

Notes on taxonomy of the subfamily Hexacentrinae with descriptions of some taxa (Orthoptera: Tettigoniidae)

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The tribe Hexacentrini, usually included in Listrosclidinae or Conocephalinae, is considered a separate subfamily consisting of about 10 genera; most of them are African, Asiatic, Australian, and New Guinean, but a single genus, *Ecuaneduba* Gor., is Neotropical. A new species of the genus *Glenophysis* Karny is described. The composition of the genus *Parateuthras* Bol. is discussed; a neotype of its type species, *P. truncatus* Bol., is designated.

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Introduction

Karny (1912) included some genera considered now within Hexacentrini in the subfamily Listrosclidinae because of similar predatory adaptations of these taxa. Later on, he put these genera in a special subfamily Hexacentrinae (Karny, 1925). The latter opinion was used also by Kästner (1933). However, in the subsequent publications (Rentz, 1979; Kevan, 1982), the name Hexacentrinae was omitted (these authors apparently included these genera in Listrosclidinae). Gorochov (1988, 1995a) found that the venation of hind wings in the genus *Hexacentrus* A.-Serv. is virtually identical to that of 5 tribes of Conocephalinae: Conocephalini, Agraeciini, Copiphorini, Salomonini, and Coniungopterini. This similarity is additionally supported by the fusion of short parts of veins *MA* and *CuA* at the base of hind wings. The true Listrosclidinae with well developed wings (*Listrosclis* A.-Serv., *Monocero-phora* Walk.) have a much more primitive type of the hind wing venation. These characters led Gorochov (1988, 1995a) to the supposition about possible belonging of *Hexacentrus* to a separate tribe of Conocephalinae.

These remarkable differences in the hind wing venation of Hexacentrini and Listrosclidinae were ignored in the book by Rentz (2001). He included Hexacentrini together with the tribes Terpandrini, Phisidini, Requenini, and Conocephalomimini in Listrosclidinae. However, this view, repeated in the modern version of "Orthoptera Species File" (Eades et al, 2007), is questionable. The structure of hind wings and tarsi in Terpandrini is very similar to that

of Saginae (but not of Listrosclidinae), so that Terpandrini as well as Sagini and Austrosaginae sensu Rentz (Rentz, 1993) probably belong to the same subfamily (Saginae). The structure of body and stridulatory apparatus in Phisidini is similar to that of Meconematinae. There is also a certain similarity of Phisidini and some of Meconematinae in the mode of life and structure of tympana (Gorochov, 1988, 1995a). This similarity suggests that the Phisidini is a tribe of Meconematinae or a separate subfamily most related to Meconematinae. The systematic position of Requenini and Conocephalomimini is not clear; these groups are in need of additional study.

Gorochov (2006) described *Ecuaneduba*, a new Neotropical genus with unclear systematic position. He compared it with the most similar subfamilies and found that this genus has some similarity to *Hexacentrus* "in the shape of pronotal disc and presence of finger-like processes on male paraprocts". But he wrote that "inclusion of the new genus in Hexacentrini is problematic, as the absence of upper spines on fore tibiae is characteristic of Hexacentrini as well as of the majority of Conocephalinae, and one must suppose parallel loss of these spines in different branches of Conocephalinae or independent restoration of them in *Ecuaneduba* (or absence of close relationship between Conocephalinae and Hexacentrini)". Additional study shows that the latter supposition is probably correct, as all studied genera of Hexacentrini are characterized by the presence of processes or lobules on the male paraprocts, and most of them have a flat and rather wide hind lobe of pronotum similar to that of *Ecuaneduba*. It is interesting that the structure of this lobe in imag-

ines and nymphs of *Ecuaneduba*, *Hexacentrus*, and probably some other genera of Hexacentrini is different (in imagines, the hind pronotal lobe is flat and wide, but in nymphs, it is narrow and forming a median keel-like fold; see Gorochov & Warchalowska-Śliwa, 1999: Figs 3, 7, 9).

So, *Ecuaneduba* probably belongs to Hexacentrini, which must be considered a separate subfamily (it may be a sister group of Conocephalinae, as the majority of representatives of Hexacentrinae and Conocephalinae have similar venation of hind wings, but with independent both the forming of “costal lobe” and fusion of parts of *MA* and *CuA*). Their predatory mode of life and some associated characters might be preserved from predatory ancestors, which also gave start to several more primitive predatory subfamilies (Listroscolidinae, Tympanophorinae, and Saginae) from the stem of the group of subfamilies related to Tettigoniinae (Gorochov, 1988, 1995a: group “Tettigoniidae”).

Subfamily HEXACENTRINAE Karny, 1925

The Hexacentrinae are characterized by the following characters: rostrum of head narrow; mandibles simple, moderately long, and without distinct sexual dimorphism; each thoracic sternite with a pair of spines or finger-like processes; fore and middle tibiae with long predatory spines on ventral surface and usually without spines on dorsal one (sometimes dorsal spines present on both pairs of these tibiae or only on middle one, but they are less numerous than ventral spines); hind wings (if not shortened) with developed “costal lobe”, false *M* consisting of different veins (proximal part of *M*, distal part of *RS*, and thickened crossvein between them), and fusion of short parts of *MA* and *CuA* at wing base (see Gorochov, 1995a: Figs 606, 608-610, 612, 614); anal plate and epiproct rather simple (without any distinct specializations) in both sexes (Figs 4, 5, 15); each male paraproct with finger-like process or distinct lobule at apex (Figs 4, 15); male cerci diverse: narrowing to acute apex, characteristically hooked, and without additional processes (Figs 5, 15), or almost cylindrical, not hooked and with 2 medial processes; male genital plate with elongate or short, comparatively narrow distal part sometimes widened at apex; its styli rather long and narrow (Figs 6, 16, 18); male genitalia membranous or with distinct sclerite (Gorochov, 2006: Figs 3-6).

This subfamily includes the genera *Hexacentrus* Audinet-Serville, 1831, *Parateuthras* Bolivar, 1905, *Teuthroides* Bolivar, 1905, *Parahexacentrus* Karny, 1912, *Euhexacentrus* Hebard, 1923, *Glenophysis* Karny, 1926, *Aerotegmina* Hemp, 2001, *Alison* Rentz, 2001, *Ecuaneduba* Gorochov, 2006,

and possibly *Poecilomerus* Karny, 1907. The genera *Parateuthras* and *Poecilomerus* together with *Arachnoscelis* Karny, 1911 were transferred by Gorochov (1995b) from Listroscolidinae to Phisidini after very brief study during his first visit to Berlin (Museum für Naturkunde der Humboldt-Universität). After additional study, this taxonomic position was supported for *Arachnoscelis*, but not for *Parateuthras*. The similarity of tympanal organs in the latter genus and Phisidini is associated with strong inflation of the tympanal part of fore tibiae (Figs 12, 13) unusual of all other groups of Tettigoniidae. In *Parateuthras*, the fore tibiae have a deep concavity near the distal edge of each tympanum (synapomorphy of the group “Tettigoniidae”), but *Arachnoscelis* and other Phisidini have no such concavity. A similar concavity was also found in *Poecilomerus*.

Another problem is associated with the Australian and New Guinean genus *Alison*. All representatives of this genus have a very characteristic ovipositor: somewhat shortened, high (wide), and with strongly inflated proximal half. A similar ovipositor was described also for *Parateuthras*, *Teuthroides*, and *Parahexacentrus* from New Guinea (Karny, 1912), as well as for *Euhexacentrus* from the Philippines (Hebard, 1923) and *Aerotegmina* from Tanzania (Hemp, 2001). Moreover, the coloration and tegminal shape in *Parateuthras* and *Parahexacentrus* is similar to that of *Alison thamyris* Rentz, 2001 (also from New Guinea). The latter species must be included in *Parateuthras*, and a neotype must be designated for the type species of this genus, as the original type material is destroyed (Paris, 1994). *Parahexacentrus* is possibly a synonym of *Parateuthras*. All other species included in *Alison*, including its type species, are characterized by a different shape of tegmina, but they must be compared with the *Teuthroides* and *Euhexacentrus* having some similarity to them in the tegminal shape.

Finally, it is necessary to support here the placement of the genus *Glenophysis* in Hexacentrinae (Karny, 1926; Gorochov, 1998), as it has all diagnostic characters of this subfamily. The inclusion of *Glenophysis* in Meconematinae in the modern version of “Orthoptera Species File” (Eades et al, 2007) is a mistake.

Glenophysis borneo sp. n.

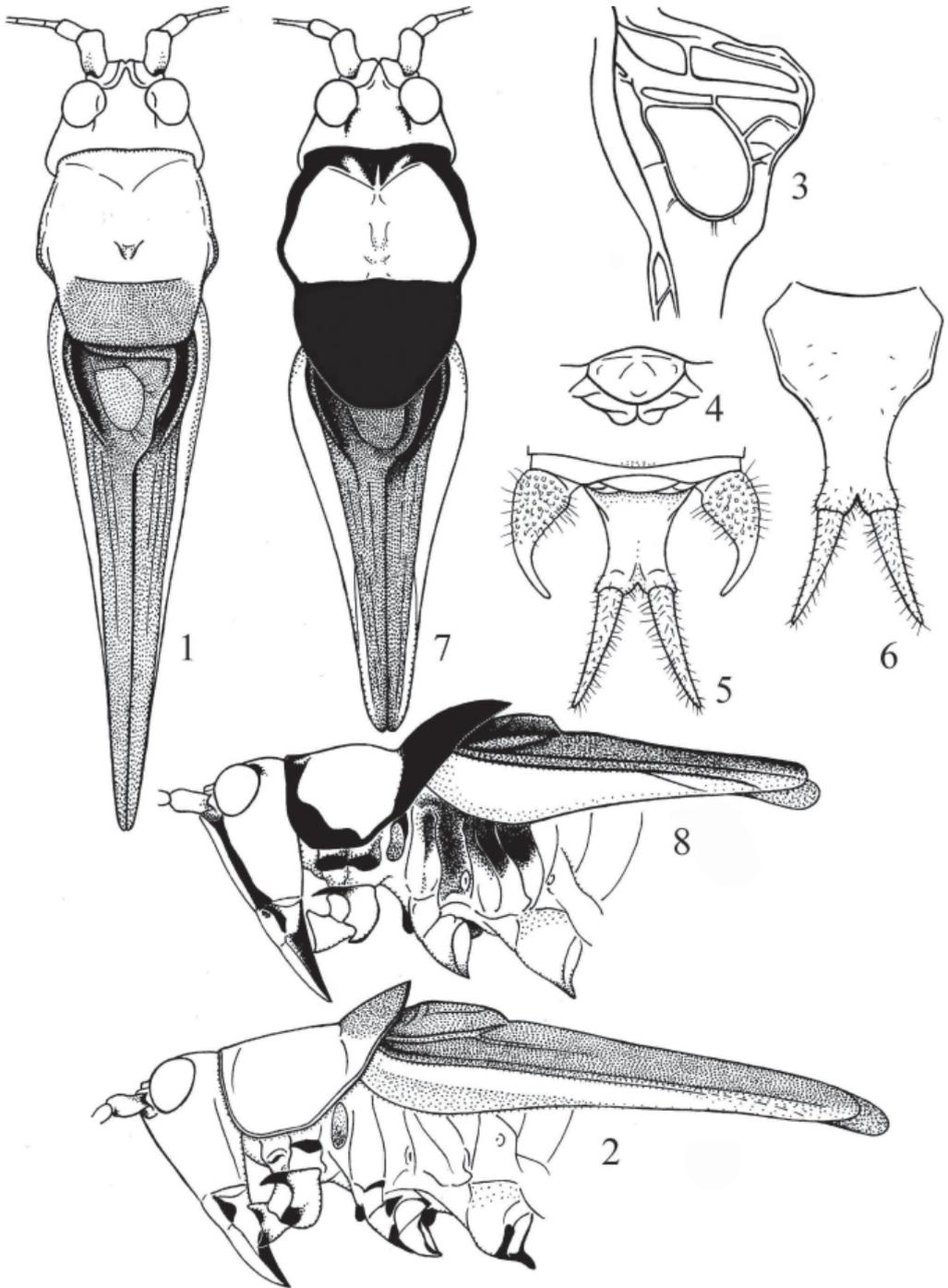
(Figs 1-6, 9, 10)

Holotype. ♂, **Malaysia**, Sabah (North Borneo), 5°33'N, 116°31' E, Trus Madi Mt, near 1000 m, primary tropical forest, at light, 13-25.V.2007, A. Gorochov.

Paratypes. 10 ♂, 3 ♀, same data as holotype.

All type specimens are deposited at Zoological Institute, St. Petersburg.

Description. *Male* (holotype). Shape of body typical of this genus. Coloration yellowish (green-



Figs 1-8. *Glenophysis* Karny, male. 1-6, *G. borneo* sp. n. (1, 2, paratype; 3-6, holotype); 7, 8, *G. pretiosa* Karny. Head, pronotum and tegmina from above (1, 7); same structures with hind wings, thoracic pleurites and coxae from side (2, 8); stridulatory apparatus of upper tegmen (3); epiproct with paraprocts partly from above and partly from behind (4); abdominal apex from above (5); genital plate from below (6).

ish in live specimen) with following marks: head with brownish antennal flagellum, small light brownish spots at base and apex of scape, very slight darkenings between antennae, and black both proximal and distal spots on mandible (as in Figs 1, 2); pronotum with brown hind lobe; tergites of pterothorax with dark brown both stripe along hind edge and median band; thoracic pleurites and coxae with black spots as in Fig. 2; fore and middle trochanters with small blackish spots around distal edge; femora with brown denticles (hind femora also with brownish distal part); tibiae brownish with brown distal part of spines and denticles (fore tibiae also with dark brown apex); tarsi brownish with dark brown spots; tegmina with brown dorsal part (excepting transparent mirror of lower tegmen), comparatively narrow white stripe along upper edge of lateral part, and comparatively wide greyish stripe along its lower edge (as in Figs 1, 2); hind wings darkish with transparent stripe along costal edge, brownish stripe along previous stripe, and whitish some longitudinal veins; abdomen with brown median band (not reaching epiproct) and light brown both a pair of small spots on dorsal surface of genital plate apex and apical portions of cerci and styli. Pronotum with rather short hind lobe; hind part of this lobe roundly truncate and not covering tegminal mirror (as in Figs 1, 2). Tegmina comparatively long, gradually narrowing to narrowly rounded apex; stridulatory apparatus of upper tegmen as in Fig. 3, but that of lower tegmen with distinctly larger and almost oval mirror. Structure of abdominal apex as in Figs 4-6.

Variation. Sometimes darkenings on scape and between antennae more distinct or absent, pronotal disc with small darkening in central part, and fore and middle tibiae partly or almost completely dark brownish green.

Female. Structure of body and coloration similar to male, but hind lobe of pronotum slightly shorter and legs distinctly shorter. Genital plate and ovipositor as in Figs 9, 10.

Length (mm). Body: ♂ 17-20, ♀ 18-19; body with wings: ♂ 19-21, ♀ 20-22; pronotum: ♂ 5.3-5.6, ♀ 4.8-5.1; tegmina: ♂ 12-14, ♀ 14-16; hind femora: ♂ 30-34, ♀ 24-26; ovipositor 8.5-9.5.

Comparison. The new species is very similar to *G. pretiosa* Karny from Malacca, but distinctly differs from the latter species in the absence of blackish marks on epicranium, fore part of pronotum, and pterothoracic pleurites, as well as in the distinctly shorter hind pronotal lobe, longer wings, and narrower white stripe on tegmina (for comparison, see Figs 1, 2 and 7, 8). From all other species of this genus, *G. borneo* is distinguished by the same characters as *G. pretiosa* (see Gorochov, 1998: key to species of *Glenophisis*).

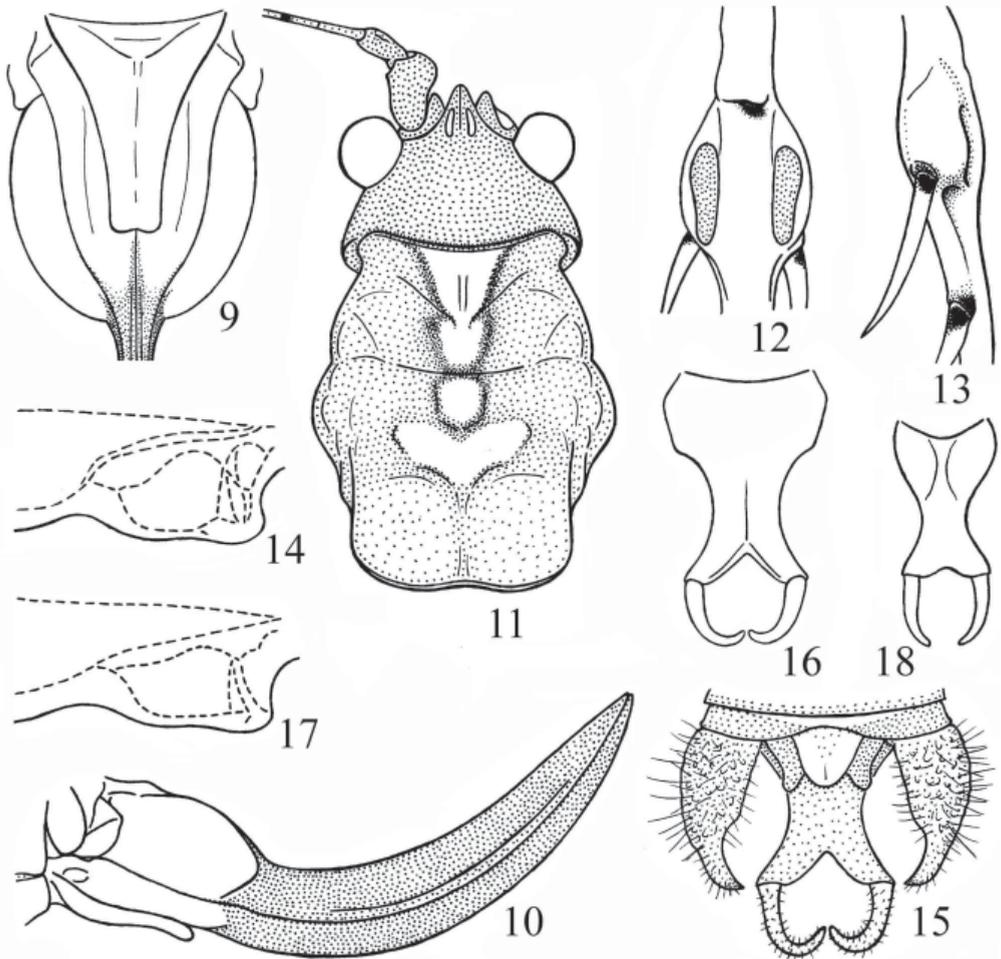
Genus *Parateuthras* Bolivar, 1905

Type species: *Parateuthras truncatus* Bolivar, 1905.

Diagnosis. Upper tubercle of head rostrum rather long, high, narrow from above, with narrowly rounded apex in profile, median groove on dorsal surface, and distinct flat lateral ocelli on lateral surfaces of base; lower tubercle of head rostrum short, rounded, distinctly separated from upper one, and bearing vertical and flat median ocellus under its apical part. Pronotum with characteristic ornament consisting of a few whitish median spots and more or less dark border around them (Fig. 11); openings of prothoracic stigmatae not covered by pronotal edges; spines of thoracic sternites with rounded apex (prothoracic spines rather long and thin; meso- and metathoracic ones distinctly shorter and thicker). Coxae (excepting fore ones) without distinct spines (only with partly rounded and partly angular tubercles); femora with sparse large (almost spine-like) lower denticles on fore edge and numerous very small lower denticles on both edges; fore tibiae long, with strongly inflated tympanal part (Figs 12, 13), curved apex, 5 pairs of long ventral spines, and a pair of shorter ventral spurs; middle tibiae similar to fore ones, but somewhat shorter, without inflation and curvature, and with a single dorsal inner spine in proximal part. Tegmina long, not inflated, rather narrow in proximal part, more or less gradually widened to apex, and obliquely truncate in apical part; stridulatory apparatus not large, occupying small part of tegmina (Fig. 14, 17); hind wings long, but slightly shorter than tegmina, and comparatively narrow. Abdominal segments and epiproct simple; each paraproct in male with short finger-like process; cerci and genital plate of male typical of Hexacentrinae (Figs 15, 16, 18); ovipositor more or less similar to that of *Teuthroides*, *Parahexacentrus*, *Euhexacentrus*, *Alison* and *Aerotegmina*: somewhat shortened, high (wide), and with strongly inflated proximal half (Karny, 1912: Taf. 1, Fig. 10).

Included species. Type species; *Alison thamyris* Rentz, 2001; possibly *Parahexacentrus paradoxus* Karny, 1907.

Comparison. This genus differs from *Alison* in the more inflated tympanal region of fore tibiae, distinctly narrower proximal part and much wider distal part of tegmina, clearly smaller tegminal stridulatory apparatus, and whitish median spots on pronotum (in *Alison*, these spots are dark). The differences from *Parahexacentrus*, *Teuthroides* and *Euhexacentrus* are unclear (the first one is possibly a junior synonym of *Parateuthras*, and others seem similar to *Alison*). From *Aerotegmina*, this genus is clearly distinguished by the tegmina with rather simple (primitive) stridulatory apparatus, and from *Hexacentrus*,



Figs 9-18. *Glenophysis* Karny and *Parateuthras* Bol. **9, 10**, *G. borneo* sp. n.; **11-16**, *P. truncatus* Bol. (neotype); **17, 18**, *P. thamyris* (Rentz) (after Rentz, 2001). Female genital plate with base of ovipositor from below (9); ovipositor from side (10); head and pronotum from above (11); part of fore tibia with tympanal organ from above (12) and from side (13); outlines of veins in stridulatory apparatus of male upper tegmen (14, 17); male abdominal apex from above (15); male genital plate from below (16, 18).

Glenophysis, and *Poecilomerus*, by the different shape of ovipositor.

Parateuthras truncatus Bolivar, 1905
(Figs 11-16)

Neotype (here designated). ♂, **Indonesia**, New Guinea, environs of Jayapura city, Cyclop Mts, about 500 m, partly primary/partly secondary forest, at night, on leaf of bush, 17-19.XI.2004, A. Gorochoy; deposited at Zoological Institute, St. Petersburg.

Description. Male (neotype). Coloration light reddish with transparent hind wings and following marks: ocelli whitish; antennal flagellum with sparse black spots; pronotum with ornament as in Fig. 11 (see also generic diagnosis); large femoral denticles yellowish, each with large dark spot at

base; apices of all femoral denticles somewhat darkened; spines of fore and middle tibiae yellowish, each with not large dark spot at base; tarsi with darkened apices of 4th segment and darkish spots on 3rd one; tegmina with more or less transparent stridulatory apparatus and rather numerous both small yellowish spots and brown dots on other parts of tegmina (reddish, yellowish and brown coloration presented only on veins and numerous veinlets, as small membranes between them almost transparent); epiproct and ventral part of abdomen whitish. Hind lobe of pronotum rather short, flat, with almost truncate apex (Fig. 11). Structure of tympanal organs and stridulatory apparatus of upper tegmen as in Figs 12-14; stridulatory apparatus of lower tegmen with distinctly

larger and oval mirror. Abdominal apex as in Figs 15, 16; apical part of cerci somewhat flattened.

Length (mm). Body 13; body with wings 28.5; pronotum 4.1; tegmina 24; hind femora 12.

Comparison. *P. truncatus* differs from *P. thamyris* in the wider and slightly shorter mirror of upper tegmen, much wider area between distal part of this mirror and *M*, and distinctly deeper notch of male genital plate between styli (for comparison see Figs 14, 17 and 16, 18). From *P. paradoxus*, this species is distinguished, judging by Karny (1912: Taf. 3, Fig. 5), by the more curved fore tibiae and somewhat narrower tegmina.

Note. The previous descriptions of *P. truncatus* suit several specimens known at present: (1) the type material of *P. thamyris* from Genjam, 40 km W of Hollandia [= Jayapura], (2) a single female from New Guinea (Kaiserin Augusta Fluss [= Sepik River], 4°23' S 142°47' E) determined by Karny as *P. truncatus* and indistinguishable from that of *P. thamyris* (this female is deposited at the Museum für Naturkunde der Humboldt-Universität, Berlin), and (3) a male designated here as the neotype of *P. truncatus*. The latter specimen is collected in the same area as *P. thamyris*, but differs from it in the above-mentioned characters of the stridulatory apparatus and the male genital plate, thus this specimen must be included in another species. The type material on *P. truncatus*, which was deposited at the Hungarian Natural History Museum (Budapest), was destroyed (Paris, 1994; personal communication by H. Steinmann, former curator of Orthoptera in this museum). This situation forces neotype designation for *P. truncatus*. The male designated here as the neotype is suitable for such a designation, because it and the missing type material of *P. truncatus* originate from the same island [the difference in their localities (Cyclop Mts and Astrolabe Bay) is not very important, as this species lives in more or less anthropogenic landscapes and apparently has a rather wide distribution].

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