyga* is complemented by new morphological data and many new records. Finally, for *Nyikoa limbe* I give only new records, thus completing the picture of current knowledge about Guinean leaf-dwelling pholcids. In total, seven leaf-dwelling species representing six genera have been recorded from Guinea, with up to five species per locality (Forêt Classée de Diéké). At the level of genera, this is comparable to the diversity of leaf-dwelling pholcids reported by Deeleman-Reinhold (1986a) for Indonesia (seven genera).

Materials and methods

A large part of the material treated herein and all the information about natural history were collected during a trip to Guinea in November and December 2008 (deposited in the Alexander Koenig Research Museum of Zoology, Bonn, ZFMK). Spiders were collected manually by turning leaves. During the day, this is the only way of finding leaf-dwelling pholcids that are essentially invisible against the light and do not readily drop when disturbed but stick firmly to the leaf or escape sideways through the vegetation (Deeleman-Reinhold and Deeleman 1983). (Night collecting is possibly even more effective (B.A. Huber, personal observation) but was not done during this trip.) A further large number of specimens were collected during three Belgian canopy fogging expeditions to Ghana and Congo D.R. (deposited in the Musée Royal de l'Afrique Centrale, Tervuren, MRAC). This method provides limited information on natural history but yields large numbers of leaf-dwelling specimens. The other specimens were borrowed from various institutions: Natural History Museum, London (BMNH), California Academy of Sciences (CAS), Institute Royal des Sciences Naturelles de Belgique, Brussels (IRSB), Musée National d'Histoire Naturelle, Paris (MNHN), National Museum of Natural History, Leiden (RMNH, collection Deeleman Reinhold), Senckenbergmuseum Frankfurt (SMF), National Museum of Natural History, Washington (USNM).

Morphological descriptions follow the style of recent publications (e.g. Huber 2000, 2005). Measurements are in mm (± 0.02 mm if two decimals are given) unless otherwise noted. Eye measurements are ± 5 μ m. Drawings were done with a camera lucida on a Leitz Dialux 20 compound microscope. Cleared epigyna were stained with chlorazol black. Photos were made with a Nikon Coolpix 995 digital camera (2048 \times 1536 pixels) mounted on a Nikon SMZ 1500 dissecting microscope or a Leitz Dialux 20 compound microscope. For scanning electron microscope photos, specimens were dried in hexamethyldisilazane (Brown 1993), and photographed with a Hitachi S-2460 electron microscope. Histological semithin serial sections (1 μ m) of the eyes of *C. cylindrogaster* were

done with a diamond knife on a Microm HM 350 rotation microtome after imbedding the specimen in Spurr's medium (ERL epoxy resin). Sections were stained with a mixture of azur II (1%) and methylene blue (1%) in an aqueous borax solution (1%) at 70°C for about 20 seconds. Geographic coordinates are in round brackets when copied from labels, in square brackets when taken from gazetteers.

Taxonomy

Crossopriza cylindrogaster Simon, 1907

(Figures 1–6, 15–23, 45–62, 148)

Crossopriza cylindrogaster Simon 1907, p. 252.

Type

Female holotype from “Guinée portugaise: Rio Cassine” [Guinea Bissau: Rio Cacine, ~11°05'N, 15°05'W]; ~1904 (L. Fea), no further data; apparently lost (could not be found in MNHN).

Note

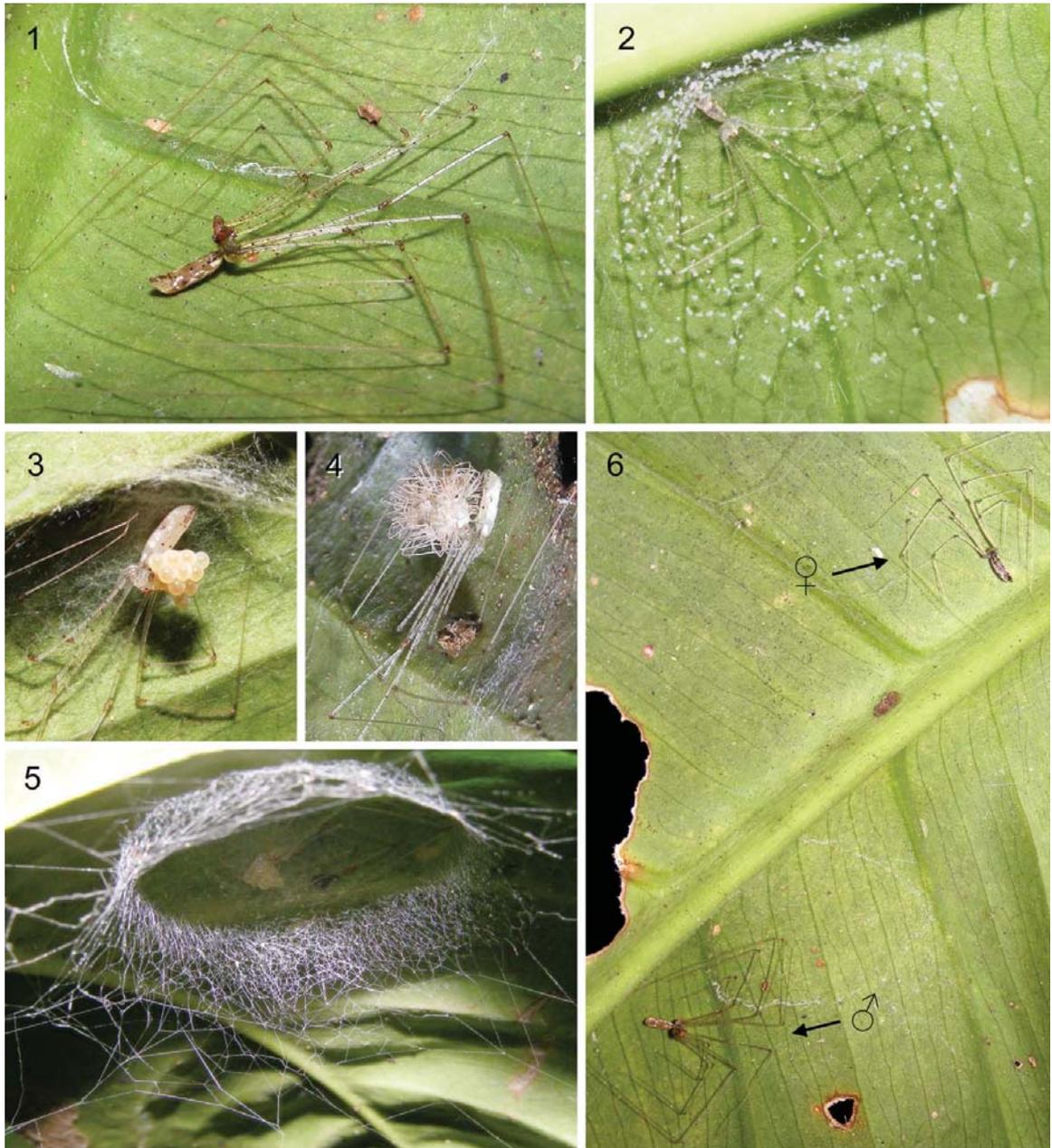
Apart from the cylindrical abdomen, Simon's (1907) description is largely restricted to the colour pattern which agrees well with that of the specimens described below. Nevertheless, material from the type locality should be checked to support the assignment of the new material to Simon's species.

Diagnosis

Easily distinguished from known congeners by the cylindrical abdomen (Figures 15–19), the coloration (very pale greenish when alive, with distinctive pattern of black spots ventrally on abdomen, Figures 1, 3, 19), the male chelicerae (two pairs of apophyses, Figure 47), and the male palp (procurus, bulb, Figures 45, 46). The female genitalia are simple and barely sclerotized, but also distinctive (pair of pockets, internal structures, Figures 19, 48, 49, 58).

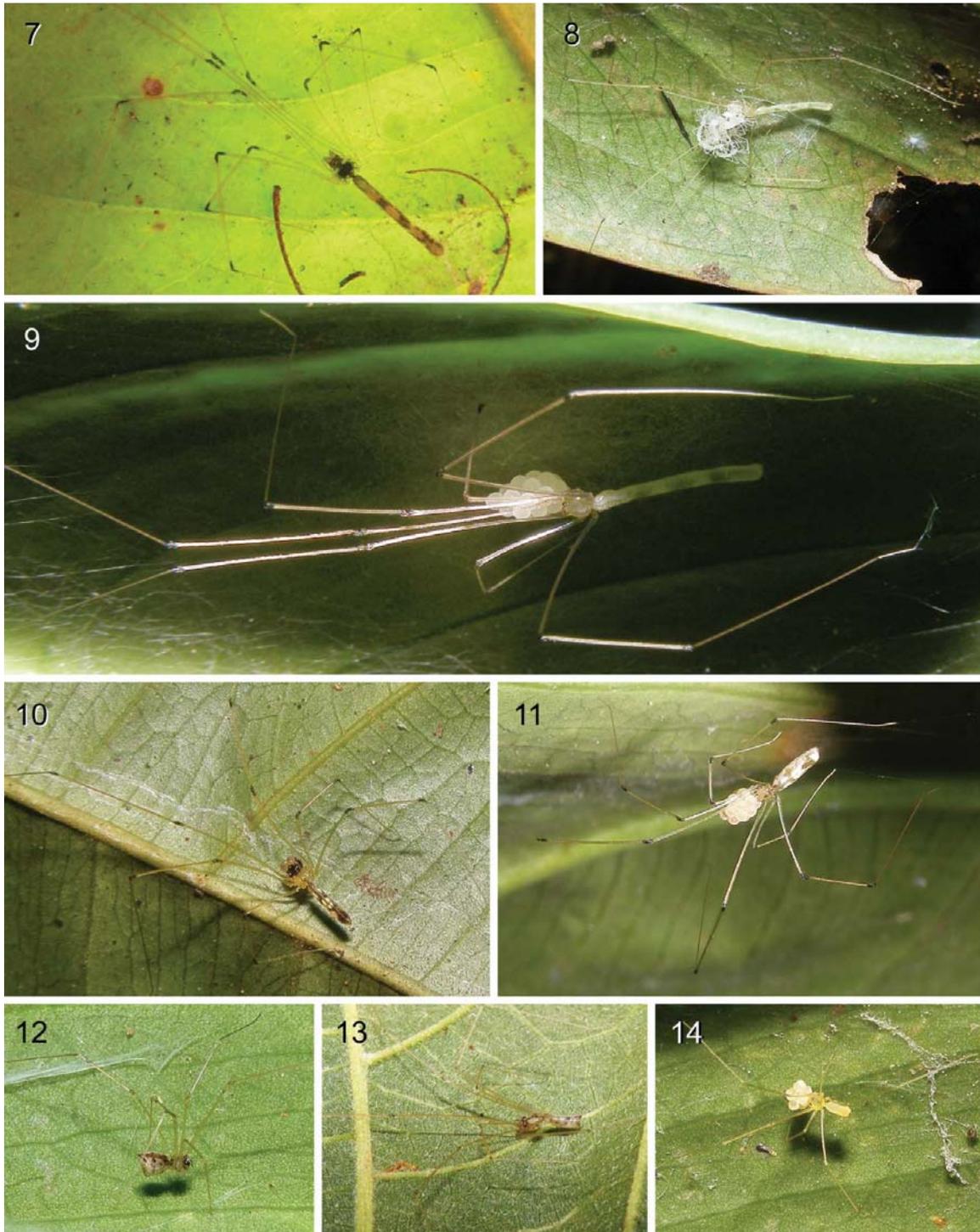
Male (Ziama)

Total body length 4.3, carapace width 1.2. Leg 1: 43.7 (11.2 + 0.5 + 10.6 + 20.1 + 1.3), tibia 2: 6.7, tibia 3: 4.5, tibia 4: 6.8, tibia 1 L/d: 92. Habitus as in Figures 15–17; carapace pale ochre-yellow with some black lateral marks, clypeus with some small black specks below triads, chelicerae without dark marks, sternum with black marks at bases of coxae 2–4, slightly darkened medially, legs pale whitish-grey, with many small black marks distributed irregularly, patellae and tibia–metatarsus joints brown, abdomen pale ochre-grey, dorsally with large white spots in two bands, ventrally with distinctive pattern of black marks. Distance PME–PME 120 µm, diameter PME 145 µm, distance PME–ALE 65 µm, distance AME–AME 20 µm, diameter AME 120 µm. Each lateral eye accompanied by small “pseudo-eye” (Figures 22, 56; see later). Ocular area slightly elevated, thoracic furrow deep, restricted to central area of carapace (Figure 50), clypeus unmodified. Chelicerae as in Figure 47, two pairs of frontal



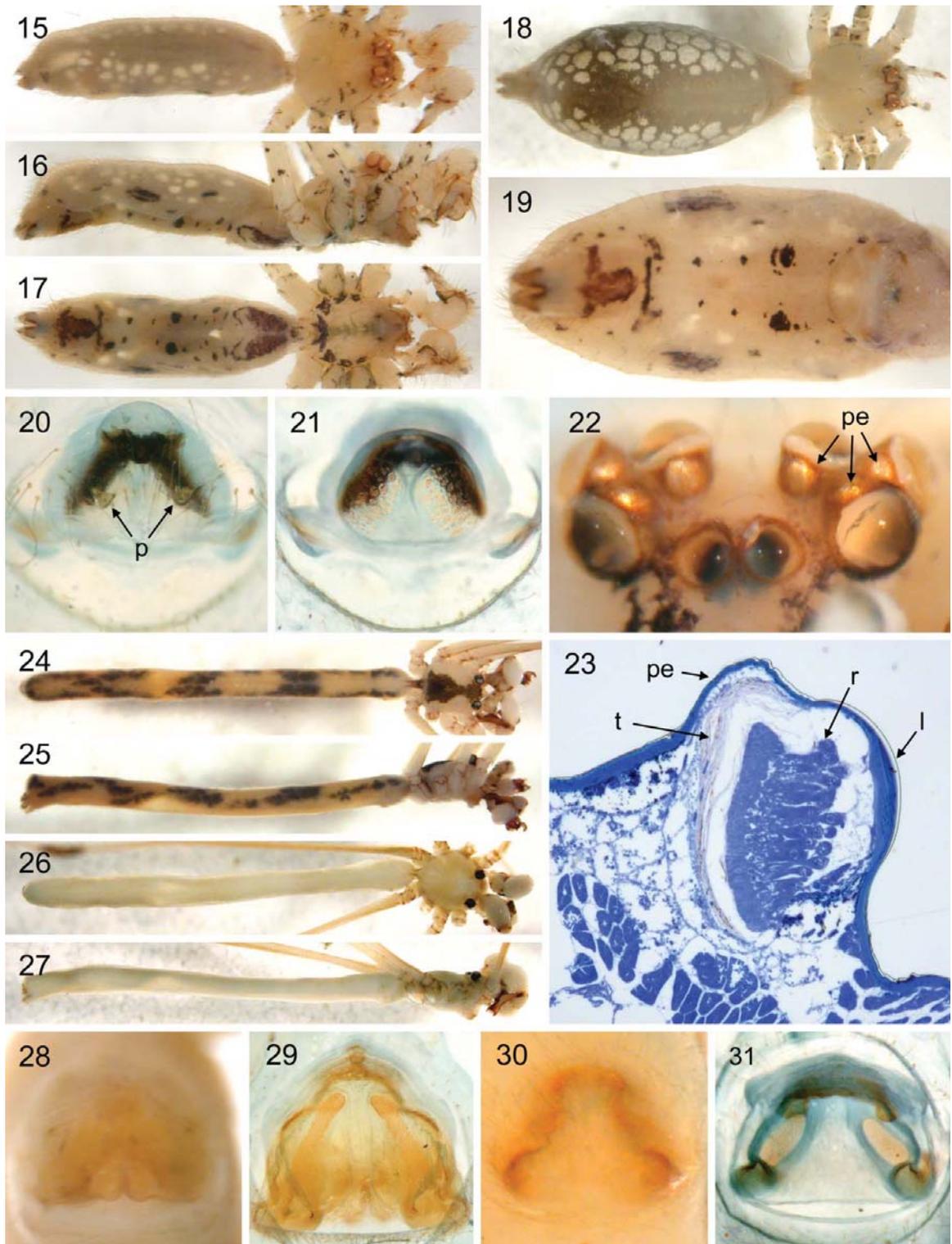
Figures 1–6. *Crossopriza cylindrogaster*. (1) Male, in typical resting position, with the back against the leaf; (2) juvenile with “spotted” web; (3) female with tetrahedral egg-sac; (4) female with newly hatched spiderlings; (5) lampshade web; (6) male and female, sharing one leaf.

apophyses, distal apophyses with one modified hair each; without stridulatory ridges. Sternum wider than long (0.95/0.65), unmodified. Palps as in Figures 45 and 46, coxa with retrolateral apophysis, trochanter unmodified, femur with retrolateral hump and ventral bulge distally, tibia almost globular, cymbium with several macrosetae, tarsal organ capsulate (Figure 52), procurus rather simple, only distally with some distinctive membranous and sclerotized elements (Figures 53, 54), bulb with short membranous embolus and basally attached to it a distinctive bulbal apophysis (Figure 53). Legs without spines and curved hairs, few vertical hairs; retrolateral trichobothrium on tibia 1 at 2%; prolateral trichobothrium present on all tibiae; tarsal pseudosegments very indistinct, only distally very few visible in dissecting

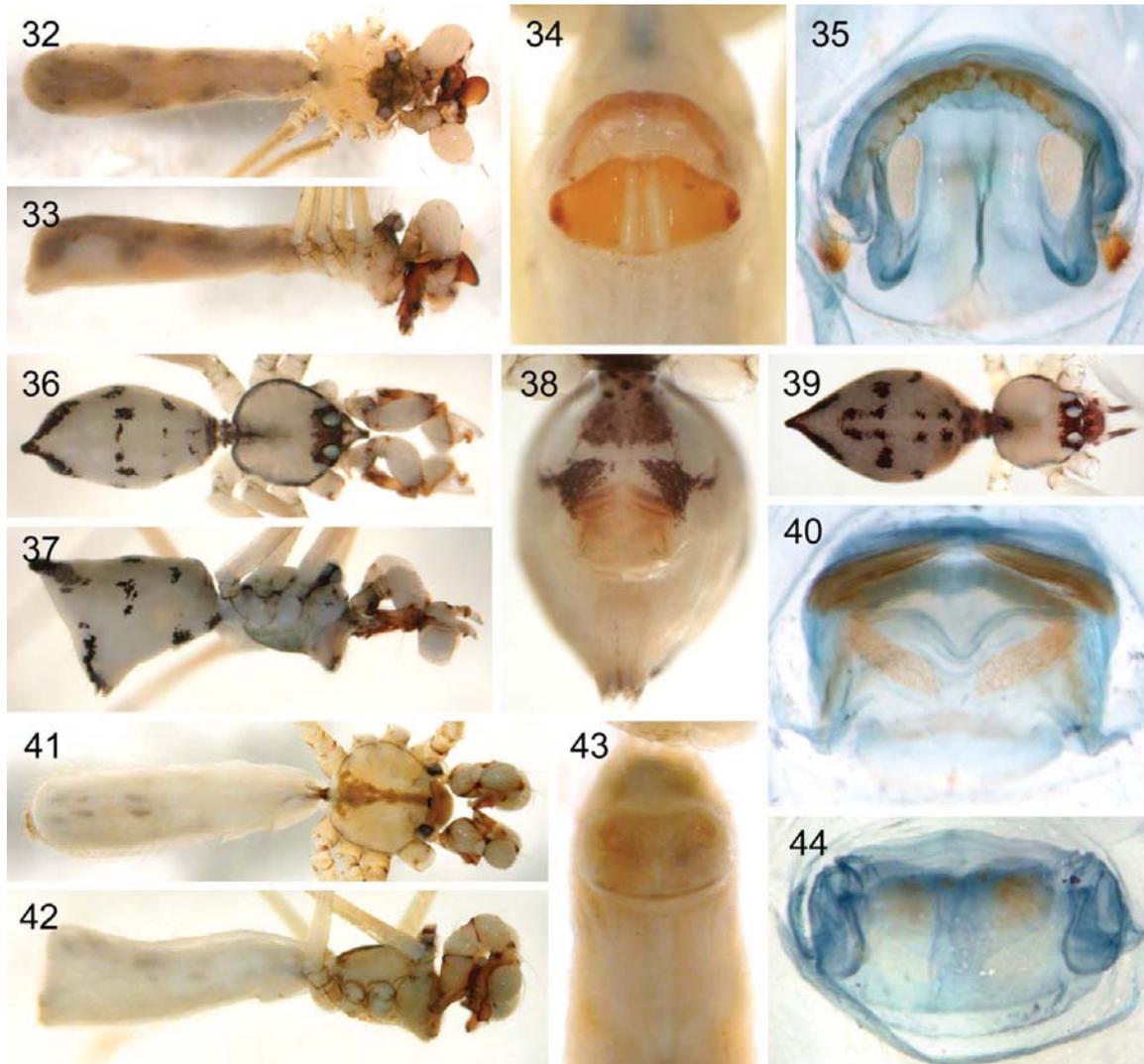


Figures 7–14. Further Guinean leaf-dwelling pholcids. (7) *Leptopholcus guineensis*, male, as seen against the light, without flash; (8–9) *Leptopholcus tipula*, females with newly hatched spiderlings and with egg-sac; (10–11) *Pholcus kakum*, n. sp., male and female with egg-sac; (12) *Spermophora dieke* n. sp., female; (13) *Pehrforsskalia conopyga*, male; (14) *Nyikoa limbe*, female with egg-sac.

microscope; tarsus 4 with two rows of comb-hairs prolatero-ventrally (Figures 61, 62). Anterior lateral spinneret (ALS) with one widened, one pointed, and five cylindrically shaped spigots (Figure 59); posterior median spinneret (PMS) with two small spigots. Gonopore with two epiandrous spigots (Figure 51).



Figures 15–31. *Crossopriza* and *Leptopholcus*. (15–23) *C. cylindrogaster*; (15–17) male, dorsal, lateral, and ventral views; (18) female, dorsal view; (19) female abdomen, ventral view; (20, 21) cleared epigynum, ventral and dorsal views; (22) female eyes and “pseudo-eyes”, frontal view; (23) semithin section of ALE with associated “pseudo-eye”; (24–27) males in dorsal and lateral views of *L. guineensis* (24, 25) and *L. tipula* (26, 27); (28–31) epigyna in ventral and cleared dorsal views of *L. guineensis* (28, 29) and *L. tipula* (30, 31). Notes: l, cuticular lens; p, epigynal pocket; pe, “pseudo-eye”; r, retina; t, tapetum.



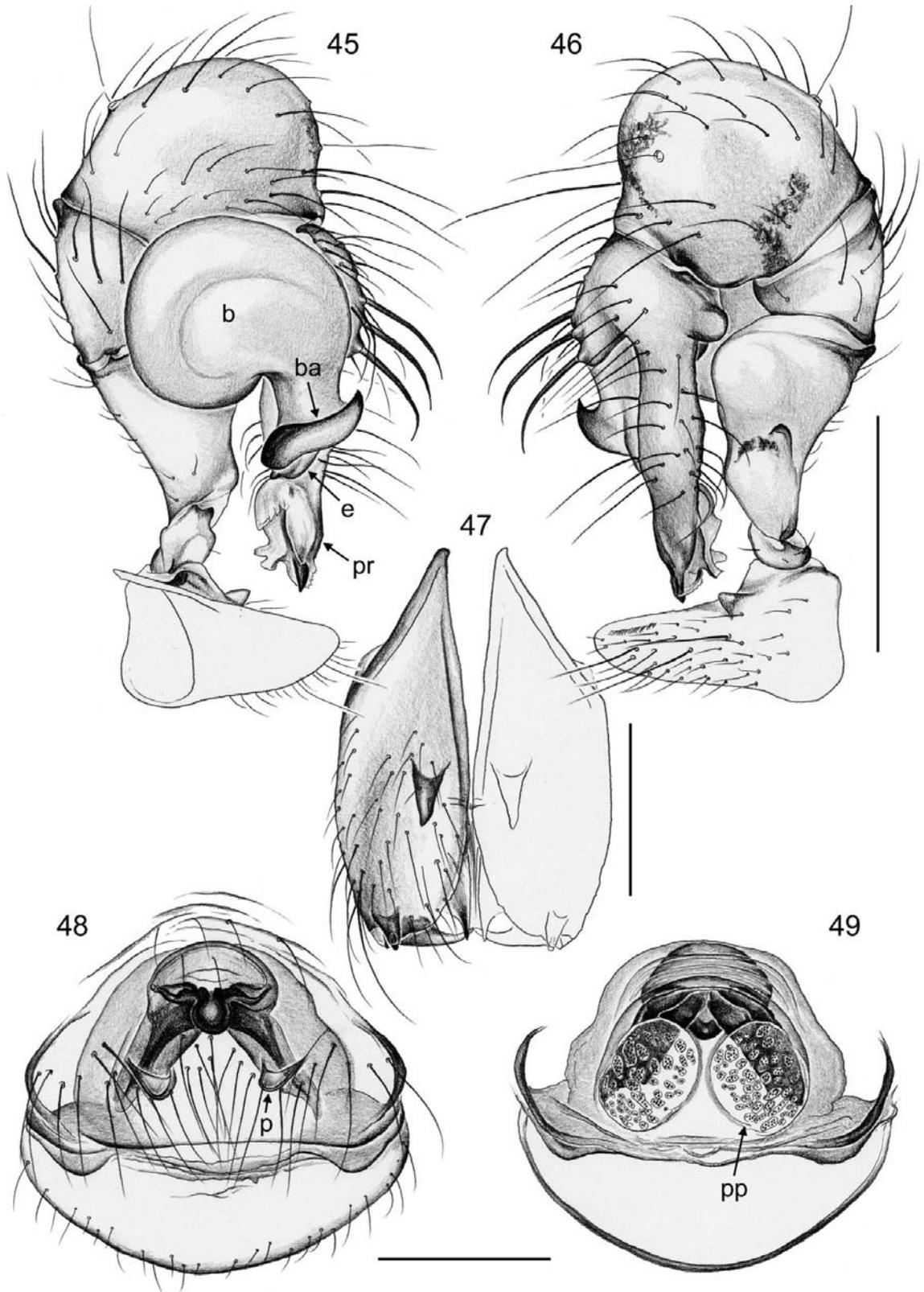
Figures 32–44. *Pholcus*, *Spermophora*, and *Pehrforsskalia*. (32–33) *Pholcus kakum*, male in dorsal and lateral views; (34, 35) *P. kakum*, epigynum ventral and cleared dorsal views; (36–37) *Spermophora dieke*, male in dorsal and lateral views; (38) *S. dieke*, female abdomen, ventral view; (39) *S. dieke*, female, dorsal view; (40) *S. dieke*, cleared epigynum, dorsal view; (41–42) *Pehrforsskalia conopyga*, male in dorsal and lateral views; (43, 44) *P. conopyga*, epigynum in ventral and cleared dorsal views.

Variation

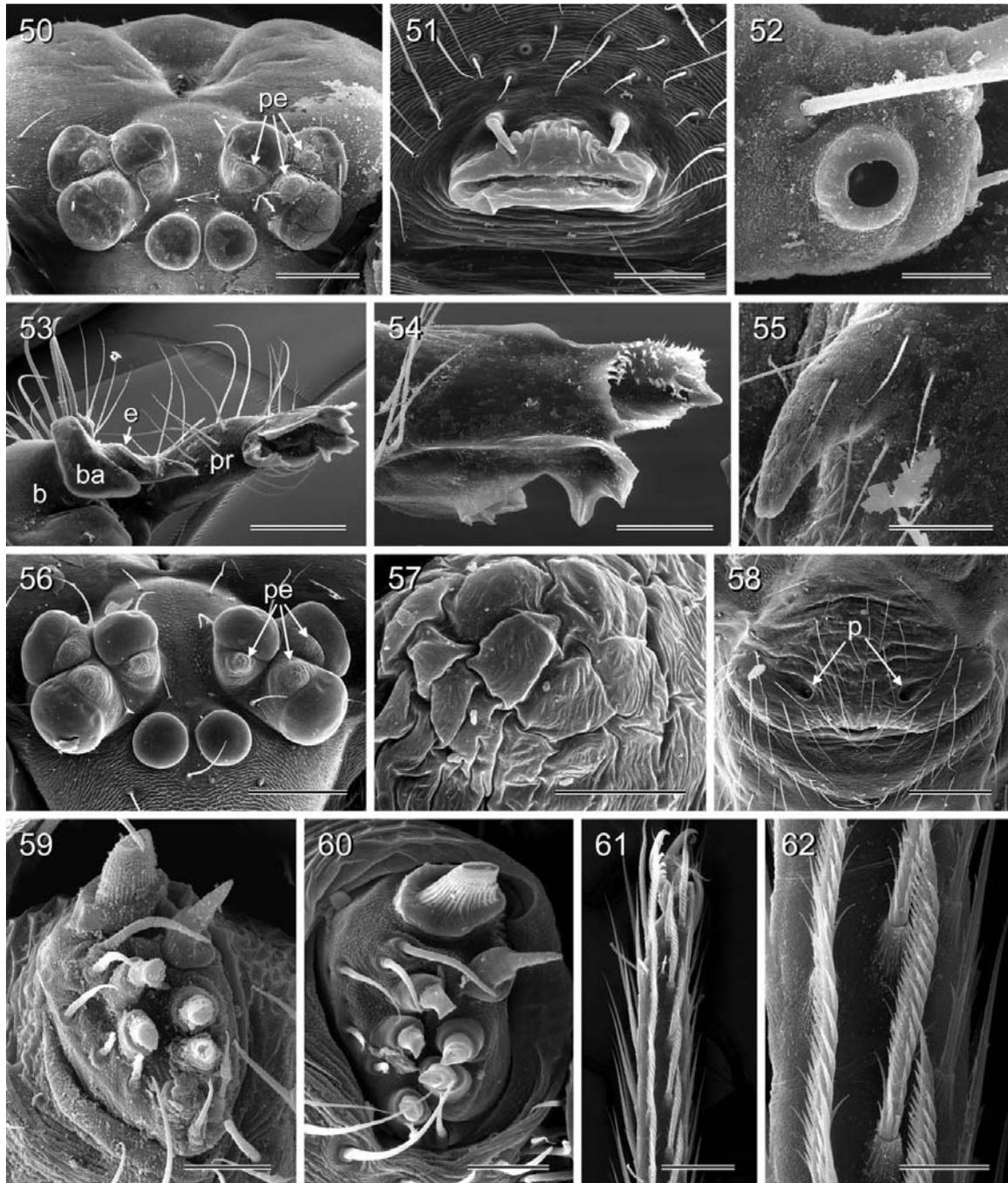
Tibia 1 in six other males: 10.0–11.0 (mean 10.5). The extent of black pigment varies, may include large parts of chelicerae, clypeus and sternum, and larger parts of palps, but never dorsal side of abdomen.

Female

In general similar to male, same colour pattern but usually with less black pigment; distance PME–PME almost as in males (110 μm); tibia 1 in 20 females: 7.2–8.7 (mean 7.9). Epigynum weakly elevated, barely sclerotized (Figure 19), with pair of pockets (Figures 20, 48, 58); internal genitalia as in Figures 21 and 49. Spinnerets and spigots as in male (Figure 60).



Figures 45–49. *Crossopriza cylindrogaster*. (45, 46) Left palp, prolateral and retrolateral views; (47) male chelicerae, frontal view; (48, 49) cleared female genitalia, ventral and dorsal views. Notes: b, bulb; ba, bulbal apophysis; e, embolus; p, epigynal pocket; pp, pore plate; pr, procurus. Scale lines: 0.3 mm (47–49), 0.5 mm (45, 46).



Figures 50–62. *Crossopriza cylindrogaster*. (50) Male carapace and eyes, frontal view; (51) male gonopore with epiandrous spigots; (52) right male palpal tarsal organ; (53) left bulb and procurus, prolatero-distal view; (54) right procurus tip, retrolateral view; (55) left proximal cheliceral apophysis, lateral view; (56) female eyes and “pseudo-eyes”; (57) wrinkled cuticle of “pseudo-eye”; (58) epigynum; (59) male ALS; (60) female ALS; (61) male left tarsus 4 tip, prolatero-ventral view; (62) comb-hairs, enlarged from Figure 61. Notes: b, bulb; ba, bulbal apophysis; e, embolus; p, epigynal pocket; pe, “pseudo-eyes”; pr, procurus. Scale lines: 20 μm (52, 57, 59, 60, 62), 60 μm (51, 54, 55, 61), 200 μm (50, 53, 56, 58).

Pseudo-eyes

In both sexes and in juveniles, each of the six lateral eyes is accompanied by a distinct elevation that has a characteristic golden shine (Figures 22, 56). Serial sections show that the tapetum extends into this elevation, lying close to the cuticle (Figure 23), which explains the strong reflectance of light. In contrast to the cuticle of the lenses which is smooth, the cuticle of the pseudo-eyes is strongly sculptured (Figure 57). Obviously, each “pseudo-eye” is just an elaboration of a lateral eye, and light enters this part only through the lens of the lateral eye. The function of these structures remains a mystery. Such pseudo-eyes seem to be widespread among the genera close to *Crossopriza* (*Holocnemus*, *Cenemus*, *Hoplopholcus*, *Stygopholcus*, *Smeringopus*, *Smeringopina*), but in most species they are very indistinct (B.A. Huber, unpublished data).

Natural history

The resting position of *C. cylindrogaster* is extremely unusual: the dorsal side of the abdomen is pressed against the leaf, the prosoma is at a right angle to the abdomen and directed away from the leaf, the legs are in a more or less usual position (femora towards dorsal) except that they are all tightly pressed against the leaf and thus approximately in one plane (Figure 1). A comparable position has not to my knowledge been described in any other pholcid, but the Brazilian leaf-dwelling *Mesabolivar luteus* seems to have much the same resting position (see http://www.uni-bonn.de/~bhuber1/pholcidae_photos.html). In *C. cylindrogaster*, the unusual position probably explains why most of the spider's body but not the dorsal side of the abdomen is covered with small black marks. When disturbed, the spiders barely react. Only when the web is strongly moved or the spider itself touched does it assume a “normal” position (hanging upside down) and slowly walk away. I could never see the shaking or whirling so typical of many other long-legged pholcids.

The web resembles that of hypochilids, the “lampshade weavers” (Figure 5). It could actually be seen as a variant of the typical pholcid domed sheet where the apex of the dome is broadly connected with the underside of the leaf. The diameter of the web is unusually small, apparently reflecting the fact that the spider's legs are to touch the wall of the lampshade. Figure 5 shows a web where the silk lines were made visible by white powder, and where the lighting conditions were adjusted for this purpose. Usually, the web is barely visible with the naked eye, as shown in Figures 1 and 6. A few webs were seen to contain large numbers of silk puffs (Figure 2). Such “ornaments” have been described previously in an unidentified *Crossopriza* species from Morocco (Hajer and Řeháková 2003), and in two species of the closely related genus *Holocnemus* (Wiehle 1933; Sedey and Jakob 1998; Hajer and Řeháková 2003). They also seem to occur in *Hoplopholcus*, another probably closely related genus (unpublished photo of *H. minous*(?) by John and Frances Murphy).

As in other pholcids (Eberhard and Briceño 1983), males were often found to rest close to females (Figure 6). However, while in other pholcids male and female share the same web, *C. cylindrogaster* males build their own web close to the female web. Sharing a single web is apparently precluded by the small size of the web. Another common pholcid trait that is uniquely modified in *C. cylindrogaster* concerns the egg-sacs. As in all pholcids, females carry the egg-sac in their chelicerae until the spiderlings hatch and even a short while after that (Figures 3, 4). Only two females with egg-sacs were collected, and in both the shape of the egg-sac was a tetrahedron (triangular pyramid) with an edge length of four eggs. Unfortunately, both egg-sacs fell apart in the collecting jar,

making exact egg counts impossible. However, the tetrahedral shape seems to predict a relatively constant number of 20 eggs [$T_n = n(n+1)(n+2)/6$]. For the spider, this egg-sac shape may result from a simple sphere packing problem (i.e. the problem to find an arrangement in which the spheres fill as large a proportion of the space as possible). The proportion of space filled by the spheres is called the density of the arrangement, and a face-centred cubic packing as in a tetrahedron fills a maximum of ~74% of space (Hales 2000). However, face-centred cubic packing need not necessarily result in a tetrahedron, so the biological reason for the tetrahedron remains largely unclear.

Distribution

Apparently widely distributed in West African rainforests (Figure 148).

Material examined

GUINEA: *Guinée Forestière*: Forêt Classée de Diéké (7°32.0'N, 8°49.9'W), 430 m above sea level (a.s.l.), 1.xii.2008 (B.A. Huber), 2♂6♀ in ZFMK; same data, 1♂1♀3 juv. in pure ethanol, in ZFMK; Forêt Classée de Zياما (8°24.2'N, 9°19.3'W), 640 m a.s.l., 2.xii.2008 (B.A. Huber), 4♂6♀ in ZFMK; same data, 3♀1 juv. in pure ethanol, in ZFMK; Mount Nimba (~7°41.5'N, 8°24.5'W), ~600 m a.s.l., forest, 29.xi.2008 (B.A. Huber), 3♀ in ZFMK; same data, 2♀3 juv. in pure ethanol, in ZFMK.

CÔTE D'IVOIRE: Apouesso, FC Bossematié (6°35'N, 3°28'W), rain forest, station 1, glue trap, 12.-13.xi.1995 (R. Jocqué), 2♂ in MRAC (202553).

GHANA: Kakum forest (5°20'N, 1°23'W), secondary forest, 15.xi.2005 (R. Jocqué, D. de Bakker, L. Baert), "fog 4", 3♂ in MRAC (217697); same data but primary forest, 21.xi.2005, "fog 9", 5♀ in MRAC (217733); 18.xi.2005, "fog 7", 1♀ in MRAC (217728); 23.xi.2005, "fog 11", 1♀ in MRAC (217684); 25.xi.2005, "fog 13", 3♀ in MRAC (217717).

CAMEROON: *South Region*: near Kribi (2°54.0'N, 9°54.4'E), 20 m a.s.l., 9.iv.2009 (B.A. Huber), 4♂4♀ in ZFMK; same data, 5♀4 juvs. in pure ethanol, in ZFMK. Between Kribi and Campo, "site 1" (2°42.2'N, 9°51.8'E), 10 m a.s.l., 10.iv.2009 (B.A. Huber), 1♀ in pure ethanol, in ZFMK. Near Ebolowa (2°54.9'N, 11°08.3'E), 620 m a.s.l., 11.-12.iv.2009 (B.A. Huber), 2♀ in ZFMK; same data, 2♀2 juvs. in pure ethanol, in ZFMK. North of Mengong (3°03.0'N, 11°25.0'E), 690 m a.s.l., 13.iv.2009 (B.A. and J.C. Huber), 1♀ in pure ethanol, in ZFMK. *Littoral Region*: near Loum, forest with banana plants (4°43.6'N, 9°42.5'E), 400 m a.s.l., 24.iv.2009 (B.A. and J.C. Huber), 4♂4♀ in ZFMK; same data, 2♀2 juvs. in pure ethanol, in ZFMK. Near Edéa, Koukoué (3°41.2'N, 10°06.4'E), 50 m a.s.l., 8.iv.2009 (B.A. Huber), 1♀ in pure ethanol, in ZFMK.

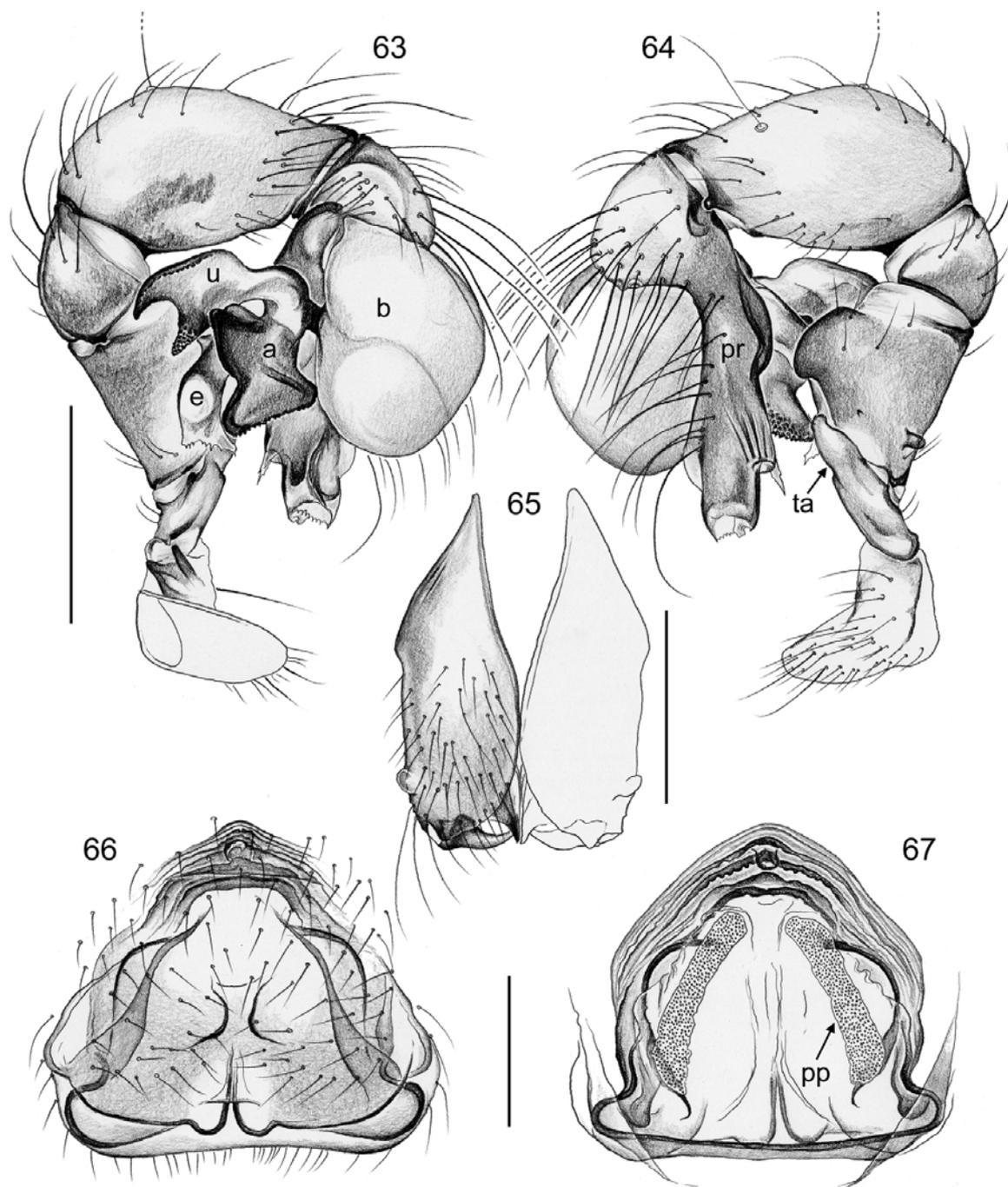
Leptopholcus guineensis Millot, 1941

(Figures 7, 24, 25, 28, 29, 63–81, 149)

Leptopholcus guineensis Millot 1941, p. 16–17, figs 6a–e. Brignoli 1980, p. 650, fig. 6.

Types

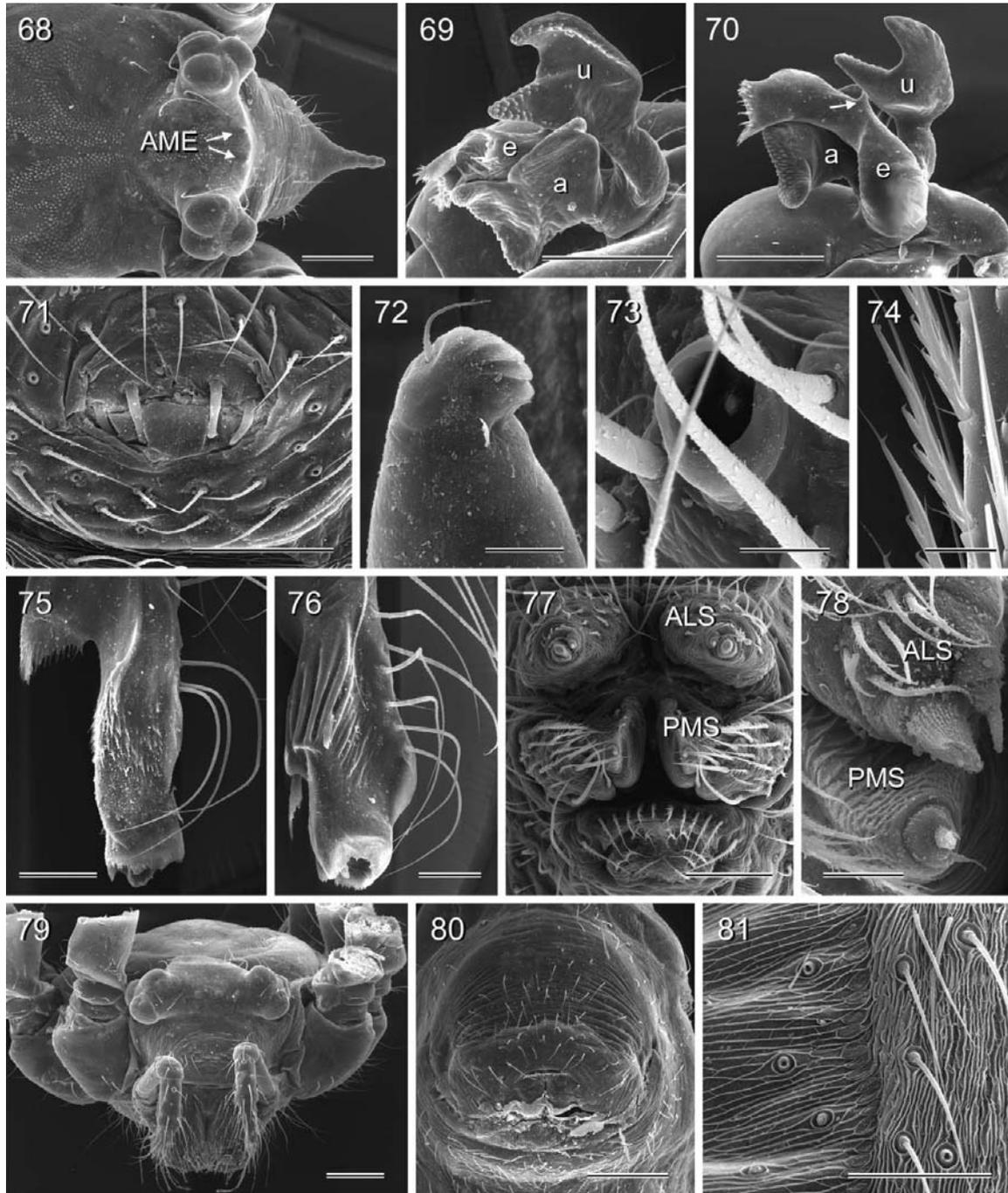
Female holotype from Dalaba [~10°41'N, 12°15'W], Moyenne-Guinée, Guinea; viii.1937 (J. Millot), in MNHN, examined. Female "cotype" from Kindia [~10°03'N, 12°51'W], Basse-Guinée, Guinea; vii.1937 (J. Millot), in MNHN, examined.



Figures 63–67. *Leptopholcus guineensis*. (63, 64) Left palp, prolateral and retrolateral views; (65) male chelicerae, frontal view; (66, 67) cleared female genitalia, ventral and dorsal views. Notes: a, appendix; b, bulb; e, embolus; pp, pore plate; pr, procurus; ta, trochanter apophysis; u, uncus. Scale lines: 0.5 mm (63, 64), 0.3 mm (65–67).

Diagnosis

Easily distinguished from most known *Leptopholcus* species by median horn on male clypeus (Figure 68; *L. signifer* Simon and *L. gracilis* Berland share such a horn); also by shapes of male bulbal apophyses (Figures 63, 69, 70).



Figures 68–81. *Leptopholcus guineensis*. (68) Male carapace, eyes and clypeus with horn; (69) left bulbal projections, prolateral view; (70) right bulbal projections, retrolateral view (arrow points to dorsal cone-shaped apophysis on embolus); (71) male gonopore with epiandrous spigots; (72) tip of right male palpal trochanter apophysis; (73) male palpal tarsal organ; (74) comb hairs on male right tarsus 4, prolateral view; (75) left procurus, prolateral (slightly dorsal) view; (76) right procurus, retrolateral view; (77) male spinnerets and anal cone; (78) female ALS and PMS; (79) female prosoma, frontal view; (80) epigynum; (81) cuticular sculpturing on male abdomen, showing difference in ventral (left) and lateral (right) pattern (frontal side on top). Notes: a, appendix; e, embolus; u, uncus. Scale lines: 20 μm (72–74, 78), 80 μm (71, 75–77, 81), 200 μm (68–70, 79, 80).

Male (Dalaba)

Total body length 7.5, carapace width 1.2. Leg 1: 35.8 (8.9 + 0.5 + 8.4 + 14.9 + 3.1), tibia 2: 6.4, tibia 3: 4.3, tibia 4: 6.3, tibia 1 L/d: 86. Habitus as in Figures 24 and 25; carapace mostly dark brown including ocular area and clypeus, only frontally-laterally pale whitish area, sternum dark with many small light spots, lighter around labium, with darker (black) margins, legs pale ochre, patella area and tibia–metatarsus joints black, femora proximally dorsally slightly darkened, abdomen pale ochre-grey, with several dark marks dorsally. Distance PME–PME 390 μm , diameter PME 125 μm , distance PME–ALE 45 μm , distance AME–AME 55 μm , diameter AME 30 μm . Ocular area elevated, each triad on low stalk directed laterally. No thoracic furrow; clypeus with distinct median projection, ~ 0.2 long (Figure 68). Chelicerae as in Figure 65, with light lateral apophyses distally. Sternum wider than long (0.75/0.65), unmodified. Palps as in Figures 63 and 64, coxa with low retrolateral bulge, trochanter with strong retrolatero-ventral apophysis with serrated tip (Figure 72), femur with large ventral protrusion and two small apophyses retrolaterally (the more ventral one barely visible), tarsal organ capsulate (Figure 73), procurus rather simple, with retrolateral ridges and subdistal transparent projection ventrally (Figures 64, 75, 76), bulb with large bifid uncus (Figures 63, 69), large appendix, embolus proximally weakly sclerotized with small conical projection dorsally (Figure 70), distally whitish. Legs without spines and curved hairs, few vertical hairs; retrolateral trichobothrium on tibia 1 at 3.5%; prolateral trichobothrium missing on tibia 1, present on other tibiae; many tarsal pseudosegments (> 30 on tarsus 1), but poorly visible in dissecting microscope; tarsus 4 with ventral row of comb-hairs (Figure 74). Spinnerets as in Figure 77, ALS with one widened and one pointed spigot; PMS with two small spigots. Gonopore with four epiandrous spigots (Figure 71).

Variation

The extent of black pigment varies considerably: in some males the light areas on the carapace extend further back; some males with light sternum or only margins darkened; some males with fewer and/or smaller marks on abdomen; the tiny (more ventral) retrolateral apophysis on the male palpal femur is missing in some males. Tibia 1 in nine other males: 8.1–10.0 (mean 8.9).

Female

In general similar to male but lighter, prosoma either without dark pattern or with pair of small spots on carapace, abdomen mostly monochromous, but in few females with marks as in males; clypeus unmodified; triads closer together (distance PME–PME 275 μm), AME pigment always present, but apparently sometimes without lenses. Tibia 1 in 13 females: 5.3–7.9 (mean 6.9). Epigynum light brown plate, sometimes protruding, frontal internal arch visible through cuticle, posteriorly with pair of distinctive median whitish bulges (Figure 28, 66); internal genitalia as in Figures 29 and 67. The females from The Gambia and Senegal are assigned tentatively because females of different species are difficult to distinguish and no males have been collected in these countries.

Distribution

Known from Guinea, and possibly also from The Gambia and Senegal (Figure 149).

Material examined

GUINEA: *Moyenne-Guinée*: Dalaba: 1 ♀ holotype above; Dalaba (10°40.7'N, 12°15.7'W), along brook in forest, 920 m a.s.l., 21.xi.2008 (B.A. Huber), 1 ♂ in ZFMK; same data, 1 ♀ in pure ethanol, in ZFMK; canyon near Doucki (10°59.6'N, 12°35.3'W), 1020 m a.s.l., 24.xi.2008 (B.A. Huber), 1 ♂ 1 ♀ in ZFMK; same data, 1 ♀ in pure ethanol, in ZFMK; SE Mamou (10°17.6'N, 11°56.5'W), forest along brook, 460 m a.s.l., 4.xii.2008 (B.A. Huber), 3 ♂ 6 ♀ in ZFMK; same data, 2 ♀ in pure ethanol, in ZFMK; NW Mamou (10°30.5'N, 12°11.6'W), 890 m a.s.l., 25.xi.2008 (B.A. Huber), 1 ♂ in ZFMK; same data, 1 ♀ in pure ethanol, in ZFMK. *Basse-Guinée*: Kindia: 1 ♀ “cotype” above; near Kindia (10°00.8'N, 12°48.6'W), along brook in plantation forest, 540 m a.s.l., 5.xii.2008 (B.A. Huber), 3 ♂ 2 ♀ in ZFMK. Conakry, in park (9°32.0'N, 13°41.2'W), 40 m a.s.l., 18.xi.2008 (B.A. Huber), 2 ♂ 1 ♀ in ZFMK; same data, 3 ♀ in pure ethanol, in ZFMK.

Assigned tentatively

SENEGAL: *Ziguinchor*: Parc National de Basse Casamance [~12°23'N, 16°38'W], 11.viii.1982 (collector not given), 1 ♀ 1 juv. in IRSB. THE GAMBIA: *Banjul*: Abuko Nature Reserve (13°23.5'N, 16°39.0'W), primary gallery forest, “shaking branches and varia”, 17.x.2008 (Yu.M. Marusik), 1 ♀ in ZFMK.

Leptopholcus tipula (Simon, 1907)

(Figures 8, 9, 26, 27, 30, 31, 82–100, 149)

Micromerys tipula Simon 1907, p. 248–249.*Leptopholcus tipula* Brignoli 1980, p. 653; Deeleman-Reinhold 1986b, p. 206.*Type*

The original description is based on a female from “Ile Fernando-Poo: Punta Frailes” (Equatorial Guinea: Bioko, ~3°46'N, 8°42'E); this specimen is apparently lost (could not be found in MNHN).

Note

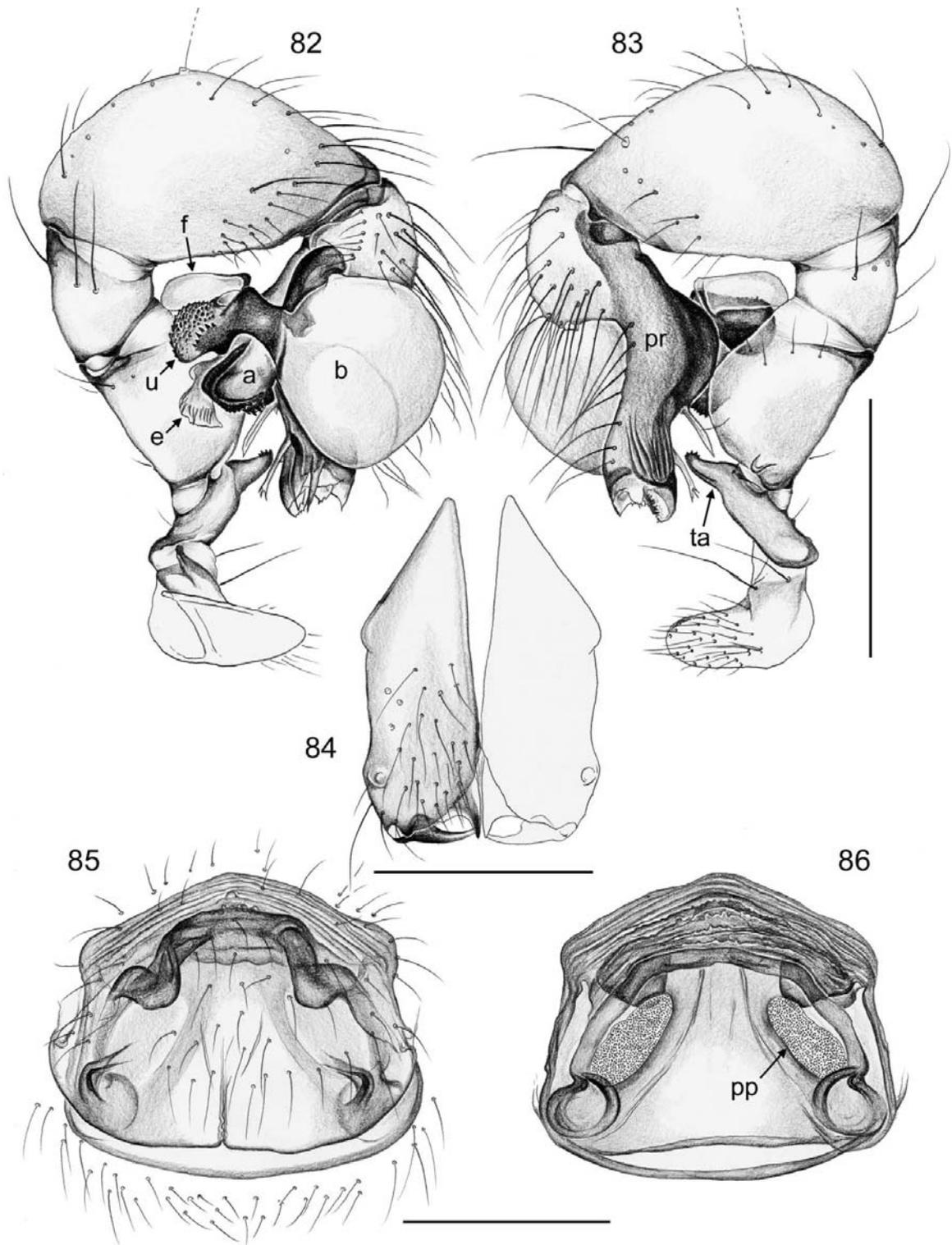
Simon (1907) mentioned additional material from Gabon, and these non-type specimens are well preserved and still available in the MNHN (see later). They are identical to specimens newly collected on Bioko very close to the type locality. In addition, no other *Leptopholcus* species has been collected on Bioko, and the only other species collected in Cameroon is clearly different (B.A. Huber, unpublished data). Together, this suggests that the following material is in fact conspecific with Simon's lost type.

Diagnosis

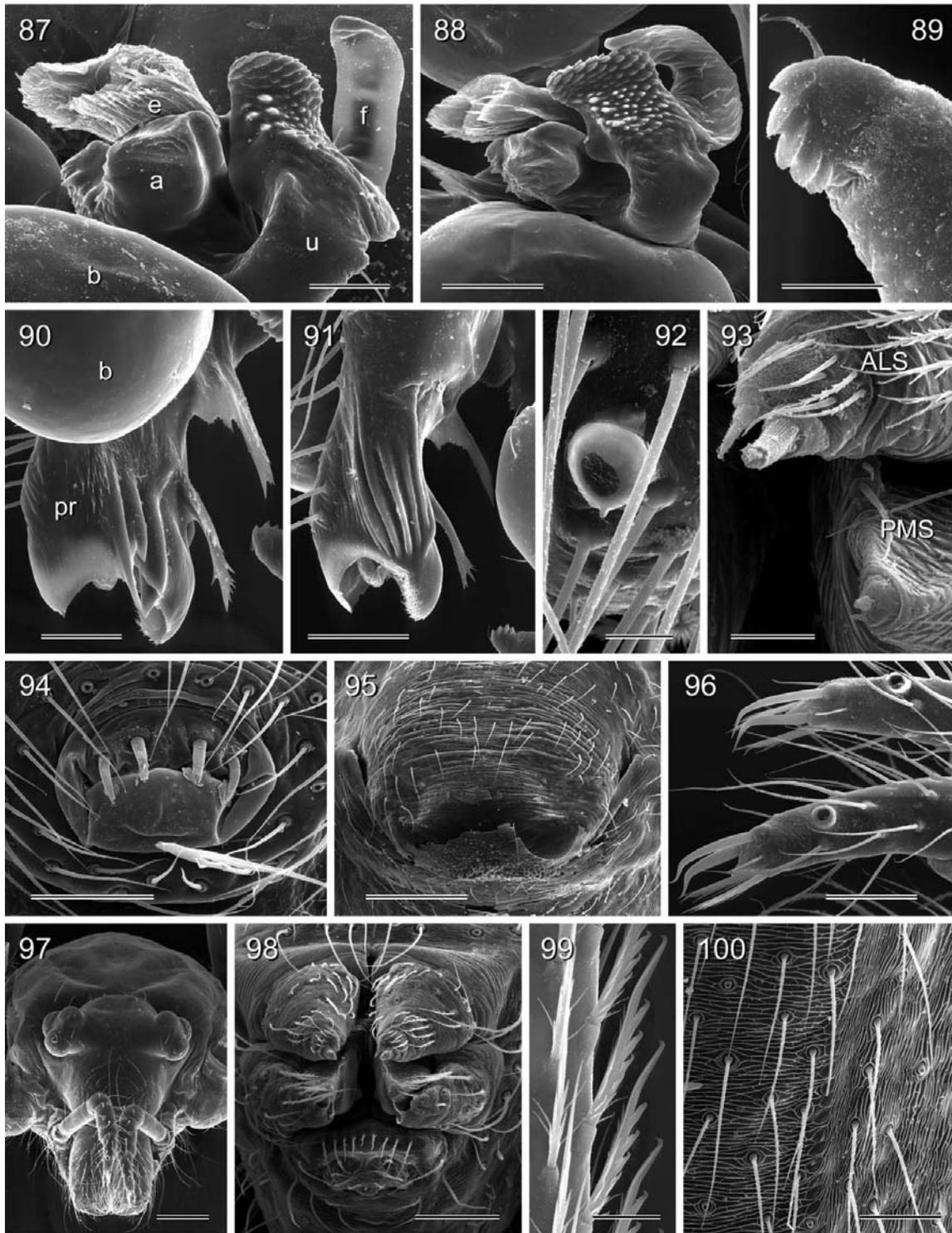
Easily distinguished from known congeners by the semitransparent flap dorsally on the uncus (Figures 82, 87, 88).

Male (Bioko: Punta Beecrof)

Total body length 7.1, carapace width 0.9. Leg 1: 36.8 (9.2 + 0.4 + 8.5 + 14.6 + 4.1), tibia 2: 6.4, tibia 3: 4.4, tibia 4: 7.2, tibia 1 L/d: 113. Habitus as in Figures 26 and 27;



Figures 82–86. *Leptopholcus tipula*. (82, 83) Left palp, prolateral and retrolateral views; (84) male chelicerae, frontal view; (85, 86) cleared female genitalia, ventral and dorsal views. Notes: a, appendix; b, bulb; e, embolus; f, flap on uncus; pp, pore plate; pr, procursus; ta, trochanter apophysis; u, uncus. Scale lines: 0.3 mm (84–86), 0.5 mm (82, 83).



Figures 87–100. *Leptopholcus tipula*. (87, 88) Left bulbal projections, prolateral, from Cameroon (87) and Guinea (88); (89) tip of right male palpal trochanter apophysis; (90) tip of right procurus, prolateral view; (91) tip of left procurus, retrolateral view; (92) right male palpal tarsal organ; (93) male ALS and PMS; (94) male gonopore with epiandrous spigots; (95) epigynum; (96) female palpal tarsi, dorso-lateral view; (97) female prosoma, dorso-frontal view; (98) female spinnerets and anal cone; (99) comb hairs on female left tarsus 4, prolateral view; (100) cuticular sculpturing on female abdomen, showing difference in ventral (left) and lateral (right) pattern (frontal side on top). Notes: a, appendix; b, bulb; e, embolus; f, flap on uncus; pr, procurus; u, uncus. Scale lines: 20 μm (89, 92, 93, 99), 60 μm (87, 90, 94, 96, 100), 100 μm (88, 91, 98), 200 μm (95, 97).

entire spider mostly pale ochre-yellow to whitish, patella area and tibia-metatarsus joints brown. Distance PME–PME 370 μm , diameter PME 80 μm , distance PME–ALE 45 μm , no trace of AME. Ocular area not elevated, each triad on low hump, some stronger hairs on posterior side. No thoracic furrow, clypeus unmodified. Chelicerae as in Figure 84, with indistinct lateral apophyses distally. Sternum wider than long (0.65/0.50), unmodified. Palps as in Figures 82 and 83, coxa unmodified, trochanter with ventral apophysis with serrated tip (Figure 89), femur with distinct retrolateral apophysis proximally, widened ventrally, tarsal organ capsulate (Figure 82), procurus with distinctive distal elements (Figures 90, 91), some of them membranous, bulb with short weakly sclerotized embolus, uncus with long dorsal transparent flap, appendix short and massive (Figures 82, 87). Legs without spines and curved hairs, few vertical hairs; retrolateral trichobothrium on tibia 1 at 3%; prolateral trichobothrium missing on tibia 1, present on other tibiae; tarsal pseudosegments not visible in dissecting microscope. ALS with one widened and one pointed spigot; PMS with two small spigots (Figure 93). Gonopore with four epiandrous spigots (Figure 94).

Variation

In some males dorsal part of clypeus slightly darkened; in some abdomen appears (still) greenish. Tibia 1 in 36 other males: 7.2–8.8 (mean 8.0). In males from Bilik, Cameroon, uncus slightly smaller; in males from Mayombe, Congo D.R., sclerotized part of uncus slightly narrower; in males from Ghana and Guinea, both uncus and appendix minimally different in shape (Figures 87 and 88 are from slightly different angles of view and thus exaggerate this difference).

Female

In general similar to male but triads closer together (distance PME–PME 300 μm). Tibia 1 in 65 females: 5.9–7.5 (mean 6.8). Tip of palpal tarsus ending in sclerotized cone accompanied by several strong bristles (Figure 96). Spinnerets and spigots as in male (Figure 98). Tarsus 4 with ventral row of comb-hairs (Figure 99). Epigynum very simple and weakly sclerotized (Figures 30, 95), with distinctive internal structures (including pair of apparent pockets) visible through cuticle (Figure 30); internal genitalia as in Figures 31 and 86. The female from Makokou, Gabon, has a slightly different epigynum and is therefore assigned tentatively.

Distribution

Widely distributed, ranging at least from western Congo D.R. to eastern Guinea (Figure 149).

Material examined

EQUATORIAL GUINEA: Bioko: Punta Beecrof (3°43.3'N, 8°39.7'E), at night, 18.x.1998 (D.K. Dabney, D. Ubick), 1♂1♀ in CAS; 3.5 km N Luba (3°28.9'N, 8°35.0'E), swampy forest, 13.x.1998 (M. Boko, D.K. Dabney, L. Henwood, R.W. Tomos, D. Ubick, J.V. Vindum), 1♀ 1 juv. in CAS.

CONGO DEM. REP.: Bas Congo, Mayombe, Luki Forest Reserve (5°37.3'S, 13°05.9'E), 270 m a.s.l., primary rainforest, 4.-13.xi.2006, 26.ix.-4.x.2007 (D. de Bakker, J.P. Michiels), 37♂65♀ in MRAC (15 vials separated from 219850-855,

224312-319; and 222067); same locality and collectors: beating along trail near guest house, 8./14.xi.2006, 2♂ 2♀ in MRAC (2 vials separated from 219959 and 991); beating along trail, primary rainforest, 11.xi.2006, 1♂ in MRAC (221534); beating in secondary forest, 16.xi.2006, 1♂ 2♀ in MRAC (219849); old secondary rainforest, 17.-25.ix.2007, 14♂ 21♀ in MRAC (9 vials, separated from 224303-311); young secondary rainforest, 14.ix.2007, 1♀ in MRAC (separated from 224301).

GABON: unspecified locality and date, collected by “Mcq.”, 1♂ 1♀ in MNHN (10499; Simon collection number 15558). 10 km S Bigouenia [~0°55'S, 10°21'E], 29.xii.1985 (A. Pauly), 1♀ in MRAC (172913). *Ogooue-Maritime*: Reserve de Faune de la Moukalaba-Dougoua, 12.2. km 305° NW Doussala (2°17.0'S, 10°29.8'E), 110 m a.s.l., rainforest, beating vegetation, 24.ii.2000 (B.L. Fisher), 1♂ in CAS (9027072).

CENTRAL AFRICAN REPUBLIC: Sangha-Mbaéré: Parc National Dzanga-Ndoki, 37.9 km 169° S Lidjombo (2°22.2'N, 16°10.3'E), 360 m a.s.l., rainforest, beating low vegetation, 20.-28.v.2001 (B.L. Fisher), 1♂ in CAS (separated from 9027099).

CAMEROON: *South Region*: near Kribi (2°54.0'N, 9°54.4'E), 20 m a.s.l., 9.iv.2009 (B.A. Huber), 3♂ 3♀ in ZFMK; same data, 2♀ 7 juvs. in pure ethanol, in ZFMK. Between Kribi and Campo, “site 1” (2°42.2'N, 9°51.8'E), 10 m a.s.l., 10.iv.2009 (B.A. Huber), 1♂ in ZFMK; same data, 2♀ 2 juvs. in pure ethanol, in ZFMK. Between Kribi and Campo, “site 2” (2°40.4'N, 9°51.4'E), 15 m a.s.l., 10.iv.2009 (B.A. Huber), 2♀ 2 juvs. in pure ethanol, in ZFMK. Bilik (3°32'N, 11°17'E), *Terminalia* forest, fogging sample 92/13, 29.i.1993 (A. Russell-Smith), 1♂ 1♀ in ZFMK; same data but “F04 A2/1B”, 1♂ 2♀ 1 juv. in ZFMK. *Littoral Region*: Douala [~4°03'N, 9°45'E], 1913 (A. Haas), 1♀ in SMF. *Southwest Region*: Fako Div., Limbe Subdiv.: 1.4 km NE of Etome (4°03.0'N, 9°07.5'E), ca. 400 m a.s.l., 13.-19.i.1992 (S. Larcher, G. Hormiga, J. Coddington, C.E. Griswold, C. Wanzie), 5♂ 4♀ in CAS; same data, 9♂ 14♀ in USNM. Mamfe [~5°45'N, 9°19'E], 7.-11.i.1949 (B. Malkin), 1♀ in CAS.

GHANA: Kakum forest (5°20'N, 1°23'W), secondary forest, 15./17./19.xi.2005 (R. Jocqué, D. de Bakker, L. Baert), 7♂ 4♀ in MRAC (3 vials: 217688, 691, 699); same data but primary forest, 16./18./21./23./25.xi.2005, 9♂ 10♀ in MRAC (5 vials: 217696, 700, 713, 716, 727).

GUINEA: *Guinée Forestière*: Forêt Classée de Diéké (7°32.0'N, 8°49.9'W), 430 m a.s.l., 1.xii.2008 (B.A. Huber), 3♂ in ZFMK; same data, 1♂ 1♀ in pure ethanol, in ZFMK; Forêt Classée de Ziama (8°24.2'N, 9°19.3'W), 640 m a.s.l., 2.xii.2008 (B.A. Huber), 2♂ 3♀ in ZFMK; same data, 2♀ in pure ethanol, in ZFMK; Mount Nimba (~7°41.5'N, 8°24.5'W), ~600 m a.s.l., forest, 29.xi.2008 (B.A. Huber), 2♀ in pure ethanol, in ZFMK.

Assigned tentatively

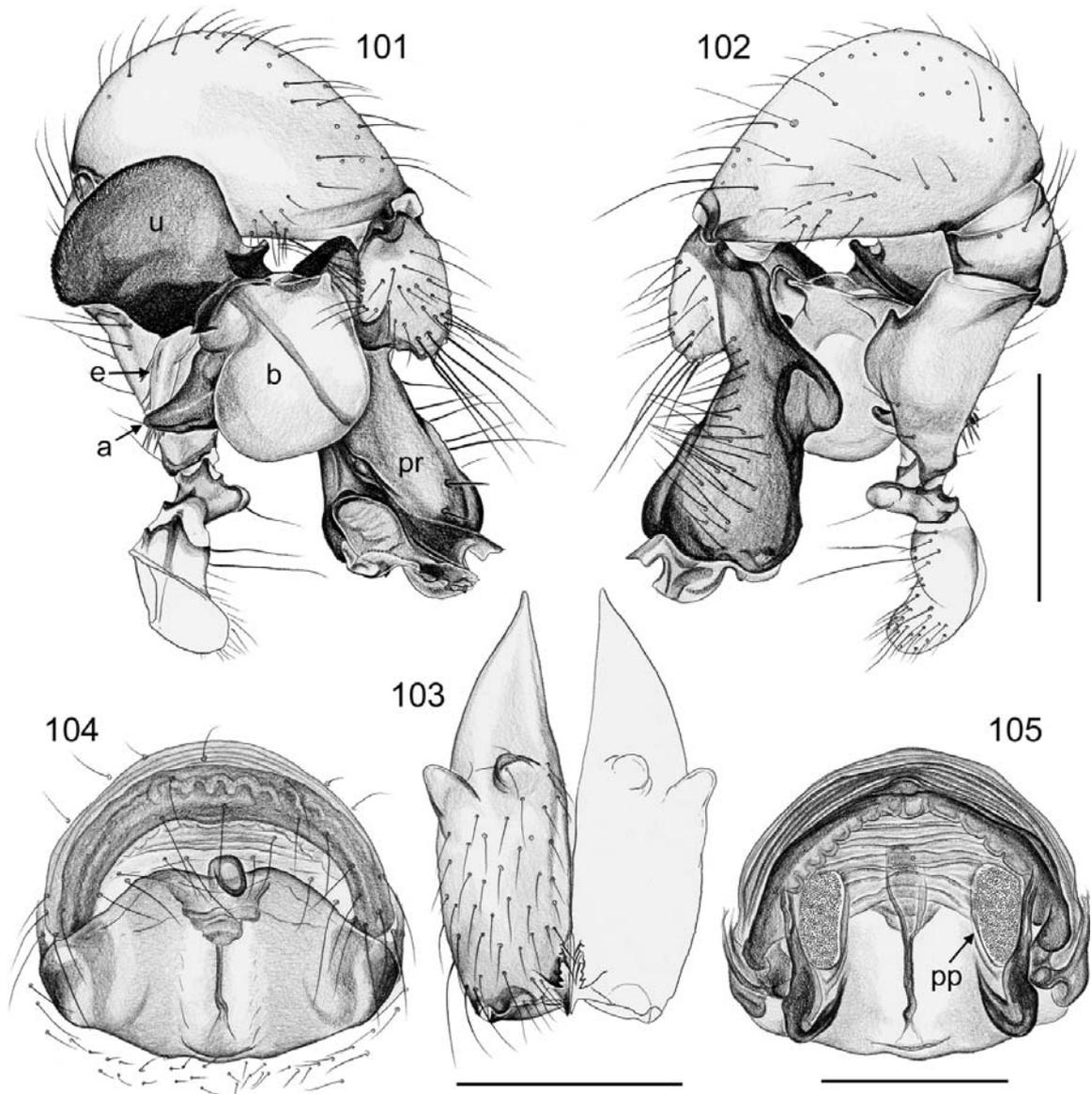
GABON: Makokou, CNRS (0°04'N, 12°08'E), Ogooue-Invindo, ix.-xi.1976 (A.L. Rypstra), 1♀ in USNM.

Pholcus kakum n. sp.

(Figures 10, 11, 32–35, 101–123, 150)

Type

Male holotype from Kakum forest (5°20'N, 1°23'W), Ghana; primary forest, 21.xi.2005 (R. Jocqué, D. de Bakker, L. Baert), in MRAC (separated from 217714).



Figures 101–105. *Pholcus kakum*. (101, 102) Left palp, prolateral and retrolateral views, respectively; (103) male chelicerae, frontal view; (104, 105) cleared female genitalia, ventral and dorsal views, respectively. Notes: a, appendix; b, bulb; e, embolus; pp, pore plate; pr, procurus; u, uncus. Scale lines: 0.3 mm (103–105), 0.5 mm (101, 102).

Etymology

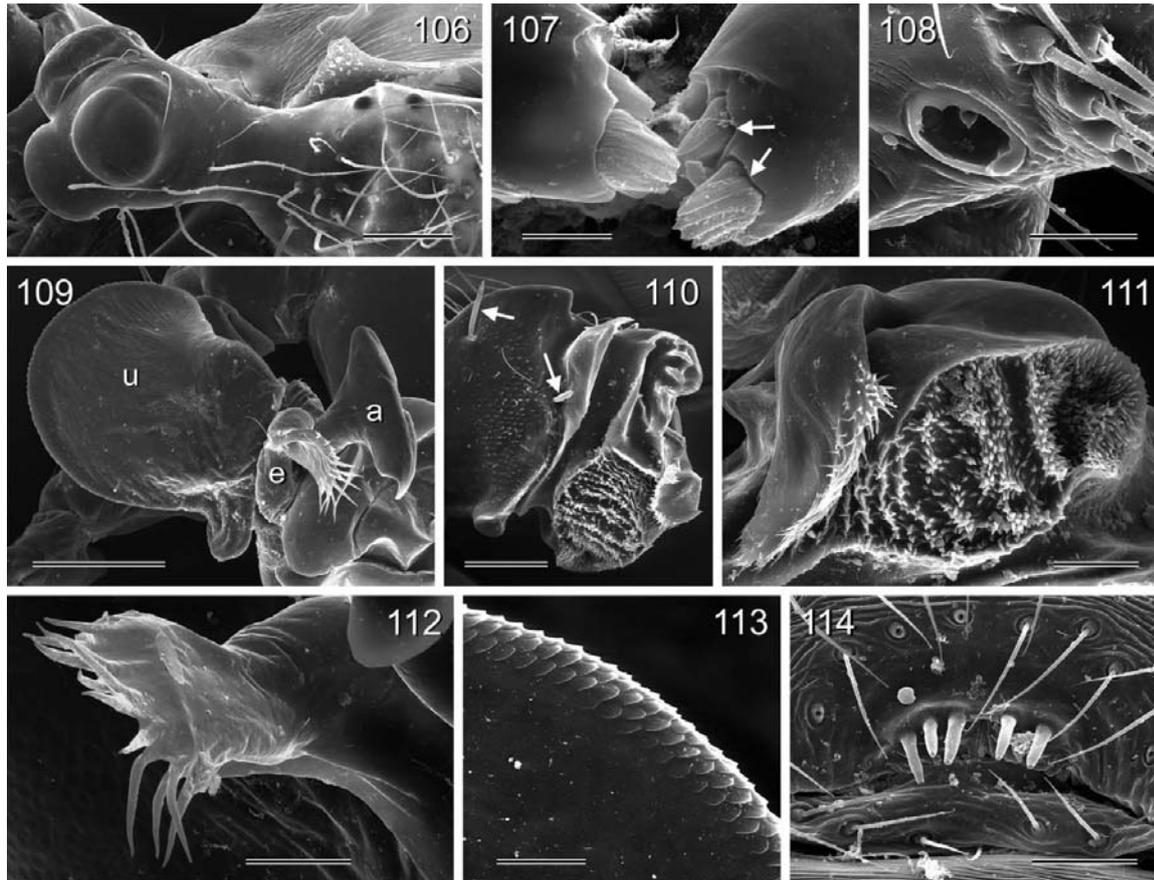
The species name is taken from the type locality and used as a noun in apposition.

Diagnosis

Distinguished from known congeners by the shapes of procurus (Figures 101, 102), uncus and appendix (Figures 101, 109), and epigynum (Figures 34, 104, 119).

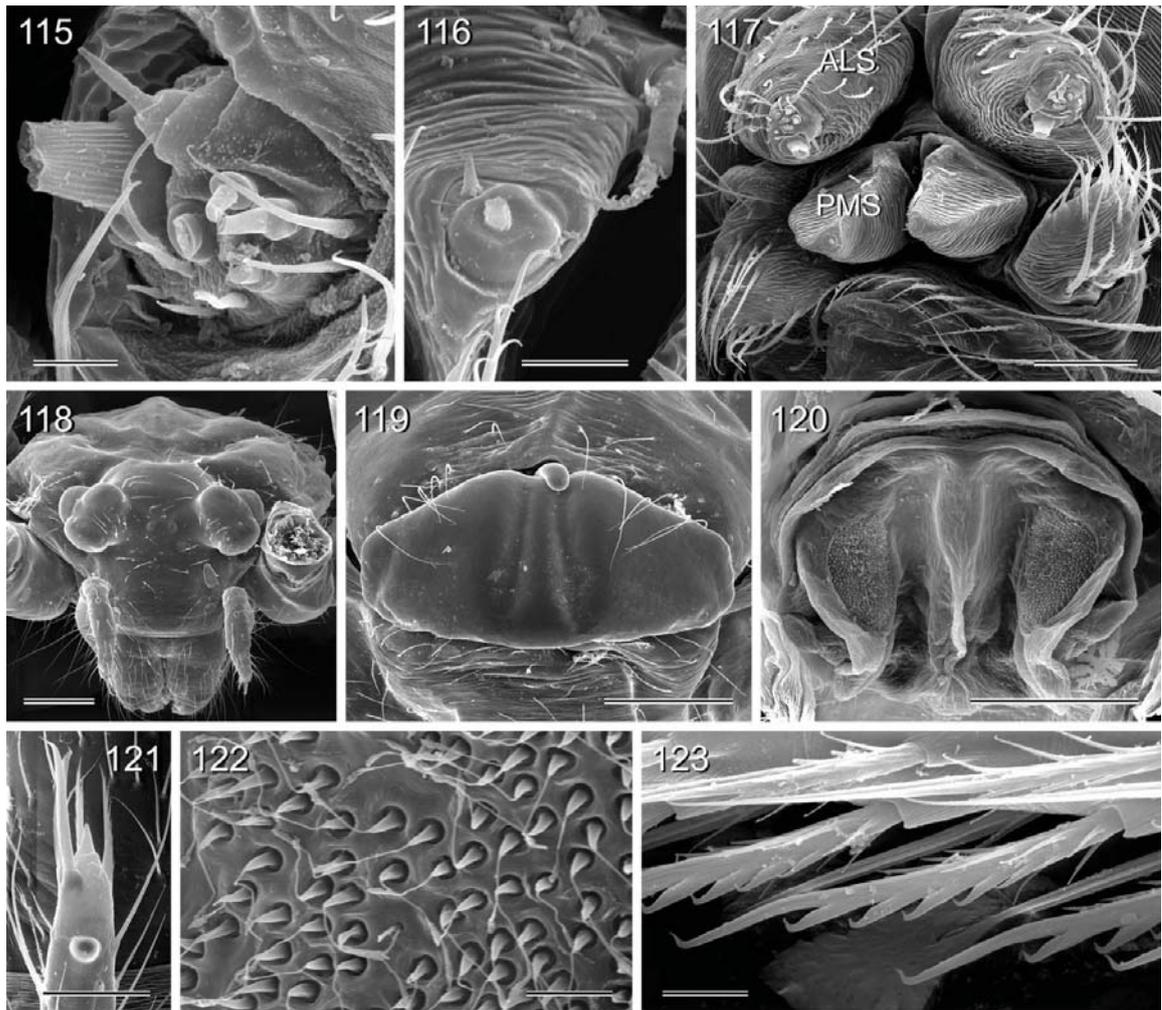
Male (holotype)

Total body length 3.7, carapace width 1.0. Leg 1: 32.0 (7.8 + 0.4 + 7.8 + 14.3 + 1.7), tibia 2: 5.0, tibia 3: 2.8, tibia 4: 4.4, tibia 1 L/d: 77. Habitus as in Figures 32 and 33;



Figures 106–114. *Pholcus kakum*. (106) Male ocular area with left eye stalk and AME, dorsal view; (107) distal male cheliceral apophyses with modified hairs (arrows); (108) left male palpal tarsal organ; (109) left bulbal projections, retrolatero-dorsal view; (110) tip of left procurus, prolateral view (arrows point to spines); (111) spiny area prolatero-distally on left procurus; (112) left embolus; (113) edge of uncus; (114) male gonopore with epiandrous spigots. Notes: a, appendix; e, embolus; u, uncus. Scale lines: 10 μm (107), 40 μm (108, 111–114), 100 μm (106, 110), 200 μm (109).

carapace mostly pale ochre-yellow, ocular area and clypeus dark brown, sternum and legs pale ochre-yellow, patellae and tibia–metatarsus joints dark brown, abdomen pale ochre-grey with indistinct dark spots dorsally, ventrally monochromous. Distance PME–PME 425 μm , diameter PME 125 μm , distance PME–ALE 25 μm , distance AME–AME 30 μm , diameter AME 20 μm . Ocular area elevated, with long hairs on posterior side, each triad on short stalk directed towards lateral (Figure 106). No thoracic furrow, clypeus unmodified. Chelicerae as in Figure 103, distal frontal apophyses with two modified hairs each (Figure 107), with lateral and frontal proximal apophyses. Sternum wider than long (0.70/0.50), unmodified. Palps as in Figures 101 and 102, coxa unmodified, trochanter with short retrolatero-ventral projection, femur with distinctive ventral modification, tarsal organ capsulate (Figure 108), procurus large, distally complex, with two prolatero-dorsal spines (Figures 101, 110) and distinctive spiny and possibly extensible area (Figure 111), bulb with large uncus with scaly edge (Figures 109, 113), T-shaped appendix, weakly sclerotized embolus with many transparent projections (Figures 109, 112). Legs without spines and curved hairs, few vertical hairs; retrolateral trichobothrium on tibia 1 at 4°;



Figures 115–123. *Pholcus kakum*. (115) Male ALS; (116) male PMS; (117) female spinnerets; (118) female prosoma, dorso-frontal view; (119) epigynum; (120) cleared female internal genitalia, dorsal view; (121) right female palpal tarsus, dorsal view; (122) detail of pore plate (enlarged from figure 120); (123) comb hairs on right female tarsus 4, prolateral view. Scale lines: 10 μm (115, 116, 122, 123), 60 μm (117, 121), 200 μm (118–120).

prolateral trichobothrium missing on tibia 1, present on other tibiae; tarsal pseudosegments indistinct, distally ~10 visible in dissecting microscope. ALS with one widened, one pointed, and five cylindrically shaped spigots (Figure 115); PMS with two small spigots (Figure 116). Gonopore of scanned male with five epiandrous spigots (Figure 114).

Variation

Tibia 1 in nine other males: 7.0–8.0 (mean 7.5).

Female

In general similar to male but triads closer together (distance PME–PME 220 μm), not on stalks (Figure 118), clypeus not darkened except upper part, carapace often with pair of posterior dark marks, dorsal spots on abdomen variably distinct. Tibia 1

in 11 females: 5.5–6.3 (mean 5.9). Epigynum with distinctive orange-brown plate with light median section traversed by darker line, with frontal “knob” (Figures 34, 119); internal genitalia as in Figures 35, 105, and 120. Tip of palpal tarsus ending in sclerotized cone accompanied by several strong bristles (Figure 121). Tarsus 4 with ventral row of comb-hairs (Figure 123). Spinnerets and spigots as in male (Figure 117).

Distribution

Known from Ghana, Côte d’Ivoire, and Guinea (Figure 150).

Material examined

GHANA: Kakum forest: 1♂ holotype above; same data, 24♂19♀ in MRAC (217714); same data but 16./18./23./25.xi.2005 (4 vials), 5♂10♀ in MRAC (217685, 217706, 217707, 217740); same data but secondary forest, 15./17./18./19.xi.2005 (4 vials), 4♂6♀ in MRAC (217683, 217719, 217723, 217732).

CÔTE D’IVOIRE: *Moyen-Comoé*: FC Songan, near Comoé river [~6°07’N, 3°13’W], hand catch in forest, 8.iii.1997 (T. Steyn), 1♀ in MRAC (207396). Apouesso, FC Bossematié (6°35’N, 3°28’W), rain forest, 18.xi.1994 (R. Jocqué), 1♀ in MRAC (201011).

GUINEA: *Guinée Forestière*: Forêt Classée de Diéké (7°32.0’N, 8°49.9’W), 430 m a.s.l., 1.xii.2008 (B.A. Huber), 1♀ in ZFMK; Forêt Classée de Zياما (8°24.2’N, 9°19.3’W), 640 m a.s.l., 2.xii.2008 (B.A. Huber), 1♂1♀ in ZFMK; same data, 2♀ in pure ethanol, in ZFMK.

Spermophora dieke n. sp. (Figures 12, 36–40, 124–127, 150)

Type

Male holotype from Forêt Classée de Diéké (7°32.0’N, 8°49.9’W), Guinée Forestière, Guinea; 430 m a.s.l., 1.xii.2008 (B.A. Huber), in ZFMK.

Etymology

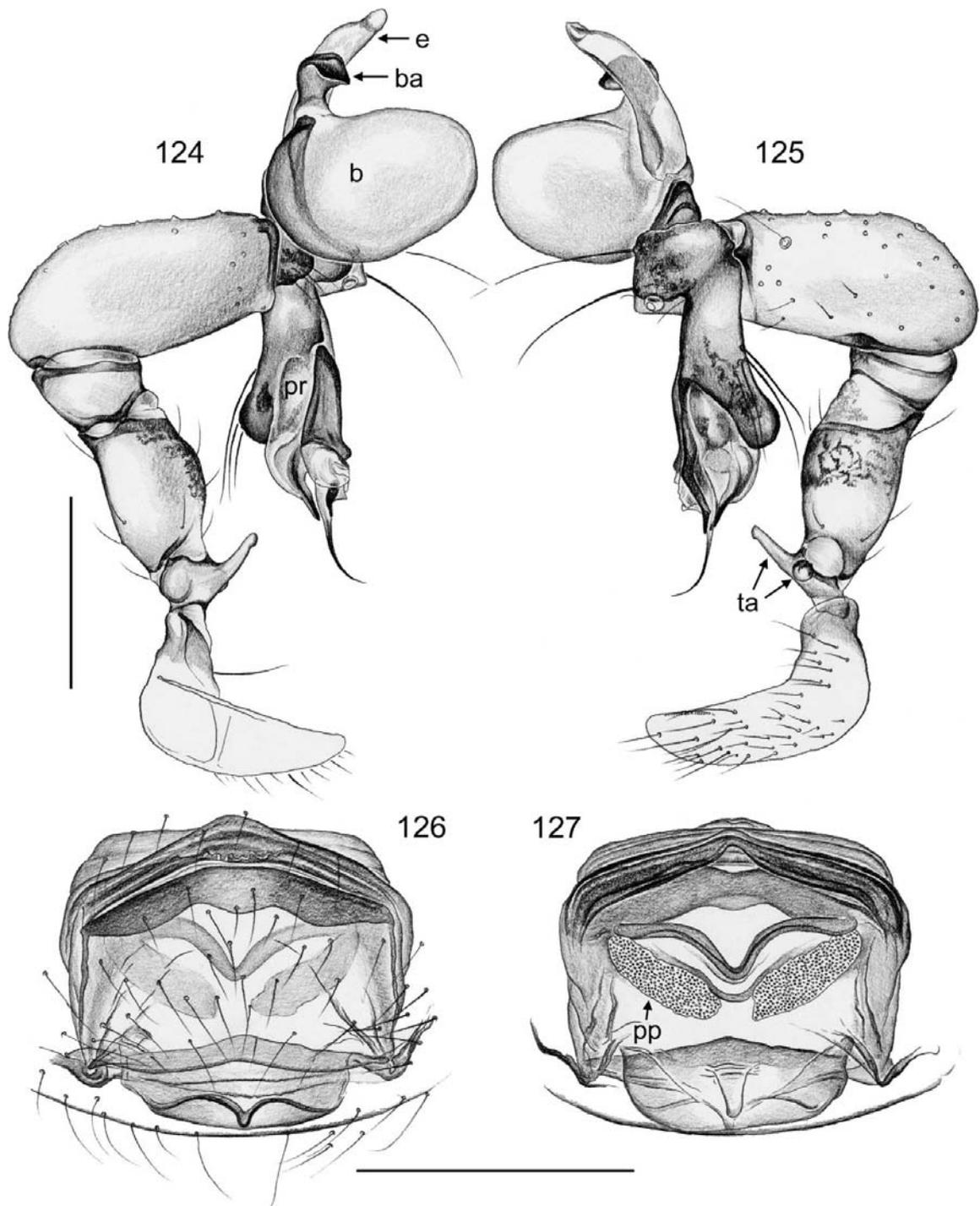
The species name is taken from the type locality and used as a noun in apposition.

Diagnosis

Easily distinguished from known congeners by the strong median projection on the male clypeus (Figure 36), and the distally unmodified male chelicerae. A probably closely related, undescribed species (with very similar male palps and chelicerae) occurs in Ghana (deposited in MRAC), but in that species the male has paired clypeus projections (B.A. Huber, unpublished data).

Male (holotype)

Total body length 1.9, carapace width 0.7. Leg 1 missing, tibia 2: 2.9, tibia 3: 1.9, tibia 4: 2.8, tibia 2 L/d: 43. Habitus as in Figures 36 and 37; carapace whitish grey with black margin and short posterior line medially, ocular area and clypeus also mostly



Figures 124–127. *Spermophora dieke*. (124, 125) Left palp, prolateral and retrolateral views; (126, 127) Cleared female genitalia, ventral and dorsal views. Notes: b, bulb; ba, bulbal apophysis; e, embolus; pp, pore plate; pr, procursus; ta, trochanter apophysis. Scale lines: 0.3 mm.

black, chelicerae without black marks, sternum pale grey, legs pale ochre-yellow with black marks on femora and tibiae subdistally, abdomen whitish-grey with black marks dorsally and laterally, ventrally two pairs of black marks frontally. Distance PME–PME 115 μ m, diameter PME 105 μ m, distance PME–ALE 35 μ m, no trace of AME. Each triad slightly elevated. No thoracic furrow, only median dark line.

Clypeus with distinctive median projection with bifid tip. Chelicerae without distal modification, only pair of light proximo-lateral apophyses. Sternum wider than long (0.55/0.40), unmodified. Palps as in Figures 124 and 125, coxa unmodified, trochanter with long ventral and retrolateral apophyses, procurus with retrolatero-ventral flap, distally complex with long sclerotized filament, bulb with proximal sclerite, membranous embolus and sclerotized hooked bulbal apophysis. Legs without spines and curved hairs, few vertical hairs; retrolateral trichobothrium on tibia 2 at 10%; tarsal pseudosegments indistinct, distally ~10 visible in dissecting microscope.

Female

In general similar to male (Figure 39), triads only slightly closer together (distance PME–PME 95 µm), clypeus unmodified. Tibia 1: 4.4 (missing in other female); tibia 2: 2.6, 2.3. The two females differ in extent of black pigment: darker female with black sternum and more spots dorsally on abdomen. Epigynum light brown, trapezoidal, weakly protruding, frontal internal structures visible through cuticle (Figures 38, 126); internal genitalia as in Figures 40 and 127.

Distribution

Known from type locality in Guinea only (Figure 150).

Material examined

GUINEA: *Guinée Forestière*: Forêt Classée de Diéké, male holotype above; same data, 2 ♀ in pure ethanol, in ZFMK.

Pehrforsskalia conopyga Deeleman-Reinhold and van Harten, 2001
(Figures 13, 41–44, 128–147, 151)

Pehrforsskalia conopyga Deeleman-Reinhold and van Harten 2001, p. 204–206, figs 30–37.

Types

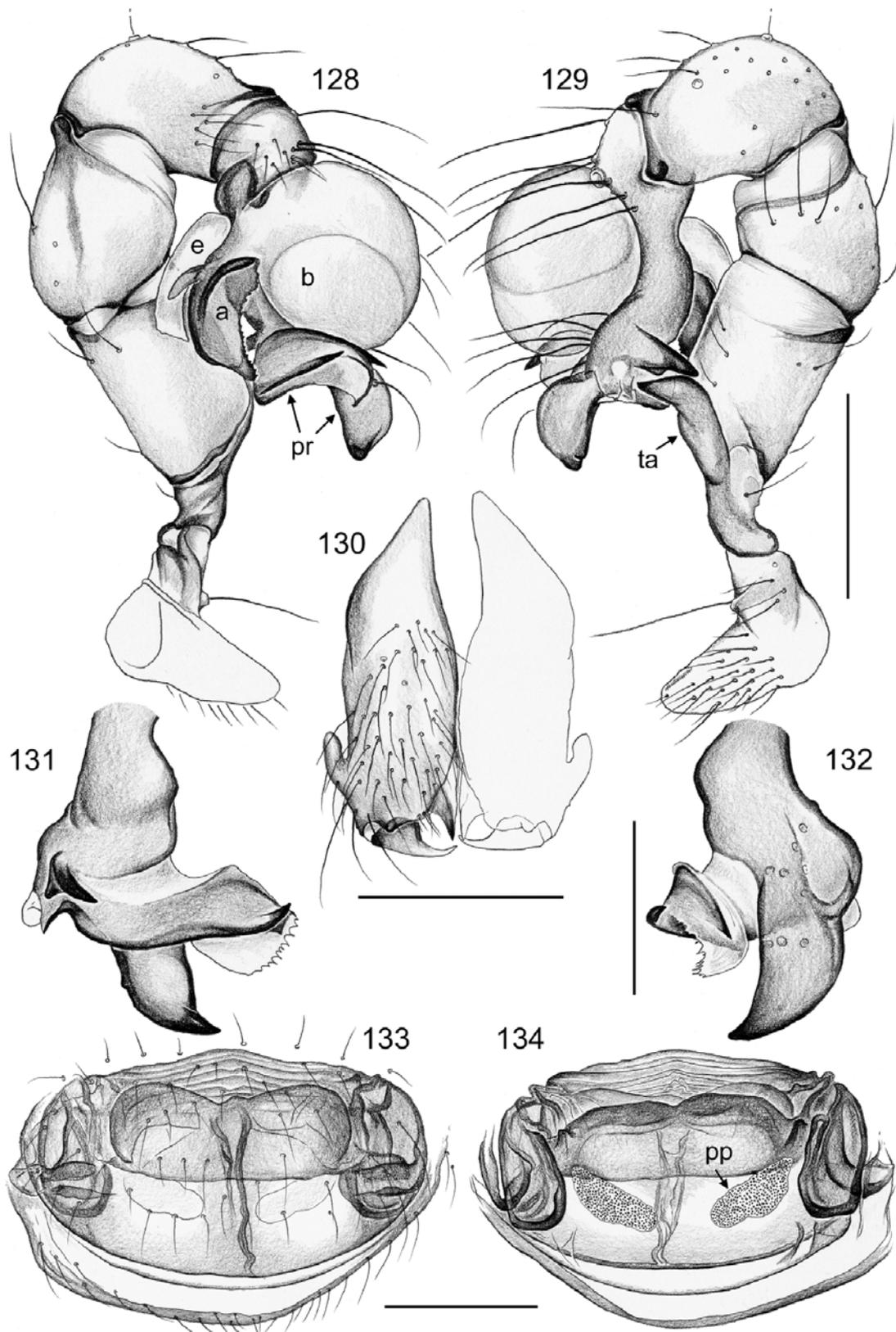
Male holotype and 8 female paratypes from Hamam ‘Ali (14°41’N, 44°08’E), Yemen; 1600 m a.s.l., vegetation bordering citrus plantation, 19.viii.1998 (A. van Harten), in RMNH, not examined.

Diagnosis

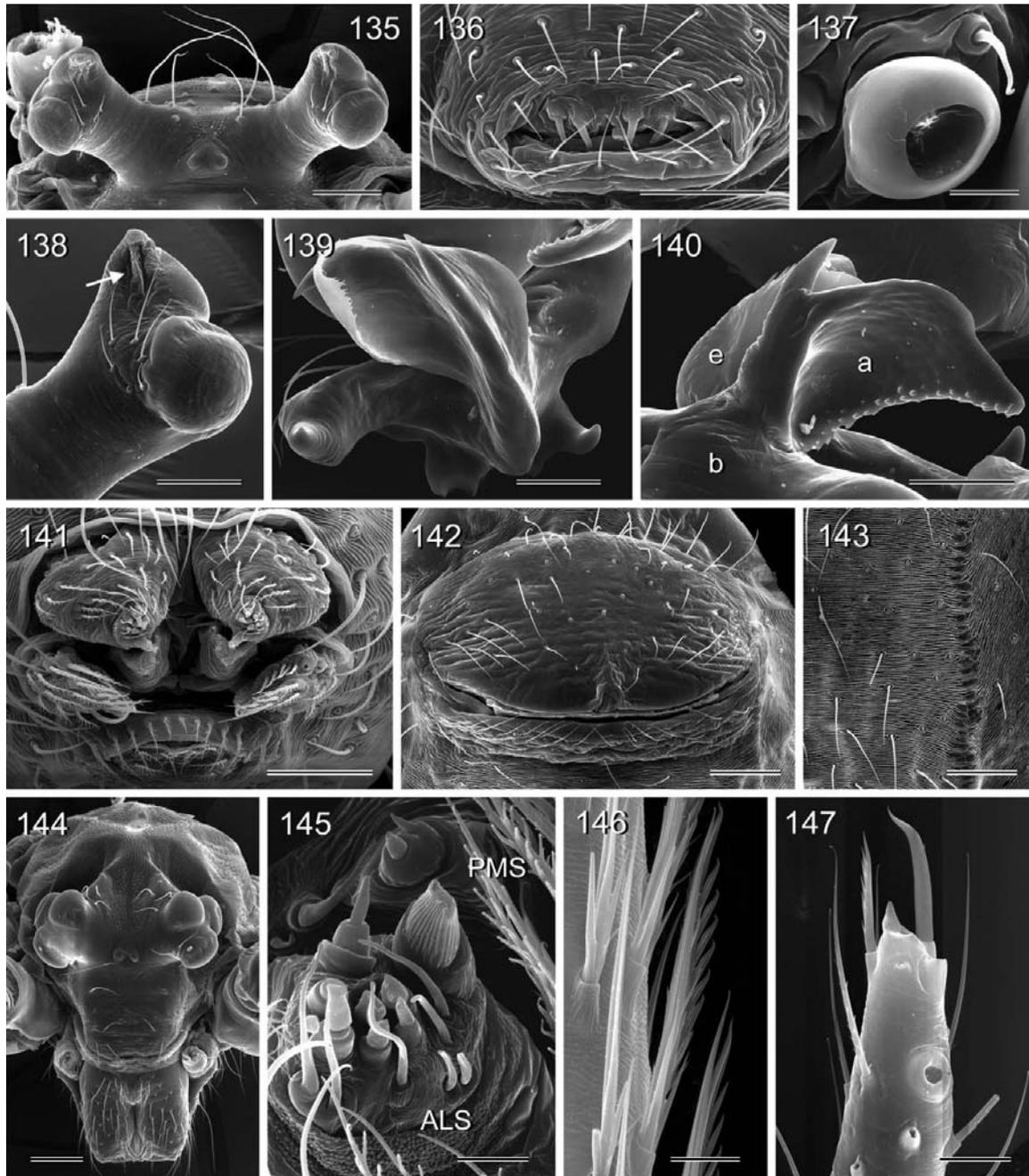
Easily distinguished from other pholcines by the unique palpal morphology (trochanter apophysis, procurus, bulbal apophysis; Figures 128, 129). Two closely related undescribed species occur in Mozambique and Tanzania (B.A. Huber, unpublished data); they differ by the shape of the procuri.

Male (Okavango)

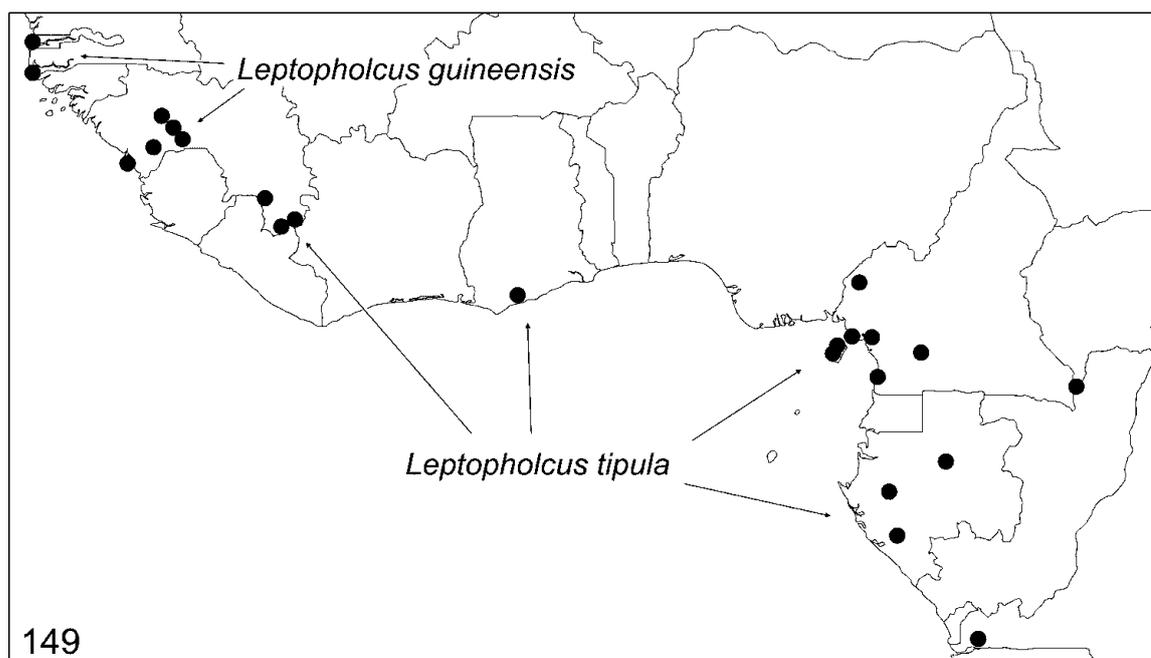
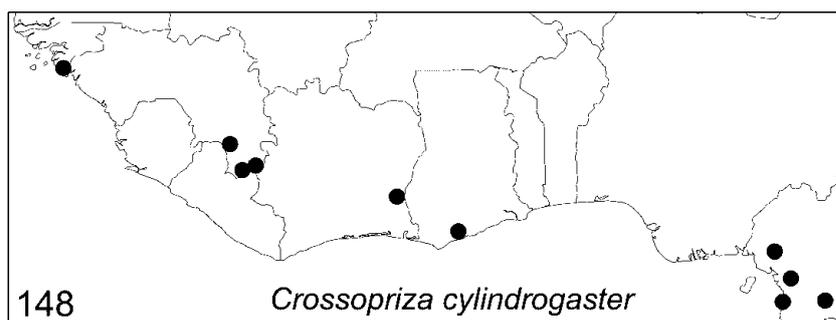
Total body length 2.5, carapace width 0.7. Leg 1: 21.9 (5.7 + 0.3 + 5.5 + 8.9 + 1.5), tibia 2 missing, tibia 3: 1.9, tibia 4: 2.7, tibia 1 L/d: 89. Habitus as in Figures 41 and 42; carapace pale ochre-yellow with brown median band widening posteriorly, ocular



Figures 128–134. *Pehrforsskalia conopyga*. (128, 129) Left palp, prolatral and retrolateral views; (130) male chelicerae, frontal view; (131, 132) left procursus, ventral (131) and prolatero-dorsal (132) views; (133, 134) cleared female genitalia, ventral and dorsal views. Notes: a, appendix; b, bulb; e, embolus; pp, pore plate; pr, procursus; ta, trochanter apophysis. Scale lines: 0.2 mm (130–134), 0.3 mm (128, 129).

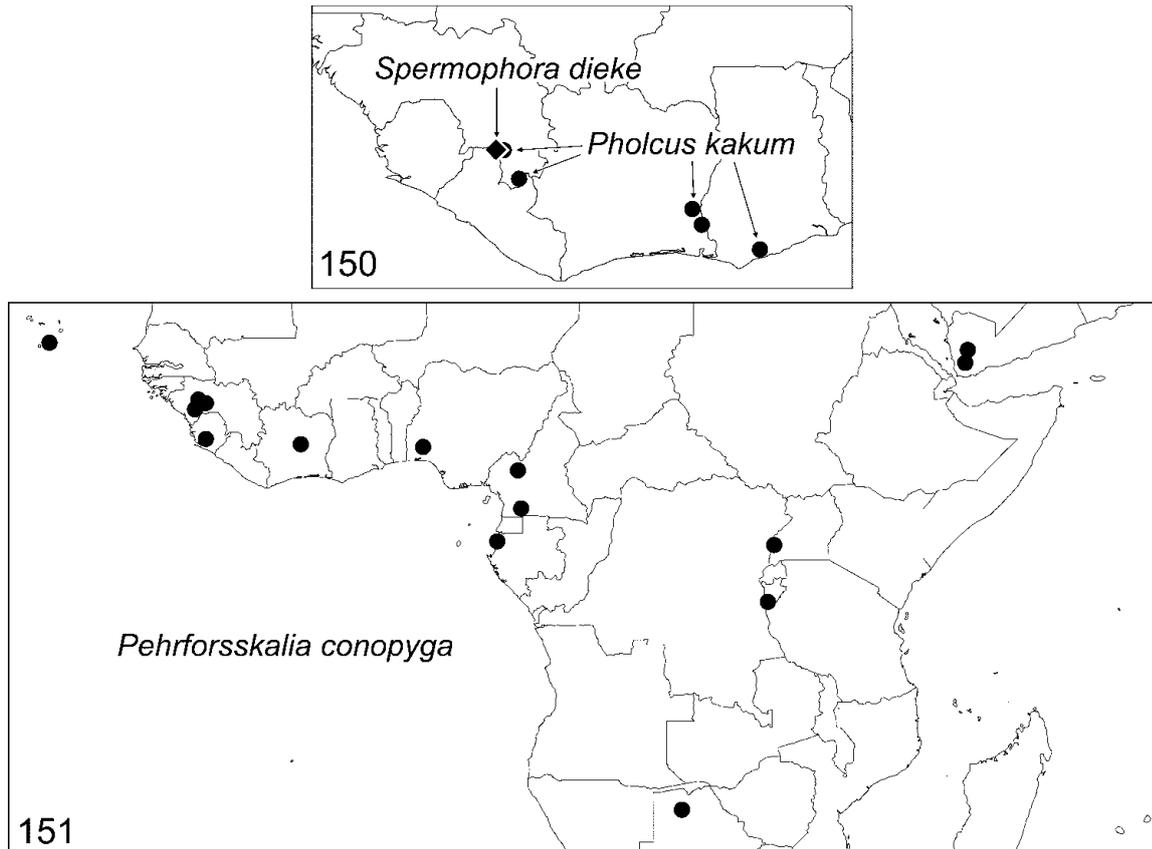


Figures 135–147. *Pehrforsskalia conopyga*. (135) Male ocular area, frontal view; (136) male gonopore with epiandrous spigots; (137) left male palpal tarsal organ; (138) left male eye stalk, frontal view (arrow points to possibly extensible area); (139) right procurus, distal view; (140) right appendix, prolateral view; (141) male spinnerets; (142) epigynum; (143) cuticular sculpturing on female abdomen, showing difference in ventral (left) and lateral (right) pattern (frontal side on top); (144) female prosoma, frontal (slightly dorsal) view; (145) female ALS and PMS; (146) comb hair on female left tarsus 4, prolateral view; (147) female palpal tarsus. Notes: a, appendix; b, bulb; e, embolus. Scale lines: 10 μm (137, 145, 146), 20 μm (147), 60 μm (136, 138–141), 100 μm (135, 142–144).



Figures 148–149. Known distributions of *Crossopriza cylindrogaster* and the two *Leptopholcus* species treated herein.

area and clypeus not darkened, sternum whitish, legs monochromous pale ochre-yellow, abdomen grey with some poorly visible marks dorsally and laterally. Distance PME–PME 400 μm , diameter PME 80 μm , distance PME–ALE 25 μm , distance AME–AME 35 μm ; diameter AME \sim 20 μm (lenses apparently present). Ocular area elevated, each triad on distinct stalk with cone-shaped projection medially of PME (with possibly expansible cuticle; Figures 135, 138), few stronger hairs posteriorly on ocular area. No thoracic furrow, clypeus unmodified. Chelicerae as in Figure 130, with unsclerotized lateral apophyses distally. Sternum wider than long (0.52/0.48), unmodified. Palps as in Figures 128 and 129, coxa with indistinct retrolateral projection, trochanter with distinctive apophysis that appears fused to femur, femur otherwise not modified, tarsal organ capsulate (Figure 137), procurus complex, distally with two main branches (one of them provided with two spine-like processes) and a black apophysis at their basis (Figures 131, 132, 139), bulb with simple, weakly sclerotized embolus, only one sclerotized projection with dorsal branch (Figures 128, 140; Deeleman-Reinhold and van Harten 2001 considered this to be homologous with the *Pholcus uncus*, but the position rather agrees with the appendix). Legs without spines and curved hairs, few vertical hairs; retrolateral trichobothrium on



Figures 150–151. Known distributions of *Spermophora dieke*, *Pholcus kakum*, and *Pehrforsskalia conopyga*. For *Nyikoa limbe*, see Huber (2007).

tibia 1 at 5%; prolateral trichobothrium missing on tibia 1, seen on tibiae 3 and 4; tarsal pseudosegments not visible in dissecting microscope. Spinnerets as in Figure 141; ALS with one widened, one pointed, and six cylindrically-shaped spigots; PMS with two small spigots. Gonopore with four epiandrous spigots (Figure 136).

Variation

In some males, median band on carapace extends to ocular area (Figure 41); patellae and tibia–metatarsus joints usually light brown; marks on abdomen variably distinct, sometimes missing. Tibia 1 in seven other males: 4.9–6.3 (mean 5.4).

Female

In general similar to male but triads closer together (distance PME–PME 170 μm) and not on stalks, ocular area only slightly elevated (Figure 144). Tibia 1 in 16 females: 3.8–5.1 (mean 4.5). Epigynum simple oval plate externally (Figures 43, 142), with distinctive internal structures visible through cuticle (Figure 133); internal genitalia as in Figures 44 and 134. Tip of palpal tarsus ending in sclerotized cone accompanied by several strong bristles (Figure 147). Spinnerets and spigots as in male (Figure 145). Tarsus 4 with ventral row of comb-hairs (Figure 146).

Distribution

Widely distributed in Africa and Yemen (Figure 151). It is here newly recorded from Guinea, Sierra Leone, Côte d'Ivoire, Cameroon, Gabon, Uganda, Burundi, and Botswana.

Material examined

CAPE VERDE: S Tiago, São Jorge dos Orgaos [15°03'N, 23°37'W, 500 m a.s.l.], in grass in irrigation ditch, 31.i.1984 (J. Prinsen), 1 ♂ in RMNH; São Jorge dos Orgaos, xii.1999 (A. van Harten), 1 ♂ 5 ♀ in RMNH.

GUINEA: *Moyenne-Guinée*: near Sêbori, forest outside of cave (10°46.6'N, 12°17.4'W), 1010 m a.s.l., 22.xi.2008 (B.A. Huber), 1 ♂ in ZFMK; same data, 5 ♀ in pure ethanol, in ZFMK; near Doucki (10°59.0'N, 12°37.9'W), gallery forest, 990 m a.s.l., 23.xi.2008 (B.A. Huber), 1 ♂ in pure ethanol, in ZFMK. *Basse-Guinée*: near Koumbaya (10°09.9'N, 12°53.2'W), forest, 230 m a.s.l., 19.xi.2008 (B.A. Huber), 4 ♂ 2 ♀ in pure ethanol, in ZFMK.

SIERRA LEONE: "Mcy", E. Simon collection no. 15371, no further data, 1 ♀ in MNHN.

CÔTE D'IVOIRE: Bouaké [~7°41'N, 5°02'W], Expt. Warda, 29.vii.1994 (A. Russell-Smith), 1 ♂ in ZFMK; same locality, viii.1994 (A. Russell-Smith), 1 ♂ 7 ♀ in ZFMK.

NIGERIA: north of Ibadan, IITA (International Institute for Tropical Agriculture) [7°29.6'N, 3°53.4'E], fallow bush, 22.iv.1994 (A. Russell-Smith), 3 ♂ 2 ♀ in ZFMK; same locality, "RD verges", 15.v.1974 (A. Russell-Smith), 1 ♂ in BMNH.

CAMEROON: *South Region*: near Ebolowa (2°54.9'N, 11°08.3'E), 620 m a.s.l., underside of banana leaf, 12.iv.2009 (B.A. Huber), 1 ♂ in ZFMK. *Northwest Region*: near Bamenda, under trash and logs at roadside (6°00.5'N, 10°18.1'E), 1750 m a.s.l., 16./18.iv.2009 (B.A. Huber), 2 ♀ in pure ethanol, in ZFMK. Near Oku (6°14.2'N, 10°31.5'E), ~2200 m a.s.l., in pile of dead leaves on ground, 17.iv.2009 (B.A. and J.C. Huber), 2 ♀ in pure ethanol, in ZFMK.

GABON: Cap Santa Clara [0°31.6'N, 9°19.2'E], forest, 29.ix.1985 (A. Pauly), 1 ♂ in MRAC (172943).

UGANDA: Ruwenzori [~0.2°N, 30°E], 1952 (G.O. Evans), 3 ♂ 4 ♀ in BMNH.

BURUNDI: Cabara [4°06.8'S, 29°31.7'E], Miombo woodland, with *Brachystegia*, by hand, 850 m a.s.l., 23.iv.2002 (B. Nzigidahera), 1 ♂ (with one teratological palp) in MRAC (213920).

BOTSWANA: Okavango Delta, grassland on Boro River [~19°34'S, 23°03'E], "at KB 347", 23.xii.1977 (A. Russell-Smith), 1 ♂ in ZFMK.

Nyikoa limbe Huber, 2007

(Figure 14)

Nyikoa limbe Huber, 2007, p. 26–30, figs 2–3, 13–31.

New records

GUINEA: *Guinée Forestière*: Forêt Classée de Diéké (7°32.0'N, 8°49.9'W), 430 m a.s.l., 1.xii.2008 (B.A. Huber), 1 ♀ in ZFMK; same data, 3 ♂ 2 ♀ 2 juv. in pure ethanol, in ZFMK.

CAMEROON: *South Region*: near Kribi (2°54.0'N, 9°54.4'E), 20 m a.s.l., 9.iv.2009 (B.A. Huber), 15♂ 15♀ in ZFMK; same data, 4♂ 6♀ in pure ethanol, in ZFMK. Near Ebolowa, Nkoetye (2°51.4'N, 11°21.7'E), 700 m a.s.l., 12.iv.2009 (B.A. and J.C. Huber), 2♀ in pure ethanol, in ZFMK. *Centre Region*: near Yaoundé, Mt. Kala (3°51.0'N, 11°20.3'E), 730 m a.s.l., 14.iv.2009 (B.A. Huber), 13♂ 12♀ in ZFMK; same data, 2♀ 1 juv. in pure ethanol, in ZFMK. *Littoral Region*: near Edéa, Koukoué (3°41.2'N, 10°06.4'E), 50 m a.s.l., 8.iv.2009 (B.A. and J.C. Huber), 1♂ 4♀ in pure ethanol, in ZFMK.

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