

REVIEW OF THE ORIENTAL GENUS *PROTOLEPTA* MELICHAR, WITH DESCRIPTION OF THE SECOND SPECIES FROM SULAWESI, INDONESIA (HEMIPTERA: AUCHENORRHYNCHA: DICTYOPHARIDAE: ORTHOPAGINI)

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Abstract—The Oriental genus *Protolepta* Melichar is revised to include two species: *P. turbata* (the type species) and *P. linnavuorii* **sp. nov.**, both from Sulawesi, Indonesia. Redescription is provided for *P. turbata* together with habitus photographs and detailed illustrations of the male genitalia for the first time. A key to the species of the genus and a distribution map are given.

Key words: Dictyopharidae, new species, Oriental region, taxonomy.

INTRODUCTION

The dictyopharid planthopper genus *Protolepta* was established by Melichar based on a single species, *Protolepta turbata* Melichar, from Sulawesi, Indonesia (Melichar, 1912). This genus, along with most other dictyopharid genera, was traditionally placed in the tribe Dictyopharini (Melichar, 1912; Metcalf, 1946), and was later assigned to Orthopagini by Emeljanov (2011). The phylogeny of the Oriental genera of Orthopagini showed *Protolepta* is closely related to the grouping of *Saigona*, *Orthopagus*, and *Dictyome-ria* (Song et al., 2016b).

While sorting and identifying dictyopharids material from the collections of the Museum für Naturkunde, Berlin, Germany (MFNB) and from the Moravian Museum, Brno, Czech Republic (MMBC), we found a second *Protolepta* species from southern Sulawesi based on comparison with the type material of *P. turbata*. Therefore, *Protolepta* is revised to include two species: *P. turbata* (the type species) and *P. linnavuorii* **sp. nov.**, both from Sulawesi, Indonesia.

MATERIAL AND METHODS

The specimens studied in the course of this work are deposited in MFNB and MMBC.

The post-abdomina of the specimens used for dissection were cleared in 10% KOH at room temperature for ca. 6–12 hours, rinsed in distilled H₂O and then transferred to 10% glycerol for examination. Observations, measurements and photography were conducted under a Leica Z16 APO A stereomicroscope equipped with a Leica DFC495 microscope camera and Leica Application Suite software (version 3.7.0) in MFNB. The final images were compiled from multiple photographs using CombineZM image stacking software and improved with the Adobe Photoshop CS5 software.

The morphological terminology and measurements used in this study follow Song et al. (2014, 2016a, b) for most characters and Bourgoïn et al. (2015) for the forewing.

TAXONOMY

PROTOLEPTA MELICHAR, 1912

Protolepta Melichar, 1912: 97; Metcalf 1946: 77

TYPE SPECIES: *Protolepta turbata* Melichar, 1912; by original designation.

DIAGNOSTIC CHARACTERS: Cephalic process very robust, cylindrical, bulbous at apex; vertex with

lateral carinae strongly ridged at base, and expanded at apex, anterior margin broadly convex and rounded, median carina nearly complete but weak and indistinct; frons distinctly inflated and bulbous at apex, intermediate carinae approaching beneath antennae; forewings with pterostigmal area quadrangular; legs moderately long, fore femora not flattened and dilated, with a large and blunt subapical spine, hind tibiae with six apical spines; phallobase with inflated membranous paired lobes, without spines.

DESCRIPTION: **Head:** produced in a very robust cylindrical cephalic process moderately bulbous at apex (Figs. 3A–C, 4A–C). An apical carina between anterior margins of frons and vertex weak but distinct. Vertex (Figs. 3A, 4A) with basal width a little wider than transverse diameter of eyes; lateral carinae strongly ridged and subparallel at base, more or less sinuate before eyes, slightly constricted and then expanded towards apex; anterior margin broadly convex and rounded, posterior margin ridged and angularly concave at about 100°; median carina nearly complete but weak and indistinct. Frons distinctly inflated and bulbous at apex; lateral carinae nearly parallel; intermediate carinae not sharp, gradually convergent posteriorly and approaching beneath antennae; median carina narrow and complete (Figs. 3C, 4C). Postclypeus and anteclypeus convex medially, with distinct median carina. Rostrum long, beyond the base of hind femora.

Eyes: large and nearly rounded, callus postocularis forming a triangular process protruded posteriorly.

Antennae: with scape very small; pedicel large and subglobose, with more than 50 distinct sensory plaque organs distributed over entire surface; flagellum long, setuliform.

Thorax: *Pronotum* (Figs. 3A, 4A) relatively narrow and elongate, anterior central margin angularly convex, lateral marginal areas straight and sloping with two longitudinal carinae on each side between eyes and tegulae, posterior margin angularly concave; median carina strongly ridged and high, with a big lateral pit at side of carina, respectively.

Mesonotum: (Figs. 3A, 4A) tricarinate on disc, lateral carinae incurved anteriorly towards median carina.

Forewings: (Fig. 2) hyaline and elongate, with ratio of length to width about 3:1; veins without setae; ScP+R and MP originating from basal cell

without common stem (Fig. 2A), or with a very short common stem (Fig. 2B) shorter than width of basal cell; MP bifurcating MP₁₊₂ and MP₃₊₄ near middle, and posterior to CuA; number of apical cells between RP and CuA with 13–14 cells; pterostigmal area quadrangular, with three cells. Legs moderately long; fore femora not flattened and dilated, with a large and blunt subapical spine; hind tibiae with 6–7 lateral and six apical spines; hind tarsomeres I with nine and tarsomeres II with 10–11 apical spines, respectively; apical spines of tarsomeres with long setae instead of platellae.

Genitalia: Male: with pygofer large and broad, dorsal margin slightly excavated to accommodate anal tube, dorso-lateral margins angularly produced posteriorly in dorsal view (Figs. 3D, 4D). Gonostyles (Figs. 3F, 4F) symmetrical, base broad, nearly parallel towards apex, broadest subapically; upper margin with a dorsally directed, black-tipped process at apex, outer upper edge with a ventrally directed, hook-like process near middle in lateral view (Figs. 3G, 4G). Aedeagus with a pair of endosomal processes directed dorsally (Figs. 3I, 4I); phallobase membranous and inflated apically, with paired lobes without spines (Figs. 3H–J, 4H–J). Anal tube (Figs. 3D, E, 4D, E) large and broad, apical dorsal margin deeply excavated to accommodate anal style in dorsal view (Figs. 3D, 4D); anal style distinctly elongate and large.

DISTRIBUTION: *Protolepta* comprises two species and is only recorded from Sulawesi (Fig. 5).

REMARKS: *Protolepta* is externally similar to *Leprota* Melichar (Song et al., 2012), but can be distinguished from the latter by the head without wrinkles (the head covered in numerous irregular transverse wrinkles in *Leprota*); the vertex with basal width a little wider than transverse diameter of eyes (the vertex with basal width nearly three times as wide as transverse diameter of eyes in *Leprota*); the forewings with fewer transverse veins on apical 1/5 (the forewings with numerous netted transverse veins on apical 1/5 in *Leprota*); and the hind tibiae with six apical teeth (with eight teeth in *Leprota*).

KEY TO SPECIES OF *PROTOLEPTA* MELICHAR

- 1. Head relatively short, as long as pronotum and mesonotum combined (Fig. 1A, C) *P. linnavuorii* sp. nov.
- Head much longer than pronotum and mesonotum combined (about 1.5:1, Fig. 1B, D). *P. turbata* Melichar, 1912

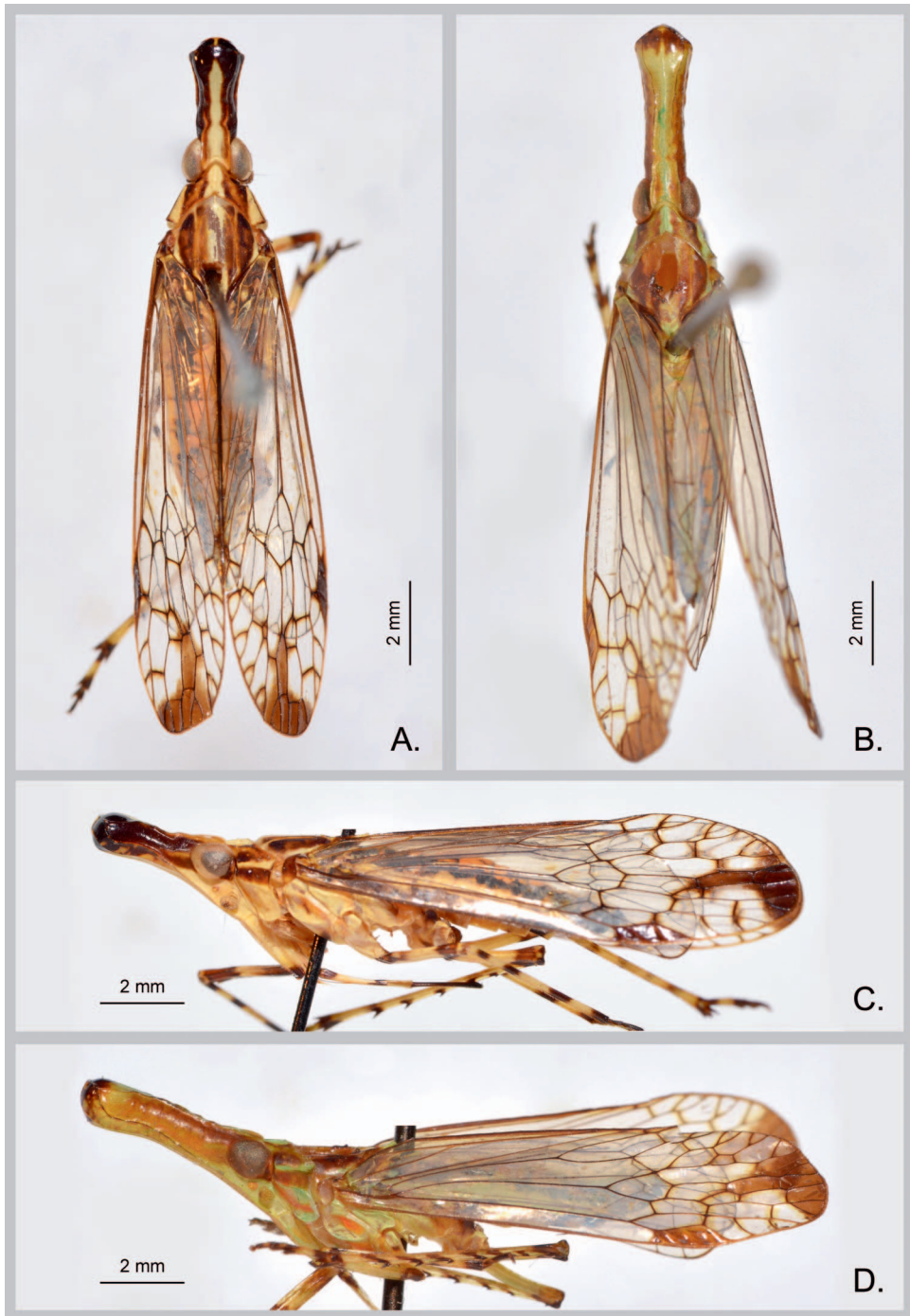


Fig. 1. Habitus of *Protolepta* species. A., C. *Protolepta linnavuorii* sp. nov., holotype, male; B., D. *Protolepta turbata*, lectotype, male.

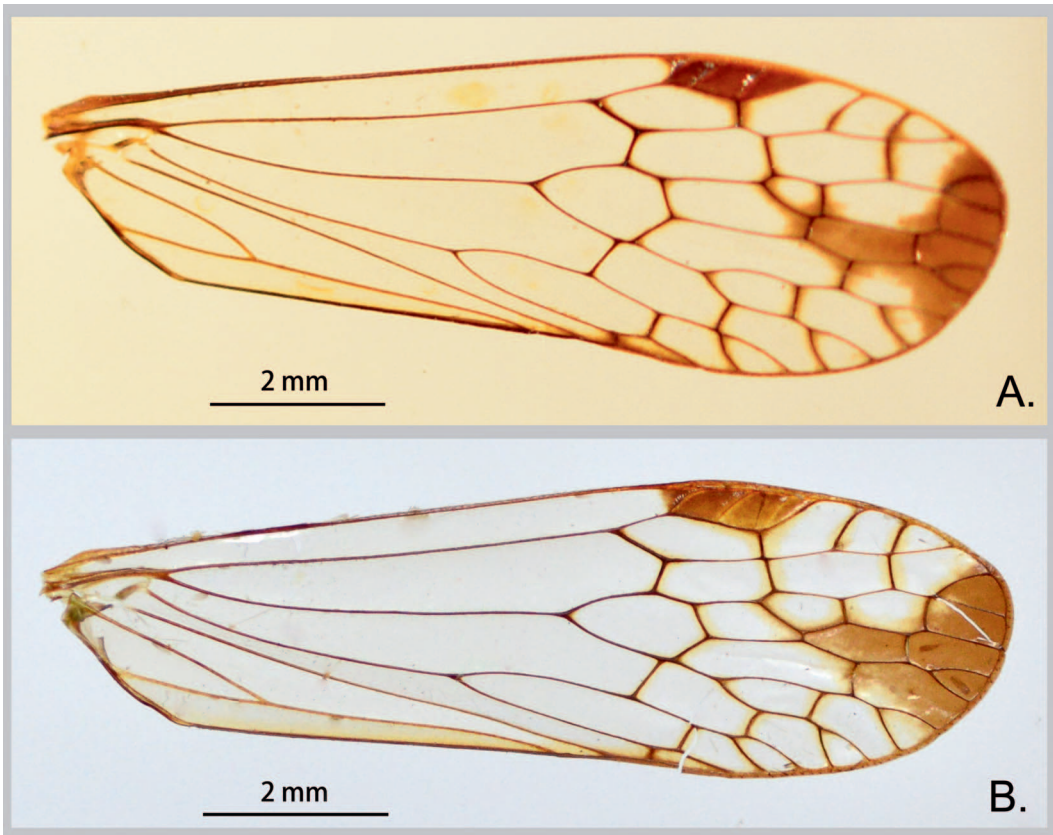


Fig. 2. Forewing of **A.** *Protolepta linnavuorii* sp. nov.; **B.** *Protolepta turbata*.

Protolepta linnavuorii, new species

Figs. 1A, C, 2A, 3

DIAGNOSIS: This new species can be distinguished from *P. turbata* by the darker body color and the shorter cephalic process.

DESCRIPTION: ♂, body length (from apex of cephalic process to tip of forewings): 16.7 mm; head length (from apex of cephalic process to base of eyes): 3.4 mm; head width (including eyes): 1.7 mm; forewing length 11.6 mm.

COLORATION: General color brownish ochraceous marked with yellowish and black in dorsal view (Fig. 1A). Head glossy blackish brown, vertex between lateral carinae, genae beneath eyes, most frons, and clypeus mostly yellowish. *Pronotum* and *mesonotum* dull ochraceous mottled with black, broad median carina, lateral marginal areas, and paranotal lobes of pronotum, and broad median carina, lateral carinae, and lateral marginal areas of mesonotum

yellowish. Forewings with stigmal area and a large triangular spot at apex dull ochraceous.

Thorax: beneath pale yellowish. Legs pale ochraceous mottled with black, fore and middle tibiae with four annulations black.

Abdomen: above and beneath pale ochraceous, with a double lateral series of large segmental spots black both dorsally and ventrally. Male genitalia black, dorsal marginal areas of pygofer and anal tube yellowish.

Head: relatively short, as long as pronotum and mesonotum combined. Vertex (Fig. 3A) with ratio of length to width between eyes 3.9:1. Forewing as Fig. 2A.

Genitalia: Male with pygofer large and broad, a little wider ventrally than dorsally (about 1.5:1); posterior margin with an elongate horn-like process near subapex in lateral view (Fig. 3E), acute apically. Gonostyles more or less expanded towards apex, broadest subapically in lateral view (Fig. 3G), apex straight; upper process elongate,

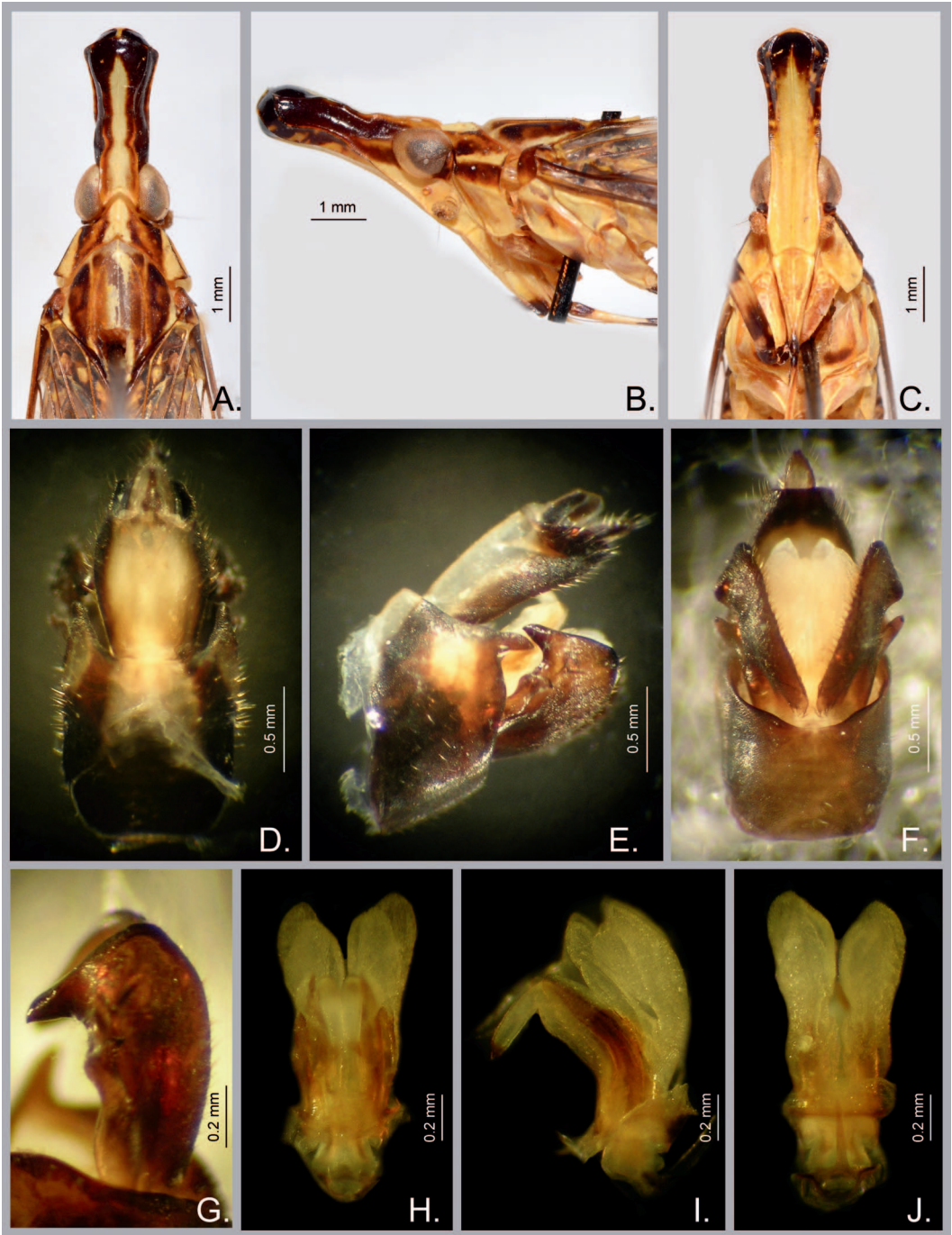


Fig. 3. *Protolepta linnavuorii* sp. nov. A. head, pronotum and mesonotum, dorsal view; B. head and pronotum, lateral view; C. head and pronotum, ventral view; D. anal tube and pygofer, dorsal view; E. pygofer, gonostyles, and anal tube, lateral view; F. pygofer and gonostyles, ventral view; G. gonostyle; H. aedeagus, dorsal view; I. aedeagus, lateral view; J. aedeagus, ventral view.

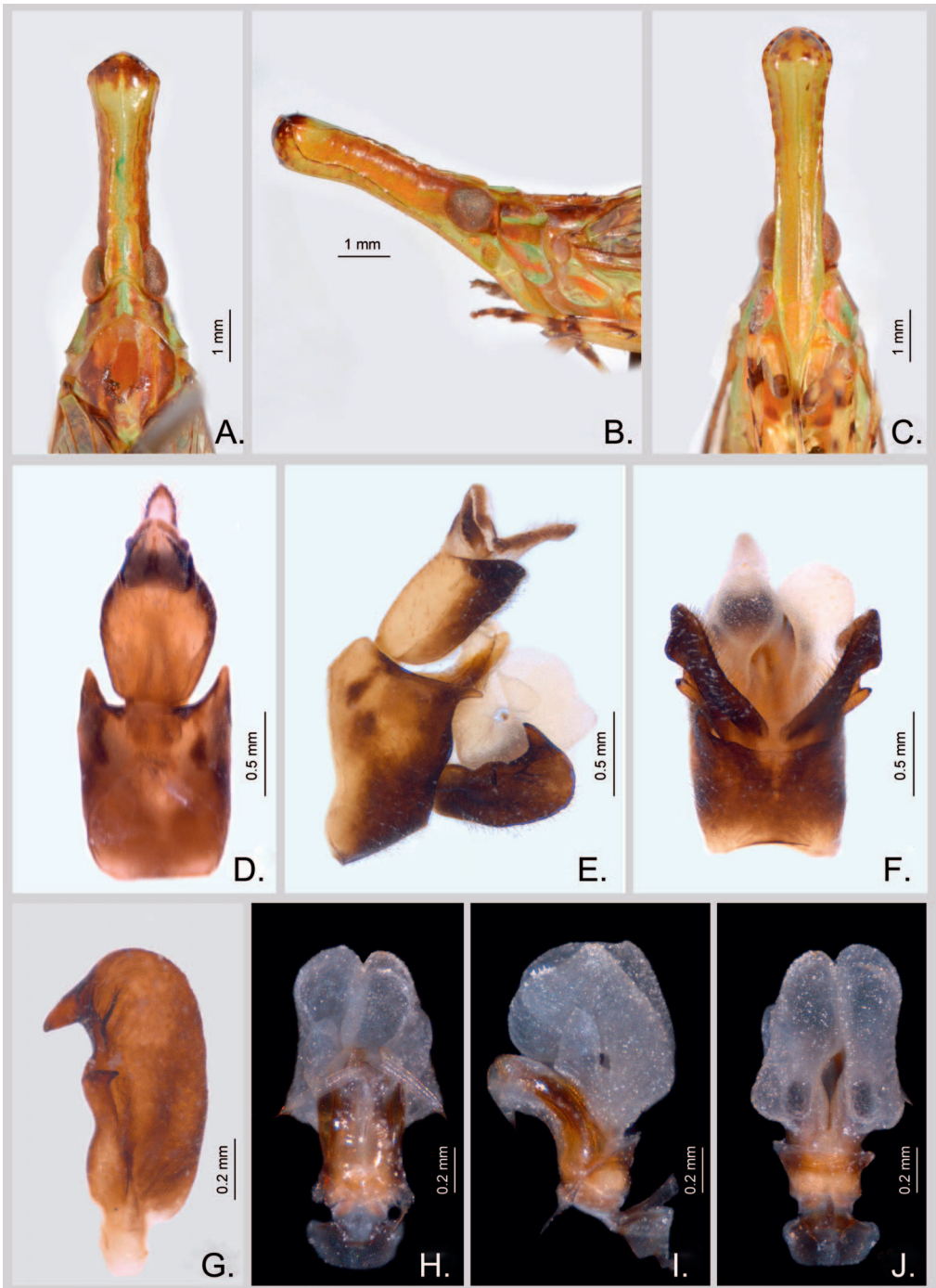


Fig. 4. *Protolepta turbata*. A. head, pronotum and mesonotum, dorsal view; B. head and pronotum, lateral view; C. head and pronotum, ventral view; D. anal tube and pygofer, dorsal view; E. pygofer, gonostyles, and anal tube, lateral view; F. pygofer and gonostyles, ventral view; G. gonostyle; H. aedeagus, dorsal view; I. aedeagus, lateral view; J. aedeagus ventral view.

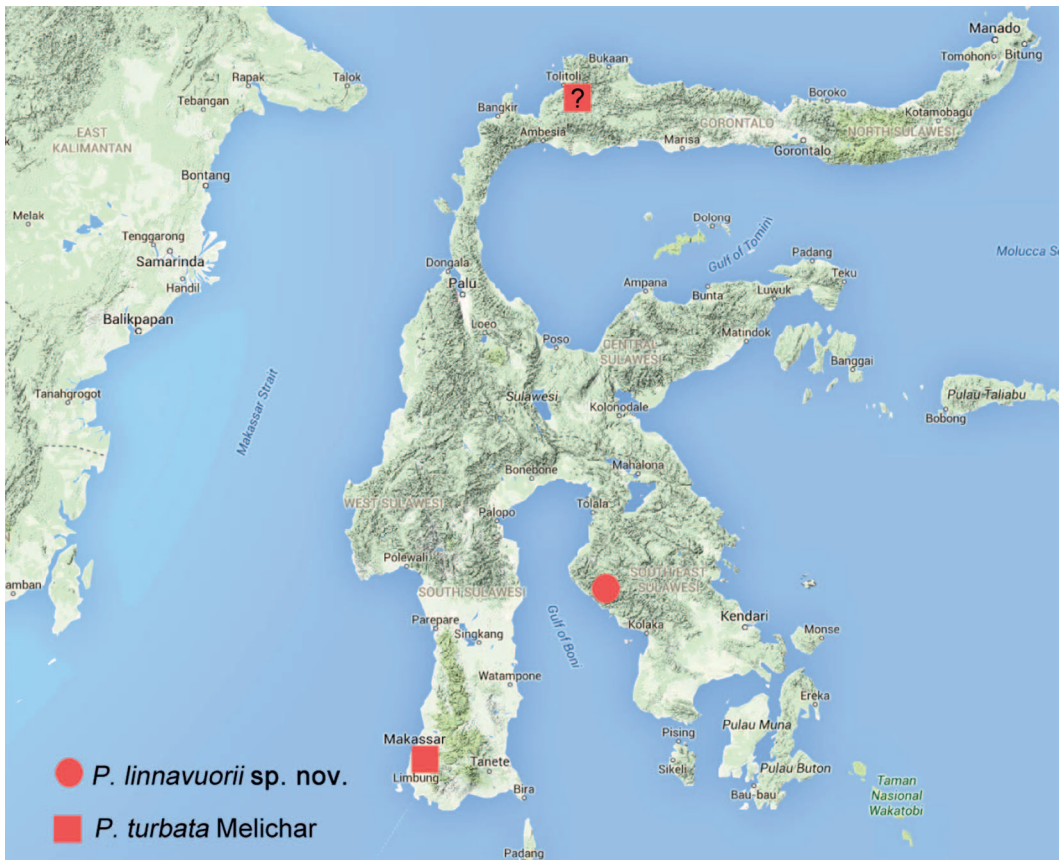


Fig. 5. Distribution of the *Protylepta* species.

acute apically. Aedeagus (Fig. 3H–J) relatively small, with a pair of long and stout endosomal processes curved in middle and directed dorsally, apex acute; phallobase membranous and moderately inflated, with two pairs of ventral lobes directed posteriorly: outer pair large and transversally expanded, and inner pair small. Anal tube large and broad, ratio of length to width near middle about 1.3:1 in dorsal view (Fig. 3D).

MATERIAL EXAMINED: Holotype: ♂, [INDONESIA]: S. O. Celebes [Sulawesi], Mengkoka – Geb. [Mengkoka Gebergte] (3°37'60"S, 121°15'0"E), Wawo, 16-30.I.32, G. Heinrich; *Protylepta turbata* Mel. [Synave's handwriting] (MFNB).

ETYMOLOGY: The new species is named after Dr. Rauno Linnavuori who is an excellent hemipterous entomologist in Finland.

DISTRIBUTION: Indonesia (Sulawesi).

Protylepta turbata Melichar, 1912

Figs. 1B, C, 2B, 4

Protylepta turbata Melichar, 1912: 98, Pl. 3, Fig. 16

REDESCRIPTION: ♂, body length (from apex of cephalic process to tip of forewings): 17.9 mm; head length (from apex of cephalic process to base of eyes): 4.7 mm; head width (including eyes): 1.6 mm; forewing length 11.4 mm.

COLORATION: General color distinctly paler than *P. linnavuorii*, ochraceous with pale yellowish and black in dorsal view (Fig. 1B). Head brownish ochraceous, vertex between lateral carinae, genae beneath eyes, most frons, and clypeus yellowish green. Pronotum and mesonotum dull ochraceous, broad median carina, lateral marginal areas, and paranotal lobes of pronotum, and

broad median carina, lateral carinae, and lateral marginal areas of mesonotum yellowish green, a broad maculata of paranotal lobes of pronotum reddish ochraceous. Forewings with stigmal area and a large triangular spot ochraceous brown.

Thorax: beneath pale yellowish. Legs pale yellowish mottled with fuscous; fore and middle tibiae with four dark brown annulations.

Abdomen: above and beneath pale yellowish, with a double lateral series of large segmental spots fuscous both dorsally and ventrally. Male genitalia dark brown with dorsal marginal areas of pygofer and anal tube yellowish.

Head: much longer than pronotum and mesonotum combined (about 1.5:1). Vertex (Fig. 4A) with ratio of length to width between eyes 5.5:1. Forewing as Fig. 2B.

Genitalia: Male with pygofer large and broad, slightly wider ventrally than dorsally (about 1.7:1); posterior margin with an elongate horn-like process near subapex in lateral view (Fig. 4E), acute apically. *Gonostyles* more or less expanded towards apex, broadest subapically in lateral view (Fig. 4F), apex straight; upper process elongate, acute at apex. *Aedeagus* (Fig. 4H–J) large and robust, with a pair of long and stout endosomal processes curved in middle and directed dorsally, apex acute; phallobase membranous and strongly inflated, with two pairs of ventral lobes directed posteriorly: outer pair large and incurved dorsally, apex bulbous, and inner pair small. Anal tube large and broad, ratio of length to width near middle about 1.1:1 in dorsal view (Fig. 4D).

TYPE MATERIAL EXAMINED: Syntype, 1♂, [INDONESIA]: S. Celebes [Sulawesi], Patunung (5°9'52"S, 119°28'24"E), Jan. 1896, H. Fruhstorfer; *Protolepta turbata*, det. Melichar [Melichar's handwriting]; Typus [red label]; *Protolepta turbata* sp. n. L. Melichar det, 1912, P. Lauterer det. 1991 [Lauterer handwriting]; Syntypus [red label] (MMBC).

DISTRIBUTION: Indonesia (Sulawesi).

REMARKS: This species was described by Melichar (1912) based on both sexes specimens from Patunung (Patunung) and Toli-Toli, Celebes, originally coming from the collection of the Hungarian Museum of Natural History, Budapest, Hungaria. In his original description, Melichar (1912) did not provide any further details on the type series. We found one male specimen from Patunung with the corresponding label data in

Melichar's personal collection in MMBC, obviously belonging to one of syntypes.

Geographically, Patunung, located on the southwest of South Sulawesi, is far away from Tolitoli in the north of Central Sulawesi (Fig. 5). Unfortunately, we didn't check all the syntypes including material from Tolitoli. So our redescription for *P. turbata* is based on the specimen from Patunung.

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