

The family Ctenobelbidae (Acari, Oribatida), with description of a new species and discussion on systematic placement and taxonomic status of the genus *Berndamerus* Mahunka, 1977

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Abstract

The oribatid mite genus *Berndamerus* Mahunka, 1977 is transferred into the family Ctenobelbidae as the subgenus *Ctenobelba* (*Berndamerus*) Mahunka, 1977, **stat. n.** from the family Amerobelbidae. The known species of *Berndamerus* combined: *C. (B.) bicostata* (Berlese, 1910), **comb. n.**, *C. (B.) eremuloides* (Berlese, 1910), **comb. n.**, *C. (B.) hellenica* (Mahunka, 1977), **comb. n.** A new species, *Ctenobelba* (*Berndamerus*) *bugiamapensis* **sp. n.**, is described from soil, Bu Gia Map National Park, southern Vietnam. It differs from the other species of the subgenus by the heterotrichy of notogastral setae, presence of adanal neotrichy and localization of adanal lyrifissures. Ctenobelbidae is recorded in Vietnam for the first time. A new diagnosis of the family Ctenobelbidae and the identification keys to the known subgenera of the genus *Ctenobelba* and species of the subgenus *Ctenobelba* (*Berndamerus*) are provided.

Keywords

Oribatid mites, Ctenobelbidae, *Ctenobelba*, *Berndamerus*, new status, new combination, new species, key, Vietnam

Introduction

The family Ctenobelbidae is monotypic, presented by the genus *Ctenobelba* Balogh, 1943 (Balogh 1943) with *Eremobelba pectinigera* Berlese, 1908 (Berlese 1908) as type species. Currently, the genus *Ctenobelba* comprises 32 species, which are distributed in the Palaearctic and Oriental regions (Subías 2004, online version 2013), and five subgenera: *Ctenobelba* (*Ctenobelba*) Balogh, 1943 (with 22 species), *C. (Aokibelba)* Subías & Shtanchaeva, 2013 (five species), *C. (Berndamerus)* Mahunka, 1977, stat. n. (three species), *C. (Bifurcobelba)* Subías & Shtanchaeva, 2010 (one species) and *C. (Caucasiobelba)* Subías & Shtanchaeva, 2010 (one species). The main morphological characters of *Ctenobelba (Berndamerus)* stat. n. were summarized by Mahunka (1977); *C. (Aokibelba)*, *C. (Bifurcobelba)* and *C. (Caucasiobelba)* – by Subías and Shtanchaeva (2010, 2013).

The primary purpose of paper is to discuss the systematic placement and taxonomic status of the subgenus *Ctenobelba (Berndamerus)* stat. n., which was described as the genus *Berndamerus* Mahunka, 1977 of the family Amerobelbidae.

During taxonomic survey of oribatid fauna of the Bu Gia Map National Park in southern Vietnam (a brief geographical and floristic descriptions of this park was given earlier – Ermilov et al. 2012a), we found a new species of *Ctenobelba (Berndamerus)* stat. n. It is a first representative of the Ctenobelbidae recorded from Vietnam. The secondary purpose of the present paper is to describe and illustrate this new species.

We provide a new diagnosis of the family Ctenobelbidae and present the identification keys to the known subgenera of the genus *Ctenobelba* and species of the subgenus *Ctenobelba (Berndamerus)* stat. n.

Material and methods

Six specimens (holotype: male; five paratypes: four females and one male) of *Ctenobelba (Berndamerus) bugiamapensis* sp. n.: southern Vietnam, Binh Phuoc Province, Bu Gia Map National Park, 12°12'N, 107°12'E, 350 m a.s.l., dark loamy soil, 13.XI.2013 (collected by A.E. Anichkin and S.G. Ermilov).

Soil samples were collected by taking 10 soil cores (diameter: 7.8 cm; depth: 10 cm). The samples collected were left in the metal cores to minimize disturbance during transportation from the field to the laboratory. Oribatid mites were extracted into 75 per cent ethanol using Berlese's funnels with electric lamps (40 W) during ten days. Specimens of the new species were found in three samples out of 10.

Holotype and paratypes were mounted in lactic acid on temporary cavity slides for measurement and illustration. The body length was measured in lateral view, from the tip

of the rostrum to the posterior edge of the ventral plate. The notogastral width refers to the maximum width in dorsal aspect (without pteromorphs). Lengths of body setae were measured in lateral aspect. All body measurements are presented in micrometers. Formulae for leg setation are given in parentheses according to the sequence trochanter–femur–genu–tibia–tarsus (femulus included). Formulae for leg solenidia are given in square brackets according to the sequence genu–tibia–tarsus. General terminology used in this paper follows that of Grandjean (summarized by Norton and Behan-Pelletier 2009).

Results

Systematic placement and taxonomic status of the genus *Berndamerus* Mahunka, 1977

Mahunka (1977) described the genus *Berndamerus* with *Berndamerus hellenicus* Mahunka, 1977, as the type species, and included it in the family Amerobelbidae. Later, Mahunka and Mahunka-Papp (1995), Subías (2004), Ermilov (2011) supported *Berndamerus* in this family.

However, mites of the family Amerobelbidae differ from those of the family Ctenobelbidae by an important morphological character – absence (versus presence) of prodorsal costulae (Norton and Behan-Pelletier 2009). All species of *Berndamerus* are with well developed costulae. Therefore inclusion of this genus in Amerobelbidae is doubtful. Thus, we suggest the genus *Berndamerus* should be transferred to the family Ctenobelbidae.

The main generic morphological character of *Berndamerus* is the arrangement of notogastral setae (located dorsally, usually in two longitudinal rows). This character state is not an apomorphy, because it is inherent also for some other taxa in the Ameroidea, including the ctenobelbid subgenus *Ctenobelba* (*Caucasiobelba*) Subías & Shtanchaeva, 2010. Thus, the generic status of *Berndamerus* cannot be supported, and we consider that it should be included as the subgenus in the genus *Ctenobelba*, differing from *Ctenobelba* (*Caucasiobelba*) by the absence of reticulate body surface: *Ctenobelba* (*Berndamerus*) Mahunka, 1977 stat. n. Hence, all species of *Berndamerus* also should be combined in *Ctenobelba* (*Berndamerus*): *C. (B.) bicostata* (Berlese, 1910) comb. n. (see Berlese 1910a; Mahunka and Mahunka-Papp 1995), *C. (B.) eremuloides* (Berlese, 1910) comb. n. (see Berlese 1910b; Mahunka and Mahunka-Papp 1995), *C. (B.) hellenica* (Mahunka, 1977) comb. n. (see Mahunka 1977).

Ctenobelba (*Berndamerus*) *bugiamapensis* sp. n.

<http://zoobank.org/03D1D2DB-8CE5-441F-B7CA-E95A4C5D5980>

http://species-id.net/wiki/Ctenobelba_bugiamapensis

Figs 1–9

Diagnosis. Body length 315–365 × 199–232. Dorsal body surface smooth, ventral body surface microfoveolate. Rostrum rounded. Transcostula poorly developed. All prodorsal

setae setiform, barbed; lamellar setae longest and thickest. Sensilli setiform, ciliate Notogastral setae *c* longest, barbed; p_1 – p_3 of medium size, barbed; other setae short, smooth. Setae *c*, *la*, *lm* inserted in one longitudinal row; *lp*, h_2 , h_3 inserted close to each other. Aggenito-adanal neotrichy present: eight pairs of setiform, barbed setae developed.

Description. *Measurements.* Body length: 348 (holotype), 315–365 (five paratypes); notogaster width: 215 (holotype), 199–232 (five paratypes).

Integument. Body color yellow-brownish to brown. Dorsal body surface smooth; ventral body surface (including subcapitular mentum, genital and anal plates) microfoveolate (diameter of foveolae up to 0.5), which is visible only under high magnification ($\times 1500$). The region adjacent to the anal aperture striate.

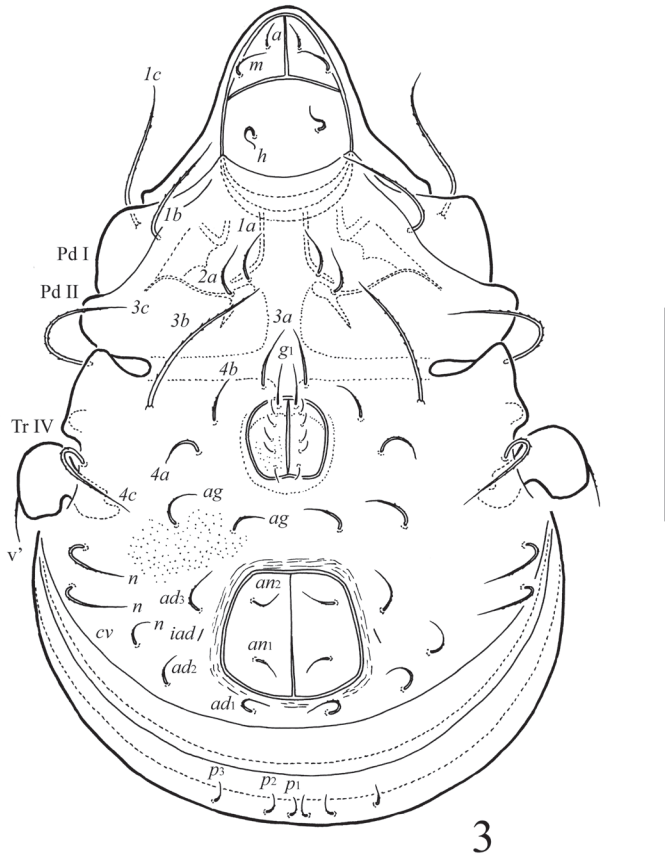
Prodorsum. Rostrum rounded. Costulae (*cos*) well developed, almost straight, as long as half of prodorsum (in lateral view). Transcostula (*tcos*) present, poorly visible. All prodorsal setae setiform, barbed: rostral setae (*ro*, 36–41) thin, inserted dorso-laterally; interlamellar setae (*in*, 73–82) slightly thicker than rostral setae, inserted posteriorly to costulae; lamellar setae longest (*le*, 94–98) and thickest, inserted on the costular tips; exobothridial setae shortest (*ex*, 24–32) and thinnest, inserted laterally on prodorsum. Sensilli (*ss*, 114–118) setiform, thickened, ciliate unilaterally. Lateral carinae (not tutoria) distinct (*car*).

Notogaster. Anterior border straight, slightly developed, with one pair of blunt-ended medial condyles. One pair of short humeral cristae present. Ten pairs of notogastral setae present: *c* (36–41) and p_1 – p_3 (18–20) setiform, thin, barbed; other setae short (6–8), smooth. Setae *c*, *la*, *lm*, *lp*, h_2 , h_3 located dorsally: *c*, *la*, *lm* inserted in one longitudinal row; *lp*, h_2 , h_3 inserted close to each other. Setae h_1 located dorso-posteriorly. Setae p_1 – p_3 located posteriorly, in one transverse row; p_1 inserted close to each other. Opisthonotal gland openings (*gla*) small, located laterally to setae *lm*. Lyrifissures *ia* located posteriorly to cristae. Lyrifissures *im*, *ip*, *ih* located dorso-laterally, *ips* – posteriorly; all nearly to muscle sigillar band. Circumventral carina (*cv*) distinct.

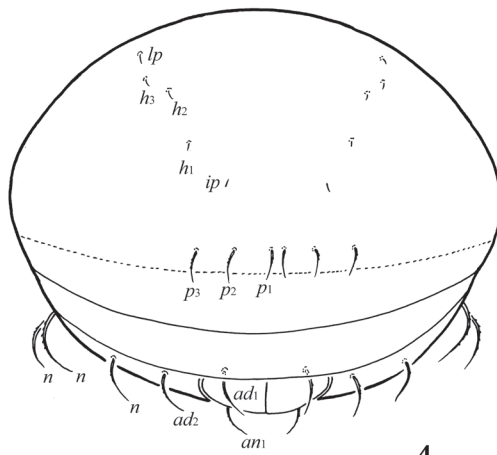
Gnathosoma. Morphology of subcapitulum, palps and chelicerae typical for *Ctenobelba* (Ermilov et al. 2012b). Subcapitulum longer than wide: 73–82 \times 53–57. Subcapitular setae setiform, barbed; *h* and *m* (both 24–26) longer than *a* (12–16). Adoral setae absent. Palps (49–53) with setation 0–2–1–3–8(+ ω). Solenidion long, thickened, not fused with *acm*, pressed to surface of palptarsus. Chelicerae (82–86) with two long, setiform, barbed setae; *cha* (24–26) longer than *chb* (16–18). Trägårdh's organ (Tg) distinct.

Lateropodosomal and epimeral regions. Pedotecta I (Pd I), II (Pd II) large, scale-like. Apodemes I, II well developed; sejugal apodemes absent, represented only epimeral borders. Epimeral setal formula: 3–1–3–3. Setae setiform, barbed: *1b*, *1c*, *3b*, *3c*, *4c* longer (73–77) and thicker than other (32–41).

Anogenital region. All anogenital setae setiform, barbed. Six pairs of genital (g_1 , 20–24; g_2 – g_6 , 12) and two pairs of anal (an_1 , an_2 , 20–24) setae short; genital setae inserted in one longitudinal row. Eight pairs of aggenito-adanal setae present (from these: two pairs of aggenital setae, *ag*; three pairs of adanal setae, ad_1 – ad_3 ; three pairs of additional, neotrichial setae, *n*). Two pairs of lateral neotrichial setae longer (53–61) than other (32–41). Lyrifissures *iad* located in inverse apoaanal position, distanced from the anal plates.

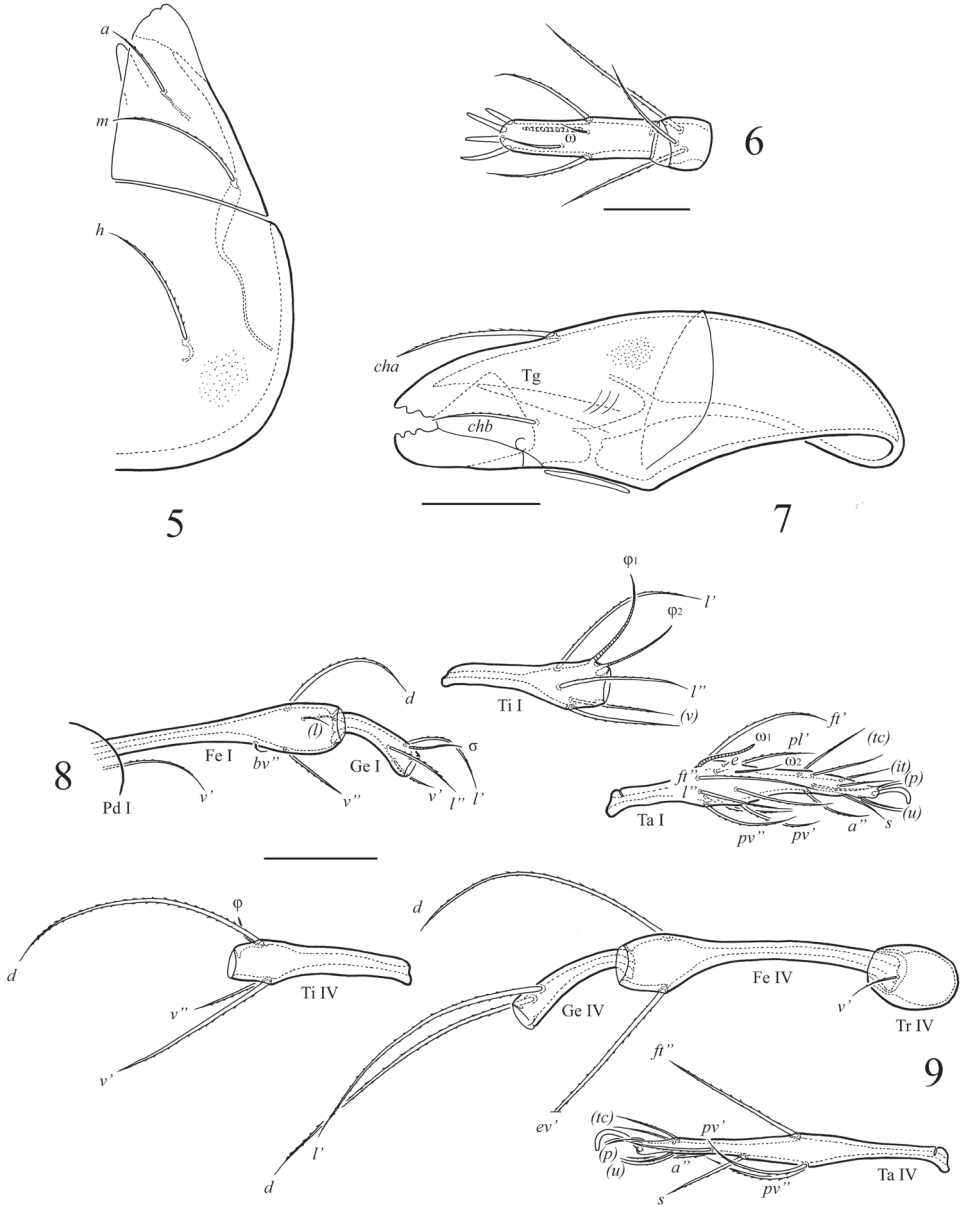


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Figures 3–4. *Ctenobelba (Berndamerus) bugiamapensis* sp. n.: **3** ventral view (legs except trochanter IV not shown) **4** posterior view. Scale bar 100 μ m.



Figures 5–9. *Ctenobelba (Berndamerus) bugiamapensis* sp. n., adult: **5** subcapitulum, left half, ventral view **6** tibia and tarsus of palp **7** chelicera **8** leg I (trochanter and basal part of femur not shown), right, antiaxial view **9** leg IV, right, antiaxial view. Scale bar 20 μ m (5, 7); 10 μ m (6); 50 μ m (8–9).

Legs. Claw of each leg smooth. Morphology of leg segments, setae and solenidia typical for *Ctenobelba* (Ermilov et al. 2012b). Formulae of leg setation and solenidia: I (1–5–3–4–20) [1–2–2], II (1–5–3–4–15) [1–1–2], III (2–3–2–3–15) [1–1–0], IV

Table 1. Leg setation and solenidia of adult and tritonymph *Ctenobelba* (*Berndamerus*) *bugiamapensis* sp. n.

Leg	Trochanter	Femur	Genus	Tibia	Tarsus
I	<i>v</i> '	<i>d</i> , (<i>l</i>), <i>bv</i> "', <i>v</i> "'	(<i>l</i>), <i>v</i> '', σ	(<i>l</i>), (<i>v</i>), φ_1 , φ_2	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), <i>v</i> '', (<i>pl</i>), <i>l</i> "', <i>e</i> , ω_1 , ω_2
II	<i>v</i> '	<i>d</i> , (<i>l</i>), <i>bv</i> "', <i>v</i> "'	(<i>l</i>), <i>v</i> '', σ	(<i>l</i>), (<i>v</i>), φ	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), ω_1 , ω_2
III	<i>l</i> '', <i>v</i> '	<i>d</i> , <i>l</i> '', <i>ev</i> '	<i>l</i> '', <i>v</i> '', σ	<i>l</i> '', (<i>v</i>), φ	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)
IV	<i>v</i> '	<i>d</i> , <i>ev</i> '	<i>d</i> , <i>l</i> '', <i>v</i> '	<i>l</i> '', (<i>v</i>), φ	<i>ft</i> "', (<i>tc</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)

Roman letters refer to normal setae (*e* to famulus), Greek letters to solenidia. Single prime (') marks setae on anterior and double prime (") setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

(1–2–3–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1. Setae setiform, barbed (except smooth *s* on tarsi I and *p*). Famulus (*e*) short, thin. Solenidia slightly thickened, blunt-ended.

Type deposition. The holotype (ethanol) is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; two paratypes (ethanol) are deposited in the collection of the Siberian Zoological Museum, Novosibirsk, Russia; three paratypes (ethanol) are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology. The specific name “*bugiamapensis*” refers to the Vietnamese park of origin, Bu Gia Map National Park.

Comparison. The new species is most similar to *Ctenobelba* (*Berndamerus*) *eremuloides* (Berlese, 1910) comb. n. in having the lamellar setae longer than rostral and interlamellar setae and the localization of notogastral setae, however, it differs from the latter by the smooth rostrum (versus with teeth), heterotrichy of notogastral setae (versus heterotrichy absent), aggenito-adanal region with eight pairs of setae (versus with six), and adanal lyrifissures located in inverse apoanal position (versus apoanal position).

New diagnosis of the family Ctenobelbidae

Prodorsum with long, parallel one pair of costulae. Rostrum rounded or dentate. Lamellar setae inserted on the costular ends. Sensilli bifurcate or setiform, with cilia (three to 25) or long branches unilaterally. Tutoria absent. Cerotegument presented by granules or reticulate ornamentation, rarely absent. Anterior margin of notogaster with one pair of tubercles. Ten pairs of notogastral setae present; they of diverse shape (thickened or leaf-like or with long, bent thin tip) or simple. Pedotecta I and II well developed. Epimeral formula: 3–1–3–3 (rarely: 3–1–3–4 or 3–1–4–4); epimeral setae *Ib* often longest, directed forward. Six pairs of genital, two to five aggenital (rarely more than five), two pair of anal and three pairs of adanal setae present (rarely more aggenital and adanal setae). Lyrifissures *iad* located posteriad to adanal setae *ad*₃. Solenidia of tibiae and genua not coupled with dorsal seta. Legs monodactylous.

Type genus: *Ctenobelba* Balogh, 1943. The genus having morphological features of the family.

Key to known subgenera of *Ctenobelba*

- 1 Aggenito-adanal region with strong neotrichy (more than 20 pairs of setae present)... **subgenus *Ctenobelba* (*Aokibelba*) Subías & Shtanchaeva, 2013**
 – Aggenito-adanal region with less than nine pairs of setae **2**
- 2 Sensilli bifurcate
 **subgenus *Ctenobelba* (*Bifurcobelba*) Subías & Shtanchaeva, 2010**
 – Sensilli setiform, with long branches or cilia unilaterally **3**
- 3 Body surface reticulate
 **subgenus *Ctenobelba* (*Caucasiobelba*) Subías & Shtanchaeva, 2010**
 – Body surface not reticulate..... **4**
- 4 Body surface without cerotegument; lamellar setae inserted at a distance from rostral and interlamellar setae on similar length
 **subgenus *Ctenobelba* (*Berndamerus*) Mahunka, 1977**
 – Body surface with cerotegument; lamellar setae inserted close to rostral setae and at a distance from interlamellar setae
 **subgenus *Ctenobelba* (*Ctenobelba*) Balogh, 1943**

Key to known species of *Ctenobelba* (*Berndamerus*)

- 1 Heterotrichy of notogastral setae present: *c* and p_1-p_3 of medium size, other setae minute; aggenito-adanal region with eight pairs of setae (including two pairs of aggenital setae), adanal neotrichy present; adanal lyrifissures located in inverse apoanal position; body size: 315–365 × 199–232 ***C. (Berndamerus) bugia-mapensis* sp. n.** (description see in this paper; distribution: southern Vietnam)
 – Heterotrichy of notogastral setae absent: all setae of medium size, similar in length; aggenito-adanal region with six to seven pairs of setae (including three to four pairs of aggenital setae), adanal neotrichy absent; adanal lyrifissures located in paraanal or apoanal position **2**
- 2 Rostrum with several teeth; lamellar setae longer than rostral and interlamellar setae; adanal lyrifissures located in apoanal position; body size: 450 × 220 ***C. (Berndamerus) eremuloides* (Berlese, 1910), comb. n.** (description see in Berlese (1910b), Mahunka and Mahunka-Papp (1995); distribution: southern Europe)
 – Rostrum rounded; lamellar setae shorter than rostral and interlamellar setae; adanal lyrifissures located in paraanal position **3**
- 3 Notogastral setae *la* inserted posteriorly to *c*, h_3 inserted antero-laterally to h_2 , h_2 distanced from *lm*; body size: 580 × 300..... ***C. (Berndamerus) bicostata* (Berlese, 1910), comb. n.** (description see in Berlese (1910a), Mahunka and Mahunka-Papp (1995); distribution: Mediterranean)
 – Notogastral setae *la* inserted latero-posteriorly to *c*, h_3 inserted anteriorly to h_2 , h_2 and *lm* located close to each other; body size: 648–664 × 328–344..... ***C. (Berndamerus) hellenica* (Mahunka, 1977), comb. n.** (description see in Mahunka (1977); distribution: Greece)

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Catalogue of the type material of Phlebotominae (Diptera, Psychodidae) deposited in the Instituto Evandro Chagas, Brazil

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Abstract

The available type material of Phlebotominae (Diptera, Psychodidae) deposited in the “Coleção de Flebotomíneos” of the Instituto Evandro Chagas (ColFleb IEC) is now presented in an annotated catalogue comprising a total of 121 type specimens belonging to 12 species as follow: *Nyssomyia richardwardi* (2 female paratypes), *Nyssomyia shawi* (9 male and 25 female paratypes), *Nyssomyia umbratilis* (female holotype and 1 female paratype), *Nyssomyia yuilli yuilli* (1 male and 1 female paratypes), *Pintomyia gruta* (1 male and 2 female paratypes), *Psychodopygus lainsoni* (2 male syntypes), *Psychodopygus leonidasdeane* (male holotype, female “allotype” and 45 female paratypes), *Psychodopygus llanosmartinsi* (2 female paratypes), *Psychodopygus wellcomei* (1 male and 4 female “syntypes”), *Trichophoromyia readyi* (male holotype, female “allotype” and 1 male paratype), *Trichophoromyia adelsonsouzai* (male holotype, 13 male 5 female paratypes), and *Trichophoromyia brachipyga* (1 male paratype).

Keywords

Collection, sand flies, taxonomy, leishmaniasis

Introduction

In the Americas, more than 450 species of the subfamily Phlebotominae Rondani, 1840 (Diptera: Psychodidae) have been described (Galati 2003) and 267 of these have so far been recorded in Brazil (Andrade et al. 2013). Phlebotomine sand flies play an important role in the transmission of virus, bacteria and protozoa, mainly *Leishmania* species. In Brazil six and eleven species have been incriminated or suspected, respectively, in the epidemiology of cutaneous leishmaniasis (Ready 2013). On the other hand and also in Brazil, the main vector of visceral leishmaniasis is the psychodid *Lutzomyia longipalpis* (Lutz & Neiva, 1912) while *L. cruzi* (Mangabeira, 1942) and *L. almerioi* Galati & Nunes, 1999 have been indicated as suspected vectors (Santos et al. 1998, Savani et al. 2009).

Biological collections are an important source of information on the composition, distribution and biological degree of biodiversity (Suarez and Tsutsui 2004). In addition, the types (the specimens described in the first published account of a new taxonomic group) deposited in these collections are the most valuable material for this information and their maintenance thus depends on financial support and curatorial care (NPS 2005).

In Brazil, there are six depositary institutions with type-species of sand flies. One of these is the “Coleção de Flebotomíneos” in the Instituto Evandro Chagas (IEC), known by the acronym “ColFleb IEC”, located in Ananindeua municipality, State of Pará. At present, this collection consists of approximately 140 *taxa* distributed in species and subspecies levels of Phlebotominae (Fraiha and Ryan 1986). Most of them were collected, mounted and deposited by previous researchers in the IEC during studies on the ecology and epidemiology of leishmaniasis in Amazonian Brazil (Lainson and Shaw 2005).

Some glass slide labels of non-type material revealed that the oldest specimens of this collection belong to the 1960's (TVS, personal observation). Although a total of 55 valid species have been described by researchers directly related to the Instituto Evandro Chagas between 1945 and 2014 (Fraiha and Ryan 1986, Santos et al. 2014), some of these type specimens seem to have been lost, such as *Evandromyia carmelinoi* (Ryan, Fraiha, Lainson & Shaw, 1986). According to original description, some paratypes of *Bichromomyia olmeca nociva* (Young & Arias, 1982) and *Psychodopygus yucumensis* (Le Pont, Caillard, Tibayrenc & Desjeux, 1986) should have been deposited in the Instituto Evandro Chagas collection, but not one of these has been found.

This study presents an annotated catalog of the type material of the Phlebotominae deposited at the ColFleb IEC to help entomologists searching for types.

Material and methods

Each type specimen was examined individually after checking the respective labels against original descriptions and additional bibliographical material. An active search

for glass slides stored in boxes of nontype material was undertaken and the slides carefully analyzed to avoid excluding types which might have been mislaid.

After screening and comparison with original drawings, the type status of the specimens was confirmed and those identified were reorganized in horizontal slide cabinets with red labels for holotypes/“allotypes”; and green labels for paratypes/“syntypes”. The list presents basic information directly from the original labels (species name, date, locality and collector/determinator). Although some types were originally classified using classical criteria (Lewis et al. 1977, Ready et al. 1980), this catalogue follows the phylogenetic classification proposed by Galati (1995). The article is presented in accordance with earlier lists of other insect groups (Zompro and Domenico 2005, Mello and Ziegler 2012, Reboleira et al. 2012). Image database and digitalization of information has been undertaken and the latter is available at Species Link Database (<http://splink.cria.org.br>).

The taxon and respective available data are listed below in alphabetical order of genus using the following format:

Binomial name Author, publication date.
Journal or Technical Bulletin, volume (number): pages.

Typology: Specimens’ number and gender. Information for all specimens was a direct copy of the labels with no modification. Labels are indicated by quotation marks (“ ”), with each line in the label separated by a double slash (//), and handwriting information in labels indicated by italics.

Type-locality: locality or municipality (geographical coordinates), State or department, country.

Original name: *as in the original description.*

Additional note: only Brazilian institutions were assessed. Characteristics of each type series were highlighted giving the number of slides and number of specimens mounted on them, mentioning if the specimens were dissected or remounted or the presence of a label on the slide.

Unusual abbreviations are listed below:

Coll.	collector
Coll. site	collection site
Det.	Determinator
Dept.	department
Met.	Method of capture
sp. n.	new species
rem.	remounted
SH.	Shannon trap
Sp.	species name

Results

The following annotated catalogue to each type species deposited in the ColFleb IEC (smlink.cria.org.br/) is given below.

List of type material

Nyssomyia richardwardi (Ready & Fraiha, 1981)

Revista Brasileira de Biologia 41(4): 705–712.

Paratypes: 1 female “Wellcome // Parasitology Unit // Slide n°44.17 // Sp *Lu. richardwardi* // Det: *Paratype* // Coll. Site Km 43 // Altamira- Itaituba // Pará- Brasil // Met. Igarapé // *Isca humana* // Date 21/8/1971” [ColFleb IEC 149]; 1 female “Wellcome // Parasitology Unit // Slide 44.18 // Sp *Lu. richardwardi* // Det: *Paratype* // Coll. Site Km 43 // Altamira- Itaituba // Pará- Brasil // Met. Igarapé // *Isca humana* // Date 21/8/1971” [ColFleb IEC 150].

Type-locality: km 43 of the Transamazonian Highway, between Itaituba (04°16'33"S; 55°59'02"W) and Altamira (03°11'41"S; 52°12'33"W) municipalities, State of Pará, Brazil.

Original name: *Lutzomyia richardwardi*.

Additional note: two slides.

Nyssomyia shawi (Fraiha, Ward & Ready, 1981)

Revista Brasileira de Biologia 41(4): 699–703.

Paratypes: 4 females “Wellcome // Parasitology Unit // Slide n°43. 'N' // Sp *Lu. shawi* // Det: *Paratype* // Coll. Site // Serra dos Carajás // Marabá, Pará // Met. *Isca humana* // Date 20/9/1974” [*N*°= slide n°43.15, 43.25, 43.28, 43.29] [ColFleb IEC 159– 162]; 8 females “Wellcome // Parasitology Unit // Slide 43'N' // Sp *Lu. shawi* // Det: *Paratype* // Coll. Site // Serra dos Carajás // Marabá- Pará // Met. *Isca humana* // Date 22/9/1974” [*N*°= slide n°43.09, 43.14, 43.16, 43.17, 43.23, 43.24, 43.26, 43.27] [ColFleb IEC 163–170]; 6 females “Wellcome // Parasitology Unit // Slide n°43'N' // Sp *Lu. shawi* // Det: *Paratype* // Coll. Site // Serra dos Carajás // Marabá- Pará // Met. *Isca humana* // Date 23/9/1974” [*N*°= slide n°43.02, 43.03, 43.04, 43.05, 43.07, 43.08] [ColFleb IEC 178– 183]; 7 females “Wellcome // Parasitology Unit // Slide 43. 'N' // Sp *Lu. shawi* // Det: *Paratype* // Coll. Site // Serra dos Carajás // Marabá- Pará // Met. *Isca humana* // Date 9/1974” [*N*°= slide n°43.01, 43.06, 43.12, 43.13, 43.18, 43.21, 43.22] [ColFleb IEC 171–177]; 9 males “Wellcome // Parasitology Unit // Slide n°43. 'N' // Sp *Lu. shawi* // Det: *Paratype* // (Serra dos carajás // Coll. Site Marabá- // Pará- Fevereiro 1975) // Met. Criado em lab. // Date Abril- Junho 1975 // R.D. Ward col.” [*N*°= slide n°43.44, 43.45, 43.48, 43.49, 43.50, 43.51, 43.53, 43.61, 43.62] [ColFleb IEC 184–192].

Type-locality: Serra dos Carajás (06°06'29"S; 50°18'36"W), Marabá municipality, state of the Pará, Brazil.

Original name: *Lutzomyia shawi*.

Additional note: 34 slides.

***Nyssomyia umbratilis* (Ward & Fraiha, 1977)**

Journal of Medical Entomology 14(3): 313–317.

Holotype: female “Wellcome // Parasitology Unit // *Lu. umbratilis* // Slide n° *Holótipo* // Sp 260.65 // Det.” [ColFleb IEC 145].

Paratype: 1 female “Wellcome // Parasitology Unit // Coll. Site *Area 2* // *Lu umbratilis* // *Jari* // Met. *Tree trunks* // Date 19/7/76 // *Lu. umbratilis*” [ColFleb IEC 146].

Type-locality: Monte Dourado (00°53'23"S; 52°36'08"W), locality, Almeirim municipality, state of Pará, Brazil.

Original name: *Lutzomyia* (*Nyssomyia*) *umbratilis*.

Additional note: The two females mounted on the same glass slide. The locality of Jari actually refers to Monte Dourado, in Almeirim municipality, State of Pará.

***Nyssomyia yuilli yuilli* (Young & Porter, 1972)**

Journal of Medical Entomology 9(6): 524–526.

Paratypes: 1 male “*Colombia* #179 // *Antioquia dept.*, // 24Km south and // 21 Km west of // *Zaragoza*. // in light trap // 3 may 1970 // coll: C.M. Porter // D L503-D1202-1 // *Lutzomyia* // *yuilli* // Young // Porter // Paratype // Det: D.G. Young” [ColFleb IEC 157]; 1 female “*Colombia* // *Antioquia dept.*, // 24Km south and // 21 Km west of // *Zaragoza*. // in light trap // 3 may 1970 // coll: C.M. Porter // D L503-D1202-1 // *Lutzomyia* // *yuilli* // Young // Porter // Paratype // Det: D.G. Young” [ColFleb IEC 156].

Type-locality: Zaragoza (07°29'23"N; 74°52'03"W), Antioquia Department, Colombia.

Original name: *Lutzomyia yuilli*.

Additional note: two slides.

***Pintomyia gruta* (Ryan, 1986)**

Flebótomos do Estado do Pará, Brasil (Diptera, Psychodidae, Phlebotominae). Documento Técnico. n°1, Instituto Evandro Chagas, Belém, Pará, 154 p.

Paratypes: 1 male “Wellcome ♂ // Parasitology Unit // Slide n° *Paratipo* // Sp *Lu. gruta* // Det: Lee Ryan // Coll. Site *Gruta* // *Carajás NI* // Met. CDC // Date: 28/3/1985” [ColFleb IEC 139]; 1 male “Wellcome ♂ // Parasitology Unit // *Paratipo* // Slide n° // Sp *Lu. gruta* // Det: Lee Ryan // Coll. Site *Gruta* // *Carajás NI* // Met. CDC // Date:

28.3.85" [ColFleb IEC 140]; 1 male "Wellcome ♂ // Parasitology Unit // *Paratipo* // Slide n° // Sp *Lu. gruta* // Det: Lee Ryan // Coll. Site *Gruta* // *Carajás NI* // Met. CDC // Date: 28.3.85" [ColFleb IEC 142]; 1 female "Wellcome ♀ // Parasitology Unit // *Paratipo* // Slide n° // Sp *Lu. gruta* // Det: Lee Ryan // Coll. Site *Carajás* // *NI Gruta no. 2* // Met. CDC // Date: 14/3/86" [ColFleb IEC 141]; 1 female "diss Wellcome ♀ // Parasitology Unit // Slide n° *Paratipo* // Sp *Lu. gruta* // Det: Lee Ryan // Coll. Site *Carajás* // *NI Gruta* // Met. CDC // Date: 10/2/1985" [ColFleb IEC 138].

Type-locality: Serra dos Carajás (06°06'29"S; 50°18'36"W), Marabá municipality, state of the Pará, Brazil.

Original name: *Lutzomyia gruta*.

Additional note: five slides. The term "diss" in the beginning of the label ColFleb IEC 183 refers to dissected specimens.

***Psychodopygus lainsoni* Fraiha & Ward, 1974**

Bulletin of Entomological Research 64: 209–212.

Syntypes: 1 male "*Psychodopygus* // *lainsoni* sp. n. // *Síntipo* ♂ - Km 46 // *Altamira-Itaituba* // *Rod. Transamazônica* // *Pará- Brasil Km 46 Altamira- Itaituba Rod. Transamazônica, Pará, Brasil* // *Criado em laboratório* // *Ps. lainsoni* ♂" [ColFleb IEC 131]; 1 male "*Psychodopygus* // *lainsoni* sp. n. // *Síntipo* ♂ - Km 46 // *Altamira- Itaituba* // *Rod. Transamazônica* // *Pará- Brasil Km 46 Altamira- Itaituba Rod. Transamazônica, Estado do Pará* // *Criado em laboratório*" [ColFleb IEC 132].

Type-locality: km 46 of the Transamazonian Highway, between Itaituba (04°16'33"S; 55°59'02"W) and Altamira (03°11'41"S; 52°12'33"W) municipalities, state of the Pará, Brazil.

Original name: *Psychodopygus lainsoni*

Additional note: one slide with two specimens. No label. Data written directly on the slide with white brush.

***Psychodopygus leonidasdeanei* Fraiha, Ryan, Ward, Lainson & Shaw, 1986**

Memórias do Instituto Oswaldo Cruz 81(3): 333–339.

Holotype: male "Wellcome // Parasitology Unit // Slide n°? // Sp *Lu. leonidasdeanei* // Det: Lee Ryan // Coll. Site *Santarém* // *Serra do BEC* // Met: SH (2) // 20/7/1984 // 18- 19hs" [ColFleb IEC 121].

Paratypes: 1 female "Wellcome // Parasitology Unit // Slide n° // Sp *Lu leonidas* // Det *deanei* // *Transamazônica* // Coll. Site *Km 112* // *Itaituba- Altamira* // Met: *isca humana* // 18:19hs // Date 30/11/71" [ColFleb IEC 130]; 42 females "Wellcome // Parasitology Unit // *Lu leonidasdeanei* // Slide n° // Sp // Det // Coll. Site *Km 112* // *Itaituba- Altamira* // Met: *Isca humana* // Date 3-4-75 // *Fraiha & Ward col.*" [ColFleb

IEC 1–6, 27, 31–33, 37, 39–42, 48, 50, 52, 53, 55, 56, 60–62, 64, 65, 67, 69–72, 77, 83, 97, 101, 102, 104, 106, 107, 117, 118, 120]; 1 female “Wellcome // Parasitology Unit // Lu leonidasdeanei // Slide n° // Sp // Det // Vicinal 11/13 Km 46 // Coll. Site Altamira // Itaituba- Lote 39 // Met: Isca humana // Date 18.12.73 // Fraiha col.” [ColFleb IEC 11]; 2 females “Wellcome // Parasitology Unit // Slide n°sp. grp. // Sp Lu. leonidasdeanei // Det Lee ryan // Coll. Site Santarém // Serra do BEC // Met SH (2) 18-19hs // date 10.7.1984 [ColFleb IEC 122 (allotype), 123].

Type-locality: Santarém (02°24'52"S; 54°42'36"W) municipality, State of the Pará, Brazil.

Original name: *Psychodopygus leonidasdeanei*

Additional note: To the male holotype the sentence “met: SH (2)” refers to Shannon trap with two collectors.

Psychodopygus llanosmartinsi Fraiha & Ward, 1980

Revista da Fundação de Serviços de Saúde Pública 25(1): 10–14.

Paratypes: 1 female “Loc Pilcopata // Dep. Cuzco // Estado // Peru // Cap por J.E. // Silva // Em 21/6/73 // Lam n°46.293 // NE n°1905/73 // Esp L. amazo // nensis // Det. A.V. Martins // Em Set. 1973. [ColFleb IEC 158]; 1 female. “Loc Pilcopata // Dep. Cuzco // Estado // Peru // Cap por J.E. // Silva // Em 21/6/73 // Lam n°46.297 // NE n°1905/73 // Esp L. amazo // nensis // Det. A.V. Martin // Em Set. 1973” [ColFleb IEC 159].

Type-locality: Pilcopata (02°30'00"S; 78°55'00"W), Cuzco Department, Peru.

Original name: *Psychodopygus llanosmartinsi*.

Additional note: two slides. The original label refers to the specimens as *Lutzomyia amazonensis*.

Psychodopygus wellcomei Fraiha, Shaw & Lainson, 1971

Memórias do Instituto Oswaldo Cruz 69(3): 489–500.

Syntypes: 1 female “*Psychodopygus* // *wellcomei* // Fraiha, Shaw & lain- // son, 1971, Sintipo ♀ // Serra Norte, Area 2 // Serra dos Carajás // Marabá, Pará, BR // Isca Humana // Área de cerrado // na borda da mata // 23. Nov. 1968 [ColFleb IEC 133]; 1 male “*P. wellcomei* // Fraiha, Shaw // & Lainson, 1971 // (capt. em armad. // Disney cl cobaio // *Psychodopygus* // *wellcomei* // Sintipo ♂ // Serra Norte- A1 // Serra dos Carajás // Marabá, Pará, BR // 23-24/XI/1968” [ColFleb IEC 134].

Type-locality: Serra dos Carajás (06°06'29"S; 50°18'36"W), Marabá municipality, State of the Pará, Brazil.

Original name: *Psychodopygus wellcomei*.

Additional note: two slides.

***Trichophoromyia adelsonsouzai* Santos, Silva, Barata, Andrade & Galati, 2014**

Memórias do Instituto Oswaldo Cruz 109: 2014 (ahead of print).

Holotype: male “Universidade de São Paulo // Faculdade de Saúde Pública // Epidemiologia // BRASIL – Pará // Vitória do Xingu entre Altamira e // Anapu (km 27 da R. Transamazônica) // Armadilhas CDC e Shannon // Cols. Santos TV & Silva FMM, // 04-15/II/2012 a 10-26/VVI/2012 // *Trichophoromyia adelsonsouzai* // Santos, Silva, Barata, Andrade & // Galati 2013/ Holótipo ♂ [Colfleb IEC 184].

Paratypes: 13 males “Universidade de São Paulo // Faculdade de Saúde Pública // Epidemiologia // BRASIL – Pará // Vitória do Xingu entre Altamira e // Anapu (km 27 da R. Transamazônica) // Armadilhas CDC e Shannon // Cols. Santos TV & Silva FMM, // 04-15/II/2012 a 10-26/VVI/2012 // *Trichophoromyia adelsonsouzai* // Santos, Silva, Barata, Andrade & // Galati 2013 [ColFleb IEC 185–194]; 5 females “Universidade de São Paulo // Faculdade de Saúde Pública // Epidemiologia // BRASIL – Pará // Vitória do Xingu entre Altamira e // Anapu (km 23 da R. Transamazônica) // Armadilhas CDC e Shannon // Cols. Santos TV & Silva FMM, // 04-15/II/2012 a 10-26/VVI/2012 // *Trichophoromyia adelsonsouzai* // Santos, Silva, Barata, Andrade & // Galati 2013 [ColFleb IEC 195–199].

Type-locality: km 47 of the Transamazonian Highway, between Altamira (03°11'41"S; 52°12'33"W) and Anapu (03°28'21"S; 51°11'55"W) municipalities, State of the Pará, Brazil.

Original name: *Trichophoromyia adelsonsouzai*.

Additional note: 19 slides.

***Thichophoromyia brachipyga* (Mangabeira, 1942)**

Memórias do Instituto Oswaldo Cruz 37(2): 111–218.

Paratype: 1 male “170 // Inst. Osw. Cruz // N°. *Paratypo* // *F. brachipygus* // Mangabeira, 1942 // Piratuba, M. Aba- // eté (Pará) em bura- // co de tatu- VIII- 940 // Mang. coll.” [ColFleb IEC 148].

Type-locality: Abaetetuba (01°43'04"S; 48°52'58"W) municipality, State of the Pará, Brazil.

Original name: *Flebotomus brachipygus*.

Additional note: one slide. The municipality of Abaeté actually refers to Abaetetuba.

***Thrichophoromyia readyi* (Ryan, 1986)**

Flebótomos do Estado do Pará, Brasil (Diptera, Psychodidae, Phlebotominae), Documento técnico n°1, Instituto Evandro Chagas, Belém, Pará, 154 p.

Holotype: 1 male “*holotype* Wellcome // Parasitology Unit // remounted 1.11.85 // Slide n°L. Ryan // Sp Lu. ready // Det: R. D. Ward // Transamazônica // Coll. Site Km

25 // Itaituba- Altamira // Met. *toca tatu* // Date 29/11/71 // coll R.D.W.” [ColFleb IEC 142].

Paratypes: 1 female “Wellcome // Parasitology Unit // *allotype* // Slide n°R.D. Ward collect // Sp *Lu. ready* // Det: Lee Ryan // Transamazon // Coll. Site Km 25 // Itaituba- Altamira // Met. CDC // Date 2.12.71” [ColFleb IEC 143 (*allotype*)]; 1 male “Wellcome // Parasitology Unit // R.D. Ward // Slide n°340.61 // Sp *Lu. ready* // Det: Lee Ryan // Transamazon // Coll. Site Km 25 // Itaituba- Altamira // Met. *Armadillo burrow* // Date 29.11.1971 // *rem. 10.2.1986*” [ColFleb IEC 145].

Type-locality: km 25 of the Transamazonian Highway, between Itaituba (04°16'33"S; 55°59'02"W) and Altamira municipalities (03°11'41"S; 52°12'33"W), State of the Pará, Brazil.

Original name: *Lutzomyia readyi*.

Additional note: three slides. Paratype [ColFleb IEC 145] was remounted on 10/II/1986 and the holotype on 1/XI/1985.

Conclusion

Until now, there are 12 sand fly species included as type specimens deposited in the COLFleb IEC. The type material of *Ev. carmelinoi*, including male holotype and the female described as *allotype* (= *paratype*), is lost. The other two species mentioned in the original description as deposited in the “Instituto Evandro Chagas”, *Bi. olmeca nociva* and *Ps. yucumensis* were not found in the collection. According to original description the species described by Mangabeira during 1938 and 1942 were deposited in the “Instituto Oswaldo Cruz” and those by Damasceno and collaborators and between 1944 and 1950 in the Natural History Museum of the United States (Smithsonian Museum, Washington D.C.).

The ColFleb IEC is the only Institute in Brazil that holds type–species of *Pi. gruta*, *Ps. leonidasdeanei* and *Th. readyi* (AJA, personal observation). The male holotype and 2 male and three female *paratypes* of *Ps. lainsoni* are deposited at the “Coleção Padrão” of the “Departamento de Epidemiologia” of the “Faculdade de Saúde Pública” of the “Universidade de São Paulo” (FSP–USP). Three other type series of sand flies can be found in the same Institution: two female *paratypes* of *Ny. umbratilis* and a male and a female “*topotypes*” of *Ny. yuilli yuilli*. In the “Coleção de Flebotomíneos” of the “Centro de Pesquisas René Rachou” (FIOCRUZ-COLFLEB) another slide of a *Ps. llanosmartinsi* male, described as “*plesiotype/paratype*”, was found in addition to two *paratype* males (n°44.38–44.39) and six *paratype* females (n°44.20–44.25) of *Ny. richardwardi*, and four *paratype* males (n°43.52, 43.54, 43.55, 43.56) and six *paratype* female (n°43.30–43.35) of *Ny. shawi*. With regards to *Ps. wellcomei*, one slide of a *syntype* female is deposited in the FIOCRUZ-COLFLEB, and one *syntype* male and two *syntype* females of the same species are found in the entomological collection named “Costa Lima” in the Instituto Oswaldo Cruz (CEIOC). According to Fraiha and Ryan (1986) more than 20 valid species were described by Dr. Octavio Mangabeira Filho.

Unfortunately, few specimens described by him have been found in Brazilian institutions (Andrey Andrade, personal communication). Of these, just one male paratype of *Trichophoromyia brachipyga* was located in the ColFleb IEC and another male paratype is deposited in the “John Lane Collection” of the FSP-USP. Finally, paratypes of *Th. adelsonsouzai* have been distributed to different collections in Brazil (Santos et al. 2014).

Depository institutions and natural history collections are very important to know and document biodiversity around the world. Unfortunately, these holdings of biodiversity information are often not easy to survey and it is common to observe that some type species are not deposited according to the original description. This may be due to the fact that the author does not always send them to the intended institution, or the specimens are later donated or sold to other institutions, or sadly they were destroyed or lost. Annotated catalogues are the first step to organize these invaluable collections and they may help in updating the deposited material. The authors hope that similar studies can be made by other institutions which have relevant collections, particularly those that hold type–species of Brazilian species.

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Tabanidae (Diptera) of Amazônia XXI. Descriptions of *Elephantotus* gen. n. and *E. tracuateuensis* sp. n. (Diachlorini) from the Brazilian coast

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Abstract

Elephantotus, a new genus of Tabanidae from the Amazon coast, Brazil, is described based on a new species *E. tracuateuensis*. Five females were collected in Pará State, and a male in Maranhão State. Arguments are presented for separating the new genus from *Dasybasis*, as well as the possibility of its occurrence being related to the nesting sites of coastal birds. The new species is characterized by its large size ($x = 2.15$ cm, $n = 5$ females), glabrous eyes, reddish-brown tegument, light brown frontal callus not touching the edges of the eyes, extending up to the vertex that has traces of ocelli, basal plate of the antennal flagellum with obtuse angle, without a tooth or spine, wings hyaline, with brown basal cells, without appendix in the fork of vein R_{4+5} , and genital furca wide with extended flaps.

Keywords

Taxonomy, new genus, coastal horse flies, Amazon basin

Introduction

Intensive collecting efforts along the Amazon coast during the last 15 years have enriched our knowledge of the fauna of the states of Amapá, Pará and Maranhão in Brazil, including the collection of five females and one male identified as Diachlorini – being described here as a new genus and species. The tribe Diachlorini has the largest

number of genera and species within the family Tabanidae, comprising 36 genera with 594 species out of 1,205 described species of neotropical horse flies (Coscarón and Papavero 2009, Henriques et al. 2012). The most recent work with the tribe in that region was published by Henriques and Krolow (2013), describing the genus *Muscotabanus* and the species *M. rafaelli* from the Brazilian Amazon.

Materials and Methods

Specimens were collected using Malaise type flight-intercept traps (Gressitt and Gressitt 1962) that were installed at the edge of a mangrove forest in relatively open marsh land near a shorebird nesting site (including *Eudocimus ruber*, *Nycticorax nycticorax*, *Ardea alba*) (Schories and Gorayeb 2001), and with tubular fluorescent lamps (40W) and 250W tungsten filament and mercury vapor bulbs.

The specimens collected were deposited in the Museu Paraense Emílio Goeldi (MPEG) in Belém, Pará State, the Instituto Nacional de Pesquisas da Amazônia (INPA) in Manaus, Amazonas State, and the Centro de Estudos Superiores de Caxias (CESC/UEMA) at the Maranhão State University. Specimens and genitalia were examined, measured, and illustrated using a Zeiss Stemi SV 11 stereomicroscope with a coupled *camera lucida*, and photographed using a Leica M205 C microscope with a coupled Leica DFC 295 camera; Leica Application Suite (LAS V3.6) software was used to process the digital images.

The measurements given in the description of the holotype females are followed by parentheses with the ranges of the five specimens.

The terminology follows Cumming and Wood (2009) and Burger (2009).

Results

Elephantotus gen. n.

<http://zoobank.org/B42B061E-C0FE-471D-8EF8-6B91E3CA6AEF>

<http://species-id.net/wiki/Elephantotus>

Etymology. Latin. *Elephantotus* = elephant. Masculine. Refers to the large sizes of the species and the shape of the furcation of the female genitalia, which have large side flaps – resembling an elephant's head and ears in frontal view.

Type species. *Elephantotus tracuataeensis* sp. n.

Diagnosis. Eyes glabrous, solid-colored. Frons slightly divergent above. Frontal callus light brown, narrower than frons, extending to vestiges of ocelli on vertex. Basal plate of antennal flagellum with obtuse angle, without tooth or spine. Palpus approximately the same length as antenna. Labella completely membranous. Thorax with reddish-brown integument with irregular yellow spots, black median stripe and yellow stripes on sutures. Wing hyaline with brown basal cells, yellowish-brown veins, except

basicostal which is brown, vein R_{4+5} fork without appendix. Genital furca wide, with flaps extended laterally. Goblets of genital ducts short.

In the key to the genera of Tabanidae Fairchild (1969), *Elephantotus* gen. n. proceeds to dichotomy 44 (p. 236) of *Dasybasis* Macquart. *Dasybasis* differs from *Elephantotus* by having a generally gray-colored body; eyes with sparse hairs; quadrangular frontal callus touching the eyes; ocellar triangle and ocelli vestigial; abdomen with longitudinal stripes and triangles on tergites (Coscarón and Philip 1967, González 1999). *E. tracueteuensis* sp. n. evidently does not belong to the genus *Dasybasis* which is characteristic of the neotropical southern temperate zone, with the exception of some species such as *D. montium* (Surcouf), 1919 and *D. schineri* (Kröber), 1931 occurring in Venezuela, Colombia and Ecuador (Coscarón and Papavero 2009).

The characteristics of some genera of Diachlorini (Fairchild, 1969) are presented here to differentiate them from *Elephantotus* gen. n.:

– *Catachlorops* Lutz – Tubercle on vertex distinguished and prominent, rarely rudimentary; proboscis usually with labella small, compact, completely or partially sclerotized, rarely completely membranous; antenna slender, dorsal spine slender, pointed, rarely shorter than basal plate; wing almost always with splotches, rarely faintly tinged, never completely hyaline.

– *Dasychela* Enderlein – not a strong or robust species, brown; wing spotted brown, hyaline or lighter colored at the end of basal cell and wing apex.

– *Phaeotabanus* Lutz – thorax without stripes; frontal callus small and round; labella much or completely sclerotized; wings usually with dark designs.

– *Stenotabanus* Lutz – most species small; eyes smooth with at least two transverse bands; frontal callus usually as wide as frons.

***Elephantotus tracueteuensis* sp. n.**

<http://zoobank.org/DE6A409B-9C29-49A7-9212-49FA631BC247>

http://species-id.net/wiki/Elephantotus_tracueteuensis

Figures 1–17

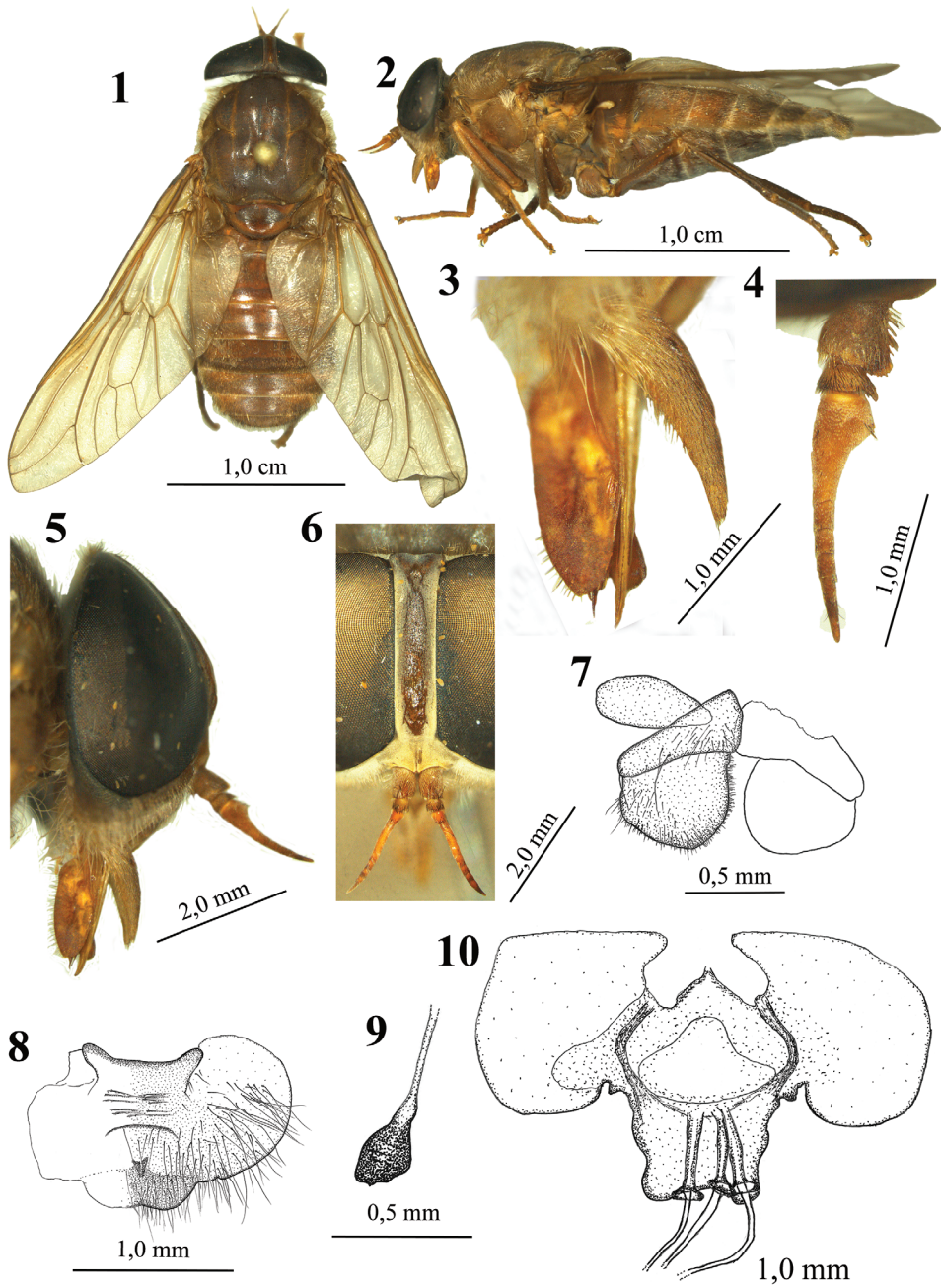
Diagnosis. Body 2.15 cm (n = 5 females), with reddish-brown integument. Eyes glabrous. Frons slightly divergent above. Frontal callus light-brown, narrower than frons, extending to vestiges of the ocelli. Antenna with scape and pedicel brown, with sparse pruinescence, flagellum orange with flagellomeres brown darkening to black at the last segment, basal plate orange, with obtuse angle. Thorax with reddish-brown integument with irregular yellow spots, black median stripe and sub-lateral yellow stripes on sutures. Wing hyaline, with brown basal cells and yellowish-brown veins, except basicostal which is brown, without appendix at forking of vein R_{4+5} . Legs with glossy light-brown integument, covered with thin white pruinescence, hind legs darker. Abdomen with reddish-brown integument banded transversely with strips of yellow-brown integument in median and anterior regions of the segments. Genital furca wide, with flaps extending laterally. Goblets of genital ducts short.

Description of the female (Figs 1–10).

Body length 2.25 cm (1.99 to 2.27 cm), width of scutum at level of the transverse suture 7.5 mm (6.1 to 7.5 mm), wing length 2.15 cm (1.87 to 2.15 cm), wing width 6.7 mm (5.9 to 6.7 mm), height of frons 3.2 mm (2.6–3.2 mm), width of frons at vertex 0.8 mm (0.6–0.9 mm), width of frons at the base 0.7 mm (0.6–0.8 mm), frontal index 4.38 (3.90 to 4.38), divergent index 1.10 (1.02 to 1.11).

Head. Eyes glabrous. Frons (Fig. 6) slightly divergent above, swollen, yellow-whitish pruinescence; callus light-brown, set well away from margins, extending to vestiges of ocelli and vertex; setae white and yellow at apex. Subcallus covered with yellowish-white pruinescence. Antenna (Fig. 4) with scape brown, whitish-yellow pruinescence, black setae on upper lateral and dorsal areas, whitish-yellow setae on lower lateral and ventral areas; pedicel brown with less pruinescence, with black setae but with some scattered yellow setae on distal half; flagellum orange with brown to black flagellomeres on last segment; basal plate with obtuse angle, orange, with sparse whitish-yellow pruinescence, with black setae at corners, and four setae on distal lateral half; flagellomeres with black setae. Face, parafacialia, gena and postgena coated whitish-yellow pruinescence, and yellow setae. Palpus (Fig. 3) yellow, with yellow pruinescence, first segment with long yellow setae, second segment with black setae yellowish brown at base, inner side without setae. Proboscis orange with yellowish-white ventral bristles on basal half but black on ventral area of labella; labella large, approximately equal in size to the second palpus segment. Occiput with white pruinescence and yellow setae on dorsal edge.

Thorax. Scutum with reddish-brown integument with irregular yellow spots, black median stripe, and yellow stripes on sutures; pruinescence weakly gray-white when viewed at certain angles; short bristles bright yellow, orangish in posterior region of the scutum, longer white bristles in tuft on posterior areas of the supra-alar and post-alar lobes. Scutellum reddish-brown with anterior half dark brown, pruinescence grayish-white, with yellow and white setae on lateral sides. Pospronotal lobe whitish-yellow with white pruinescence and yellow setae. Notopleura yellow with pruinescence and setae yellow. Pleura and coxae with reddish-brown integument, coated with dense grayish-white pruinescence and yellowish-white setae. Legs with glossy light brown integument, covered with sparse white pruinescence, hind legs darker; femora with white setae; fore and median tibia with yellow-orange setae, brown setae scattered on the dorsum of distal quarter; posterior tibia with long brown setae, and short yellow-orange setae on ventral region; tarsi with brown to black setae on dorsum. Wing hyaline with brown basal cells (Fig. 1). Tegula brown, with yellow pruinescence and white setae. Veins yellowish-brown, except for brown costal vein; no appendix at fork of vein R_{4+5} ; vein M_3 not reaching the wing margin. Calypter yellow, coated with white pruinescence, fringe of proximal calypter with brown bristles, distal calypter with white bristles. Subalar sclerite process brown on proximal half and yellow distally, coated with white pruinescence, with distal tuft of white setae. Halter brown, yellow distally coated with white pruinescence.



Figures 1–10. Female *Elephantotus trauateuensis* sp.n.: **1** Body in dorsal view **2** Body in lateral view **3** Palpus, labella and stilet **4** Antenna **5** Head in lateral view **6** Frons **7** Tergites 9, 10 and cerci **8** Sternite 8 and gonapophyses **9** Spermatheca **10** Genital furca.

Abdomen. With reddish-brown integument, with transversal bands of yellow-brown integument on the median and anterior regions of the segments; coated with sparse grayish-white pruinescence and glossy white-yellowish setae, tergite 7 with brown setae.

Terminalia. Tergites 9, 10 and cerci as in Figure 10; tergite 9 small, tergite 10 subtriangular, cerci with relatively short setae for this family. Sternite 8 very wide, and gonapophyses as in Figure 8; spermatheca and genital furca as in Figures 9 and 10, with furca clearly very wide, with flaps extending laterally, goblets of genital ducts short; spermatheca club-like, relatively large as compared to other species.

Variations. Body pruinescence varies from white, to grayish-white, to yellow. The setae vary from white, to yellowish-white, to orange; also from matte to glossy. M_3 veins vary, and do not reach the margins of either wing in the holotype, and only the right wing margin in the paratype male. The splotches at the base of wings vary from dark brown to hyaline. The integument is generally reddish-brown, but areas of the scutum, scutellum, tergites, and sternites have variable and irregular yellowish-brown stains.

Description of the male (Figs 11–17).

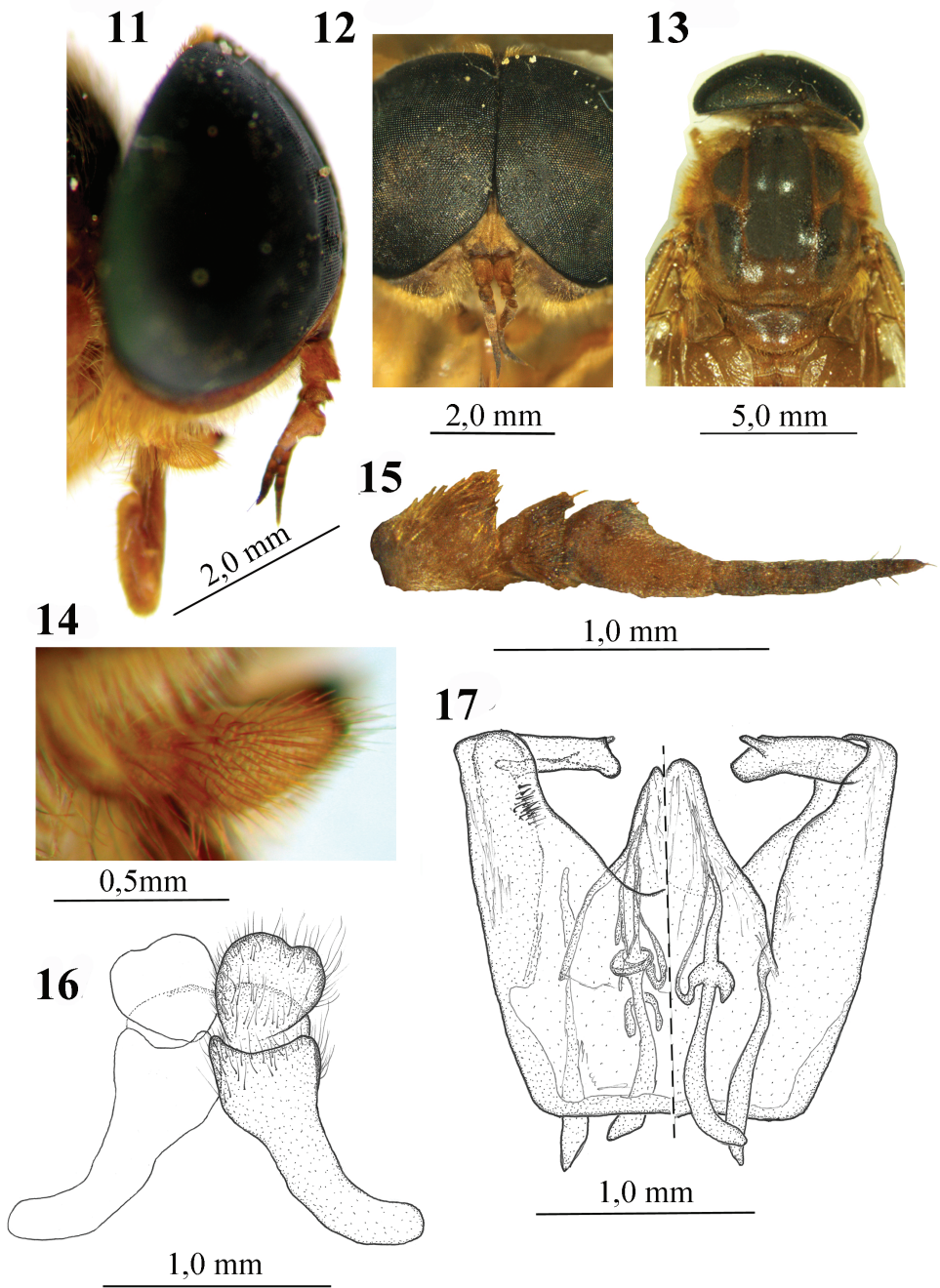
Eyes with ommatidia of similar sizes. Smaller than female, length body 13.5 mm, wing length 12.6 mm, wing width 6.3 mm. Setae generally darker than those of the female, yellow-orange; no white setae. Palpus (Figs 11 and 14) with the first and second segments coated with pruinescence and long, yellow setae, the second slightly larger than the first. Integument usually with fewer spots, reddish brown and less intense than the female, with the exception of the scutum, which has well-defined black spots, as in Figure 13. Abdomen with brown setae on the median posterior areas of sternites. Hind tibia and tarsus without black setae, all of them orange. Wing with basicostal and costal cells yellow, vein M_3 incomplete on right wing, not reaching the edge of the wing. Genitalia as in Figures 16 and 17; epandrium very long, and cerci heart-shaped with invagination on distal edge; aedeagus with dististilum with evident spine, and gonostilum with few setae on upper ventral face.

Distribution. Brazil (states of Maranhão, Pará).

Etymology. The specific epithet refers to the town of Tracuateua that belonged to the municipality of Bragança, on the coast of Pará State, Brazil.

Material examined. Holotype ♀, BRAZIL, Pará, Bragança, Isla Canela, 0°47'06"S, 46°43'41"W, IX-27 to X-5-1995, Malaise trap, ocean side of the island, mangrove margin, Col.: N. Bittencourt (MPEG).

Paratypes. 1 ♀, Same as holotype (MPEG), 2 ♀ Idem (XI-8 to XI-13-1995, 1 ♀, MPEG, 1 ♀, INPA), 1 ♀ Brazil, Pará, Augusto Corrêa, Mandarité Beach, 0°52'38"S, 46°27'47"W, X-21-2001, fluorescent light, Cols.: L. A. Souza & I. S. Gorayeb (MPEG), 1 ♂, Brazil, Maranhão, São Luiz, Res. Itapiracó, Arm. Light (fluorescent lamps (40W) and 250W tungsten filament and mercury vapor bulbs), I-19 to I-20-2004, Cols.: J. T. Camara & J. W. P. Camara Jr. (CESC / UEMA).



Figures 11–17. Male of *Elephantotus tracueteuensis* sp.n.: **11** Head in lateral view **12** Head in frontal view **13** Mesothorax and scutellum in dorsal view **14** Antenna **15** Palpus **16** Epandrium and cerci **17** Aedeagus.

Discussion

I understand the concern that this genus is not based on a phylogenetic analysis of Diachlorini, but believe this genus to represent a unique lineage because it has the following characteristics not found in any other Diachlorini: large frontal callus, occupying more than half the frons, not touching the margins, slightly swollen; short proboscis with large membranous labella, the same size as the antennal flagellum; genital furca very wide, with flaps extended laterally; genital ducts to the goblets, short; and the following combined characters, glabrous eyes, wings hyaline without appendix on vein R_{4+5} , basal plate antenna with obtuse angle without tooth.

Like other horse fly species that occur exclusively in coastal ecosystems, the specimens of *Elephantotus* gen. n. were collected along the coastline near an extensive nesting area of coastal birds. It probably evolved in association with large concentrations of warm-blooded animals, and we therefore suggest that other similar coastal areas be investigated for other species of horse flies that may have evolved in association with these flocks of birds.

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Six new species of *Philiris* Röber, 1891 (Lepidoptera, Lycaenidae) from Papua New Guinea

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Abstract

Six new species of the large lycaenid genus *Philiris* Röber, 1891 (*Philiris petriei* **sp. n.**, *Philiris bubalisatina* **sp. n.**, *Philiris baiteta* **sp. n.**, *Philiris radicala* **sp. n.**, *Philiris hindenburgensis* **sp. n.** and *Philiris parsonsi* **sp. n.**), from Papua New Guinea, are described and illustrated, as are the early stages of the former taxon, with *Litsea* sp. near *callophyllantha* K. Schum (Lauraceae) recorded as the larval food plant. The holotypes of all but the latter are deposited in the ANIC, with that of *P. parsonsi* located in the BMNH. The external facies and male genitalia of all new species are compared in detail to putative known related species, and the types of these, in nearly all cases, are also illustrated.

Keywords

Taxonomy, Lepidoptera, Lycaenidae, Lucini, new species, Papua New Guinea

Introduction

Philiris Röber, 1891 is one of the most speciose genera in the Australian region, where it is confined to Maluku, New Guinea, the Bismarcks and eastern Australia, with a concentration on the mainland of New Guinea. The genus was revised by Tite (1963), who recognised 56 species and later in an unpublished thesis by Sands (1981a) who

added an additional 11 species in two separate publications (Sands 1979, 1981b) and placed the taxa into 21 species groups (validated by Parsons 1998), although he suggested that certain groups were ill-defined. Tite (1963) assumed a relationship of *Philiris* with *Candalides* Hübner, 1819 but Eliot (1973) showed that the former is positioned within the tribe Luciini Waterhouse & Lyell, 1914, together with several other genera, which are all essentially restricted to the Australian Region. *Philiris* was placed by Eliot (1973) in the *Hypochrysoptera* C. Felder section of the tribe. The two genera are closely related and their adult behaviour is generally similar. Sands (1981a) proposed that the genus *Parachrysoptera* Bethune-Baker, 1904 is a synonym of *Philiris* (validated by Parsons 1998). Parsons (1984, 1998) modified this nomenclatural arrangement of the genus based on a study of *Philiris* early stages and their food plants. The early stages of several *Philiris* species have been documented in the literature (e.g. Forbes 1977; Parsons 1984; Wood 1984; Müller 2000).

Unlike members of related genera, the undersides of many *Philiris* are relatively unmarked and generally similar, which was discussed by Tite (1963). However, most species have a characteristic pink, yellow, silver, grey or golden hue which is useful in the identification of species, as is the presence, including intensity, or absence of a black spot on the inner margin of the hindwing underside (Sands 1981a).

Morphology of the male genitalia, in particular the aedeagi, sociunci and valvae provides important characteristics for separating closely related species within Luciini (Tite 1963; 1969; Sands 1981a). These workers showed that vast differences are apparent in the shape of the valvae, including some species which exhibit asymmetry.

Members of *Philiris* inhabit altitudes between sea level and almost 2000m, with many species in mainland New Guinea being restricted to the lower to mid-montane zones and being apparently absent from the lowlands (Parsons 1998). In this paper a number of new species from this altitudinal zone are introduced, largely as a result of systematic surveying in remote areas of Papua New Guinea in recent years.

Descriptions follow that of the numerical vein system.

Materials and methods

Specimens were collected using long-handled nets and/or reared from early stages sleeved on their larval food plants. Adults and immature stages were photographed using a Nikon D300s Digital SLR Camera with a Nikon AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED Macro lens and Nikon R1C1 Close-up Kit Flashes Speedlites and Speedlights. Genitalia were photographed using the same camera with a Meiji Techno EMZ-5TR-P-FOI Trinocular Stereozoom Microscope, with OPTTEK FL95E Fibreoptic Illuminator and twin arm optical fibre. Landscape photographs were taken using the above camera with an AF-S DX Nikkor 18-105mm f3.5-5.6G ED VR Lens. Individual sliced genitalia images were concatenated using the software Helicon Focus 6.0 and edited in Adobe Photoshop CS6. Genitalia slides were photographed using a Nikon CoolScan ED5000 with modified slide scanner. Plates were designed in Adobe InDesign CS6.

Abbreviations

- AM** Australian Museum, Sydney, Australia.
ANIC Australian National Insect Collection, Canberra, ACT, Australia.
BMNH British Museum (Natural History), London, England.
CJMC Reference collection of Chris J. Müller, Sydney, Australia.
EAPC Reference collection of Edward A. Petrie, Sydney, Australia.
UFL McGuire Collection, University of Florida, United States of America.
NARI National Agricultural Research Institute, Boroko, Port Moresby, Papua New Guinea.

Taxonomy

Philiris petriei Müller, sp. n.

<http://zoobank.org/76578F35-0BE9-4C66-BEAB-94A69C8E6B72>

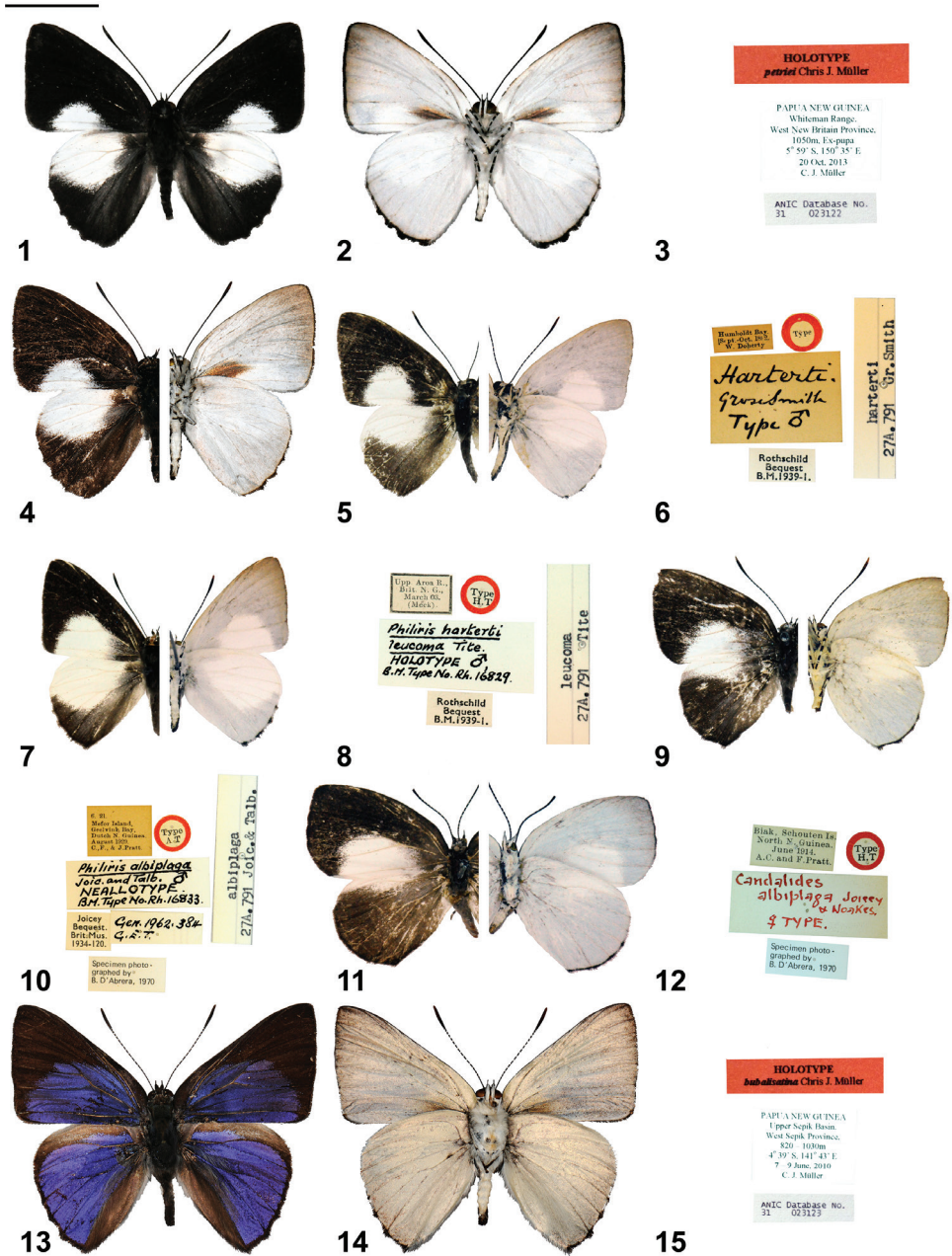
http://species-id.net/wiki/Philiris_petriei

Figs 1–4, 61, 88–92, 97

Type material. Holotype ♂ (Figs 1–3): Papua New Guinea, Whiteman Range, West New Britain Province, 1050m, Ex-pupa, 5°59'S, 150°35'E, 20 Oct, 2013, Chris J. Müller, genitalia dissected and held in vial pinned to specimen, pupal exuvia pinned to specimen (ANIC), Registration: ANIC Database No. 31-023122. Paratypes (8 ♂♂): 4 ♂♂ labelled Papua New Guinea, Whiteman Range, West New Britain Province, 950m, 5°58'S, 150°29'E, 10–18 Dec, 2005, Chris J. Müller (2 ♂♂ BMNH; 1 ♂ NARI; 1 ♂ EAPC); 3 ♂♂ labelled Mt. Otto summit, West New Britain Province, 1320m, 5°33'S, 150°24'E, 19–22 Dec, 2006, Chris J. Müller (2 ♂♂ CJMC; 1 ♂ AM); 1 ♂ labelled Bainings Mts., East New Britain Province, 1000m, 4°38'S, 152°02'E, xii.2008, L. Wills leg. (UFL).

Diagnosis. Males of *Philiris petriei* sp. n. are readily distinguished from other species in the genus. *P. petriei* sp. n. is a large species with a forewing length that surpasses that of its putative congeners, *P. harterti* (Grose-Smith, 1894) and *P. albiplaga* (Joicey & Talbot, 1916). *P. harterti* occurs widely in mainland New Guinea (nominat in northern and western NG mainland; subspecies *leucoma* Tite, 1963 in eastern NG mainland). The holotypes of both taxa are illustrated here-in (see Figs 5–8). *P. harterti* also occurs on Yapen Island, where it is known by ssp. *melanoma* Tite, 1963. *P. albiplaga* is restricted to the Schouten Islands (Biak and Mefor). Since the holotype is a female specimen (Figs 11, 12), Tite (1963) designated one of two known males of *P. albiplaga* as a neallotype (Figs 9, 10).

The shape of the fore wing in *P. petriei* is slightly rounded at the apex, whereas it is pointed in the other species, particularly so in *P. harterti*. The hind wing termen is weakly serrated near the tornus in *P. petriei*, unlike in related species and the cilia on the underside of the hindwing tornal area is continuously black, as in *P. albiplaga*, whereas



Figures 1–15. *Philiris* adults (left side upperside and right side underside, where halved) and label data. **1** *P. petriei* holotype ♂ upperside **2** *P. petriei* holotype ♂ male underside **3** *P. petriei* holotype ♂ label data **4** *P. petriei* paratype ♂ (halved) **5** *P. harterti harterti* holotype ♂ (halved) **6** *P. harterti harterti* holotype ♂ label data **7** *P. harterti leucoma* holotype ♂ (halved) **8** *P. harterti leucoma* holotype ♂ label data **9** *P. albiplaga* neoallotype ♂ (halved) **10** *P. albiplaga* neoallotype ♂ label data **11** *P. albiplaga* holotype ♀ (halved) **12** *P. albiplaga* holotype ♀ label data **13** *P. bubalisatina* holotype ♂ upperside **14** *P. bubalisatina* holotype ♂ underside **15** *P. bubalisatina* holotype ♂ label data. Scale bar = 10 mm.

the cilia are mostly white in *P. harterti* and black only at the vein terminals. The underside of the forewing in *P. petriei* bears a large dark basal patch, not present in either *P. harterti* or *P. albiplaga*. The frons in *P. petriei* are black (Fig. 97), while they are rusty red and brown in *P. harterti* (Fig. 98) and *P. albiplaga*, respectively. The white area on the forewing above is much more reduced in *P. petriei* than in *P. harterti* and *P. albiplaga*, bearing more resemblance to the pattern in *P. bicolor* (Bethune-Baker, 1904), a species with red frons similar to *P. harterti*. In *P. petriei*, the forewing white patch is restricted to the inner margin and does not extend beyond vein 2, only marginally extending beyond 1b, while in *P. harterti* and *P. albiplaga* this white area continues beyond vein 2 and reaches, or exceeds, vein 3 and the edge of the cell. No obvious variation has been noted in the type series of *P. petriei*, with all specimens similar in size and maculation.

The male genitalia of *P. petriei* (Fig. 61) also show a relationship to both *P. harterti* (Fig. 62) and *P. albiplaga* (Fig. 71). However, the genitalia of the former species are larger than both *P. harterti* and *P. albiplaga*, and the sociuncus is narrowly V-shaped dorsally, whereas it is rather rounded in *P. harterti* and broadly U-shaped in *P. albiplaga*. The valva is triangular-shaped at the base in *P. petriei*, whereas it is bulbous in *P. harterti* and with conspicuous median lobes in *P. albiplaga*. The phallus is long and slender in *P. petriei* (Fig. 61c) and the vesica is boat shaped at its apex, whereas the phallus of *P. harterti* (Fig. 62c) is comparatively short and squat and the apex of the vesica is bifurcated symmetrically. The phallus of *P. albiplaga* is not clearly defined in either slide mounts of the Mefor Island male specimens but appears to be heavily sclerotized and the vesica is tongue-shaped (Fig. 71c).

Description. ♂ (Figs 1–3, 97): Forewing length 17.5 mm, antenna 11.5 mm (holotype). Head, palpus, thorax and abdomen black dorsally, white ventrally, frons black with white eye ring; antenna shaft black, ringed weakly with white, apical half of club orange-brown ventrally; legs white with black areas on tibiae.

Fore wing termen slightly convex but straight between veins 2 and 4, inner margin slightly convex; upperside with ground colour black, a restricted triangular area of white in the median and postmedian area, extending from the inner margin to midway between veins 1b and 2 and from about one-third along the termen to approximately 3mm from the termen at the tornus, white area suffused with light grey narrowly towards base, cilia black; underside uniformly white, with apical area and termen broadly suffused with brown, a large rhomboid-shaped patch of dark brown scales extending from base to median area, cilia black.

Hind wing slightly rounded, termen weakly serrated between veins 2 and 4; upperside with ground colour black, apical area broadly white and extending along costa to near base and to the middle of the hind wing, filling distal half of cell and discocellulars, cilia black except in apical area where they are white; underside uniformly white with weak brown suffusion broadly along termen, cilia black and longer in tornal area, white at apex.

♀: Unknown.

Male genitalia (Fig. 61): Vinculum and tegumen ring broadly oval, sociuncus broad, socii with lateral margin rounded, socii weakly separated by V-shaped sinus,

saccus tapered posteriorly, brachium tapered dorsally and slightly hooked at apex; valva long, symmetrical, triangular-shaped at base and tapered apically; phallus with pre-zonal section approximately equal in length to postzonal section, slender, with vesica apically flanged.

Etymology. This species is named in honour of Edward A. Petrie, Sydney, Australia, renowned for his expertise in Australian Lycaenidae, in particular their life histories.

Distribution. New Britain Island, Papua New Guinea.

Ecology. When compared with those of the related *P. harterti*, the flight behaviour of *P. petriei* males differs in that the latter species generally flies on mountain tops (e.g. Fig. 84) from 1100 hrs until just after midday, whereas *P. harterti* does not normally appear in its hill top territories until about 1330. Males of *P. petriei* fly high, usually above six metres above the ground, whereas those of *P. harterti* generally fly much lower, between 1–4 metres above the ground. There appear to be two broods annually for the life cycle of *P. petriei*, with adults flying in November and December and again in April and May. Conversely, adults of *P. harterti* fly throughout the year in mainland New Guinea.

Parsons (1998) recorded the life history of *P. harterti* on saplings of *Litsea callophyllantha* (Lauraceae). A pupal exuvia of a *Philiris*, presumed to be *P. petriei*, was located in the Whiteman Range, New Britain, by the author during January 2013 on a small plant of *Litsea* species. Some months later two eggs were located on the same plant and one was sleeved. Both eggs hatched after some days and developed very slowly through the winter months, reaching final instar during August. One of the larva pupated in late September (larval duration 121 days), emerging in early Oct (pupal duration 14 days). Owing to the lack of floescence (flowers and/or fruit), it has not been possible to identify the *Litsea* species on which the new species feeds, although similarly to *L. callophyllantha*, it appears to grow very slowly and remain as a sapling for years until an opening in the canopy creates an opportunity for the plant to flourish. The food plant of *P. petriei* is very different from the large leaved *Litsea guppyi* (F. Muell) F. Muell. Ex Forman., the food plant of *Philiris siassi* Sands, 1979 (Müller 2002), which flies in the same habitats as *P. petriei*.

The early stages of both *P. harterti* (Figs 93–96) and *P. petriei* (Figs 88–92) are exceptionally well camouflaged on their foodplant, with those of *P. petriei* even more so than the larvae and pupae of *P. harterti*. The early stages are quite distinct between the two taxa, with the pupa of the new species being much less speckled and with more irregular dark patches than in *P. harterti*. The anterior of the pupa of *P. petriei* lacks the very long setae present in *P. harterti*. The mature larvae of the two taxa differ in that that of *P. petriei* is brown while the larva of *P. harterti* is greenish and the setae are much coarser in the latter species. The early stages of *P. petriei* are described below.

Egg (Not illustrated): Approximately 0.5 mm diameter, white, domed, wider than high, intricately sculptured. Similar to those of other *Philiris* taxa examined.

First Instar (Not illustrated): c. 1.0 mm long, grass green, with long translucent setae.

Second Instar (Fig. 88): c. 4mm long, 1.5 mm wide, deep green centrally with light green-brown margins, with long translucent setae.

Third Instar (Not illustrated): c. 7.0 mm in length, 1.5 mm wide, similar to second instar but with lateral margin brown rather than green.

Fourth Instar (Fig. 89): c. 10.0 mm in length, 2.5 mm wide, flattened, flanged laterally, centrally deep green with broad light brown margins, finely speckled with white, with long light brown setae on margins.

Final Instar (Fig. 90): c. 15 mm in length, 4.5 mm wide, flattened, flanged laterally, light red-brown, weakly speckled with white, with long light brown setae on margins.

Pupa (Figs 91, 92): 13 mm in length, 4.5 mm wide, light brown with dark brown irregular mottled patches, particularly on eyes and surrounding the wing cases, fine short setae (<1 mm long) anteriorly and on abdomen.

Similarly to the larva of *P. harterti*, the first two instars feed on the underside epidermis of the leaf of the food plant, sheltering concealed within these shallow depressions which become feeding scars on the foliage. The third instar larvae chews troughs from the stem of the food plant, within which it eventually rests, progressively increasing the size of the trough to accommodate the sheltering larva. At this stage the larva also chews right through the leaf, creating holes. Eventually, the larva pupates within the trough, where it is remarkably well concealed.

Remarks. *P. petriei* may possibly be restricted to the island of New Britain within the Bismarck Archipelago. Substantial surveying of pristine habitats by the author in New Ireland from sea level to the highest elevations has not yielded any specimens of this taxon. The insect may also be confined to upland habitats, with all specimens taken above 950m. It appears to be a rather rare species, possibly due to the scarcity of its larval food plant.

***Philiris bubalisatina* Müller, sp. n.**

<http://zoobank.org/FAC04FF7-1FF1-4256-B386-53F2A17E3F58>

http://species-id.net/wiki/Philiris_bubalisatina

Figs 13–15, 63

Type material. Holotype ♂ (Figs 13–15): “Papua New Guinea, Upper Sepik Basin, West Sepik Province, 4°39'S, 141°43'E, 820–1030m, 7–9 June, 2010, Chris J. Müller, genitalia dissected and held in vial pinned to specimen, (ANIC), Registration: ANIC Database No. 31-023123. Paratypes (2 ♂♂): 1 ♂ labelled “Papua New Guinea, Upper Sepik Basin, West Sepik Province, 560m, 4°40'S, 141°46'E, 8–12 Feb, 2010, C. J. Müller” (AM); 1 ♂ labelled “Papua New Guinea, Baiyer River, Western Highlands Province, 1190m, 5°30'S, 144°10'E, 12–18 Nov, 2013, C. J. Müller” (CJMC).

Diagnosis. *Philiris bubalisatina* is unlike any known species, its external facies showing affinities with the *Philiris marginata* (Grose-Smith, 1894), *P. fulgens* (Grose-Smith & Kirby, 1897) and *P. helena* (Snellen, 1887) groups. The wing shape of *P. bubalisatina* is highly acute, with a long pointed forewing and a remarkably elongate hind wing. The forewings are more exaggeratedly pointed than in *P. vicina* (Grose-Smith, 1898), *P. marginata* (holotypes; Figs 18, 19, 77 and 20, 21, 76, respectively) (both *P. marginata* group) and *P. fulgens* (holotype; Figs 22, 23, 78), even ‘subspecies’

septentrionalis Joicey & Talbot, 1916 (holotype; Figs 24, 25, 79). The fore wing upperside is a bright shining lilac-blue, which is more bluish on the hind wing and the dark margins are very broad, while that on the hind wing is of hairline thickness. The underside of *P. bubalisatina* is unique in *Philiris*, being a pale buff-cream, with a yellowish hue. Unlike other species with non-white undersides (essentially those in the *helena* group), e.g. *P. apicalis* Tite, 1963 (holotype; Figs 26, 27, 80 and subspecies *ginni* Müller; Fig. 28), that of *P. bubalisatina* is semi-glossy rather than matt. There is no black spot at the inner margin of the hind wing underside. There appears to be little variation in the type series of *P. bubalisatina*, although one paratype from the Upper Sepik has a slightly shorter fore wing length and the shape of the fore wing is slightly more convex than in the other specimens.

The male genitalia of *P. bubalisatina* is also highly distinctive and does not closely resemble those of any known *Philiris*. The bulbous valvae with lateral appendages are unusual and are only otherwise shared with *P. lavendula* Tite, 1963 (holotype; Figs 16, 17, 75). However the sociuncus in the male genitalia of the latter species is deeply incised and the valvae are much more acute than in *P. bubalisatina*. *P. bubalisatina* and *P. lavendula* have dissimilar external facies, with the former species having a broad forewing upperside border with a shining lilac-purple ground colour and a buff-coloured underside, whereas *P. lavendula* has a much narrower upperside border, a matt purple ground colour and a white underside. The wing shape of the two taxa also differ markedly.

Description. ♂ (Figs 13, 14): Forewing length 20 mm, antenna 12 mm (holotype). Head, palpus and thorax dark grey dorsally, cream ventrally, abdomen dark grey dorsally, cream-buff ventrally, frons dark grey with white eye ring; antenna shaft black, ringed conspicuously with white between segments, apical half of club brown ventrally; legs cream with black areas on tibiae.

Forewing termen nearly straight, inner margin straight, apex pointed; upperside with ground colour black, a large area of shining purple-lilac extending from base to near end of cell and postmedian area to approximately 2mm from termen at tornus, cilia black; underside uniformly glossy pale buff-cream with apical area suffused with dark scales, darker basal patch at inner margin, cilia narrowly black.

Hindwing elongated towards tornus, slightly produced near tornus at veins 2, 3 and 4; upperside shining purple-blue (more bluish than fore wing shining area) and narrowly bluish-white nearest to costa, termen narrowly (<1mm) black, costa light brown above vein 7 and midway between cell and vein 8, merging with dark termen between veins 7 and 6, inner margin broadly brown to vein 1b, cilia black; underside uniformly glossy pale buff-cream with dark brown scaling near termen, cilia narrowly black, broader at tornus and at ends of veins 2, 3, and 4.

Male genitalia (Fig. 63): Vinculum and tegumen ring oval, tapered towards sociuncus, sociuncus rather broad, socii with lateral margin square-shaped, dorsally rounded, socii weakly separated by V-shaped sinus, saccus tapered posteriorly, brachium tapered dorsally and slightly hooked at apex; valva symmetrical, bulbous at base with long appendage stemming from lateral margin; phallus large, with zone of intricate cornuti in post-zonal section, vesica apically flanged.

♀: Unknown.

Etymology. The name is a combination of the Latin word ‘bubalinus’, for the colour buff, reflecting the unusual pale yellowish-brown hue to the underside, and ‘satina’, which refers to the satin lustre to the underside.

Distribution. West Sepik and Western Highlands Provinces, Papua New Guinea.

Ecology. All specimens of *P. bubalisatina* were taken at, or just before, midday as they perched momentarily on foliage overhanging rapid torrents, several metres above the ground. The taxon has a remarkably rapid and robust, wide-ranging flight, which is rather Hesperiid-like.

Remarks. Since it is difficult to accurately determine, the correct nomenclatural positioning of *P. bubalisatina* would be assisted by information about its life history and larval food plants. Several *Philiris* larvae were found in the general type locality area and some were reared to adult (e.g. *P. violetta* (Röber, 1926), *P. praeclara* Tite, 1963 and *P. harterti*). It is not known if larvae of the new species were present among individuals that were not able to be reared to adult due to time constraints. A molecular phylogeny of the genus *Philiris* will undoubtedly better resolve its taxonomic position.

***Philiris baiteta* Müller, sp. n.**

<http://zoobank.org/E2CE34E9-1520-42A5-9E95-DAA8C6D2CBF3>

http://species-id.net/wiki/Philiris_baiteta

Figs 29–33, 64

Type material. Holotype ♂ (Figs 29–31): “Papua New Guinea, Hindenburg Range, Western Province, 1000m, 5°13'S, 141°14'E, 13–17 Feb, 2013, Chris J. Müller, genitalia dissected and held in vial pinned to specimen, (ANIC), Registration: ANIC Database No. 31-023124. Paratypes (8 ♂♂, 1 ♀): 4 ♂♂ labelled the same as the holotype (1 ♂ AM, 1 ♂ BMNH, 2 ♂♂ CJMC); 3 ♂♂ labelled “Papua New Guinea, Baiteta, Madang Prov. 5°00'S, 145°44'E, 380m, 6 August 1987, D.P.A. Sands (on loan to ANIC); 1 ♂ labelled the same as last but 31 July 1987 (on loan to ANIC); 1 ♀ labelled “nr. Oetakwa R., Snow Mts., Dutch N. G., up to 3500 ft., x. xii. 1910 (Meek)” (BMNH).

Diagnosis. *Philiris baiteta* is a distinctive species that was previously confused with the related *P. hypoxantha* (Figs 34, 35). The type specimen of *P. hypoxantha* from south-western Papua Province could not be located but the description (in German) by Röber (1926) is detailed and he describes the wings above as ‘monotonously sepia-brown with low shine’ Röber (1926, p. 375, translated).

A single female of *P. baiteta* in the BMNH (Fig. 32, 32) was recognised tentatively as a ‘form’ of *P. hypoxantha* by Tite (1963) who also added comment that its significance could not be assessed until more material became available. This is obviously the true female belonging to *P. baiteta*.

P. baiteta is readily distinguished from *P. hypoxantha* by the large area of cream-white in the costal and subapical area of the hindwing upperside. Both wings above are uniformly brown in *P. hypoxantha*. The underside of *P. baiteta* is cream-yellow,



Figures 16–30. *Philiris* adults (left side upperside and right side underside, where halved) and label data. **16** *P. lavendula* holotype ♂ (halved, flipped horizontally) **17** *P. lavendula* holotype ♂ label data **18** *P. vicina* holotype ♂ (halved) **19** *P. vicina* holotype ♂ label data **20** *P. marginata* holotype ♂ (halved, flipped horizontally) **21** *P. marginata* holotype ♂ label data **22** *P. fulgens* holotype ♂ (halved) **23** *P. fulgens* holotype ♂ label data **24** *P. f. septentrionalis* holotype ♂ (halved) **25** *P. f. septentrionalis* holotype ♂ label data **26** *P. apicalis* holotype ♂ (halved) **27** *P. apicalis* holotype ♂ label data **28** *P. a. ginni* ♂ (halved) **29** *P. baiteta* holotype ♂ upperside **30** *P. baiteta* holotype ♂ underside. Scale bar = 10 mm.

with a broad cream border to the greyish area on the inner margin of the forewing. Conversely, in *P. hypoxantha*, the underside is bright yellow.

The unusual male genitalia of *P. baiteta* (Fig. 64), *P. hypoxantha* (Fig. 66) and *P. hemileuca* (Fig. 65) emphasise a close relationship of the three taxa, yet each show vast differences in their morphology, in particular the shape of the valva. In all three species the valva is sharply tapered to a spike anteriorly. In both *P. hemileuca* (Fig. 65b) and *P. baiteta* (Fig. 64b) an additional posterior dorso-lateral spike is present, which is much longer and more pronounced in the latter species than in *P. hemileuca*. The phallus of the three species also exhibit notable differences with *P. hypoxantha* bearing an apically enlarged vesica (Fig. 66c), which is bifurcated in *P. hemileuca* (Fig. 65c), yet rather abruptly terminated in *P. baiteta* (Fig. 64c). Parsons (1998) noted that the male genitalia of *P. hypoxantha* bear some resemblance to those of *P. vicina* (Fig. 77), especially in the shape of the valvae and aedeagus.

Description. ♂ (Figs 29–31): Forewing length 14 mm, antenna 8 mm (holotype). Head, palpus and thorax dark brown dorsally, white ventrally, abdomen dark brown dorsally, white ventrally, frons dark grey with white eye ring; legs white with black areas on tibiae; antenna shaft black, ringed conspicuously with white between segments, club wholly black.

Fore wing termen nearly straight, inner margin straight, apex pointed; upperside with ground colour dark uniform brown, cilia brown; underside pale yellow-cream, grading through white towards inner margin where the area between the inner margin and vein 2 and the cubitus are light grey-brown, cilia dark brown.

Hind wing slightly acute at tornus; upperside with ground colour dark uniform brown, a large cream-white apical area extending from base to beyond vein 6 into space 5 but not connected to termen; cilia dark brown except at apex where they are cream; underside uniformly pale yellow, cilia as in upperside.

Male genitalia (Fig. 64): Vinculum and tegumen ring rather rectangular, sociuncus rather broad, square-shaped, socii with lateral margin square-shaped, dorsally rounded, socii not obviously separated by sinus, saccus tapered posteriorly, brachium tapered dorsally; valvae symmetrical, bulbous dorsally at base but flat, boat-shaped laterally, with long toothed appendage ventro-posteriorly and a shorter appendage dorso-posteriorly; phallus with pre-zonal section approximately equal in length to post-zonal section; zone of compacted cornuti in post-zonal section, vesica apically flanged.

♀: (Figs 32, 33), Forewing length 14.5 mm, antenna 8 mm. Similar to male but larger, wings much more rounded. Forewing upperside with diffuse patch of cream white in median area between veins 2 and 4; forewing underside with brown area along inner margin not reaching termen. Hindwing upperside with cream-white patch slightly more extensive, reaching further into space 5.

Etymology. This species is named after the locality in Madang Province where Dr Don Sands, Brisbane, Australia, collected part of the type series, also recognising its distinction from the related *P. hypoxantha*.

Distribution. Western and Madang Provinces, Papua New Guinea; Snow Mountains (Papua), Indonesia.

Ecology. Both *P. baiteta* (Fig. 87) and *P. hypoxantha* were collected around midday as they settled on foliage some metres above the ground over a rapid flowing stream in precipitous terrain (Fig. 86), together with a number of other *Philiris* species. Both species exhibited a rapid, fluttering flight.

Remarks. *P. baiteta* appears to form a small group within *Philiris* also comprising *P. hemileuca* (holotype; Figs 36, 37) and *P. hypoxantha* (Figs 34, 35) and *P. baiteta* appears to fall midway between the two. All species have been taken in the Hindenburg Range area, Western Province, where *P. hemileuca* occurs above about 1500m, while *P. hypoxantha* and *P. baiteta* have been taken together at around 1000m. The latter two species have also been taken flying together elsewhere, in the Snow Mountains, where A. Meek even collected both species on the same day.

***Philiris radicala* Müller, sp. n.**

<http://zoobank.org/EEF3D73A-0478-45A0-83B8-997BBECA6B9B>

http://species-id.net/wiki/Philiris_radicala

Figs 38–43, 67, 68

Type material. Holotype ♂ (Figs 38–40): “Papua New Guinea, Hindenburg Range, Western Province, 1000m, 5°13'S, 141°14'E, 13–17 Feb, 2013, Chris J. Müller, genitalia dissected and held in vial pinned to specimen, (ANIC), Registration: ANIC Database No. 31-023125. Paratypes (7 ♂♂, 2 ♀♀): labelled the same as the holotype (1 ♂ AM, 1 ♂ BMNH, 1 ♂ NARI, 4 ♂♂ CJMC, 1 ♀ ANIC, 1 ♀ AM).

Diagnosis. *Philiris radicala* is unique within *Philiris*, with its very unusual colouration in the male upperside and matt white underside ground colour and dark border to the underside termen in both sexes. The taxon shows some relationship to *P. intensa* (Butler, 1876) (Holotype; Figs 44, 45 and female; Fig. 46), with which it flies in the Hindenburg Range, although the latter species is more commonly encountered below 500m, while *P. radicala* flies between 700–1100m. The male upperside of *P. intensa* is a deep, bright, shining sky blue, whereas that in *P. radicala* is an iridescent turquoise (green-blue). The dark border to both wings on the upperside of the male *P. radicala* is much broader than in *P. intensa* and the border of the forewing is straight, forming a line between the postmedian section of the costa and the tornus, while this border is curved in *P. intensa*. The female upperside of *P. radicala* bears very large white median patches on both wings, unlike *P. intensa* and the discocellulars of *P. radicala* are distinctly dark brown. On the underside of both sexes the ground colour is an unusual powdery matt white, the termen of both wings is heavily blackened, particularly at the vein ends, and dark scaling occurs in the subterminal area. These features are not present in *P. intensa*.

The male genitalia of *P. radicala* corroborates a relationship with *P. intensa*, with both possessing laterally pointed socii (more so in the latter species than in *P. radicala*, see Figs 69, 70) and similar aedeagi. Both taxa also bear triangular-shaped valvae, which are approximately equilateral in *P. radicala* but much longer and apically ta-



Figures 31–45. *Philiris* adults (left side upperside and right side underside, where halved) and label data. **31** *P. baiteta* holotype ♂ label data **32** *P. baiteta* paratype ♀ upperside **33** *P. baiteta* paratype ♀ underside **34** *P. hypoxantha* ♂ (halved) **35** *P. hypoxantha* ♀ (halved) **36** *P. hemileuca* holotype ♂ (halved, flipped horizontally) **37** *P. hemileuca* holotype ♂ label data **38** *P. radicala* holotype ♂ upperside **39** *P. radicala* holotype ♂ underside **40** *P. radicala* holotype ♂ label data **41** *P. radicala* paratype ♀ upperside **42** *P. radicala* paratype ♀ underside **43** *P. radicala* paratype ♂ (halved, flipped horizontally) **44** *P. intensa* holotype ♂ (halved) **45** *P. intensa* holotype ♂ label data. Scale bar = 10 mm.

pered in *P. intensa*. The valvae are slightly asymmetrical in *P. radicala* but symmetrical in the latter species.

Description. ♂ (Figs 38–40): Forewing length 17 mm, antenna 9 mm (holotype). Head, palpus and thorax dark grey dorsally, white ventrally, abdomen dark grey dorsally, white ventrally, frons dark grey with white eye ring; legs white with black areas on tibiae; antenna shaft black, ringed conspicuously with white between segments, apex of club tipped with brown.

Fore wing termen slightly convex, inner margin very slightly bowed near base, apex slightly rounded; upperside bright shining turquoise, costa and termen broadly black, 2mm wide at tornus but up to 5mm wide at apex, the boundary between the dark border and shining turquoise area is straight between veins 2 and 8, cilia white but broadly black at vein ends, giving chequered appearance; underside matt white with apical area suffused with black scales, termen and vein ends distinctly black, cilia as in upperside.

Hind wing rounded; upperside bright shining turquoise, termen broadly black (2 mm wide), between inner margin and vein 1a dark brown-black, grading to light grey-brown basally, apex broadly black, costa broadly light grey, basally grey-brown, cilia white but broadly black at vein ends, giving chequered appearance; underside matt white, subterminal area narrowly suffused with black scales, termen and vein ends distinctly black, cilia as in upperside.

Male genitalia (Figs 67, 68): Vinculum and tegumen ring oval, enlarged towards sociuncus, sociuncus broad, socii with lateral margin pointed apically, dorsally sub-rounded, socii separated by slightly protruding sinus, saccus tapered posteriorly, brachium tapered dorsally and slightly hooked at apex; valva slightly asymmetrical, with left valva longer than left valva, valva equilateral triangle-shaped; phallus slender, with zone of intricate cornuti in post-zonal section, vesica with central ‘tongue’ apically.

♀ (Figs 41, 42): Forewing length (17 mm), antenna length (9 mm), antenna, head, palpus, thorax, legs and abdomen similar to male.

Fore wing termen slightly convex, inner margin very slightly bowed near base, apex slightly rounded; upperside dark brown-black, large area of white extending from base along inner margin to postmedian area and occupying about two-thirds of cell, margins of this pale patch suffused with powder blue, costal half of discocellulars heavily brown-black, intruding into pale area, cilia as in male; underside as in male.

Hind wing rounded; upperside dark brown-black, apical area broadly grey-white, cell and basal area along vein 1b grey-white with powder blue suffusion, inner margin and basal part of costa light grey-brown, discocellulars heavily brown-black, intruding into pale area, cilia as in male; underside as in male.

Etymology. The name ‘radicala’ reflects the extraordinary colouration of the male upperside and overall divergent morphology of this species.

Distribution. Western Province, Papua New Guinea.

Ecology. Males of *P. radicala* were taken around midday and early afternoon as they settled at the tops of tall saplings, between 8–10 metres above the ground, in small clearings created by tree falls in very steep terrain. Females were recorded in similar areas, where they fed at the small white flowers of an unidentified tree. Conversely,

males of *P. intensa*, flying at the same localities but generally at a lower altitude, were always seen to fly within 2–3 metres above the ground in areas of regrowth proximal to streams.

***Philiris hindenburgensis* Müller, sp. n.**

<http://zoobank.org/5DE19383-BA6A-42EA-A2A2-FC8D199927C7>

http://species-id.net/wiki/Philiris_hindenburgensis

Figs 47–49, 72

Type material. Holotype ♂ (Figs 47–49): Papua New Guinea, Hindenburg Wall, Western Province, 1800m (5°07'S, 141°15'E), 9–12 Feb, 2013, Chris J. Müller (ANIC), Registration: ANIC Database No. 31-023126. No Paratypes.

Diagnosis. *Philiris hindenburgensis* is a small species with rounded wings that is unique among those species in the genus with predominantly purple-blue uppersides to the males, in bearing a very broad dark border to the costa and inner margin of the hindwing upperside where the purple-blue is essentially restricted between veins 2 and 6. The broad forewing border that is parallel to the termen is also a feature of the males of *P. satis* Tite, 1963 (Holotype; Figs 50, 51, 81), *P. oreas* Tite, 1963 (Holotype; Figs 52, 53, 82) and *P. albihumerata* Tite, 1963 (Holotype; Figs 54, 55, 83). However, these taxa all have glossy white undersides with a large, prominent black spot on the inner margin of the hindwing underside. In *P. hindenburgensis*, the underside is a light grey-white and the spot on the inner margin is merely represented as a barely recognisable brown smear.

The male genitalia of *P. hindenburgensis* are highly distinctive and do not resemble those of any known *Philiris* species. The sociuncus is long and tapered such that the socii are not obviously separated and the lateral margin of the socii is concave. The valvae in *P. hindenburgensis* are most unusual, with long, slightly asymmetric appendages stemming from the lateral margin of the bulbous base.

Description. ♂ (Figs 47–48): Forewing length 15.5 mm, antenna 8.5 mm (holotype). Head, palpus and thorax dark grey dorsally, light grey ventrally, abdomen dark grey dorsally, light grey ventrally, frons dark grey with white eye ring; legs light grey with black areas on tibiae; antenna shaft black, ringed conspicuously with white between segments, apex of club brown.

Fore wing termen slightly convex, inner margin very slightly bowed in middle, apex slightly rounded; upperside dull frosty purple-blue, termen broadly dark brown-black and of even width (1.5 mm wide), cilia dark brown black; underside uniformly light grey-white, a small dark brown basal patch near inner margin, cilia light grey but dark brown-black at vein ends.

Hind wing rounded; upperside dull frosty purple-blue, costa and inner margin very broadly dark brown so that purple area is, with the exception of a few bordering purple scales, restricted between veins 2 and 6, termen broadly dark brown (approximately 1.5 mm wide), cilia light grey-white but dark brown at vein ends; underside



46



47



48

HOLOTYPE
hindenburgensis Chris J. Müller

PAPUA NEW GUINEA
Hindenburg Wall,
Western Province,
1800m
5° 07' S, 141° 15' E
9–12 Feb. 2013
C.J. Müller

ANIC Database No.
31 023126



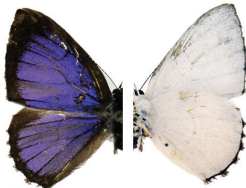
50

Philiris satis
Tite, HOLOTYPE ♂
B.M. Type No. Rh. 16865.

Rothschild
Bequest
B.M. 1939-1,
1648

51

49



52

Philiris oreas
Tite, HOLOTYPE ♂
B.M. Type No. Rh. 16867.

Rothschild
Bequest
B.M. 1939-1,
1648

Gen. 1961-211,
G.E.T.

oreas
27A-796
Tite

53



54



56



57

Philiris albiumerata
Tite, HOLOTYPE ♂
B.M. Type No. Rh. 16863

Rothschild
Bequest
B.M. 1939-1,
1686

55

On Creek nr. Kupang,
Np. Kesumba Mission,
DE HINDANGS PABU, PNC
N.J. PARSONS 17-11-1921
I.P.T.A. coll. Alt 500 m

Philiris sp. nov.
♂
N.J. PARSONS det. 1922

Brit. Mus.
1987-194

B.M.(N.H.)
Rhopalocera
since No.
(N) 1065

58



59

Candalides angabunga
Tite

Rothschild
Bequest
B.M. 1939-1,
1686

Gen. 1961-212,
G.E.T.

60

Specimen photo-
graphed by
B. D'Abreu, 1970

Figures 46–60. *Philiris* adults (left side upperside and right side underside, where halved) and label data. **46** *P. intensa* ♀ (halved) (Hindenburg Range, Western Province), **47** *P. hindenburgensis* holotype ♂ upperside **48** *P. hindenburgensis* holotype ♂ underside **49** *P. hindenburgensis* holotype ♂ label data **50** *P. satis* holotype ♂ (halved) **51** *P. satis* holotype ♂ label data **52** *P. oreas* holotype ♂ (halved) **53** *P. oreas* holotype ♂ label data **54** *P. albiumerata* holotype ♂ (halved) **55** *P. albiumerata* holotype ♂ label data **56** *P. parsonsi* holotype ♂ upperside **57** *P. parsonsi* holotype ♂ underside **58** *P. parsonsi* holotype ♂ label data **59** *P. angabunga* holotype ♂ (halved) **60** *P. angabunga* holotype ♂ label data. Scale bar = 10 mm.

uniformly light grey-white, a very obscure small brown spot between veins 1a and 1b approximately one third the distance from the base to the tornus, cilia light grey-white, dark brown-black at vein ends.

Male genitalia (Fig. 72): Vinculum and tegumen ring long, tapered posteriorly towards sociuncus, sociuncus narrow and rounded, socii with lateral margin pointed apically, concave in middle, dorsally socii unseparated by sinus, saccus tapered posteriorly, brachium long and tapered dorsally; valva slightly asymmetrical, with left valva longer than right valva, valva bulbous at base, with a long appendage stemming from lateral margin and tapering apically; phallus with large median zone of intricate cornuti, vesica with dorsal flange apically.

♀. Unknown.

Etymology. This species is named after the type locality, the monumental Hindenburg Wall.

Distribution. Western Province, Papua New Guinea.

Remarks. Few species of *Philiris* occur at high altitude and in the Hindenburg Wall area at 1800m (Fig. 85) and above, the only species recorded by the author, besides *P. hindenburgensis*, were *P. biplaga* Sands, 1981 and *P. montigena* Tite, 1963, all of which were recorded proximal to streams during rare periods of strong sunshine.

***Philiris parsonsi* Müller, sp. n.**

<http://zoobank.org/92B7442D-AE55-430F-97EF-D716A2FC17D9>

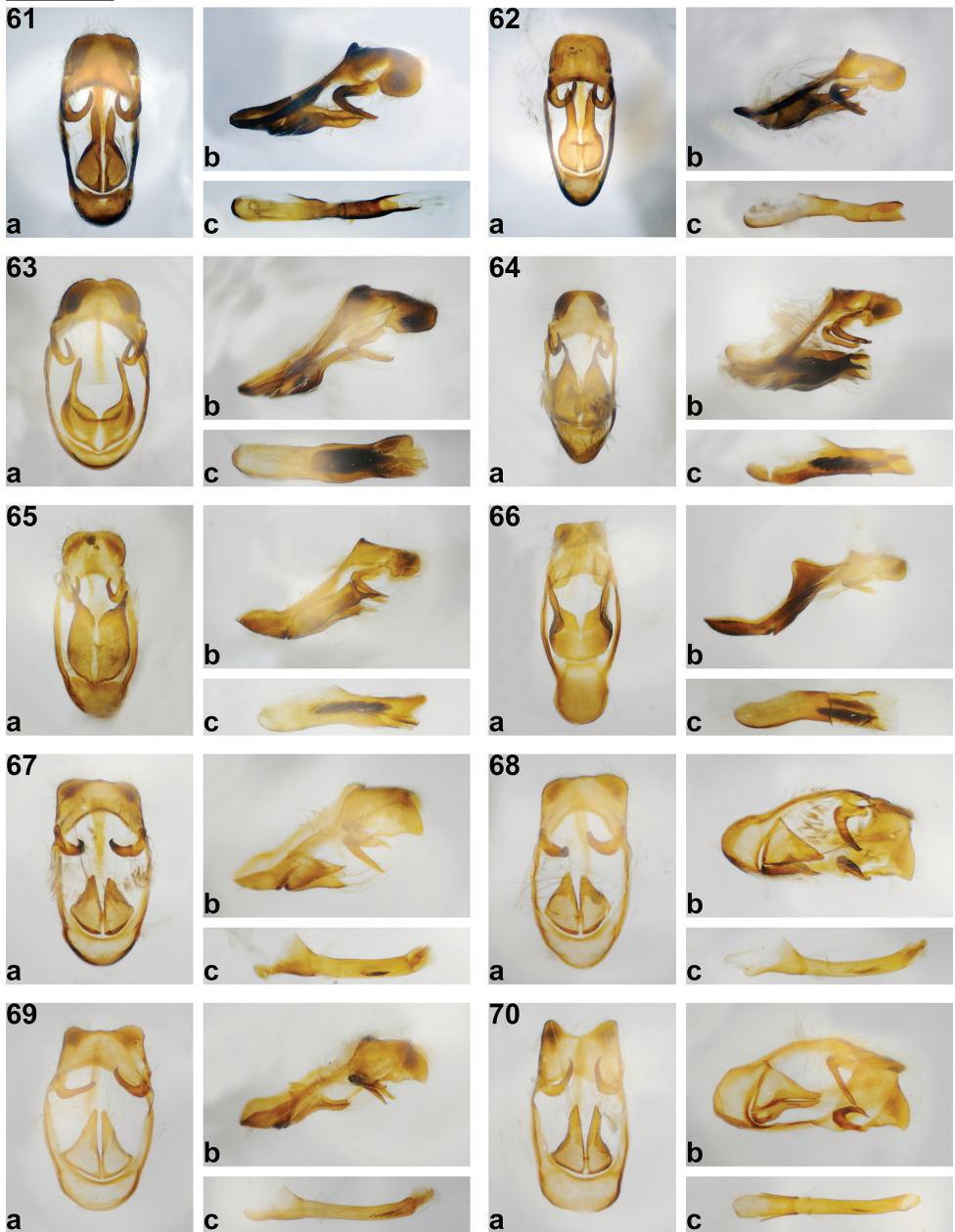
http://species-id.net/wiki/Philiris_parsonsi

Figs 56–58, 73

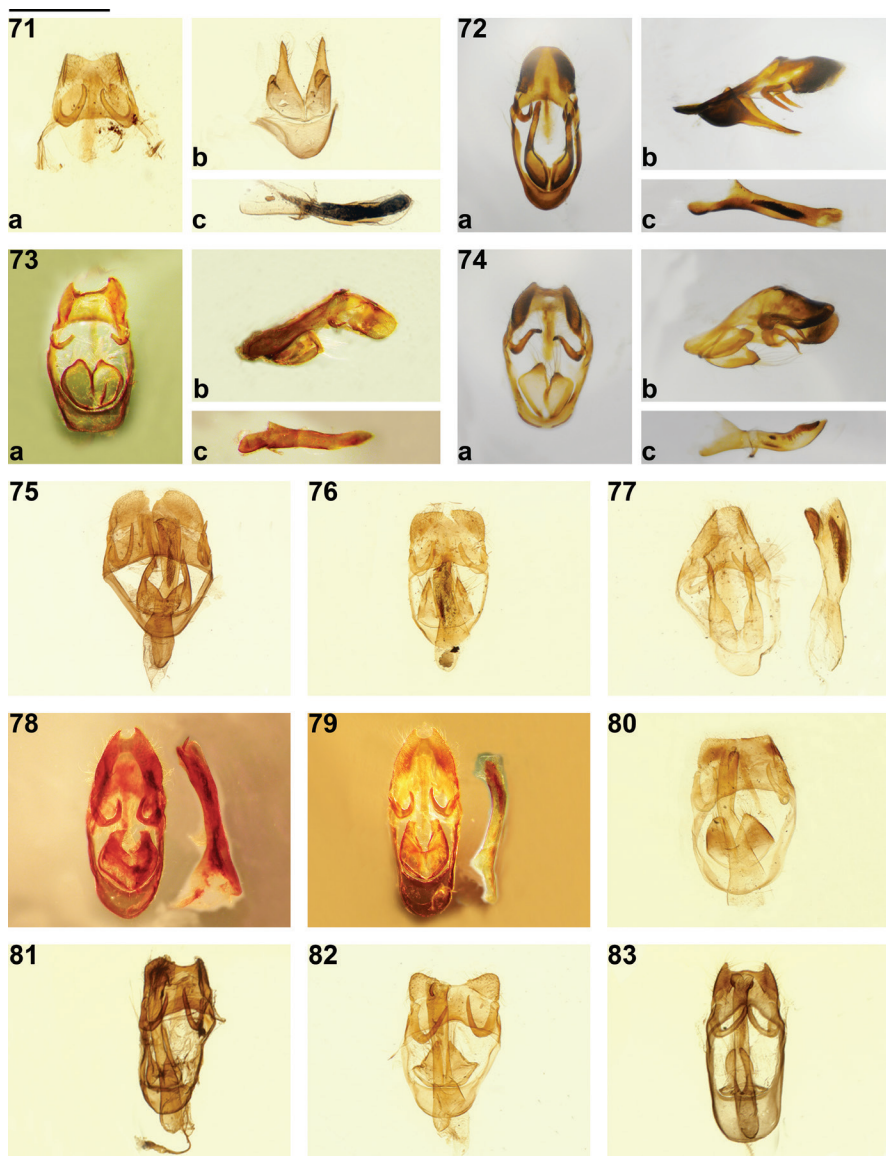
Philiris sp. c (Parsons 1998, p. 378, Plates 53, XII, XXVI)

Type material. Holotype ♂ (Figs 56–58, 73): “On Creek nr. Kupeng, Nr. Koinambe Mission, W. Highlands Prov; PNG, M. J. Parsons, 18-11-1981, I. F. T. A. coll. Alt 1500m”, “*Philiris* sp. nov. ♂, M. J. Parsons det. 1982”, “Brit. Mus. 1987-194”, B.M.(N.H.) Rhopalocera No. (V) 1065”. No Paratypes.

Diagnosis. *Philiris parsonsi* is a distinctive species, presently known only from the unique male holotype, which Parsons (1998) illustrated as an undescribed species. He compared the external facies and male genitalia to *P. angabunga* Bethune-Baker, 1908 (Holotype; Figs 59, 60), within the *Philiris refusa* (Grose-Smith, 1894) group. However, the shape of the forewing and the colouration and maculation of both wing surfaces are unlike any of the described species within that species group. The forewing of *P. parsonsi* is more elongated than in other species and the dark border is much narrower, with the exception of *P. biplaga* and *P. pagwi* Sands, 1979, which have borders parallel to the termen and broader at the tornus, respectively, while that in *P. parsonsi* is widest at the apex. The upperside ground colour in *P. parsonsi* is an unusual pale lilac colour and there are white scales present in the median area of the forewing, not present in other species. The underside configuration of black spots is more complex



Figures 61–70. *Philiris* male genitalia (a genitalia in ventral view with aedeagus removed, b genitalia in lateral view, c aedeagus in lateral view). **61** *P. petriei* (Whiteman Range, West New Britain Province) **62** *P. barterti* (Nr. Wabo, Gulf Province) **63** *P. bubalisatina* holotype ♂ **64** *P. baiteta* (Hindenburg Range, Western Province) **65** *P. hemileuca* (Telefomin, West Sepik Province) **66** *P. hypoxantha* (Nr. Oetakwa River, Papua) **67** *P. radicala* holotype ♂ **68** *P. radicala* (Hindenburg Range, Western Province) **69** *P. intensa* (Bulolo, Morobe Province), **70** *P. intensa* (Nr. Wabo, Gulf Province). Scale bar = approx. 1 mm.



Figures 71–83. *Philiris* male genitalia. **71** *P. albiplaga* (Mefor Island, Papua) (a sociuncus in ventral view, b valvae in ventral view, c aedeagus in lateral view) **72** *P. hindenburgensis* holotype ♂, (a genitalia in ventral view with aedeagus removed, b genitalia in lateral view, c aedeagus in lateral view) **73** *P. parsonsi* holotype ♂, (a genitalia in ventral view with aedeagus removed, b genitalia in lateral view, c aedeagus in lateral view) **74** *P. angabunga* ♂ (Fane, Central Province) (a genitalia in ventral view with aedeagus removed, b genitalia in lateral view, c aedeagus in lateral view) **75** *P. lavendula* holotype ♂ genitalia in ventral view **76** *P. marginata* holotype ♂ genitalia in ventral view **77** *P. vicina* holotype ♂ genitalia in ventral view with aedeagus at right **78** *P. fulgens* holotype ♂ genitalia in ventral view with aedeagus at right **79** *P. f. septentrionalis* holotype ♂ genitalia in ventral view with aedeagus at right **80** *P. apicalis* holotype ♂ genitalia in ventral view **81** *P. satis* holotype ♂ genitalia in ventral view **82** *P. oreas* holotype ♂ genitalia in ventral view **83** *P. albihumerata* holotype ♂ genitalia in ventral view.



Figures 84–98. *Philiris* habitats, live adults and early stages. **84** Mt. Otto, West New Britain Province—typical habitat of *Philiris petriei* **85** Hindenburg Range 1800 m, Western Province—type locality of *P. hindenburgensis* **86** Hindenburg Range, approx. 1000 m, near type locality of *P. baiteta* and *P. radicala* **87** *P. baiteta* male perched in territory (Hindenburg Range) **88** *P. petriei* second instar larva in dorsal view **89** *P. petriei* fourth instar larva in dorsal view **90** *P. petriei* final instar larva in dorsal view **91** *P. petriei* pupa in dorsal view **92** *P. petriei* pupa in lateral view **93** *P. harterti* final instar larva in dorsal view **94** *P. harterti* pupa in dorsal view **95** *P. harterti* pupa in lateral view **96** *P. harterti* final instar larva in lateral view **97** *P. petriei* adult male frons **98** *P. harterti* adult male frons. Scale bar = 1 mm (Fig 88), = 2 mm (Figs 89–96).

than in other species and bears a total of ten individual markings, whereas a maximum of five spots are present in any other species (that for *P. maculata* Sands, 1981).

The male genitalia of *P. parsonsi* (Fig. 73) is also distinctive, the tegumen ring being very squat and squared dorsally when compared with that of *P. angabunga* (Fig. 74). The socii in *P. parsonsi* are widely spaced and the valvae are smaller than those of *P. angabunga* and rounded, whereas those of *P. angabunga* are triangular-shaped.

Description. ♂ (Figs 56–57): Forewing length 13.5 mm, antenna 7 mm (holotype). Head, palpus and thorax dark grey dorsally, white ventrally, abdomen dark grey dorsally, white ventrally, frons grey with white eye ring; legs white with black areas on tibiae; shaft black, ringed conspicuously with white between segments, apex of club brown.

Fore wing termen very slightly convex, inner margin very slightly bowed near base, apex slightly rounded; upperside pale lilac-blue, a scattering of white scales in median area, largely concentrated, but not restricted to, the area between veins 2 and 4, apical area broadly dark brown-black, border 5 mm wide at apex, narrowing evenly to meet tornus, cilia dark brown; underside dull white, cell with a large black spot (approximately 1.5 mm wide) about two thirds from base, two smaller obscure brown-black spots surrounding this spot, slightly closer to base and junction of cubitus with vein 3, discocellulars black, forming an elongated spot, cilia white, dark brown-black at vein ends.

Hind wing rounded; upperside pale lilac-blue, costa and inner margin dark, termen very narrowly dark brown (hairline thickness), cilia dark brown; underside dull white, two large (approximately 1.5 mm diameter) black spots in cell, about two thirds from base, a much smaller spot close to upper spot on basal side, a large black spot between veins 1a and 1b and another obscure dark brown spot of similar size between veins 1b and 2, both spots about one third from base, discocellulars black, forming an elongated spot, cilia as in forewing underside.

Male genitalia (Fig. 73): Vinculum and tegumen ring approximately rectangular-shaped, expanded at sociuncus, sociuncus broad, socii with lateral margin rounded, dorsally socii widely separated by U-shaped sinus, saccus short and squared dorsally, brachium short and abruptly terminated; valva slightly asymmetrical, with right valva larger than left valva, valva rounded with a small protrusion apically; phallus with pre-zonal section shorter than post-zonal section, tapered apically.

♀. Unknown.

Etymology. Named after the collector of the holotype, Dr Michael Parsons, California.

Distribution. Western Highlands Province, Papua New Guinea.

Remarks. The unique holotype was taken in a creek by Parsons (pers. comm. 2013), flying together with *P. angabunga*. Although not listed on the specimen label, Parsons (1998) noted that the creek is known as Wara [Tok Pisin for River] Pimbi.

Discussion

The distinctive black and white colour of both sexes of the species in the *P. harterti* species-group was noted by Sands (1981a). *Parachrysoptera* was originally erected for *Philiris*

bicolor based on its red frons and wing venation but Sands (1981a) proposed that *Parachrysops* be subsumed within *Philiris* based on the two fore-mentioned characters being shared with *P. harterti*. *Philiris petriei* is very unusual within the group in that it possesses black frons, as opposed to the typical red frons.

Although Sands (1981a) proposed that *P. hypoxantha* and *P. hemileuca* be placed in their own species group, Parsons (1998) suggested, due to the colour above, in particular *P. hemileuca*, a relationship to the *harterti* species group.

There were two syntypes of *P. hemileuca* in the original description by Jordan (1930), described as *Candalides hemileuca*. The lectotype designated by Parsons (1998) is in poor condition when compared to the other syntype.

The genitalia slide preparation of the lectotype (then yet to be designated) by Bennett in 1955 for the work of Tite was significantly distorted (examined by the author) and was not illustrated by Tite (1963). Interestingly, Jordan (1930), in his description of *P. hemileuca*, well-illustrated the genitalia of this species, only then known by the two syntypes, of which only one (later designated the lectotype by Parsons (1998) was dissected. Therefore, Jordan obviously made drawings from the genitalia before it was mounted by Bennett. Jordan (1930) particularly noted the apically toothed claspers (valvae) of *P. hemileuca*.

This work has further high-lighted areas of butterfly endemism in Papua New Guinea. In particular, expeditions within the mountains comprising the central cordillera of New Britain Island have yielded other recent noteworthy discoveries (Müller 2013; Müller and Wills 2013 and references there-in). The Hindenburg Range and Star Mountains in Western Province also host a number of recently described taxa (Lachlan 1999, 2000) and the Upper Sepik Basin supports a number of distinctive butterfly taxa, yet to be described (C. Müller, unpublished).

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Description of two new species of *Hisonotus* Eigenmann & Eigenmann, 1889 (Ostariophysi, Loricariidae) from the rio Paraná-Paraguay basin, Brazil

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Abstract

Two new species of *Hisonotus* are described from the rio Paraná-Paraguay basin in Brazil. The most remarkable features of the new species are the odontodes forming longitudinally aligned rows (one odontode after the other, but not necessarily forming parallel series) on the head and trunk (*vs.* odontodes not forming longitudinally aligned rows), a pair of rostral plates at the tip of the snout (*vs.* a single rostral plate), the functional v-shaped spinelet (*vs.* spinelet non-functional, square-shaped, or absent). These features suggest close phylogenetic relationships with *Hisonotus bockmanni*, *H. insperatus*, *H. luteofrenatus* and *H. piracanjuba*. Additionally, both new species are distinguished from their congeners by characters related to head length and depth, orbital diameter, suborbital depth, caudal peduncle depth, pectoral-fin spine length, snout length and counts of teeth. *Hisonotus parsi* **sp. n.** further differs from its congeners by having contrasting dark geometric spots on the anterodorsal region of the body, a character lacking in *H. oliveirai* **sp. n.** The variation in number and shape of the rostral plate, posterior rostrum plates, infraorbitals and the preopercle in both new species and in *H. insperatus* are discussed.

Keywords

Cascudinhos, fresh water, head plates, Hypoptopomatinae, Neotropical fish

Introduction

Hypoptopomatinae is composed of 19 genera and about 135 valid species (Eschmeyer and Fong 2013). This group includes *Hisonotus* Eigenmann & Eigenmann, 1889, which has as type species *H. notatus* Eigenmann & Eigenmann, 1889. Regan (1904) considered *Hisonotus* to be a synonym of *Otocinclus* Cope, 1871. This taxonomy had been followed until Schaefer (1998a), who resurrected *Hisonotus* and listed the following combination of diagnostic characters: reduced or absent snout plates anterior to the nostril, the rostrum with enlarged odontodes, and thickened plates forming the lateral rostral margin. Additional characters used to distinguish *Hisonotus* from other genera of Hypoptopomatinae include a rostrum with enlarged odontodes and thickened plates forming the lateral rostral margins; the latter character is also present in some other species of Hypoptopomatinae, especially in species of *Microlepidogaster* Eigenmann & Eigenmann, 1889 (Britski and Garavello 2007).

The genus *Hisonotus* currently contains 31 valid species (Eschmeyer 2013), 16 of which described in the past decade. Two species from the upper rio Tapajós, *H. chromodontus* and *H. luteofrenatus*, were described by Britski and Garavello (2007). Later, four new species, *Hisonotus iota*, *H. leucophrys*, *H. megaloplax* and *H. montanus*, were described by Carvalho and Reis (2009) from the upper rio Uruguay. An examination of *Hisonotus* from the Laguna dos Patos system revealed an unexpectedly high local species richness of the genus including seven more new species – *Hisonotus armatus* Carvalho, Lehmann, Pereira & Reis, 2008, *H. brunneus* Carvalho & Reis, 2011, *H. carreiro* Carvalho & Reis, 2011, *H. heterogaster* Carvalho & Reis, 2011, *H. notopagos* Carvalho & Reis, 2011, *H. prata* Carvalho & Reis, 2011, and *H. vireo* Carvalho & Reis, 2011. Recently, three more new species were described – *Hisonotus piracanjuba* Martins & Langeani, 2012, *H. bockmanni* Carvalho & Datovo, 2012, and *H. bocaiuva* Roxo, Silva, Oliveira & Zawadzki, 2013. Herein, based on recent collection efforts, we add two new species to the genus *Hisonotus*: one from the upper rio Paraná basin and the other as the first species for this genus from the rio Paraguary basin.

Material and methods

All measurements and counts were taken from the left side of the fish. Measurements were made from point to point to the nearest 0.1 mm with a digital caliper. Body plate and osteology nomenclature follows Schaefer (1997) and measurements follow Carvalho and Reis (2009) as shown in Table 1. Abbreviations used in the text followed Carvalho and Reis (2009). Morphometrics are given as percentages of standard length (SL), except for subunits of the head region that are expressed as percentages of

head length (HL). Specimens were cleared and double stained (c&s) according to the method of Taylor and Van Dyke (1985). Vertebral counts also include the five vertebrae that comprise the Weberian apparatus. Dorsal-fin ray counts include the spinelet as the first unbranched ray. All examined specimens were collected according to the Brazilian laws, and are deposited under permanent scientific collection licenses. After collection, specimens were euthanized using 1% benzocaine in water, fixed in 10% formaldehyde and preserved in 70% alcohol. All samples are deposited at the DZSJRP, Departamento de Zoologia e Botânica, Universidade Estadual Paulista, São José do Rio Preto; LBP, Laboratório de Biologia e Genética de Peixes, Universidade Estadual Paulista, Botucatu; MCP, Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre; MZUSP, Museu de Zoologia, Universidade de São Paulo, São Paulo; NUP, Coleção Ictiológica do Nupelia, Universidade Estadual de Maringá, Maringá; ZUEC, Museu de História Natural "Prof. Dr. Adão José Cardoso", Universidade Estadual de Campinas, Campinas; ZMA, Zoologisches Museum, Universiteit van Amsterdam, Amsterdam. Zoological nomenclature follows the International Code of Zoological (4th Ed.).

Results

Hisonotus oliveirai sp. n.

<http://zoobank.org/2D0CE389-F31D-48AE-8C62-E1C6531410DF>

http://species-id.net/wiki/Hisonotus_oliveirai

Figure 1; Table 1

Holotype. MZUSP 115061, 26.4 mm SL, female, Brazil, Paraná State, boundary between municipalities of Cambira and Apucarana, ribeirão Cambira, affluent of rio Ivaí, upper rio Paraná basin, 23°38'54"S, 51°29'58"W, coll. Zawadzki CH, de Paiva S, 29 October 2007.

Paratypes. All from Brazil, Paraná State. DZSJRP 18244, 3 males, 26.3–26.8 mm SL, ribeirão Salto Grande, rio Ivaí basin, municipality of Maria Helena, 23°37'08"S, 53°12'18"W, coll. Graça WJ, 30 December 2004. LBP 7358, 1 female, 28.4 mm SL, 1 unsexed, 12.4 mm SL, ribeirão Keller, rio Ivaí basin, boundary between municipalities of Marialva and Bom Sucesso, 23°38'30"S, 51°51'33"W, coll. Devidé R, 15 October, 2002. LBP 13332, 1 male, 23.2 mm SL, 1 unsexed c&s, 23.7 mm SL, rio Mourão, rio Ivaí basin, municipality of Campo Mourão, 24°02'23"S, 52°16'22"W, coll. Zawadzki CH, November 2010. LBP 13333, 1 male, 23.6 mm SL, 1 female, 25.4 mm SL, rio Mourão, rio Ivaí basin, municipality of Campo Mourão, 24°02'23"S, 52°16'22"W, coll. Pavanelli CS, 4 December 2006. LBP 13334, 1 male, 24.9 mm SL, ribeirão Keller, rio Ivaí basin, boundary between municipalities of Marialva and Bom Sucesso, 23°38'30"S, 51°51'32"W, coll. Zawadzki CH, November 2010. LBP 13335, 1 male, 26.0 mm SL, ribeirão Salto Grande, rio Ivaí basin, municipality of Maria Helena, 23°37'08"S, 53°12'18"W, coll. Graça WJ, 30 December 2004. LBP

Table 1. Morphometrics and meristics of *Hisonotus oliveirai* and *H. paresi*. SD = standard deviation.

	<i>Hisonotus oliveirai</i> n = 27				<i>Hisonotus paresi</i> n = 15			
	Holotype	Range	Mean	SD	Holotype	Range	Mean	SD
SL	26.4	22.8–28.4	24.4	1.43	26.2	18.0–26.2	22.7	2.99
Percents of SL								
Head length	36.5	35.6–41.1	37.7	1.41	39.2	36.1–41.7	39.4	1.44
Predorsal length	46.8	45.3–52.1	48.3	1.51	47.9	46.9–51.8	49.0	1.54
Dorsal-fin spine length	22.4	22.4–28.3	24.5	1.62	25.4	25.2–27.0	26.2	0.50
Anal-fin unbranched ray length	18.7	16.3–21.3	19.2	1.34	18.2	17.4–21.4	19.8	0.87
Pectoral-fin spine length	23.6	21.6–27.6	24.7	1.57	27.5	27.0–30.1	28.2	0.53
Pelvic-fin unbranched ray length	18.4	16.8–23.2	20.6	1.45	18.7	18.0–21.1	19.7	0.98
Cleithral width	24.6	23.8–26.8	25.3	0.89	23.5	22.2–24.3	23.3	0.49
Thoracic length	18.4	17.6–21.6	19.0	0.80	18.8	16.1–19.8	17.8	1.12
Abdominal length	21.9	17.9–22.3	20.5	1.24	21.5	16.2–21.6	19.0	1.82
Body depth at dorsal-fin origin	21.1	18.6–23.9	21.6	1.25	18.8	16.9–20.7	18.1	1.30
Caudal-peduncle length	28.3	26.3–31.5	29.3	1.18	27.5	25.3–29.8	27.7	1.61
Caudal-peduncle depth	10.5	10.8–12.5	11.4	0.64	10.6	10.2–11.3	10.7	0.27
Percents of HL								
Snout length	50.7	46.9–52.2	49.6	1.49	51.5	50.7–57.1	53.7	1.50
Orbital diameter	15.9	13.9–17.6	15.6	0.93	12.8	11.0–14.1	12.5	0.88
Interorbital width	35.2	32.1–37.1	34.9	1.52	32.8	32.4–36.0	34.2	1.21
Head depth	54.7	51.6–59.2	55.4	2.17	45.3	42.4–47.7	44.8	1.99
Suborbital depth	24.7	20.9–25.5	24.1	1.26	20.8	17.4–22.0	20.0	0.85
Mandibular ramus	11.2	6.8–12.9	10.7	1.12	6.0	6.0–8.0	6.8	0.57
Meristics								
	Holotype	Low–High	Mode	SD	Holotype	Low–High	Mode	SD
Left premaxillary teeth	13	11–18	14	2.0	10	6–10	8	1.37
Left dentary teeth	14	11–15	13	1.22	6	4–7	6	0.42
Left lateral scutes	24	24–25	24	0.64	24	24–25	24	0.48

14917, 4 females, 28.8–29.6 mm SL, 2 males, 26.6–27.4 mm SL, ribeirão Cambira, rio Ivaí basin, boundary between municipalities of Cambira and Apucarana, 23°58'54"S, 51°29'58"W, coll. Zawadzki CH, de Paiva S, 29 November 2007. LBP 17578, 3 females, 27.7–30.4 mm SL, 2 males, 25.4–26.1 mm SL, rio Mourão, rio Ivaí basin, boundary between municipalities of Engenheiro Beltrão and Quinta do Sol, 23°49'41"S, 52°11'43"W, coll. Zawadzki CH, Ruiz HB, Vieira RS, 01 April 2013. MCP 47860, 1 male, 25.6 mm SL, 1 female, 25.9 mm SL, ribeirão Salto Grande, rio Ivaí basin, municipality of Maria Helena, 23°37'08"S, 53°12'18"W, coll. Graça WJ, 30 December 2004. NUP 3578, 7 females, 27.8–28.1 mm SL, 8 males, 24.7–26.8 mm SL, 1 female c&s, 27.6 mm SL, 1 male c&s, 25.5 mm SL, ribeirão Salto Grande, rio Ivaí basin, municipality of Maria Helena, 23°37'08"S, 53°12'18"W, coll. Graça WJ, 30 December 2004. NUP 7065, 1 male, 23.3 mm SL, 1 female, 25.4 mm SL, 1 c&s unsexed, 24.5 mm SL, rio Mourão, rio Ivaí basin, municipality of Campo Mourão, 24°02'23"S, 52°16'22"W, coll. Zawadzki CH, 7 April 2009. NUP 9839, 1 male, 25.3 mm SL, 1 female, 25.8 mm SL, 1 female c&s, 25.0 mm SL, collected with holotype. NUP 15614, 10, 3 males, 25.9–26.5 mm SL, 7 females, 27.2–29.9 mm SL,



Figure 1. *Hisonotus oliveirai*, holotype, MZUSP 115061, female, 26.4 mm SL, from ribeirão Cambira, affluent rio Ivaí, upper rio Paraná basin, boundary between municipalities of Cambira and Apucarana, Paraná State, Brazil.

rio Mourão, rio Ivaí basin, municipality of Engenheiro Beltrão, 23°37'41"S, 52°03'38"W, coll. Zawadzki CH, Ruiz HB, Silva HP, 22 October 2012. ZUEC 8006, 2, unsexed, 25.0–27.9 mm SL, rio Mourão, rio Ivaí basin, municipality of Engenheiro Beltrão, 23°37'41"S, 52°03'38"W, coll. Zawadzki CH, Ruiz HB, Silva HP, 22 October 2012. ZMA 250.056, 2, 1 male, 26.1 mm SL, 1 female, 25.6 mm SL, rio Mourão, rio Ivaí basin, municipality of Engenheiro Beltrão, 23°37'41"S, 52°03'38"W, coll. Zawadzki CH, Ruiz HB, Silva HP, 22 October 2012.

Diagnosis. *Hisonotus oliveirai* can be distinguished from all congeners, except *H. insperatus* Britski & Garavello, 2003, *H. luteofrenatus* and *H. parsi*, by having odontodes forming longitudinally aligned rows (one odontode after the other, but not necessarily forming parallel series) on head and trunk, Fig. 2(A), (B) (*vs.* odontodes not forming longitudinally aligned rows). Additionally, the new species can be distinguished from all congeners except *H. insperatus*, *H. luteofrenatus*, *H. parsi*, and *H. piracanjuba*

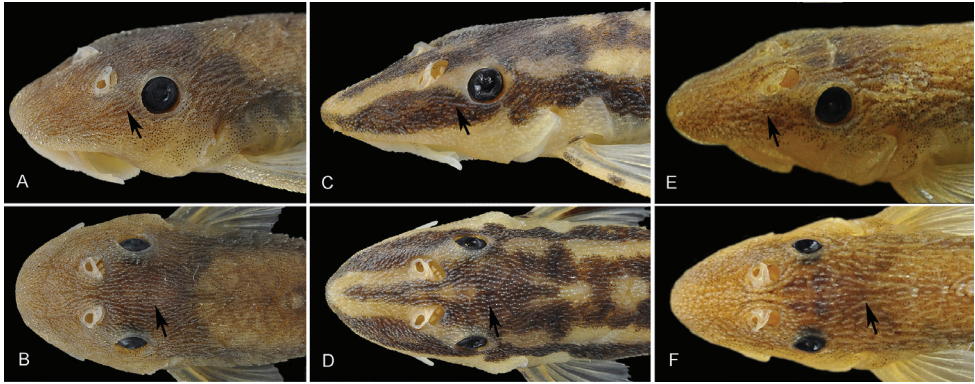


Figure 2. Variation in hypertrophied series of anterolateral (**A, C, E**) and anterodorsal (**B, D, F**) odontodes across three species. **A** *Hisonotus oliveirai*, paratype, NUP 9839, female, 25.8 mm SL, small odontodes **B** *H. oliveirai*, paratype, NUP 9839, female, 25.8 mm SL, small odontodes **C** *H. parsi*, paratype, NUP 10928, male, 24.2 mm SL, small odontodes **D** *H. parsi*, paratype, NUP 10928, male, 24.2 mm SL, small odontodes **E** *H. insperatus*, LBP 1316, 24.7 mm SL, large and conspicuous odontodes **F** *H. insperatus*, LBP 1316, 24.7 mm SL, large and conspicuous odontodes.

by having a pair of rostral plates at the tip of the snout (*vs.* a single rostral plate). Moreover, *H. oliveirai* can be further distinguished from all congeners except *H. bockmanni*, *H. chromodontus*, *H. insperatus*, *H. luteofrenatus*, and *H. parsi* by having a functional v-shaped spinelet (*vs.* spinelet non-functional, square-shaped, or absent). The new species can be distinguished from *H. bockmanni* and *H. parsi* by lacking contrasting dark geometric spots on the anterodorsal region of the body (*vs.* presence); from *H. insperatus* by having small, inconspicuous odontodes forming rows on the head and trunk (Fig. 2A, B; *vs.* large, conspicuous odontodes forming rows on the head and the trunk, Fig. 2E, F), a deeper head 51.6–59.2% HL (*vs.* 44.3–48.7% HL) and higher suborbital depth 20.9–25.5% HL (*vs.* 16.6–20.1% HL); from *H. luteofrenatus* by having a deeper caudal peduncle 10.8–12.5% SL (*vs.* 8.9–10.2% SL) and shorter snout 46.9–52.2% HL (*vs.* 67.0–75.3% HL); from *H. parsi* by a having deeper head 51.6–59.2% HL (*vs.* 42.4–47.7% HL), more premaxillary teeth 11–18 (*vs.* 6–10), and more dentary teeth 11–15 (*vs.* 4–7); from *H. piracanjuba* by having a deeper caudal peduncle 10.8–12.5% SL (*vs.* 8.3–9.5% SL), and shorter snout 46.9–52.2% HL (*vs.* 67.7–72.7% HL).

Description. Morphometric data presented in Table 1. Maximum body length 28.4 mm SL. Dorsal profile of head slightly convex to straight from upper part of rostrum to posterior margin of nares, convex from eyes to posterior margin of parieto-supraoccipital, and straight to dorsal-fin origin. Dorsal profile of trunk slightly concave and descending from dorsal-fin origin to end of dorsal-fin base, straight to caudal peduncle. Ventral profile strongly concave from snout tip to opercular region; convex from opercular region to anal-fin origin; concave to caudal-fin insertion. Greatest body depth at dorsal-fin origin (18.6–23.9% SL). Greatest body width at opercular region, gradually decreasing towards snout and caudal fin. Cross-section of caudal peduncle almost ellipsoid; rounded laterally and almost flat dorsally and ventrally.

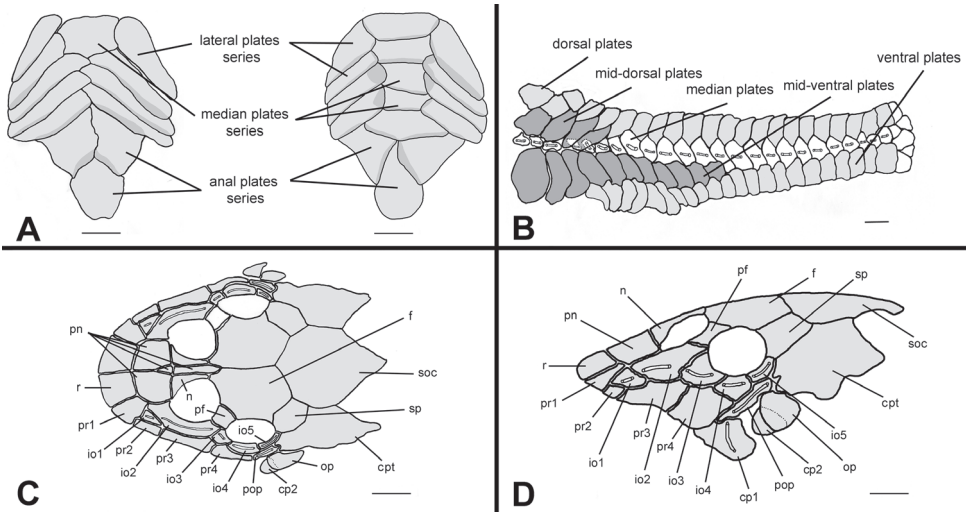


Figure 3. *Hisonotus oliveirai*, paratype, NUP 7065, sex unknown, 24.5 mm SL **A** Ventral view of abdominal region showing intraspecific variation in abdominal dermal plate patterns **B** lateral trunk plates; cranial bones and dermal plates of the head in dorsal **C** and lateral **D** view. Scale bars: 1 mm.

Head rounded in dorsal view, snout round to slightly pointed. Dorsal and ventral series of odontodes along anterior margin of snout completely covering its tip; odontodes larger than remaining ones on head. Odontodes on head and trunk hypertrophied and arranged in longitudinal rows (most prominent on head). Eyes moderately small (13.9–17.6% in HL), dorsolaterally positioned. Lips roundish with papillae uniformly distributed on base of dentary and premaxilla and slightly decreasing distally. Lower lip larger than upper lip; its border fringed. Maxillary barbel present; joined to lower lip by membrane for half its length. Teeth slender and bicuspid; mesial cusp larger than lateral cusp. Premaxillary teeth 11–18. Dentary teeth 11–15.

Dorsal-fin ii,7; dorsal-fin spinelet short and V-shaped; dorsal-fin lock functional; dorsal-fin origin slightly posterior to pelvic-fin origin. Tip of adpressed dorsal fin almost reaching end of anal-fin base. Pectoral-fin i,6; its tip almost reaching middle of pelvic-fin unbranched ray length when depressed. Pectoral axillary slit present between pectoral-fin insertion and lateral process of cleithrum. Pectoral spine supporting odontodes on ventral, anterior and dorsal surfaces. Pelvic-fin i,5; tip of pelvic-fin longest ray almost reaching anal-fin origin when depressed in females and reaching anal-fin origin in males. Pelvic-fin unbranched ray with dermal flap along its dorsal surface in males. Anal-fin i,5; its tip reaching 7th or 8th plate from its origin. Caudal-fin i,14,i; distal margin forked. Adipose-fin absent. Total vertebrae 27.

Body covered with bony plates except above lower lip, around pectoral and pelvic-fin origins and on dorsal-fin base. Cleithrum and coracoid totally exposed. *Arrector fossae* partially to completely enclosed by ventral lamina of coracoids. Abdomen entirely covered by plates (Fig. 3A); abdomen covered by large, elongate lateral plate series, formed by two lateral rows, approximately of same size; median plates formed by two

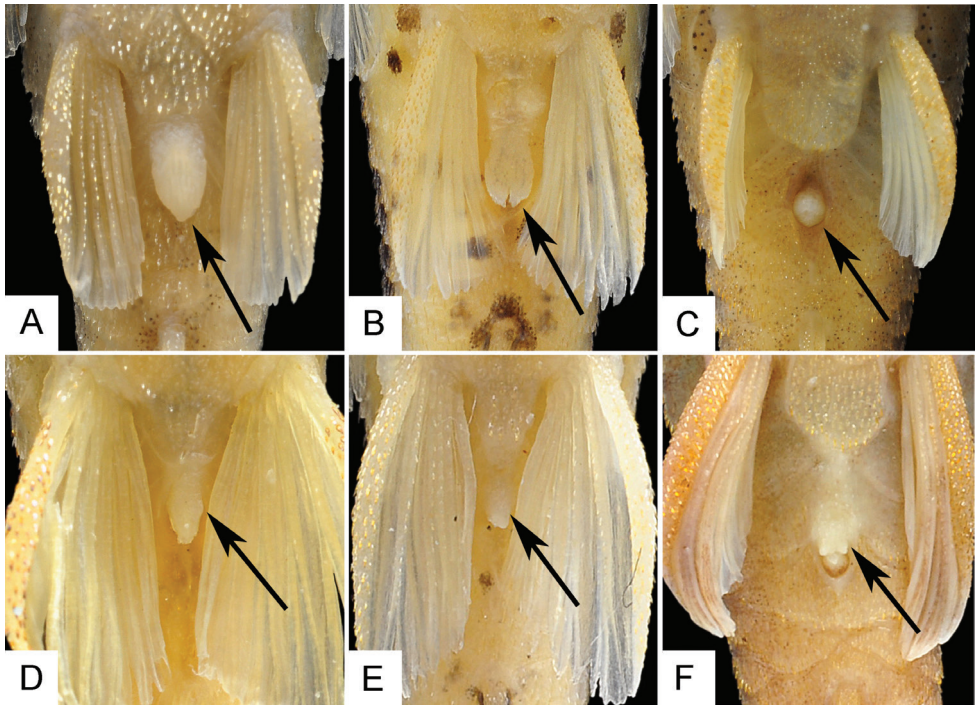


Figure 4. Ventral view of abdominal region of three species of *Hisonotus*, arrows indicate anal membrane in *Hisonotus oliveirai* (**A, D**) and *H. parsi* (**B, E**) contrasting with the lack of the anal membrane in *H. chromodontus* (**C, F**). **A** *H. oliveirai*, MZUSP 115061, holotype, female, 26.4 mm SL **B** *H. parsi*, MZUSP 115062, holotype, female, 26.2 mm SL **C** *H. chromodontus*, LBP 7964, female, 28.1 mm SL **D** *H. oliveirai*, NUP 3578, male, 27.1 mm SL **E** *H. parsi*, NUP 10928, male, 24.2 mm SL **F** *H. chromodontus*, LBP 12278, male, 26.7 mm SL.

patterns of plate distributions; first, median plate series not reaching anal shield plates with lateral plate series beginning to contact each other at middle of abdomen; second, median plate series reaching anal shield and lateral plate series remaining separate; anal plates series covered by large square or triangular plates. Body entirely covered laterally by plates (Fig. 3B); mid-dorsal plates poorly developed and reaching middle of dorsal-fin base; median plates series continuous in median portion of body; mid-ventral plates reaching vertical through end of dorsal-fin base.

Parts of dorsal head bone plates presented in Fig. 3C. Snout tip formed by one pair of square rostral plates (r). Nasal (n) rectangular, forming anterior medial nostril margin, posterior nasal margin contacting frontals (f), anterior and lateral margins contacting pre-nasals (pn). Pre-nasals (pn) positioned posterior to rostral plates (r); formed by two large square-shaped plates, one small and triangular and one elongated and rectangular between nares. Posterodorsal head plates consist of compound pterotic (cpt), parieto-supraoccipital (soc) and frontal (f; largest bones of head), prefrontal (pf) and sphenotic (sp). Compound pterotic (cpt) covered with few and small, unclustered fenestra. Lateral surface of head illustrated in Fig. 3D. Posterior rostrum plates pr1-pr2 smallest, rectangular

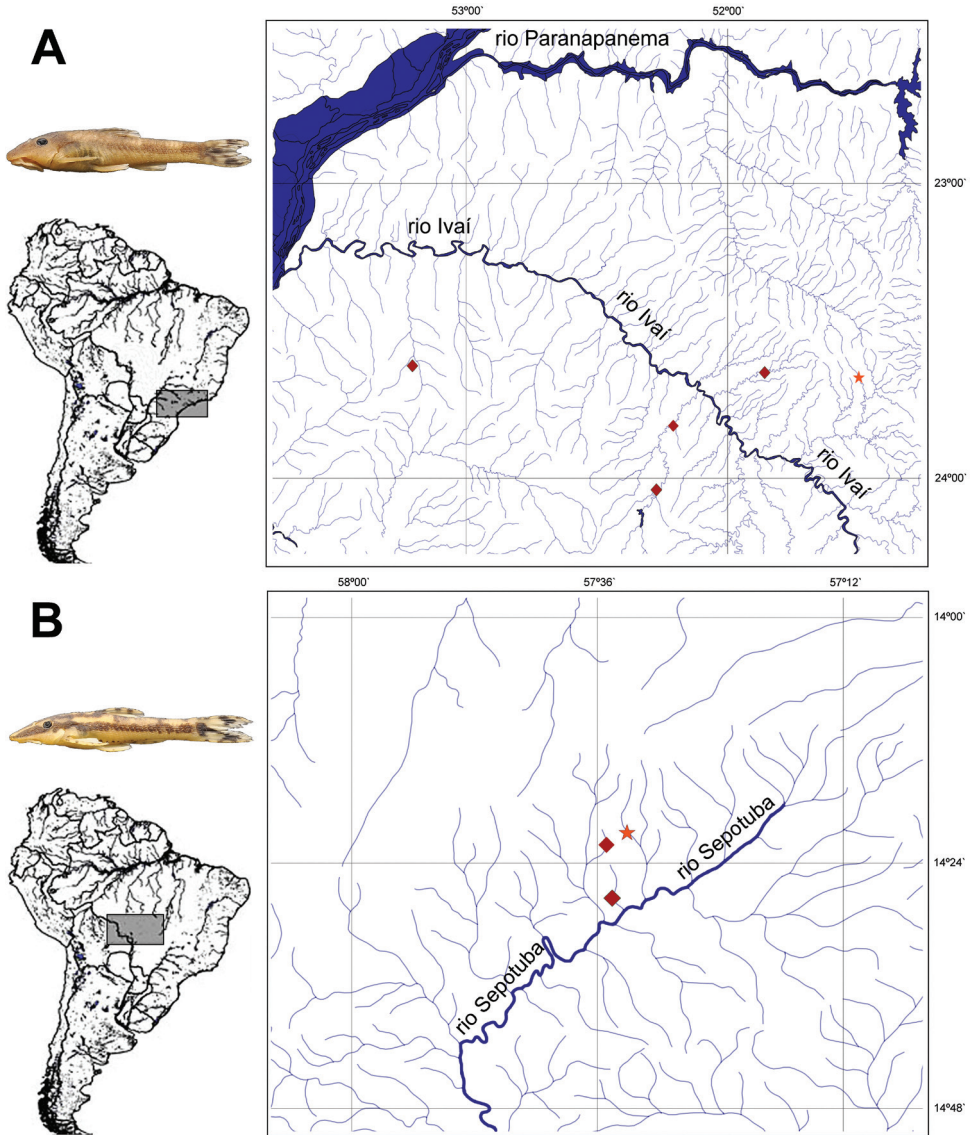


Figure 5. Map of the distribution of **A** *Hisonotus oliveirai*. Star = holotype locality, ribeirão Cambira. Diamonds = paratype localities **B** *H. parsi*. Star = holotype locality, riacho Águas Claras. Diamonds = paratype localities.

shaped; pr4-pr3 largest, first rectangular and second square. Complete infraorbital plate series (io1-io5), present just above posterior rostrum series, all covered by laterosensory canal system; io2 largest and io5 smallest; io3, io4 and io5 forming inferior orbital margin of eyes. Preopercle (pop) elongate and rectangular, covered by laterosensory canal; preopercle present under pr4, io4 and io5, and upper cp1, cp2 and op. Subocular cheek plates (cp1-cp2) and opercle (op) form posterior lateral margin of head.

Coloration in alcohol. Pale yellowish ground color. Dorsal surface of head dark brown, except for pale yellowish areas on snout tip, lateral margin of head and tip of parieto-supraoccipital. Three dark-brown saddles crossing dorsum, reaching longitudinal dark stripe on side of trunk: first below dorsal-fin origin, second typically at adipose-fin region, and third at end of caudal peduncle. Ventral region of anal-fin origin with small single-chromatophore spots. Caudal fin hyaline with two black bars; first at caudal-fin origin, second at middle of caudal fin (Fig. 1).

Sexual dimorphism. Adult males are distinguished by having a papilla at the urogenital opening (*vs.* papilla absent in females); a pelvic fin that extends beyond anal-fin origin (*vs.* pelvic fin not reaching anal-fin origin in females); and an unbranched pectoral- and pelvic-fin ray supporting a dermal flap on their proximal dorsal surface in males. Both sexes have a membrane at anal opening; however, the membrane is longer and large in females (Fig. 4A) than in males (Fig. 4D), covering almost the entire urogenital opening.

Distribution. *Hisonotus oliveirai* is only known from four small to medium-sized streams, the ribeirão Salto Grande, ribeirão Keller, rio Mourão, and the ribeirão Cambira, all tributaries of the rio Ivaí in the upper rio Paraná basin (Fig. 5A).

Etymology. The specific epithet *oliveirai* (a noun in the genitive case) is a patronym honoring professor Claudio Oliveira from the Universidade Estadual Paulista Júlio de Mesquita Filho (UNESP), Botucatu, São Paulo State, in recognition of his dedication and contributions to the studies of Neotropical freshwater fishes.

***Hisonotus paresi* sp. n.**

<http://zoobank.org/FBC435D8-A305-4027-A3C5-5556971CFF8E>

http://species-id.net/wiki/Hisonotus_paresi

Figure 6; Table 1

Holotype. MZUSP 115062, 26.2 mm SL, female, Brazil, Mato Grosso State, municipality of Santo Afonso, riacho Águas Claras, affluent rio Sepotuba, rio Paraguay basin, 14°21'03"S, 57°33'07"W, coll. Troy WP, 14 September 2010.

Paratypes. All from Brazil, Mato Grosso State, rio Sepotuba basin. DZSJRP 18245, 2 females, 19.9–24.3 mm SL, collected with holotype. LBP 13347, 2 females, 18.9–19.6 mm SL, collected with holotype. LBP 13351, 9, 14.7–24.3 mm SL, riacho Águas Claras, Santo Afonso, 14°21'03"S, 57°33'07"W, coll. Troy WP, April 2012. LBP 13352, 1, 23.7 mm SL, riacho Águas Claras, Santo Afonso, 14°21'03"S, 57°33'07"W, coll. Troy WP, April 2012. LBP 17532, 1 male 22.6 mm SL, 2 female 19.5–23.8 mm SL, 1 unsexed not measured, riacho Maracanã, boundary between municipalities of Santo Afonso and Nova Marilândia, 14°22'40"S, 57°35'11"W, coll. Troy WP, Paliga T, Silva VM, 3 April 2010. NUP 10928, 2 males, 23.2–24.2 mm SL, 2 c&cs, 23.6–24.2 mm SL, 1 unsexed not measured, collected with holotype. NUP 10976, 3 unsexed, 16.7–20.5 mm SL, riacho São Jorge, municipality of Santo Afonso, 14°27'26"S, 57°34'34"W, coll. Zawadzki CH, Troy WP, 19 August 2010.



Figure 6. *Hisonotus paresi*, holotype, MZUSP 115062, female, 26.2 mm SL, riacho Águas Claras, affluent rio Sepotuba, rio Paraguay basin, municipality of Santo Afonso, Mato Grosso State.

Diagnosis. *Hisonotus paresi* can be distinguished from all congeners, except *H. bockmanni*, by the presence of contrasting dark geometric spots on the anterodorsal region of body (*vs.* absence of geometric spots). Additionally, the new species can be distinguished from all congeners, except *H. insperatus*, *H. luteofrenatus*, *H. oliveirai*, *H. piracanjuba*) by having a pair of rostral plates at the tip of the snout (*vs.* a single rostral plate). Also *H. paresi* can be distinguished from all congeners, except *H. insperatus*, *H. luteofrenatus* and *H. oliveirai* by having odontodes forming longitudinally aligned rows on head and trunk, Fig. 2C, D (*vs.* odontodes not forming longitudinally aligned rows). The new species can be distinguished from *H. bockmanni* by having a continuous median series of perforated plate (*vs.* median plate series of perforated plates discontinuous, that is, with a gap of unperforated plates), by lacking unpaired plates between the contra-lateral dorsal series (*vs.* having two tiny unpaired plates between the contra-lateral dorsal series, placed eight plates posterior to dorsal fin – see fig. 4 in Carvalho and Datovo 2012), and by having the anterior half of the caudal fin darkly pigmented medially (*vs.* caudal fin with

anterior half hyaline); from *H. insperatus* by a longer pectoral-fin spine, 27.0–30.1% in SL (*vs.* 20.6–25.9%); from *H. luteofrenatus* by a longer head 36.1–41.7% SL (*vs.* 28.8–33.3%), smaller orbital diameter 11.0–14.1% HL (*vs.* 15.0–18.1%) and shorter snout 50.7–57.1% HL (*vs.* 67.0–75.3%); from *H. oliveirai* by lower head depth 42.4–47.7% HL (*vs.* 51.6–59.2%), fewer premaxillary teeth 6–10 (*vs.* 11–18) and fewer dentary teeth 4–7 (*vs.* 11–15); from *H. piracanjuba* by longer head 36.1–41.7% SL (*vs.* 27.9–32.2), deeper caudal peduncle 10.2–11.3% SL (*vs.* 8.3–9.5%), fewer premaxillary teeth 6–10 (*vs.* 14–22) and fewer dentary teeth 4–7 (*vs.* 12–19).

Description. Morphometric data presented in Table 1. Maximum body length 26.2 mm SL. Lateral profile of head convex; straight from upper part of rostrum to posterior margin of nares, slightly curved from eyes to posterior margin of parieto supraoccipital, almost straight to dorsal-fin origin. Dorsal profile of trunk slightly concave, descending from base of dorsal-fin origin to end of dorsal-fin base, straight to caudal peduncle. Ventral profile slightly concave from snout tip to pectoral-fin origin, convex to anal-fin origin, slightly concave to caudal peduncle. Greatest body depth at dorsal-fin origin (16.9–20.7% SL). Greatest body width at opercular region, gradually decreasing towards snout and caudal fin. Cross-section of caudal peduncle almost ellipsoid; rounded laterally and almost flat dorsally and ventrally.

Head rounded in dorsal view. Snout slightly pointed, its tip rounded, elongated (50.7–57.1% HL) and depressed in front of each nostril on dorsal surface. Dorsal and ventral series of odontodes completely covering anterior margin of snout; odontodes of snout similar in size to remaining ones found on head. Snout tip lacking band devoid of odontodes. Odontodes on head and trunk well defined and arranged into longitudinal rows (character more prominent in head). Eyes small (11–14.1% HL), dorsolaterally positioned. Lips roundish and papillose; uniformly distributed on base of dentary and premaxilla and slightly decreasing distally. Lower lip larger than upper lip; its border strongly fringed. Maxillary barbel present. Teeth slender and bicupid; mesial cusp larger than lateral cusp. Premaxillary teeth 6–10. Dentary teeth 4–7.

Dorsal-fin ii,7; dorsal-fin spinelet short and V-shaped; dorsal-fin lock functional; its origin slightly anterior to pelvic-fin origin. Tip of adpressed dorsal-fin rays surpassing end of anal-fin base. Pectoral-fin i,6; tip of longest pectoral-fin ray almost reaching half of pelvic-fin length, when depressed. Pectoral axillary slit present between pectoral-fin insertion and lateral process of cleithrum. Pectoral spine supporting odontodes anteroventrally. Pelvic-fin i,5; its tip almost reaching anal-fin origin when depressed in females and reaching anal-fin origin in males. Pelvic-fin unbranched ray with dermal flap along its dorsal surface in males. Anal fin i,5; its tip reaching 7th and 8th from its origin. Caudal-fin i,14,i; distal margin emarginated. Adipose-fin absent. Total vertebrae 27.

Body covered with bony plates except on ventral part of head, around pectoral and pelvic-fin origin and on dorsal-fin base. Cleithrum and coracoid totally exposed. *Arrector fossae* partially enclosed by ventral lamina of coracoids. Abdomen entirely covered by plates (Fig. 7A), abdomen formed by lateral plate series with elongate and large plates, formed by two lateral plates series, similar in size; median plates formed by one to three plates series reaching anal shield. Lateral of body entirely covered by

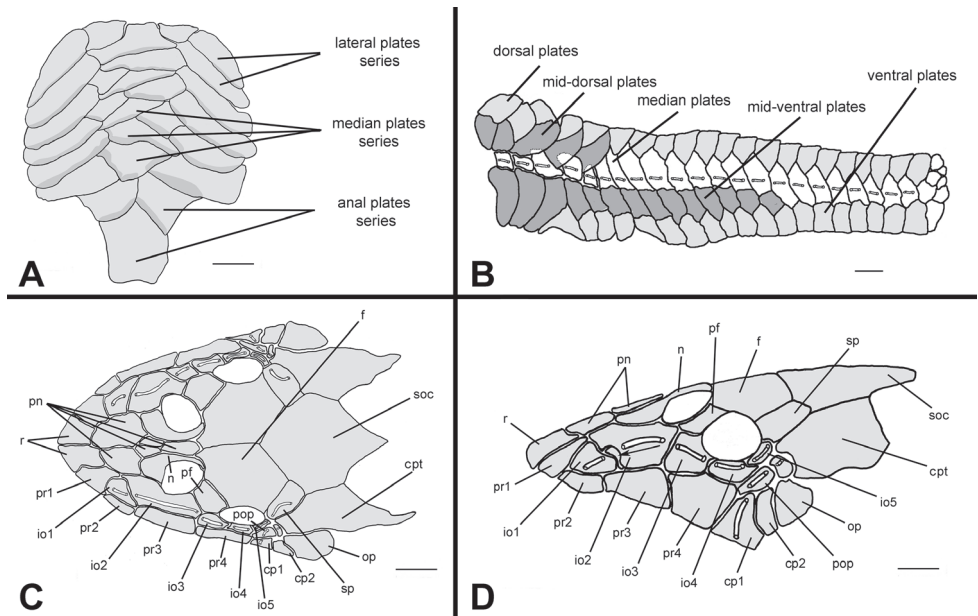


Figure 7. *Hisonotus parsi*, paratype, NUP 10928, male, 24.2 mm SL **A** Ventral view of abdominal plates **B** lateral trunk plates; cranial bones and dermal plates of the head in dorsal **C** and lateral **D** view. Black arrows (**D**) indicate an extra plate that is absent in the right side of the same specimen. Scale bars: 1 mm.

plates (Fig. 7B); mid-dorsal plates poor developed, reaching middle of dorsal-fin base; median plates not interrupted in median portion of body; mid-ventral plates reaching end of dorsal-fin base.

Parts of dorsal head bone plates presented in Fig. 7C. Snout tip formed by one pair of rostral square-shaped plates (r). Nasal (n) almost rectangular forming anterior medial nostril margin in contact posteriorly with frontals (f) and anteriorly and laterally with pre-nasals (pn). Pre-nasals (pn) positioned posteriorly of rostral plates (r), formed by two large and one small square-shaped plates, and one elongate rectangular shaped between nares. Top of head composed by compound pterotic (cpt), parieto supraoccipital (soc) and frontal (f), largest bones of head, and prefrontal (pf) and sphenotic (sp). Compound pterotic (cpt) fenestrated randomly distributed. Lateral surface of head presented in Fig. 7D. Posterior rostrum plates pr1-pr2 small, and rectangular shaped; pr4-pr3 largest, first rectangular and second square-shaped. Infraorbital plate series complete (io1-io5), present just above posterior rostrum series, all covered by latero-sensory canal system; io2 largest and io5 smallest; io3, io4 and io5 forming inferior orbital margin of eyes; preopercle (pop) elongated and rectangular, covered by latero-sensory canal; preopercle present under io4 and io5, and upper cp1, cp2 and op. Subocular cheek plates (cp1-cp2) and opercle (op) form posterior lateral margin of head.

Coloration in alcohol. Ground color of dorsal and ventral region of head and trunk pale yellowish. Conspicuous longitudinal dark stripe enlarging from rostral

plates to anterior corner of eyes, straightening and bordering on ventral margin of eyes, enlarging again through compound pterotic and lateral series of plates to caudal-fin. Another conspicuous longitudinal dark stripe starting medially at pre-nasal plate region and enlarging on supraoccipital region. Unpigmented portion of snout appears as hyaline v-shaped mark from rostral plate passing through nares to orbital margins. Longitudinal dark stripe from superior portion of sphenotic through mid-dorsal plates to posterior margin of dorsal-fin base. Dark blotch on compound pterotic overlaps mid-dorsal longitudinal dark stripe. Dark saddle on middle portion of predorsal region reaches mid-dorsal longitudinal dark stripe. Overall, pigmentation pattern forms geometric spots on anterodorsal region of body. Three dark saddles usually cross posterodorsal region of body, reaching longitudinal stripe on side of trunk: first saddle at middle of dorsal fin, second at adipose-fin region, and third at end of caudal peduncle. Saddles inconspicuous in some specimens. Ventral region of body almost completely pale yellowish, except few dark spots on caudal peduncle and dark ring at anal-fin origin. Dorsal, pectoral, and pelvic fins with dark chromatophores forming irregular sets of bands: three on dorsal and pectoral fin, and one on pelvic fin. Anal fin with few scattered chromatophores, sometimes forming bands. Caudal fin hyaline, except for dark spot on origin of rays, and dark band on middle of rays (Fig. 6).

Sexual dimorphism. Adults males have a papilla in urogenital opening (*vs.* absent in females); have a longer pelvic fin that extends beyond anal-fin origin (*vs.* pelvic fin not reaching anal-fin origin in females); and have an unbranched pelvic-fin ray supporting a dermal flap along its dorsal surface. Both sex have a membrane on the anal opening; however, this membrane is more developed in females (Fig. 4B) than in males (Fig. 4E), covering almost the entire urogenital opening.

Distribution. The species is known from three small tributaries the riacho Águas Claras, riacho Maracaña and riacho São Jorge, all draining to the rio Sepotuba, in the upper rio Paraguay basin (Fig. 5B).

Etymology. The species name *paresi* (a noun in apposition), refers to the the Paresí Indians who speak Paresí, a branch of the Aruak language. The Paresí used to live throughout most of Mato Grosso State including the municipality of Santo Afonso. Paresí were also some of the main guides of Marechal Cândido Rondon, the famous Brazilian pioneer in this region of Brazil at the beginning of the 18th century.

Discussion

Hisonotus oliveirai is externally similar to *H. insperatus* and *H. piracanjuba* both species from upper stretches of the rio upper rio Paraná basin, *H. paresi* resembles more closely to *H. bockmanni* from the rio Tapajós basin. *Hisonotus insperatus*, *H. chromodontus*, *H. luteofrenatus*, and *H. oliveirai* have conspicuous odontodes forming well defined and widely spaced rows on the head and trunk (the main character used to distinguish these species), while *H. paresi* has smaller, less conspicuous odontodes that form closely spaced rows (Fig. 2). Additionally, *H. insperatus*, *H. oliveirai* and *H. piracanjuba* have a

deep head with a snout tip that rises abruptly to the interorbital region in lateral view, resulting in a short-snouted head profile. In *H. bockmanni*, *H. chromodontus*, *H. luteofrenatus* and *H. parsi*, the snout tip rises gently to the interorbital region in lateral view, resulting in a more long-snouted profile. The two snout patterns fit existing geographic patterns since *H. insperatus*, *H. oliveirai* and *H. piraicanjuba* inhabit the upper rio Paraná while *H. parsi* is from the upper rio Paraguay and *H. bockmanni*, *H. chromodontus* and *H. luteofrenatus* are from the upper rio Tapajós. Such patterns among apparently closely related but now allopatric species suggest that the latter three species may have once shared a more broadly distributed ancestor. *Moenkhausia cosmops* Lima, Britski & Machado 2007, *Leporinus octomaculatus* Britski & Garavello, 1993, *Moenkhausia phaeonota* Fink, 1979, *Hyphessobrycon vilmae* Géry, 1966, and *Aequidens rondoni* Miranda-Ribeiro, 1918, *Parodon nasus* Kner, 1859, *Hemiodus semitaeniatus* Kner, 1858, are other examples of fishes occurring in the upper rio Paraguay basin, as well as in the upper rio Tapajós basin. Also, *Batrochoglanis melanurus* Shibatta & Pavanelli, 2005, which occurs at the upper rio Paraguay, appears to have its sister-taxon in the rio Tapajós basin. According to Hubert and Renno (2006) and Lima et al. (2007) these examples suggest that there may be a dispersal route between the upper rio Tapajós and the upper rio Paraguay basins.

Carvalho and Datovo (2012) reported a functional V-shaped spinelet as a character shared among *H. bockmanni*, *H. chromodontus*, *H. insperatus* and *H. luteofrenatus*, and this character is also present in *Hisonotus oliveirai* and *H. parsi*. They suggested that this is apparently synapomorphic within *Hisonotus*, and suggested that those species could compose a new monophyletic genus within the Hypoptopomatinae.

Hisonotus parsi has an unusual coloration pattern with contrasting dark stripes and bands converging to form geometric spots on the anterodorsal region of body, which is more similar in coloration to species of *Otocinclus* than to *Hisonotus*. However, *H. parsi* is morphologically similar to nominal species already assigned to *Hisonotus*, rather than to any other Hypoptopomatinae species. Additionally, *H. parsi* and *H. oliveirai* exhibit one of the diagnostic characters used to define *Hisonotus* in its resurrection by Schaefer (1998a): enlarged odontodes on rostrum. Thus, the aforementioned characters shared with *H. bockmanni*, *H. insperatus*, *H. luteofrenatus*, *H. oliveirai*, *H. parsi* and *H. piraicanjuba* suggest a close phylogenetic relationship among these species.

Osteological characters are known to be conservative within Hypoptopomatinae species compared to external anatomy (Schaefer 1987, 1997, 1998b; Garavello 1977; Mo 1991; de Pinna 1998; Diogo et al. 2001; Ribeiro et al. 2005). Britski and Garavello (2003) used the presence of a pair of rostral plates in the snout tip to diagnose *Hisonotus insperatus*. Martins and Langeani (2012) also used that same character to distinguish *H. piraicanjuba*. This character is present in both *H. oliveirai* and *H. parsi*. However, our results showed that the number and shape of head plates can be highly variable among specimens of a given species. We analyzed 18 cleared and stained specimens of *H. insperatus* from rio Capivara and rio Araquá from Botucatu, São Paulo State. Three individuals of *H. insperatus* had a single rostral plate, instead of a pair of rostral plates, however, all specimens of *H. oliveirai* and *H. parsi* had a pair of rostral

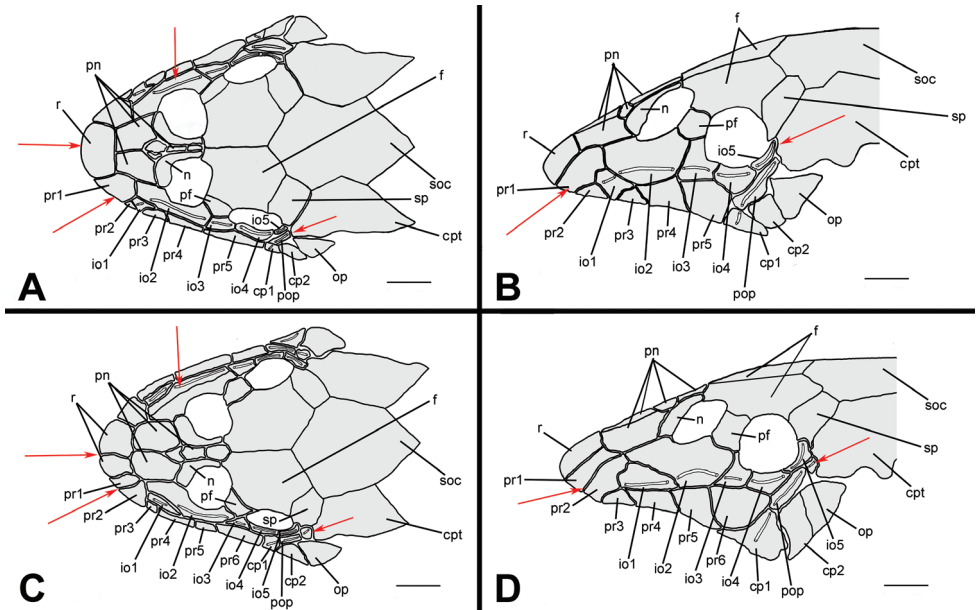


Figure 8. Cranial bones and dermal plates of the head of *Hisonotus insperatus* in dorsal (**A, C**) and lateral (**B, D**) view. Specimen illustrated in **A** and **B**: LBP 13336, female, 26.0 mm SL, from rio Capivara; specimen in **C** and **D**: LBP 13337, female, 28.6 mm SL, from rio Araquá, (both from Botucatu, São Paulo State). Red arrows indicate differences in osteology between the specimens. Scale bars: 1 mm.

plates. Variation in plate shape and number was further found in other head plates, including the posterior rostrum plates, infraorbitals and preopercle plate (red arrows in Fig. 8). For instance, the same specimen might have the fourth infraorbital divided in the right side, but not in the other left side Fig. 8C. This bilateral asymmetry was also found in a paratype of *H. oliveirai* (NUP 9839, 23.7 mm SL). Moreover, the first infraorbital of both sides might reach the ventral margin of the rostrum, among the second and third posterior rostrum plates (Fig. 8 A, B), or not (Fig. 8C, D). Additionally, the size of the first infraorbital is variable among the specimens of *H. insperatus* and *H. oliveirai*. A similar pattern of variation was observed on posterior rostrum plates: the first and second posterior rostrum plates appear to be split only in the left side of the specimen (Fig. 8C, D), increasing the number of posterior rostrum plates to six, *versus* four in the right side. Finally, an extra plate is found among preopercle and compound pterotic perforated to infraorbital canal of the specimen of Fig. 8C, D, but not in the remaining specimens.

Comparative material

All from Brazil, except when stated otherwise: *Hisonotus aky* Azpelicueta, Casciotta, Almirón & Koerber, 2004: MHNG 2643.039, 2, 33.1–34.2 mm SL, paratypes, ar-

roio Fortaleza, Argentina; *Hisonotus bocaiuva* Roxo, Silva, Oliveira & Zawadzki, 2013: MZUSP 112204, male, 24.2 mm SL, holotype, córrego Cachoeira, Bocaiúva, Minas Gerais; LBP 9817, 9, 3 c&s, 18.3–23.2 mm SL, paratypes, córrego Cachoeira, Bocaiúva, Minas Gerais; *Hisonotus carreiro* Carvalho & Reis, 2011: MCP 40943, 3, 33.6–35.8 mm SL, arroio Guabiju, Guabiju, Rio Grande do Sul; *Hisonotus charrua* Almirón, Azpelicueta, Casciotta & Litz, 2006: LBP 4861, 1, 35.9 mm SL, arroio Guaviyú, Artigas, Uruguai; MHNG 2650.051, 1, 34.2 mm SL, paratype, arroio Aspinillar, Uruguay; *Hisonotus chromodontus* Britski & Garavello, 2007: LBP 7964, 25, 24.0–28.3 mm SL, 3 females c&s, 26.5–28.9 mm SL, 1 male c&s 24.9 mm SL, rio dos Patos, Nova Mutum, Mato Grosso; LBP 12278, 2, 26.7–28.7 mm SL, 1 unsexed c&s, 26.7 mm SL, rio Sumidouro, Tangará da Serra, Mato Grosso; MZUSP 45355, holotype, 25.9 mm SL, affluent rio Preto, Diamantino, Mato Grosso; *Hisonotus depressicauda* Miranda Ribeiro, 1918: MZUSP 5383, 24.4 mm SL, paralectotype (designated by Britski, 1969), Sorocaba; *Hisonotus francirochai* Ihering, 1928: LBP 13923, 22, 25.7–35.7 mm SL, córrego sem nome, Capitinga, Minas Gerais; MZUSP 3258, 29.4 mm SL, lectotype (designated by Britski 1969), rio Grande, São Paulo; *Hisonotus heterogaster* Carvalho & Reis, 2011: LBP 3335, 39, 20.8–30.1 mm SL, arroio sem nome, rio Grande, Rio Grande do Sul; *Hisonotus insperatus* Britski & Garavello, 2003: LBP 1299, 3, 23.5–29.6 mm SL, 1 female c&s, 24.8 mm SL, rio Araquá, Botucatu, São Paulo; LBP 1316, 2, 24.1–27.4 mm SL, 1 female c&s, 24.7 mm SL, 1 male c&s, 23.9 mm SL, rio Araquá, Botucatu, São Paulo; LBP 1344, 2, 22.9–24.9 mm SL, rio Araquá, Botucatu, São Paulo; LBP 1373, 1, 25.8 mm SL, rio Araquá, Botucatu, São Paulo; LBP 1405, 2, 22.2–27.3 mm SL, rio Araquá, Botucatu, São Paulo; LBP 4699, 17, 19.6–26.9 mm SL, 4 females c&s, 20.3–26.8 mm SL, 3 males c&s, 24.3–26.1 mm SL, ribeirão Cubatão, Marapoama, São Paulo; LBP 4945, 5, 27.3–28.5 mm SL, 2 females c&s, 28.2–29.9 mm SL, Botucatu, São Paulo; LBP 6770, 5, 25.1–28.2 mm SL, 3 females c&s, 20.0–27.0 mm SL, ribeirão Cubatão, Marapoama, São Paulo; LBP 13336, 1 female c&s, 26.0 mm SL, rio Capivara, Botucatu, São Paulo; LBP 13337, 2 females c&s, 27.4–28.6 mm SL, rio Araquá, Botucatu, São Paulo; MZUSP 22826, paratype, 1, 25.4 mm SL, córrego Água Tirada, Três Lagoas, Mato Grosso; MZUSP 24832, paratype, 1, 23.8 mm SL, rio Corumbataí, Corumbataí, São Paulo; MZUSP 78957, holotype, 29.6 mm SL, rio Capivara, Botucatu, São Paulo; MZUSP 78960, paratypes, 31, 12.6–26.0 mm SL, 5 c&s, 22.7–24.7 mm SL, rio Pardo, Botucatu, São Paulo; MZUSP 78965, paratypes, 10, 15.6–28.6 mm SL, 3 c&s, not measured, rio Araquá, Botucatu, São Paulo; MZUSP 78968, paratypes, 5, 24.1–27.3 mm SL, córrego da Figueira, Lins, São Paulo; *Hisonotus iota* Carvalho & Reis, 2009: LBP 13072, 5, 32.3–33.0 mm SL, rio Chapecó, Coronel Freitas, Santa Catarina; *Hisonotus laevior* Cope, 1894: LBP 3377, 1, 25.2 mm SL, arroio dos Corrientes, Pelotas, Rio Grande do Sul; LBP 6037, 8, 33.4–47.0 mm SL, rio Maquiné, Osório, Rio Grande do Sul; LBP 13187, 7, 19.4–45.8 mm SL, Córrego sem nome, Camaquá, Rio Grande do Sul; *Hisonotus leucofrenatus* Miranda Ribeiro, 1908: LBP 2085, 7, 38.3–50.6 mm SL, rio Sagrado, Morretes, Paraná; LBP 6837, 36, 35.1–43.5 mm SL, rio Fau, Miracatu, São Paulo; *Hisonotus leucophrys* Carvalho & Reis, 2009: LBP 13065, 6, 17.2–33.6 mm SL, rio Ariranhas, Xavantina,

Santa Catarina; LBP 13073, 1, 36.8 mm SL, rio Guarita, Palmitinho, Rio Grande do Sul; *Hisonotus luteofrenatus* Britski & Garavello, 2007: MZUSP 62593, holotype, 28.6 mm SL, córrego Loanda, Cláudia, Mato Grosso; MZUSP 62594, paratype, 8, 22.4–30.5 mm SL, riacho Selma, Sinop, Mato Grosso; MZUSP 95940, 3, 26.1–28.5 mm SL, affluent rio Teles Pires, Itaúba, Mato Grosso; *Hisonotus maculipinnis* Regan, 1912: BMNH 1909.4.2.19–22, 1, 27.0 mm SL, syntype, rio de La Plata, Argentina; *Hisonotus megaloplax* Carvalho & Reis, 2009: LBP 13108, 6, 36.4–37.8 mm SL, Córrego sem nome, Saldanha Marinho, Rio Grande do Sul; *Hisonotus montanus* Carvalho & Reis, 2009: LBP 13051, 3, 26.4–27.2 mm SL, rio Goiabeiras, Vargem, Santa Catarina; LBP 13055, 5, 24.8–31.9 mm SL, rio Canoas, Vargem, Santa Catarina; *Hisonotus nigricauda* Boulenger, 1891: BMNH 1891.3.16.53–62, 1, 32.0 mm SL, syntype, Rio Grande do Sul; LBP579, 16, 34.1–40.1 mm SL, rio Guaíba, Eldorado do Sul, Rio Grande do Sul; *Hisonotus notatus* Eigenmann & Eigenmann, 1889: LBP 3472, 20, 21.0–34.3 mm SL, rio Aduelas, Macaé, Rio de Janeiro; LBP 10742, 25, 24.4–43.3 mm SL, rio Macabu, Conceição de Macabu, Rio de Janeiro; *Hisonotus paulinus* Regan, 1908: BMNH 1907.7.6.9, 28.4 mm SL, holotype, rio Piracicaba, São Paulo; *Hisonotus piracanjuba* Martins & Langeani, 2012: NUP 5059, 1, 24.7 mm SL, córrego Posse, Anápolis, Goiás; NUP 10979, 3, 21.4–21.8 mm SL, ribeirão Bocaina, Piracanjuba, Goiás; *Hisonotus prata* Carvalho & Reis, 2011: MCP 40492, 18, 19.5–33.2 mm SL, rio da Prata, Nova Prata, Rio Grande do Sul; LBP 9918, 14, 21.7–32.6 mm SL, Laguna dos Patos system, Nova Prata, Rio Grande do Sul; *Hisonotus ringueleti* Aquino, Schaefer & Miquelarena, 2001: FMNH 108806, 2, 25.7–32.2 mm SL, rio Quaraí basin, Uruguay; LBP 13148, 1, 24.5 mm SL, arroio Putiá, Uruguiana, Rio Grande do Sul. *Microlepidogaster arachas* Martins, Calegari & Langeani, 2013: LBP 10882, 3, 22.8–35.3 mm SL, rio Paraná basin, Araxás, Minas Gerais; *Microlepidogaster dimorpha* Martins & Langeani, 2011: LBP 10683, 2, 28.8–35.6 mm SL; rio Paraná basin, Uberaba, Minas Gerais; *Otothyris travassosi* Garavello, Britski & Schaefer, 1998: LBP 1971, 13, 14.0–27.2 mm SL; coastal drainage, Canavieiras, Bahia; *Otothyropsis marapoama* Ribeiro, Carvalho & Melo, 2005: LBP 4698, 6, 23.9–36.3 mm SL; rio Tietê basin, Marapoama, São Paulo. *Parotocinclus* cf. *bahiensis* Miranda Ribeiro, 1918: LBP 7182, 3, 27.9–35.6 mm SL; rio Paraguaçu basin, Lençóis, Bahia. *Parotocinclus maculicauda* Steindachner, 1877: LBP 2869, 15, 20.2–44.7 mm SL, rio Ribeira do Iguape basin, Miracatu, São Paulo; *Parotocinclus polyochrus* Schaefer, 1988: LBP 12272, 2, 21.2–22.6 mm SL, ribeirão Ínsula, Barra do Garça, Mato Grosso; *Parotocinclus prata* Ribeiro, Melo & Pereira, 2002: LIRP 1136, 38, 19.8–41.9 mm SL; rio São Francisco basin, Presidente Oligário, Minas Gerais.

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