

Additional species and records of the “horn-backed” *Pilophorus* plant bugs in Southeast Asia (Heteroptera: Miridae: Phylinae)

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Three new species of the “horn-backed” phylinae plant bug genus *Pilophorus* Hahn, namely, *P. erinaceulus*, *P. maruyamai* and *P. parvolus*, are described from Borneo, Malaysia and Sumatra, Indonesia. The following species are newly recorded within Southeast Asia: *P. lambirensis* from the Malay Peninsula; *P. laticollaris* from Sumatra; *P. longirostris* and *P. multivillus* from Borneo. A supplementary key to the key by Nakatani et al. (2013) is provided.

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Introduction

The phylinae plant bug genus *Pilophorus* Hahn, 1926 from Southeast Asia, has been treated by Carvalho (1986), Schuh (1984, 1989), Zhang & Liu (2009), Zou (1983, 1987, 1989) and others. This genus is known to be myrmecomorphic: Yasunaga & Schuh

(2013) reported that *Pilophorus pleiku* (Schuh, 1984) is associated with ants on its host plant. Nakatani et al. (2013) described seven *Pilophorus* species which are mingled with *Crematogaster* (*Decacrema*) ants (Formicidae) on *Macaranga* trees from the Malay Peninsula and Borneo. At least some of them pilfer

and feed on food bodies which are produced by *Macaranga* spp. as a reward for protection by ants. Shimizu-kaya et al. (2015) report the feeding on food bodies by *Pilophorus* spp. including *P. unifasciatus*. The *Pilophorus* species associated with *Macaranga* trees commonly exhibit a unique feature, namely, the scutellum is elevated to form a conical, horn-like process and it is possible that the process is formed as a result of ant mimicry.

In the course of the recent survey, three undescribed species of “horn-backed” *Pilophorus* species were found on Borneo, Malaysia and Sumatra, Indonesia. Herein, we describe three new species and record new distributional data of four species (Fig. 1).

Material and methods

All specimens examined in this study were collected from myrmecophytic *Macaranga* spp. which are associated with *Crematogaster* ants in the Malay Peninsula, Borneo (Malaysia) and Sumatra (Indonesia). Specimens were preserved in absolute ethanol when they were collected and later kept as dried specimens. Appendages that dropped off during the stay in ethanol were mounted on a separate piece of paper and pinned with the specimen body and labels. The terminal segments of the abdomen were boiled in 5% KOH solution for 5 minutes to observe the genital structures. All measurements are given in millimeters. All new species are accredited to Nakatani and Komatsu. The following acronyms are used in the text: Forest Research Center,

Sarawak, Malaysia (FRCS), Museum Zoologicum Bogoriense, Bogor, Indonesia (MBBJ) and National Institute for Agro-Environmental Sciences, Tsukuba, Japan (NIAES). Area names with an asterisk mean new distributional records.

Pilophorus erinaceulus Nakatani & Komatsu sp. n.

Pilophorus sp. 1: Shimizu-kaya et al. 2015: 112 (Table 3), Fig. 17.

Figs 2, 3, 8, 11, 12, 19–22

Type material. Holotype, ♂, **Malaysia**, Sarawak, Miri, Lambir Hills National Park, 23.iv.2014, U. Shimizu-kaya leg. (FRCS). Paratypes, 1 ♂/2 ♀ (female specimens are teneral), same data as for holotype (FRCS, NIAES).

Diagnosis

Recognized by the slender and bright brown body, tufts of bristles on head, scutellum and hemelytra. This new species is similar to *P. multivillus* Nakatani & Komatsu, 2013, from which it can be discriminated by the antenna with a thin and cylindrical segment II and an elongate segment IV, and by the absence of an anterior band of scale-like setae on clavus.

Description

Slender-bodied, length apex tylus–cuneal fracture 2.52.

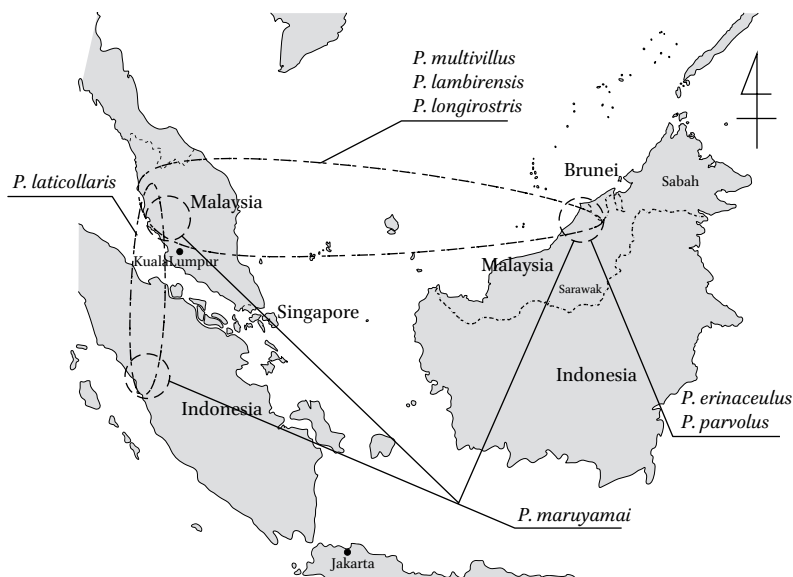


Fig 1. Distribution map of *Pilophorus* spp.



Figs 2–7. *Pilophorus* spp. – 2, 4, 6, dorsal aspect; 3, 5, 7, lateral aspect; 2, 3, *P. erinaceulus*, paratype, male; 4, 5, *P. maruyamai*, holotype; 6, 7, *P. parvulus*, holotype. Scale: 2 mm.

Coloration. Body castaneous. Head anterior part slightly pale. Antenna brown; basal part of segment III narrowly pale. Labium widely yellowish brown; apical half of segment IV infuscate. Pronotum widely castaneous and gradually paler anteriorly; prosternum pale yellowish brown. Mesoscutum and scutellum castaneous; mesepisternum and mesepimeron slightly paler. Hemelytra brown; posterior part of corium and cuneus castaneous; membrane dark gray. Legs widely brown; basal half of fore coxae and apical half of middle and hind coxae pale; pale spots at base of trichobothria on hind femur. Abdomen castaneous.

Surface and vestiture. Dorsum with characteristic tufts composed of long, thick, black erect bristles. Head, pronotum and scutellum moderately polished. Head with rows of black bristles on margin of eyes and hind margin of vertex. Pronotum almost glabrous. Scutellum without scale-like setae; tip of process on scutellum with tuft of bristles. Hemelytra matte and covered sparsely with dark setae; laterally with long reclining brown setae; posterior part of corium and cuneus shiny; anterior band of scale-like

setae on corium at level of apex of scutellum; posterior band of scale-like setae complete, placed at level of apex of clavus; clavus with a band of scale-like setae; four tufts of bristles on clavus; a large tuft at inner margin of corium; golden appressed setae scattered on area between two bands of setae on clavus and most of corium; a patch of scale-like setae on mesepimeron. Abdomen densely covered with long reclining setae; segments II–IV each laterally with patches of scale-like setae.

Structure. Face broader than height in frontal view (Fig. 8). Antennal segment II cylindrical. Labium extending to middle coxa. Pronotum strongly swollen and elevated posteriorly and lateral margin slightly concave. Mesoscutum broadly exposed; scutellum strongly swollen and elevated, forming process with rounded apex. Sensory lobe of left paramere well developed, with flat and rounded process. Endosoma C-shaped, without process medially.

Dimensions (δ). Total body length: 3.25; maximum width across hemelytra: 0.95; head width: 0.93; distance from tip of tylus to vertex: 0.78; vertex width: 0.40; length of antennal segments I–IV: 0.43, 1.50,

0.53, 0.90; length of labial segments I–IV: 0.38, 0.40, 0.28, 0.35; width of pronotum: 0.99; length of hind femur, tibia and tarsus: 1.45, 2.08, 0.43.

Host plant

Collected on *Macaranga winkleri* Pax & K.Hoffm., 1914.

Biology

This new species was found on new leaves and stems of the apical parts of *M. winkleri*, which plant-symbiotic ants protect intensely (Figs 11, 12). During our observation, the bugs avoided being attacked, though they did not present any conciliatory behavior towards the ants. This species is different from other *Pilophorus* species on *Macaranga* plants in that it has been found only on mature trees of the host plant species (Figs 17, 18).

Etymology

From Latin, *erinaceus* (hedgehog), referring to the bristle-like spines of hedgehogs.

Pilophorus maruyamai Nakatani & Komatsu sp. n.

Pilophorus sp. 2: Shimizu-kaya et al. 2015: 112 (Table 3), Fig. 17.

Figs 4, 5, 9, 13, 23–26

Type material. Holotype, ♂, **Malaysia**, Pahang, Cameron Highlands, Brinchang, 8.viii.2013, T. Komatsu leg. (NIAES). Paratypes, Malaysia, 1 ♂, Borneo, Sarawak, Miri, Lambir Hills National Park, 19.vi.2013, U. Shimizu-kaya leg.; 1 ♀, 30.vi.2013, 2 ♂/2 ♀, 21.iv.2014, same locality and collector (FRCS, NIAES). **Indonesia**, 1 ♂/2 ♀, Sumatra, Padang, Pauh, Kampus Limau Manis, 27.ix.2013, T. Komatsu leg. (MBBJ, NIAES).

Diagnosis

Recognized by the elongate labium which reaches the middle of the abdomen and thick process on

scutellum. This new species is closely related to *P. longirostris* Nakatani & Komatsu, 2013, from which it can be distinguished by the band of scale-like setae on clavus adjacent to the inner patch of setae on corium.

Description

Small, short-bodied, length apex tylus–cuneal fracture 2.3–2.50.

Coloration. Body castaneous with a broad ocherous band. Head widely pale except vertex castaneous. Antennal segments I and basal half of II reddish brown; basal region of III and IV white; apical half of II and III, and most part of IV infusate. Pronotum castaneous; pleurites somewhat brighter; prosternite yellowish brown; mesosternite castaneous. Hemelytra region anterior to posterior band of scale-like setae ocherous, remainder castaneous; membrane dark gray. Legs yellowish brown; fore coxae usually reddish brown, sometimes basal half paler; apical part of middle femora and apical half of hind femora posteriorly tinged with red; middle and hind tibiae widely infusate. Abdominal segments II–IV yellowish brown, remainder reddish brown.

Surface and vestiture. Head, pronotum and scutellum shiny. Apex of scutellum with a patch of scale-like setae. Hemelytra widely matte; posterior part of corium and cuneus shiny; anterior band of scale-like setae at level of apex of scutellum; posterior band of scale-like setae on corium discontinuous, appearing as two small patches, inner one adjacent to the band on clavus; hemelytra anterior to change in surface texture broadly covered with golden appressed setae. Mesepimeron with a patch of scale-like setae. Abdominal segments II–IV each with a pair of patches of scale-like setae laterally.

Structure. Antennal segment II weakly tumid apically. Labium elongate, reaching middle of abdomen. Pronotum strongly inflated. Mesoscutum broadly exposed; scutellum strongly swollen and elevated, forming thick conical process. Sensory lobe of left paramere with flattened, spatula-like process. Right



Figs 8–10. Head, frontal aspects of *Pilophorus* spp. – 8, *P. erinaceulus*, holotype; 9, *P. maruyamai*, holotype; 10, *P. parvulus*, holotype.

paramere broad. Endosoma elongate C-shaped, without process medially.

Dimensions (♂/♀). Total body length: 3.08/3.16; maximum width across hemelytra: 1.19/1.26; head width: 0.76/0.84; distance from tip of tylus to vertex: 0.65/0.68; vertex width: 0.42/0.42; length of antennal segments I–IV: 0.23/0.25, 0.86/0.97, 0.30/0.32, 0.47/0.53; length of labial segments I–IV: 0.44/0.49, 0.44/0.44, 0.37/0.40, 0.46/0.49; width of pronotum: 1.06/1.14; length of hind femur, tibia and tarsus: 1.04/1.10, 1.41/1.54, 0.32/0.34.

Host plants

Collected on *Macaranga bancana* (Miq., 1866) and *M. hullettii* King ex Hook.f., 1887.

Biology

This new species was found mainly on the apex, stems and petioles around the apical parts of *M. bancana* (Fig. 13). The interaction between the bugs and plant-symbiotic ants was similar to that of *P. erinaceulus*.

Etymology

Named after Associate Professor Munetoshi Maruyama (Kyushu University) who supported our survey.

Distribution

Malaysia (Malay Peninsula, Borneo), Indonesia (Sumatra).

Pilophorus parvulus Nakatani & Komatsu

sp. n.

Pilophorus sp. 4: Shimizu-kaya et al. 2015: 112 (Table 3), Fig. 17.

Figs 6, 7, 10, 14, 15, 27–30

Type material. Holotype, ♂, **Malaysia**, Borneo, Sarawak, Miri, Maxwell Hill, 25.vi.2013, U. Shimizu-kaya leg. (FRCS). Paratypes, 1 ♀ (teneral specimen), 23.iv.2013, 4 ♂/2 ♀ (five teneral specimens are included), 19–30.vi.2013, same locality and collector as for holotype (FRCS, NIAES).

Diagnosis

Recognized by the small body, elongate labium, and discontinuous posterior band of scale-like setae on corium. This new species is closely related to *P. unifasciatus* Nakatani & Komatsu, 2013.

Description

Small, short-bodied, length apex tylus–cuneal fracture 1.75–1.93.

Coloration. Body castaneous with a broad ocherous band. Frons and vertex castaneous; jugum and lorum pale brown, slightly tinged with red. Antenna pale yellowish brown; apical 1/3 of antennal segments II, apical half of segment III and most

of IV except base infusate. Labium pale yellow with apex infusate. Pronotum castaneous; prosternum pale yellowish brown slightly tinged with red; mesepimeron castaneous; ostiolar peritreme pale yellowish brown. Hemelytra widely ocherous; posterior part of band of scale-like setae of clavus and posterior 1/4 of outer corium infusate; membrane dark gray. Legs pale yellow; apical 3/4 of hind femora with reddish brown markings; middle and hind tibial spines dark brown. Abdomen castaneous or reddish brown; segments II–IV somewhat paler ventrally.

Surface and vestiture. Head, pronotum and scutellum shiny. Apex of scutellum with patch of scale-like setae. Hemelytra widely matte; infusate area shiny; anterior band of scale-like setae on corium at level of apex of scutellum; posterior band of scale-like setae on corium divided into two separate patches, inner patch combined with band on clavus, outer one nearby lateral margin; hemelytra with scattered golden appressed setae anterior to posterior band of scale-like setae. Mesepimeron with a patch of scale-like setae. Abdominal segments II–IV each with a pair of patches of scale-like setae laterally.

Structure. Face slightly longer than width in frontal view (Fig. 10). Antennal segment II cylindrical. Labium elongate, extending beyond middle of abdomen. Pronotum moderately swollen and elevated posteriorly, lateral margins concave. Mesoscutum widely exposed; scutellum swollen and elevated, forming moderately protruded process with round apex. Endosoma with thin and curved process medially.

Dimensions (♂/♀). Total body length: 2.17/2.35; maximum width across hemelytra: 0.71/0.89; head width: 0.55/0.57; distance from tip of tylus to vertex: 0.57/0.61; vertex width: 0.30/0.35; length of antennal segments I–IV: 0.22/0.25, 0.86/0.85, 0.24/0.30, 0.52/0.55; length of labial segments I–IV: 0.37/0.36, 0.33/0.31, 0.32/0.32, 0.36/0.41; width of pronotum: 0.71/0.83 length of hind femur, tibia and tarsus: 0.93/0.93, 1.31/1.34, 0.37/0.33.

Host plant

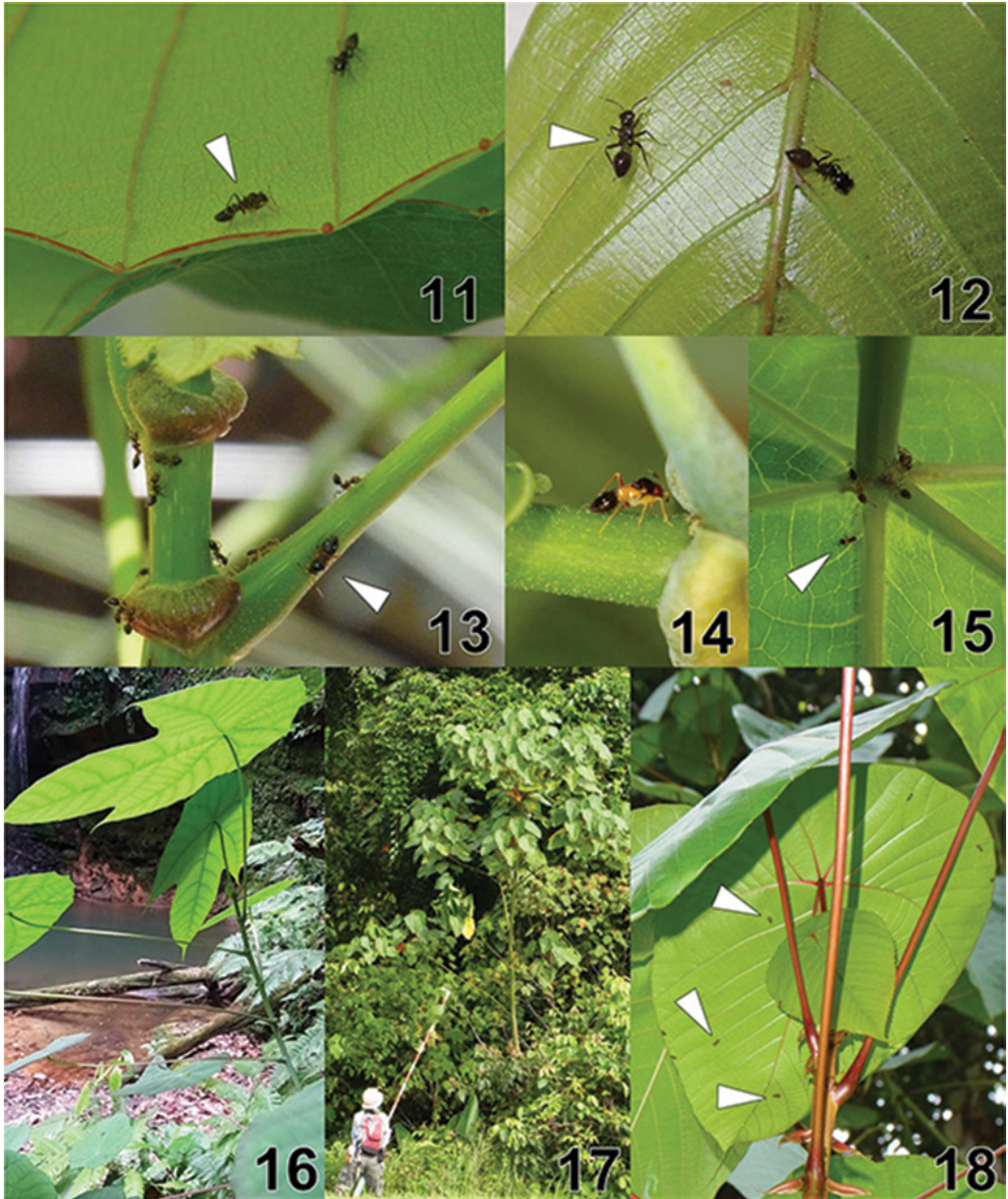
Collected on *Macaranga havilandii* Airy Shaw, 1969 (Fig. 16).

Biology

This new species was found on the abaxial side of new leaves and stems around apical parts of *M. havilandii*, where they often settle near the petiole insertion (Fig. 15). The interaction between the bugs and plant-symbiotic ants was similar to that of *P. erinaceulus* and the other *Pilophorus* species found on *Macaranga* plants.

Etymology

From Latin, parvulus (tiny), referring to the small body size of this new species.



Figs 11–18. Live images of *Pilophorus* spp. and their host plants, *Macaranga* spp. – 11, 12, *P. erinaceulus* on *M. winkleri* with ants, 11, adult, 12, nymph; 13, *P. maruyamai*, adult with ants; 14, 15, *P. parvulus* on *M. bancana*, 14, adult, 15, nymph with ants; 16, young tree of *M. havilandii*; 17, 18, *M. winkleri*. White triangles indicate *Pilophorus* plant bugs.

Pilophorus lambirensis Nakatani et Komatsu, 2013

Pilophorus lambirensis: Nakatani et al. 2013: 118.

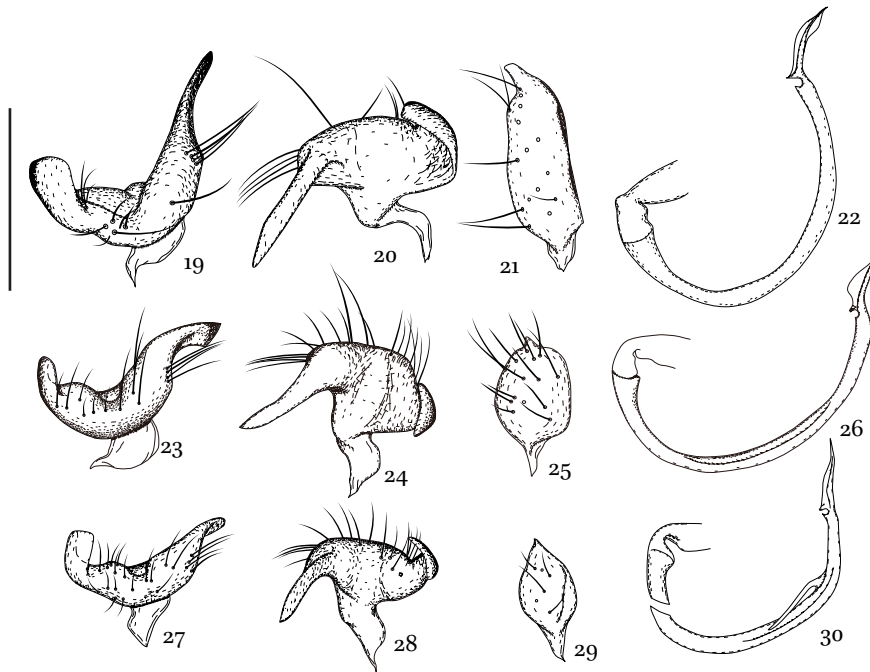
Material examined. Malaysia, Selangor, Ulu Gombak, 1 ♀, 10.viii.2013, T. Komatsu leg. (NIAES).

Note

The specimen examined here was collected from *M. bosei* King ex Hook. f., 1887.

Distribution

Malaysia (*Malay Peninsula, Borneo).



Figs 19–30. Male genitalia of *Pilophorus* spp. – 19, 20, 23, 24, 27, 28, left paramere; 21, 25, 29, right paramere; 22, 26, 30, endosoma; 19–22, *P. erinaceulus*, holotype; 23–26, *P. maruyamai*, holotype; 27–30, *P. parvulus*, holotype. Scale: 0.2 mm.

Pilophorus laticollaris Nakatani et Komatsu, 2013

Pilophorus laticollaris: Nakatani et al. 2013: 122.

Material examined. Indonesia, Sumatra, Padang, Pauh, Kampus Limau Manis, 2 ♂, 1 ♀, 28.xi.2013, T. Komatsu leg. (NIAES).

Note

The specimens examined here were collected from *M. hypoleuca* (Rchb. f. & Zoll., 1866).

Distribution

Malaysia (Malay Peninsula), Indonesia (*Sumatra).

Pilophorus longirostris Nakatani et Komatsu, 2013

Pilophorus longirostris: Nakatani et al. 2013: 118.

Material examined. Malaysia, Sarawak, Miri, Lambir Hills National Park, 2♂, 1♀, 28.vi.2013, U. Shimizu-kaya leg. (FRCS, NIAES).

Note

The specimens examined here were collected from *M. bancana* (Miq., 1866).

Distribution

Malaysia (Malay Peninsula, *Borneo).

Pilophorus multivillus Nakatani et Komatsu, 2013.

Pilophorus multivillus: Nakatani et al. 2013: 122.

Pilophorus sp. 3: Shimizu-kaya et al. 2015:112 (Table 3), Fig. 17.

Material examined. Malaysia, Sarawak, Miri, Lambir Hills National Park, 1♂, 1♀, 16.iv.2014, U. Shimizu-kaya leg. (FRCS, NIAES).

Note

Though generally specimens from Sarawak, Borneo, are slightly shorter than ones from the Malay Peninsula, no difference was observed in male genital structure. The specimens examined here were collected from *M. bancana* (Miq., 1866).

Distribution

Malaysia (Malay Peninsula, *Borneo).

Supplemental key to key for “horn-backed” species of *Pilophorus* in Malaysia in Nakatani et al. (2013)

1. Labium elongate, extending beyond the middle of abdomen 1'
 - Labium short, at most reaching hind coxa only 2

- 1'. Band of scale-like setae on clavus apart from inner posterior band on corium; pronotum and scutellum strongly shiny and strongly elevated *P. longirostris*
- Band of scale-like setae on clavus adjacent to inner posterior band on corium; pronotum and scutellum weakly shiny and elevated almost to the same level as in other “horn-backed” species 1”
- 1”. Body large, length of apex tylus–cuneal fracture more than 2.3 mm, fore coxa red or reddish brown *P. maruyamai*
- Body small, length of apex tylus–cuneal fracture less than 2 mm, usually 1.7–1.9 mm; coxae entirely pale *P. parvulus*
3. Head covered with long and thick bristles; hemelytra with many tufts of bristles 3'
- Head without bristles; hemelytra with a tuft of bristles at apex of clavus 4
- 3'. Antennal segment II more or less tumid, segment IV slightly longer than III; clavus with two bands of scale-like setae *P. multivillus*
- Antennal segment II cylindrical and thin, segment IV almost twice of III in length; clavus with a band of scale-like setae *P. erinaceulus*

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