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Revision of an extraordinary Selizini genus *Urana* Melichar, 1902 from Madagascar (Hemiptera: Fulgoromorpha: Flatidae)

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This paper revises an extraordinary Madagascan genus *Urana* Melichar, 1902, with two species *Urana paradoxa* Melichar, 1902 and *Urana unica* sp. nov. The genus represents the tribe Selizini of the subfamily Flatinae. Additionally, distribution of the genus is discussed.

Keywords: planthoppers; Fulgoromorpha; Flatidae; Madagascar; taxonomy

Introduction

The tribe Selizini was established by Melichar (1923) and belongs to the subfamily Flatinae. General characteristics of the tribe are given in the work of Peng et al. (2010). This tribe is distributed worldwide and covers 50 known genera (Peng et al. 2010). In the Afrotropical Region it is represented by 10 genera and 22 species (Melichar 1923; Synave 1956; Metcalf 1957; Fennah 1965; Medler 2001; Peng et al. 2010). These are: *Afrocyarda* Fennah, 1965; *Cyarda* Walker, 1858; *Increda* Medler, 2001; *Juba* Jacobi, 1910; *Mosiona* Melichar, 1923; *Paraseliza* Melichar, 1923; *Sajuba* Medler, 2001; *Seliza* Stål, 1862; *Stenocyarda* Fennah, 1965 and *Urana* Melichar, 1902.

Afrotropical Selizini are mostly distributed in the southern part of the continent and only two monospecific genera are known from Madagascar – *Urana paradoxa* Melichar, 1902 and *Cyarda angustata* Melichar, 1902. However, after the examination of the type material of *Cyarda angustata*, and comparing it to *Afrocyarda* Fennah, 1965, *Cyarda* Walker, 1858 and *Stenocyarda* Fennah, 1965 it appears that a new genus should be established for this taxon (unpublished work in progress).

The genus *Urana* was erected by Melichar (1901: 200, 1902: 166 – see taxonomic note) for its only species *Urana paradoxa* described on the basis of one specimen from Antananarivo, in central part of Madagascar. The genus is endemic to Madagascar and it is so extraordinary that it is not comparable with any other genera of African Selzini.

The present paper redescribes the genus *Urana* consisting at present of two species: *Urana paradoxa* and the newly described *Urana unica*.

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Material and methods

Material

The studied material comes from the entomological collections of the Muséum national d'Histoire naturelle, Paris (Th. Bourgoin; MNHN), the Institut royal des Sciences naturelles de Belgique, Bruxelles (J. Constant; IRSNB), and Museum für Naturkunde Humbolt-Universität zu Berlin (J. Deckert; ZMB).

Preparations and illustration

The abdomens of the specimens examined were cut off and cleared for 30 minutes in a warm (50°C) 10% KOH solution with a few drops of black chlorazol (CAS No. 1937–37–7) for dyeing the ectodermic genital ducts based on the method introduced by Carayon (1969) and Bourgoin (1993). Dissections and cleaning of the genital structures were carried out in distilled water. Final observations and drawings were made in glycerol using a camera lucida attached to Olympus microscopes (SZH10 and BX50). The photographs of the habitus were taken using a stereoscopic microscope Leica MZ 16 with IC three-dimensional camera; images were produced using SYNOPTICS AUTOMONTAGE software. The photographs of genital structures were taken using a light microscope Leica DM5500B with Leica DFC490 camera; final images were created using the HELICON 5.0 software and ADOBE PHOTOSHOP. The scanning electron micrographs 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.

Measurements and abbreviations

The following proportions of measurements and abbreviations were made and 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 the anterior margin/length of vertex at midline; C/E, width of frons at upper margin/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 base to the apical margin in median portion/width of tegmen measured from the apex of clavus to the anterior margin.

The nomenclature of the male genitalia follows Bourgoin and Huang (1990) and for the female genitalia Bourgoin (1993). Vein nomenclature follows the interpretation proposed by Szwedo and Żyła (2009).

Taxonomy

Genus ***Urana*** Melichar, 1901
(Figures 1–8)

Urana Melichar, 1901: 200, 1902: 166.

Urana: Melichar 1923, Metcalf 1957, Synave 1955, 1956.

Taxonomic note

The Melichar monograph is divided into two parts; in the first part (Melichar 1901) the genus *Urana* is placed in the genera key section and marked as "gen. n.", in the second part (Melichar 1902) the full descriptions of the genus and species are given. Gender: feminine.

Type species

Urana paradoxa Melichar, 1902, designated by monotypy.

Diagnosis

Differs from other Afrotropical genera of Selizini by the following external characters: frons with Y-shaped median carina, disc of mesonotum with four gibbosities.

Description

Head. Head with compound eyes narrower than thorax (Figures 1B, D; 2B).

Vertex separated from frons, wider than long in midline, weakly covered by pronotum in median-posterior part; anterior margin carinated, deeply incised in median portion, lateral margins carinated, almost straight and parallel; posterior margin partly elevated and carinated. Disc of vertex without carinae, depressed, placed about same level as pronotum (Figures 1D; 2B,E,F).

Frons elongated; upper margin shorter than length in midline, widest below antennae; upper margin (in frontal view) concave; lateral margins elevated, carinate, with "breaking" point at about three-quarters length; disc of frons with Y-shaped median carina; upper arms of carina short, common stem reaching almost to fronto-clypeal suture; lateral carinae present, short and arcuate connected with short arms of Y-carina; lower part between lateral margins and median carina distinctly and obliquely ribbed (Figures 1E; 2F–H).

Antennal pedicel elongate, with setae and plate organs present apically and on upper surface (Figure 3B,C). Compound eye elongately rounded with small callus at posterior margin. Ocelli present but weakly visible. Clypeus narrower than frons, without carinae; disc of clypeus in median portion convex (Figures 1E; 2G,H). Rostrum reaching between hind coxae, apical segment shorter than subapical (Figure 1C).

Thorax. Pronotum distinctly longer than vertex in midline; anterior margin elevated, arcuate, in median portion partly flattened, posterior margin shallowly concave; disc of pronotum with median and lateral carinae; median carina weakly visible reaching to posterior margin, from half of length within groove formed by lateral and arcuate ridges connected with posterior margin; lateral carinae clearly visible, obsolete near anterior margin, disc between carinae and ridges strongly depressed; lateral parts of disc with crest (postocular eminence) (Figures 1D; 2B,C,E).

Mesonotum deltoid, longer than cumulative length of vertex and pronotum at midline. Disc of mesonotum with lateral carinae connected at base reaching to posterior margin, median carina absent; disc of mesonotum between lateral carinae flattened with distinct and high gibbosities placed in anterio-lateral part; disc outside lateral carinae with bluntly rounded small gibbosities near posterior margin (Figures 1B,D; 2A–D).

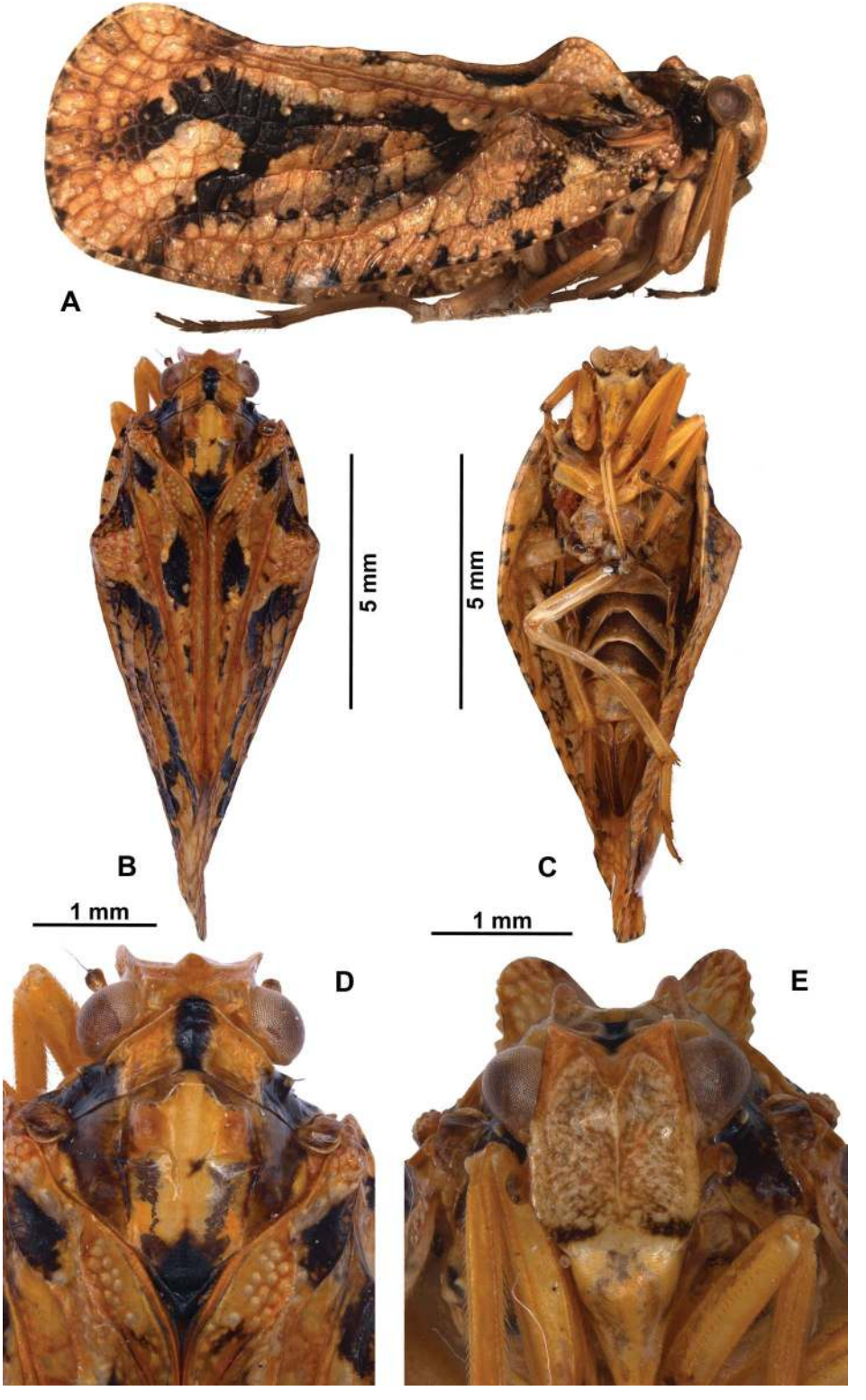

Figure 1. *Urana paradoxa* Melichar, 1902, female: (A) habitus, lateral view; (B) same, dorsal view; (C) same, ventral view; (D) anterior part of body, dorsal view; (E) frons, frontal view.

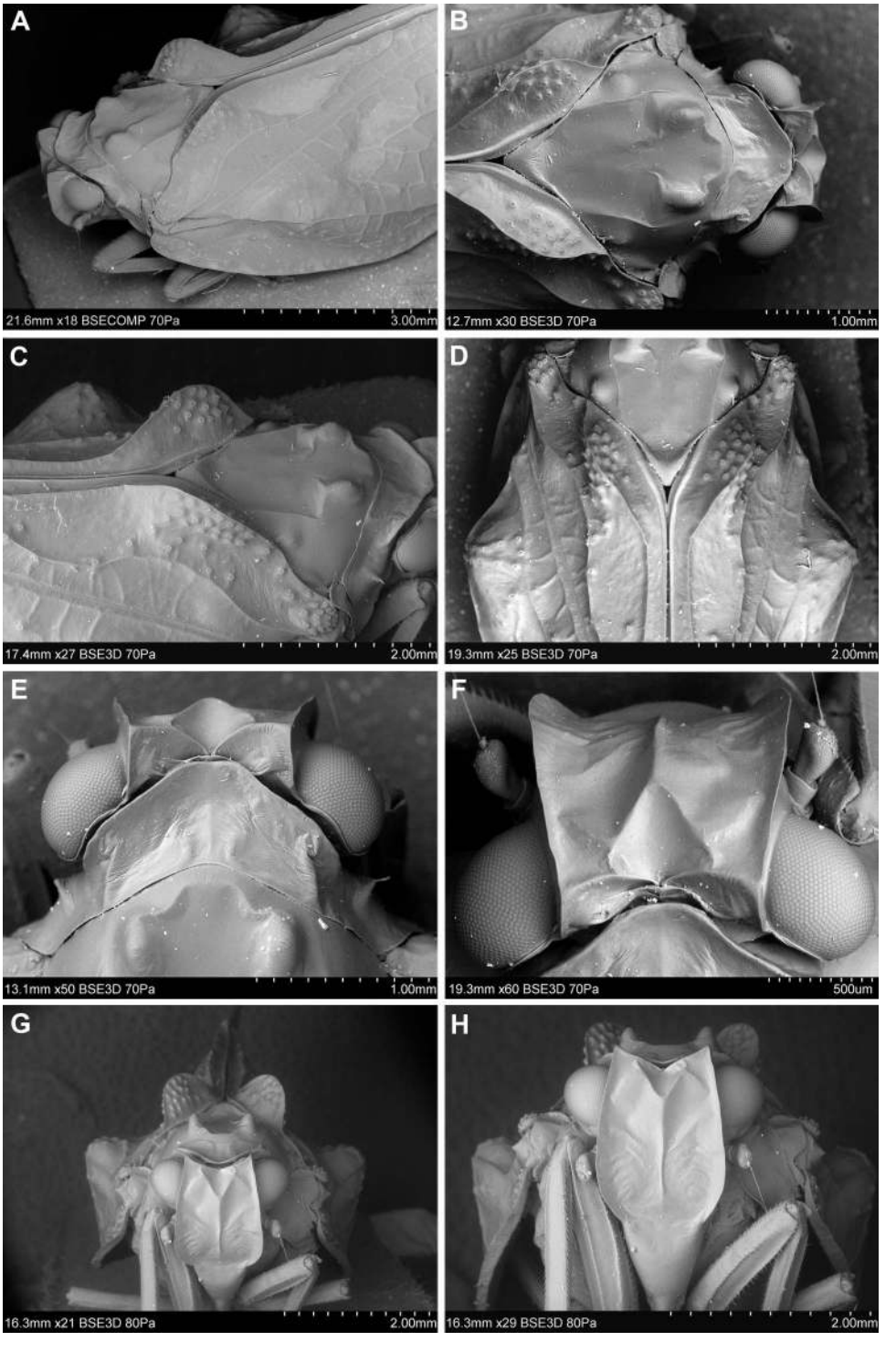

Figure 2. *Urana paradoxa* Melichar, 1902, female: (A) anterior part of body, dorso-lateral view; (B) same, dorsal view; (C) thorax, dorso-lateral view; (D) mesonotum and base of tegmen, dorsal view; (E) head and thorax, dorsal view; (F) frons, dorsal view; (G, H) anterior part of body, frontal view.

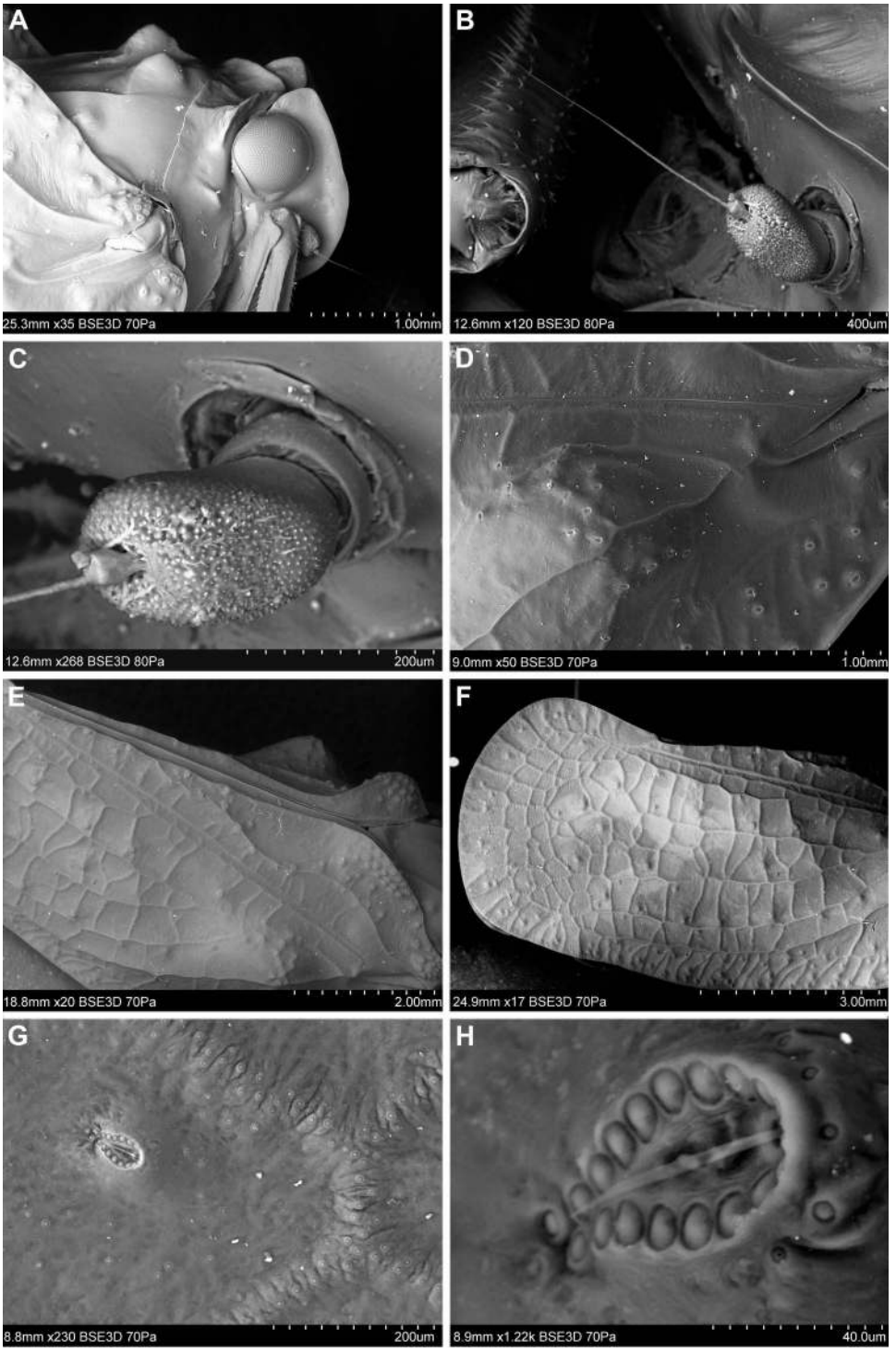

Figure 3. *Urana paradoxa* Melichar, 1902, female: (A) head and thorax, lateral view; (B, C) antenna; (D) base of tegmen and bulla; (E) base of tegmen and clavus; (F) posterior part of tegmen; (G, H) sensory and wax gland-plates on tegmen.

Whole tegmen with dense net of transverse veinlets, without nodal line and with three apical lines. Tegmen elongated; costal margin in posterior one-third weakly arcuate, almost straight (not sinuate) before apex, costal angle rounded, just after level of sutural angle, apical and postclaval margin convex (Figures 1A; 2A,C,D; 3D–F). Costal area short, parallel-sided, with dense transverse veinlets, ending at the level of fusion of claval veins. Costal cell much wider than costal area, tapering distally, with apex at same level as costal area. Basal cell much longer than wide. Tegmen with two longitudinal veins Sc+R and M arising as short common stem from basal cell, Sc+R fork at top of bulla, Sc+RA fork at level of M fork, RA single with dense transverse veinlets between the vein and costal margin, RP single; M forked distinctly basad of Cu fork, M_{1+2} forked at the level of apical line, ending with six to eight terminals, M_{3+4} forked just after distal end of clavus, ending with five to eight terminals; CuA bifurcated at about apex of costal area, CuA_1 with three terminals, CuA_2 with two or three terminals. Apical cells subrectangular, subapical cells short and almost quadrate, third row of cells quadrate, shorter than subapical cells. Sensory and wax gland-plates dispersed on tegmen (Figure 3D–H). Clavus with strongly elevated base of A_1 vein; Pcu weakly elevated, sinuate, fused with A_1 after half of clavus length; transverse veinlets present between CuP – Pcu and Pcu – A_1 (Figures 1A; 2A–D; 3E,F).

Fore and middle femora slightly shorter than tibiae, subrectangular in cross-section; tibiae almost square in cross-section. Hind femora distinctly shorter than tibiae; tibiae arcuate with two lateral spines in distal half, with row of eight big apical teeth, lateral teeth much longer than median; basitarsomere longer than cumulative length of second and third tarsomeres, with five or six apical spines; second tarsomere with two well-developed lateral spines, median portion not exceeding the level of spines (Figures 4A–C).

Male genitalia. Anal tube (in lateral view, Figures 5C; 6B) elongated, with maximum width near midlength, tapering apically; anus placed about middle of anal tube length. Anal tube (in dorsal view, Figures 5D; 6A) elongated, basal part distinctly narrower than median part.

Pygofer (lateral view) higher than wide; about the same width at dorsal and ventral part, dorso-posterior angle bluntly rounded, without processes; posterior margin weakly arcuate.

Genital styles (lateral view, Figures 5E; 6C) longer than wide and bearing distinct, narrow and sharp capitulum; dorsal margin without concavity near the base of the capitulum; dorsal and ventral margins almost parallel; internal margin of capitulum with bluntly angled process at about middle of height.

Phallic complex. Periandrium (Figures 5A,B; 6D,E) closed basally, dorsally open; ventral part with elongated lobes. Basal part with teeth, dorsal periandrium medially with small teeth, apically with elongated process.

Aedeagus s.s. divided by long lateral split into dorsal and ventral part; ventral part apically bilobate; dorsal part a bit longer than ventral, with lateral and apical lobes.

Female genitalia. Pregenital sternite with huge lateral lobes, weakly separated from median part; anterior margin weakly concave, posterior margin convex, flattened in median portion and covered by additional narrow lobe; margin of lobe convex with flattened median portion and medially small incision. Lateral lobes with straight and

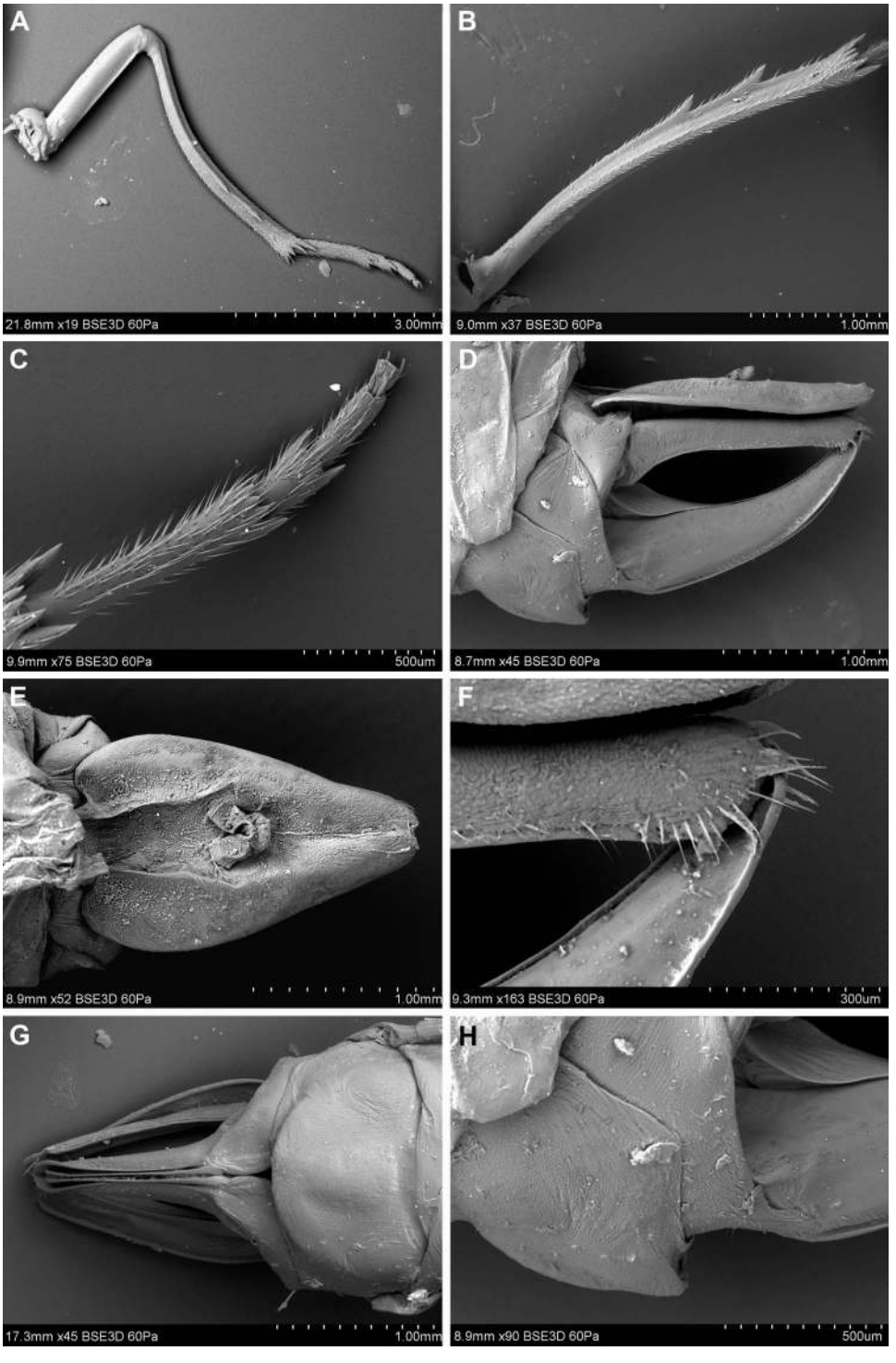

Figure 4. *Urana paradoxa* Melichar, 1902, female: (A) hind leg, lateral view; (B) hind tibia, ventral view; (C) hind tarsomere, ventral view; (D) genital capsule, lateral view; (E) anal tube, dorsal view; (F) end of gonoplac, lateral view; (G) pregenital sternite, ventral view; (H) same, lateral view.

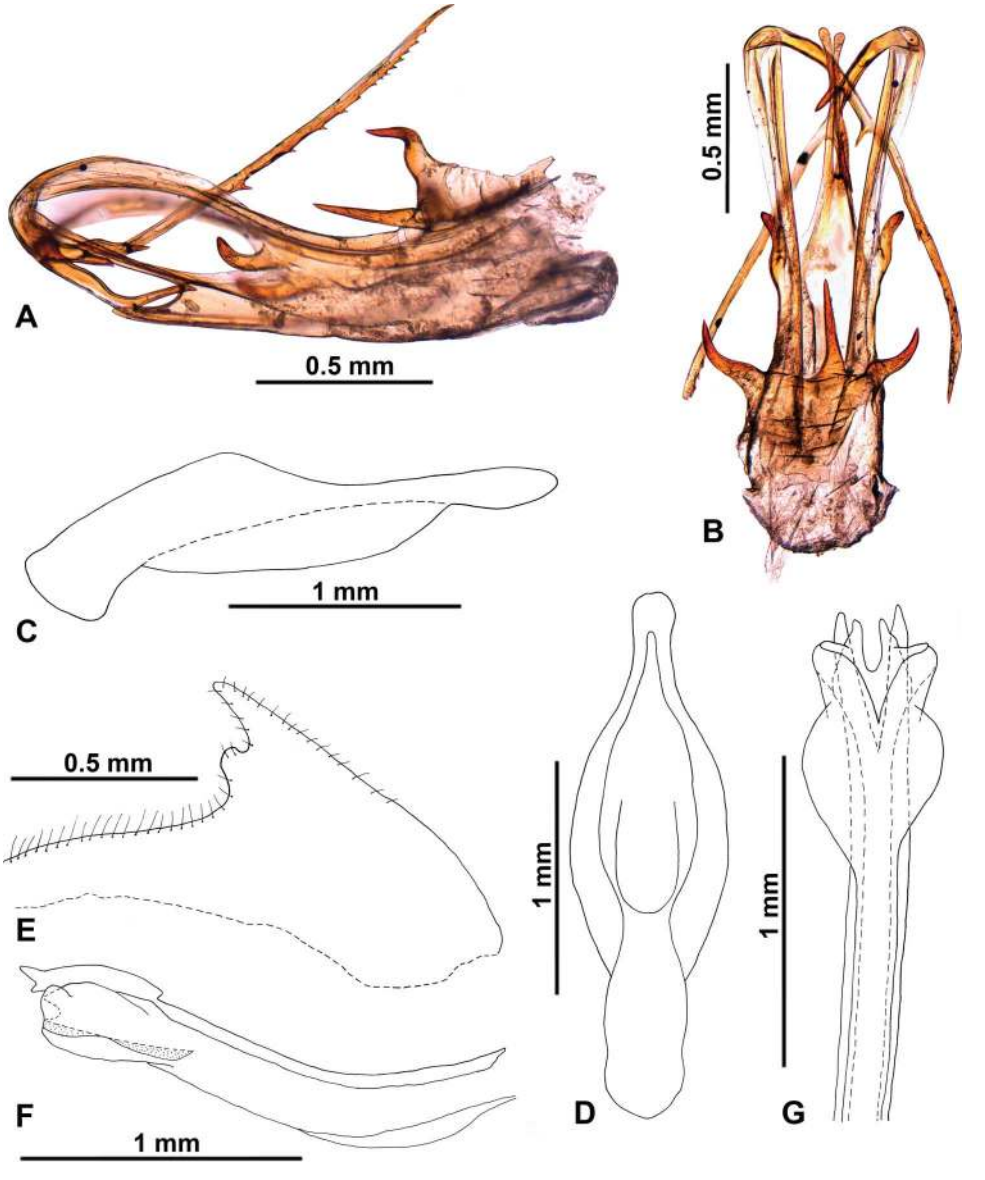

Figure 5. *Urana paradoxa* Melichar, 1902, male: (A) periandrium, lateral view; (B) same, dorsal view; (C) anal tube, lateral view; (D) same, dorsal view; (E) stylus, lateral view; (F) aedeagus, lateral view; (G) same, ventral view.

subparallel margins, anterior margin convex, posterior margin almost straight. Disc of sternite in median portion slightly elevated (Figures 4D,G,H; 7A).

Anal tube reaching end of gonoplac and completely covering gonoplac. Anal tube, in lateral view, narrow with parallel dorsal and ventral margins (Figure 4D). Anal tube, in dorsal view, elongately pear-shaped with shallow incision apically. Anus placed at about midlength of anal tube length. Surface and margins of anal tube almost without setae (Figures 4E; 7B).

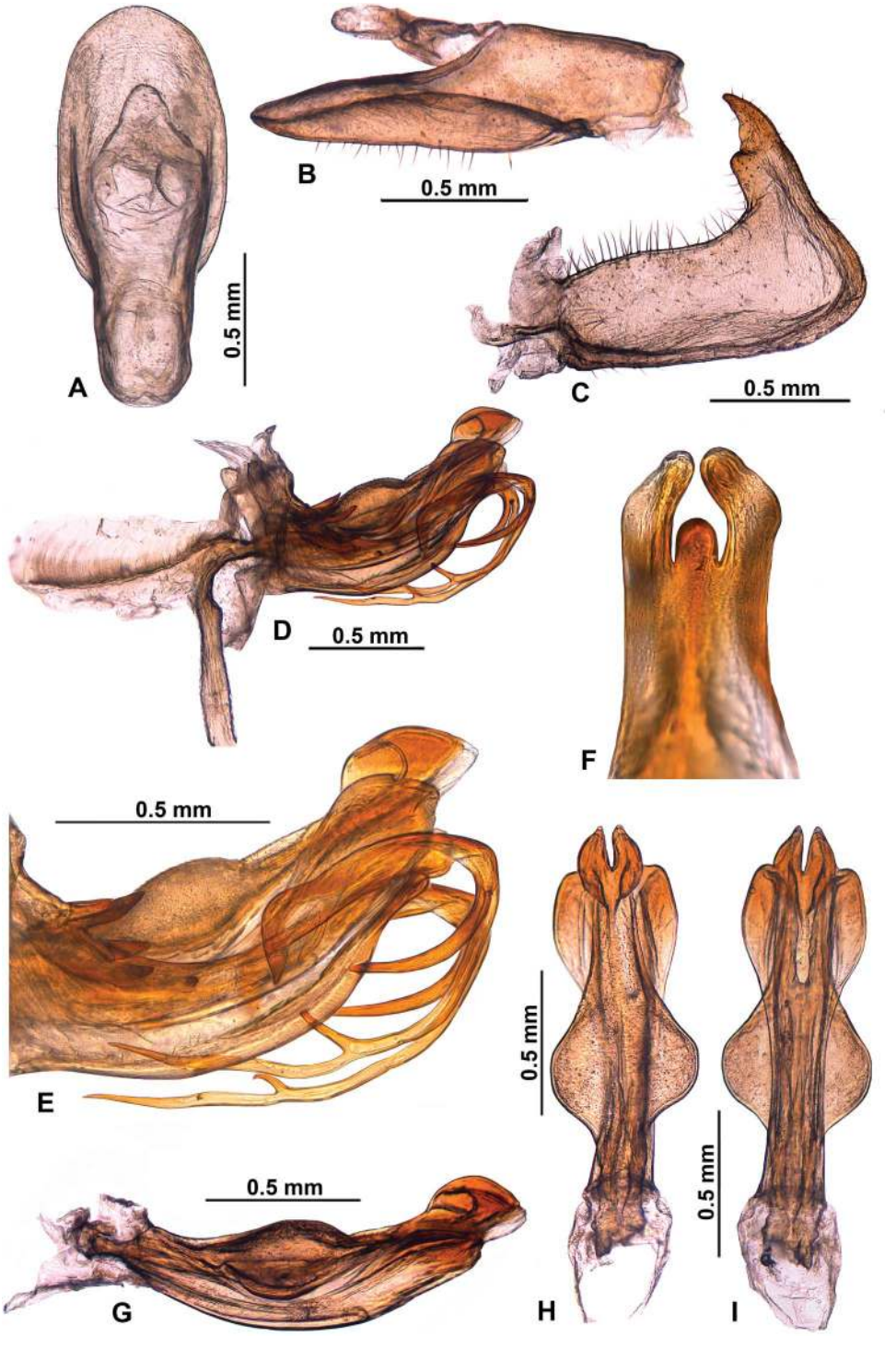

Figure 6. *Urana unica* sp. nov., male: (A) anal tube, dorsal view; (B) same, lateral view; (C) stylus, lateral view; (D, E) phallic complex, lateral view; (F) apical part of ventral periandrium; (G) aedeagus, lateral view; (H) same, dorsal view; (I) same, ventral view.

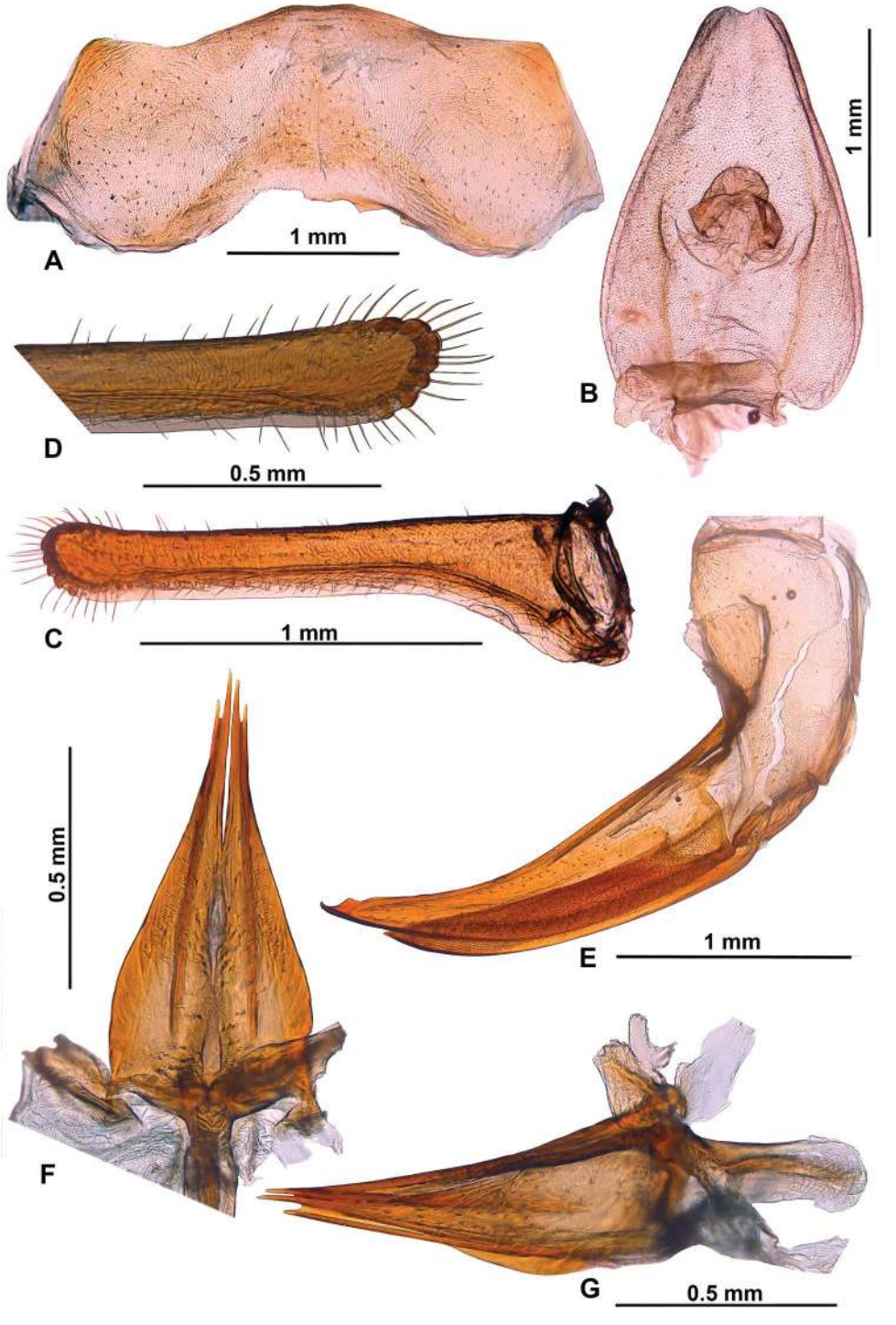

Figure 7. *Urana paradoxa* Melichar, 1902, female: (A) pregenital sternite, ventral view; (B) anal tube, dorsal view; (C) gonoplac, lateral view; (D) end of gonoplac, internal view; (E) gonapophysis VIII, lateral view; (F) gonapophysis IX and gonospiculum bridge, dorsal view; (G) same, lateral view.

Gonoplac unilobate, extremely narrow and elongated with parallel margins; posterior margin with row of four to seven well-developed teeth; narrow membranous part placed alongside ventral margin (Figures 4D; 7C,D).

Gonaphophysis VIII sabre-shaped, tapering apicad and laterally flattened; apical part of ventral margin folded, apical part of dorsal margin with single tooth. Endogonocoxal process a bit shorter than gonaphophysis VIII, sabre-shaped with spiniferous microsculpture, tapering apicad (Figures 4D,F; 7E).

Gonaphophyses IX and gonospiculum bridge as in Figure 7F,G.

Bursa copulatrix of single pouch, elongated, cells weakly visible with central placed sclerotized plate. Spermatheca well developed; *ductus receptaculi* in half ribbed and widened; *diverticulum ductus* shorter than *ductus receptaculi*, anterior part tubular, posterior part in the form of elongated and membranous bulla.

Coloration. General body colour ochraceous with orange tinge and dark brown or black patches on pronotum, mesonotum and tegmina; frons orange with milky white dots, two dark patches above frontoclypeal suture; legs ochraceous; abdominal sternites yellowish to brownish, lateral parts of tergites dark brown to black with yellow apical and posterior margins; genital capsule yellowish to brownish.

Distribution

Madagascar: Antsiranana, Antananarivo, Fianarantsoa, Toliara Provinces.

***Urana paradoxa* Melichar, 1902**

(Figures 1–5; 7; 8)

Urana paradoxa Melichar, 1902.

Urana paradoxa: Melichar 1923, Synave 1956, Metcalf 1957, Medler 1990.

Diagnosis

Closely similar to *U. unica* sp. nov. but differs by the male genital structures: basal part of periandrium with three dorsal teeth (Figure 5A,B) – more in *U. unica* (Figure 6D,E); ventral part with lower keel-shaped median lobe – Figure 5A (*U. unica* – without lobe); upper ventral lobes elongated and narrow with deep median split (Figure 5A,B) – in *U. unica* with three upper short lobes (Figure 6F).

Description

Total length 0.91–1.10 cm.

Head. Vertex: proportion A/B = 6.00–9.00; anterior margin in the specimen from Anjanaharibe weakly concave in median portion. Frons: proportion C/E = 0.70–0.84; proportion D/E = 0.97–1.02.

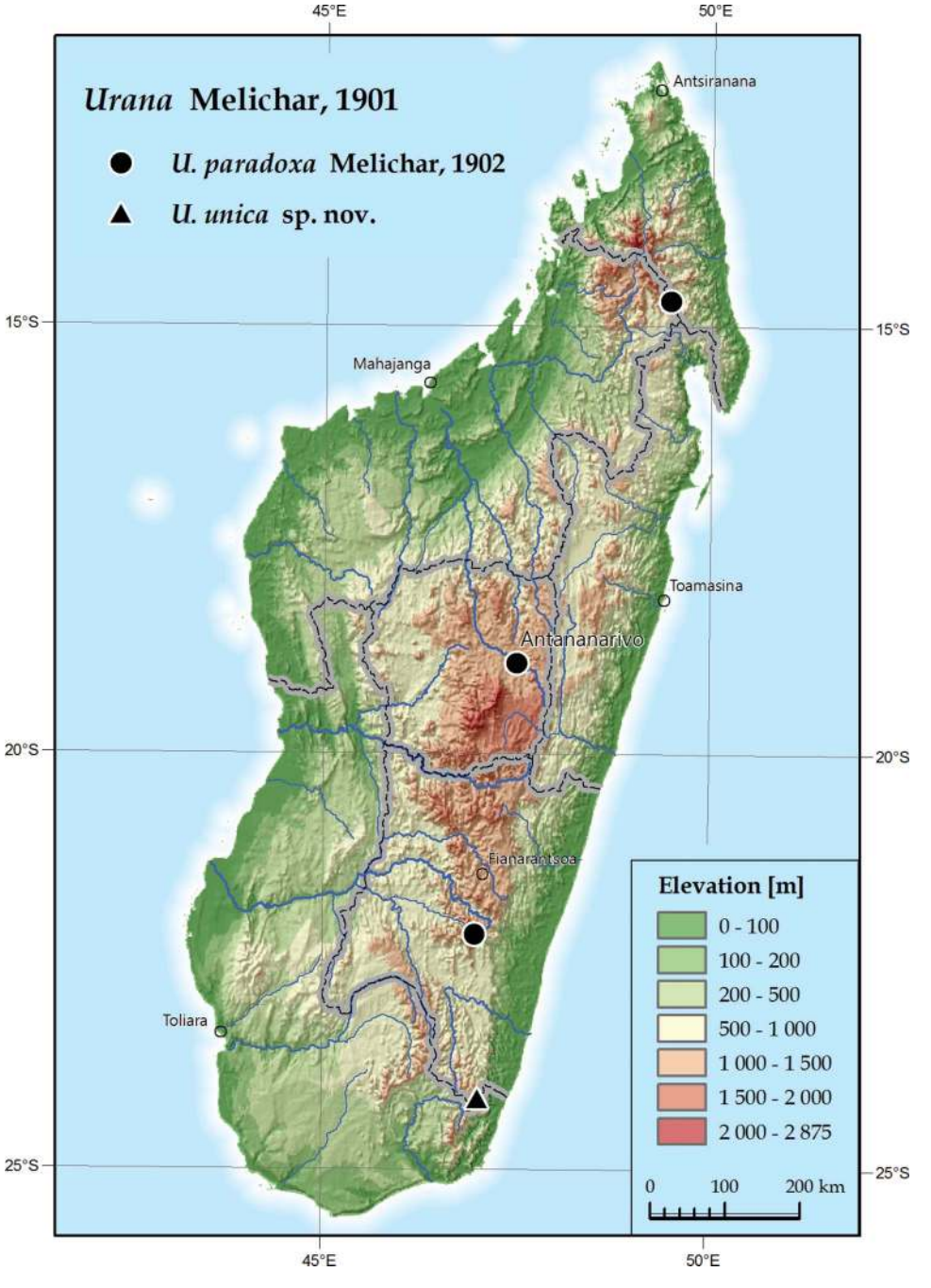

Figure 8. Distribution map of genus *Urana* Melichar, 1901.

Thorax. Pronotum: proportion F/B = 3.00–6.00. Mesonotum: proportion G/F = 3.33–3.78, proportion G/B+F = 1.82–2.94, proportion G/H = 0.80–0.94. Tegmina: proportion I/J = 2.62–2.75.

Male genitalia. Anal tube (in lateral view, Figure 5C): lower margin convex; apical part distinctly narrower than median. Anal tube (in dorsal view, Figure 5D): lateral margins in median portion convex, apical portion tapering apicad. Genital styles: posterior margin not concave in median portion; lower part of genital styles destroyed. Periandrium (Figure 5A,B): basal part with three dorsal teeth (median straight, lateral aurochs-horn-like); ventral part with three lobes: lower one laterally flattened, keel-shaped, surpassing half of upper lobes length; upper lobes extremely elongated and narrow with deep median split; lateral part of periandrium apically with huge single-armed appendage with basal one or two processes and short teeth. Aedeagus s.s.: lateral lobes smaller than those of *U. unica* and placed subapically, dorso-apical lobes as in Figure 5F,G.

Type material

Holotype, ♂: [Madagascar, Antananarivo, Sikora J.F.], [Hymenopt mimicry Fall] [Urana paradoxa Melichar det.], [Typus], [Zool. Mus. Berlin]. The holotype is deposited in ZMB.
Note: In original description (Melichar 1902) and in Medler (1990) the name of type locality is given as Antanarivo.

Additional materials

Two ♀♀: [Madagascar-East dct. Andapa Anjanaharibe 1600 m IV-60 P. Soga], [Institut Scientifique], [R.I.Sc.N.B. I.G. 22.889], [H. Synave det., 1963 Urana paradoxa Mel] – (IRSNB); [Andringitra East Anjavidilava 1850–1950 m 18 December/15 January 1971], [FDHM 2], [Museum Paris Madagascar Centre mission C.N.R.S. R.C.P. n° 225] – (MNHN).

Distribution

Madagascar: Antsiranana, Antananarivo, Fianarantsoa Provinces.

Urana unica sp. nov.
(Figures 6; 8)

Etymology

The specific epithet comes from the Latin 'unicus' which means unique and extraordinary.

Diagnosis

See Diagnosis of *Urana paradoxa* Melichar, 1902.

Description

Total length 0.94–1.00 cm.

Head. Vertex: proportion A/B = 8.00–8.66. Frons: proportion C/E = 0.78–0.84; proportion D/E = 0.98–1.03.

Thorax. Pronotum: proportion F/B = 5.00–7.00. Mesonotum: proportion G/F = 3.66–3.78, proportion G/B+F = 3.05–3.31, proportion G/H = 0.88–0.89. Tegmina: proportion I/J = 2.61–2.73.

Male genitalia. Anal tube (in lateral view, Figure 6B): lower margin almost straight. Anal tube (dorsal view, Figure 6A): lateral margins almost straight and parallel; apical margin widely arcuate about as wide as median portion. Genital styles: posterior margin weakly concave in median portion. Periandrium (Figure 6D–F); basal part (on one side) with one dorsal, two or three (holotype) or one or two (paratype) dorsolateral and one lateral tooth; ventral part without keel-shaped lobe but with three upper short lobes (Figure 6F); lateral part apically with huge two-armed appendage; basal arm single and short, oriented basad and curved ventrad; apical arm distinctly longer than basal one with three processes, from the longest basal to the shortest apical. Aedeagus s.s.: lateral lobes big and placed medially, dorso-apical lobes as in Figure 6G–I.

Type material

Holotype, ♂: [Chafnes anosyennes Massif nord, 1900 m haute Ranomandry 17/26 November 1971], [Museum Paris Madagascar East mission C.N.R.S. R.C.P. n° 225] – (MNHN).
Paratype, ♂: [Chafnes anosyennes Massif nord, 1900 m haute Ranomandry 17/26 November 1971], [Museum Paris Madagascar East mission C.N.R.S. R.C.P. n° 225] – (MNHN).

Distribution

Madagascar: Toliara Province.

Discussion

The described flatid fauna of the island of Madagascar covers 33 species of Flatinae and 37 species of Flatoidinae (Synave 1956, 1966; Metcalf 1957), in contrast to 158 species known from mainland Africa (Metcalf 1957; Fennah 1957; Synave 1962; Linnavuori 1973; Medler 1988, 2001). With respect to the Selizini, the tribe in Madagascar seems extremely scarce as there are only three species in two genera reported from the island, compared with 20 species in eight genera living in Africa. Preliminary studies based on the material from several museum collections indicate that the biodiversity of Flatinae in Madagascar is much higher than previously estimated (Świerczewski and Stroiński 2011; Stroiński and Świerczewski 2011).

The high mountain ecosystems form one of the most biologically diverse and endemic places in all of Madagascar, on the other hand they are the least explored and documented in the island. Their fauna covers many spectacular species including the revised genus *Urana*. Both species of the genus are recorded from the 1250 to 1900 m

in the mosaic habitats of high-altitude montane forest (humid forest) and wooded grassland–bushland vegetation. Precise descriptions of the local environmental conditions for Andringitra and Chafnes anosyennes Massif are given by Paulian et al. (1971, 1973).

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