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PEYRIERASUS GEN. NOV. – A NEW GENUS OF FLATIDAE (HEMIPTERA: FULGOROMORPHA) FROM SOUTHEASTERN MADAGASCAR

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Abstract.— The paper describes a new flatid genus, *Peyrierasus* **gen. nov.**, and a new species *P. philippiae* **sp. nov.** from Anosyan mountains of southeastern Madagascar. Additionally, the illustrations of the female internal genital structures are provided.

Key words.— Entomology, taxonomy, mountain fauna, endemism.

INTRODUCTION

Madagascar represents one of the world's top 12 "mega diversity" hotspots, characterized by high levels of taxonomic endemism and species diversity (Myers *et al*. 2000, Ganzorn *et al*. 2001, Goodman and Benstead 2005). However, little is known of the processes that created the present species richness and endemism in Madagascar as only fragmentary taxonomic, phylogenetic, and distributional information exists. Wilmé *et al*. (2006) proposed that the diversification processes in Madagascar, especially at low elevations, occur within recognizable ecoregions, which may correlate to watersheds separated by arid areas which impede gene flow. Conversely, several studies have shown the high species diversity of the mountain massifs and their supposed role as refugia, centres of clade origin and endemism (Raxworthy and Nussbaum 1996, Boumans *et al*. 2007).

Flatidae constitutes one of the largest families within planthoppers (Fulgoromorpha, Hemiptera) with 1446 described species in 299 genera and 12 tribes distributed worldwide (Bourgoin 2013). Presently, the Flatidae fauna of Madagascar includes, in total, 17 genera with 39 species of Flatinae and 11 genera with 37 species of Flatoidinae (Świerczewski and Stroiński 2013). Flatidae seems to be an ecologically important component of Madagascan terrestrial ecosystems and, according to our previous studies, reveals a firm association with particular vegetation formations. Thus, this group may serve as an effective tool to recognize the biodiversity of rare and endangered ecosystems e.g. *Phlebopterum tapiae* Świerczewski et Stroiński, 2012 in tapia woodlands (Świerczewski and Stroiński 2012a) or *Latois nigrolineata* Świerczewski et Stroiński, 2012 in littoral forests (Świerczewski and Stroiński 2012b). As for mountain vegetation, the examples are species of *Urana* Melichar, 1902 (Stroiński and Świerczewski 2012) associated with high mountain rainforest and this here described *Peyrierasus philippiae* from the montane scrubland (*Philippia* sp. – Ericaceae) of Anosyan mountain ranges (Chaînes Anosyennes).

Precise descriptions of the local environmental conditions for the Anosyan mountains are given by Paulian *et al*. (1973).

MATERIAL AND METHODS

Preparations and illustration. The abdomens of the specimens examined were removed and cleared for

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30 min. in warm (50°C) 10% KOH solution with a few drops of black chlorazol (CAS No. 1937–37–7) for dying the ectodermic genital ducts based on the method introduced by Carayon (1969) and Bourgoin (1993). Dissections and cleaning of genital structures were performed in distilled water. Final observations and drawings were done in glycerin using a camera lucida attached to a light microscope. The photos of the habitus and male and female genital structures were taken using a stereomicroscope Leica MZ 16 with digital camera IC 3D; final images were produced using Helicon Focus and Adobe Photoshop software. The SEM photographs of uncoated specimens were taken in the Laboratory of Scanning Microscopy, MIZ PAS (Warsaw), using a scanning microscope HITACHI S-3400N under low vacuum conditions. The nomenclature of the male genitalia follows Bourgoin (1988) and Bourgoin and Huang (1990), and for the female genitalia Bourgoin (1993).

Measurements and abbreviations. The following proportions of measurements made with an ocular micrometer and abbreviations were used in this study:

Total length – measured (in dorsal view) from the apex of head to the apex of tegmina,
A/B – width of vertex measured at anterior margin/length of vertex measured at midline,
C/E – width of frons between eyes/length of frons at midline,
D/E – maximum width of frons/length of frons at midline,
F/B – length of pronotum at midline/length of vertex at midline,
G/F – length of mesonotum/length of pronotum at midline,
G/B+F – length of mesonotum/cumulative length of vertex and pronotum at midline,
G/H – length of mesonotum at midline /width of mesonotum between lateral angles,
I/J – length of tegmen measured from the base to the apical margin in median portion/width of tegmen measured from the apex of clavus to the anterior margin.

Vein nomenclature after interpretation proposed by Szwedo and Żyła (2009) and antennal structures nomenclature after Stroiński *et al.* (2011).

Material. The material studied comes from the collection of the Muséum national d'Histoire naturelle (MNHN), Paris, France. Depositories of material are abbreviated as follows:

MNHN – Muséum national d'Histoire naturelle, Paris (France);
MIZ – Museum and Institute of Zoology PAS, Warszawa (Poland).

Taxonomy

Peyrierasus gen. nov.
(Figs 1–53)

Type species. *Peyrierasus philippiae* gen. et sp. nov., here designated.

Etymology. The generic name is after André Peyrieras – a well-known collector of Madagascan insects.

Diagnosis. The genus differs from the genus *Urana* Melichar, 1902 by the following main external characters: frons without carinae (*Urana* – frons with Y-shaped median carina), disc of mesonotum without gibbosities (*Urana* – disc with gibbosities), claval veins not elevated (*Urana* – veins elevated).

Description. **Head**. Head with compound eyes in dorsal view about as wide as thorax (Figs 2, 5, 7–8).

Vertex much wider than long at midline, medially partly covered by pronotum (Figs 5, 8–9, 13). Anterior margin weakly concave, in form of elevated suture, laterally obsolete; posterior margin carinated and medially incised; lateral margins carinated. Disc of vertex without carinae.

Frons (Figs 4, 15–16) wrinkled, with convex upper part and partly flattened upper surface, placed a bit lower than thorax; lower part of frons weakly concave. Disc of frons without carinae, but with small sensory pits (Fig. 17). Lateral margins of frons carinated; frons in frontal view widest about level of compound eyes.

Compound eyes elongately oval, with small callus placed at lower-posterior margin. Ocelli absent (Figs 3, 14). Antennal pedicel short and widest apically, with setae and plate organs distinctly restricted to a hollow area at the top and partly on upper surface (Figs 18–22). Sensilla placodea of the clover leaf-like type. Clypeus narrower than frons, without carinae (Figs 4, 15–16). Rostrum with apical segment distinctly shorter than subapical, apex reaching hind coxae.

Thorax. Pronotum distinctly longer than vertex at midline, without carinae (Figs 5, 8–10, 14); disc of pronotum with lateral impressions and elongate, lobiform postocular eminences.

Mesonotum triangular (Figs 5, 8, 11–12); disc anteriorly with median groove and short incomplete carina; lateral carinae internally arcuate and elevated, reaching posterior margin; lateral parts of mesonotum without gibbosities.

Tegmen (Figs 1, 23–30) coriaceous, elongate and weakly convex, with well visible venation and small bulla, without apical, subapical and nodal lines; transverse veinlets forming irregular net in apical part of tegmen. Costal and posterior margins arcuate, costal and sutural angles bluntly rounded; postclaval sutural margin absent. Costal area narrower than costal cell, with transverse veinlets, terminating before end of clavus. Costal cell with several transverse veinlets.

Basal cell long and narrow. ScP+R forked basad of $^1/_4$ of tegmen length (before bulla) and distinctly basad of M forking; ScRA elevated; M fork before half of tegmen; Cu bifurcated after end of clavus. Claval veins Pcu and A_1 fused before end of clavus, Pcu well visible only in basal part, vein A_1 elevated; transverse veinlets absent. Tubercles with concentration on costal area, alongside apical margin, between basal RP and M veins and on basal part of clavus.

Femora shorter than tibiae; hind tibia arcuate and partly flattened laterally with 2 lateral spines placed after midlength, apically with row of well-developed teeth; basitarsomere as cumultative length of 2nd and 3rd tarsomeres with row of apical spines, second tarsomere with 2 lateral spines.

Male genitalia. Anal tube (in lateral view, Fig. 32) elongate, tapering apicad; apical part with basal narrow lobe oriented ventrad; anus placed a bit before midlength. Anal tube (in dorsal view, Figs 33–34) elongate, basal part distinctly narrower than apical part; apical part tapering apicad; anus placed a bit before midlength.

Pygofer (in lateral view, Fig. 31) higher than wide, dorso-posterior angle bluntly rounded.

Genital styles (in lateral view, Fig. 35) longer than wide and bearing distinct, long and sharp capitulum; ventro-posterior angle weakly projected.

Phallic complex. Periandrium divided into dorsal and ventral parts, lateral split reaching $^1/_3$ of periandrium (Fig. 36). Dorsal part of periandrium lobiform, membranous tapering apicad, with 4 lateral and 2 apical denticles; upper surface of dorsal periandrium with single, median horn (Figs 36–37).

Ventral part of periandrium V-shaped; apical part distinctly narrower than basal, curved dorsad, with 2 horns on ventral surface; median portion laterally with wide vertical lobes; upper part with 2 processes – upper process short, lower process narrow, elongate reaching beyond midlength of periandrium (Figs 36, 38).

Aedeagus s.s. divided into dorsal and ventral parts (Figs 39–41). Dorsal part with lateral lobes in median portion; apical part bilobate, subapically with vertical appendage. Ventral part with lateral lobes.

Female genitalia. Pregenital sternite massive, lateral lobes weakly separated (Figs 42–44); anterior margin weakly concave, medially with sclerotized lobe; posterior margin medially with two bluntly triangular lobes separated by shallow concavity.

Anal tube (in lateral view, Fig. 47) flattened, elongate and narrow, reaching end of gonoplac; anus placed about midlength; ventral surface with long setae. Anal tube (in dorsal view) pear-shaped or oval (Figs 45–46); anus placed about midlength.

Gonoplac unilobate, laterally flattened, elongate (Fig. 48); posterior margin rounded with single row of well-developed teeth; narrow, membranous part placed alongside ventral margin, extending half of gonoplac.

Gonaphophysis VIII sabre-shaped and laterally flattened, tapering apicad (Fig. 49); apical part of ventral margin folded externally, apical part of dorsal margin with 2 teeth. Endogonocoxal process a bit shorter than gonaphophysis VIII, sabre-shaped with spiniferous microsculptures.

Gonaphophyses IX and gonospiculum bridge as in Figs 50–51.

Bursa copulatrix of single, elongately oval, houge pouch and narrow basis; cells well visible, without ornamentation. Spermatheca well developed; *ductus receptaculi* much longer than *diverticulum ductus* (Fig. 52).

Distribution. Madagascar: Toliara Province (Fig. 53).

Peyrierasus philippiae sp. nov.
(Figs 1–53)

Etymology. Specific epithet comes from the name of *Philippia* (subgenus of *Erica*) – the ericoid shrub, from which the specimens representing a new species were collected.

Diagnosis. Only one species in genus; see diagnosis of the genus.

Description. Total length 0.40–0.45 cm.

Head. Vertex: proportion A/B = 4.40–5.10; lateral margins parallel; disc of vertex lowered than margins (Figs 5, 9, 13). Frons: proportion C/E = 0.86–0.98; proportion D/E = 0.86–0.98; lateral margins of frons arcuate. Clypeus in median portion convex; frontoclypeal suture arcuate (Figs 4, 15–16).

Thorax. Pronotum: proportion F/B = 2.44–3.00; anterior and posterior margins arcuate and almost parallel (Figs 5, 9). Mesonotum: proportion G/F = 2.41–2.72, proportion G/B+F = 1.81–2.00, proportion G/H = 0.82–0.95; surface between lateral carinae almost flat and lowered (Figs 11, 13). Tegmina: proportion I/J = 2.50–2.71; ScRA vein forking into Sc and RA near posterior margin, M_{1+2} and M_{3+4} veins forks in apical part of tegmen (Figs 23–24, 26). Hind tibia apically with 7 teeth; basitarsomere with 10–11 apical spines.

Male genitalia. Anal tube (in lateral view, Fig. 32) with basal part distinctly wider than apical. Anal tube (in dorsal view, Fig. 33) with anterior margin arcuate and posterior margin shallowly concave. Pygofer (in lateral view, Fig. 31) with dorso-posterior angle 'elevated'. Genital styles (in lateral view, Fig. 35) with ventral margin arcuate and dorsal margin rising.

Phallic complex. Dorsal part of periandrium: basal denticle larger, remaining smaller; margin between basal and the following denticle deeply concave; apical denticles the same size or one of them larger (Figs

36–37). Ventral part of periandrium: basal part of vertical lobes weaker sclerotized than upper part (Figs 36, 38). Aedeagus s.s.: dorsal part apically with median incision, ventral part apically widened (Figs 40–41).

Female genitalia. Gonoplac: posterior margin with row of 9 teeth, dorsal and ventral part externally with long setae, median portion of internal surface with short and thick setae (Fig. 48). Spermatheca: *ductus receptaculi* in ¾ narrow and ribbed, widening apicad; *diverticulum ductus* smooth and narrow with apical bulb (Fig. 52).

Coloration (Figs 1–5). Head and thorax milky white with brownish patches. Tegmen – costal area white, apical margin brown, clavus whitish-brown, area between costal cell and M_{3+4} orange with whitish markings. Abdomen sternites straw-coloured, tergites brown with whitish-yellow margins, genital capsule yellowish to brownish.

Type material. Holotype, ♂: [Madagascar Chaînes Anosyennes], [Massif Nord zone sommitale alt. 1900 m], [Haut fourré arbustif de montagne à Philippia], [fauchage de Philippia 22.II.1971. rec. Peyrieras] (Fig. 6) – (MNHN)

Paratypes: 5♂♂, 7♀♀, the same data as for the Holotype – 4♂♂, 5♀♀ (MNHN), 1♂, 2♀♀ (MIZ).

Distribution. Madagascar: Toliara Province (Fig. 53).

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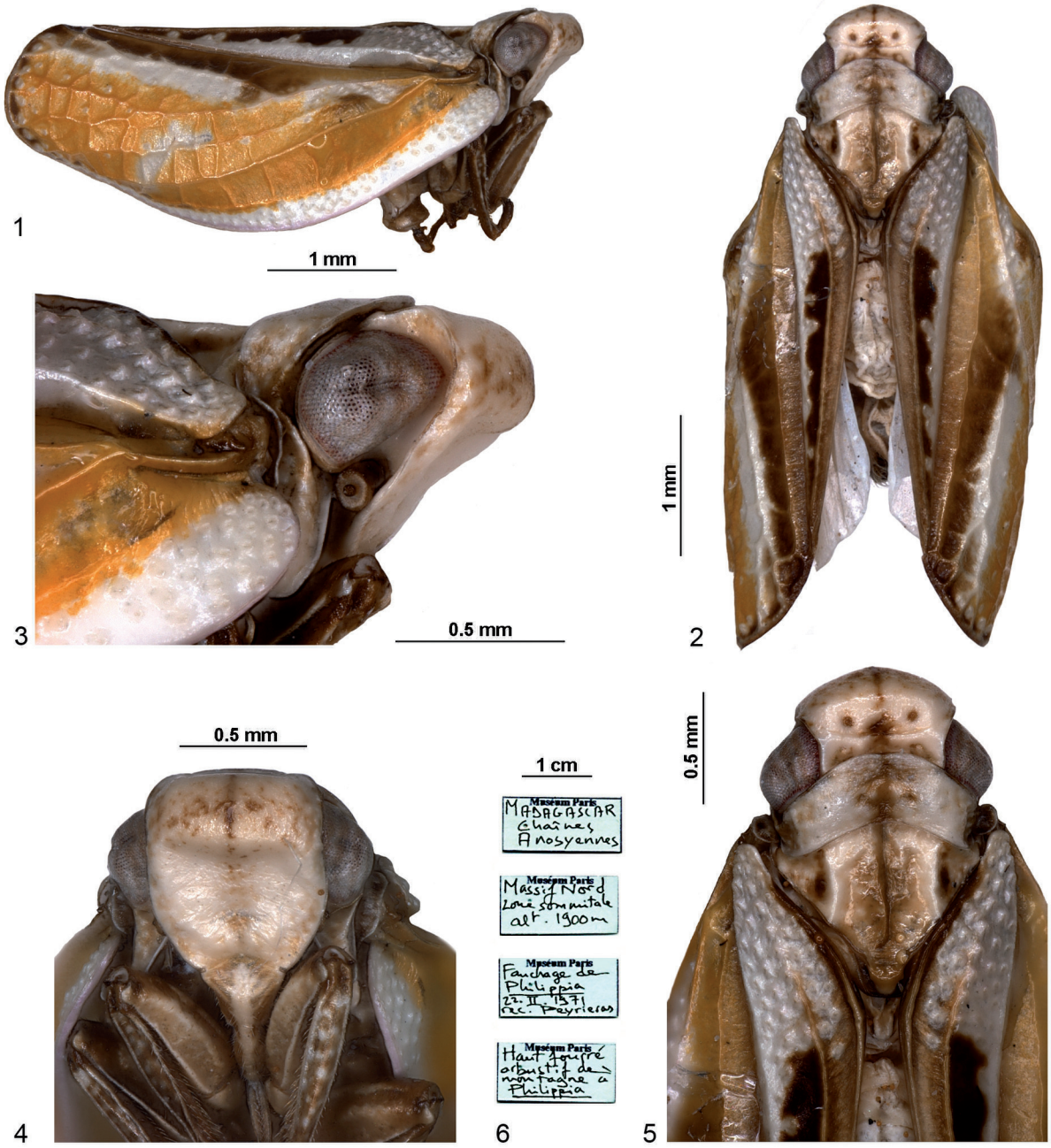
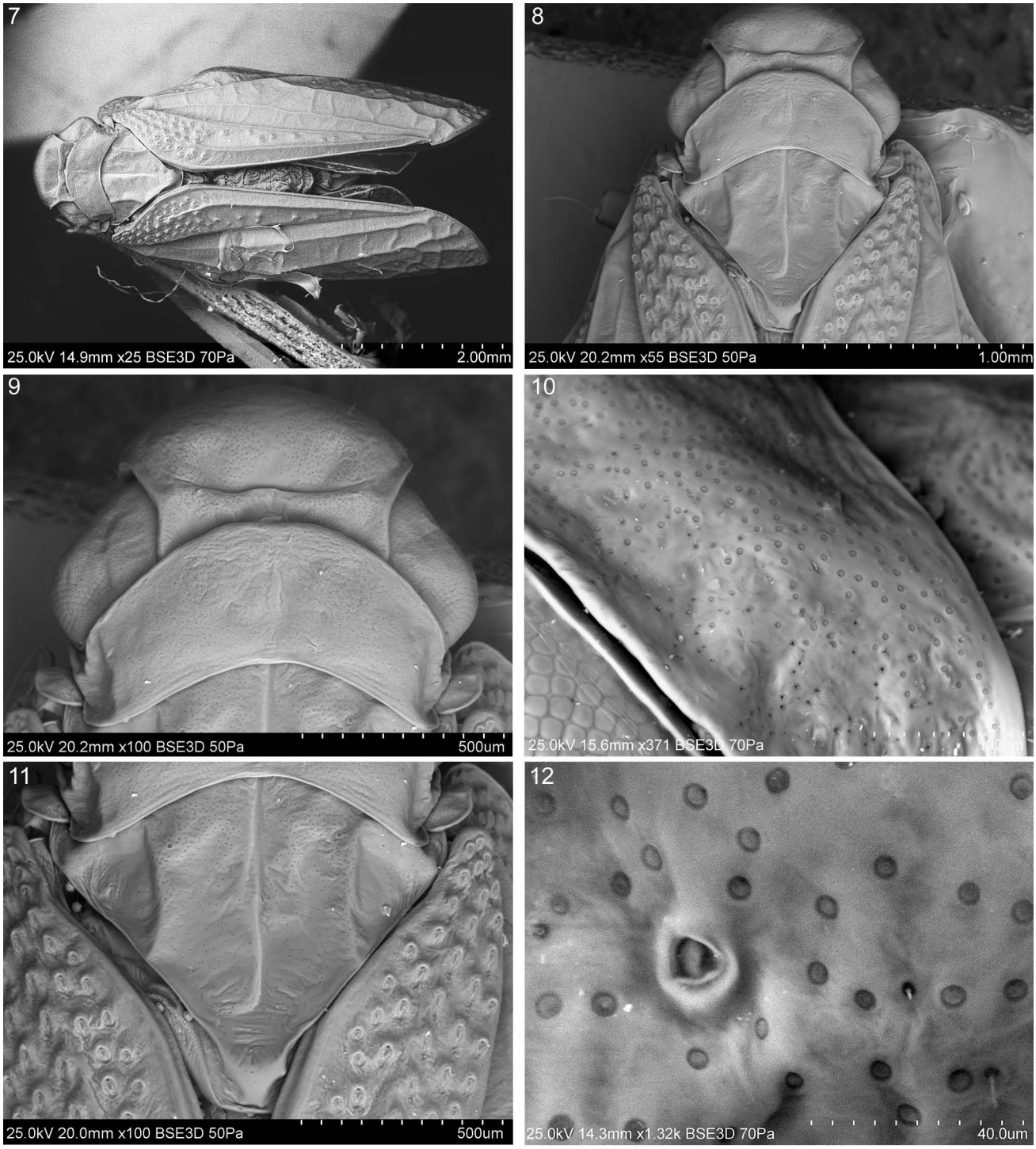
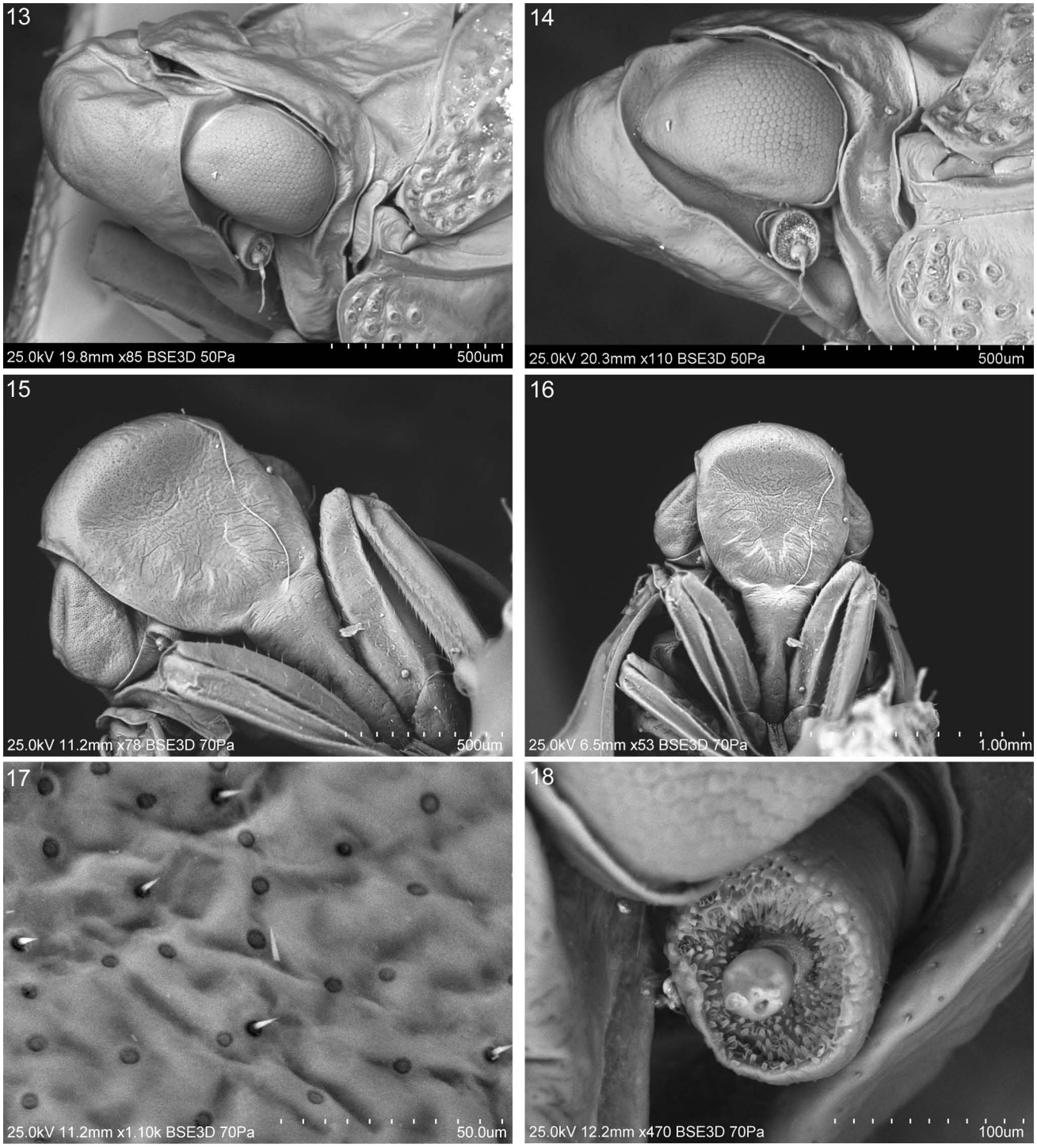


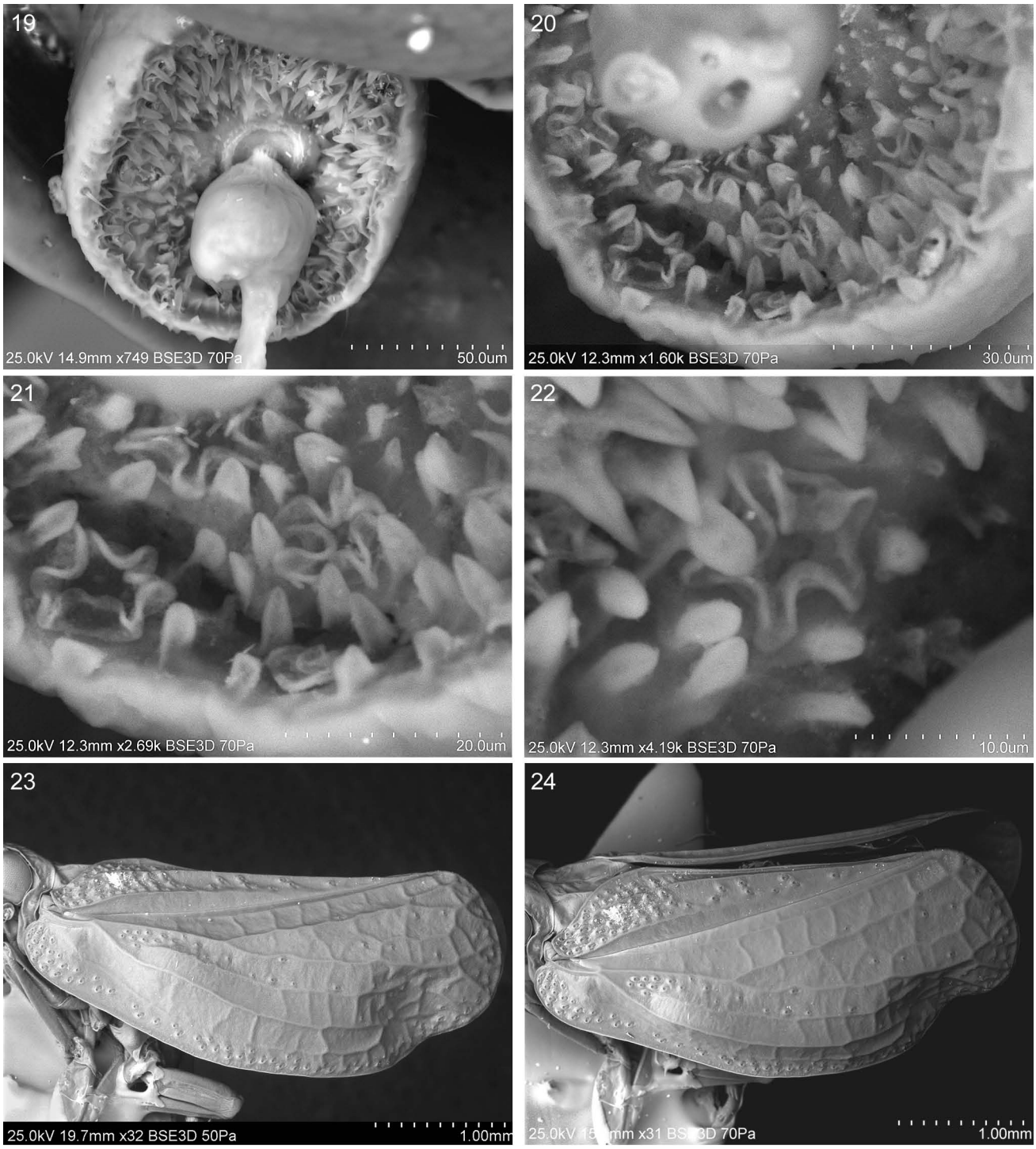
Figures 1–6. *Peyrierasus philippiae* gen. et sp. nov. (1) Habitus, lateral view; (2) same, dorsal view; (3) anterior part of body, lateral view; (4) same, frontal view; (5) same, dorsal view; (6) holotype labels.



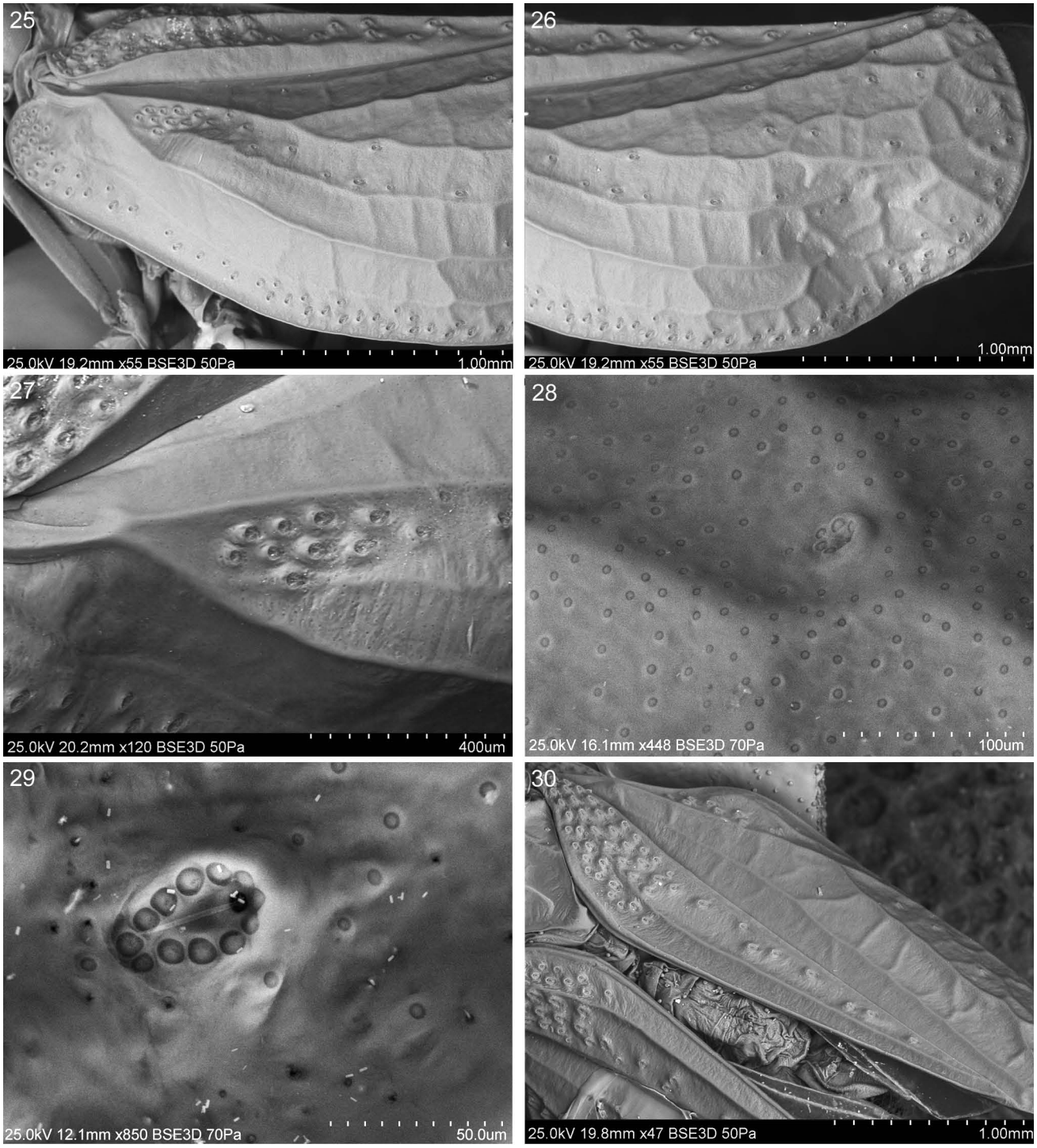
Figures 7–12. *Peyrierasus philippiae* gen. et sp. nov., SEM photos. (7) Habitus, dorsal view; (8) anterior part of body, dorsal view; (9) head and pronotum, dorsal view; (10) pronotum, sensory and excretory structures; (11) mesonotum, dorsal view; (12) same, sensory and secretory structures.



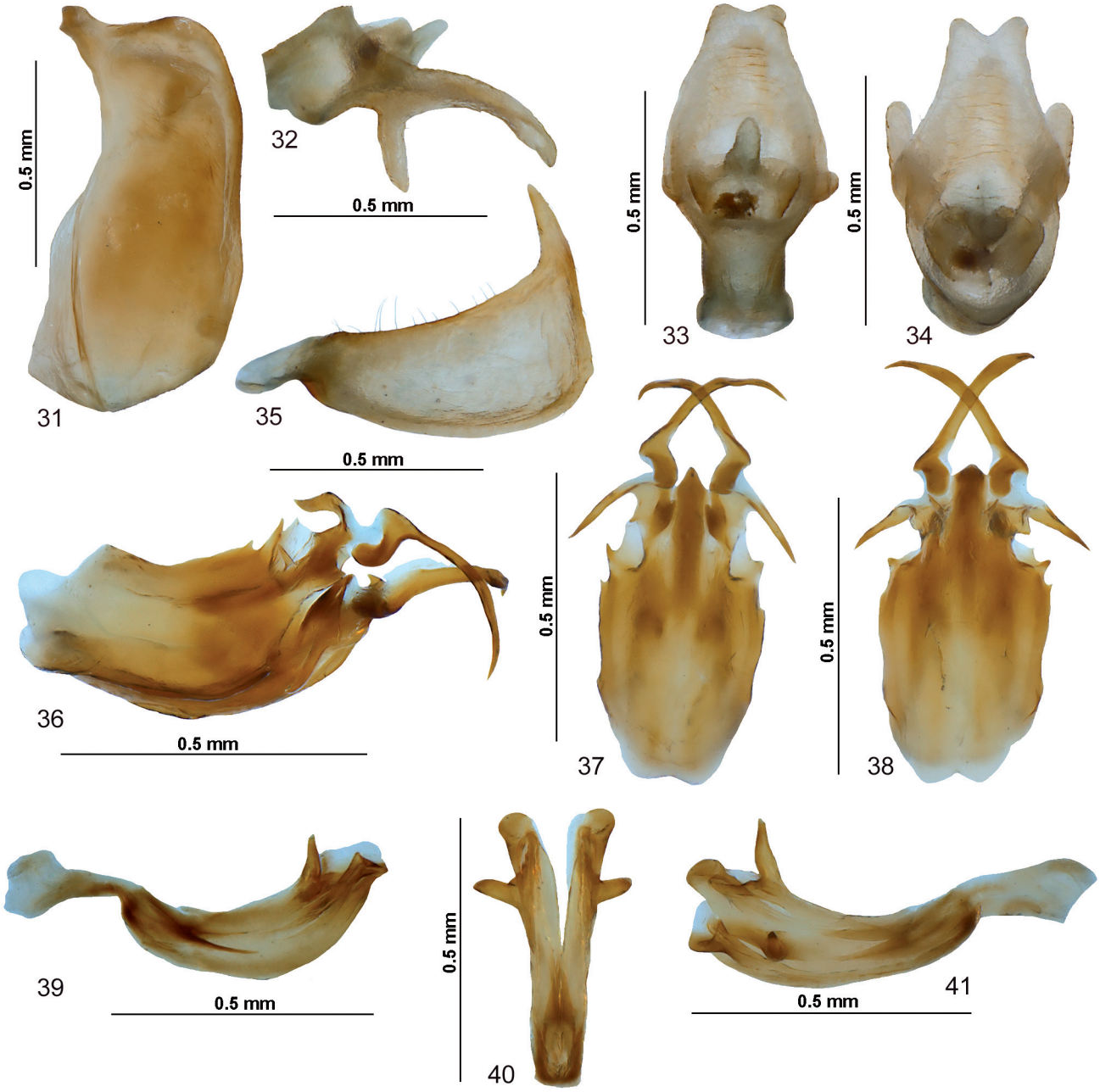
Figures 13–18. *Peyrierasus philippiae* gen. et sp. nov., SEM photos. (13) Anterior part of body, fronto-lateral view; (14) same, lateral view; (15–16) frons, frontal view; (17) same, sensory and secretory structures; (18) antenna, antero-dorsal view.



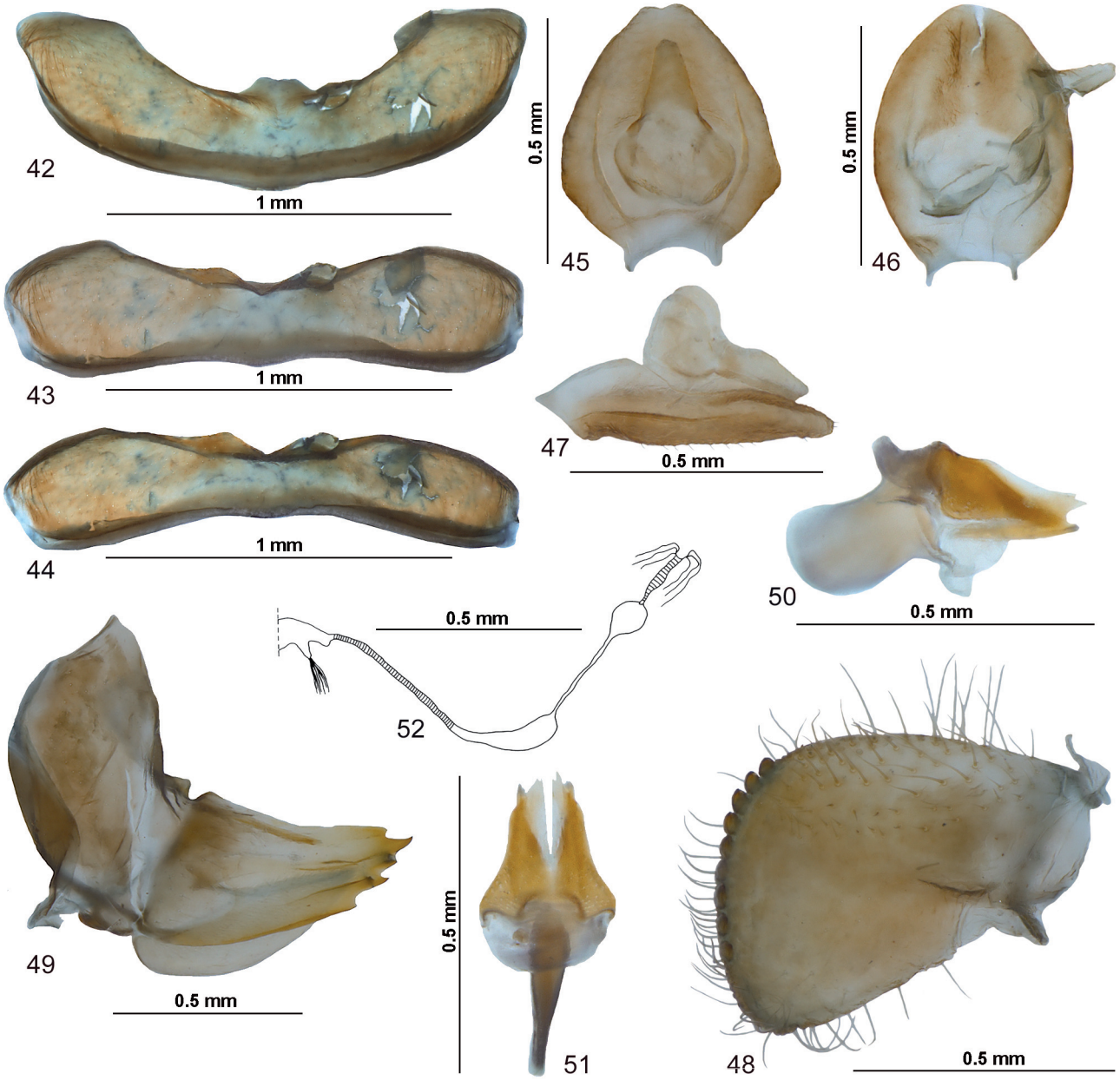
Figures 19–24. *Peyrierasus philippiae* gen. et sp. nov., SEM photos. (19–20) Antenna, apical part; (21–22) same, antennal plate organs; (23–24) tegmen, general view.



Figures 25–30. *Peyrierasus philippiae* gen. et sp. nov., tegmen, SEM photos. (25) Basal part; (26) apical part; (27) basal cell and base of the longitudinal veins; (28–29) sensory and secretory structures, membrana; (30) clavus.



Figures 31–41. *Peyrierasus philippiae* gen. et sp. nov., male. (31) Pygofer, lateral view; (32) anal tube, lateral view; (33–34) same, dorsal view; (35) stylus, lateral view; (36) periandrium, lateral view; (37) same, dorsal view; (38) same, ventral view; (39) aedeagus, lateral view; (40) same, ventral view; (41) same, dorso-lateral view.



Figures 42–52. *Peyrierasus philippiae* gen. et sp. nov., female. (42–44) Pregenital sternite; (45) anal tube, dorsal view; (46) same, dorsal view, another specimen; (47) same, lateral view; (48) gonoplac, external view; (49) gonaphophysis VIII, lateral view; (50) gonapophyses IX and gonospiculum bridge, lateral view; (51) same, dorsal view; (52) spermatheca.

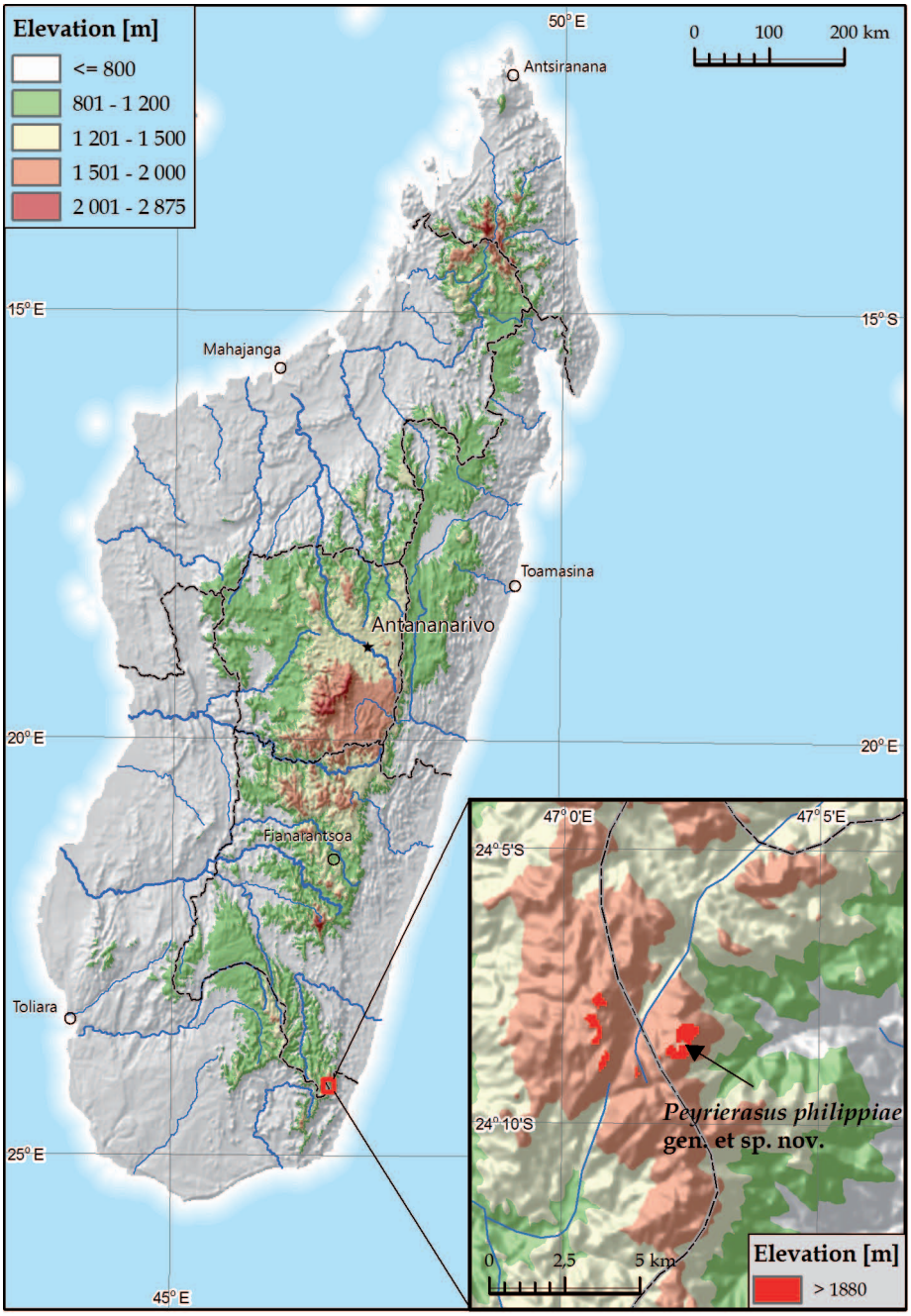


Figure 53. *Peyrierasus philippiae* gen. et sp. nov. Distribution map.