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Cylindera (*Conidera*) *mindoroana* sp. n. (Coleoptera: Cicindelidae), a new tiger beetle species from the Philippines

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Abstract. *Conidera* Rivalier, 1961 is a well-defined subgenus of tiger beetles (Coleoptera: Cicindelidae) hitherto only known from two species endemic to the island of Luzon. This paper describes the first species from Mindoro, with a doubtful record from Mindanao. *Cylindera* (*Conidera*) *mindoroana* Zettel and Wiesner, new species, differs strongly by an unusual shape of the female's elytra. A diagnosis for *Conidera* and a key to the species of this subgenus is presented.

Key words. Cicindelini, diagnosis, new species, Mindoro, endemic species, diversity, key.

Introduction

Tiger beetles were recently re-established as a separate family Cicindelidae within the Coleoptera Geadephaga (López-López and Vogler 2017). They have been recognized as an important indicator group for biodiversity assessment and conservation aspects (Cassola and Pearson 2000). The Philippines are home to an extraordinarily rich tiger beetle fauna including many endemic species. In his world catalog, Wiesner (1992) listed 94 cicindelid species from the Philippines. About twenty years later Cassola (2011) recognized 139 species of tiger beetles (120 endemic) that inhabit the Philippines, which places the country seventh in rank globally for total number of species, and fifth in rank for number of endemic species. Considering its small land area, the Philippines have the richest cicindelid fauna in the world (2145 km^2 / species; Cassola 2011). Most recently, Cabras et al. (2016) listed 137 species and 18 subspecies. Four additional species have since been described (Dheurle 2016; Zettel and Pangantihon 2017), including the new species in this paper. The approximately 141 tiger beetle species recorded from the Philippines represent about 5.0% of the 2,840 species known worldwide (Wiesner, personal data). About 90% of the Philippine cicindelid species are endemic (see discussion).

In this study, we introduce a new species of *Conidera* Rivalier, 1961. Rivalier (1961) described *Conidera* as a subgenus of the diverse and widely distributed genus *Cylindera* Westwood, 1831 due to overall similarities in the endophallic structures. However, *Conidera* has a very distinctive appearance within *Cylindera*, and superficially resembles *Thopeutica* Chaudoir, 1861, a genus geographically restricted to Sulawesi and the Philippines. *Conidera* can be readily distinguished from all other Philippine Cicindelidae by the combination of a metallic labrum (not white, yellow, or bicolored as in most other species of *Cylindera*), distinctly elongated mandibles with four to six teeth (besides molar complex; Fig. 3, 4), a slender, anteriorly narrowed pronotum (Fig. 1, 2), and a slender aedeagus (Fig. 14-16) with a weakly curled flagellum (Fig. 17–22). In contrast, *Thopeutica* has a three-toothed mandible and a characteristic flagellum, that is complexly coiled in four to five convolutions (comp. Rivalier 1961, sub *Diotophora* Rivalier, 1961; see also Cassola and Ward 2004).

Previously only two species were included in *Conidera*: *Cylindera* (*Conidera*) *conicollis* (Schaum, 1862) (type species) and *C.* (*Conidera*) *mandibularis* (Schaum, 1860), both from the island of Luzon (Wiesner 1992; Cabras et al. 2016).

Materials and Methods

In addition to the six type specimens of *C. mindoroana* sp. n. (see type material below) we have studied seven specimens of *C. conicollis* (from Luzon: Mountain Province, Laguna Province, and unspecified locality; Natural History Museum Vienna and coll. Wiesner, Wolfsburg) and nine specimens of *C. mandibularis* (from Quezon, Camarines Norte, Camarines Sur; coll. Wiesner, Wolfsburg, and coll. Zettel, Vienna) for comparison.

A Leica Wild M10 binocular microscope with a camera lucida was used for verbal description, measurements, and line drawings.

Measurements (all in millimeters):

BL Body length. Maximum length along body axis from apex of labrum to apex of elytra.
HW Head width. Maximum width of head, including eyes, in dorsal aspect.
PW Pronotum width. Maximum width of pronotum, in dorsal aspect.
PL Pronotum length. Length of pronotum along midline, in dorsal aspect.
EL Elytron length. Length of elytron measured diagonally from apex of mesoscutellum to rounded apex of elytron.

Terminology of aedeagus structures follows Freitag et al. (1985).

Digital photos (Fig. 1, 2, 14–22) were taken with a Leica DFC490 camera attached to a Leica Z16 APO lens barrel and a Planapo 1.0 × WD97mm lens with the help of Leica Application Suite V3, stacked with Zerene-Stacker 64-bit, and processed with Adobe Photoshop 7.0. Line drawings (Fig. 3-13) were made with the help of a Wild M10 binocular microscope with a camera lucida.

Aedeagi were cleared in 2-hydroxypropanoic acid (lactic acid) prior to examination and photographing. After having been studied, aedeagi were embedded in a transparent, water-soluble medium (dimethylhydantoin formaldehyde resin) on the same cardboard as the specimen.

Results

Subgenus *Conidera* Rivalier, 1961

Diagnosis. Medium-sized to large species of *Cylindera* (body length ca. 7–12.5 mm). Color dark bronze-brown to dark olive green. Elytral pattern (Fig. 8–13) uniform, consisting of one small subbasal spot, one medial narrow, transverse, slightly oblique stripe, and one small subapical spot. Head relatively slender. Labrum dark bronze-brown to blackish. Mandible (Fig. 3–4) distinctly elongated, with narrow shaft and long teeth, at least four teeth (occasionally up to six) between molar dentition (covered by labrum) and apex. Pronotum slender, length greater or slightly smaller than width; maximum width near base; sides anteriorly converging. Male: foretarsus weakly enlarged, with narrow brush of hairs on tarsomeres 1–3. Aedeagus slender (Fig. 14–16), 7.5–9.5 times as long as wide, dorsally with a small subapical corner. Endophallic sclerites (Fig. 17–22) uniform; flagellum weakly curled. Mesepisternal coupling sulcus of female narrow and deep. Glossy humeral area of female elytra distinct, although variably extended among species. Apex of female elytra variably modified, strongly convex (Fig. 9) or acuminate-truncated (Fig. 11, 13).

Diversity and distribution. Three species endemic to the Philippines.

Cylindera (*Conidera*) *mindoroana* Zettel and Wiesner, new species

(Fig. 1–5, 8, 9, 14, 17, 20)

Etymology. Named after the terra typica, the island of Mindoro.

Type material. Holotype male, (coll. Wiesner, Wolfsburg, Germany, long term loan of Natural History Museum Stuttgart) and three paratype females (coll. Wiesner, Wolfsburg, Germany), Philippines, Mindoro, Mt. Halcon, IX.2010, leg. Noel Mohagan. One paratype female, (coll. Zettel, Vienna, Austria),

Oriental Mindoro, Roxas, San Vicente, 7.V., local collector. One paratype male, (coll. Wiesner, Wolfsburg, Germany), Philippines, Mindanao, Bukidnon Province, XI.–XII., leg. Noel Mohagan.

Diagnosis. Medium-sized species (body length 9.7–11.1 mm) of *Conidera*, with characteristic color pattern of the subgenus (Fig. 1, 2). Sides of clypeus glabrous. Labrum (Fig. 5) strongly protruded in middle, forming a lobe with small acute tip, with 16–18 setiferous pores. Mandible (Fig. 3, 4) with four teeth between basal dentition and apex; in male with large gap between tooth 1 and 2. Pronotum length slightly larger than width in males, subequal or smaller than width in females. Each elytron rounded posteriorly; sutural spine shifted anteriorly, in male slightly, in female strongly (Fig. 8, 9). Elytron of female with large, strongly glossy area expanded over entire humeri.

Description.

Measurements. Holotype: BL = 10.9, HW = 2.45, PW = 1.96, PL = 2.03, EL = 6.21. Paratype, male (n = 1): BL = 10.8, HW = 2.41, PW = 1.92, PL = 2.06, EL = 6.14. Paratypes, females (n = 4): BL = 9.7–11.1, HW = 2.24–2.52, PW = 2.00–2.38, PL = 1.87–2.02, EL = 5.59–6.27.

Color (Fig. 1, 2). Head dorsally black with greenish reflections on antennal plates, clypeus, and margins of labrum, occasionally also on foremargin of frons. Sides of head bluish green. Eyes pale. Mandibles testaceous at base, distally black. Labial and maxillary palpi testaceous, last labial palpomere and last 2–3 maxillary palpomeres with bluish infuscation. Antenna with antennomeres 1–4 metallic green with some bronze or blue reflections, antennomeres 5–11 black. Pronotum chiefly black with slight bronze tinge; sides with some slight greenish reflections. Ground color of elytra dull black, in male with slight olive greenish, in female with weak bronze tinge; punctures on green ground are blue. Humeral areas more vividly colored than rest of elytra, in male greenish, in female dark violet-blue; sides with narrow blue margins. White pattern as characteristic for the subgenus. Thoracic and abdominal sternal sclerites metallic green to bluish, much more vivid than dorsum. Legs: trochanters brownish bronze; coxae and femora metallic green to blue; tibiae and tarsi blue to bronze black.

Structures. Head narrow, fully glabrous, except one pair of setae at the dorsal eye margin. Eyes moderately globose. Frons and vertex coriaceous, with fine longitudinal striation, which is much stronger on suborbital declivity. Temples transversely striate; genae longitudinally striate. Clypeus finely shagreened, without setiferous punctures at sides. Labrum (Fig. 5) smooth, with numerous (16–18) setiferous pores (bearing long white setae if not broken off), twice as wide as long, with distinct medial lobe bearing a small apical tip. Mandibles very long and slender, with four teeth between basal dentition (covered by labrum) and apex; in male with large gap between teeth 1 and 2 (Fig. 3), in female without gap. Antenna very long and slender, in male reaching subapical spot of elytra, in female a little shorter than in male; scape and antennomeres 2–4 smooth, 5–11 dull.

Pronotum. Narrow, with maximum width near base; length slightly larger than width in males, subequal or smaller than width in females. Disk glabrous, coriaceous, with fine transverse striation that is more obvious at anterior collar. Sides densely punctured and pilose. Posterior transverse furrow deep, medially protruded forward. Mesepisternal coupling sulcus of female developed as a large and deep groove; surface smooth with few small punctures. Sides of prothorax including sides of pronotum, mesepisternum (except coupling sulcus of female), metepisternum, metasternum, abdominal sternites, and parts of forefemur covered with white adpressed to decumbent hairs. Legs with short white decumbent to subdecumbent stiff setae.

Elytra. Much wider than head (ca. 1.5 times), sides slightly and apex strongly convex; punctures fine and dense (Fig. 8, 9). Suture in male slightly and in female distinctly concave in posterior third. Sutural spine small and slightly preapical in male, larger and more distant from elytral apex in female. In female the smooth area covering entire humeri. Apical border microserrulate.

Aedeagus. Medial lobe slender and elongated (Fig. 14), although minimally wider than in other *Conidera* species. Endophallic structures (Fig. 17, 20) in an arrangement that is typical for the subgenus. Small stiffening rib with left apex not upcurved, subapically with strong bend; right apex bifid; arciform piece long, distally extremely slender.

Distribution. Recorded from two localities on Mindoro Island. The record from Mindanao based on a single male (matching the holotype very well) requires confirmation.

Comparative notes. The female can be immediately recognized by the aberrant shape of the elytron; this character is less expressed in the male. Besides the characters mentioned in the key below, there are also minor differences in the endophallic structures (comp. Fig. 17–22; white arrows) that support the status of a separate species but should be examined in more specimens. The endophallic structures of *C. conicollis* are most similar to the new species, except that the small stiffening rib is less bent before its left apex; both species share a bifid right apex of the small stiffening rib and a slender arciform piece. *Cylindera mandibularis* differs distinctly from both other species of *Conidera* by a relatively broad arciform piece; in addition, its small stiffening rib has an upcurved left apex and an acute right apex.

Key to species of *Conidera*

1. Labrum strongly protruded in middle, its median length more than twice its lateral length (Fig. 5); each elytron rounded posteriorly; sutural spine shifted anteriorly, in female much stronger than in male (Fig. 8, 9); medium-sized species, body length 9.7–11.1 mm; locality from Mindoro (and Mindanao?) . . . . . ***Cylindera* (*Conidera*) *mindoroana* Zettel and Wiesner, new species**

— Labrum weakly protruded in middle, its median length at most 1.6 times its lateral length (Fig. 6, 7); elytron not or hardly rounded posteriorly, truncated in female; sutural spine normal, at apex of elytron (Fig. 10–13); locality from Luzon **2**

2(1). Labrum with small medial tooth (Fig. 7); sides of clypeus glabrous; small species, body length 7–8 mm . . . . . ***Cy.* (*Co.*) *mandibularis* (Schaum, 1860)**

— Labrum lacks medial tooth (Fig. 6); sides of clypeus setose; large species, body length 11–12.5 mm . . . . . ***Cy.* (*Co.*) *conicollis* (Schaum, 1862)**

Discussion

Since its description by Rivalier (1961), *Conidera* has been recognized as a distinct, monophyletic clade that is supported by several morphological characters, i.e., mandible dentition, pronotum shape, elongated aedeagus, and modification of elytra of females. The position of the subgenus in *Cylindera* is supported by strong similarities in the composition of endophallic structures (Rivalier 1961). However, its closer relatives among the various *Cylindera* clades remain unknown.

Conidera is restricted to the Philippines (Cabras et al. 2016, this paper). The Philippines are well known for a high endemism in insects. This is especially evident in taxa that possess reduced dispersal abilities (like wingless weevils; see, e.g., Yap and Gapud 2007; Yap 2008) or inhabit specialized habitats (like aquatic beetles and bugs; see Freitag et al. (2016) and Zettel (2014), respectively). Many such species are restricted to single islands. It is more surprising that the same phenomenon, although to a lesser degree, can be observed in insects that are excellent flyers, such as dragonflies (Hämäläinen and Müller 1997) or tiger beetles (e.g., Cassola and Ward 2004; Cabras et al. 2016; Zettel and Pangantihon 2017).

There are now approximately 141 tiger beetle species, including *C. mindoroana*, listed for the Philippines (Cabras et al. 2016; Dheurle 2016; Zettel and Pangantihon 2017), plus 18 taxa described as subspecies (Cabras et al. 2016), some of which may deserve the rank of species. The Philippine fauna includes only ten species with a wide Oriental distribution, including species with locally distributed "subspecies" of unclear taxonomic rank like, e.g., *Tricondyla aptera* (Olivier, 1790) and *Lophyra striolata* (Illiger, 1800). Another five species from Sundaland reach the Philippines on the island group of Palawan, which is faunistically similar to Borneo but isolated from the remaining Philippine islands. Approximately ten additional species are now listed as non-endemic, but either the Philippine (four species) or the "foreign" records (six species) appear doubtful. Considering the number of species that apparently should be described as new or elevated to species rank, the percentage of endemic Philippine tiger beetle species may finally be as high as 90–95%.

Recent publications (e.g., Cassola and Ward 2004; Cabras et al. 2016; Zettel and Pangantihon 2017), and observations by the first author indicate a high percentage of regional endemism too. Many tiger beetle species seem to be restricted to single islands or biogeographic subregions (as delimited by Ong et al. (2002) and Catibog-Sinha and Heaney (2006)). However, this pattern is strongly blurred by inaccurate, incorrect or doubtful distribution data (both locality data and species identifications) from the past but also from modern insect trade. Examples can be taken from literature data (meticulously compiled by Cabras et al. (2016)) that indicate "sympatric subspecies" and other taxonomic problems to be solved in the future.

As pointed out by Pearson and Cassola (2005), the more recent tiger beetle taxonomy, to a large extent, lies in the hands of "expert amateurs, whose only reward was to see the taxonomic knowledge of tiger beetles grow". Future work will rely on their help too.

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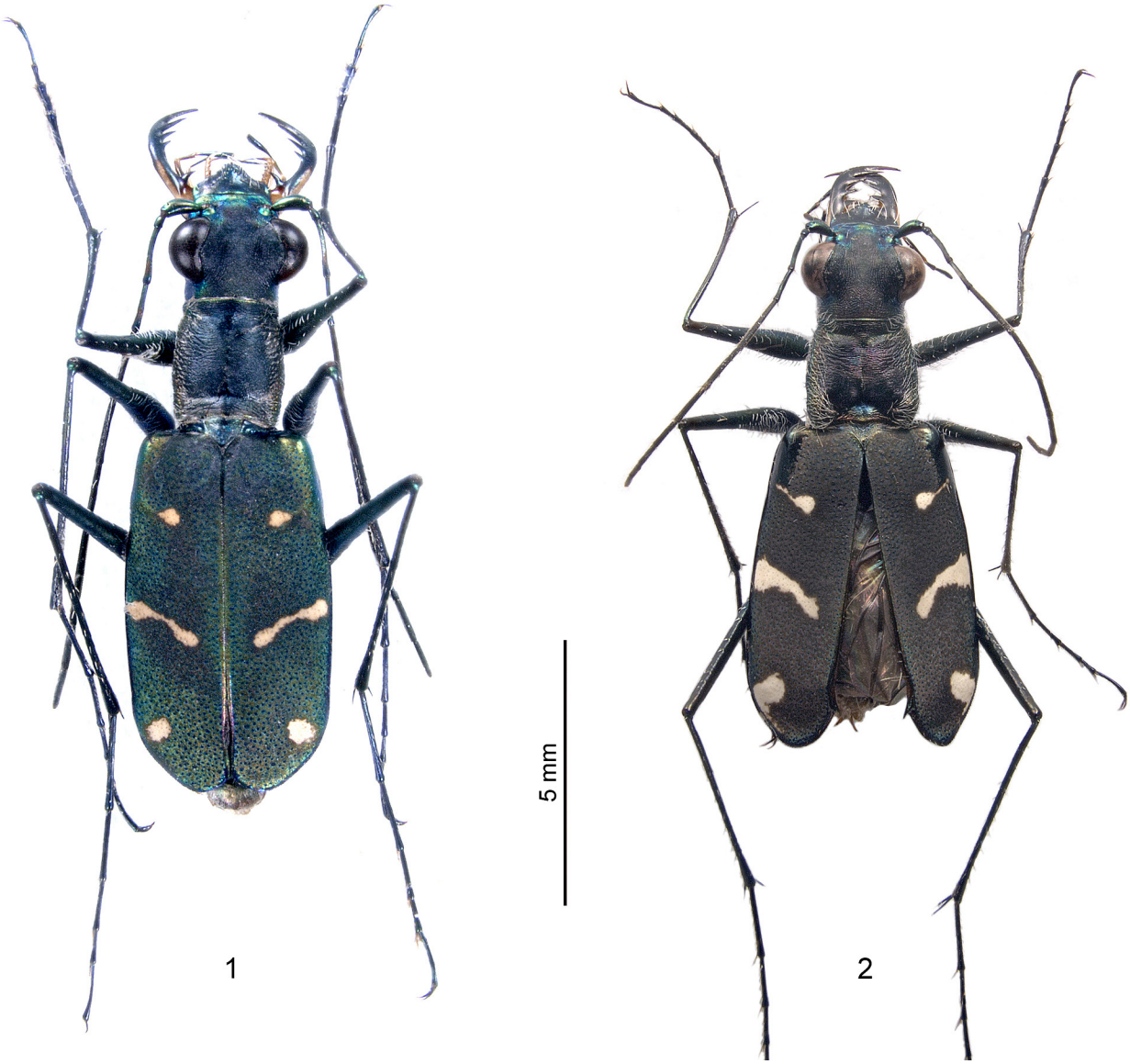
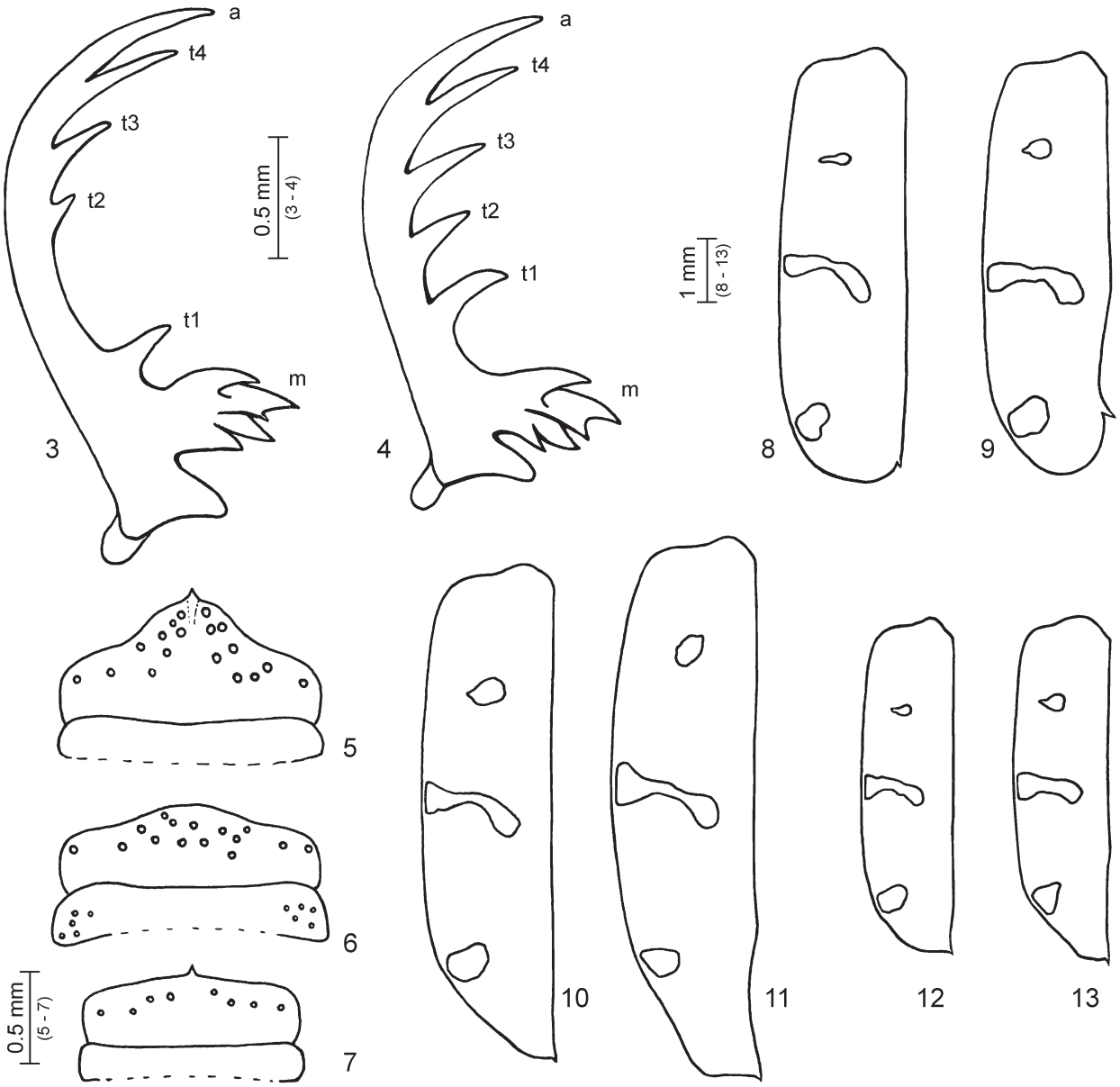
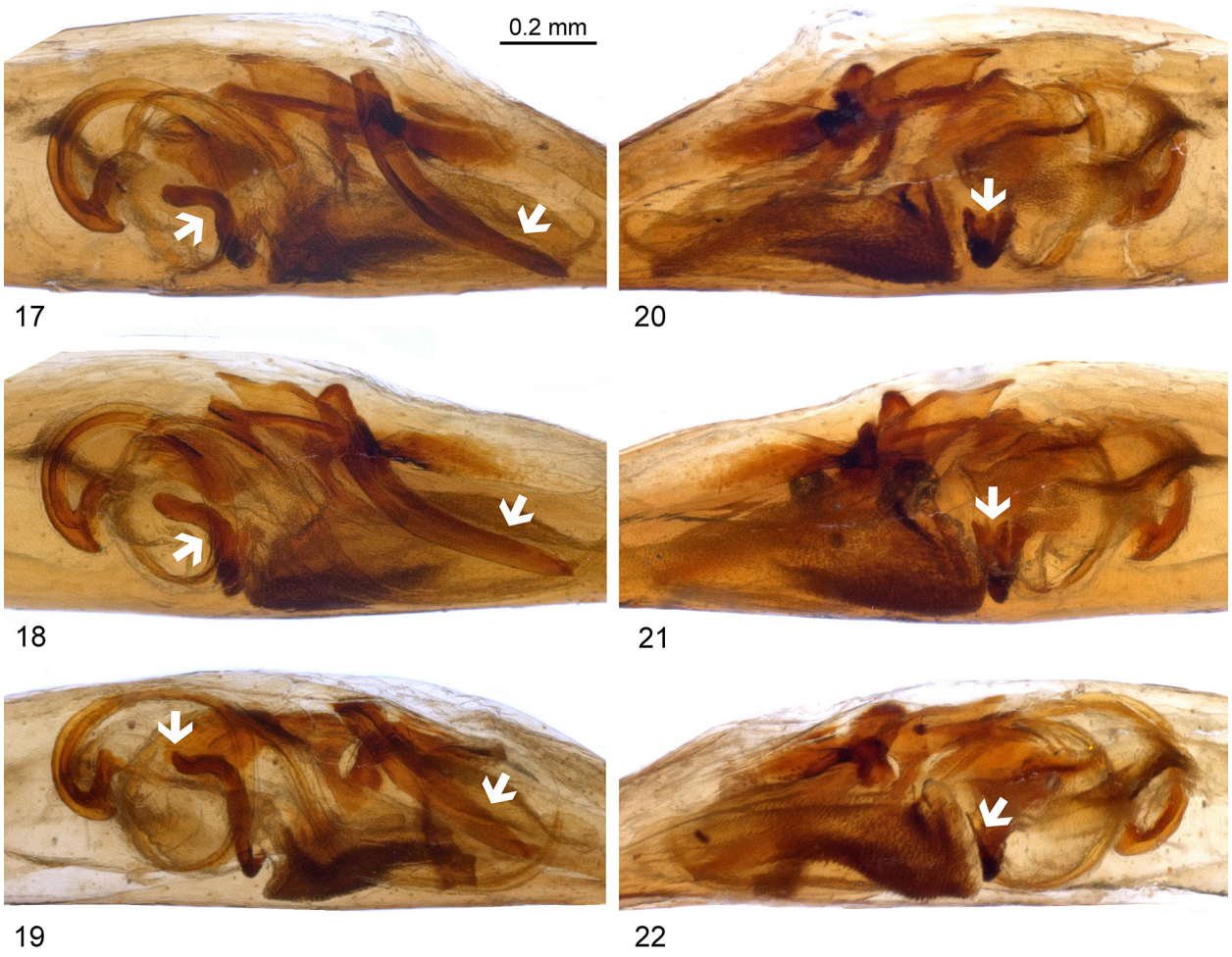


Figures 1–2. *Cylindera* (*Conidera*) *mindoroana* new species, habitus pictures. **1)** Holotype male. **2)** Paratype female.



Figures 3–13. *Cylindera* (*Conidera*). **3–4)** Mandibles of *C. mindoroana* new species, a = apex, m = molar complex, t1–t4 = tooth 1–4 (see generic diagnosis). **3)** Holotype male. **4)** Paratype female. **5–7)** Labrum and clypeus of males, setae omitted. **5)** *C. mindoroana* new species. **6)** *C. conicollis* (Schaum, 1862). **7)** *C. mandibularis* (Schaum, 1860). **8–13)** Left elytron. **8)** *C. mindoroana* new species, male. **9)** *C. mindoroana* new species, female. **10)** *C. conicollis* (Schaum, 1862), male. **11)** *C. conicollis* (Schaum, 1862), female. **12)** *C. mandibularis* (Schaum, 1860), male. **13)** *C. mandibularis* (Schaum, 1860), female.

Figures 14–16. Median lobe of aedeagus. **14)** *C. mindoroana* new species. **15)** *C. conicollis* (Schaum, 1862). **16)** *C. mandibularis* (Schaum, 1860).



Figures 17–22. Endophallic structures, arrows indicate possibly species-specific characters. **17–19)** Left side. **17)** *C. mindoroana* new species. **18)** *C. conicollis* (Schaum, 1862). **19)** *C. mandibularis* (Schaum, 1860). **20–22)** Right side. **20)** *C. mindoroana* new species. **21)** *C. conicollis* (Schaum, 1862). **22)** *C. mandibularis* (Schaum, 1860).