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New species of the katydid genus *Stictophaula* (Orthoptera, Tettigoniidae, Phaneropterinae) from Borneo and Sumatra

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Новые виды кузнечиков рода *Stictophaula* (Orthoptera, Tettigoniidae, Phaneropterinae) из Борнео и Суматры

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Abstract. 6 new species of the genus *Stictophaula* Hebard, 1922 from Borneo (*S. mistshenkoi* sp. n.; *S. coco* sp. n.; *S. aspersa* sp. n.; *S. multa* sp. n.; *S. rara* sp. n.) and Sumatra (*S. recens* sp. n.) are described. These species are distinguished from all the similar species and from each other by the characters of coloration, shape of male genital plate, and structure of male genitalia.
Key words. Orthoptera, Tettigoniidae, Phaneropterinae, *Stictophaula*, new species, South-East Asia.

Резюме. Описаны 6 новых видов рода *Stictophaula* Hebard, 1922 из Борнео (*S. mistshenkoi* sp. n.; *S. coco* sp. n.; *S. aspersa* sp. n.; *S. multa* sp. n.; *S. rara* sp. n.) и Суматры (*S. recens* sp. n.). Эти виды отличаются от всех других сходных видов и один от другого признаками окраски, формой генитальной пластинки самца и строением гениталий самца.
Ключевые слова. Orthoptera, Tettigoniidae, Phaneropterinae, *Stictophaula*, новые виды, Юго-Восточная Азия.

Introduction

In the genus *Stictophaula* Hebard, 1922, 18 species distributed in South-East Asia (from Southern China and Thailand to Java and Borneo) were included (Hebard, 1922; Ingrisch, 1994; Gorochov, 1998, 2003, 2004; Gorochov, Kang, 2004). 6 new species from Borneo and Sumatra are added to this taxon in the present paper. There is also the older generic name *Arnobia* Stål, 1876 supposed for a single Japanese species (Stål, 1876). This species, *Locusta* (*Phaneroptera*) *pilipes* Haan, 1842, is enigmatic, and some authors ascribed this name to a species from equatorial region of South-East Asia (Brunner-Wattenwyl, 1878; Bey-Bienko, 1954). Later Ingrisch (1994) included a few species congeneric with *A. pilipes* of the latter authors in *Stictophaula*. Gorochov (1998) put all the known species similar to *Stictophaula* species in 2 tentative genera: *Arnobia* and *Stictophaula.* But he wrote in this paper that these genera may be only 2 subgenera of the same genus. The present paper is in accordance to the tentative supposition of Gorochov. Unification of these possible subgenera in one genus is in need of revision of true *A. pilipes* (*A. pilipes pilipes* from Japan) for the clarification of correct name of this united genus.

The present paper is based on material from the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (all types of the new species described here are deposited in this institution). Its collections obtain financial support from Rosnauka for UFC no. 2-2.20, and this study is supported by the Russian Foundation for Basic Research (project no. 07-04-00540).

Genus *Stictophaula* Hebard, 1922

Type species – *Stictophaula bakeri* Hebard, 1923 (Singapore).

Note. This genus differs from the nearest genus (or subgenus) *Arnobia* in the following characters: pronotum is with the roundly convex hind edge of disc (in *Arnobia*, median part of this edge is with the very shallow median notch or almost truncate); male genital plate is usually with a pair of moderately long hind lateral lobules and a pair of short hind medial projections (Fig. I: 4–9), but sometimes this plate is with short hind lateral lobules (Fig. I: 1–3) or without hind medial projections (Fig. I: 10) (in *Arnobia*, this plate is with 2 or 3 short hind lobules only); male genitalia are with a distinct denticulate median sclerite and sometimes with an additional median sclerite (Fig. II: 4, 5, 9, 10, 14, 15, 20, 21, 26, 27, 31) (in *Arnobia*, these genitalia are lacking any median sclerites). In relation to the other characters of external morphology, *Stictophaula* and *Arnobia* are very similar to each other They have also a certain similarity in structure of male genitalia: their genitalia are provided with a pair of small lateral sclerotized plates in the male genitalia (these plates may be weakly sclerotized and almost indistinct). So, their morphology supports the idea about close-relationship of these taxa.

***Stictophaula mistshenkoi* sp. n.** (Fig. I: 1, 2; II: 1–6)

Holotype – ♂, **Northern Borneo**, state Sabah, mt. Trus Madi, ~1000 m, partly primary/partly secondary forest, at light, 13–25.V.2007, A. Gorochov. *Paratypes*: 1 ♂, 5 ♀, same data.

Description. Male (holotype). Size and structure of body typical of *Stictophaula*. Coloration yellowish (greenish in living specimen) with rose rostrum of head, very numerous distinct rose dots on pronotum (these dots more distinct after keeping in alcohol), numerous black marks on fore femora (numerous dots on dorsal and medial parts, small spots on medial and lateral sides along their ventral edges, and characteristic longitudinal line along ventral edge of outer side), several small blackish and brown dots on base of fore tibiae, small brownish longitudinal spot on membranes of both tympana (near their dorsal edge), moderately small brownish spots on lateral field of tegmina (between *R* and *M*, between branches of *RS*, and between *M* and dorsal field), brown membranes between veinlets of middle and distal parts of dorsal tegminal field, brownish marks at base of proximal part of this field and (in upper tegmen only) around medial end of stridulatory vein (Fig. II: 1, 2), and transparent both majority of other tegminal membranes and hind wings. Tegmina long and narrow, 4.8 times as long as wide; stridulatory vein of upper tegmen characteristically curved (almost *S*-shaped: Fig. II: 1); mirror of lower tegmen with almost indistinct lateral edge (Fig. II: 2); apical part of hind wings distinctly exposed behind tegminal apex. Abdominal apex without lobes or processes on tergites, with short and rather wide epiproct having almost angular apex, simple arcuate cerci having rather thin distal half (this half with acute and slightly medially curved apical part), and characteristic genital plate having apical part with short lateral lobules and a pair of very small medial projections at middle of shallow notch between these lobules (Fig. I: 1); genitalia with small median sclerite characteristic in shape and having slightly curved distal part (in profile) and large spine-like denticles on distal half of ventral part (including very large apical denticle; Fig. II: 4, 5).

Variations. In paratype, shape of hind part of genital plate as in Fig. I: 2.

Female. General appearance as in male, but base of proximal part of dorsal tegminal field with brown or dark brown marks only on lateral area (Fig. II: 3). Genital plate short, almost transversally triangular, but with roundly attenuatous median part and slightly concave lateral edges of this part; ovipositor short (Fig. II: 6).

Length in mm. Body: ♂ 17–18, ♀ 16–20; body with wings: ♂ 41–42, ♀ 41–43; pronotum: ♂ 5–5.2, ♀ 5.1–5.3; tegmina: ♂ 32–33, ♀ 32–34; hind femora: ♂ 16.5–17, ♀ 17.5–18.5; ovipositor 6.3–6.6.

Comparison. The new species is most similar to *S. annae* Gorochov, 1998 (Borneo) in the shape of male median genital sclerite, but distinguished by the very different shape of male genital plate (this

plate is with the much shorter hind lateral lobes). From all the other congeners, *S. mistshenkoi* differs in the shape of male genital sclerite and of male genital plate.

Etymology. This species is named in memory of L.L. Mistshenko.

***Stictophaula coco* sp. n.** (Fig. I: 3; II: 7–10)

Holotype – ♂, **Northern Borneo**, state Sabah, environs of National park Gunung Arab in Coco Range, 1500 m, primary forest, on leave of bush (at night), 26–27.V.2007, A. Gorochov.

Description. Male (holotype). Size and coloration of body similar to those of *S. mistshenkoi*, but head and pronotum almost without rose marks (a few sparse and very small rose dots presented on head dorsum behind rostrum and on some areas of pronotum; specimen after keeping in alcohol), outer side of fore femora without any dark longitudinal line, proximal part of dorsal tegminal field with dark brown

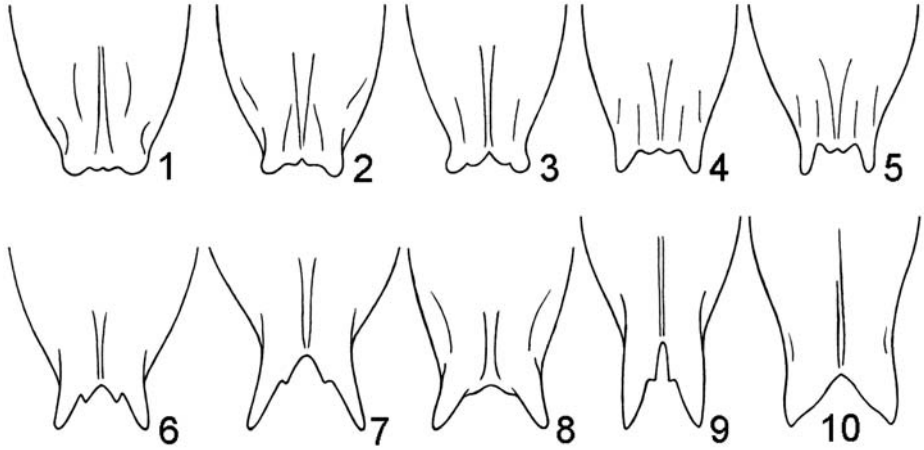

Fig. I: 1–10. *Stictophaula*, male genital plate without base from below: 1, 2, *S. mistshenkoi* sp. n.; 3, *S. coco* sp. n.; 4, 5, *S. aspersa* sp. n.; 6–8, *S. multa* sp. n.; 9, *S. rara* sp. n.; 10, *S. recens* sp. n.

lateral marks at base and darkish membranes between more medial basal veinlets situated before stridulatory vein (Fig. II: 7, 8), genital plate with slightly deeper notch between hind medial projections (Fig. I: 3), and median sclerite of genitalia somewhat shorter and with distinctly smaller denticles (apical denticle much smaller than in *S. mistshenkoi*; Fig. II: 9, 10).

Female unknown.

Length in mm. Body 19; body with wings 41; pronotum 5; tegmina 32; hind femora 17.

Comparison. The new species is most similar to *S. mistshenkoi*, but distinguished by the larger darkened areas of proximal part of male dorsal tegminal field as well as shorter median sclerite of male genitalia having distinctly shorter denticles (especially apical denticle). From all the other representatives of *Stictophaula*, the new species differs in the same characters as *S. mistshenkoi*.

***Stictophaula aspersa* sp. n.** (Fig. I: 4, 5; II: 11–16)

Holotype – ♂, **Northern Borneo**, state Sabah, mt. Trus Madi, ~1000 m, partly primary/partly secondary forest, at light, 13–25.V.2007, A. Gorochov. *Paratypes*: 1 ♂, 3 ♀, same data.

Description. Male (holotype). Size and coloration of body similar to those of *S. mistshenkoi*, but rostrum of head and pronotum uniformly light (specimen after keeping in alcohol), black marks on fore femora somewhat less numerous and smaller (only dots on dorsal part and row of sparse dots on lower half of medial and lateral sides presented), fore tibiae with several additional dark dots on middle third,

spots on lateral field of tegmina reddish and more numerous (sparse additional spots on costal area, between branches of *RA*, and between *RA* and *RS* presented), one of these spot situated between *R* and *M* near (before) base of *RS* distinctly larger and with lighter central part and darker (dark brown) membranes around this central part, and proximal part of dorsal tegminal field more darkened (Fig. II: 11, 12). Structure of body also similar to that of *S. mistshenkoi*, but tegmina somewhat wider (3.8 times as long as wide), stridulatory vein of upper tegmen less curved (Fig. II: 11), mirror of lower tegmen with more distinct lateral edge (Fig. II: 12), apical part of genital plate with distinctly longer lateral lobules (Fig. I: 4), and median sclerite of genitalia with: narrower proximal part, more strongly curved apical part in profile, and smaller denticles (size of denticles almost as in *S. coco*; Fig. II: 14, 15).

Variations. In paratype, largest spot on lateral tegminal field with weakly distinct lighter central part, genital plate as in Fig. I: 5, and median genital sclerite somewhat narrower.

Female. General appearance as in male, but basal half of proximal part of dorsal tegminal field dark brown with brownish venation (Fig. II: 13). Genital plate similar to that of *S. mistshenkoi*, however ovipositor slightly longer (Fig. II: 16).

Length in mm. Body: ♂ 17–20, ♀ 21–27; body with wings: ♂ 42–44, ♀ 45–47; pronotum: ♂ 5.2–5.4, ♀ 5.6–5.9; tegmina: ♂ 34–35, ♀ 36–38; hind femora: ♂ 17.5–18.5, ♀ 18–19; ovipositor 7–7.3.

Comparison. Differences between *S. aspersa* and *S. mistshenkoi*, similar in the shape of male genital plate, are listed above. From *S. coco*, the new species differs in the same characters as *S. mistshenkoi*, and from all the other congeners, in the peculiarities of coloration and characteristic shape of both male genital plate and male genital median sclerite. Female of *S. aspersa* is similar to females of the genus *Arnobia* in the large darkening on the proximal part of dorsal tegminal field, but distinguished from them by the practically rounded hind edge of pronotal disc.

***Stictophaula multa* sp. n.** (Fig. I: 6–8)

Holotype – ♂, **Northern Borneo**, state Sabah, mt. Trus Madi, ~1000 m, partly primary/partly secondary forest, at light, 13–25.V.2007, A. Gorochov. *Paratypes*: 19 ♂, 2 ♀, same data.

Description. Male (holotype). Size and coloration of body similar to those of *S. mistshenkoi*, but head rostrum uniformly light, rose dots on pronotum slightly smaller (specimen after keeping in alcohol), coloration of fore legs almost as in *S. aspersa* (however distal part of fore tibiae with several additional very small brownish dots), stridulatory vein of upper tegmen brownish, and proximal part of dorsal tegminal field with somewhat more numerous brown and brownish marks between veinlets (Fig. II: 17, 18). Structure of body parts also similar to that of *S. mistshenkoi*, but distinguished by slightly more distinct lateral edge of mirror in lower tegmen, much longer hind lateral lobules of genital plate, clearly deeper notch between hind medial (denticle-like) projections of this plate (Fig. I: 6), and median sclerite of genitalia with strongly curved distal part (in profile) and distinctly smaller denticles (Fig. II: 20, 21).

Variations. Coloration and shape of some structures in paratypes varied: fore femora often with rose or reddish areas between nearest dark marks; dark and darkish marks in proximal part of dorsal tegminal field sometimes slightly more numerous; apical part of genital plate somewhat variable (Fig. I: 7, 8).

Female. General appearance as in male, but coloration of pronotum and tegmina as in female of *S. mistshenkoi* (Fig. II: 19). Genital plate similar to that of *S. mistshenkoi* and *S. aspersa*; ovipositor distinctly longer than in both these species (Fig. II: 22).

Length in mm. Body: ♂ 17–22, ♀ 16–18; body with wings: ♂ 40–43, ♀ 39–40; pronotum: ♂ 4.9–5.2, ♀ 5–5.2; tegmina: ♂ 32–34, ♀ 32–33; hind femora: ♂ 16–17.5, ♀ 17.6–18.8; ovipositor 7.7–8.

Comparison. The new species is distinguished from *S. mistshenkoi*, *S. coco*, and *S. aspersa* by the much longer hind lateral lobules of male genital plate. There is also a certain similarity of *S. multa* to *S. bakeri* Hebard, 1922 and *S. quadridens* Hebard, 1922 (both from Singapore) in the shape of male genital plate, but this plate in *S. bakeri* has the longer (almost spine-like) hind median projections, and *S. quadridens* is with the "limbs immaculate" (Hebard, 1922). From all the other congeners, the new species differs in the structure of apical part of male genital plate in combination with the peculiarities of coloration, shape of median sclerite in the male genitalia, and length of ovipositor.

***Stictophaula rara* sp. n.** (Fig. I: 9; II: 23–28)

Holotype – ♂, **Northern Borneo**, state Sabah, mt. Trus Madi, ~1000 m, partly primary/partly secondary forest, at light, 13–25.V.2007, A. Gorochov. *Paratype* – ♀, same data.

Description. Male (holotype). Size and coloration of body similar to *S. mistshenkoi*, but head rostrum uniformly light, head dorsum (behind rostrum) with sparse and small reddish dots, pronotum with numerous small brown dots on upper half (on disc and upper half of lateral lobes) and reddish ones on lower half, fore femora with sparse small blackish dots and several small black spots on lower part of medial and lateral sides, fore tibiae additionally with several small brownish dots at middle third, tegmina with almost indistinct darkish spots on lateral field and with several darkish marks before stridulatory vein and after mirror at proximal part of dorsal field (Fig. II: 23, 24). Structure of body parts similar to *S. multa*, but lateral edge of mirror in lower tegmen more distinct, genital plate with distinctly deeper and narrower notch between hind medial projections (Fig. I: 9), and median sclerite of genitalia distinctly *S*-shaped in profile (in *S. multa*, it slightly curved or almost straight) and with more strongly curved distal part having long apical denticle and rather short subapical denticles (Fig. II: 26, 27).

Female. General appearance as in male, but head without distinct dots, dots of lower half of pronotum brown, fore femora with additional brown longitudinal line along ventral edge of lateral side, and coloration of proximal part of dorsal tegminal field as in female of *S. mistshenkoi* and *S. multa* (Fig. II: 25). Genital plate and ovipositor similar to those of *S. aspersa*, but ventral edge of ovipositor slightly more arcuate (Fig. II: 28).

Length in mm. Body: ♂ 19, ♀ 24; body with wings: ♂ 43, ♀ 45; pronotum: ♂ 5.5, ♀ 5.7; tegmina: ♂ 34, ♀ 35; hind femora: ♂ 18, ♀ 18.5; ovipositor 7.4.

Comparison. The new species is most similar to *S. multa*, but it differs from the latter species in the more uniform coloration of tegmina, brown dots on pronotal dosc, deeper and narrower hind median notch of male genital plate, and distinctly more strongly curved median sclerite of male genitalia. From all the other congeners, *S. rara* differs in the peculiarities of coloration, length of ovipositor, and shape of male genital plate and of male median genital sclerite.

***Stictophaula recens* sp. n.** (Fig. I: 10; II: 29–31)

Holotype – ♂, **Southern Sumatra**, prov. Sumatera Selatan, environs of vill. Banding Agung on lake Ranau (Danau Ranau), 04˚48.695' S, 103˚55.289' E, 600–700 m, 19–22.IV.2009, A. Gorochov, M. Berezin, E. Tkatsheva.

Description. Male (holotype). General appearance typical of *Stictophaula*. Coloration yellowish (greenish in living specimen) with following marks: rostrum of head with rose tinge; anterior half of pronotum with numerous small rose dots (specimen after keeping in alcohol); fore femora with 4 groups of large blackish dots inside 4 large rose spots situated on dorsal half, a few short black longitudinal stripes situated along ventral edge of lateral side, and several black dots along ventral edge of medial side; fore tibiae with 3 blackish marks on proximal part (a pair on tympana near their dorsal edge and dorsal one between tympana) and a few dark dots near them; tegminal lateral field with 3 short and thickened longitudinal whitish veinlets situated between *R* and *M* (near base of *RS*, near base of its most proximal branch, and between base of *RS* and base of *MA*); tegminal dorsal field with large brown lateroproximal spot and several brownish marks not far from stridulatory vein (after it) (Fig. II: 29, 30), and dark membranes in middle and distal parts of this field; other membranes between tegminal veinlets and hind wings almost transparent. Tegmina long and narrow, 4.8 times as long as wide; stridulatory apparatus as in Fig. II: 29, 30; hind wings somewhat longer than tegmina. Abdomen more or less similar to that of *S. mistshenkoi*, but genital plate without hind medial projections (Fig. I: 10), and genitalia with 2 median sclerites (Fig. II: 31): dorsal sclerite (partly membranous, long, rather narrow, strongly arcuate in profile, with semimembranous finger-like apical process and small denticles) and ventral one (semimembranous, small, with numerous very small setae).

Female unknown.

Length in mm. Body 17; body with wings 43; pronotum 5.3; tegmina 34; hind femora 19.

Comparison. The new species is most similar to *S. dohrni* Gorochov, 1998, *S. soekarandae* Gorochov, 1998 (both from Sumatra) and *S. omissa* Gorochov, 2003 (Java) in the shape of dorsal sclerite of male genitalia, but clearly distinguished from them by the absence of lateral lobes of this sclerite and much smaller ventral sclerite of male genitalia. From all the other congeners, *S. recens* differs in the presence of only 3 whitish thickened veinlets in the tegmina, absence of hind medial projections in the male genital plate, and characteristic structure of male genitalia.

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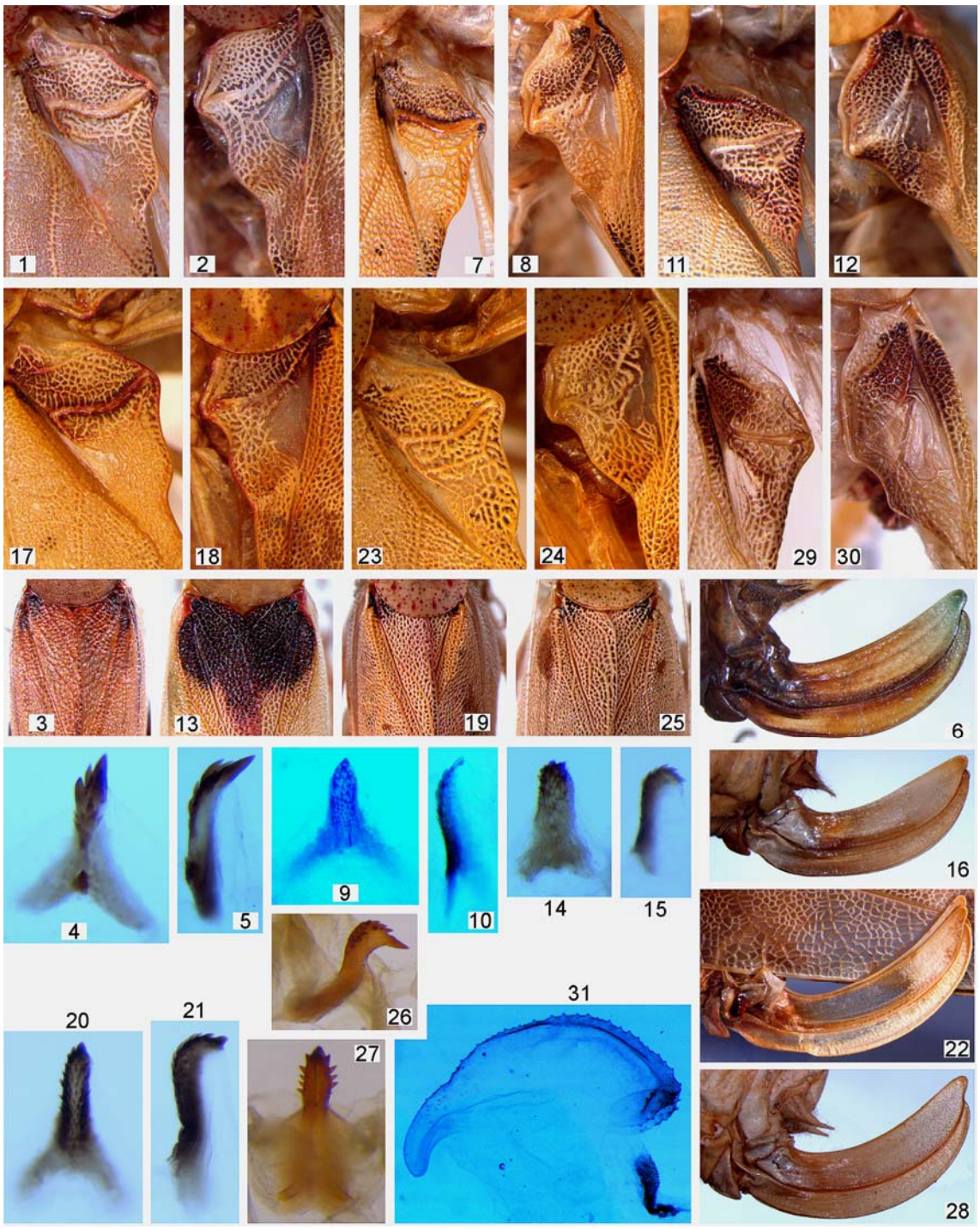

Fig. II: 1-31. *Stictophaula*: 1-6, *S. mistshenkoi* sp. n.; 7-10, *S. coco* sp. n.; 11-16, *S. aspersa* sp. n.; 17-22, *S. multa* sp. n.; 23-28, *S. rara* sp. n.; 29-31, *S. recens* sp. n. Proximal part of dorsal field of male upper (1, 7, 11, 17, 23, 29) and lower (2, 8, 12, 18, 24, 30) tegmina; same part of female tegmina (3, 13, 19, 25); median sclerites of male genitalia from below (4, 9, 14, 20, 27) and from side (5, 10, 15, 21, 26, 31); ovipositor from side (6, 16, 22, 28).