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Five new species of *Peltonotus* Burmeister (Scarabaeidae: Dynastinae: Cyclocephalini) from Southeast Asia

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Abstract. The Southeast Asian scarab beetle genus *Peltonotus* Burmeister (Scarabaeidae: Dynastinae) is associated with aroid flowers and possesses a unique, articulated maxillary tooth. We describe five **new species** of *Peltonotus*: *P. animus* and *P. cybele* from Sumatra, *P. favonius* from Vietnam, *P. mushiyaus* from Borneo, and *P. tigerus* from Thailand. The circumscription of *P. karubei* Muramoto is broadened to include new color variation, and the body size range for the genus is increased with *Peltonotus mushiyaus,* n. sp., now being the smallest member of the genus. We provide an amended key to species, distribution maps, diagnoses and accompanying comparative images, and discuss classification of the genus within the Scarabaeidae.

Keywords. Borneo, Sumatra, Thailand, Vietnam, Rutelinae

Introduction

Members of the scarab genus *Peltonotus* Burmeister (Scarabaeidae: Dynastinae: Cyclocephalini) are associated with aroid flowers (Araceae) and are distributed in southeast Asia (Fig. 25-27)(Jameson and Wada 2004). With the transfer of *Peltonotus* to the tribe Cyclocephalini (Smith 2006), the tribe now includes two genera that are distributed in the Old World, the other being *Ruteloryctes* Arrow in Africa. Within Southeast Asia, the genus *Peltonotus* most resembles the dynastine genera *Neohyphus* Heller and *Melanhyphus* Fairmaire (both Dynastinae: Orcytoderini). Species of *Peltonotus* are separated from species in those genera based upon the apex of the labrum projecting anteriorly beyond the clypeus (retracted under the clypeus in *Neohyphus* and *Melanhyphus*), and a frontoclypeal suture that is not raised (raised in *Melanhyphus*; not raised in *Neohyphus*). Additionally, *Peltonotus* is unique within the Scarabaeidae for possessing an articulated maxillary tooth (see Fig. 29-30 in Jameson and Wada 2004). Species in the genus possess a black or castaneous pronotum with black, castaneous, or reddish elytra, sometimes with black or castaneous elytral maculae. Body length ranges from about 1-2 cm. One new species described herein (*P. mushiyaus,* n. sp.) extends the circumscription of the genus because of its small size: at 11.8 mm, *P. mushiyaus,* n. sp. is the smallest species in the genus.

The revision of the genus *Peltonotus* (Jameson and Wada 2004) provided numerous species-specific, diagnostic characters (e.g., form of mentum, maxilla, female epipleuron, male parameres, protibia). However, for some species, only one sex is known, creating difficulties in identification and association of males and females. With the inclusion of these new species, six species lack known males: *P. cybele*, n. sp., *P. kyojinus* Jameson and Wada, *P. mushiyaus*, n. sp., *P. nethis* Jameson and Wada, *P. pruinosus* Arrow, and *P. tigerus*, n. sp. The following four species lack known females: *P. deltomentum* Jameson and Wada, *P. favonius*, n. sp., *P. karubei* Muramoto, and *P. animus,* n. sp. This lack of information should be considered when attempting to identify specimens.

Similar to cyclocephaline scarab beetles of the New World that pollinate and feed on aroid and palm flowers (Ratcliffe and Cave 2006), species of *Peltonotus* are also associated with aroids (Jameson and Wada 2004). The arum family (Araceae) includes over 3700 species and 107 genera. It is most diverse in the New World tropics but is also represented in the Old World tropics and north temperate regions. Aroid

inflorescences are elongate and usually surrounded by a modified leaf called a spathe. Many aroids are thermogenic (heat-producing) with flowers reaching up to 45° Celsius (Bay 1995). The high temperature produces volatile compounds that attract beetles. While feeding and mating on the flower, beetles become coated with sticky pollen. Because species of *Peltonotus* are intimately tied to habitat and the aroids they use for mating sites and nutrition, it is possible that many new species await discovery. Nine species were included in the genus before it was revised in 2004 (Jameson and Wada 2004). Ten species (111% increase) were added to the genus by Jameson and Wada (2004), increasing the diversity to 19 species. With the addition of the five species we describe herein, the genus now includes 24 species: 13 species distributed on the island of Borneo, four on the island of Sumatra, one in peninsular Malaysia, and six in mainland Asia from Nepal in the west to Vietnam in the east.

Habitat loss continues at a high rate, particularly in the rainforest habitats of Southeast Asia (Bradshaw et al. 2009) which are the home to *Peltonotus* species. Deforestation has negative ramifications for pollination and survival of flowering plants, among them the aroids that are pollinated by *Peltonotus* species. Declines in forest pollinators reduce plant reproduction in neighboring agricultural areas (Sodhi et al. 2007). In Southeast Asia, for example, 2.5 million hectares of rainforest were destroyed between 1990-1997 (Archard et al. 2002), 1.5 million hectares were destroyed in Indonesia between 1990-1997 (Archard et al. 2002), and in Thailand, 50% of the primary and secondary forests were destroyed between 1970-1990 (Bradshaw et al. 2009). These deforestation rates lead to extinction of a large number of cryptic and poorly studied taxa (Bradshaw et al. 2009), and among them could be members of the genus *Peltonotus*.

Classification of the genus *Peltonotus*

The genus *Peltonotus* was described over 150 years ago (Burmeister 1847), and classification of the genus vacillated between the scarab subfamilies Dynastinae and Rutelinae until very recently. Classification conflicts were due to a lack of character-based circumscription for the subfamilies Dynastinae and Rutelinae (Jameson 2000; Jameson and Ratcliffe 2009). Phylogenetic methods and character-based monography have assisted in creating a more stable classification. Phylogenetic analysis of the tribe Rutelini (Rutelinae) that included member of the genus *Peltonotus* provided character support that suggested that *Peltonotus* was more closely related to members of the Dynastinae (tribe Cyclocephalini) than to members of the Rutelinae (Jameson 1998; Jameson and Wada 2004). Phylogenetic analyses of the Scarabaeoidea based on molecular data (Smith et al. 2006) corroborated the morphological data, placing the genus *Peltonotus* firmly within the Dynastinae. Molecular analyses provide strong support that *Peltonotus* + *Parastasia* Westwood form a clade that is sister to all remaining Dynastinae + Rutelinae (Smith et al. 2006). Jameson (1998) hypothesized that the genus *Peltonotus* might be a member of the Cyclocephalini, but Jameson and Wada (2004) declined assigning *Peltonotus* to a tribe within the Dynastinae due to lack of additional data. Based on strong molecular support, Smith (2006) assigned *Peltonotus* to the dynastine tribe Cyclocephalini (Dynastinae).

Methods and Material

Characters and specimens were examined using a dissecting microscope (6.3–50.0 times magnification) and fiber-optic illumination. Morphological characters used for species identification (including puncture size and density; type of setae; form of male protibia; form of female epipleuron) are defined in Jameson and Wada (2004). Digital images of specimens and structures were captured using the Auto-Montage imaging system by Syncroscopy. Images were edited in Adobe Photoshop CS2 (background removed, contrast manipulated).

We use the phylogenetic species concept (Wheeler and Platnick 2000) in this work: "A species is the smallest aggregation of (sexual) populations or (asexual) lineages diagnosable by a unique combination of character states." Formation of specific epithets follows conventions in International Code of Zoological Nomenclature (1999) and Blackwelder (1967). The generic name *Peltonotus* is considered masculine in gender (Jameson and Wada 2004).

Specimens examined in this research were borrowed from the following institutions: Masayuki Fujioka Collection, Tokyo, Japan (**FUJI**); Mary Liz Jameson Collection, University of Nebraska State Museum, Lincoln, NE, USA (**MLJC**); National Science Museum (N.H.), Tokyo, Japan (curator Shuhei Nomura)

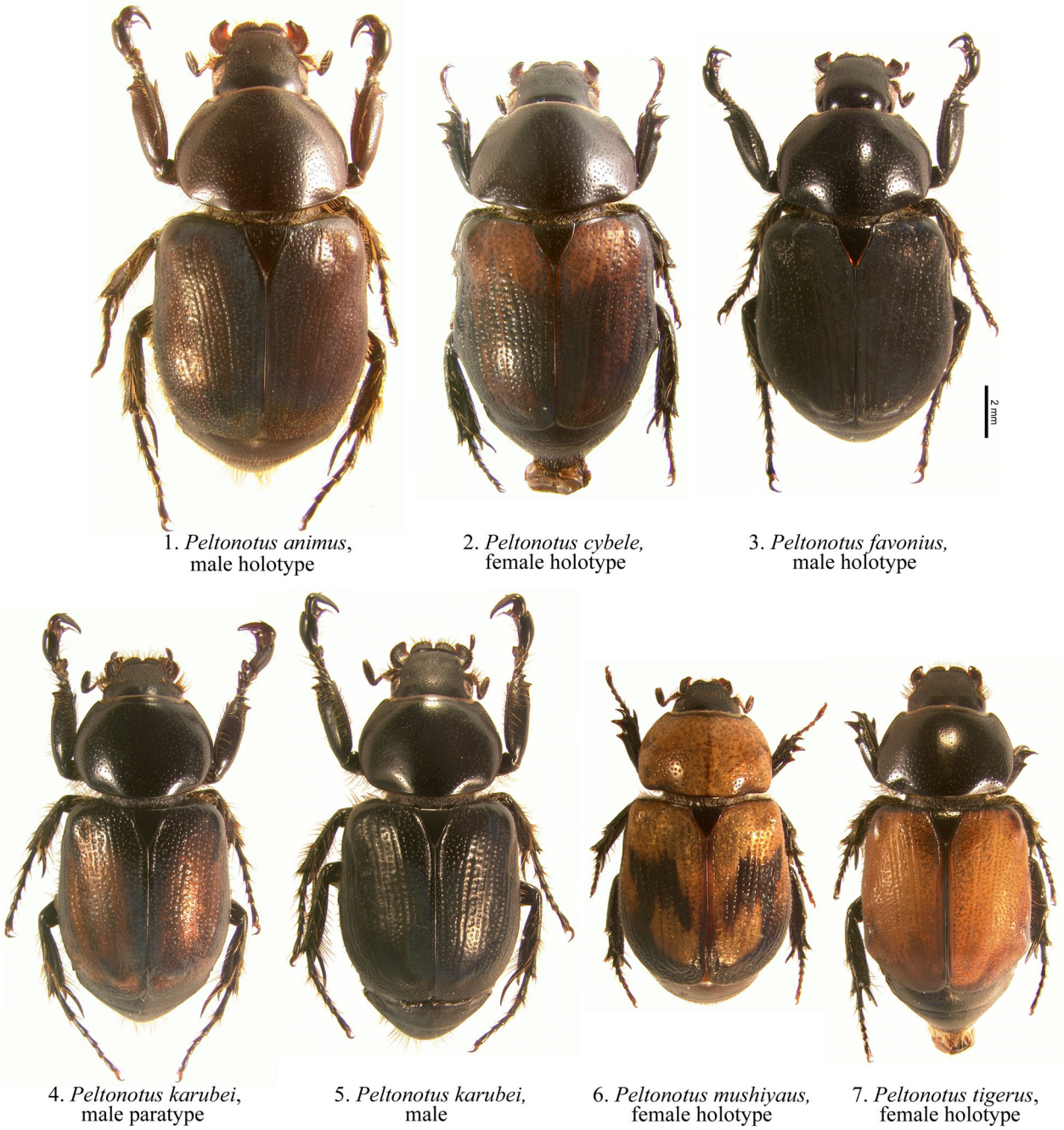

Figure 1-7. *Peltonotus* species dorsal habitus. **1)** *P. animus* (holotype, male). **2)** *P. cybele* (holotype, female). **3)** *P. favonius* (holotype male). **4)** *P. karubei* (male paratype). **5)** *P. karubei* (male) showing variation. **6)** *P. mushiyaus* (holotype female). **7)** *P. tigerus* (holotype female). Scale bar = 2 mm.

(**NSMT**); Kaoru Wada Collection, Tokyo, Japan (**WADA**); Queen Sirikit Botanic Garden Entomology Collection, Chiang Mai, Thailand (**QSBG**); and University of Kentucky Department of Entomology, Lexington, Kentucky (curator Michael Sharkey) (**HICC**).

***Peltonotus animus* Jameson and Wada, n. sp.**
(Fig. 1, 8, 17a-b, 24, 25)

Type Material. Holotype male housed at WADA (from WADA) with following label data and with male genitalia and maxilla mounted beneath specimen: a) "Bukit, Tinggi, 1-VII-1991" (hand-written, black ink), b) "This species near Peltonotus silvanus but differ Genitalia and color" (hand-written, black ink), c) our holotype label.

Description. Holotype male. Length 16.5 mm. Widest width 7.7 mm. *Color* (Fig. 1): Head, pronotum, scutellum, pygidium, elytron, and venter castaneous. Elytra with weak iridescent bloom. *Head*: Surface of frons with base sparsely punctate, disc and apex moderately densely punctate; punctures simple, multisetigerous at apex; setae minute (1-20+ per puncture) and moderately long (0-1 per puncture). Surface of clypeus moderate densely punctate; punctures simple, multisetigerous; setae minute (1-20+ per puncture) and moderately long (0-1 per puncture). Clypeus laterally weakly bowed, apex truncate, corners square, beaded; bead weakly arcuate posteriorly. Labrum broadly emarginate at middle. Mandible with external edge rounded, inner apex with 2 teeth. Mentum with apical half rounded, notched at middle; palpomere 2 dorsoventrally flattened, about 2.5 times width of palpomere 1, setose; setae dense, moderately long, rufous, weakly thickened, some setae curled at the apex. Maxilla (Fig. 8): Mala with dense lamellate setal brush; stipes with setae dense, long, not flattened at apex, some curled at apex; palpomere 2 with internomedial bump. Antennal club slightly longer than segments 2-7. *Pronotum*: Bead lacking anterior to scutellum; anterior bead incomplete at middle. Surface moderately densely punctate; punctures simple, lacking setae. Lateral margin lacking long setae. *Elytron*: Sutural length about 4.0 times length of scutellum. Surface with 5 moderately developed, punctate, longitudinal striae between suture and humerus; punctures ocellate, moderate in size, moderately dense, some multisetigerous at apex; setae minute (1-20+ per puncture). Intervals similarly sculptured. *Propygidium*: Surface shagreened and moderately densely punctate; punctures simple, unisetigerous; setae moderate in length, tawny and rufous. *Pygidium*: Surface moderately densely punctate; punctures ocellate, unisetigerous (base to disc) and multisetigerous (apex); setae minute (7-12+ per puncture) and moderately long (0-1 per puncture). *Venter*: Prosternal keel elongate; apex projecting anteriorly at about 90° with respect to ventral plane, extends to about 1/2 height of protrochanter, truncate. *Legs*: Protibia (Fig. 24) of male tridentate (basal tooth obsolete); lateral margin with short, dense setae. Protarsomere 5 subequal in length to tarsomeres 1-4, greatly thickened; protarsomeres 3-4 with apices expanded, dorsal and ventral apices of tarsomeres 1-4 clothed dense, short setae. Anterior claws with inner claw broadly curved, about 3 times thicker than outer claw; outer claw elongate-arcuate, about 1/2 the length of inner claw; empodium bulbous at base. Meso- and metatibial claws of male with 2 setae, claw angled toward venter, about 3/4 length of metatarsomere 5. Metatibia of male with apical spurs nearly straight; ventral spur produced to middle of metatarsomere 1, dorsal spur produced to middle of metatarsomere 2. *Parameres*: Fig. 17a-b.

Diagnosis. *Peltonotus animus* is most similar to *P. silvanus* Jameson and Wada, but it is distinguished based on the following characters: mala with setae curled at the apices (Fig. 8) (not curled in *P. silvanus*); pronotum lacking setae laterally and apically (multisetigerous laterally and apically in *P. silvanus*); elytral sutural length 4.0 times length of scutellum (3.2 times length of scutellum in *P. silvanus*); elytra with 5 moderately developed, punctate striae (7 striae in *P. silvanus*); propygidium with simple, unisetigerous punctures (multisetigerous with minute and long setae at apex of propygidium in *P. silvanus*); pygidium multisetigerous only at apex (pygidium entirely multisetigerous in *P. silvanus*, with minute and long setae); and form of the male genitalia (Fig. 17a-b).

Peltonotus animus is easily separated from other species in the genus based on the form of the male genitalia (Fig. 17a-b), form of the mouthparts (labial palpomere 2 greatly enlarged, maxilla with lamellate setal brush [Fig. 8], and maxillary stipes with long setae, some of which are curled at the apex [Fig. 8]), and protibia tridentate with basal tooth obsolete (Fig. 24).

Etymology. The specific epithet "*animus*" is derived from the Latin "*anima*" meaning soul or life, in reference to the cultural traditions of the Minangkabau cultural group in West Sumatra. The Minangkabau cultural beliefs were derived from "animism", and remnants of those beliefs still exist in the region.

Figure 8-13. Maxilla (dorsal view) showing mala with or without lamellate setal brush (black arrow) and form. **8)** *P. animus* (holotype). **9)** *P. cybele* (holotype). **10)** *P. favonius* (holotype). **11)** *P. karubei*. **12)** *P. mushiyaus* (holotype). **13)** *P. tigerus* (holotype).

Animism refers to the belief that non-human entities, such as animals, plants, and natural phenomena can have souls. Often these entities must be placated by offerings in order to gain favors. We name this species in reverence to the forest spirits in the Minangkabau region.

Distribution (Fig. 25). Central Sumatra, Indonesia.

Locality records (1 specimen) from WADA (deposited in WADA). INDONESIA (SUMATRA). *West Sumatera Province* (1): Bukittinggi.

Temporal Data. July (1).

Remarks. Based on its distribution, *P. animus* is probably sympatric with *P. gracilipodus* Jameson and Wada and *P. cybele*. We considered that *P. animus* could be associated with *P. cybele* (known only from one female), but the form of the mouthparts clearly indicate that these are different species.

In the key to species (Jameson and Wada 2004), *P. animus* keys most closely to *P. malayensis* Arrow because some setae on the maxillary stipes are apically curly. However, the form of the male genitalia indicates that these are two distinct species.

***Peltonotus cybele* Jameson and Wada, n. sp.**
(Fig. 2, 9, 19, 25)

Type Material. Holotype female housed at WADA with following label data and maxilla card-mounted beneath specimen: a) "Padang, W. Sumatra, INDONESIA, Jun. 1 1989" (handwritten, black ink), b) "24" (handwritten on light green label), c) "new?" (handwritten, black ink), d) our holotype label.

Description. Holotype female. Length 14.5 mm. Widest width 7.2 mm. *Color* (Fig. 2): Head, pronotum, scutellum, propygidium, pygidium, and venter castaneous; elytra castaneous, suffused with dark red and with iridescent bloom. *Head*: Surface of frons impunctate (base to mid-disc) to moderately densely punctate (mid-disc to apex); punctures simple, some unisetigerous; setae minute. Surface of clypeus moderately densely punctate (base to mid-disc) to densely, confluently punctate (mid-disc to apex); punctures simple, some unisetigerous; setae minute. Clypeus laterally weakly bowed, apex truncate, corners square, beaded; bead weakly arcuate posteriorly. Labrum broadly emarginate at middle. Mandible weakly, obliquely quadrate, apex truncate, inner apex lacking teeth. Mentum with apical half rounded, notched at middle; palpomere 2 not obviously flattened dorsoventrally, 1.5 times width of palpomere 1, sparsely setose; setae moderately long, rufous, not curled at apex, not flattened. Maxilla (Fig. 9): Mala lacking lamellate setal brush; stipes with setae sparse, long, not flattened, not curled at apex; palpomere 2 with weak internomedial bump. Antennal club subequal in length to segments 2-7. *Pronotum*: Bead lacking anterior to scutellum; anterior bead incomplete at middle. Surface moderately densely punctate, punctures simple, lacking setae laterally. *Elytron*: Sutural length about 4.0 times length of scutellum. Surface with 5 poorly developed, punctate, longitudinal striae between suture and humerus; punctures moderate in size, moderately dense, lacking setae. Intervals with similar sculpturing. Epipleuron (Fig. 19) in ventral view expanded, deeply incised at base of sternite 2; in dorsal view, expansion well-developed. *Propygidium*: Surface shagreened and moderately densely punctate (base to mid-disc) to moderately densely punctate (mid-disc to apex); punctures simple, unisetigerous or lacking setae; setae minute (0-1 per puncture), tawny. *Pygidium*: Surface moderately densely punctate; punctures ocellate, moderately large and large, some unisetigerous; setae minute. *Venter*: Prosternal keel elongate; apex projecting anteriorly at about 90° with respect to ventral plane; apex extends to about mid-height of protrochanter, quadrate. *Legs*: Anterior claws 1/2 length of protarsomere 5, angled toward venter. Meso- and metatibial claws weakly angled toward venter, about 3/4 length of metatarsomere 5.

Diagnosis. *Peltonotus cybele* is similar to *P. similis* Arrow and *P. adelphosimilis* Jameson and Wada with which it shares similarities in the form of the maxilla (malar region without lamellate setae, stipes with simple setae [Fig. 9]), labial palpomere 2 (not dorsoventrally flattened and greatly enlarged), and form of the epipleural incision (Fig. 19). It is separated from *P. adelphosimilis* and *P. similis* based on the head that has unisetigerous punctures (multisetigerous in *P. adelphosimilis* and *P. similis*).

This species is unique because the epipleuron is deeply incised at the base of sternite 2 (in ventral view) (Fig. 19). The epipleuron is similarly incised in *P. similis* and *P. malayensis* (Fig. 20), but in these species the incision is located adjacent to sternite 3.

Etymology. The species epithet refers to Cybele, the Roman goddess of nature.

Figure 14-18. Male genitalia in dorsal and left lateral view. **14a-b)** *P. karubei*. **15a-b)** *P. favonius* (holotype). **16a-b)** *P. malayensis*. **17a-b)** *P. animus* (holotype). **18a-b)** *P. silvanus*.

19. *Peltonotus cybele* 20. *Peltonotus malayensis* 21. *Peltonotus mushiyaus* 22. *Peltonotus tigerus* 23. *Peltonotus favonius* 24. *Peltonotus animus*

Figure 19-22. Female elytral epipleuron (gray, ventral view) with position of metacoxa. **19)** *P. cybele* (holotype). **20)** *P. malayensis*. **21)** *P. mushiyaus* (holotype). **22)** *P. tigerus* (holotype) shared with *P. nethis* (image identical to Fig. 58 in Jameson and Wada 2004). Epipleura all the same scale. Detail of right foreleg. **23)** *P. favonius* (holotype male). **24)** *P. animus* (holotype male).

Distribution (Fig. 25). Sumatra, Indonesia.

Locality records (1 specimen) from WADA. INDONESIA (SUMATRA). *Sumatera Barat* (1): Padang.

Temporal Data. June (1).

Remarks. Based on its distribution, *P. cybele* is probably sympatric with *P. gracilipodus* and *P. animus*.

In the female key to species by Jameson and Wada (2004), specimens of *P. cybele* key to couplet 15 (*P. adelphosimilis* and *P. similis*). However, *P. cybele* possesses unisetigerous punctures on the head (punctures clearly multisetose in *P. adelphosimilis* and *P. similis*) and the epipleural incision is adjacent to the base of sternite 2 (epipleural incision is adjacent to sternite 3 in *P. adelphosimilis, P. similis,* and *P. malayensis* [Fig. 20]).

***Peltonotus favonius* Jameson and Wada, n. sp.**
(Fig. 3, 10, 15a-b, 23, 25)

Type Material. Holotype male housed at NSMT (loaned from FUJI) with following label data and with maxilla and male parameres mounted beneath specimen: a) "nr. Dalat, VIETNAM JUN. 2006." b) our holotype label.

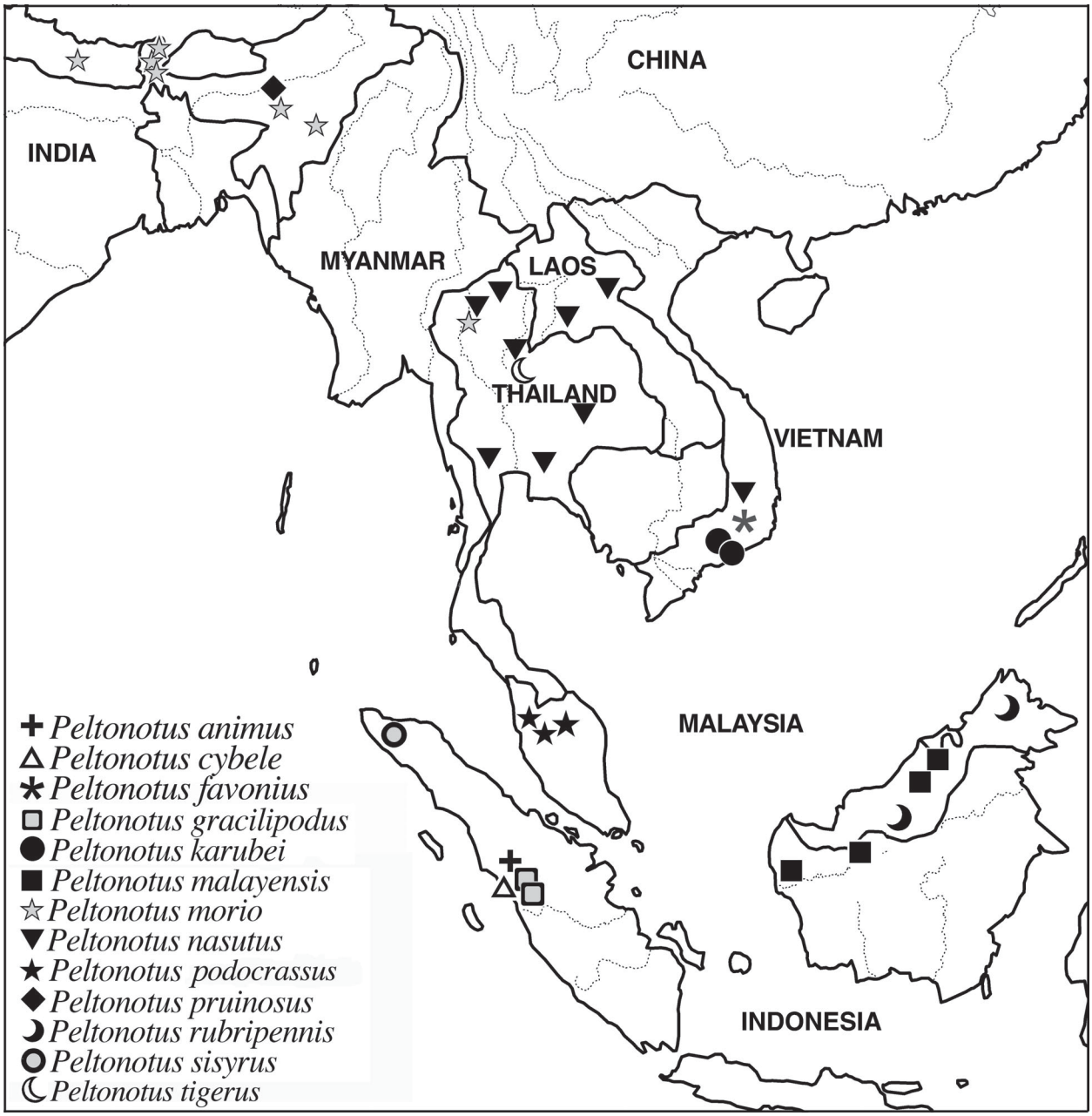

Figure 25. Distribution of *Peltonotus* species in Southeast Asia and Sundaland.

Description. Holotype (Fig. 3). Length 14.6 mm. Widest width 7.3 mm. *Color* (Fig. 3): Head, pronotum, scutellum, propygidium, pygidium, and venter shining black; elytra black with iridescent blue bloom. *Head*: Surface of frons with base impunctate, middle frons to apex moderately densely punctate; punctures simple, not setigerous. Surface of clypeus moderately densely to confluently punctate; punctures simple, not setigerous. Clypeus laterally weakly bowed, apex truncate, corners square, beaded; bead weakly arcuate posteriorly. Labrum broadly emarginate at middle. Mandible obliquely quadrate, apex truncate, inner apex with 1 tooth. Mentum with apical half rounded, notched at middle; palpomere 2 simple, slightly wider than palpomere 1, lacking setae. Maxilla (Fig. 10): mala lacking lamellate setal brush; stipes with setae moderately dense, long, not flattened, not curled at apex; palpomere 2 without internomedial bump. Antennal club subequal in length to segments 2-7. *Pronotum*: Bead lacking at base; anterior bead complete. Surface moderately densely punctate, punctures simple, lacking setae. Lateral

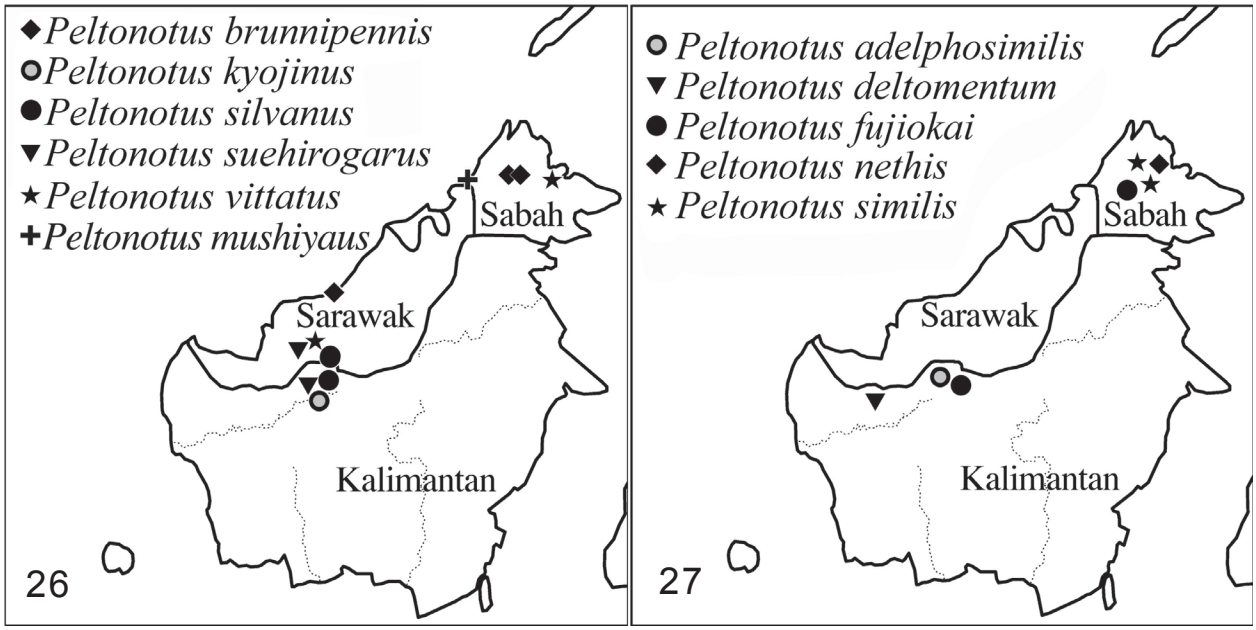

Figure 26-27. Distribution of some *Peltonotus* species in Borneo.

margin lacking long setae. *Elytron*: Sutural length about 4.2 times length of scutellum. Surface with 5 moderately developed, punctate, longitudinal striae between suture and humerus; punctures moderate in size, moderately dense, ocellate. Intervals with similar sculpturing. *Propygidium*: Surface shagreened and rugopunctate (base to mid-disc) to densely, confluently punctate (mid-disc to near apex); punctures simple. *Pygidium*: Surface shagreened and confluently punctate either side of mid-line; punctures simple, not setigerous. *Venter*: Prosternal keel elongate; apex projecting anteriorly at about 90° with respect to ventral plane, produced to mid-height of protrochanter, truncate. *Legs*: Protibia (Fig. 23) of male bidentate; lateral margin lacking short, dense setae. Protarsomere 5 (Fig. 23) of male subequal in length to tarsomeres 1-4; protarsomere 3-4 with apices expanded, dorsal and ventral apices clothed with dense, short setae. Anterior claws of male with inner claw curved, about 3 times thicker than outer claw; outer claw simply arcuate, about 1/2 length of inner claw; empodium bulbous at base. Meso- and metatibial claws of male with 2 setae. Metatibia of male apical spurs weakly curved; ventral spur produced to middle of metatarsomere 1, dorsal spur produced to base of metatarsomere 2. *Parameres*: Fig. 15a-b.

Diagnosis. *Peltonotus favonius* is most similar to *P. pruinosus* Arrow, a species for which males are not known and which is distributed in the Assam Valley, India. *Peltonotus favonius,* however, differs from *P. pruinosus* based on the following characters: mandible with one tooth at inner apex (lacking teeth in *P. pruinosus*); palpomere 2 simple, slightly wider than palpomere 1, and with sparse setae (palpomere 2 is subequal in width to palpomere 1 and lacking setae in *P. pruinosus*); propygidium rugopunctate to densely, confluently punctate with simple punctures (propygidium is moderately densely punctate with ocellate punctures laterally in *P. pruinosus*), and; pygidium confluently punctate either side of mid-line in *P. favonius* (moderately densely punctate in *P. pruinosus*).

Etymology. The specific epithet comes from the Roman wind god, Favonius, who held dominion over plants and flowers. The name is in reference to the species' hypothesized association with aroid flowers.

Distribution (Fig. 25). Vietnam.

Locality record (1 specimen) from loaned from FUJI and deposited at NSMT. VIETNAM (1). Da Lat.

Temporal Data. June (1)

Remarks. We considered that this specimen on which this species is based may be the unknown male of *P. pruinosus* (known only by one female), but the form of the mouthparts, propygidium, and pygidium (see "Diagnosis") are not consistent with *P. pruinosus*.

In the male key to species by Jameson and Wada (2004), *P. favonius* keys to *P. rubripennis* Miyake and Yamaya. However, the difference in form of the male genitalia (Fig. 15) clearly indicates that these are two distinct species.

***Peltonotus karubei* Muramoto**
(Fig. 4-5, 11, 14a-b, 25)

Peltonotus karubei was described based on seven male specimens (holotype and six paratypes) (Fig. 4, paratype) from the Dambri waterfall near Bao Loc in Lam Dong Province, southern Vietnam (Muramoto 2000). Females are not known for the species. An additional male specimen of *P. karubei* broadens the concept of the species based on its entirely black elytral coloration (Fig. 5). Elytral coloration is reddish-orange for all specimens in the type series. A single male specimen was collected in April 2004, 45 km east of Bao Loc on Mount Braian (specimen deposited in FUJI). Only three species of *Peltonotus* are known to occur in Vietnam: *P. nasutus* Arrow (elytral coloration black to castaneous with dorsum shining), *P. favonius*, n. sp. (elytral coloration black with iridescent bloom), and *P. karubei* (elytral coloration reddish-orange or black with iridescent bloom). The form of the labrum (deeply, narrowly emarginated), bidentate protibia, form of the maxilla (Fig. 11), and form of the male genitalia (Fig. 14a-b) easily separate *P. karubei* from other species in the genus. Despite the variation in color, the species is readily identified using the key in Jameson and Wada (2004).

***Peltonotus mushiyaus* Jameson and Wada, n. sp.**
(Fig. 6, 12, 21, 26)

Type Material. Holotype female loaned from FUJI and housed at NSMT with following label data and maxilla mounted beneath specimen: a) "Sipitang Perf., Sabah N. BORNEO, E. MALAYSIA, APR. 2002." (typeface) and b) our holotype label. Specimen lacking female genitalia.

Description. Holotype female (Fig. 6). Length 11.8 mm. Widest width 6.3 mm. *Color* (Fig. 6): Head, scutellum, pronotal margins, elytral margins, propygidium, pygidium, and venter castaneous; disc of pronotum orangish-tan; disc of elytra orangish-tan with broad, castaneous maculae. Dorsal surface of elytra with iridescent bloom. *Head*: Surface of frons with base moderately densely punctate, disc and apex densely punctate, some confluent at margins; punctures simple, some unisetigerous; setae short, tawny. Surface of clypeus moderately densely punctate, some confluent at apex and margins; punctures simple, some unisetigerous; setae short. Clypeus laterally weakly bowed, apex truncate, corners square, beaded; bead weakly arcuate posteriorly. Labrum broadly emarginate at middle. Mandible with external edge rounded, inner apex with 1 tooth. Mentum with apical half rounded, notched at middle; palpomere 2 not dorsoventrally flattened, about 1.5 times width of palpomere 1, lacking abundant setae. Maxilla (Fig. 12): mala lacking lamellate setal brush; stipes with sparse, moderately long, simple setae (not flattened or curly at apex); palpomere 2 without internomedial bump. Antennal club slightly longer than segments 2-7. *Pronotum*: Posterior bead lacking; anterior bead complete. Surface moderately densely punctate; punctures simple, lacking setae. Lateral margin lacking long setae. *Elytron*: Sutural length about 4.3 times length of scutellum. Surface with 5 weakly developed, punctate, longitudinal striae between suture and humerus; punctures ocellate or elongate, moderate in size, moderately dense, lacking setae. Intervals similarly sculptured. Epipleuron (Fig. 21) in ventral view not expanded, not incised at apex; in dorsal view expansion not developed adjacent to metacoxa. *Propygidium*: Surface shagreened and moderately densely punctate, punctures small (base) to moderately large (apex), simple, lacking setae. *Pygidium:* Surface moderately densely punctate (disc) to densely punctate (margins); punctures ocellate, lacking setae. *Venter*: Prosternal keel broadly triangular; apex projecting anteriorly at about 90° with respect to ventral plane, extends to about 1/3 height of protrochanter, rounded at apex. *Legs*: Protibia tridentate,

teeth subequal; lateral margin with short, dense setae. Claws (all legs) subequal in size, 1/2 length of tarsomere 5, weakly angled toward venter.

Diagnosis. The orangish-tan pronotal and elytral coloration (Fig. 6) of this species separates it from all known species of *Peltonotus*. In addition, the poorly developed prosternal keel is unique to this species (weakly developed and produced to only about 1/3 height of protrochanter). We hypothesize that males of this species will possess orangish-tan elytra with castaneous vittae or maculae, similar to the sexual dimorphism in elytral coloration observed in *P. vittatus* Arrow.

Etymology. The specific epithet, "*mushiyaus*" is derived from the Japanese words "mushi" (insect) and "ya" (man). In Japanese, "mushi ya" is used to describe those people who are very important to the study of beetles and insects. We name this species in honor of Mr. Masayuki Fujioka who has helped to foster greater knowledge of scarab beetles in Japan and world-wide. For scarab enthusiasts, Mr. Fujioka is "mushi ya". The beautiful specimen on which the species is named was lent to us from Mr. Fujioka.

Distribution (Fig. 26). Sabah State, Bornean Malaysia.

Locality records (1 specimen) from FUJI and deposited at NSMT. BORNEAN MALAYSIA (1). *Sabah State* (1): Sipitang Perf.

Temporal Data. April (1).

Remarks. *Peltonotus mushiyaus* is the smallest species in the genus *Peltonotus* (the next smallest species is *P. rubripennis* which ranges in size from 12.0-12.5mm). This is the only known species of *Peltonotus* in which the female possesses orangish-tan elytra with dark maculae (Fig. 6).

Females of three species of *Peltonotus* share the simple form of the epipleuron (Fig. 21): *P. fujiokai* Jameson and Wada, *P. nethis* Jameson and Wada, and *P. rubripennis*. *Peltonotus mushiyaus* is separated from *P. fujiokai* based on the complete anterior pronotal bead (incomplete at middle in *P. fujiokai*). It is separated from *P. nethis* based on broadly emarginate apex of the labrum (deeply, narrowly emarginate in *P. nethis*) and the lack of a dense lamellate setal brush on the maxilla (present in *P. nethis*). It is separated from *P. rubripennis* based on the epipleural expansion which is not developed in dorsal view (moderately developed adjacent to metacoxa in *P. rubripennis*) and weakly developed prosternal keel that extends to about 1/3 height of protrochanter (in *P. rubripennis*, the keel is elongate and produced to about 1/2 height of protrochanter). Females of two previously described species of *Peltonotus* are not known: *P. deltomentum* Jameson and Wada and *P. karubei* . We ruled out the possibility that this species could be either of these species: females of *P. deltomentum* will possess a broadly triangular apex of the mentum (broadly rounded in *P. mushiyaus*), and females of *P. karubei* will possess a labrum that is deeply, narrowly emarginate at the apex (broadly emarginate in *P. mushiyaus*). Females described herein (*P. favonius* and *P. animus*) do not possess the characters observed in *P. mushiyaus*.

In the female key to species by Jameson and Wada (2004), specimens of *P. mushiyaus* will key to *P. vittatus*. However, characters that are observed in *P. vittatus* (e.g., well-defined incision on the epipleuron, elytral coloration reddish) clearly indicate that these are two distinct species.

***Peltonotus tigerus* Jameson and Wada, n. sp.**
(Fig. 7, 13, 22, 25)

Type Material. Holotype female housed at QSBG with following label data and maxilla mounted beneath specimen: a) "THAILAND: Phetchabun: Thung Salaeng Luang NP, Gang Wang Nam Yen, 706 m, 16°37.178'N 100°53.504'E, Malaise; 31.v-7.vi.2007; Pong-pitak Pranee & Sathit T2087" and b) our holotype label. Specimen lacking left foretarsus.

Description. Holotype female (Fig. 7). Length 13.7 mm. Widest width 6.2 mm. *Color* (Fig. 7): Head, pronotum, scutellum, pygidium, and venter black or castaneous. Elytra reddish-brown with weak irides-

cent bloom. *Head*: Surface of frons with base impunctate (middle) to sparsely punctate (laterally), middle frons to apex moderately densely punctate; punctures simple, some multisetigerous; setae minute (1-12+ per puncture). Surface of clypeus moderately densely punctate, more dense laterally; punctures simple, some multisetigerous; setae minute (1-12+ per puncture) with a few short setae near margin (1 per puncture). Clypeus laterally weakly bowed, apex truncate, corners square, beaded; bead not weakly arcuate posteriorly. Labrum narrowly emarginate at middle. Mandible with external edge rounded, inner apex with teeth worn (apparently 1 tooth). Mentum with apical half rounded, notched at middle; palpomere 2 dorsoventrally flattened, about 2 times width of palpomere 1, setose; setae moderately dense, moderately long, rufous, weakly thickened, not curled. Maxilla (Fig. 13): mala with dense lamellate setal brush; stipes with setae dense, long, flattened at apex, not curled at apex; palpomere 2 enlarged (but lacking internomedial bump). Antennal club subequal to segments 2-7. *Pronotum*: Basal bead lacking; apical bead complete, indicated with nearly contiguous punctures. Surface moderately densely punctate; punctures simple, lacking setae. Lateral margin lacking long setae. *Elytron*: Sutural length about 4.6 times length of scutellum. Surface with 5 poorly developed, punctate, longitudinal striae between suture and humerus; punctures ocellate, moderate in size, moderately dense, some unisetigerous on disc; setae minute. Intervals similarly sculptured. Epipleuron (Fig. 22) in ventral view expanded, broadly incised at sternite 4; in dorsal view expansion well-developed. *Propygidium*: Surface shagreened and moderately densely punctate; punctures simple, unisetigerous; setae short, rufous. *Pygidium:* Surface from base to mid-disc shagreened and moderately densely punctate; punctures simple, lacking setae. Surface from mid-disc to apex moderately densely punctate; punctures simple, some unisetigerous; setae short, rufous. *Venter*: Prosternal keel elongate; apex projecting anteriorly at about 90° with respect to ventral plane, extends to about 3/4 height of protrochanter, truncate. *Legs*: Protibia tridentate, teeth subequal in size; lateral margin with short, dense setae. Metatibial ventral spur produced to middle of metatarsomere 1, dorsal spur produced to middle of metatarsomere 1. Claws (all legs) subequal in size, 2/3 length of tarsomeres 5, weakly angled toward venter.

Diagnosis. *Peltonotus tigerus* is the only species in the genus that possesses reddish-brown elytra (Fig. 7). Females of *P. vittatus* have reddish-brown elytra with dark vittae, and all remaining species in the genus possess black or castaneous elytra. We hypothesize that males of this species also will have reddish-brown elytra. *Peltonotus tigerus* is most similar to *P. podocrassus* Jameson and Wada, but it is separated based on the following characters: form of labial palpomere 2 two times wider than palpomere 1 (three times wider than palpomere 1 in *P. podocrassus*); maxillary palpomere 2 enlarged, but lacking internomedial bump (with a weak internomedial bump in *P. podocrassus*); pronotum lacking setae (with multisetigerous punctures laterally in *P. podocrassus*), and; pygidium with punctures unisetigerous or lacking setae (with multisetigerous punctures in *P. podocrassus*). *Peltonotus tigerus* is separated from other species of *Peltonotus* based on its reddish-brown elytra, rounded apex of the mentum, deeply emarginated labrum, maxilla with dense lamellate brush (Fig. 13), and the metatibial spur that is subequal or slightly longer than metatarsomere 1 (the metatibial spur is usually subequal in length to metatarsomeres 1-2).

Etymology. *Peltonotus tigerus* is named after the acronym for the research project that yielded the holotype specimen (TIGER: Thailand Inventory Group for Entomological Research). Michael Sharkey (University of Kentucky) and Brian Brown (Los Angeles County Museum), coordinators for TIGER, are thanked for loaning us the holotype specimen. The name "*tigerus*" is a noun in apposition.

Distribution (Fig. 25). Thailand.

Locality records (1 specimen) from QSBG. THAILAND. *Phetchabun State* (1): Thung Salaeng Luang National Park (Gang Wang Nam Yen, 706 m, 16°37.178'N 100°53.504'E).

Temporal Data. May-June (1).

Remarks. The holotype specimen was collected in a malaise trap at 706 m elevation in Thung Salaeng Luang National Park. The park region consists of a mixture of limestone, slate, and hard pan; numerous

streams originate in the park (Sharkey, pers. comm., April 2009). Deciduous forest predominates with lowland scrub and tropical, broad-leaved evergreen in isolated areas.

In the key to species (Jameson and Wada 2004), *P. tigerus* keys most closely to *P. suehirogarus* Jameson and Wada or *P. podocrassus*, but the different form of the incision on the elytral epipleuron and elytral coloration indicates these are distinct species.

Modifications to the Key to *Peltonotus* Species

The male key to species by Jameson and Wada (2004) should be modified to allow for the identification of *P. favonius* and *P. animus* as follows. Males for *P. cybele, P. mushiyaus,* and *P. tigerus* are not known:

10. Maxillary stipes with setae curly at apex (Fig. 8; Fig. 30 in Jameson and Wada 2004); genitalia not as in Fig. 18 ..... **10.1**
— Maxillary stipes with setae straight, not curly at apex; genitalia as in Fig. 18 ..... ***P. silvanus* Jameson and Wada**

10.1 (10). Elytral color reddish; genitalia as in Fig. 16 ..... ***P. malayensis* Arrow**
— Elytral color castaneous (Fig. 1); genitalia as in Fig. 17 ..... ***P. animus* Jameson and Wada, n. sp.**

13. Pronotal basal bead lacking; length less than 15.0 mm **13.1**
— Pronotal basal bead extending medially to beyond basal angle; length greater than 17.0 mm **14**

13.1(13). Foretibia tridentate with basal tooth very weakly developed (Fig. 32 in Jameson and Wada 2004); length less than 12.0 mm; genitalia as in Fig. 46 in Jameson and Wada 2004 ..... ***P. rubripennis* Miyake and Yamaya**
— Foretibia bidentate (Fig. 23); length more than 14.0 mm; genitalia as in Fig. 15 ..... ***P. favonius* Jameson and Wada, n. sp.**

The female key to species by Jameson and Wada (2004) should be modified to allow for the identification of *P. cybele*, *P. mushiyaus,* and *P. tigerus* as follows. Females for *P. favonius* and *P. animus* are not known:

4. Elytra with castaneous vittae (e.g., Fig. 6) **4.1**
— Elytra entirely castaneous, reddish, or black (lacking vittae) **5**

4.1(4). Elytral epipleuron incised at apex (Fig. 64a-b in Jameson and Wada 2004) ..... ***P. vittatus* Arrow**
— Elytral epipleuron simple, lacking apical incision (Fig. 21) ..... ***P. mushiyaus* Jameson and Wada, n. sp.**

9.0. Elytra entirely reddish (Fig. 7) ..... ***P. tigerus* Jameson and Wada, n. sp.**
— Elytra entirely black **9.1**

9.1(9). Epipleural expansion well-developed in dorsal view (Fig. 63 in Jameson and Wada 2004) ..... ***P. suehirogarus* Jameson and Wada**
— Epipleural expansion moderately developed in dorsal view (Fig. 53 in Jameson and Wada 2004) ..... ***P. podocrassus* Jameson and Wada**

15. Epipleuron with round emargination in ventral view (Fig. 19; Fig. 61 in Jameson and Wada 2004); not occurring in Mt. Bawang, Kalimantan region **15.1**
— Epipleuron with oval emargination in ventral view; occurring in Mt. Bawang, Kalimantan region (e.g., Fig. 67 in Jameson and Wada 2004) ..... ***P. adelphosimilis* Jameson and Wada**

15.1 (15). Head with multisetigerous punctures; occurring in Borneo ..... ***P. similis* Arrow**
— Head with unisetigerous punctures; occurring in Sumatra .....
..... ***P. cybele* Jameson and Wada, n. sp.**

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