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New taxa and notes on spine-headed katydids (Orthoptera: Conocephalinae: Agraeciini) from the Philippines

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Abstract

The diversity of the Agraeciini spine-headed katydids (Orthoptera: Tettigoniodea: Conocephalinae) in Southeast Asia remains poorly known, with species still awaiting discovery. Recent field collections in the Philippines resulted in the discovery of three novel species and redescription of two known species of Agraeciini, namely, (1) *Anthracites furvuseques* sp. nov. from Siargao in Mindanao, a species close to *A. major* Hebard, 1922; (2) *Axylus mabinii* sp. nov. from Luzon; (3) a new variant in *Axylus* c.f. *philippinus* (Hebard, 1922); (4) *Salomona lumadae* sp. nov. from Siargao in Mindanao; and (5) *Salomona brevicollis* Stål, 1877 comb. resurr. is a valid species distinct from *Salomona maculifrons* Stål, 1877.

Key words: new species, resurrected combinations, Southeast Asia, taxonomy, Tettigoniodea

Introduction

The Agraeciini, or spine-headed katydids, is a tribe of cone-headed katydids (Orthoptera: Tettigoniodea: Conocephalinae). It is a very speciose group, with more than 100 genera distributed worldwide (Cigliano *et al.*, 2018). Despite considerable work on the taxonomy of Agraeciini, many species are still unknown and waiting for discovery. This holds true for the species from Southeast Asia, partly because of fragmentary sampling (Ingrisch, 1998; Tan *et al.*, 2017), and owing to these katydids being strictly nocturnal or canopy-dwelling and are often difficult to find (Ingrisch, 1998; Ingrisch & Tan, 2012; Tan & Ingrisch, 2014).

The first major monographic works on the Agraeciini in Southeast Asia was done by Willemse (1959) and Ingrisch (1998), in which the former focused on the genus *Salomona* Blanchard, 1853, and the latter revised the taxonomy of 40 genera and 160 species. As many as 70 species new to science were also described (Ingrisch, 1998). Subsequently, different authors contributed to the discovery of additional new species from all over Southeast Asia (e.g., Gorochoy, 2008; 2011; 2015; 2016; Naskrecki & Rentz, 2010; Ingrisch & Tan, 2012; Tan & Ingrisch, 2014; Tan *et al.*, 2015). Furthermore, Ingrisch's work on Agraeciini in Southeast Asia continued with three more volumes (Ingrisch, 2008; 2009; 2015).

Currently, there are 16 genera known from the Philippines, and at least 29 species described from the Philippines (Cigliano *et al.*, 2018). Nonetheless, recent collections in the Philippines by the authors revealed more new species. More materials also allowed us to better understand species boundaries of previously little-known

species. In this paper, we describe two new species from Siargao in Mindanao, namely *Anthraxes furvuseques* sp. nov. and *Salomona lumadae* sp. nov. Another new species is also described from Laguna in Luzon, namely *Axyalus mabinii* sp. nov. Based on specimens from museum collections, we find that *Salomona brevicollis* Stål, 1877 comb. resurr. is a valid species distinct from *Salomona maculifrons* Stål, 1877.

Materials and methods

Night surveys involving opportunistic collection were conducted by M.K. Tan, Huiqing Yeo, J.B. Baroga- Barbecho, and S.A. Yap in the coastal forests (Fig. 1) of Siargao (40–100 m.a.s.l.) in Mindanao between 7 and 9 April 2018 and lowland hill dipterocarp of Mount Makiling (150–250 m.a.s.l.) between 10 and 11 April 2018. Specimens collected from the previous survey conducted by T. Robillard, at Laguna in Luzon Island were also examined. The specimens were preserved in absolute analytical-grade ethanol and later pinned and dry-preserved. A single hind leg from each specimen was also preserved in absolute analytic-grade ethanol for future molecular work.



FIGURE 1. Environment of the coastal forest in Siargao Island where the Agraeciini were collected.

Male genitalia were dissected from softened specimens, and genitalia were removed by squeezing the cerci against one another laterally. For dry-pinned specimens, the specimen was first softened using a mixture of absolute ethanol and diluted KOH solution. The male genitalia were then cleaned using aqueous KOH and subsequently preserved in glycerine.

Habitus images were made with a Canon EOS 500D digital SLR camera with a compact-macro lens EF 100mm f/2.8 Macro USM. Close-up images of morphological features (including male genitalia) were done using a Canon EOS 50D digital SLR camera with a macro photo lens MP-E 65mm f/2.8 USM (1-5×). Canon Macro Twin Lite MT-24EX and Canon Macro Ring Lite MR-14EX were used for lighting and flash. Image editing was accomplished using Adobe Photoshop CC 2014. Scales were given with the images.

Measurements of dry-pinned specimens were made using a 0.05 mm vernier caliper. Detailed measurements of the stridulatory apparatus were done by taking close-up images using a macro photo lens MP-E 65mm f/2.8 USM (1-5×) and measuring in Adobe Photoshop. The following terms are used in the measurements: BL = body length;

BWL = body with wing length; PL = pronotum length; PW = pronotum width; TL = tegmen length; HFL = hind femur length; HTL = hind tibia length; OL = ovipositor length. For BL, it refers to the length from the apex of the fastigium to the apex of the epiproct (female) or subgenital plate (male) (Naskrecki & Rentz, 2010). For BWL, it refers to the length from the apex of the fastigium to the apex of the tegmina (for macropterous species only).

Depositories

UPLBMNH	Museum of Natural History, University of the Philippines Los Baños, Philippines
ZRC	Zoological Reference Collection, Lee Kong Chian Natural History Museum (former Raffles Museum of Biodiversity Research), National University of Singapore
MNHN	Muséum national d'Histoire naturelle, Paris, France.

Systematics part Orthoptera:

Tettigonioidea Subfamily

Conocephalinae Tribe Agraeciini

Genus *Anthracites* Redtenbacher, 1891

Type species: *Anthracites nitidus* Redtenbacher, 1891

Brief diagnosis. Pronotum lateral lobes strongly descending posteriorly; pronotum ventral margin concave. Mesosternal lobes with medium long apical cone. Hind knee lobes bispinose. Male cercus blunt, with two internal processes near apex. Male titillators separate with lateral extensions in prolongation of tip of titillators or separate with widened base from apical area of titillators. Female subgenital plate often partly or fully divided along midline and lateral surfaces elevated and modified. Ovipositor falcate (Ingrisch, 2015).

Remarks. The genus is currently known from the Philippines and Sulawesi. Ten species were described from the Philippines (Ingrisch, 2015): *Anthracites bilineatus* Ingrisch, 2015; *Anthracites flagellatus* Ingrisch, 2015; *Anthracites geniculatus* Dohrn, 1905; *Anthracites major* Hebard, 1922; *Anthracites nitidus* Redtenbacher, 1891; *Anthracites pyramidalis* Ingrisch, 2015; *Anthracites romblon* Ingrisch, 2015; *Anthracites sinuatus* Ingrisch, 2015; *Anthracites unispinus* Ingrisch, 2015; *Anthracites zebra* Hebard, 1922. The taxonomy of the genus has been revised by Ingrisch (2015).

Anthracites furvuseques Tan, Baroga-Barbecho & Yap new species (Figs. 2–5)

Material examined. Holotype (male, Siargao18_38): Philippines, Mindanao, Surigao del Norte, Siargao Island, Del Carmen, Brgy. Katipunan, N9.86431 E126.03367, 41.4±6.6 m.a.s.l., 9 April 2018, 0035, coll. M.K. Tan, H. Yeo, J.B. Baroga-Barbecho, S.A. Yap (UPLBMNH).

Paratypes: Philippines, same locality, coll. M.K. Tan, H. Yeo, J.B. Baroga-Barbecho, S.A. Yap: 1 male (Siargao18_08), N9.87602 E126.00954, 30.5±5.0 m.a.s.l., 7 April 2018, 1951 hours; 1 female (Siargao18_09), N9.87604 E126.00954, 31.3±4.9 m.a.s.l., 7 April 2018, 2000 hours; 1 female (Siargao18_11), N9.87604 E126.00919, 28.9±4.9 m.a.s.l., 7 April 2018, 2006 hours (all ZRC).

Diagnosis. The new species differs from all known congeners by the male cercus dorso-ventrally compressed but slanting with distal part conical and with two inner processes pointing inwards in distal half, both processes of male cercus stout and triangular with apex slightly curved and sclerotised, and by the shape of the titillators that are stiffened along rim and provided with two pairs of lateral sclerites that are connected by a simple, narrow bridge. *A. furvuseques* sp. n. strongly resembles *Anthracites major* Hebard, 1922 from Surigao, *Anthracites flagellatus* Ingrisch, 2015 from Misamis Orientalis, and *Anthracites nitidus* Redtenbacher, 1891 from Mindanao by its black

body. However, it differs from *A. major* by: anterior and middle legs black around knees (unicolourous in *A. major*); posterior femora with black dorsal stripes (absent in *A. major*); two inner processes of male cercus similar in size and robustness (instead of the ventral one being decidedly heavier); sternites and subgenital plate brown (instead of black). From *A. flagellatus* it differs by: male tegmen more tint of black and mirror more angular (instead of rounded in *A. flagellatus*), shape of male cercus and titillators, and subgenital plate with median carina but without dorsad-pointing lateral spine-like processes. From *A. nitidus* it differs by two inner processes of male cercus similar in size and robustness (instead of the dorsal one being decidedly heavier), and titillators stiffened along rim.



FIGURE 2. *Anthracites furvuseques* sp. nov. live male habitus in dorsal view. The male was lying on *Pandanus* foliage.

Description. Habitus of male as shown in Fig. 2. Fastigium verticis compressed laterally (Fig. 3A), in dorsal view conical with a fine longitudinal groove, lateral ocelli before middle, apex truncated, shorter than scapus (Fig. 3B). Frons shining with few shallowly impressed dots (Fig. 3A). Pronotum smooth to slightly wrinkled, disc broadly rounded into paranota, apical area rounded and faintly shouldered; anterior transverse sulcus short, posterior transverse sulcus longer and angularly rounded; anterior margin truncated but faintly concave in middle; posterior margin subtruncate (Fig. 3B). Paranota with ventral margin concave, posterior margin swollen (Fig. 3C). Acoustic spiracle large and elongated oval, completely covered by paranota (Fig. 3C). Tegmen micropterous, mirror area almost fully covered by pronotal disc (Fig. 3B), reaching only middle of 2nd abdominal tergite, with rounded apex; hind wing present, but covered by tegmen (Fig. 3C). Prosternum with two long acute spines pointing nearly ventrad. Mesosternal and metasternal lobes conical with acute apices. Tympanum on anterior tibia slightly swollen with a narrow slit. Anterior coxa with a long and curved spine (Fig. 3C). Femora with the following number of spines on ventral margins: anterior femur 3 external, 6 internal; middle femur 5 external, 3 internal; posterior femur 7 external, 2 internal. Knee lobes of anterior and middle femora obtuse externally and spinose internally; knee of posterior femur bispinose on both sides, longer than those of anterior and middle femora.

Male. Mirror on left tegmen small, angularly rounded, circa 1.3 times wider than long (Fig. 3D). Stridulatory file on underside of left tegmen straight; about 1.5 mm long; with about 80 teeth fairly regularly spaced throughout (Fig. 3E). Tenth abdominal tergite at posterior margin truncated, emarginated in middle; posterior end in middle depressed; depression and posterior margin with setae (Fig. 3F). Epiproct tongue-shaped. Cercus short and stout,

pointing slightly inwards, dorso-laterally compressed; distal part conical with obtuse apex; with two inner processes pointing inwards in distal half; both processes stout and triangular, apex slightly curved and sclerotised; dorsal process slightly longer than ventral (Figs. 3F–H). Subgenital plate longer than wide, with anterior margin concave, gently converging lateral margins, apical margin deeply excised, excision truncated, with a medial carina running from bottom of excision to centre of plate (Fig. 3I). Styli stout and long with apex rounded (Fig. 3I). Titillators (Figs. 3J–M) separate, bases narrow band-shaped and curved (Fig. 3K); stiffened along rim and provided with two pairs of lateral sclerites (Fig. 3J).

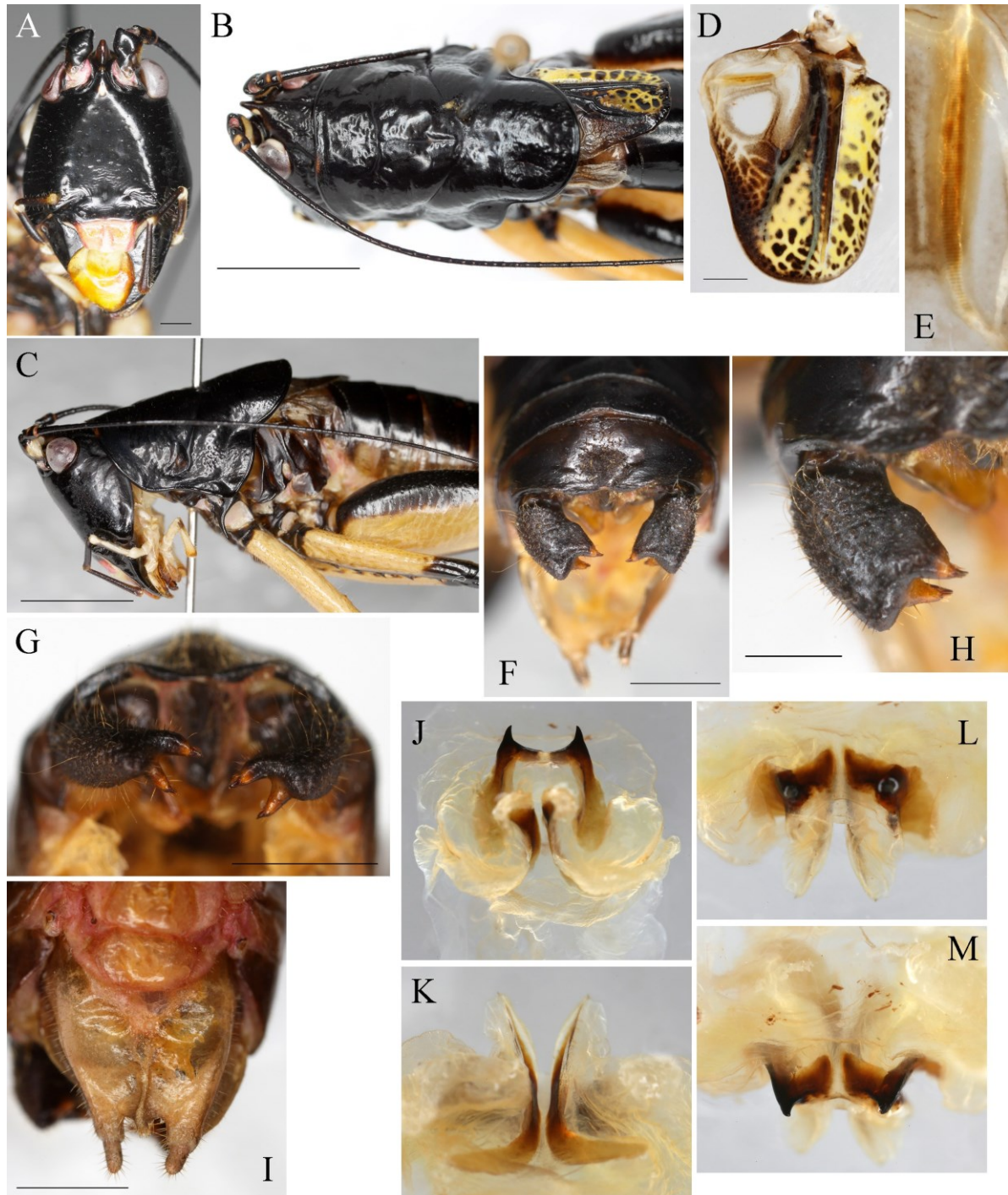


FIGURE 3. *Anthracites fuvuseques* sp. nov. male: face in anterior view (A); head and pronotum in dorsal (B) and lateral (C) views; left tegmen in ventral view (D); stridulatory file on left tegmen in ventral view (E); abdominal apex in dorsal (F) and posterior (G) views; cercus in dorsal view (H); subgenital plate in ventral view (I); titillators (J–M). Scale bars: 5 mm (B, C), 2 mm (F, G, I), 1 mm (A, D, H).

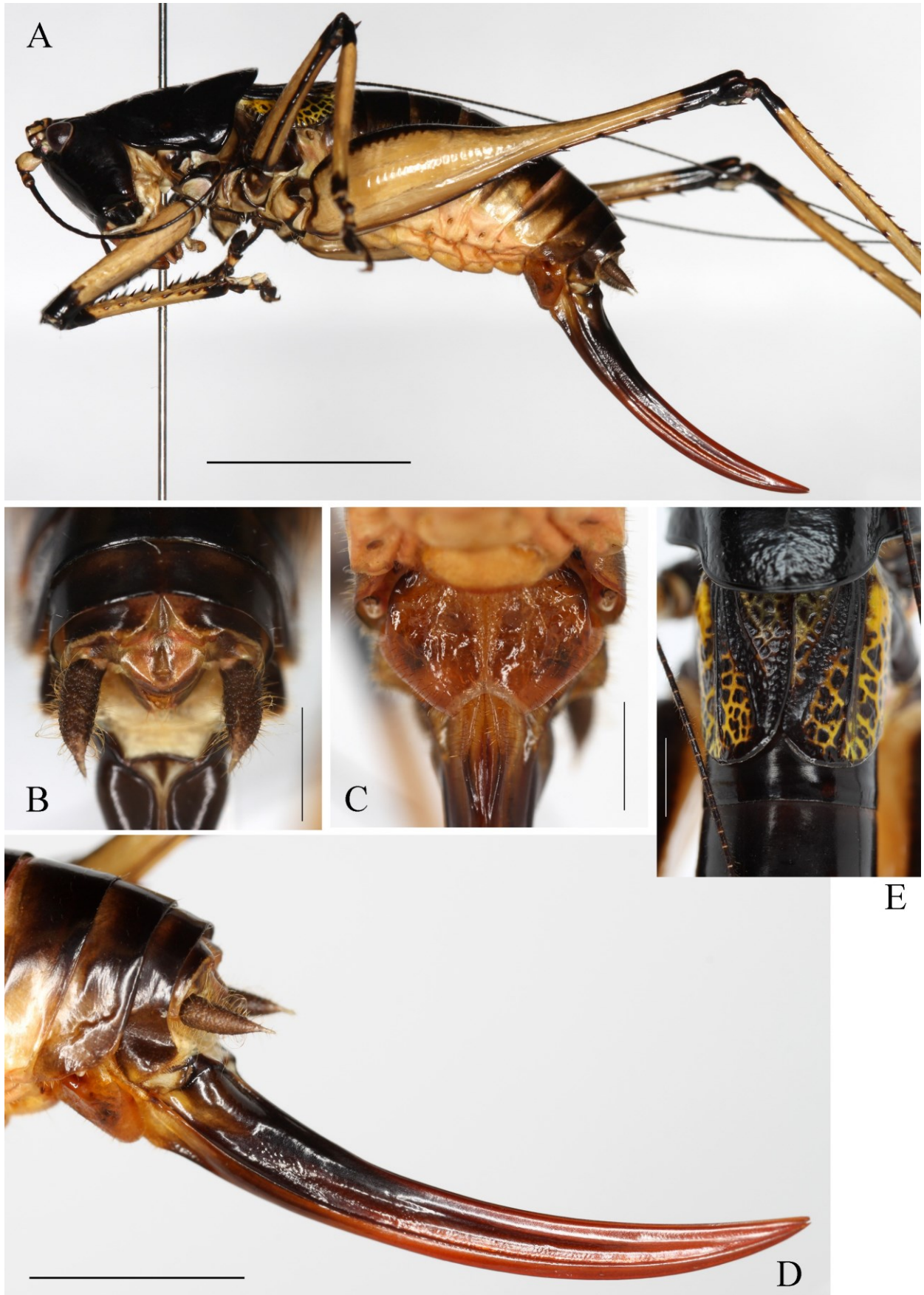


FIGURE 4. *Anthracites furvuseques* sp. nov. female: habitus in lateral view (A); abdominal apex in dorso-posterior (B), ventral (C), and lateral (D) views; tegmina in dorsal view (E). Scale bars: 10 mm (A), 5 mm (D), 2 mm (B, C, E).

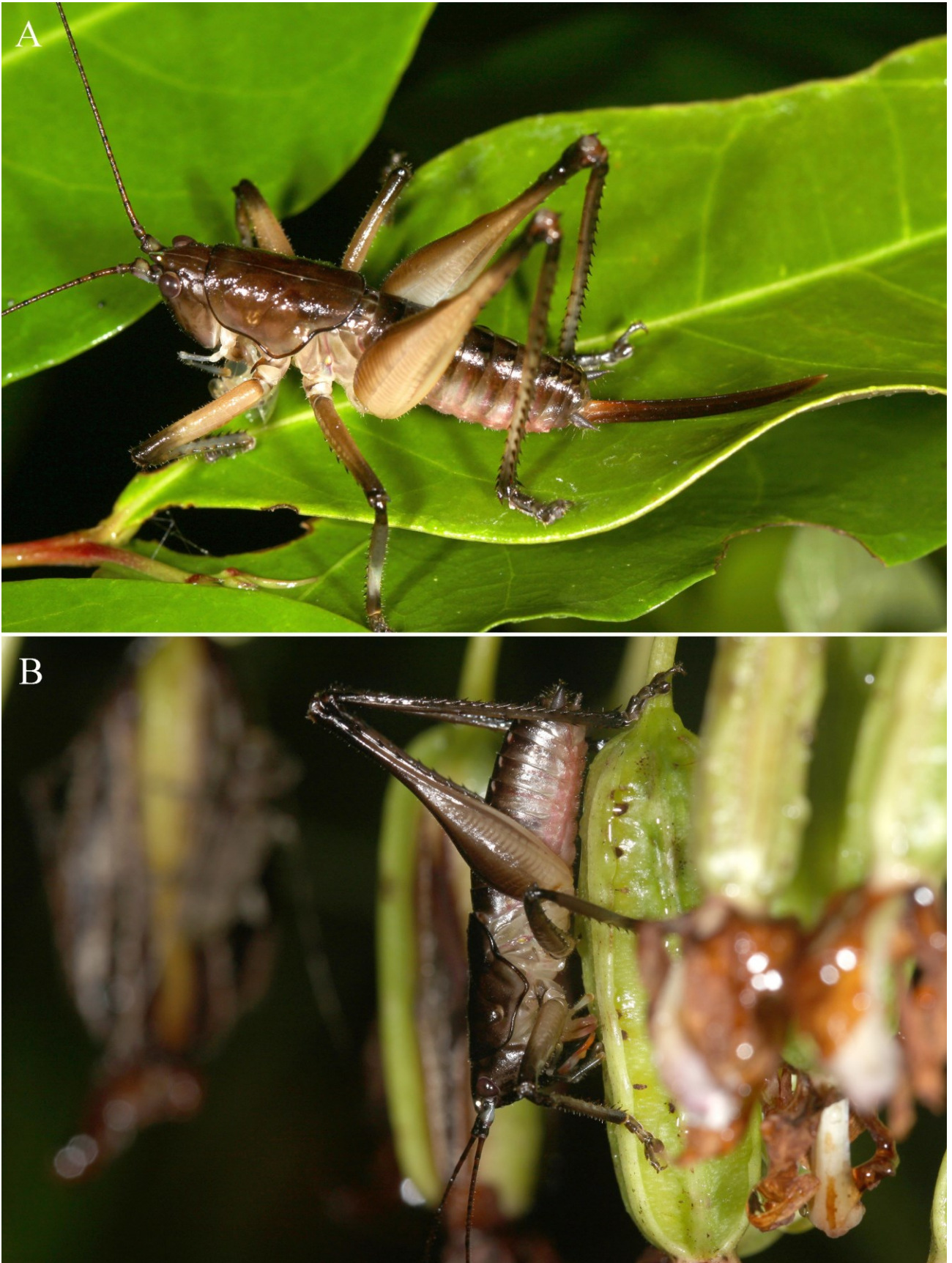


FIGURE 5. *Anthracites furvuseques* sp. nov. juveniles feeding on (A) small snail and (B) seed pod of *Spathoglottis* ground orchid.

Female (Fig. 4A). Tenth abdominal tergite short and transverse, deeply and widely emarginated in middle; forming two broadly rounded lobes (Fig. 4B). Epiproct broadly triangular with basal depression and broadly rounded apex (Fig. 4B). Cerci with apex pointing (Fig. 4B). Subgenital plate large, wider than long, roundly emarginated in middle, with two lateral angular lobes (Fig. 4C). Ovipositor long sabre-shaped; margins smooth (Fig. 4D).

Colouration. Body black with pale legs. Face black, median ocellus yellow; scapus black ventrally and on inner side, pale dorsally and on outer side; antennae black; maxillary palpi with basal three segments pale, apical and subapical segments black; mandible black, clypeus pink-orange, labrum yellow-orange (Figs. 3A–C). Pronotum completely black (Figs. 3B, 3C). Tegmen with lateral field bright yellow with irregular black spots, spots smaller closer to costal (anterior) margin; dorsal field mostly black, posterior of mirror also bright yellow with irregular black spots (Figs. 3D, 4E). Spines on anterior coxa black (Fig. 3C). Anterior and middle femora black at base and at knee, otherwise pale; anterior and middle tibiae pale with base and apex black; fore and middle tarsi black. Posterior femur pale laterally, with a black longitudinal dorsal stripe that extends from the base to nearly the knee; knees, including lobes black. Posterior tibia black near knee, otherwise pale with black dorsal spines. Posterior tarsus black. Abdominal tergite black, with anterior margin pink when alive, with two faint orange spots in middle of posterior margin. Male tenth abdominal tergite and epiproct also black; brown setae on tenth abdominal tergite (Fig. 3F). Cercus black with brown setae, apices of internal processes brown (Fig. 3H). Sternites and subgenital plate brown. Ovipositor with dorsal valve mostly black, red brown apically, ventral valve mostly red brown with tint of black at base.

Measurements ([^] indicates measurement for male holotype). BL: male 26.0–29.3[^], female 30.7; PL: male 9.4[^]–9.8, female 9.2–9.4; PW: male 6.2[^]–6.5, female 6.9–7.0; TL: male 5.4–6.0[^], female 5.4–5.8; HFL: male 21.8–22.1[^], female 22.3–23.2; HTL: male 22.0[^]–22.3, female 21.7–23.2; OL: female 16.3–16.5 mm.

Etymology. The species name refers to the Dark Knight (in Latin; dark = *fervus*, knight = *eques*). This species is named after the fictional superhero character Batman in the Dark Knight Trilogy directed by Christopher Nolan. The species' black colouration resembles the dark suit of the vigilante while the titillators also shows certain resemblance to the iconic Batman mask (Fig. 3J) and logo (Fig. 3M) in the film.

Natural history. The new species is a common *Agraeciini* species found in the coastal vegetation on the island (Fig. 1) at night. The species was observed to feed on small snails (Fig. 5A) and possibly seed pods of ground orchids (*Spathoglottis* sp.) (Fig. 5B).

Genus *Axylus* Stål, 1877

Type species: *Axylus castaneus* Stål, 1877

Brief diagnosis. Mesosternal lobes with medium long to long apical cone. Hind knee lobes bispinose. Male cercus conical or laterally compressed with a proximal and a distal internal process. Male titillators separate with lateral extensions branching from apical area; with a pair of lateral sclerites. Ovipositor elongate and little curved or falcate and highest just behind mid length (Ingrisch, 2015).

Remarks. The genus is currently known from east of the Wallace Line (sensu Huxley) which includes the Philippines. Seven species were described from the Philippines (Ingrisch, 2015): *Axylus brachypterus* Ingrisch, 2015; *Axylus castaneus* Stål, 1877; *Axylus furcatus* Ingrisch, 2015; *Axylus montanus* Ingrisch, 2015; *Axylus negros* Ingrisch, 2015; *Axylus philippinus* (Hebard, 1922); *Axylus taylori* (Hebard, 1922). The taxonomy of the genus has been revised by Ingrisch (2015).

Axylus mabinii Tan & Robillard new species (Figs. 6, 7)

Material examined. Holotype (male, TR347): Philippines, Luzon, Laguna, UPLB University Land Grant, secondary forest at night, N14°23'56.9" E121°32'47.2", 376 m.a.s.l., 4 July 2011, coll. T. Robillard (UPLBMNH). Allotype: 1 female (TR348), same locality as holotype, mating with holotype on palm tree, coll. T. Robillard (MNHN-EO-ENSIF4390).

Paratypes: 1 female (TR398) and 1 male (TR399), Philippines, Luzon, Laguna, UPLB University Land Grant, herbaceous area near station, N14° 24' 02.5" E121° 32' 30.3", 327 m.a.s.l., mating, 5 July 2011, coll. T. Robillard (MNHN-EO-ENSIF4391-43920).

Diagnosis. The new species differs from all known congeners by black patterns on the pronotum: two black spots on the anterior angle of disc and two larger black lateral bands on the posterior area of disc, and by the male cercus that is very stout and conical, laterally compressed with obtuse apex and provided with a broad baso-internal process and a slender ventral process. The new species is most similar to *Axylus taylori* (Hebard, 1922) from Luzon and *Axylus nigrifrons* (Brunner v. Wattenwyl, 1898) from Lombok in the shape of the female ovipositor and in the colour patterns on frons and pronotum, but differs by shape and processes of the male cercus and the titillators. Also the colour pattern on pronotal disc differs from that of *A. taylori* by the anterior and posterior pairs of spots being not continuous and from that of the *A. nigrifrons* by additional posterior pairs of black spots. The shape of the female ovipositor is also similar to that of *Axylus inferior* (Brunner v. Wattenwyl, 1898) from Sulawesi but *A. mabinii* sp. n. differs distinctly by the male cercus and by colour pattern.



FIGURE 6. *Axylus mabinii* sp. nov. male (A) and female (B) habitus in lateral view. Scale bars: 10 mm.

Description. Habitus of male as shown in Fig. 6A. Fastigium verticis compressed laterally (Fig. 7A), in dorsal view conical, shorter than scapus, apex obtuse, with ocelli at base (Fig. 7B); ventral area compressed and ventral margin separated by a weak sinuosity from fastigium frontis (Fig. 7A). Vertex with a pair of irregular sulci (Fig. 7B). Frons shining with few shallowly impressed dots and wrinkles especially towards clypeus. Pronotum subsmooth, disc rounded into paranota, apical area subflat and shouldered; two transverse sulci not interrupted in middle; anterior margin faintly emarginated in middle; posterior margin rounded (Fig. 7B). Paranota strongly descending posteriorly (typical of genus), with anterior angle rounded; ventral margin concave and considerable descending posteriorly; posterior angle angularly rounded; auditory swelling long-ovoid; humeral sinus weak (Fig. 7C). Macropterous, tegmen surpassing abdominal apex and slightly longer than hind wing, apex rounded. Prosternum with two long acute spines. Mesosternal lobes long-conical, apex subacute; metasternal lobes short conical, apex obtuse; medial plate with an obtuse tubercle. Anterior coxa with a long and curved spine (Fig. 7C). Internal and external tympana on anterior tibia conchate with narrow openings. Femora with the following number of spines on ventral margins: anterior femur 7 external, 7 internal; middle femur 6 external, 3 small internal at the base; posterior femur 10–13 external, 7 internal (2 distal spinose and 5 basal minute nodular). Knee lobes of anterior and middle femora obtuse externally and short spinose internally; of posterior femur bispinose on both

sides. Tibiae with the following number of spines on ventral margins: anterior tibia 7 external, 7–8 internal; middle tibia 9 external, 8 internal.

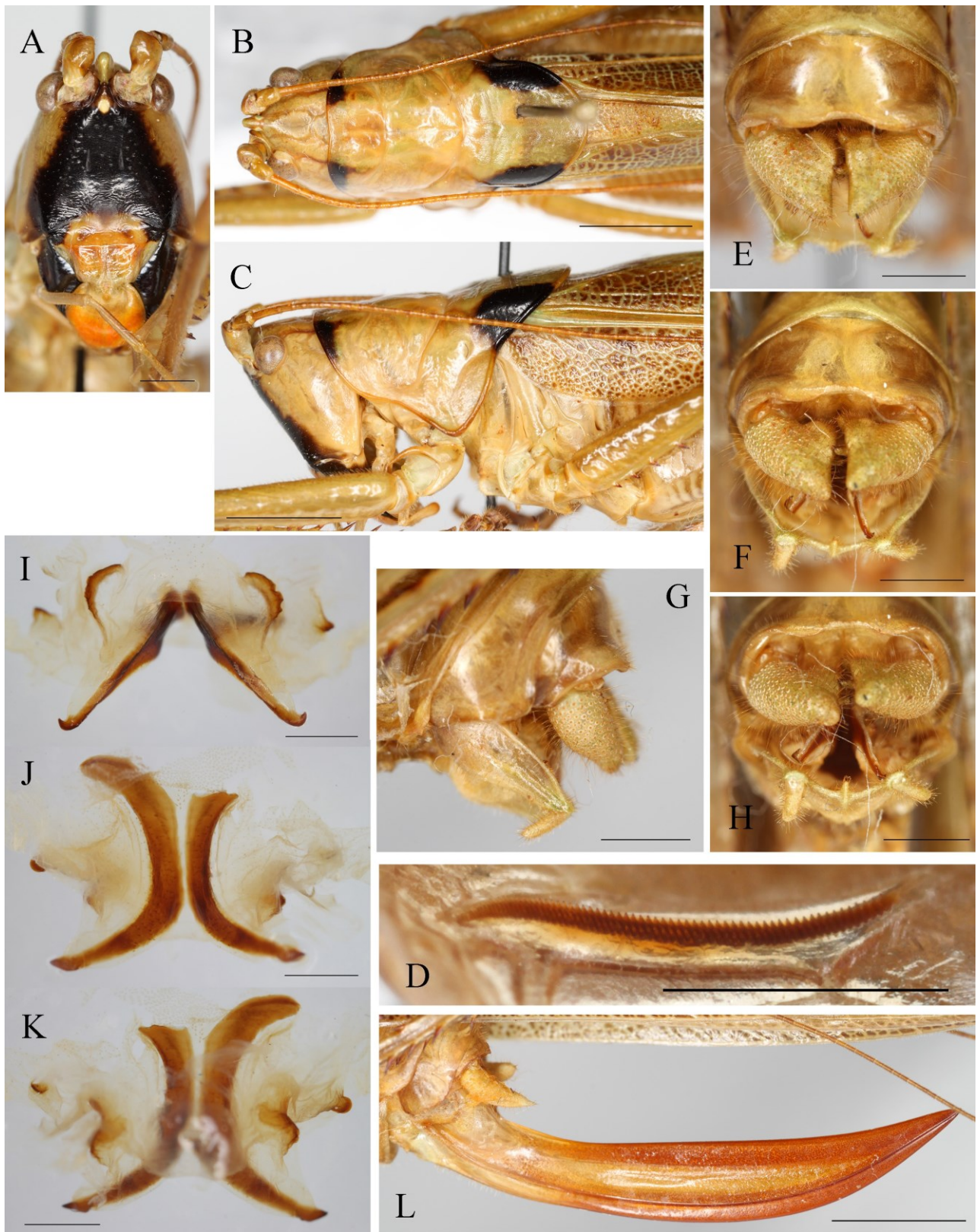


FIGURE 7. *Axylus mabinii* sp. nov.: face in anterior view (A); head and pronotum in dorsal (B) and lateral (C) views; stridulatory file of left tegmen in ventral view (D); male abdominal apex in dorsal (E), dorso-posterior (F), lateral (G), and posterior (H) views; titillators in posterior (I), ventral (J) and dorsal (K) views. Scale bars: 5 mm (B, C, L); 2 mm (A, E–H); 1 mm (D, I–K).

Male. Stridulatory file on underside of left tegmen slightly sinuous; about 1.55 mm long; with teeth increasingly wider and more widely spaced towards middle compared to basal end; with about 64 teeth (Fig. 7D). Tenth abdominal tergite at posterior margin truncated, faintly and broadly emarginated in middle, forming faint lateral lobes (Figs. 7E, 7F). Epiproct broadly tongue-shaped, concealed by tenth abdominal tergite (Fig. 7F). Cerci very stout and conical (Fig. 7G), laterally compressed; apex obtuse; with a broad baso-internal process pointing anteriorly and internally; ventral of this process with a slender process pointing internally; both processes with apex sclerotised and acute (Figs. 7E, 7F, 7H). Subgenital plate barely surpassing cerci, with rounded lateral carinae and a narrow but distinct median carina; apex widely excised; styli short with apex obtuse. Titillators large, elongate, separate; basally with rounded apex; converging in middle and nearly parallel to one another before diverging apically; slender posteriorly and produced into an acute apex, curved dorsad just before apex (Fig. 7I–K). Dorsal sclerites slender and curved, with posterior margin undulated (Fig. 7I). Lateral sclerites semi-membranous, with a rounded nodular sclerite (Fig. 7K).

Female (Fig. 6B). Tenth abdominal tergite excised in midline, apical margin on each side truncate. Epiproct broadly rounded. Cerci with apex pointing. Subgenital plate small, broad, triangular, with apex rounded. Ovipositor compressed, elongofalcate but basal area substraight; dorsal margin substraight in middle, only slightly curved apically; ventral margin curved after basal area; widest slightly after middle, margins smooth (Fig. 7L).

Colouration. Yellow brown. Face black, fastigium verticis yellow brown, median ocellus yellow, genae yellow brown; scapus and antennae yellow brown; maxillary palpi yellow brown, clypeus and labrum orange, mandible black (Fig. 7A). Pronotum yellow brown, with two black spots at anterior angles of disc and two larger black lateral bands in posterior area of disc; all black spots slightly continue onto paranota (Figs. 7B, 7C). Tegmen yellow brown (Fig. 6). Legs mostly yellow brown (Fig. 6). Abdominal tergites and sternites yellow brown. Ovipositor ventro-basally yellow, otherwise red brown (Fig. 7L).

Measurements (1 male holotype, 1 female paratype). BL: male 34.5, female 34.6; BWL: male 54.9, female 56.3; PL: male 11.7, female 11.0; PW: male 7.5, female 8.8; TL: male 42.8, female 44.8; HFL: male 28.0, female 28.8; HTL: male 27.1, female 28.2; OL: female 21.1 mm.

Etymology. This species is named after Apolinario Mabini y Maranan (1864–1903), a Filipino revolutionary leader and hero who confronted both the Spanish and American colonial rules.

Axylus c.f. *philippinus* (Hebard, 1922)
(Figs. 8, 9)

Material examined. 1 male (TR349) and 1 female (TR350): Philippines, Luzon, Laguna, UPLB University Land Grant, 4.vii.2011, secondary forest at night, N14°23'56.9" E121°32'47.2", 376 m.a.s.l., coll. T. Robillard (MNHN). Remarks. Our specimens resemble *Axylus philippinus* in habitus (Figs. 8, 9A, 9B), shape of the male cercus (Figs. 9E, 9F) and the female ovipositor (Fig. 9K) but differ as follows: frons red brown, of same colour as genae (Figs. 9C, 9D), instead of black distinctly different from genae; male subgenital plate angularly and deeply excised (Fig. 9G) instead of roundly and less deeply excised; female subgenital plate not regularly curved from one side to the other (Fig. 9J). Since the titillators of congeners of *Axylus* can differ drastically in shape, the similarities of the titillators between that of our specimens (Figs. 9H, 9I) and those examined in Ingrisch (2015) suggest that despite the differences in other morphology, our specimens from Laguna, UPLB University Land Grant are probably a variant or subspecies of *Axylus philippinus*. To test the species boundaries, we reckon that incorporation of molecular data could be useful.

Genus *Salomona* Blanchard, 1853

Type species: *Salomona marmorata* (Blanchard, 1853)

Brief diagnosis. Large, robust; large, flat, and broad frons, often rugose or punctate; short fastigium of vertex; male subgenital plate with long styli; falcate or subfalcate ovipositor (Naskrecki & Rentz, 2010).

Remarks. The genus is relatively widespread and can be found in Southeast Asia, Australia, and western

Pacific islands. Four species were described from the Philippines: *Salomona conspersa* Stål, 1877; *Salomona maculifrons* Stål, 1877; *Salomona tetra* Walker, 1869; *Salomona vittifrons* Walker, 1869. The taxonomy of the genus has been revised by Willemse (1959).



FIGURE 8. *Axylus philippinus* male (A) and female (B) habitus in lateral view. Scale bars: 10 mm.

Salomona lumadae Tan, Baroga-Barbecho & Yap new species
(Figs. 10, 11)

Material examined. Holotype (male, Siargao18_35): Philippines, Mindanao, Surigao del Norte, Siargao Island, Del Carmen, Brgy. Katipunan, N9.86082 E126.03313, 59.6±5.5 m.a.s.l., 9 April 2018, 0001 hours, coll. M.K. Tan, H. Yeo, J.B. Baroga-Barbecho, S.A. Yap (UPLBMNH).

Diagnosis. This new species differs from all known congeners by colour patterns of the tegmen and by the shape of the male cercus that is provided with a stout, bulbous, baso-internal process that bears a smaller anterior bulbous process. The presence of a baso-internal process on the male cerci similar to that of the new species occurs in only a few other species from Papua New Guinea: *Salomona godeffroyi* (Pictet, 1888) from which the new species differs by the frons that is rugose instead of subsmooth and the male cerci are not curved internally near apex; from *Salomona karnya* Willemse, 1959 it differs by the baso-internal process of the cercus being not elongated; from *Salomona limbata* Karny, 1907 it differs by the tenth abdominal tergite that does not have a long apical process in the middle; from *Salomona megacephala* (Haan, 1843), which is also similar by the presence of small lateral depressions on the tenth abdominal tergite, it differs by the absence of a distal internal process at the cerci; from *Salomona solida* (Walker, 1869) it differs by the frons that is not red and by the baso-internal process of the cerci that are more rounded instead of cubical and have only one anterior bulbous process instead of two; and from *Salomona ustulata* Redtenbacher, 1891 it differs by the rugose and yellow instead of smooth and red frons and the cerci are stouter and conical instead of elongate.

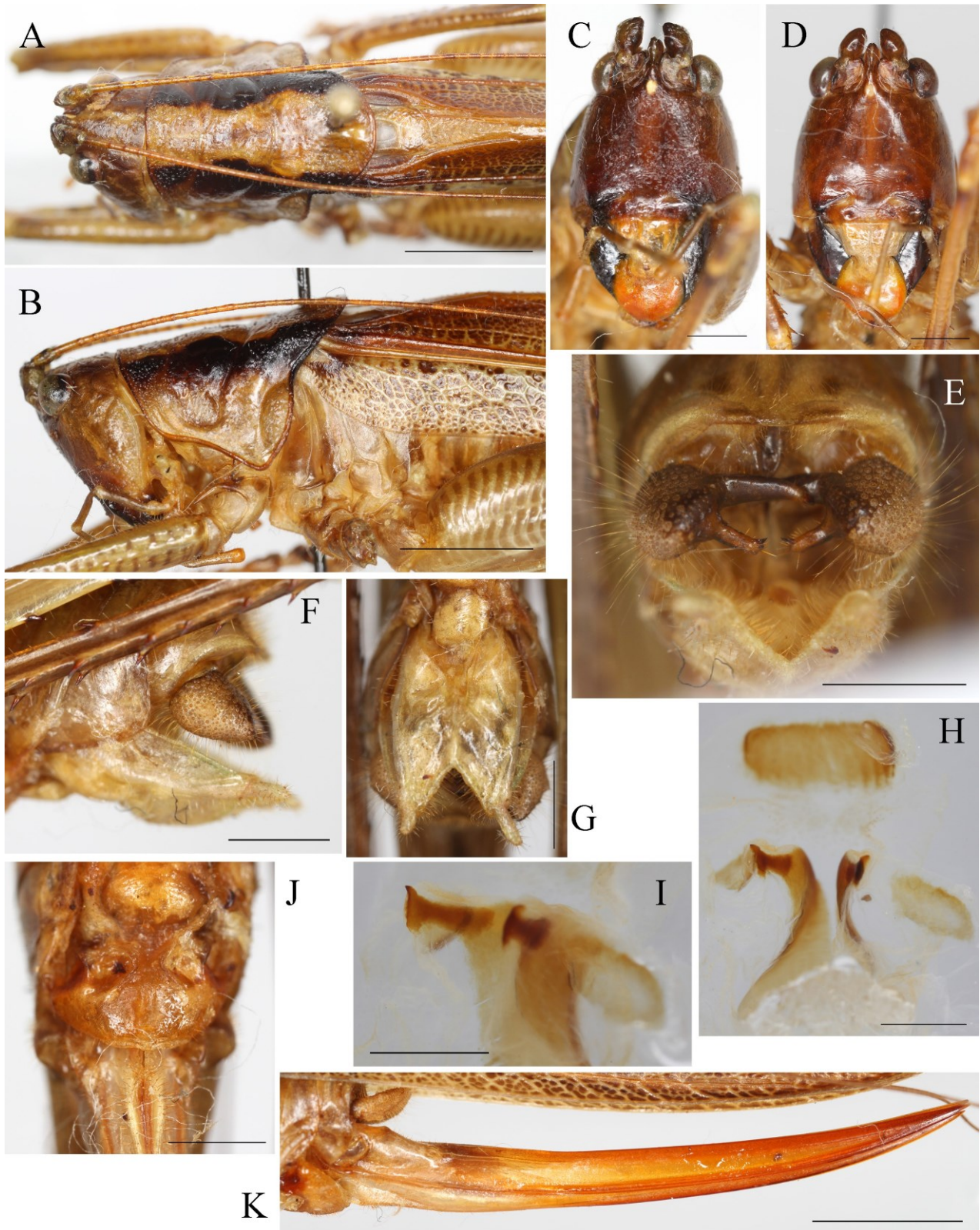


FIGURE 9. *Axylus philippinus*: head and pronotum in dorsal (A) and lateral (B) views; male (C) and female (D) face in anterior view; male abdominal apex in posterior (E) and lateral (F) views; male subgenital plate in ventral view (G); male titillators (H, I); female subgenital plate in ventral view (J); and ovipositor in lateral view (K). Scale bars: 5 mm (A, B, K), 2 mm (C–G, J), 1 mm (H, I).



FIGURE 10. *Salomona lumadae* sp. nov. live male habitus on a branch.

Description. Male habitus as shown in Fig. 10. Fastigium verticis in dorsal view elongated conical, apex truncate, about as long as scapus, with ocellus in middle (Fig. 11A). Vertex subrugose (Fig. 11A). Frons with large impressed dots, genae rugose (Fig. 11B). Pronotum rugose with impressed dots, disc broadly rounded into paranota, apical area subflat and shouldered (Fig. 11C); anterior margin straight but faintly concave in middle; posterior margin broadly rounded (Fig. 11A). Acoustic spiracle elongated, taller than long, completely covered by paranota. Tegmen macropterous, barely reaching abdominal apex and just as long as hind wing, apex rounded. Prosternum with two stout spines with subobtus apices. Mesosternal and metasternal lobes conical with blunt apices. Femora with the following number of robust spines on ventral margins: anterior femur 8 external, 9 internal of increasing size distally; middle femur 7 external of increasing size distally, 3 internal at base; posterior femur 12 external of increasing size distally, 0 internal. Knee lobes of anterior and middle femora obtuse externally and long spinose internally; of posterior femur spinose on both sides. Tibiae with the following number of spines on ventral margins: anterior tibia 6 external, 6 internal; middle tibia 10 external, 8 internal.

Male. Stridulatory file on underside of left tegmen straight; about 1.89 mm long; with teeth increasingly wider and more widely spaced towards middle (compared to basal end); with circa 70 teeth (Fig. 11D). Tenth abdominal tergite depressed in middle, with one oval depression near middle on each side of depression; posterior margin prolonged into two lateral lobes with deep rounded excision in middle; posterior lobes triangular with obtuse apex (Fig. 11E). Epiproct broadly tongue-shaped, depressed in middle (Fig. 11F). Cerci conical, slightly compressed towards lateral area, internal margin straight with surface depressed, external margin curved, apex subacute; with a stout baso-internal process which is bulbous and bearing a smaller anterior bulbous process (Figs. 11E–H). Subgenital plate wider than long, apical margin deeply, narrowly and roundly excised; styli conical and very short (Fig. 11I).

Female. Unknown.

Colouration. Pale brown when alive (Fig. 10), yellow brown when preserved in ethanol. Face pale brown, fastigium verticis with a black spot ventrally, antennal socket ventrally with two black spots; scapus pale brown, pedicel pale brown with a ventral black spot, antennae yellow brown; maxillary palpus, clypeus and labrum orange,



FIGURE 11. *Salomona lumadae* sp. nov. male: head and pronotum in dorsal (A) and lateral (C) views; face in anterior view (B); stridulatory file of left tegmen in ventral view (D); abdominal apex in dorsal (E), dorso-posterior (F, G), and ventral (H, I) views; tegmen in lateral view (J). Scale bars: 5 mm (A, C, J), 2 mm (B, E-I), 1 mm (D).

mandible black (Fig. 11B). Pronotum pale brown (Fig. 11C). Tegmen generally with cells black, most obvious in costal area (anterior area) (Fig. 11J); veins in costal area turquoise, otherwise red brown (Fig. 10). Femora and tibiae pale brown and brown respectively, with black ventral spines; tibiae with two dorsal black spots at base and before first ventral spine; stout spine of femoral knee lobe also black. Hind femur basally green, medially yellow green, distally green, knee dark red brown. Abdominal tergites pale brown; sternites very pale brown. Abdominal apex pale brown (Figs. 11E–I).

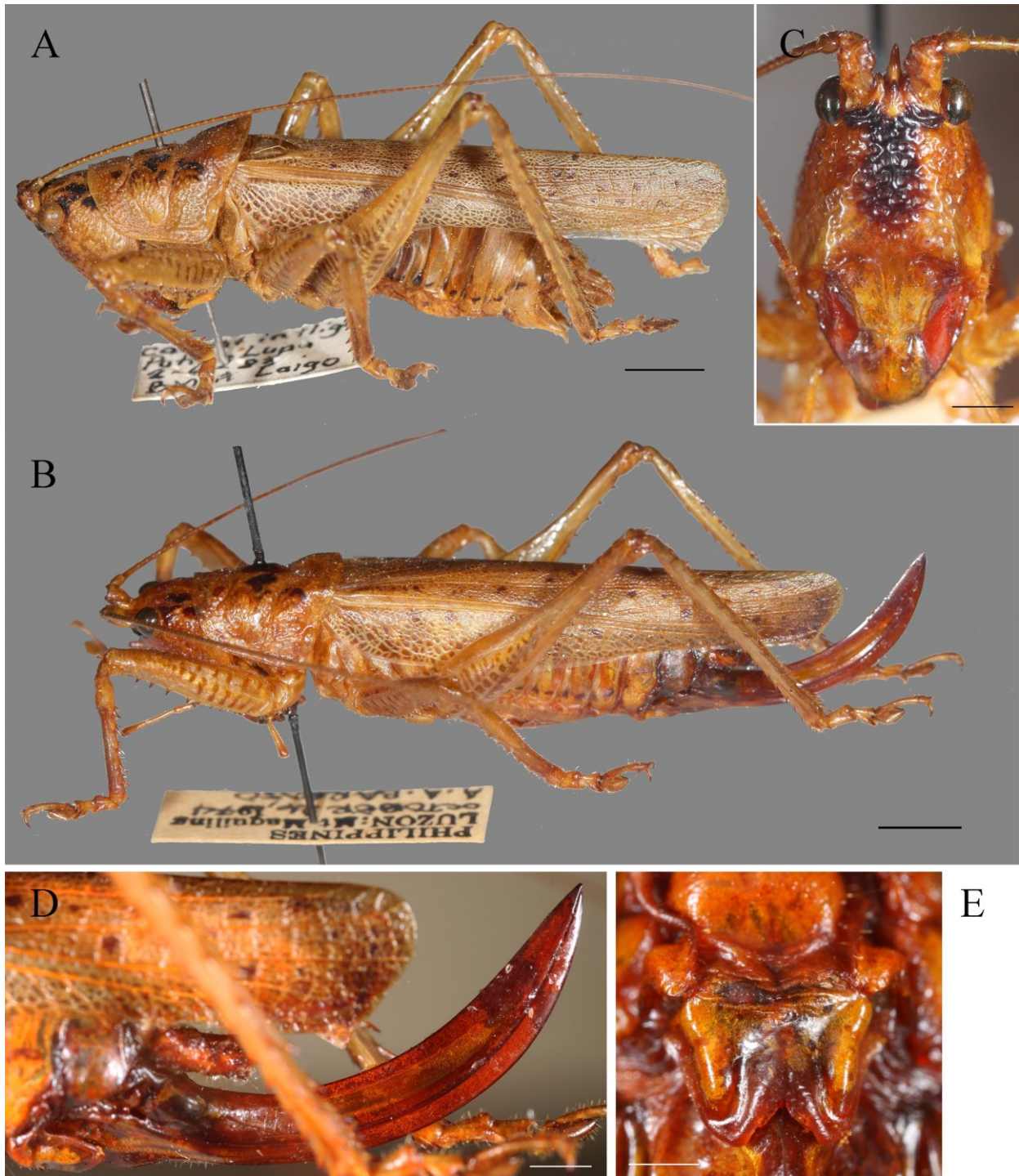


FIGURE 12. *Salomona maculifrons* male (A) and female (B) habitus in lateral view; face of female in anterior view (C); female abdominal apex in lateral (D) view; female subgenital plate in ventral view (E). Scale bars: 5 mm (A, B), 2 mm (C, D), 1 mm (E).

Measurements (holotype). BL 37.6; BWL 41.0; PL 10.3; PW 6.5; TL 28.8; HFL 17.9; HTL 17.5 mm.

Etymology. This species is named after the indigenous people in the southern Philippines, including Siargao Island; lumad means indigenous in Cebuano, an Austronesian language spoken in the Philippines. This species is dedicated to the Lumads.

Natural history. The new species can be found among coastal vegetation.

Salomona brevicollis Stål, 1877 comb. resurr.

Material examined. Images of type specimen (female, NRM-ORTH0001233) in Cigliano et al., 2018 (Orthoptera Species File Online).

Salomona maculifrons Stål, 1877

(Fig. 12)

Material examined. 1 female, Philippines, Luzon, Los Baños, Mount Makiling, October 1974, coll. A.A. Barroso; 1 male, Philippines, Luzon, Los Baños, Puting Lupa, 2 June 1983, coll. B.M.A. Laigao; 1 female, Philippines, Luzon, Los Baños, Soledad, February 1992, coll. R. Rubles (all UPLBMNH).

Remarks. *Salomona brevicollis* was described based on a female but was later synonymised under *Salomona maculifrons* by Willemse (1959). After examining both male (Fig. 12A) and female specimens (Fig. 12B) of *S. maculifrons* from UPLBMNH, we found that the female holotype of *S. brevicollis* differs from that of *S. maculifrons* by the black pattern on the frons that is more elaborated instead of restricted to a single oval spot in the latter [Fig. 12C]), the fastigium verticis is shorter and stouter instead of long, conical and with acute apex [Fig. 12C]), the female ovipositor appears wider (higher) in subapical than in subbasal area (Fig. 12D). The colour pattern of the frons on *S. maculifrons* does not vary drastically between specimens, indicating that the different colour pattern in the female holotype of *S. brevicollis* is a genuine species differences, rather than a conspecific variation.

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