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Running title: New *Heminicsara* from West Papua

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Abstract

Heminicsara Karny, 1912 is a katydid genus of Agraeciini from the *Axylus* genus group. It currently comprises 62 species from mainly New Guinea and surrounding archipelagos. Based on recent fieldwork in Lobo in West Papua, Indonesia, a new species of *Heminicsara* is described here: *Heminicsara incrassata* **sp. nov.** It is most readily characterised from congeners and other species of the *Axylus* genus group by the male tenth abdominal tergite forming a large shield-shaped plate. This represents the first species of *Heminicsara* described and known from the south-west of New Guinea.

Key words. *Axylus*, Conocephalinae, Indonesia, katydid, Southeast Asia

Introduction

Katydids of the tribe Agraeciini are highly diversified in species number and morphology. In the Southeast Asian and Oriental regions, the first major taxonomic revision of Agraeciini was done by Ingrisch (1998). This led to further new species discoveries and taxonomic treatments of specific groups (Gorochov, 2011, 2015, 2016; Ingrisch & Tan, 2012; Tan & Ingrisch, 2014; Tan et al., 2018). Many of these publications focus on species from areas west of the Wallace Line. To the east of Wallace Line, Willemse (1959) provided a thorough revision of the genus *Salomona* which includes many species from, but not limited to New Guinea nor to the east of the Wallace Line. More recently, monographic contributions to the taxonomy of Agraeciini from New Guinea and surrounding regions also include studies by Naskrecki & Rentz (2010), Ingrisch (2009, 2015, 2019, 2020) and Rentz & Su (2019), in addition to smaller contributions (Tan & Robillard,2020). These contributions, which include many new species and genera, demonstrate that a huge part of the species we of the Agraeciini from this biodiverse region remain unknown.

Heminicsara Karny, 1912 is one of the Agraeciini genera limited to New Guinea and the surrounding archipelagos. It belongs to the *Axylus* genus group Ingrisch, 2015, characterised by deep lateral lobes of the pronotum, long prosternal spines, short and obtuse fastigium verticis and quadrangular cross-section in the anterior tibiae (Ingrisch, 2015). This genus currently comprises 62 species, 51 species of which were only described recently (Ingrisch, 2015). Even though recent new species were described from old museum specimens, more species can be expected with more intensive sampling in under-explored parts of the genus distribution. Recent fieldwork in West Papua, Indonesia led to the discovery of a new species, which is described here: *Heminicsara incrassata* **sp. nov.** This represents the first species of *Heminicsara* described and known the south-west of New Guinea.

Materials and Methods

The katydids were collected during the "Lengguru 2014" expedition in Papua, Indonesia and will be deposited in the collections of the Muséum national d'Histoire naturelle Paris, France (MNHN) and in the Museum Zoologicum Bogoriense, Bogor, Indonesia (MZB). Square brackets in the list of specimens are used for additional information not mentioned on the specimen labels or translated from French labels.

Male titillators were dissected in specimens, softened using KOH, by cutting the membranes between the paraprocts and the subgenital plate. They were then cleaned with cold KOH, and subsequently kept in glycerine. Close-up images of habitus and morphological features were done using a Canon EOS 6D digital SLR camera with a macro photo lens MP-E 65 mm f/2.8 USM (1–5×). Imaging stacking was done using Helicon Remote version 9.3.1. W and Helicon Focus 6.8.0. Photographs of male titillators were done with a binocular microscope Leica MZ16 with AmScope Microscope Eyepiece Camera (MU1000, 10 MP Aptina Color, CMO50) attached via an AmScope FMA050 fixed microscope adaptor and the montage software AMScope version ×64, 3.7. Image editing was accomplished using Adobe Photoshop CC2014.

Measurements of specimens were made using ImageJ 1.51j8 (Wayne Rasband, Research Services Branch, National Institute of Mental Health, Bethesda, MD, USA). In the measurements, the following abbreviations are used: BL = body length; PL = pronotum length; PW = pronotum width; TL = tegmen length; FIIIL = posterior femur length; FIIIW = posterior femur width; TIIIL = posterior tibia length.

Family Tettigoniidae Krauss, 1902

Subfamily Conocephalinae Burmeister, 1838

Tribe Agraeciini Redtenbacher, 1891

Genus group *Axylus* Ingrisch, 2015

Genus *Heminicsara* Karny, 1912

Heminicsara Karny, 1912: 9 –1926: 200; Ingrisch, 2015: 166 (with key to species)

Type species: *Heminicsara jacobii* Karny, by original monotypy

***Heminicsara incrassata* Tan, Ingrisch & Robillard, sp. nov.**

Material examined. Holotype: INDONESIA • ♂; Nouvelle-Guinée [New Guinea], Lobo [village in the Bay of Kaimana], S3.7033056, E134.071444 (LOBO6), 221 m.a.s.l., forêt proche [forest near] PK8/ route Lobo-Kaimana, crête [ridge] prox. camp, forêt primaire [primary forest], 21–30.X.2014, jour [day], on *Pandanus*, T. Robillard leg., LEN2014-TR346 (MZB).

Paratype. INDONESIA • 1♂; Nouvelle-Guinée [New Guinea], Lobo [village in the Bay of Kaimana], S3.764667, E134.100111 (LOBO1), 23 m.a.s.l., forêt littorale sur pente, autour du camp [littoral forest on slope, around the camp], sur tronc (height = 2.5 m) [on tree trunk]; 21–30.X.2014, nuit [night], T. Robillard leg., LEN2014-TR66 (MNHN-EO-ENSIF11334).

Type locality. Indonesia, West Papua: Lobo (a coastal village in the Bay of Kaimana)

Etymology. The species name refers to the enlarged and thickened tenth abdominal tergite, the most distinct character of this species from the congeners (from Latin, incrassata = thickened).

Diagnosis. This new species is different from species from the *Axylus* genus group by the combination of these characters: colouration generally pale green, mottled dark; face dark between the eyes, frons grey-brown; pronotum disc with two transverse lateral spots at anterior third and an X-shaped dark pattern behind anterior third, male tenth abdominal tergite forming a large shield-shaped plate with two long apical lobes pointing ventrad, male cercus conical with a strongly curved inner-basal process and titillators fused and elongated.

This new species is similar to fully-winged species *Heminicsara bilobata* Ingrisch, 2015 from north-central New Guinea, *Heminicsara mamberamo* Ingrisch, 2015 from Mamberamo in West Papua and *Heminicsara sica* Ingrisch, 2015 from East Sepik in Papua New Guinea by the slightly prolonged tenth abdominal tergite, but it differs by the presence of two long apical lobes pointing ventrad. It also differs from these congeners by face and pronotum colouration, titillators being fused and elongated (instead of separated) and male cercus with only one internal basal process, which is strongly curved (instead of long with apical spines) and male cercus without distal internal process. It also differs from *H. bilobata* and *H. mamberamo* by the fused titillators (instead of separated or free). It is also similar to *H. sica* by the fused titillators but differs by the male cercus missing a semi-circular

bulge at apex, and the male subgenital plate being missing long, laterally compressed projections curved dorsad and fused with styli.

This new species has a somewhat similar colouration as long-winged *Heminicsara despecta* Naskrecki & Ingrisch, 2015 from Muller Range in Papua New Guinea and *Heminicsara schlaginhaufeni* (Karny, 1912) occurring along the northern coast of New Guinea but differs by less black mottled patterns, the male abdominal apex (including tenth abdominal tergite and cercus) and titillators.

This new species also differs from fully winged species (with only females known) by dark patterns on the pronotal lateral lobe limited to the anterior and posterior ends (instead of being connected or only present at posterior end) and FW anterior part of costal area distinctly narrow and widening posteriorly: *Heminicsara cingima* Ingrisch, 2015 from central mountain range of New Guinea, *Heminicsara coriformis* Ingrisch, 2015 from Nabire, *Heminicsara excisa* (Karny, 1926), *Heminicsara scutula* Ingrisch, 2015 from Central Province of Papua New Guinea, *Heminicsara siwi* Ingrisch, 2015 from Arfak Mountains, *Heminicsara tabtab* Ingrisch, 2015 and *Heminicsara wanuma* Ingrisch, 2015 from Adelbert Range in Papua New Guinea. It is similar to *H. coriformis* provided in the pre-subcostal area with network of white veinlets but differs from it by larger eyes. It also differs from *H. excisa* by the absence of vertical black band widening ventrad on the face.

Descriptions. Fully-winged, medium-sized species with habitus typical of the genus, as shown in Fig. 1. Fastigium verticis conical, fairly stout, not surpassing scapus, apex obtuse (Fig. 2A). Frons flat, oblique, subsmooth in the middle and very weakly rugose on the lateral parts; without lateral carinae (Fig. 2B). Maxillary palps elongated and slender; apical segment longest with apex truncated, subapical segment slightly longer than third segment. Eyes oval, weakly protruding (Figs. 2A, 2B); median ocellus reduced, indicated only by light oval spot (Fig. 2B); lateral ocelli between fastigium of vertex and scapus, small and oblong (Fig. 2A). Pronotum smooth, lateral lobe slightly more rugose; disc distinctly longer than wide, broadly rounded into paranota (Figs. 2A, 2C); anterior margin very faintly emarginated in middle; posterior area not raised, projecting posteriorly and covering stridulatory file and base of mirror, margin rounded (Fig. 2A). Lateral lobe about 3.2 times as long as high; ventral margin very faintly concave, ventro-posterior angle slightly projecting, posterior margin broadly rounded (Fig. 2C). Thoracic auditory spiracle completely covered by paranota (Fig. 2C). Prosternum with two fairly long spines (Fig. 2D). Mesosternal and metasternal lobes conical with blunt apices; median plate less broad than meso- and meta-sterna (Fig. 2D). Anterior coxa with a long dorsal spine pointing anteriorly, apex acute (Fig. 2A). Anterior tibia with both tympana slit-shaped covered by slightly swollen conchate covering (Fig. 2B). Femora with the following number of robust spines on ventral margins: anterior femur 7 external (slightly smaller than internal ones), 7 internal of increasing size distally; middle femur 7 external, 3 small internal at base; posterior femur 11 external of increasing size distally, 6 barely visible small internal (all anterior of the most basal external spines). All knee lobes long spinose externally and internally, except for external knee lobe of middle femora. Tibiae with the following number of spines on ventral margins: anterior tibia 9 external, 9 internal; middle tibia 10 external, 9 internal.

Male. Tegmen macropterous, surpassing hind femora, apex rounded (Fig. 1). Mirror fully developed, somewhat triangular, 1.2 times wider than long, anterior margin wider than posterior margin (Fig. 3A). Stridulatory file straight; about 2.2 mm long; with teeth evenly distributed; with circa 78 teeth (Fig. 3B). Hind wings concealed under tegmina (Fig. 1). Tenth abdominal tergite highly modified, forms a large shield-shaped plate; setose, especially in the medial area; apical half bent ventrally; apical margin producing two elongated lobes in the middle, pointing ventrad, apex oblique, rounded between the two apical lobes; apical lobe carinate along external margin with apex subacute (Figs. 3D–E). Epiproct concealed under the prolongation of tenth abdominal tergite. Cercus elongate and conical with apex rounded; ventro-inner margin with a stout and strongly curved basal lobe with apex rounded and pointing ventrad (Fig. 3F). Subgenital plate rectangular, slightly longer than broad, posterior margin narrowly and angularly excised in middle, lateral lobes stout; styli cylindrical, long, apex obtuse (Fig. 3G). Phallus with fused titillators (Figs. 3H, 3I). Titillator slender and elongated; dorso-lateral margins carinate and diverging posteriorly into laminate lobules (Fig. 3H); posterior end truncated (Fig. 3I).

Female. Unknown.

Colouration. Pale green (yellow when preserved and discoloured) with mottled dark patterns (Fig. 1). Head dorsum pale green with some faint grey-brown strips, fastigium verticis grey-brown (Fig. 2A). Scapus dark brown and pedicel yellow brown (Fig. 2B); antennal segments red brown to dark brown (Fig. 2A). Face dark between the eyes, frons grey-brown. Clypeus black in dorsal parts, yellow brown on ventral half; maxillary palpus and labrum pale yellow; mandible black (Fig. 2B). Pronotum generally pale green. Dorsal disc with anterior part with lateral transverse black spots, anterior third dark brown in middle, between the lateral spots; posterior of the anterior third with X-shaped dark pattern, posterior arms of X-shaped pattern larger and extending to dorsal part of lateral lobe (Fig. 2B). Lateral lobe of pronotum green to yellow green (Fig. 2C). Tegmen generally with cells black; veins white (Figs. 1B, 2C, 3A). Coxae pale yellow. Femora pale green with a faint dark dorsal band at apical end just before knees (most obvious in posterior femora); knees yellow green; spines brown with black apices (Figs. 1A,

2C). Anterior tibia yellow brown, with dark spots between and posterior of tympana (Fig. 2B). Abdominal tergites, sternites and apex pale green (Figs. 1, 2D, 3D–E).

Measurements (mm). Holotype BL = 27.0, PL = 6.0, PW = 7.0, TL = 28.2, FIIIL = 17.8, FIIIW = 4.6, TIIIL = 17.0; paratype BL = 28.5, PL = 9.9, PW = 7.2, TL = 27.9, FIIIL = 18.7, FIIIW = 4.6 TIIIL = 17.3 (slightly deformed).

Habitats. The two known specimens were collected in primary forest, one on a *Pandanus* tree, one on a tree trunk at about 2.5 m high.

Acknowledgments

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Figure captions

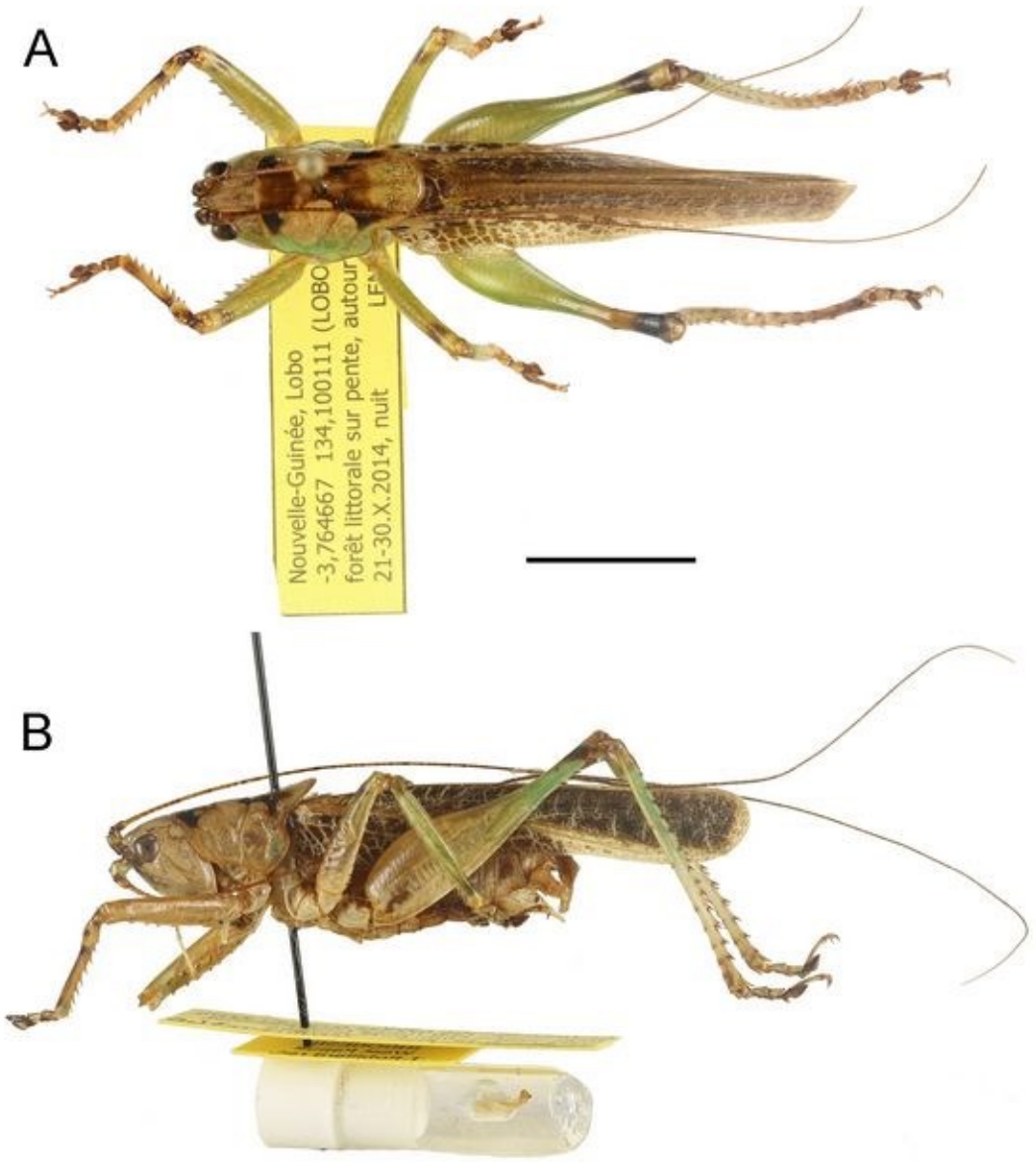

FIGURE 1. *Heminicsara incrassata* **sp. nov.** habitus in dorsal (A) and lateral (B) views. Scale bar: 10 mm.

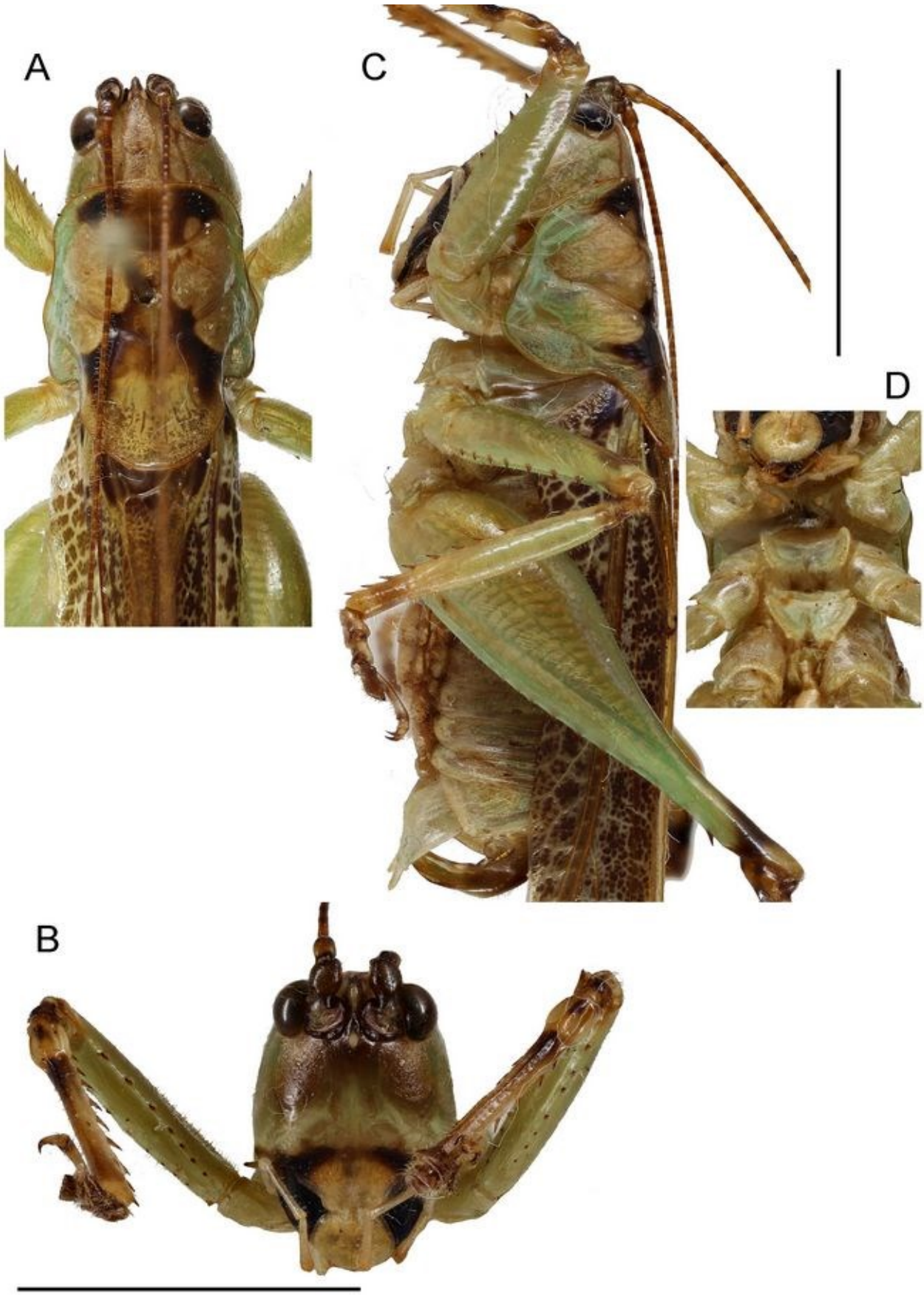

FIGURE 2. *Heminicsara incrassata* **sp. nov.** head and pronotum in dorsal view (A), head and anterior legs in anterior view (B), body in lateral view (C), thorax in ventral view (D). Scale bar: 10 mm.

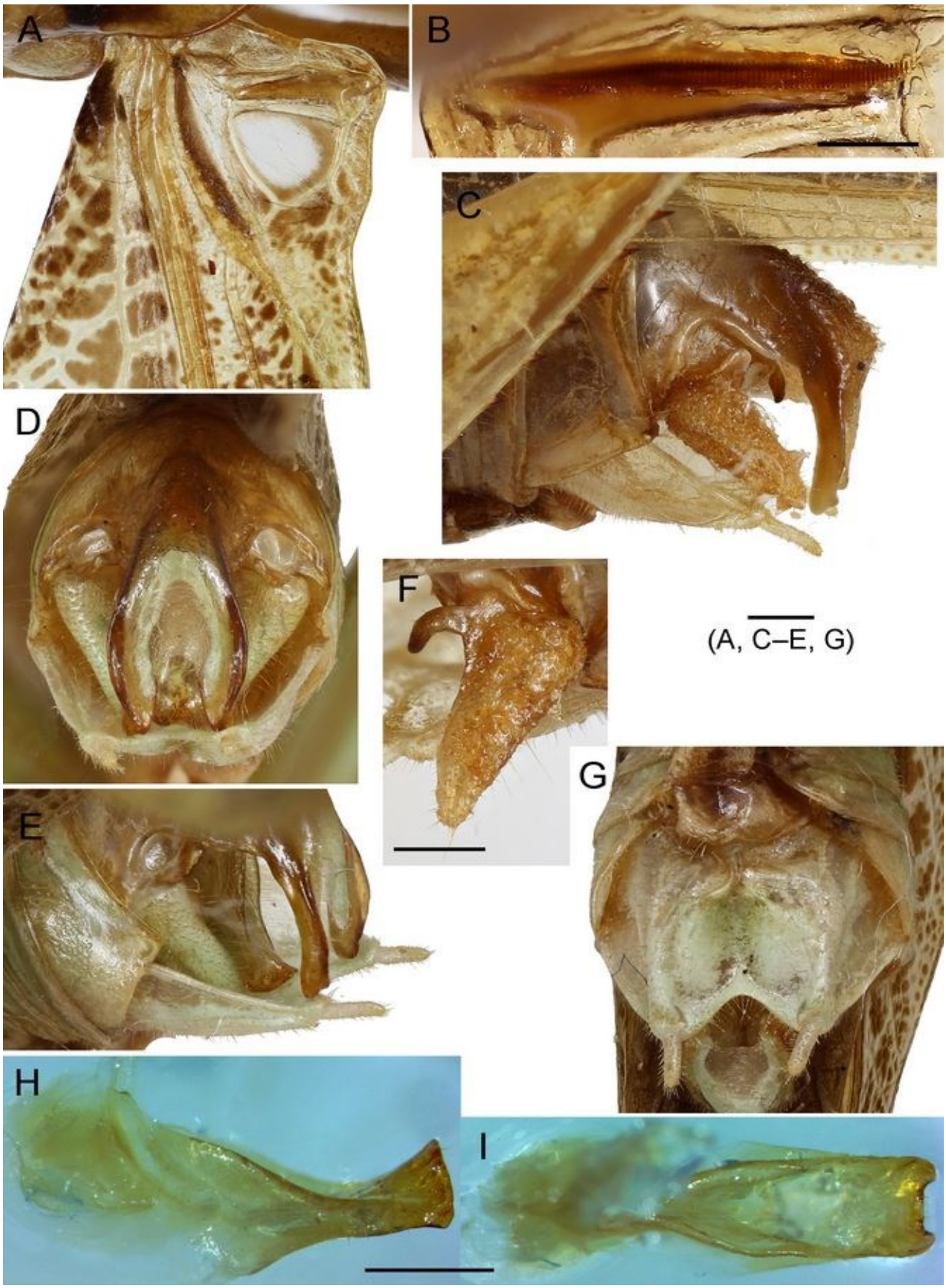

FIGURE 3. *Heminicsara incrassata* **sp. nov.** base of tegmen in dorsal view (A), stridulatory file in ventral view (B), abdominal apex without titillators in lateral (C) and posterior (D) views, abdominal apex with titillators in lateral view (E), cercus in dorsal view (F), titillators in lateral (H) and dorsal (I) views. Scale bars: 1 mm (A, C–G), 0.5 mm (B, H, I).