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Schmidt, 1910 (Scarabaeidae: Aphodiinae) from the Philippines**

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Abstract. A new species of the genus *Termitodiellus* Nakane, 1961—*T. mindanaoensis* Minkina and Kakizoe, **new species** from Mindanao Island in the Philippines is described and illustrated. Photographs of the epipharynx of *Termitodiellus* species are provided for the first time. A short discussion of the phylogeny of Rhyparini Schmidt, 1910 is presented.

Key words. Oriental Region, Mindanao Island, description, tribal phylogeny.

Introduction

The rhyparine genus *Termitodiellus* was established by Nakane (1961) based on *Termitodiellus esakii* (Nomura, 1943), which was originally described as a member of the genus *Termitodius* Wasmann, 1894. The following seven species are currently recognized in *Termitodiellus*: *T. besucheti* (Paulian, 1983) from the Malay peninsula and Borneo; *T. esakii* (Nomura, 1943) from Yap Island, Micronesia; *T. hainanensis* Jiang and Wang, 2020 from China; *T. hammondi* (Krikken and Huijbregts, 1987) from Borneo; *T. interruptus* (Krikken and Huijbregts, 1987) from Sulawesi; *T. luzonensis* (Howden, 1995) from Luzon Island, the Philippines; and *T. monticola* (Krikken and Huijbregts, 1987) from Sulawesi (Skelley 2007). *Termitodiellus esakii* was collected from a termite nest (Nomura 1943). Therefore, the genus *Termitodiellus* is considered to be termitophilous (Vårdal and Forshage 2010).

We describe here the eighth species of the genus *Termitodiellus* from Mindanao Island, the Philippines and provide a short discussion of the phylogeny of the tribe Rhyparini.

Materials and Methods

The specimens were observed with a Nikon SMZ-U stereoscopic microscope. The photos of specimens were taken with an Olympus OM-D E-M1 Mark II with Mitutoyo Plan Apo (×5 or ×10) lens and Raynox DCR-150 as tube lens for habitus and genitalia, and an Olympus BX43 microscope equipped with an Olympus E-5 camera for the epipharynx. Photos were stacked using CombineZP software.

The holotype and paratypes of the new species bear red, printed labels and indicate the status name and sex of the specimen, names of the authors, and month and year of the designation.

The holotype and some paratypes are in the private collection of Łukasz Minkina (LMC) deposited at the Institute of Systematics and Evolution of Animals in Kraków (Poland). The remaining paratypes are in the private collections of Cezary Nowak (CNC) in Włoszczowa (Poland), Showtaro Kakizoe (SKC) in Fukuoka (Japan), Masayuki Fujioka (MFC) in Tokyo (Japan), and Masakazu Kawahara (MKC) in Osaka (Japan).

Terminology of the description mainly follows Krikken and Huijbregts (1987).

Taxonomy

Termitodiellus mindanaoensis Minkina and Kakizoe, new species

(Fig. 1–11)

Type material. *Holotype* ♂. Philippines, Mindanao Island, Alamada, North Cotabato, I. 2019, local coll. (LMC).

Paratypes. 1♂, 5♀, same data as holotype (CNC, SKC). 4♂, 4♀, same data as holotype except, III. 2019 (MKC, CNC, LMC). 2♀, same data as holotype except, VIII. 2019 (LMC). 1♀, same data as holotype except, South Catabato, III.2019 (LMC). 2♂, 3♀, same data as holotype except, 10. III. 2019 (SKC). 4♂, 4♀, same data as holotype except, IV. 2019 (SKC). 1 ex, same data as holotype except, VI. 2019 (LMC). 1♂, same data as holotype except, VIII. 2019 (SKC). 1♀, same data as holotype except, X. 2019 (MFC). 1♀, Philippines, Mindanao Island, Composteia New Albay, III. 2017, Local Collector leg. (MKC). 1♂, Philippines, Mindanao Island, Lanao del Sur, Amai Manabilang, Mt. Piapayungan, I. 2019, Local Collector leg. (SKC). 1♂, Philippines, Mindanao, Wao, Lanao, VI. 2019, Local Collector leg. (CNC), 3♀, Philippines, Agusan del Sur, vii. 2019, Local Collector leg. (LMC). Description of holotype male. Dorsum (Fig. 1). Body length 3.9 mm, greatest width 1.8 mm. Dorsally dark brownish. Relatively wide; shiny; all punctures bearing short, thick macrosetae.

Head. Clypeus (Fig. 6) anteriorly gently, widely rounded, with rounded angles at sides, considerable lateral emargination and a further widely rounded angle separated by a small emargination from the distinctly protruding, rounded genae. Clypeocentral disc distinctly convex, ringed by a shallow, pubescent peridiscal impression, with a pair of distinct, long, convergent costae, on sides with distinct, fine punctures bearing small setae. Frons with four short but distinct longitudinal costae (two frontodiscal and two frontolateral) of structure similar to costae on clypeal convexity; punctures of frons with setae similar to those on clypeus. Head covered by rather regularly spaced, dense, fine punctures bearing short, thick setae. Epipharynx (Fig. 11) transverse, with lateral sides broadly rounded. Anterior border concave; corypha absent, on its place present very wide, weakly convex exalcation, with few small, short and sparsely distributed setae in middle, and much thinner, quite long, dense setae on sides; additionally on each side of that structure there are small teeth in shape of inverted scalene triangle, and few relatively long and thick setae on anterior part of pedicel. Tormae short, regularly rounded.

Prothorax. Pronotum shiny, with six distinct convex costae and seven longitudinal furrows, and two lateral lobes on each side. Anterior and posterior lobe of similar width, form widest part of pronotum. Paramedian and discolateral costae interrupted near middle; submarginal costa interrupted in apical median third; costae with small punctures bearing short, thick setae. Middle furrow with rather regularly spaced, medium sized, dense punctures nearly on whole surface, with small basal area lacking punctures; second furrow with regularly spaced, medium-sized, dense punctures over whole surface, except base and central part lacking punctures; third and fourth furrows with regularly spaced, medium-sized, dense punctures nearly on whole surface, except at level of costa interruption. All furrow punctures bearing short, thick setae.

Pterothorax. Each elytron with six elevated costae and five flat intervals. Almost entire surface of first pair of intervals, except just before apex, basal half of second intervals and basal part of remaining intervals, with distinct microreticulation, elytra here weakly shiny; remaining interval surface shiny, without microreticulation. Intervals irregularly punctured on microreticulate surface, all punctures with short, thick setae. Costae on sides with dense punctures bearing short, thick setae. Postdiscal bulb reduced. Caudal bulb nearly spherical, rounded when viewed from above, and elongately rounded in lateral view.

Venter (Fig. 2) moderately shiny, with distinct microreticulation on median impression and indistinct microreticulation on remaining surface. Metaventrite flattened in middle, with distinct wide, shallow median impression devoid of punctures; sides of median impression with flattened surface and rows of small punctures; anterolateral juxtacostal impressions large, wider than median impression, shallow; the rest of punctation of metaventrite dense, regularly spaced; all punctures bearing short, thick setae. Abdominal ventrites shiny, without microreticulation, with two transverse rows of punctures, laterally

a small, rounded, shallow impression; anal ventrite with moderately large rounded and shallow impressions laterally, surface area with regular punctation; punctures of abdominal ventrites with short, thick setae. Pygidium in middle with longitudinal furrow on each side; punctation similar to punctation of abdominal ventrites. Meso- and metafemora lacking teeth on posterior margins; all femora moderately shiny, with distinct microreticulation; entire surface with dense, regular punctation bearing short, thick setae. Mesotibiae with large, flattened, inwardly hooked apical spine.

Male genitalia. Aedeagus (Fig. 9–10) nearly rectangular in dorsal view, with phallobase noticeably longer than parameres, sinusoidal in lateral view, with two indistinct setae on each side.

Sexual dimorphism. Male mesotibia near apex gently sinuate along medial margin, with large, flattened, inwardly bent apical spine (Fig. 1–2, 7). Female (Fig. 3–4, 8) metatibia nearly straight along medial margin, near apex, with rather small, not so much flattened, nearly straight apical spine.

Affinity. The only species previously known from the Philippines is *Termitodiellus luzonensis* (Howden, 1995), however it was collected only on Luzon and can be shown to notably differ from *T. mindanaoensis* n. sp. by: the lack of dense punctures on the pronotum and elytral intervals, which additionally are always rounded; by much different, not spherical shape of caudal bulbs, which are incised in the middle; and relatively smaller body size (3.1 mm). Howden (1995) mentioned that *T. luzonensis* is most closely related to *T. interruptus* (Krikken and Huijbregts, 1987) without citing any arguments, however because of similar proportions of the body and discomedian costae not interrupted it seems to be more closely related to *T. mindanaoensis* n. sp. than to *T. interruptus* (Krikken and Huijbregts, 1987). Because of the dense punctation of pronotum and elytral intervals, and proportions of the body it seems to be most similar to *Termitodiellus esakii* (Nomura, 1943) and seems to be evolutionarily intermediate between that and the other known species. From *T. esakii* (Nomura, 1943) it can be easily distinguished by following characters: larger body size (3.9 mm vs. 3.0 to 3.3 mm); basal part of pronotal furrows without punctures (vs. whole surface of pronotal furrows with punctures); elytral intervals impunctate in apical part (vs. whole surface of elytral intervals with punctures); and different shape of caudal bulbs (Nomura 1943; Cartwright and Gordon 1971; Howden and Storey 1992). From all other known species *T. mindanaoensis* n. sp. can be easily distinguished by: punctures in elytral intervals irregularly spaced (vs. punctures in elytral intervals arranged in very distinct rows); proportions of the body. Only *T. interruptus* (Krikken and Huijbregts, 1987) has similar proportions, but the new species can be easily distinguished by discomedian costae which are not interrupted, and dense and regularly spaced punctures on most of the pronotal surface (in other species a large part of pronotum lacks punctures).

Etymology. Toponymic; an adjective derived from the name of Mindanao Island, where the new species was collected.

Discussion

Phylogenetic relationships within Rhyparini Schmidt, 1910 are still being debated. Howden and Storey (1992) analyzed the phylogeny of Rhyparini and Stereomerini Howden and Storey, 1992 using four genera for operational taxonomic units (OTU) of the Rhyparini: *Rhyparus* Westwood, 1845, *Sybacodes* Fairmaire, 1896, *Termitodius* and *Termitodiellus*. According to their result, the four genera are monophyletic. However, the resulting tree provided by Vårdal and Forshage (2010) does not support this result. Vårdal and Forshage (2010) used the above four genera and *Cartwrightia* Islas, 1959 for OTU of the Rhyparini. As a result, the monophyly of Rhyparini was not supported, but was instead shown to be paraphyletic.

The aedeagus of *T. mindanaoensis* n. sp. is similar to that of some species of *Sybacodes* Fairmaire, 1896 because of the general shape and proportions of parameres to phallobase. Especially, the aedeagus of *T. mindanaoensis* n. sp. is similar to the aedeagus of *Sybacodes borneensis* Minkina, Mencl and Bellmann, 2018. We do not support the results of Vårdal and Forshage (2010) and consider these aedeagal structures an autapomorphic character defining the OTU Rhyparini as proposed by Howden and Storey (1992). We believe that it is necessary to elucidate detailed phylogenetic relationships with more information, including DNA sequence information.

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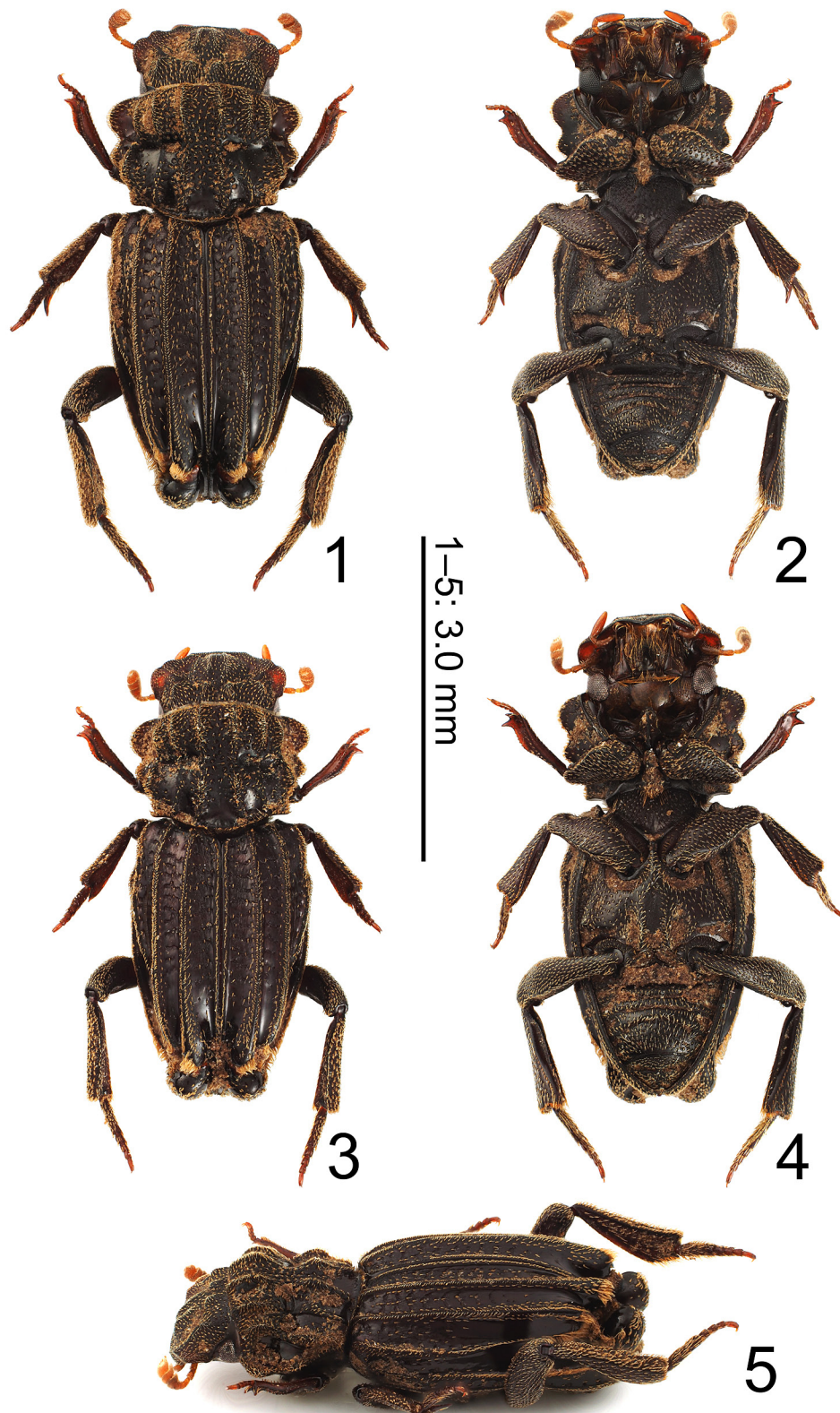
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Figures 1–5. *Termitodiellus mindanaoensis*, new species. 1) Dorsal view, holotype male. 2) Ventral view, paratype male. 3) Dorsal view, paratype female. 4) Ventral view, paratype female. 5) Dorso-lateral view, holotype male.



Figures 6–11. *Termitodiellus mindanaoensis*, new species. 6) Head, holotype male. 7) Left mesotibia, paratype male. 8) Left mesotibia, paratype female. 9) Aedeagus, dorsal view. 10) Aedeagus, lateral view. 11) Epipharynx.