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Synopsis of the aroid scarabs in the genus *Peltonotus* Burmeister (Scarabaeidae, Dynastinae, Cyclocephalini) from Sumatra and description of a new species

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Abstract

We provide a synopsis of the Sumatran species in the scarab beetle genus *Peltonotus* Burmeister (Scarabaeidae: Dynastinae: Cyclocephalini), describe a new species of *Peltonotus* from Sumatra, and describe the male of *P. cybele* Jameson & Wada from Sumatra (previously known only by the female holotype). To enable identification, we include a key to the five Sumatran species of *Peltonotus*, comparative images and diagnoses for all species, and temporal and geographical distributions.

Keywords

Araceae, Indonesia, beetle

Introduction

The southeast Asian scarab beetle genus *Peltonotus* Burmeister (Scarabaeidae: Dynastinae: Cyclocephalini) is associated with aroid flowers (Araceae) (Jameson and Wada 2004, 2009; Grimm 2009). The natural history, distribution, identification,

and history of classification of species in the genus were reviewed by Jameson and Wada (2009). With the addition of the species that we describe herein, the genus *Peltonotus* includes 25 species, including the following species that are distributed in Sumatra: *P. animus* Jameson & Wada 2009, *P. cybele* Jameson & Wada 2009, *P. gracilipodus* Jameson & Wada 2004, *P. sisyrus* Jameson & Wada 2004, and *P. talangensis* Jameson & Jakl, sp. n. All species that reside in Sumatra are endemic to the island. Ongoing biodiversity surveys will likely reveal additional species that await discovery. Based on the high species diversity within central Sumatra (four species in 100 miles^2), it is possible that the species diversity of Sumatra approximates that in Sabah, Borneo (six species in 100 miles^2). We provide a synopsis of the five Sumatran species in the genus *Peltonotus,* including a key to species, comparative images, species diagnoses, the description of a new species, information on natural history, and distribution maps.

With the inclusion of the new species and the male of *P. cybele*, only one species of *Peltonotus* from Sumatra lacks known females (*P. animus*). The males of all species from Sumatra are known. This is contrasted with our lack of knowledge for many species of *Peltonotus* in which identification is complicated by the absence of associated male and female specimens. Overall, five species of *Peltonotus* lack known males: *P. kyojinus* Jameson & Wada 2004, *P. mushiyaus* Jameson & Wada 2009, *P. nethis* Jameson & Wada 2004, *P. pruinosus* Arrow 1910, and *P. tigerus* Jameson & Wada 2009. Four species lack known females: *P. animus* Jameson & Wada 2009, *P. deltomentum* Jameson & Wada 2004, *P. favonius* Jameson & Wada 2009, and *P. karubei* Muramoto 2000.

Little natural history information is available for the Sumatran species of *Peltonotus*, and most species are known from very few specimens and localities. Collection localities reveal that species are concentrated on the western side of the island (coinciding with montane habitat) and at elevations from 1000–1500 m. Specimens have been collected from February to April, June to July, and October to November.

Methods

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 follow the phylogenetic species concept (Wheeler and Platnick 2000) which states that "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 the International Code of Zoological Nomenclature (1999) and Blackwelder (1967). The generic name *Peltonotus* is considered masculine in gender

(Jameson and Wada 2004). Specimens examined during this research are deposited in the following institutional and private collections: Brett C. Ratcliffe Collection, Lincoln, NE, USA (BCRC); The Natural History Museum, London, England (BMNH; Malcolm Kerley); Field Museum of Natural History, Chicago, IL, USA (FMNH; Al Newton, Margaret Thayer); Masayuki Fujioka Collection, Tokyo, Japan (FUJI); Museum National d'Histoire Naturelle, Paris, France (MNHN; Olivier Montreuil); Mary Liz Jameson Collection, Wichita, KS, USA (MLJC); National Museum (Natural History), Prague, Czech Republic (NMPC); National Science Museum (N.H.), Tokyo, Japan (NSMT; Shuhei Nomura); Nationaal Natuurhistorische Museum ("Naturalis"), Leiden, Netherlands (RMNH); Stanislav Jakl Collection, Prague, Czech Republic (SJC); United States National Collection, Washington, D.C., USA (USNM; currently housed at UNSM); University of Nebraska State Collection, Lincoln, NE, USA (UNSM); Kaoru Wada Collection, Tokyo, Japan (WADA); Museum fur Naturkunde der Humboldt Universitat zu Berlin, Berlin, Germany (ZMHB; Manfred Uhlig).

Key to the Sumatran species of *Peltonotus*

Males: Protibial claws with one claw enlarged and expanded; elytral epipleuron not developed in ventral view.

Females: Protibial claws similar in size and shape; elytral epipleuron developed or simple in ventral view.

1. Apical half of mentum acute, triangular (Figs 9–10) **2**
1'. Apical half of mentum rounded (*e.g.,* Fig. 8)..... **3**
2. Surface of frons and clypeus multisetigerous; male genitalia as in Fig. 21a–b; female epipleuron incised and with elongate-oval emargination at sternite 4 in ventral view (Fig. 16)..... ***P. sisyrus* Jameson & Wada**
2'. Surface of frons and clypeus unisetigerous; male genitalia as in Fig 22a–b; female epipleuron simple, not incised and emarginated in ventral view (Fig. 17)..... ***P. talangensis* Jameson & Jakl, sp. n.**
3. Protibia tridentate (Fig. 12); male genitalia as in Fig. 19a–b; female epipleuron incised and with rounded emargination in ventral view (Fig. 14)..... ..... ***P. cybele* Jameson & Wada**
3'. Protibia bidentate (Fig. 11); male genitalia not as in Fig. 19a–b; female epipleuron not as in Fig. 14..... **4**
4. Apex of metatibia in male with longer spur produced to apex of metatarsomere 2; male genitalia as in Fig. 18a–b; female unknown .... ***P. animus* Jameson & Wada**
4'. Apex of metatibia in male with longer spur produced to middle of metatarsomere 2; male genitalia as in Fig. 20a–b; female epipleuron incised and with moderately developed emargination in ventral view (Fig. 15)..... ..... ***P. gracilipodus* Jameson & Wada**

***Peltonotus animus* Jameson & Wada, 2009**
Figs 1, 5, 11, 18a–b, 23

Diagnosis. *Peltonotus animus* (Fig. 1) is distinguished from other Sumatran species of *Peltonotus* based on the following characters: apex of metatibia in male with longer spur produced to apex of metatarsomere 2 (shared with *P. sisyrus*; spur shorter in *P. cybele*, *P. talangensis*, and *P. gracilipodus*); mala with setae curled at the apices (Fig. 5) (shared with *P. gracilipodus*; not curled in *P. cybele, P. talangensis*, and *P. sisyrus*); protibia bidentate (Fig. 11) (shared with *P. gracilipodus* and *P. sisyrus*; tridentate in *P. cybele* and *P. talangensis*); and form of the male genitalia (Fig. 18a–b). Outside of Sumatra, *P. animus* shares many character states with *P. silvanus* Jameson & Wada 2004 from Sarawak and Kalimantan on the island of Borneo (see Jameson and Wada 2009).

Locality records (n=1) (Fig. 23). SUMATRA. West Sumatra Province (1): Bukittinggi.

Temporal data. July (1).

Remarks. *Peltonotus animus* is known only from the male holotype specimen (housed in WADA).

***Peltonotus cybele* Jameson & Wada, 2009**
Figs 2–3, 6, 12, 14, 19a–b, 23

Peltonotus cybele was previously known only by the female holotype specimen (Fig. 3). Discovery of the first male specimens (e.g., Fig. 2) and a second female facilitates identification of the species.

Description of male (n=2). The male differs from the female holotype in the following respects. Length 16.4–16.5 mm. Widest width 8.0 mm. *Color* (Fig. 2): Head, pronotum, scutellum, propygidium, pygidium, and venter castaneous; elytra dark reddish-brown with iridescent bloom. *Head:* Maxilla (Fig. 6) as in holotype, mala lacking lamellate setal brush; stipes with setae sparse, long, not flattened, not curled at apex; palpomere 2 with weak internomedial bump. *Elytron:* Surface with 5 poorly developed, punctate, longitudinal striae between suture and humerus, lateral-most striae poorly defined. *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, 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:* Protibia (Fig. 12) of male tridentate; lateral margin with short, dense setae. Protarsomere 5 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 4 times thicker than outer claw; outer claw simply arcuate, about half length of inner claw; empodium bulbous at base. Meso- and metatibial claws with 2 setae. Metatibia with apical spurs weakly curved;

1 *Peltonotus animus*, male

2 *Peltonotus cybele*, male

3 *Peltonotus cybele*, female

4 *Peltonotus talangensis*, holotype male

Figures 1–4. *Peltonotus* species dorsal habitus. **1** *P. animus* (holotype, male) **2** *P. cybele,* male **3** *P. cybele* (holotype, female) **4** *P. talangensis* (holotype, male).

ventral spur produced to middle of metatarsomere 1, dorsal spur produced to apex of metatarsomere 2. *Parameres*: Figs 19a–b.

Diagnosis. Within Sumatra, *P. cybele* is distinguished from other species of *Peltonotus* based on the dark reddish-brown elytral coloration in the male (elytra castaneous and suffused with reddish brown in the female). Additional characters that enable identification include: protibia of the male tridentate (Fig. 12) (shared with *P. talangensis*; bidentate in *P. animus*, *P. gracilipodus*, and *P. sisyrus*); mentum with rounded apex (shared with *P. animus* and *P. gracilipodus*; apex triangular in *P. talangensis* and *P. sisyrus*); unisetigerous punctures on the head (shared with *P. talangensis*; punctures clearly multisetigerous in *P. animus, P. sisyrus,* and *P. gracilipodus*); form of the male genitalia (Fig. 19a–b); and female epipleuron incised and with rounded emargination in ventral view (Fig. 14). Outside of Sumatra, *P. cybele* shares several similarities with *P. similis* Arrow 1931 and *P. adelphosimilis* Jameson & Wada 2004 from Sabah on the island of Borneo (Jameson and Wada 2009).

Locality records (Fig. 23) (n=4). SUMATRA. *West Sumatera Province* (4): Padang, Mt. Sanngul (20–30 km N. Payakumbuh, 1000–1300m).

Temporal data. June (1), April (2), October (1).

Remarks. *Peltonotus cybele* was previously known only from the holotype female (housed in WADA). We record the first known male specimens and an additional female specimen (housed in MLJC and SJC). The second known female greatly resembles the female holotype in size, coloration, and other respects.

Peltonotus gracilipodus Jameson & Wada, 2004

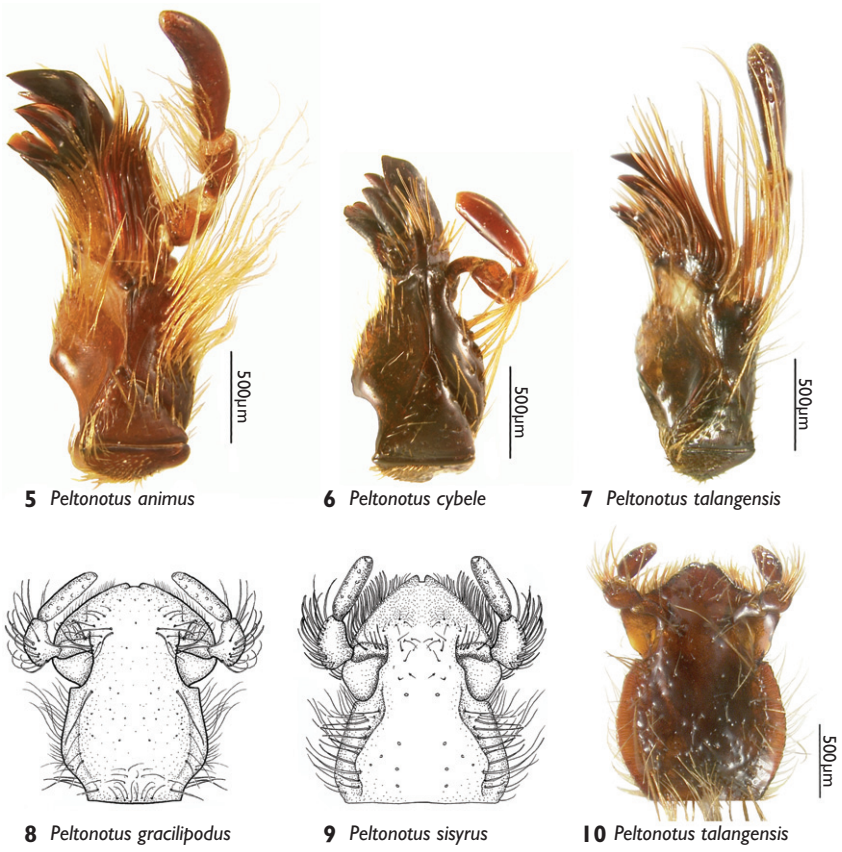
Figs 8, 15, 20a–b, 23

Diagnosis. Within Sumatra, *P. gracilipodus* is separated from other species of *Peltonotus* based on the surface of the frons and clypeus that has multisetigerous punctures (shared with *P. animus* and *P. sisyrus;* unisetigerous in *P. cybele* and *P. talangensis*); form of the mentum that is rounded in the apical half (Fig. 8) (shared with *P. animus* and *P. cybele*; triangular in *P. sisyrus* and *P. talangensis*); form of the male genitalia (Fig. 20a–b); and form of the female epipleuron in ventral view (Fig. 15). Outside of Sumatra, *P. gracilipodus* closely resembles *P. podocrassus* Jameson & Wada 2004 from peninsular Malaysia. In fact, males of both species have very similar genitalic forms and females have very similar eplipleural forms. Other characters differ between the species (*e.g.,* length of the metatibial spur, slender versus robust form of the fifth protarsomere in the male). Similarity in the genitalic form may provide evidence of recent isolation of ancestral populations in Sumatra and peninsular Malaysia.

Locality records (Fig. 23) (n=13). SUMATRA. *West Sumatera Province* (10): Harau Valley (Payakumbuh near Bukittinggi), Padang, Pang Kavan, Siboga. *No data* (3).

Temporal data. March (2), April (2), June (2), July (1), October (3), November (1).

Remarks. Male and female specimens of *P. gracilipodus* are housed in BCRC, WADA, MLJC, MNHN.



5 *Peltonotus animus* **6** *Peltonotus cybele* **7** *Peltonotus talangensis*

8 *Peltonotus gracilipodus* **9** *Peltonotus sisyrus* **10** *Peltonotus talangensis*

Figures 5–10. Maxilla (dorsal view) showing mala with or without lamellate setal brush and form. **5** *P. animus* (holotype) **6** *P. cybele* (holotype) **7** *P. talangensis* (holotype). Mentum (ventral view) showing form **8** *P. gracilipodus* **9** *P. sisyrus* **10** *P. talangensis* (holotype).

Peltonotus sisyrus Jameson & Wada, 2004

Figs 9, 16, 21a–b, 23

Diagnosis. *Peltonotus sisyrus* is separated from other Sumatran *Peltonotus* species based on the form of the mentum that is triangular in the apical half (Fig. 9; shared with *P. talangensis*); surface of frons and clypeus that is multisetigerous (shared with *P. gracilipodus* and *P. animus*; unisetigerous in *P. talangensis* and *P. cybele*); and the form of the female epipleuron (Fig. 16). Outside of Sumatra, only one additional species, *P. deltomentum* (from Kalimantan on the island of Borneo) shares the triangular apex of the mentum.

Locality records (Fig. 23) (n=2). SUMATRA. Aceh Province (2): Banda Aceh, Brastagi.

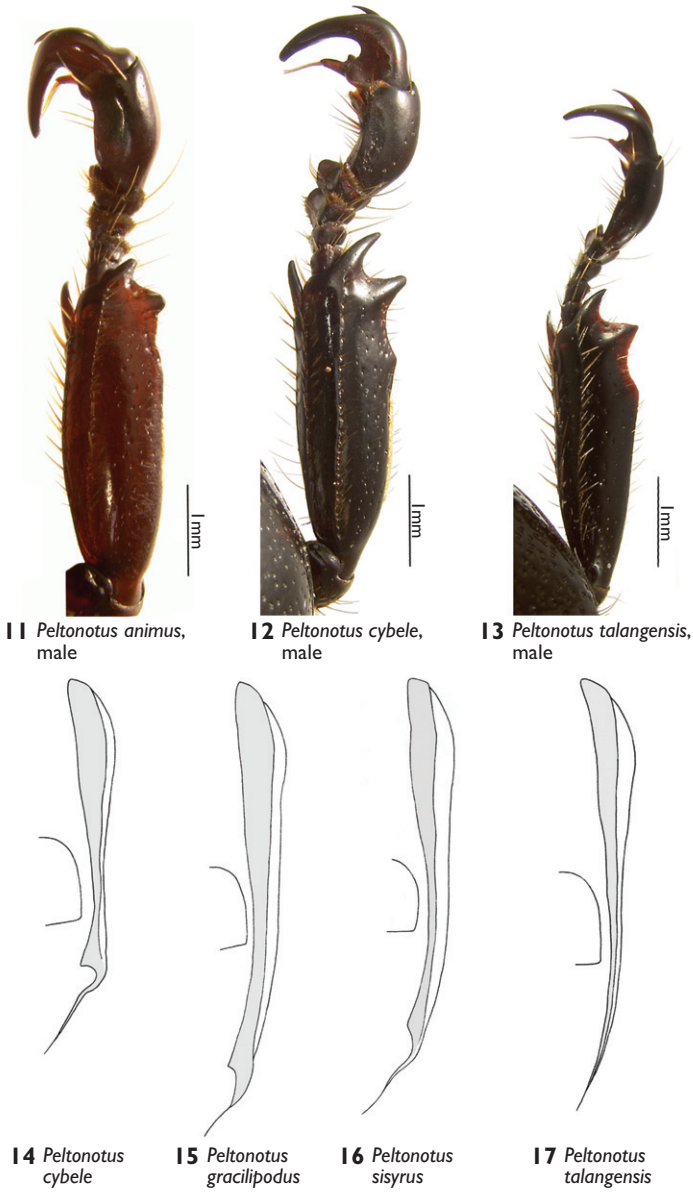
Temporal data. June (1), November (1).

Remarks. This species is known from one male and one female specimen housed in FUJI.

Peltonotus talangensis **Jameson & Jakl, sp. n.**
urn:lsid:zoobank.org:act:B054C6BA-51E5-4E49-BBB3-B63CB89551A9
Figs 4, 7, 10, 13, 17, 22a–b, 23

Type Material. Holotype male housed at NMPC with the following label data and with male genitalia, mentum, and maxillae mounted beneath specimen: a) "West Sumatra, Mt. Talang, 1500m, II-2006, Col. Stan Jakl" (type set), b) our holotype label. Allotype female labeled as male but with our allotype label (deposited at NMPC). 116 paratypes (95 males, 21 females) with label data as holotype and our paratype labels. Fifty eight paratypes deposited in SJC, ten in MLJC, and four in each of the following institutions: BCRC, BMNH, FMNH, FUJI, MNHN, NMPC, NSMT, RMNH, UNSM, USNM, WADA, ZMHB.

Description of holotype (male). Length 14.1 mm. Widest width 6.8 mm. *Color* (Fig. 4): Head, pronotum, scutellum, pygidium, elytron, and venter castaneous. Elytra lacking iridescent bloom. *Head:* Surface of frons at base sparsely punctate, disc and apex moderately densely (base) to densely (apex) punctate; punctures simple, moderate in size, some unisetigerous; setae short and moderately long, mixed. Surface of clypeus moderately densely punctate (base) to densely punctate (margins); punctures simple, moderate in size (base) to small (apex), some unisetigerous; setae moderately long. Clypeus laterally weakly arcuate, corners square, apex truncate, beaded; bead not weakly arcuate posteriorly. Labrum broadly emarginate at middle. Mandible with external edge rounded, inner apex with 1 poorly developed tooth. Mentum with apical half triangular (Fig. 10), notched at middle; palpomere 2 dorsoventrally flattened, about 1.5 times width of palpomere 1, setose; setae dense, moderately long, rufous, weakly thickened, not curled at apices. Maxilla (Fig. 7): Mala with lamellate setal brush; stipes with setae dense, long, not flattened at apex, not curled at apices; palpomere 2 with poorly developed internomedial bump. Antennal club slightly longer than segments 2–7 combined. *Pronotum:* Basal bead lacking anterior to scutellum; anterior bead incomplete. Surface moderately densely punctate, more so laterally; punctures simple, lacking setae. Lateral margin lacking long setae. *Elytron:* Sutural length about 4.0 times length of scutellum. Surface shagreened with 5 moderately developed, impressed, punctate, longitudinal striae between suture and humerus; punctures ocellate, moderate in size, moderately dense, lacking setae. Intervals similarly sculptured. *Propygidium:* Surface densely punctate, some contiguous (disc) to confluently punctate (laterally); punctures simple, moderate in size, unisetigerous; setae short, tawny and rufous. *Pygidium:* Surface densely punctate, more so laterally; punctures ocellate, unisetigerous; setae short, rufous. *Venter:* Prosternal keel elongate; apex projecting anteriorly at about 90° with respect to ventral plane, extends to about a quarter of the height of protrochanter, truncate. *Legs:* Protibia (Fig. 13) of male tridentate; lateral margin lacking short, dense setae. Protarsomere 5 subequal in length to tarsomeres 1–4 combined, moderately thickened; protarsomeres 3–4 with apices weakly expanded, dorsal and ventral apices of tarsomeres 1–4 clothed with dense, short setae. Anterior claws with inner claw broadly curved, about 2 times thicker than outer claw; outer



Figures 11–17. Right foreleg of male, dorsal view, showing form. **11** *P. animus* (holotype, male) **12** *P. cybele* (male) **13** *P. talangensis* (paratype, male). Female elytral epipleuron (gray, ventral view) with position of metacoxa **14** *P. cybele* (holotype) **15** *P. gracilipodus* **16** *P. sisyrus* **17** *P. talangensis* (allotype, female). Epipleura all the same scale.

claw elongate-arcuate, about half length of inner claw; empodium bulbous at base. Meso- and metatibial claws of male with 2 setae, claw angled toward venter, about half length of metatarsomere 5. Metatibia of male with apical spurs nearly straight; ventral

spur produced to middle of metatarsomere 1, dorsal spur produced to apex of metatarsomere 1. *Parameres:* Fig. 22a–b.

Allotype (female). Differs from the holotype male in the following respects: Length 15.2 mm. Widest width 7.2 mm. *Elytron:* Epipleuron (Fig. 17) in ventral view simple, terminating adjacent to sternite 3; in dorsal view, expansion not developed.

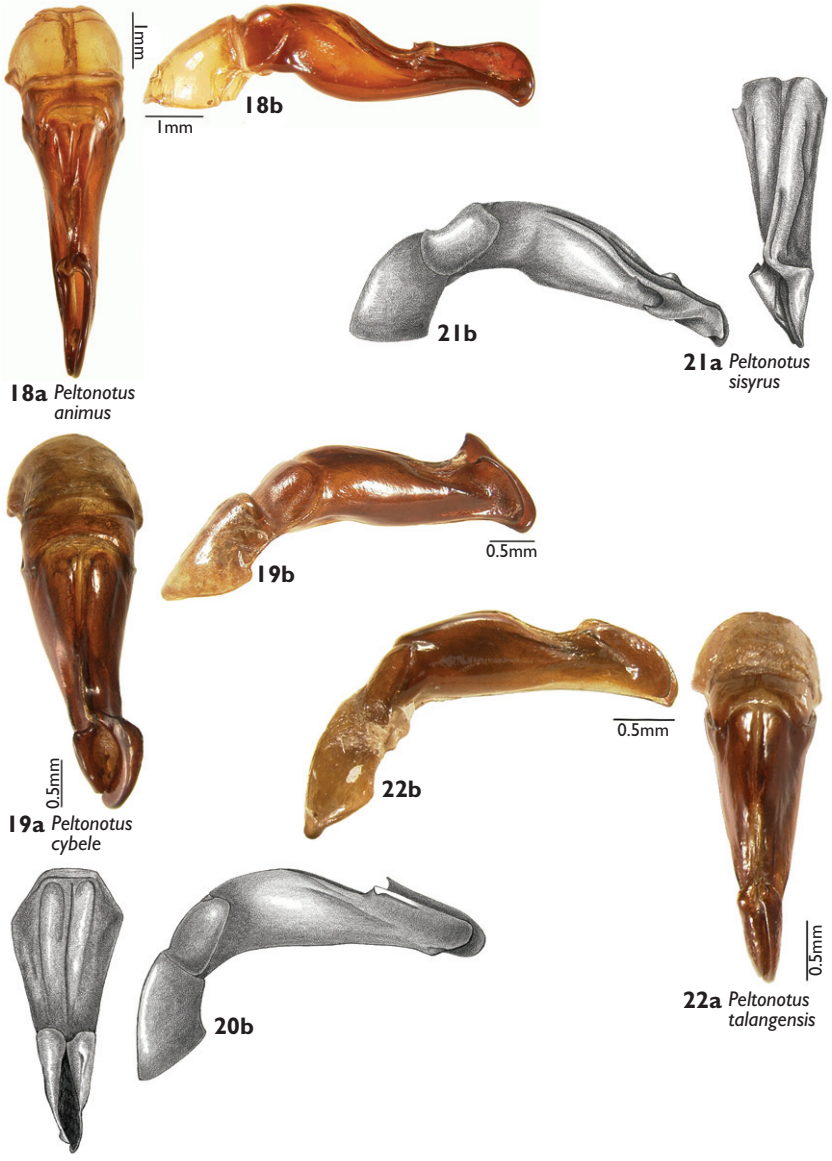


Figure 18. Male genitalia in dorsal and left lateral view. **18a–b** Phallobase and parameres of *P. animus* (holotype) **19a–b** Phallobase and parameres of *P. cybele* **20a–b** Parameres **a** and phallobase plus parameres **b** of *P. gracilipodus* **21a–b** Parameres **a** and phallobase plus parameres **b** of *P. sisyrus*. **22a–b** Phallobase and parameres of *P. talangensis* (holotype).

Propygidium: Surface moderately densely punctate, some punctures confluent laterally; punctures simple, small, moderate in size (mixed). *Legs:* Anterior claws half length of protarsomere 5, angled toward venter.

Paratypes (females=21, males=95). Differ from the holotype and allotype in the following respects: *Color*: Elytron castaneous with weak reddish undercolor.

Diagnosis. *Peltonotus talangensis* is distinguished from other Sumatran *Peltonotus* species based on the form of the mentum that is triangular in the apical half (Fig. 10; shared with *P. sisyrus*); surface of frons and clypeus unisetigerous (shared with *P. cybele;* multisetigerous in *P. sisyrus, P. gracilipodus* and *P. animus*); the short prosternal keel that extends to about a quarter of the height of the protrochanter (in all other species of *Peltonotus,* the prosternal keel extends one third to three quarters the height of the protrochanter); and the simple female epipleuron (Fig. 17). Outside of Sumatra, *P. talangensis* shares the triangular apex of the mentum with *P. deltomentum* from Kalimantan on the island of Borneo.

Locality records (Fig. 23) (n=118). SUMATRA. *West Sumatera Province* (118): Mt. Talang (1500m).

Temporal data. February (118).

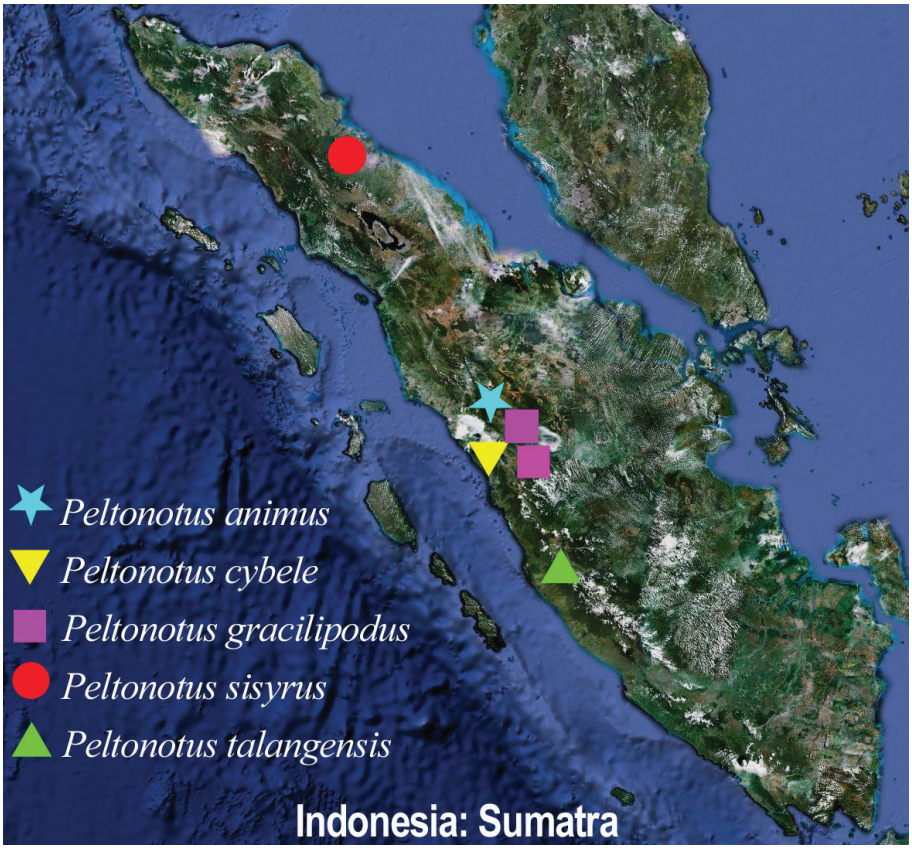


Figure 23. Distribution of *Peltonotus* species in Sumatra.

Remarks. *Peltonotus talangensis* was collected at 1450 m elevation on the southern slopes of Mt. Talang in the Diatas Lake region (February 15–16, 2006). This locality is home to a number of endemic species (including a new species of Cetoniinae) and is climatically much cooler (even at 1000 m elevation) than other volcanoes in the region. Specimens were collected at lights for two nights only, after which adult flight activity completely ceased, although collecting in the region was on-going.

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