

On the Taxonomy of the Genus *Rosacris* Bolívar, 1931 (Orthoptera: Tetrigidae)

Zur Taxonomie der Gattung *Rosacris* Bolívar, 1931 (Orthoptera: Tetrigidae)

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Summary: The genus *Rosacris* Bolívar, 1931 is a pygmy grasshopper (Orthoptera: Tetrigidae) genus hitherto known only from a holotype male of its type species *Rosacris antennata* Bolívar, 1931 from Makiling Mt. (Luzon island, the Philippines) and originally assigned to the Discotettiginae. Redescription of the genus and its type species are based on the holotype and a new photographic record of the species (Isarog Mt.) found in Flickr (www.flickr.com). The holotype is found to be male nymph rather than an adult animal. The species is morphologically similar to members of the genus *Metamazarredia* Günther, 1939 from the Philippines. Therefore the genus is transferred from the subfamily Discotettiginae to Metrodorinae. Assumption exists that the specimens hitherto identified as *R. antennata* represent nymphs of *Metamazarredia fuscipes* (Stål, 1877).

Key words: Discotettiginae, Metrodorinae, the Philippines, Flickr, nature macro-photography

Zusammenfassung: Die Gattung *Rosacris* Bolívar, 1931, ein Zwerg-Grashüpfer (Orthoptera: Tetrigidae), ist bislang nur durch den Gattungsholotypen *Rosacris antennata* Bolívar, 1931 vom Mount Makiling (Insel Luzon, Philippinen) bekannt. Sie wurde ursprünglich der Unterfamilie Discotettiginae zugeordnet. Die Wiederbeschreibung des Gattungstypus‘ basiert auf dem Holotypus und einem neuen Foto der Art vom Mount Isarog auf dem Fotoportal Flickr (www.flickr.com). Der Holotypus scheint eher eine männliche Nymphe als ein adultes Tier zu sein. Die Art ist morphologisch den Vertretern der Gattung *Metamazarredia* Günther, 1939, ebenfalls von den Philippinen, ähnlich. Deshalb wurde die Gattung aus der Unterfamilie Discotettiginae in die der Metrodorinae überführt. Es besteht die Vermutung, dass die bisherigen Exemplare von *R. antennata* Nymphen von *Metamazarredia fuscipes* (Stål, 1877) sind.

Schlüsselwörter: Discotettiginae, Metrodorinae, die Philippinen, Flickr, Natur-Makrofotografie

1. Introduction

The genus *Rosacris* was established by I. BOLÍVAR (1931) for a single species named *R. antennata* Bolívar, 1931, based on a single male specimen from Mt. Makiling, a dormant volcano in the Laguna province (Luzon Is., the Philippines) with an elevation up to 1,090 m a.s.l. Based on the antennal morphology, i.e. the presence of flattened antennal segments, the species was originally placed in the subfamily Discotettiginae (=

Discotettiginae in BOLÍVAR 1931). The original description, which includes a drawing of the species' habitus and brief comments on its relationship with *Hirrius* Bolívar, 1887 (another member of the Discotettiginae), was never cited again during later revisions of the family Tetrigidae. Even GÜNTHER (1938), who reviewed the Discotettiginae seven years later, overlooked the publication. OTTE (1997), in the first printed version of the Orthoptera Species File, listed this species as of uncertain placement within

Tetrigidae. The type specimen was listed in the catalogue of Bolívar's collection (PARÍS 1994). Two additional records of the genus were recently found (1) on April 15th 2015 on Flickr (photos by P. BERTNER, dorsal and lateral habitus of a nymph, from Isarog Mt.) and (2) on April 14th 2016 on eBay (female specimen for sale, from Luzon, without specified locality).

The aims of this article are (1) to present a new record of *Rosacris antennata* from Mt. Isarog on Luzon Is. (the Philippines), (2) to redescribe the genus and its type species and (3) to discuss the position of the genus within the current Tetrigidae taxonomy and its relationship to other genera.

2. Material and methods

For this study, the curator of the Orthoptera collection in the Museo Nacional de Ciencias Naturales (MNCN, Madrid, Spain) MERCEDES PARÍS sent me the photos of the lectotype (= holotype) of *Rosacris antennata* Bolívar and the original description (Bolívar 1931) of the genus and the species. Morphological terminology and measurements follow TUMBRINCK (2014) and SKEJO & CABALLERO (2016). Measurements of the holotype were obtained using the ImageJ software (ABRAMOFF et al. 2004) after calibration with a scale added by the curator after processing the photographs. A photographic record was found (1) on Flickr (a social network to share photos) [<https://www.flickr.com/photos/rainforests/13064225934/in/photolist-kUrzdJ>] and later more photos were obtained directly from the photographer, P. BERTNER, and (2) on eBay (from user Philinsectbugs).

3. Results

3.1. Family Tetrigidae Rambur, 1838 (superfamily Tetridoidea Rambur, 1838)

Diagnosis: Family of short-horned grasshoppers (Caelifera) easily separated from

other Caeliferan families by (I) the long pronotum, usually covering the abdomen, (II) tarsal formula 2-2-3, (III) lack of an arolium between the claws and (IV) presence of a sternomentum (modified first sternum).

Composition: Nine subfamilies (Batrachideinae, Cladonotinae, Cleostratinae, Discotettiginae, Lophotettiginae, Metrodorinae, Scelimeninae, Tetriginae, Tripetalocerinae) and a few tribes (Clinophaestini, Coptotettigini, Criotettigini, Dinotettigini, Miriatriini, Xerophyllini) with 270-290 genera and 1800-2000 currently described species (EADES et al. 2016).

Distribution: Globally except for the Antarctic continent, the majority of the species (about 75%) occur in the tropical region, with the highest known biodiversity of the family in the Indomalayan and Wallacean regions (EADES et al. 2016).

Since taxonomy follows Orthoptera Species File (EADES et al. 2016) where the genus is denoted as of uncertain placement within Tetrigidae and since in the original description the genus was assigned to the subfamily Discotettiginae, here I present diagnosis and composition of Discotettiginae, as well as that of Metrodorinae, the subfamily I assign the genus to after morphological comparison with *Metamazarredia* spp.

3.2. Subfamily Discotettiginae Hancock, 1907

Diagnosis: The paranota not square shaped, antennae 11-14 segmented, with all or only a few subapical segments widened. The only true diagnostic character of this subfamily is the morphology of antennae (see discussion). The group is polyphyletic. It is probably synonymous with true Scelimeninae based upon the morphology of the genus *Discotettix* Costa, 1864 (SKEJO et al. in press). Composition and distribution. One tribe composed of a single genus (Discotettigini: *Discotettix*) and five more genera (excluding *Rosacris*) without tribal placement. Distri-

buted in SE Asia (ancient Sundaland and surroundings).

- 1) *Arulenus* Stål, 1877: Mindanao (the Philippines, 2 spp.),
- 2) *Discotettix* Costa, 1864 (type genus of the subfamily): peninsular Malaya (1 sp.), Sumatra (2 spp.), Borneo (2 spp.), Mindanao (the Philippines, 1 sp.),
- 3) *Flatocerus* Liang & Zheng, 1984: China (10 spp., probably including a few synonymous names) [the genus is likely synonymous with *Phaesticus* (SKEJO & STOROZHENKO, unpublished data)],
- 4) *Hirrius* Bolívar, 1887: Mindanao (the Philippines, 2 spp.), Sulawesi (3 spp.),
- 5) *Kraengia* Bolívar, 1909: Sulawesi (1 sp.),
- 6) *Phaesticus* Uvarov, 1940: China (3 spp.), India: Assam (1, not identified sp.), Thailand (1 sp.), peninsular Malaya, Sumatra, Java (1 sp. in the whole region), Borneo (1 sp.).

3.3. Subfamily Metrodorinae Bolívar, 1887

Diagnosis (after PAVÓN-GONZALO et al. 2012): Mainly characterized by having the median ocellus and the antenna placed below the eyes, a relatively small divergence of the rami of the frontal costa not forming wide scutellum, and a similar length of the first and third segments of the hind tarsus. Many species of Metrodorinae also exhibit the posterior angles of the lateral lobes of the pronotum produced outwards (the main character used when the subfamily was established) often becoming acutely spinose. All these characters together separate the subfamily from the other eight subfamilies of Tetrigidae, although none of them is enough to characterize Metrodorinae by itself.

Composition and distribution: 85 genera and 528 species in all the continents excluding Europe and Antarctica. Africa including Madagascar (22 genera, 85 spp.), N America (1 sp. in Mexico), S America (15 genera, 78 spp.), temperate Asia (20 genera, 216 spp., probably including numerous synonymous

names), tropical Asia including Malesia, Melanesia and Papuasias (42 genera, 163 spp.), Australia (2 genera, 3 spp.).

3.4. Genus *Rosacris* Bolívar, 1931

Diagnosis: Small body size (~ 10 mm); U-shaped carinae of the vertex; 14-segmented antennae with widened subapical segments (10^{th} - 12^{th}); pronotum (and median carina) strongly elevated in frontal 2/3 of its length; organs of flight not visible (= nanoproneural, apterous); tibiae of fore and mid legs robust and rectangular in section. Very similar to members of the genus *Metamazarredia* Günther, 1939, more specifically *M. fuscipes* (Stål, 1877) (Fig. 3) the only difference being lack of the organs of flight in *R. antennata*.

Original etymology and vernacular name: *Rosa* from the family name of professor DANIELLE ROSA, and (*a*)*cris* from ancient Greek *akeris* (ἀκρίς), meaning locust. Here I propose an English common name for this genus and species – Rosa's turtlehopper, because the morphology of the pronotum of the species resembles a pygmy jumping turtle.

Type species: *Rosacris antennata* Bolívar, 1931 by original monotypy.

Composition: Monotypic – *Rosacris antennata* Bolívar.

Distribution: Luzon Island (the Philippines): Mt. Makiling [N14.129735, E121.199807] (type locality of *R. antennata*) and Mt. Isarog [N13.658922, E123.372851] (locality of the new record) – volcanic mountains.

3.5. Species *Rosacris antennata* Bolívar, 1931 (Figs 1, 2)

Literature records: *Rosacris antennata*: BOLÍVAR 1931, PARÍS 1994, YIN, SHI & YIN 1996

Locus typicus: the Philippines: Luzon Isl.: Makiling Mt.

Material examined: Holotypus*: 1♂ (Figure 1) [nymph!] Monte Makiling, Luzón [the Philippines] Baker [leg.] (first label, printed); *Orctacris** [?] gen. n. *antennatus* (second label, handwritten by I. Bolívar); Inventory

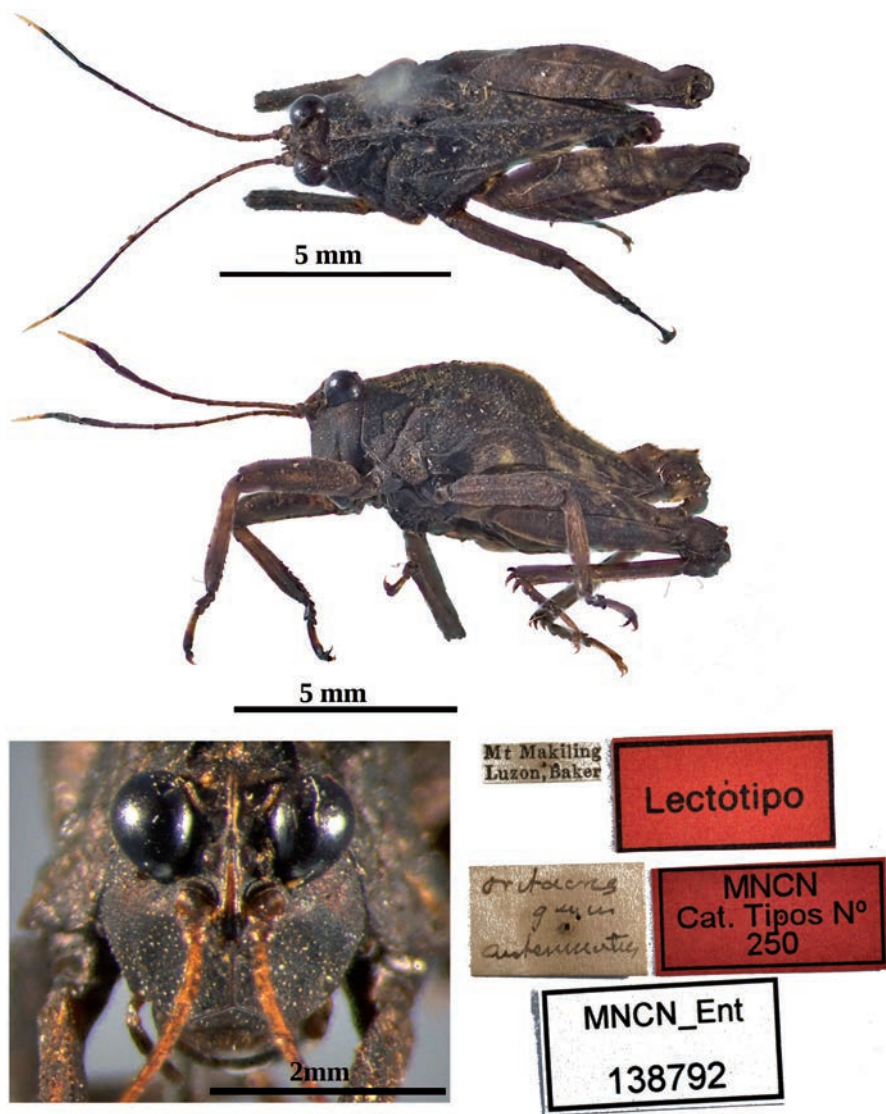


Fig. 1: Holotype (male) of *Rosacris antennata* from MNCN, Madrid, Spain: dorsal habitus, lateral habitus, head and labels. Photo: MERCEDES PARÍS.

Abb. 1: Holotyp (Männchen) von *Rosacris antennata* aus MNCN, Madrid, Spanien: Dorsal- und Lateralansicht, Kopf und Beschriftungen. Foto: MERCEDES PARÍS.

number Cat. Tipos No 250, MNCN_Ent 138792 (MNCN).

Other material studied: 1♂ (Figure 2) (nymph) the Philippines: Luzon Isl.: Isarog Mt. 3.III.2014. (Flickr) photo: P. BERTNER, det. J. SKEJO; 1♀ (nymph) Luzon Isl. [without specified locality, photos of bad quality]

14.IV.2015. (eBay) seller: Philinsectbugs, det. J. SKEJO.

[* PARÍS (1994) designated the only specimen of the species as lectotype. However, it is clear from the original description that the generic and the specific name were based on a single male specimen from Mt. Makiling.



Fig. 2: *Rosacris antennata* specimen from Isarog Mt. Photo: PAUL BERTNER.

Abb. 2: Exemplare von *Rosacris antennata* vom Mount Isarog. Foto: PAUL BERTNER.

Thus, the specimen PARÍS designated lectotype is in fact the holotype (a single specimen in the type series) and thus I correct the designation here and cite it as holotypus. PARÍS (1994) also stated that BOLÍVAR changed the generic name from the originally proposed (on the label: *Orctacris*) to *Rosacris* in the original description, the name derived after the family name of Professor DANIELLE ROSA.]

Distribution: the Philippines: Luzon Isl.: Makiling Mt. and Isarog Mt.

Holotype (male) re-description (Fig. 1)

General characters: Small species (body length about 10 mm). Body smooth, finely granulated with very small and smooth tubercles that are not placed on the carinae.

Nanopronotal, apterous species. General body color brown. Antennae black with white-yellowish apical segments. Head has the same color as the rest of the body. Compound eyes black. Pronotum with pale and dark colored stripes in the infrascapular area. Fore and mid femora brown with weak pale bands, fore and mid tibiae paler than femora. Fore tibiae have distal third of dark brown color. Hind femora brown with two pale colored stripes from the dorsal carina towards the external area. Hind tibiae brown. Proximal tarsal segments of fore and mid legs dark, distal segments with proximal half yellowish, distal half dark. First and second segment of hind tarsi dark colored, third pale colored, except a dark part in the apex (before the claws).

Head: Head exerted slightly above the level of the pronotum. Fastigium of vertex not produced in front of the eyes in dorsal view, concave in frontal view. Anterior margin of fastigium of vertex slightly convex. Fossulae present and deep. Median carina of vertex present in the distal half of the vertex length. Lateral carinae of vertex present, elevated, U-shaped. Supraocular lobes present. Vertex narrower than compound eye. Median ocellus situated in the distal margin of scutellum, between facial carinae. Paired ocelli situated between the compound eyes, slightly below the middle of the compound eye height. Frontal costa in lateral view visible, very prominent. Frontal costa bifurcation between the compound eyes, slightly above double ocelli. Scutellum narrow, facial carinae almost parallel, slightly divergent. Antennal grooves and scapus considerably wider than scutellum, flagellum as wide as scutellum. Maxillar palpi flattened, brown. Eyes in dorsal view elliptic, in lateral view globular with truncated lower margin, in frontal view irregularly globular. Antennal grooves situated at the level of the lower margins of the compound eyes, large, almost touching scutellum. Antenna with 14 segments: 1st scapus, 2nd pedicell, 3rd-7th

basal segments, each distal one longer than the preceding proximal, 8th central segment about 8 time longer than wide, 8th-9th distal cylindrical segments, >5 times longer than wide, 10th-12th subapical segments, 10th and 11th large and widened, 12th reduced in comparison to previous two, but foliaceous as well, apical 13th-14th reduced in size.

Pronotum: Pronotum elevated in frontal two thirds, strongly descending in the last third; covering 4/5 of the abdomen, reaching about half the length of the hind femora. Anterior margin of pronotum truncated, slightly angular. Median carina continuous, running from the anterior margin to the apex. Pronotal carinae present, well developed. Extralateral carinae present, but weak. Interscapular area very wide at the level between coxae of mid and hind legs, then narrowing towards the apex of pronotum, sinuate. Lateral area narrow in anterior part and widened towards the apex. Humero-apical carinae weak and straight. Lateral area wide. Pronotal apex blunt. A single paranotal lobe present, directed downwards, slightly outwards. Apex truncated. Pronotal sulci strong and deep. Lateral pronotal projection directed ventrally, slightly laterally, with truncated apex, ventral sinus present, tegminal sinus absent.

Wings: Fore and hind wings absent.

Legs: Dorsal margin of fore and mid femora straight. Ventral margin of fore femora straight, ventral margin of mid femora undulate. Fore femora almost circular in section. Fore and mid tibiae widened, rectangular in section, with sulcate outer margin. Distal tarsal segments of fore and mid legs considerably longer than proximal one. Hind femora slender (ratio length: maximum width 3.15). External median area with seven transverse ridges. Dorsal margin of the hind femora concave in distal half. Genicular and antigenicular teeth low and sharp, situated on the elevated dorsal carina. Hind tibiae robust, with a few spines that are not prominent. First and third tarsal segments

almost equal in length. Pulvilli angular, but not acute spinose.

Measurements: Body length (from fastigium to the end of the abdomen) 10.11 mm, pronotum length 8.11 mm, pronotum width (between lateral pronotal projections) 2.59 mm, pronotum height (from the lowest part of lateral projection to the highest part of median carina) 3.21 mm, fore femur length 2.65 mm, fore femur width 0.83 mm, mid femur length 2.45 mm, mid femur width 0.69 mm, hind femur length 5.21 mm, hind femur width 1.69 mm. Vertex width 0.48 mm, compound eye width 0.65 mm.

On the specimen from the Isarog Mt. (Fig. 2)

The male nymph photographed on the Isarog Mt. (the Philippines: Luzon Isl.) shows considerable similarity with the holotype of *Rosacris antennata* from MNCN and I refer to it as to the same species as the holotype, despite of possibility that it represents nymph of *Metamazarredia fuscipes* (see discussion). However, a few differences are to be noted. (I) The pronotum of the specimen from Isarog is slightly more robust than that of the holotype. (II) The color of the Isarog specimen is paler (light and with clear dark bands on fore and mid femora, as well as in infrascapular area) than in holotype. It is important to note that nymphs of most Orthoptera are paler than adults and that dried museum specimens may darken compared to living specimen, so I think there is no taxonomic value in these differences. (III) The dorsal carina of the hind femora is more compressed and higher in Mt. Isarog specimen, which is a typical juvenile character and based upon this feature it is possible to conclude that it is a male nymph and not an adult specimen. An interesting observation that can be noted after examination of the photographs are epizoic interactions with algae (which are visible on the legs, pronotum, vertex, especially right fossula),

that may contribute to a better camouflage of the animal within algae and mosses in its natural habitat. This symbiosis is not unusual in Tetrigidae (it was observed also in e.g. *Discotettix* spp. specimens from Sumatra, Borneo and Mindanao).

4. Discussion and conclusions

According to the current definition of Tetrigidae subfamilies, the genus *Rosacris* is a member of the Metrodorinae subfamily, based on extreme morphological similarity to *Metamazarredia* spp. *Rosacris antennata* is quite different in morphology from representatives of the subfamily Discotettiginae. Among Discotettiginae, the antennae possess three slightly widened segments similar to *R. antennata*, which can be found in members of the genus *Flatocerus*, but are usually followed by a few more segments that are slightly widened. Also, the projected frontal costa and vertex in *Flatocerus* are similar to *Phaesticus*, but strongly projected supraocular lobes are not present in the latter genus. Furthermore, the pronotal morphology differs from *Phaesticus* and *Flatocerus*, but is almost the same as that of certain *Metamazarredia* species (genus within Metrodorinae). All the members of the subfamily Discotettiginae exhibit similar morphology of widened antennal segments. However, similar pattern of compressed antennal segments can be observed in members of at least 11 genera assigned to subfamilies other than Discotettiginae: (I) *Tripetalocera*, *Tripetaloceroidea*, *Clinophaestus* and *Birmana*, (Tripetalocerinae: SE Asia), (II) *Ophiotettix* (Metrodorinae: New Guinea), (III) *Metamazarredia* (Metrodorinae: Borneo and the Philippines), (IV) *Andriana* and *Hybotettix* (Metrodorinae: Madagascar), (V) *Hyperpyboella* (Metrodorinae: New Caledonia), (VI) *Chiriquia* Morse, 1900 (Metrodorinae: N South America), (VII) *Lophotettix* (Lophotettiginae: S and C America).

The holotype of *R. antennata* is probably not an adult animal, but a last instar nymph, not

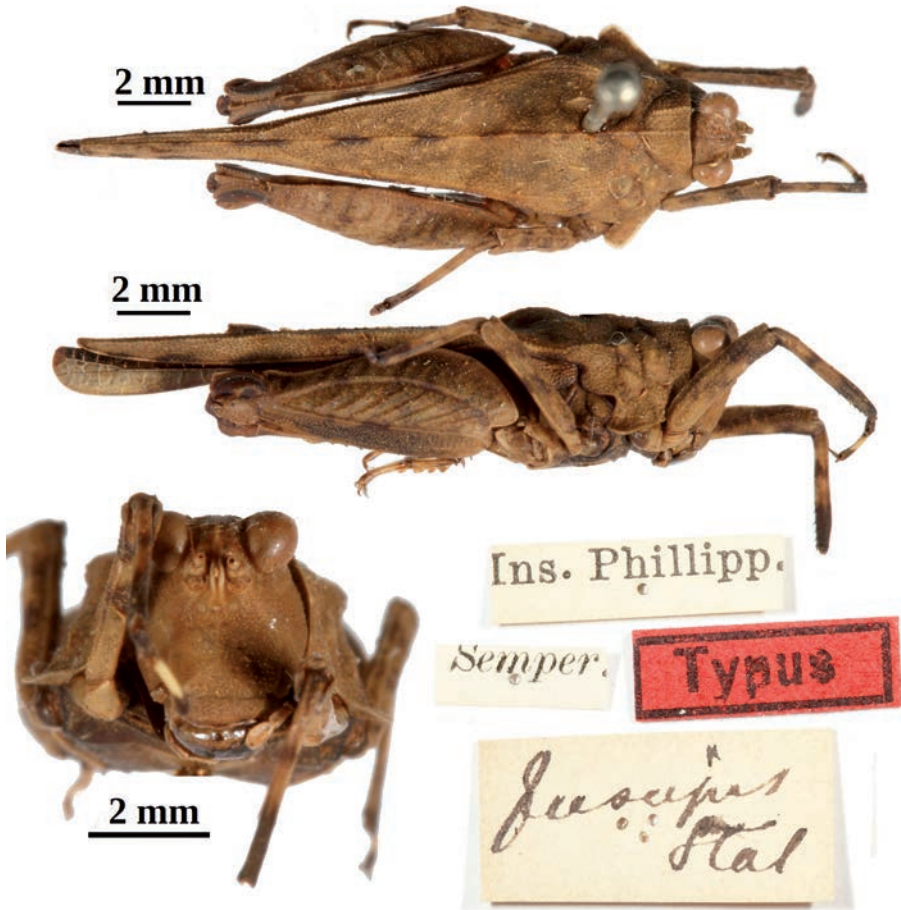


Fig. 3: Holotype (female) of *Metamazarredia fuscipes* from Naturhistoriska Riksmuseet, Stockholm, Sweden: dorsal habitus, lateral habitus, head and labels. Photo: JOSEF TUMBRINCK.

Abb. 3: Holotyp (Weibchen) von *Metamazarredia fuscipes* aus dem Naturhistorischem Reichsmuseum, Stockholm, Schweden: Dorsal-, und Lateralansicht. Kopf und Beschriftungen. Foto: JOSEF TUMBRINCK.

having genicular and antigenicular teeth, but possessing high dorsal carina of hind femora running towards the knee and forming two teeth-like projections. The larval stages in Tetrigidae can be clearly recognized by the missing incision between the antegenicular teeth and the knee of the hind femur (TUMBRINCK 2014). These teeth were drawn in the original descriptive paper as fully incised teeth of an adult animal, but after holotype examination, I conclude that the drawing is wrong and that these teeth are not true

teeth, but projections of the elevated dorsal margin.

There are many morphological characters shared between *Metamazarredia* spp. and *R. antennata*. In conclusion, the only character separating *Rosacris* and *Metamazarredia* is the absence of flight organs in *Rosacris*.

Taxonomic position of the genus *Metamazarredia* was discussed within the comprehensive revision of the Metrodorinae (GÜNTHER 1939). Morphology of *Metamazarredia* spp. was discussed and the author did not assign

the genus to Discotettiginae, a conclusion with which I completely agree. GÜNTHER (1939) made a comparison of the genus with *Mazarredia* spp. The specimens I assigned to *R. antennata* could be nymphs of *Metamazaredia fuscipes* (Fig. 3). The species is already known from Isarog Mt. (male from Museum für Naturkunde, Berlin), so the specimen from Isarog here identified as *R. antennata* is likely to represent a nymph of *M. fuscipes*. For a final conclusion on the relation of *R. antennata* and *M. fuscipes*, a series of specimens from Makiling Mt. and other similar mountains are needed, as well as research on the nymphal morphology of *Metamazaredia* spp.

R. antennata is one of the species that seem to have a mutualistic relationship with algae (and possibly also mosses), which are found growing on the fine tubercula of the integument of the vertex, pronotum and legs. The species lives in the volcanic mountains Makiling Mt. (a dormant volcano) with an elevation up to 1090 m a.s.l. and Isarog Mt. (a potentially active stratovolcano) with an elevation up to 2000 m a.s.l. These mountains display a variety of habitats (warm grasslands, wet grasslands, lowland forests, wet and cool mountainous forests) and are rich in biodiversity. There are many similar volcanic mountains on Luzon Isl. that have not yet been investigated in terms of the Tettigidae fauna. I assume that similar specimens will be found in many other localities after comprehensive systematic research and comparison with nymphs of *Metamazaredia fuscipes*, thus giving the final conclusion on identity of specimens hitherto identified as *R. antennata*.

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