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A description of the second species of the genus *Platybolium* Blair, 1938 (Coleoptera: Tenebrionidae) collected from a nest of *Pheidole singaporensis* Özdikmen, 2010 (Hymenoptera: Formicidae) in Thailand

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Abstract

Platybolium watanai **sp. nov.**, the second species of the genus, is described from Thailand, with illustrations of the diagnostic characters, including the defensive glands and the cuticular structures of females. The type species of the genus, *Platybolium alvearium* Blair, 1938, is known from beehives in a wide range of the Oriental region, but the new species was found in an ant nest of *Pheidole singaporensis* Özdikmen, 2010. Myrmecophily in the new species is discussed.

Key words: Defensive glands, female cuticular structures, myrmecophily, new species, Triboliini

Introduction

Nests of ants of the genus *Pheidole* Westwood, 1839 harbor various species of myrmecophilous insects, especially beetles (Luna de Carvalho 1989; Maruyama *et al.* 2013). Recently, some interesting myrmecophilous beetles were discovered from the nests of *P. singaporensis* Özdikmen, 2010, namely *Chimaerocyon shimadai* Fikáček, Maruyama, Vondráček & Short, 2013 (Hydrophilidae) from the Malay Peninsula (Fikáček *et al.* 2013) and *Cryptocephalomorpha siamensis* Maruyama, Komatsu & Sakchoowong, 2016 (Carabidae) from Thailand (Maruyama *et al.* 2016). In 2015, the authors MM and HS investigated the myrmecophilous insect fauna in Doi Suthep National Park, northern Thailand, and examined nests of various ant species. We found a peculiar species of Tenebrionidae from the entrance of a *P. singaporensis* nest at the base of a large living tree. It was subsequently identified as a member of the genus *Platybolium* Blair, 1938 by KA.

The genus *Platybolium* was established for the type species (monotype), *Platybolium alvearium* Blair, 1938. This genus had been assigned to the tribe Triboliini Gistel, 1848 (subfamily Tenebrioninae) (Bouchard *et al.* 2021) and included the single species *P. alvearium*, which is known from India, Himalaya, Nepal, China, and Vietnam. *P. alvearium* is a well-known wax-eater in beehives (Blair 1938; Cherian & Mahadevan 1940; Wilson 1971; Pande *et al.* 2015; Chandra & Mattu 2017; Dolson *et al.* 2019, etc.). The *Platybolium* specimens from the *P. singaporensis* nest in Doi Suthep differed morphologically from *P. alvearium* and were found to be an undescribed species. We describe it as a new species and illustrate its external morphology, defensive glands, and the cuticular structures of females.

Material and methods

Technical terms and methods follow Ando (2021). The body was photographed using a Canon camera (EOS

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7D) with an MP-E 65 lens, and the images were combined with the montage software Zerene Stacker. Holo- and paratypes designated in this study are deposited in the Kyushu University Museum, Fukuoka, Japan (KUM), but some paratypes are in Department of National Parks, Wildlife and Plant Conservation, Thailand (DNP), and private collection of Kiyoshi Ando (CKA).

Genus *Platybolium* Blair, 1938

Platybolium watanai sp. nov.

(Figs. 1–9)

Type series. Holotype: ♂, Thai: Chiang Mai, Doi Suthep National Park, National Park Lodging, 18˚48'21.74"N, 98˚55'5.46"E, 1050 m, 22–23.XII.2015, Maruyama-M. leg. (KUM). Paratypes: 3 ♂♂, 3 ♀♀, same data as for the holotype (2 in KUM, 2 in DNP, 2 in CKA).

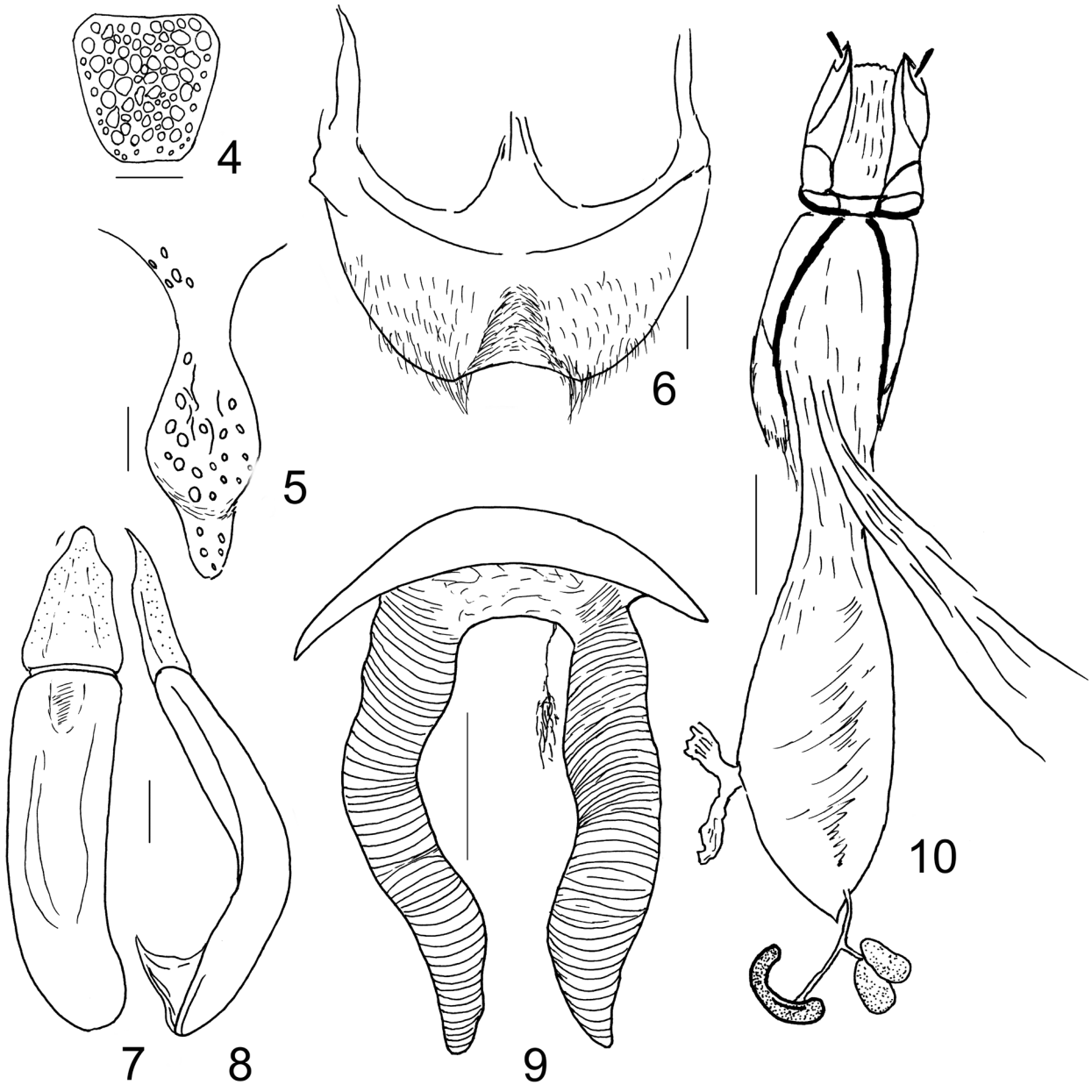
Description. Oblong, subparallel-sided, weakly convex, covered with fine microsculpture, subshiny. Colour dark reddish brown, darkened in part; dorsal side blackish brown except marginal portions. Body length: 4.7–5.4 mm in male (n = 4; average 5.1 mm), 4.7–5.7 mm in female (n = 3; average 5.3 mm).

FIGURES 1–3. *Platybolium watanai* **sp. nov.**: **1.** holotype, dorsal view; **2.** ditto, dorso-lateral view; **3.** paratype at the host ant nest entrance. Scales: 1.0 mm.

Male. Head transversely rhombic, with rounded anterior margin though very slightly sinuous in middle; punctures dense, larger and clear on frons to vertex, smaller and obscure on clypeus and genae; clypeus and frons weakly convex, individually; genae flattened, roundly produced laterad; frons sloping laterally, overhanging like eaves on inner margins of eyes, space between eyes 4.71–5.33 times as wide as an eye (n = 4; average 5.01 times); eyes coarsely facetted, strongly invaded by genae. Antennae short, reaching apical two-fifths of pronotum, compactly articulate, gradually dilated towards apical antennomeres, especially strongly so in distal five antennomeres; 3rd

antennomere distinctly shorter than its apical width (5:7). Ultimate maxillary palpomeres obconical. Mentum obtrapezoidal (Fig. 4), slightly wider than long (19:17), weakly convex in middle and depressed laterally, coarsely and irregularly punctate.

Pronotum transversely trapezoidal, somewhat reflexed at sides, widest at basal third and nearly as wide as elytra, 1.96–2.07 times as wide as long (n = 4; average 2.02 times); disc gently convex, weakly sloping laterally, broadly depressed along lateral margins; punctures coarse and very dense, nearly as large as and/or slightly larger than on frons, constantly becoming sparser and smaller in lateral depressed areas; anterior margin moderately emarginate, straight in median three-fifths, very finely beaded; anterior corners obtusely rounded, slightly produced; lateral margins gently rounded, finely beaded; posterior corners nearly rectangular, rounded at the tip; basal margin weakly bisinuate, thinly beaded. Scutellum large, obtriangular, with dense punctures.



FIGURES 4–10. *Platybolium watanai* **sp. nov.**: **4.** mentum; **5.** prosternal process; **6.** eighth sternite; **7, 8.** aedeagus (right: lateral view; left: dorsal view); **9.** defensive glands; **10.** female cuticular structure in ventral view. Scales: 0.1 mm for 4–8; 0.5 mm for 9–10.

Elytra elongate, subparallel-sided, gently convex, widest at middle or behind middle, 1.41–1.46 times as long as wide (n = 4; average 1.43 times), finely beaded at sides and strongly depressed along sides in about outer

half of 9th intervals; with rows of punctures instead of striae; punctures in rows dense and irregular, larger than on pronotum, distinct even in apical declivity; intervals weakly to moderately convex, densely with microscopic piligerous punctures, weakly carinate on mid of 8th one, the carina terminated before apical declivity of elytron; epipleura flat or weakly depressed, gently and finely punctate, reaching apex of 5th abdominal ventrite.

Prothoracic hypomera distinctly depressed, densely punctate, with irregular rugosities. Prosternum moderately convex towards middle, coarsely and densely punctate, hardly beaded at apex; prosternal process guttiform (Fig. 5), incurved behind coxae, irregularly punctate. Mesoventrite with V-shaped posterior ridge coarsely punctate, without anterior angle in lateral view. Metaventrite moderately convex, with punctures moderately dense and piligerous. Abdomen weakly convex, densely covered with piligerous punctures; 8th sternite weakly emarginate at apex and slightly depressed in middle (Fig. 6). Defensive glands distinctly and densely annulate as in Fig. 9.

Aedeagus robust (Figs. 7, 8), 0.28–0.30 times as long as elytra (n = 4; average 0.29 times); basale weakly convergent towards base, scarcely emarginate or notched at apex, 2.22–2.89 times as long as apicale (n = 4; average 2.59 times); apicale short, styliform, microscopically punctate, with sides emarginate in apical third.

Legs short and robust. Femora fusiform, densely with setiferous punctures; anterior margins of profemora and posterior margins of meso- and metafemora distinctly ancipital. Tibiae short; outer margins of protibiae densely and minutely denticulate, those of mesotibiae sparsely so; inner margins of protibiae with irregular and minute tubercles. Tarsi simple, compactly articulate.

Female. Space between eyes 5.33–5.71 times as wide as an eye (n = 3; average 5.46 times); pronotum 1.93–2.00 times as wide as long (n = 3; average 1.96 times); elytra widest at middle or basal third, 1.48–1.50 times as long as wide (n = 3; average 1.49 times); ovipositor and tract are shown in Fig. 10, gonostyle lateral, coxite lobes not confused with each other, coxite lobe 1 baculus and paraproct baculus well sclerotized, vagina without window, spermathecal gland short and apical, accessory gland with an arcuate terminal capsule.

Etymology. Patronym. Named in recognition of Dr. Watana Sakchoowong, who always supports MM in his collecting trips and obtaining research permits in Thailand.

Differential diagnosis. The new species is similar to *Platybolium alvearium* Blair, 1938 (type of the genus), but is readily separable from the latter by having the wider and flatter lateral margins of the pronotum and elytra, and by the more shining body surface. They are also distinguished in the following key.

Key to the species of the genus *Platybolium*

1. Body dorsally rugose-punctate, matte; canthus as wide as lateral length of eye; frons densely rugose-punctate, raised in a small elevation above each eye; 3rd antennomere scarcely longer than its apical width; pronotum rugosely punctate throughout; elytra narrowly margined, carinate on each interval, 8th and 9th carinae abbreviated about the level of the base of last abdominal ventrite . . . . . *P. alvearium* Blair, 1938
- Body dorsally not rugose-punctate, shining; canthus wider than lateral length of eye; frons not rugose-punctate, overhanging like eaves on eyes; 3rd antennomere distinctly shorter than its apical width (5:7); pronotum densely punctate throughout, not rugose; elytra with wide and flattened margins, carinate only 8th interval; the carina terminated before apical declivity of elytron. . . . . *P. watanai* **sp. nov.**

Discussion

When Blair (1938) established the genus *Platybolium*, he stated that it belonged to the tribe Triboliini. This treatment has been followed in all subsequent reports (Cherian & Mahadevan 1940; Löbl *et al.* 2008; Pande *et al.* 2015; Dolson *et al.* 2019, etc.). The structure of the ovipositor, female tract, and defensive glands of this genus are reported herein for the first time. Based on character states such as the densely annulate defensive glands, vagina without a distinct bursa copulatrix (Tschinkel & Doyen 1980; Matthews & Bouchard 2008), well-developed accessory gland, and head morphology, we believe that this genus could be in the tribe Alphitobiini. The type species is likely to share the same characteristics, and future investigations are needed, including additional species that may be discovered in the future.

In his description, Blair (1938) reported that *Platybolium alvearium* was collected from excrement of the honeycomb moth *Galleria mellonella* Linnaeus, 1758 (India) and from honey beehives during postprandial feeding (Coimbatore, India). Many subsequent reports on this species (Cherian & Mahadevan 1940; Wilson 1971; Chandra

& Mattu 2017; Dolson *et al.* 2019, etc.) have confirmed that it is a honey beehive parasite and wax-eater. However, seven individuals of the newly described species, *P. watanai* **sp. nov.**, were found in a nest of *Pheidole singaporensis* Özdikmen, 2010, which do not secret wax, unlike honeybees. The beetles were not attacked by ants and even walked among them. Therefore, we are confident that this species is a myrmecophile associated with this ant species. Recently, some new species of beetle symbionts (those of Carabidae and Hydrophilidae) were also found from *P. singaporensis* nests in Southeast Asia (Fikáček *et al.* 2013; Maruyama *et al.* 2016). Of these, *Cryptocephalomorpha siamensis* (Carabidae) was collected in a similar situation, i.e., beetles were walking among ants around the nest entrance. Its congener *Cryptocephalomorpha* sp. was also found together with *P. watanai* **sp. nov.** Although we were unable to observe their behavior in detail, they are most probably ant nest scavengers because *P. singaporensis* usually have large debris dumps in the nest (Maruyama, pers. obs.).

It is interesting that one of the two closely related species is associated with bees and the other with ants. Morphologically, neither species is very specialized as a symbiotic insect. *Platybolium watanai* has a pronotum and elytra with wider, flatter margins, which suggests a higher degree of morphological specialization. This character state is common in other myrmecophilous beetles, such as *Amphotis marginata* (Fabricius, 1781) (Nitidulidae) and *Holloceratognathus passaliformis* (Holloway, 1962) (Lucanidae). Its function is not fully understood, but it probably evolved to respond to attacks from ants. In both species, each femur has a longitudinal groove that holds the tibia. This character state is also observed in non-inquilinous tenebrionids, but could be a functional adaptation for living in bee and ant nests. It is not known which symbiotic relationship evolved first in this genus, that with honeybees or ants, but this is worth considering when other species are found.

Separately from *P. watanai*, several individuals of another tenebrionid *Platydema cechenosternoides* Kaszab, 1982 were found near the same ant nest, albeit slightly farther from the ant nest than where *P. watanai* was found and it is unclear whether it is related to this ant; *Platydema cechenosternoides* is a little recorded species despite its conspicuous coloration, and may have a special ecology, so we cannot rule out at relationship with the ant.

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