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Review of the Gymnopleurini (Coleoptera: Scarabaeidae: Scarabaeinae). II. The genus *Paragymnopleurus* Shipp

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II. The genus *Paragymnopleurus* Shipp

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Review of the Gymnopleurini (Coleoptera: Scarabaeidae: Scarabaeinae).
II. The genus *Paragymnopleurus* Shipp

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Abstract. The genus *Paragymnopleurus* Shipp, 1897 (Coleoptera: Scarabaeidae: Scarabaeinae: Gymnopleurini) is characterized and its constituent taxa are keyed and illustrated. Twelve species and five subspecies are deemed valid, and five species groups are recognized. Three **new synonymies** include: *Paragymnopleurus stipes japonicus* Balthasar is synonymized with *P. ambiguus* Janssens, and *P. maurus malayanus* Ochi and Kon and *P. maurus pauliani* Janssens are synonymized with the nominotypical subspecies. First country and provincial records are reported for *P. brahminus* (Waterhouse), *P. maurus* (Sharp) and *P. sinuatus szechouanicus* Balthasar. A lectotype is here designated for *Gymnopleurus singularis* Waterhouse, validating an unpublished designation. A checklist of valid species and synonyms is provided.

Key words. Gymnopleurini, *Paragymnopleurus*, checklist, species groups, key to species and subspecies, new synonymies, new records, Palearctic and Oriental regions.

Introduction

The tribe Gymnopleurini (Coleoptera: Scarabaeidae: Scarabaeinae) was characterized and its constituent genera keyed in Part I (Pokorný and Zídek 2009), and it is thus sufficient to reiterate that *Paragymnopleurus* Shipp differs from the other three genera (*Gymnopleurus* Illiger, *Allogymnopleurus* Janssens and *Garreta* Janssens) in having the clypeus anteriorly emarginate, more-or-less bidentate, with the anterolateral margin sometimes slightly undulate; the gena – clypeus contact smooth, without an excision or genal extension forward or laterally; and the profemur produced into a crenulate carina along the proximal three quarters of the anterior margin.

Most species are in a subdued way polychromatic, ranging from black through dark gray to bronze, and together with the species of *Garreta* are among the largest members of the tribe, up to 24 mm in length. Also the sculpture is subdued, finely punctate on the pronotum and shallowly striate on the elytra; to the naked eye the surface looks smooth or nearly so. Sex can be best determined from the protibial spur, which is stubby, terminally truncate or excised in males and sickle-shaped, gradually tapering to a sharp tip in females. The males of some species also have the distal part of the protibia medially swollen. Aedeagi are too similar to be of any use in species determinations and are therefore not illustrated.

The genus is limited to Asia and contains only 12 species, making it the smallest in the tribe. Because most of the species either extend from the continent onto the islands of Indonesia and western Philippines (Palawan) or are known only from islands, they form isolated populations some of which have been recognized as subspecies.

Paragymnopleurus sinuatus (Olivier) and *P. leei* (Donovan) (= *P. sinuatus*) were described as *Scarabaeus*, other species preceding Janssens' 1940 revision as *Gymnopleurus*, and those postdating Janssens' work as *Paragymnopleurus*. Balthasar (1963) treated all species then known, but he regarded *Paragymnopleurus* Shipp and the genera of Janssens (*Allogymnopleurus* and *Garreta*) as subgenera of *Gymnopleurus*. According to the International Code of Zoological Nomenclature (ICZN 1999: Article 51.3.2) Balthasar's combination does not affect the authorship, and his names are thus cited without parentheses. Furthermore, Balthasar (1963: 214) included in the synonymy of *P. melanarius* (Harold)

the name “*ruficornis* Boucomont (nec Motschulsky)”, although he was aware that the species *Gymnopleurus ruficornis* Motschulsky, 1854 belongs in the genus *Garreta*. This is an obvious oversight on his part, because Boucomont (1921: 3) did not coin the name but attributed it to Motschulsky.

Materials and Methods

Specimens used in this study are deposited in the following collections:

- BMNH** — The Natural History Museum, London, UK;
ISNB — Institut Royal des Sciences Naturelles, Brussels, Belgium;
JZPC — J. Zídek, Prague, Czech Republic (private collection);
MNHN — Muséum National d’Histoire Naturelle, Paris, France;
NMPC — National Museum (Natural History), Prague, Czech Republic;
NSMT — National Science Museum (Natural History), Tokyo, Japan;
OXUM — Oxford University Museum of Natural History, Oxford, UK;
RMNH — Nationaal Natuurhistorische Museum, Leiden, Netherlands;
SPPC — S. Pokorný, Prague, Czech Republic (private collection).

Other abbreviations used in the following checklist: HT – holotype, LT – lectotype, PT – paratype, PLT – paralectotype; f – female, m – male; **ncr** – new country record, **npr** – new provincial record. Invalid names in the list below are offset by emdashes.

Checklist of *Paragymnopleurus*

Paragymnopleurus Shipp, 1897: 166, type sp. *Scarabaeus sinuatus* Olivier, by orig. des.

Syn. *Progymnopleurus* Garreta, 1914: 52, type sp. *Scarabaeus sinuatus* Olivier (see Janssens 1940: 5).

aethiops (Sharp, 1875: 34); HT – MNHN; = *melanarius*.

ambiguus Janssens, 1943: 1; HT+3PT – ISNB; Taiwan. **Fig. 1**

brahminus (Waterhouse, 1890: 411); HT – BMNH; China (Fujian, Shanghai, Sichuan, Zhejiang [**npr** – JZPC, OXUM]), n. Vietnam (Vind Phu Prov.: Tam Dao; **ncr** – SPPC). **Fig. 3**

calcar (Sharp, 1875: 36); HT – MNHN; = *planus*.

celebicus (Sharp, 1875: 37); HT – MNHN; = *planus*.

dubius (Sharp, 1875: 36); HT – MNHN; = *planus*.

leei (Donovan, 1798: pl. 1.4), as *Scarabaeus*; type lost; = *sinuatus* (syn. by Janssens 1940: 20).

martinezi Balthasar, 1955: 393; HT – NMPC; China (Sichuan); [see Comments]. **Fig. 4, 21**

maurus maurus (Sharp, 1875: 34); HT – MNHN; Malaysia, Borneo, Sumatra. **Fig. 5**

maurus malayanus Ochi and Kon, 1997: 236; HT+14PT – NSMT; Malaysia, w. Sumatra; = *m. maurus*, **syn. n.** [see Comments]. **Fig. 6**

maurus pauliani Janssens, 1940: 17+19, as sp.; HT+1PT – ISNB; Borneo (Sarawak; Brunei, **ncr** – SPPC); = *m. maurus*, **syn. n.** [see Comments]. **Fig. 7**

melanarius (Harold, 1867: 76); HT – MNHN; China (Hong Kong, Shanghai, Sichuan), Taiwan, India, Sri Lanka, Laos, Vietnam, Borneo, Java, Sumatra. **Fig. 8, 23**

planus (Sharp, 1875: 35); HT – MNHN; Malaysia, Sulawesi. **Fig. 9**

rudis (Sharp, 1875: 37); HT – MNHN; Flores, Java, Lombok, Sumbawa, Thailand. **Fig. 10**

singularis (Waterhouse, 1890: 410); “Corea”; LTm+2PLT – BMNH; = *maurus* [see Comments]. **Fig. 11**

sinuatus sinuatus (Olivier, 1789: 160); HT – MNHN; s. China, Taiwan, Korean peninsula, Nepal, India, se. Asia, Indonesia. **Fig. 12**

sinuatus abax (Sharp, 1875: 39), as sp.; HT – MNHN; Cambodia.

sinuatus assamensis (Waterhouse, 1890: 411), as sp.; HT – BMNH; n. India, Nepal, China, Myanmar. **Fig. 13**

sinuatus productus (Sharp, 1875: 38), as sp.; HT – MNHN; Laos (HT), Cambodia, Vietnam.

sinuatus szechouanicus Balthasar, 1934: 149; HT+2PT – NMPC; China (Sichuan, Xizang), Thailand (**ncr** – JZPC). **Fig. 14**

sparsus sparsus (Sharp, 1875: 38); HT – MNHN; Malaysia, s. Kalimantan. **Fig. 15**

sparsus arnoldi Krikken and Huijbregts, 1987: 3; HT – RMNH; Sumatra. **Fig. 16**

sparsus javanus Krikken and Huijbregts, 1987: 3; HT – RMNH; Java. **Fig. 17**

sparsus palawanicus Ochi and Kon, 1997: 236; HT+5PT – NSMT; Philippines (Palawan); = *s. sparsus* [see Comments].

spinotus (Boucomont, 1914: 248), as var. of *G. maurus*; HT – MNHN; Borneo (Kina Balu); = *striatus* [var. of *striatus* in Janssens 1940: 18]. **Fig. 18**

stipes stipes (Sharp, 1875: 35); HT – MNHN; Philippines (Mindoro).

stipes japonicus Balthasar, 1955: 395, as ssp. (as var. on label); HT – NMPC; Japan (Honshu); = *ambiguus*, **syn. n.** [see Comments]. **Fig. 2**

striatus (Sharp, 1875: 33); HT – MNHN; Singapore, Borneo, Sumatra. **Fig. 19**

sumatrensis Ochi and Kon, 1997: 235; HT+7PT – NSMT; w. Sumatra. **Fig. 20**

Comments

The subspecies in the above checklist were treated by Janssens (1940) as varieties and subsequently upgraded to subspecies by Balthasar (1955). An exception is *P. maurus pauliani*, which was described by Janssens (1940) as a species and demoted to subspecies by Balthasar (1955). Two of the subspecies (*P. maurus pauliani* and *P. sparsus palawanicus*) are not deemed valid here, because they differ from the nominotypical subspecies only in color. Our conjecture is that they are color phases caused by differing temperature conditions during the larval development, which is supported by a recent study of the related genus *Gymnopleurus* (Davis et al. 2008).

Our study supports the division of the genus into five species groups:

1/ The melanarius group is characterized by mesotibia with two spurs; lateral margins of pronotum evenly rounded; anterior keel of metasternum evenly rounded; and anterior margin of clypeus bidentate. It includes only *P. melanarius*.

2/ The striatus group is characterized by mesotibia with two spurs; lateral margins of pronotum angular and toward anterior corners straight or weakly emarginate; anterior keel of metasternum evenly rounded; and anterior margin of clypeus bidentate. It includes *P. maurus*, *P. brahminus*, *P. striatus*, *P. ambiguus*, *P. stipes* and *P. sumatrensis*.

3/ The martinezi group is characterized by mesotibia with two spurs; lateral margins of pronotum evenly rounded; anterior keel of metasternum evenly rounded; and anterior margin of clypeus weakly quadridentate. It includes only *P. martinezi*.

4/ The sinuatus group is characterized by mesotibia with one spur; pronotum not at all or only weakly narrowing toward base, causing lateral angles to be obfuscate and posterior corners strongly projecting; anterior keel of metasternum obliquely triangular; and anterior margin of clypeus bidentate to weakly quadridentate (in some *P. sinuatus*). It includes *P. sinuatus* and *P. rudis*.

5/ The planus group is characterized by mesotibia with one spur; pronotum markedly narrowing toward base, causing lateral angles to be pronounced and posterior corners projecting only weakly; anterior keel of metasternum obliquely triangular; and anterior margin of clypeus bidentate. It includes *P. planus* and *P. sparsus*.

As in *Garreta*, in which all species bear two mesotibial spurs, in groups 1-3 of *Paragymnopleurus* the major spur is fixed, whereas the second spur is very small, articulated, hidden on the inner side between the major spur and the overlying first tarsomere, and in worn specimens may be broken off. The anterior metasternal process is hereby called a keel because it does not extend forward but merely forms an oblique anterior part of the metasternal plate which then slopes down (in ventral view) toward the meta-mesossternal suture.

The following taxa require further comments:

***Paragymnopleurus martinezi* Balthasar (Fig. 4)**

Balthasar (1955) based this species on a male from Sichuan (loc. “Nitou-Tatsienlu”) and doubted its generic (his subgeneric) assignment because of characters transitional between *Paragymnopleurus* and *Garreta*, namely a quadridentate clypeus and two mesotibial spurs. Löbl (2006: 155) placed this species in *Gymnopleurus* s. str. with the notation “DA” (doubtful assignment), because at that time the holotype could not be located. The holotype at NMPC has since resurfaced, and our examination confirms that it is a valid species. It remains in *Paragymnopleurus* because the clypeus is only weakly quadridentate (the lateral teeth are mere undulations, as in some *P. sinuatus*), the clypeus – gena transition is smooth, without any excision at the suture, and the anterior margin of the profemur is carinate for about the proximal three-fourths of length. This combination of characters is unique in the genus and defines the monobasic *martinezi* species group.

***Paragymnopleurus maurus malayanus* Ochi and Kon (Fig. 6) and *P. maurus pauliani* Janssens (Fig. 7)**

We compared BMNH and OXUM specimens of *P. maurus malayanus* from Malaysia and *P. maurus pauliani* from Borneo (Brunei) with the nominotypical subspecies. We have not found any morphological differences, and therefore regard these taxa as full synonyms of *P. maurus maurus*.

***Paragymnopleurus singularis* (Waterhouse) (Fig. 11)**

Neither Janssens (1940: 69) nor Balthasar (1963: 222) saw this species and only quoted the original description, the former leaving it in *Gymnopleurus* and the latter assigning it tentatively to *Paragymnopleurus*. Balthasar regarded it as a local form of *P. sinuatus*, the only other species of *Paragymnopleurus* known from the Korean peninsula. We have examined the three BMNH syntypes of *G. singularis* from “Corea”, which F. Génier (Ottawa) in 2002 re-identified as *P. maurus* and from which he selected a male lectotype. Since Génier’s designation has not been published, it is here validated. The lectotype here designated lacks the right metatarsus and bears seven labels, Génier’s 2002 “Lectotype *Gymnopleurus singularis* Waterhouse” (handwritten) and “= *Paragymnopleurus maurus* (Sharp)” (handwritten), older “*Gymnopl. singularis* (Type) Waterh.” (handwritten), a male symbol (printed), and three discs – “Corea” (handwritten), “Type” (printed, with red rim), and “Lectotype” (printed, with blue rim). The paralectotypes are both females and are labeled similarly to the lectotype, but the “Paralectotype” discs have greenish rims.

***Paragymnopleurus stipes japonicus* Balthasar (Fig. 2)**

Balthasar (1955) based this subspecies on a female labeled as from “Mukogum Hyogoken, Japan”, which according to Dr. Shuhei Nomura of the National Museum in Tokyo is an old name for the area between Kobe and Osaka, Hyogo Prefecture, in southern Honshu. Today the area is thoroughly urbanized, divided among the cities of Ashiya, Takarazuka, Nishinomyia and Amagasaki. Löbl (2006: 31, 156) listed this subspecies as a *nomen dubium* and commented that “According to K. Masumoto (pers. communication) this taxon is unknown from Japan, and its relevant type material is not traceable.” Neither is this taxon nor any other gymnopleurine mentioned in the most recent treatment of Japanese Scarabaeoidea (Kawai et al. 2008). The holotype at NMPC has since resurfaced, and its examination reveals no characters that would allow separation from *P. ambiguus*, which occurs in Taiwan. *Paragymnopleurus stipes japonicus* is therefore hereby synonymized with *P. ambiguus*. Since Balthasar’s specimen is the only gymnopleurine ever reported from Japan, accidental introduction is more likely than northward dispersal from Taiwan via the Ryukyu Islands, because an established population of such a relatively large (~20 mm) species could hardly escape attention. Another possibility of course is an erroneous locality label.

We are aware of only two other specimens of *Paragymnopleurus* purportedly from Japan, virtually identical females in the BMNH collection, each of which bears three labels: “*Gymnopleurus sinuatus* Ol.” (handwritten), “Japan teste Staudinger 1900” (handwritten), and “Japan. G. Lewis 1910 – 320”

(printed). They reside in a tray labeled “*P. stipes japonicus*”, but who identified them as such is not known and the lack of locality data makes their provenance suspect. They both are subtly bicolored, with the pronota lighter bronze than the elytra; they best fit the description of one of the bronze subspecies of *P. sinuatus*, possibly *P. s. productus*.

Key to Species and Subspecies

1. Anterior margin of clypeus weakly quadridentate (Fig. 21), mesotibia with two apical spurs; length 14 mm ***P. martinezi* Balthasar**
- Anterior margin of clypeus bidentate, mesotibia with one or two apical spurs **2**

- 2(1). Mesotibia with two apical spurs, but second spur very small (Fig. 22), difficult to see and often broken off; if uncertain about its presence, examine anterior keel of metasternum which should be broadly rounded **3**
- Mesotibia with one apical spur. Anterior keel of metasternum obliquely triangular **9**

- 3(2). Lateral margins of pronotum rounded (Fig. 23), lateral angles barely perceptible; elytra very slightly shagreened, finely and weakly striate; black, velvety, pronotum usually slightly more glossy than elytra; length 14-20 mm ***P. melanarius* (Harold)**
- Lateral margins of pronotum angular, anterior portion straight or weakly bowed inward (Fig. 24) **4**

- 4(3). Metasternum anteriorly impunctate and glabrous (or lacking long setae); ventral sides of meso- and metafemora with short setae **5**
- Metasternum anteriorly asperately punctate to granulose, with long hairs; ventral sides of meso- and metafemora with short or long setae **6**

- 5(4). Black, matte; lateral margins of pronotum between lateral angles and posterior corners straight (Fig. 3); elytral striae very fine, barely perceptible; elytral intervals with small, flat granules; length 15-22 mm ***P. brahminus* (Waterhouse)**
- Black, slightly velvety with weak glossy sheen; lateral margins of pronotum between lateral angles and posterior corners weakly bowed inward (Fig. 19); elytral striae fine but distinct; elytral intervals punctate; length 16-18 mm ***P. striatus* (Sharp)**

- 6(4). Ventral sides of meso- and metafemora with short setae; length 18-24 mm ***P. ambiguus* Janssens**
- Ventral sides of meso- and metafemora with long hairs **7**

- 7(6). Pronotum and elytra smooth, finely shagreened; metasternum with black pubescence; length 14-16 mm ***P. stipes* (Sharp)**
- Pronotum and elytra finely, asperately punctate; metasternum with reddish-brown pubescence **8**

- 8(7). Margins of pronotum between lateral angles and posterior corners straight; elytral intervals slightly convex, with large, asperate punctures; length 15-18 mm ***P. sumatrensis* Ochi and Kon**
- Margins of pronotum between lateral angles and posterior corners weakly curved inward; elytral intervals flat, with scattered small granules; length 12-16 mm ***P. maurus* (Sharp)**

- 9(2). Pronotum not, or only weakly, narrowed toward base, its lateral angles rounded, posterior corners strongly extended **10**
- Pronotum clearly narrowed toward base, its lateral angles very distinct, posterior corners weakly extended **11**

- 10(9). Disc of pronotum weakly shagreened or smooth, very finely and sparsely punctate, punctures medially simple, toward margins becoming asperate; elytral striae very fine, sparsely punctate; elytral intervals shagreened more strongly than pronotum, with dense, fine granules; dark bronze to black, sometimes with metallic sheen; chiefly continental species; length 14-22 mm ***P. sinuatus* (Olivier)**
- a/ Black, matte or with velvety lustre. China, Taiwan, Korean peninsula, Nepal, India, se. Asia, Indonesia ***P. sinuatus sinuatus* (Olivier)**
- b/ Dark bronze, posterior corners of pronotum extended more than in (a); Laos, Cambodia, Vietnam ***P. sinuatus productus* (Sharp)**
- c/ Greenish black, rather glossy, finely sculptured; posterior corners of pronotum extended less than in (a); Cambodia ***P. sinuatus abax* (Sharp)**
- d/ Coppery, rather glossy; disc of pronotum punctate more than in (a), punctures anteriorly becoming asperate; n. India, Nepal, China, Myanmar ***P. sinuatus assamensis* (Waterhouse)**
- e/ Dark coppery, sculptured more coarsely than in (a), posterior corners of pronotum weakly extended.; China (Sichuan, Xizang), Thailand ***P. sinuatus szechouanicus* Balthasar**
- Similar to *P. sinuatus* but more coarsely sculptured; pronotal disc and elytral intervals strongly shagreened and asperately punctate; chiefly insular species; length 13-18 mm ***P. rudis* (Sharp)**
- 11(9). Lateral angles of pronotum vague (Fig. 9); elytral striae shallow, indistinct, intervals finely shagreened, impunctate; ventral side of profemur posteriorly with short hairs; dorsum black, matte; length 15-18 mm ***P. planus* (Sharp)**
- Lateral angles of pronotum sharp, posteriorly followed by inward curvature (Fig. 15); elytra distinctly striate, intervals strongly punctate; posteroventral surface of profemur with dense long hairs; body always with distinct metallic sheen; length 12-14 mm .. ***P. sparsus* (Sharp)**
- a/ Semi-matte, bronze to greenish bronze; elytral intervals coarsely asperately punctate; Malaysia and Kalimantan ***P. sparsus sparsus* (Sharp)**
- b/ Nearly black with weak bronze lustre; elytral intervals coarsely asperately punctate; Java .. ***P. sparsus javanus* Krikken and Huijbregts**
- c/ Nearly black (n. Sumatra) or bronze (w. Sumatra); elytral intervals coarsely asperately punctate ***P. sparsus arnoldi* Krikken and Huijbregts**

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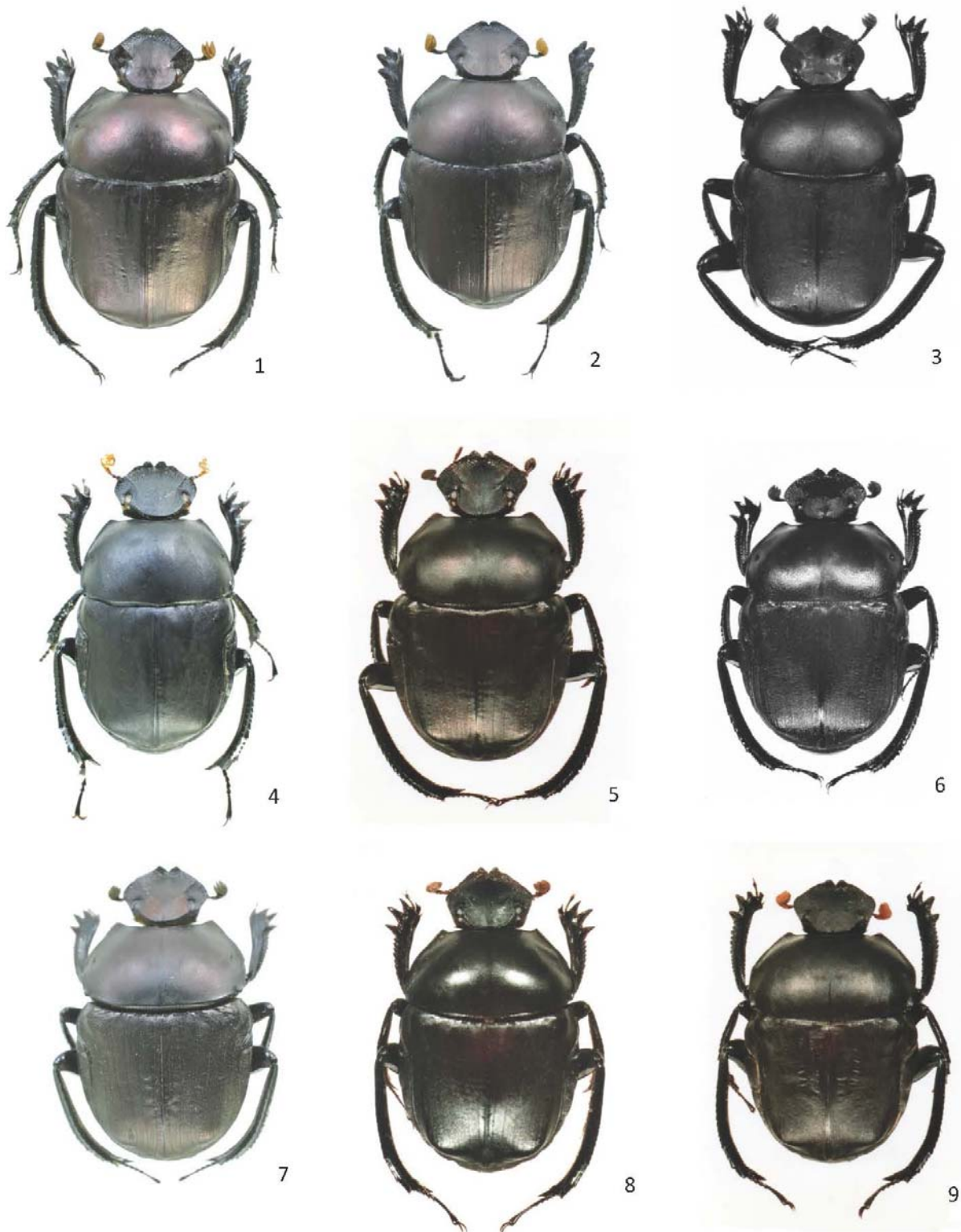
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Figures 1-9. 1) *Paragymnopleurus ambiguus* Janssens, female, 23 mm. 2) *P. stipes japonicus* Balthasar [= *P. ambiguus*], male holotype, 21 mm. 3) *P. brahminus* (Waterhouse), female, 21 mm. 4) *P. martinezi* Balthasar, male holotype, 14 mm. 5) *P. maurus maurus* (Sharp), male, 16.5 mm. 6) *P. maurus malayanus* Ochi and Kon, female, 15.5 mm. 7) *Paragymnopleurus maurus pauliani* Janssens, female, 15.5 mm. 8) *P. melanarius* (Harold), male, 19.5 mm. 9) *P. planus* (Sharp), male, 17 mm.



Figures 10-18. 10) *P. rudis* (Sharp), male, 18 mm. 11) *P. singularis* (Waterhouse) [= *P. maurus*], male lectotype, 19 mm. 12) *P. sinuatus sinuatus* (Olivier), male, 17 mm. 13) *Paragymnopleurus sinuatus assamensis* (Waterhouse), male, 15 mm. 14) *P. sinuatus szechouanicus* Balthasar, female, 20 mm. 15) *P. sparsus sparsus* (Sharp), female, 15 mm. 16) *P. sparsus arnoldi* Krikken and Huijbregts, male, 13 mm. 17) *P. sparsus javanus* Krikken and Huijbregts, female, 15 mm. 18) *P. spinotus* (Boucomont), female, 19 mm.



Figures 19-24. 19) *Paragymnopleurus striatus* (Sharp), male, 20 mm. 20) *P. sumatrensis* Ochi and Kon, female, 16 mm. 21) Clypeus of *P. martinezi*. 22) Mesotibial spurs of *P. sumatrensis*. 23) Rounded lateral margin of pronotum (*P. melanarius*). 24) Angular lateral margin of pronotum (*P. brahminus*).