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Revision of the Genus *Meloe* Linnaeus (Coleoptera: Meloidae) of Japan

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Abstract Japanese species of the genus *Meloe* are revised taxonomically. Eight species under two subgenera are recognized including three new species, *Meloe* (*Meloe*) *hachijoensis* sp. nov. from Hachijo-jima (Tokyo: Izu Islands); *M*. (*M*.) *nipponicus* sp. nov. and *M*. (*Eurymeloe*) *kurosawai* sp. nov. from Honshu. *Meloe* (*M*.) *menoko* Kôno, 1936 is treated as a junior synonym of *M*. (*M*.) *auriculatus* Marseul, 1876. All species are described and redescribed with the figures of habitus, male and female antennae, and male genitalia etc. New distributional records are as follows: *M*. (*M*.) *coarctatus* Motschulsky, 1858 from Hokkaido, Hashira-jima (Yamaguchi), Yashiro-jima (Yamaguchi), Akahone-jima (Ehime) and Okino-shima (Kochi); *M*. (*M*.) *auriculatus* Marseul, 1876 from Shimokoshiki-jima (Kagoshima); *M*. (*Eurymeloe*) *corvinus* Marseul, 1876 from Etorofu-tou (Hokkaido), Izu-Ôshima (Tokyo: Izu Islands), Miyake-jima (Tokyo: Izu Islands), Kuchino-shima (Kagoshima: Tokara Islands), Tokuno-shima and Okinoerabu-jima (Kagoshima: Amami Islands) and Yonaguni-jima (Okinawa: Yaeyama Islands). A key to species is also given.
Key Words: Blister beetles, description, taxonomy, new species, junior synonym, Japan
ZooBank LSID: https://zoobank.org/References/A811F9BB-B5AD-4C00-A392-C1175EDFA846

Introduction

The family Meloidae (Coleoptera, Tenebrionoidea) is distributed in all biogeographical regions, and represented by about 120 genera and 3,000 species (Bologna *et al*. 2002; Bologna 2008). The genus *Meloe* Linnaeus, 1758 (Meloidae, Meloinae, Meloini) is widely distributed on all continents, except in the Oceania region and South America (Pan & Ren, 2018). Fifteen subgenera and 125 species and subspecies are known in the Palearctic Region (Bologna, 2020). Pan & Bologna (2021) reviewed the subgenus *Meloe* of the Palearctic Region, and described ten new species and synonymized some species. All subgenera of *Meloe* were recently elevated to the genus level by Sánchez-Vialas *et al*. (2021), but Pan & Bologna (2021) mentioned this taxonomic treatment will be rejected.

Seven species of two subgenera have been recorded from Japan (Kurosawa, 1963, 1985). Ecological knowledge of them were reported by many authors: Masuda (1947) [ecological reports and descriptions of larva and pupa]; Miyatake (1988, 1989), Miyatake *et al*. (1989), Nakatani (1989), Sakuratani (1988), Yamashita *et al*. (1989) [an ecological report of *M*. *auriculatus*]; Maeta (2000) [ecological reports of *M*. *coarctatus* and *M*. *corvinus*]; Okano *et al*. (2015) [mating behaviors of *M*. *coarctatus*, *M*. *proscarabaeus sapporensis* and *M*. *corvinus*]; Tateno (2016a, b, c) [detailed ecological reports and a picture book of *M*. *coarctatus*]. On the other hand, Japanese species of the genus *Meloe* have not been reviewed taxonomically except for some historical studies (e.g. Miwa, 1928; Kôno, 1936a, b; Kurosawa, 1963, 1985; Kifune *et al*., 1973). Treatment of Japanese species was almost fixed by Kurosawa (1963), and currently, we have followed this treatment. Therefore, in Japanese studies before 1963, some species names (both Japanese names and scientific names) differ from species names of fixed by Kurosawa (1963) and it is difficult to judge that treated species equal or not. Recently, there is a study that conducted genetic analysis on some Japanese species, and the results have revealed the existence of hidden species (Ohnishi *et al*., 2021).

In this paper, we morphologically review the Japanese species of the genus *Meloe* based on the numerous adult specimens preserved in Japanese museums and private collections.

Material and Methods

Over 2,500 adult specimens were examined for this study: 146 exs. *Meloe* (*Meloe*) *proscarabaeus exaratus* (including the holotype and paratypes of *M*. *sapporensis*); 241 exs. *M*. (*M*.) *violaceus* (including one paratype as *M*. *menoko*; misidentification); 981 exs., *M*. (*M*.) *coarctatus*; 690 exs., *M*. (*M*.) *auriculatus* (including the holotype and paratypes of *M*. *menoko*); 93 exs., *M*. (*M*.) *hachijoensis* sp. nov.; 13 exs., *M*. (*M*.) *nipponicus* sp. nov.; 363 exs. *M*. (*Eurymeloe*) *corvinus*; 66 exs. *M*. (*E*.) *kurosawai* sp. nov. The specimens data are shown in supplementary file (https://zenodo.org/record/8082195).

The specimens examined are preserved in the following institutions:

EUMJ Ehime University Museum, Matsuyama, Ehime, Japan
KMNH Kurashiki Museum of Natural History, Kurashiki, Okayama, Japan
KUC Kyushu University Collection, Fukuoka, Japan
MNHA Museum of Nature and Human Activities, Hyogo, Sanda, Hyogo, Japan
NIAES National Institute for Agro-Environmental Sciences, Tsukuba, Ibaraki, Japan
NSMT National Museum of Nature and Science, Tsukuba, Ibaraki, Japan
OMNH Osaka Museum of Natural History, Osaka, Japan
OMM Omogo Mountain Museum, Kumakogen, Ehime,

Japan
SEHU Hokkaido University Museum, Sapporo, Hokkaido, Japan
SKH Sayo-cho Konchukan, Sayo, Hyogo, Japan
TSM Toyama Science Museum, Toyama, Japan
TUA Tokyo University of Agriculture, Atsugi, Kanagawa, Japan
CKAM Collection of Katsumi Akita, Mie, Japan
CTDK Collection of Toshiaki Dejima, Kagawa, Japan
CSHH Collection of Shigehisa Hori, Hokkaido, Japan
CYKK Collection of Yuzo Kuroda, Kyoto, Japan
CTSO Collection of Taichi Shibata, Osaka, Japan
CMSO Collection of Masayuki Shimono, Osaka, Japan
CYTG Collection of Yasushi Takai, Gifu, Japan

The specimens for dissection were soaked in hot water for about 30 minutes, and then the genital organs were removed by forceps under a stereobinocular microscope (Leica S8-APO). The genital organs extracted from the abdomen were soaked in 10% KOH for a few minutes, then, the muscles and visceral tissues were removed. The dissected genitalia were observed under a digital microscope HiROX KH–1300 and images were captured with the 2D measurement software SHX–13M ver. 2. 9. 0. Habitus was photographed using a microscopy camera system (Nikon DS–Fi1–L2) and Single–lens reflex camera (Canon Kiss X9 and OM-D E-M5 Mark III). The verbatim label data indicated by double quotation marks (“ ”) are given for holotype. Terminology follows mainly Pinto *et al*. (1970) and Pan & Bologna (2021), especially on the male genitalia and the position of antennae; the position of tegmen (ventral view vs. dorsal view) is in agreement with Bologna *et al*. (2013). Morphological terminology applied to male genital structures in Meloidae follow Selander (1964, 1966) and Bologna *et al*. (2013) and the orientation of male genital structures follows Gerber *et al*. (1972). Scientific names of host bees follow Tadauchi & Murao (2014). The abbreviations for measurement used in this study are as follows: HL: head maximum length (from occiput to ventral margin of clypeus); HW: head maximum width; EL: elytral length (from basal margin to apex); EW: elytral maximum width; PL: maximum length of pronotum; PW: maximum width of pronotum; TL: total length (apex of clypeus to apex of abdomen). The arithmetic means of the measurement are given in parenthesis after the range. TL is different from the length when *Meloe* is alive because abdomen of dried specimen had shrunk and the angle of the head is often different depending on the specimen. Therefore, TL should be used as a reference value, not as an exact value when *Meloe* alive. The antennae of the male specimens used in figure are oriented that the posterior side facing up so that the shape can be seen from the dorsal view. The distribution maps were created in QGIS 3.16 based on maps which published by the Geospatial Information Authority of Japan.

Taxonomy

Genus ***Meloe*** Linnaeus, 1758

Meloe Linnaeus, 1758: 419. Type species: *Meloe proscarabaeus* Linnaeus, 1758, by subsequent designation (Latreille, 1810: 430).
See Pinto & Selander (1970) and Bologna & Pinto (2002) for complete synonymies and description.

Diagnosis. Body color is black to metallic blue, sometimes tinged purple or dark green; rarely with red to orange on parts of body. Pubescence is typically sparse; the dorsal is subglabrous, the ventral is more densely, but the dorsal of some species are densely covered with pubescence in dorsal. Hind wing is absent. Elytra are degenerated, imbricate basally, dehiscent apically. Legs are unmodified in male; tibiae in both sexes each with two spurs at apex; outer spur of hind tibiae obliquely truncate. Tarsal claws cleft to base; ventral edges of blades entire. Posterior margin of male ventrite usually subacutely or broadly, evenly emarginate. Male genitalia with gonoforceps evenly sclerotized; aedeagus with two dorsal hooks and one ventral hook (Pinto & Selander 1970).

Bionomics. When the adult start activity on the ground, the abdomen is small and often hidden under elytra. The adults are herbivory and eat weeds. The abdomen is enlarged by eating weeds and individual difference of abdominal size is conspicuously. According to the observation in Tateno (2016b), *Meloe* (*M*.) *coarctatus*, takes about a week for the abdomen to enlarge sufficiently after appear to the ground. The enlarged abdomen is soft and moist, so it shrinks significantly when it dries. Individual differences in body size are considerable, but females are generally larger than males. According to the observation of *M*. (*M*.) *coarctatus*, individual variation of body size depends on whether 5th instar larvae could invade other bee’s nest and predate on host bee’s larva and pollen ball made by bees (Tateno, 2016a, b).

Key to the Japanese subgenera of the genus *Meloe*

1. Pronotum as long as to longer than wide; sexual dimorphism in antenna conspicuous; male antennomeres VI and VII modified.……Subgenus *Meloe*
– Pronotum less than 2/3 as long as wide; sexual dimorphism in antenna absent; antennae moniliform to subfiliform in both sexes.……Subgenus *Eurymeloe*

Subgenus ***Meloe*** Linnaeus, 1758

Meloe Linnaeus, 1758: 419. Type species: *Meloe proscarabaeus* Linnaeus, 1758.
Complete synonymies and description see Pinto & Selander (1970) and Bologna & Pinto (2002).

Remarks. The sexual dimorphism appears clearly in antennae; male antennomeres VI and VII are deformed. The male antennae are used for mating behavior and are the important taxonomic character (Pinto & Selander, 1970; Okano *et al*., 2015). Species differences also appear in male genitalia, but there are individual variations and it may be difficult to distinguish species by only male genitalia.

The species groups of the subgenus were proposed by Pan & Bologna (2021): 5 species groups from the Nearctic Region (*americanus*, *angusticollis*, *franciscanus*, *strigulosus* and

tropicus groups); 2 species groups from the Afrotropical Region (*hottentotus* and *proscarabaeus* groups); 4 species groups from the Palaearctic Region (*angusticollis*, *distincticornis*, *lobatus* and *proscarabaeus* groups). In Japan, this subgenus comprises six species and three species groups: *proscarabaeus*, *angusticollis* and *lobatus* groups (Pan & Bologna 2021), and the *lobatus* group is subdivided into *lobatus* and *subcordicollis* subgroups (Pan & Bologna 2021).

Key to the Japanese species of the subgenus *Meloe*

1. Lateral margins of pronotum sinuate. Combined length of antennomeres VIII–XI equal to antennomeres II–VII……2
– Lateral margins of pronotum curved. Combined length of antennomeres VIII–XI shorter than antennomeres II–VII……5
2. Antennomere I as long as length of antennomeres II–IV combined; length of antennomere III almost equal length of antennomere IV. ……*Meloe* (*Meloe*) *coarctatus* Motschulsky, 1858
- Antennomere I shorter than length of antennomeres II–IV combined; antennomere III clearly longer than the length of antennomere IV. ……3
3. Antennomeres VII of male rounded trapezoidal, antennomere VII narrower than antennomere VI. Elytral wrinkles clearly and luster relatively weakly. Scutellum protruded posteriorly at one point in middle. Median groove absent on scutellum……*Meloe* (*Meloe*) *nipponicus* sp. nov.
- Antennomeres VII of male large, antennomere VII wider than antennomere VI. Elytral wrinkles weak and luster relatively strong……4
4 Antennomere VII of male human ear-shaped; sometimes protruded apically at antennal socket with constriction under antennal socket. Body almost tinged with dark blue or purple……*Meloe* (*Meloe*) *auriculatus* Marseul, 1876
- Antennomere VII of male sub-bean-shaped; protruded apically at antennal socket with constriction above antennal socket in large individuals, but without constriction in small individuals. Body tinged with bluish green or green, distributed in Hachijo-jima……*Meloe* (*Meloe*) *hachijoensis* sp.nov.
5. Head and pronotum punctate strongly and densely, its luster weak; scutellum emarginate arcuately……*Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832
- Head and pronotum punctate weakly and sparsely, its luster distinct; scutellum protruded at one point……*Meloe* (*Meloe*) *violaceus* Marsham, 1802

The ***proscarabaeus*** species group (sensu Pan & Bolohna 2021)

The pronotum is as wide as long or slightly wider; the punctures on the head and pronotum are deep and wide (except for *M. proscarabaeus aegyptius*), sometimes coarse, more or less dense or almost coalescing; the male antennomere V without platform, VI and VII are not distinctly transverse, VII is widest at apical half; posterior margin of the scutellum is almost straight (Pan & Bologna, 2021).

Meloe* (*Meloe*) *proscarabaeus exaratus Faldermann, 1832

[Japanese name: Oo-tsuchihanmyou]

(Figs. 1A, D; 4A, I; 5A; 6A; 7A, H, Q; 8A, G; 9A–C; 11; 12B, C; 14A)

Meloe exaratus Faldermann, 1832: 210.

Meloe (*Meloe*) *proscarabaeus exaratus*: Pan & Bologna, 2021: 19–24.

Meloe (*Proscarabaeus*) *sapporensis* Kôno, 1936a: 87–98 (Fig. 11); Kôno, 1936b: 52–62. [syn.].

Meloë proscarabaeus sapporensis: Kurosawa, 1963: 261–262, pl. 131, fig. 1. [syn.].

Meloe proscarabaeus sapporensis: Kurosawa, 1985: 412, pl. 70, fig. 4. [syn.].

Meloe (*Meloe*) *proscarabaeus sapporensis*: Kifune *et al*., 1973: 47–65; Bologna, 2008: 402 [catalog]; Okano *et al*., 2015: 44–49 [mating behavior]; Bologna, 2020: 547 [catalog]. [syn.].

Meloë proscarabaeus: Motschulsky, 1860: 19; Lewis, 1879: 20; Pagenstecher, 1887: 139 [catalog].

Meloe proscarabaeus: Satô, 1989: 414–415 [catalog]; Ohnishi *et al*., 2021: 122–139.

Meloë violaceus: Matsumura, 1906: 21, pl. 57, fig. 9 [misidentification].

Meloe violaceus: Miwa, 1928: 73 [misidentification]; Masuda, 1947: 61–76, pl. 2, figs. 1–4, 7, pl. 3, figs. 15, 16, 19, 22, 25, 28–30, pl.4, figs. 31–35 [misidentification].

Specimens examined. 19 exs. from Hokkaido (including the holotype and two paratypes of *Meloe sapporensis*); 40 exs. from Honshu; 84 exs. from Shikoku.

Redescription based on Japanese specimens. Male. TL 16.6–27.2 mm.

Color: Body (Fig. 1A) black, often tinged with dark blue, sometimes tinged with dark purple; surface slightly shiny.

Head: Head (Fig. 4A) slightly narrowed ventrally in frontal view, but sub-parallel in small individuals, irregularly and densely covered with large punctures and very short blackish setae, smooth between punctures; vertex flat or weakly emarginate in middle; frons punctate irregularly in center, with two indistinct depressions near antennal bases; frontoclypeal suture angulated in middle; frontal furrow indistinct, extended from frontoclypeal suture to 1/2 level of eyes; HL/HW 0.92–0.98 (0.95). Eyes slender, slightly convex, slender sub-reniform, narrowed below. Labrum broadly emarginate at anterior margin. Antennomeres (Fig. 7A, H, Q) I–V and VIII–XI sub-cylindrical; II sub-globose; III slightly longer than IV; V–VII formed semicircularly in dorsal view; VI widest, transversal trapezoidal, almost rounded square, slightly arcuate in posterior side, almost flat in anterior side; VII trapezoidal, arcuate in posterior side, strongly arcuate in anterior side; VIII–XI sub-filiform, VIII shortest; XI sub-cylindrical over middle and conically narrowed to apex.

Pronotum: Pronotum (Fig. 4I) arcuate at lateral margins, widest in anterior 1/3, weakly emarginate at posterior margin, densely and irregularly covered with large punctures; PW/PL 0.94–1.03 (0.99).

Scutellum: Scutellum (Fig. 5A) covered with punctures densely and irregularly, but evenly sparsely in center; posterior margin emarginate arcuately, not protruded posterior.

Elytra: Elytra (Fig. 6A) covered with strong wrinkles; EL/EW 3.56–4.35 (3.97).

Abdomen: Terga covered with weak wrinkles and short hairy setae; sternites closely covered with punctures bearing long hairy setae. Last ventrite broadly concave, bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9A–C): Gonostyli bilobed in apical 1/4 to 1/3 (apical lobe), evenly tapering apically, pointed at apices. Gonocoxal plate widest in apical 1/3, distinctly convex ventro-laterally in apical 1/3, as long as gonostyli, arcuate in lateral margins. Aedeagus with two short apical hooks on dorsal side and movable one small endophallic hook on ventral side; forming straightly between apex of aedeagus and apex of distal hook on ventral side; apical hooks parallel; angle of apical hooks acutely, but blunter than the *lobatus* group.

Female (Fig. 1D). TL: 16.5–27.6 mm. External features of head, pronotum, and elytra same as in male. HL/HW 0.90–0.94 (0.93); PW/PL 0.98–1.01 (0.99); EL/EW 3.67–4.22 (3.87); EL/PL 2.63–2.82 (2.72); EW/PW 0.68–0.74 (0.71). Antennae (Fig. 8A, G) sub-filiform; antennomere VIII–XI narrower than others in lateral view. Last ventrite emarginate very feebly.

Type locality. (as *Meloe exaratus* Faldermann) Province du Caucase (Pan & Bologna 2021).

Distribution (after Pan & Bologna 2021). Anatolia, Caucasus, Levant, North Egypt, Iran, Central Asia, S Siberia, E to Mongolia, China ("Manchuria", Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Guizhou, Inner Mongolia, Jilin, Liaoning, Ningxia, Qinghai, Sichuan, Xinjiang, Xizang, Zhejiang), Russian Far East, Japan.

Distribution in Japan. Hokkaido, Honshu, Izu-Ôshima, Shikoku.

Remarks. This species resembles *Meloe* (*Meloe*) *violaceus* in Japan, but differs as the following points: male antennomeres VI and VII wider; scutellum emarginated arcuately; punctures of head and pronotum larger and denser than *M*. (*M*.) *violaceus*. This species is widely distributed in the Eurasian continent, but has not been recorded in Tsushima.

This species was described as "*Meloe sapporensis*" based on specimens from Hokkaido (Kôno 1936). Since *Meloe sapporensis* was treated as a subspecies of *M. proscarabaeus* by Kurosawa (1963), that treatment has been followed (Kurosawa 1985; Bologna 2008, 2018). As distinguishable points from *M. proscarabaeus proscarabaeus*, it is pointed out that the body color is more blackish and the color of metatarsal pads is darker (Kurosawa, 1963, 1985). However, as a result of comparing Japanese specimens including the holotype and paratypes with Eurasian specimens, those distinguishable points could not be recognized as subspecies differences but individual variation. Pan & Bologna (2021) treated *M. sapporensis* as junior synonym of *M. proscarabaeus exacratus*, and our observations also support this treatment. The distribution of *M. proscarabaeus exacratus* is quite wide in Eurasia, but its distribution in Japan is localized and rare.

Bionomics. This species is mainly populating mountainous regions, and active in spring, and often feed on weeds in groups.

Courtship behavior: Okano *et al*. (2015). See also Okano (2014c) for movie.

Host record: *Eucera difficilis* Pérez: Masuda (1947) and Kifune *et al*. (1973).

The ***angusticollis*** group (sensu Pan & Bolohna 2021)

It includes only *M. angusticollis* from North America and one Palaearctic taxon: *M. violaceus* Marsham, 1802. The pronotum is as wide as long or slightly wider; the punctures on the head and pronotum are quite deep and wide, sometimes coarse, variously dense, or almost coalescing; the male antennomere V without platform, VI and VII are not distinctly transverse, VII is widest at apical half; the scutellum is distinctly protruded posteriorly (Pan & Bologna 2021).

Meloe* (*Meloe*) *violaceus Marsham, 1802

[Japanese name: Murasaki-oo-tsuchihanmyou]

(Figs. 1B, E; 4B, J; 5B; 6B; 7B, I, R; 8B, H; 9D–F;14B)

Meloe violaceus Marsham, 1802: 482–483; Ohnishi *et al*., 2021: 122–139.

Meloë violaceus: Motschulsky, 1860: 19; Lewis, 1879: 20; Pagenstecher, 1887: 139 [catalog].

Meloe (*Meloe*) *violaceus*: Bologna, 2008: 402 [catalog]; Bologna, 2020: 548 [catalog]; Pan & Bologna, 2021: 25–28.

Meloe (*Proscarabaeus*) *semenowi*: Kôno, 1936a: 87–98; Kôno, 1936b: 52–62. Synonymized by Tshernyshev (2017).

Meloë violaceus semenowi: Kurosawa, 1963: 261–262, pl. 131, fig. 2.

Meloe violaceus semenowi: Kurosawa, 1985: 412, pl. 70, fig. 5; Satô, 1989: 414–415 [catalog].

Specimens examined. 177 exs. from Hokkaido (including one paratype as *M. menoko*); 60 exs. from Honshu.

Redescription based on Japanese specimens. Male. TL 21.3–31.2 mm.

Color: Body (Fig. 1B) dark blue, sometimes tinged with dark violet; surface weakly to strongly shiny.

Head: Head (Fig. 4B) subparallel-sided or narrowed ventrally, covered with medium punctures and short blackish setae, smooth between punctures; vertex flat or sometimes emarginate in middle; frons relatively impunctate in center, with pair of depressions above antennal socket; frontoclypeal suture distinctly angulated in middle; frontal furrow extended from frontoclypeal suture to top level of eyes; HL/HW 0.97–1.08 (1.01). Eyes narrow, slightly convex, short sub-reniform. Labrum emarginate arcuately in anterior margin. Antennomeres (Fig. 7B, I, R) I–V and VIII–X inverted conical; III slightly longer than IV; V–VII formed semi-circularly in dorsal view; VI and VII transverse; VI widest, narrow trapezoidal, slightly arcuate in lateral margins, almost flat in anterior surface; VII slender trapezoidal, arcuate in lateral margins, slightly strongly arcuate in internal surface; VIII shortest; XI sub-cylindrical over middle and conically narrowed to apex.

Pronotum: Pronotum (Fig. 4J) arcuate or slightly sinuate in lateral margins, widest at anterior 1/3, emarginate triangular at posterior margin, depressed strongly along posterior margin, covered with small to moderate punctures. PW/PL 0.83–0.98 (0.92)

Scutellum: Scutellum (Fig. 5B) punctate densely and irregularly, covered with short brownish setae; posterior margin projected at one point.

Elytra: Elytra (Fig. 6B) covered with strong wrinkles. EL/EW 3.86–4.72 (4.41)

Abdomen: Terga covered with weakly wrinkles and short hairy setae; sternites closely covered with punctures bearing long hairy setae. Last ventrite broadly concave; bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9D–F): Gonostyli bilobed in apical 1/3 (apical lobe), tapering strongly in basal 1/4, evenly tapering in apical 3/4, pointed at apices, but apex rounded in lateral view. Gonocoxal plate widest at almost half, distinctly convex dorso-laterally in apical 2/3, almost same length of gonostyli, arcuate in lateral margins. Aedeagus with two short apical hooks on dorsal side and movable one small endophallic hook on ventral side; arcuate slightly between apex of aedeagus and apex of distal hook on dorsal side; apical hooks sub-parallel; angle of apical hooks acutely, but blunter than the *lobatus* group.

Female (Fig. 1E). TL 22.1–36.9 mm. External features of head, pronotum, and elytra same as in male. HL/HW 0.97–1.40 (1.09); PW/PL 0.90–0.92 (0.91); EL/EW 4.13–9.28 (5.36); EL/PL 2.50–3.08 (2.84); EW/PW 0.37–0.72 (0.63). Antennae (Fig. 8B, H) subfiliform; width of antennomere VIII–XI slightly narrower than others in lateral view. Last ventrite emarginate very feebly.

Type locality. no record but likely England (Pan & Bologna 2021).

Distribution (after Bologna, 2020). Japan. Azerbaijan, Albania, Andorra, Austria, Belgium, Bosnia Herzegovina, Bulgaria, Belarus, Croatia, Russia (European Territory; East and West Siberia; Far East), Czech Republic, Denmark, Estonia, Finland, France, Great Britain, Germany, Georgia, Greece, Hungary, Ireland, Italy, Kazakhstan, Latvia, Lithuania, North Macedonia, Moldova, The Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Ukraine, Serbia and Montenegro, Algeria, Morocco, Iran, India (Kashmir), Kyrgyzstan, Kazakhstan, Tajikistan, Turkey, Uzbekistan.

Distribution in Japan. Hokkaido, Honshu (westernmost record: Mie Prefecture).

Remarks. In Japan, this species is related to *Meloe* (*Meloe*) *proscarabaeus exaratus*, but differs as the following points: male antennomeres VI and VII narrower; scutellum protruded posteriorly at one point; punctures of head and pronotum sparser; generally lighter in body color.

This species is distributed widely in Eurasia and known some geographical differences (Pan & Bologna, 2021). Compared to the specimens from Eurasia, Japanese population have some characteristic features: elytral wrinkles stronger; pronotum narrower; antennae longer, antennomere VII slightly smaller and slenderer; lateral sides of head are almost sub-parallel, but individual variations are distinctly.

Bionomics. This species is mainly populating mountainous regions, and is distributed from northern to eastern Japan, and becomes rare as it goes western area of Japan. This species active in spring to early summer.

The ***lobatus*** group (sensu Pan & Bolohna, 2021)

The male antennomeres V and VI are distinctly modified and wider than long, V without apical platform, VI–VII are distinctly depressed on the anterior side, VI is hugely transverse, VII is different in shape in two subgroups, I is longer than IV; legs are more or less robust; punctures on the head and pronotum are variously shaped in two subgroups: *lobatus* and *subcordicollis* subgroups.

The ***lobatus*** subgroup (sensu Pan & Bolohna, 2021)

The antennae are slender, the male antennomere VI is sub-equal to or distinctly narrower than VII, VII is transverse, distinctly wider than long in lateral view, VIII is sub-cylindrical. The head and pronotum are covered with fine and sparse punctures (Pan & Bologna, 2021).

Meloe* (*Meloe*) *auriculatus Marseul, 1876

[Japanese name: Kyushu-tsuchihanmyou]

(Figs. 1C, F; 4C, K; 5C; 6C; 7C, J, S; 8C, I; 9G–I; 10; 12B; 14C)

Meloe auriculatus Marseul, 1876: 480–482; Borchmann, 1917: 121 [catalog]; Miwa, 1928: 63–78; Kurosawa, 1985: 413, pl. 70, fig. 8; Satô, 1989: 414–415 [catalog]; Ohnishi *et al*., 2021: 122–139.

Meloë auriculatus: Lewis, 1879: 20; Pagenstecher, 1887: 139 [catalog]; Kurosawa, 1963: 261–262, pl. 131, fig. 4.

Meloe (*Meloe*) *auriculatus*: Kifune *et al*., 1973: 47–65; Bologna, 2008: 402 [catalog]; Bologna, 2020: 547 [catalog]; Pan & Bologna, 2021: 33–34.

Meloe (*Proscarabaeus*) *menoko* Kôno, 1936a: 87–98 (Fig. 9); Kôno, 1936b: 52–62. syn. nov.

Meloë menoko: Kurosawa, 1963: 261–262, pl. 131, fig. 5.

Meloe menoko: Kurosawa, 1985: 413, pl. 70, fig. 7; Satô, 1989: 414–415 [catalog].

Meloe (*Meloe*) *menoko*: Bologna, 2008: 402 [catalog]; Bologna, 2020: 548 [catalog]; Ohnishi *et al*., 2021: 122–139.

Specimens examined. 309 exs. from Hokkaido (including the holotype, one allotype and two paratypes of M. *menoko*); 309 exs. from Honshu; 28 exs. from Shikoku; 35 exs. from Kyushu (including 2 exs. from Shimokoshiki-jima).

Redescription. Male. TL 8.0–18.5 mm.

Color: Body (Fig. 1C) blackish blue, often tinged with dark blue or dark purple, rarely bluish green; surface slightly to strongly shiny.

Head: Head (Fig. 4C) subparallel-sided or converging posteriorly in small individual, sparsely to moderately covered with small punctures and short blackish setae, smooth between punctures; vertex flat or weakly emarginate in middle; frons relatively impunctate in center, with two

indistinct depressions on insides eyes; fronto-clypeal suture angulated in middle; frontal furrow indistinctly, extended from fronto-clypeal suture to top level of eyes; HL/HW 0.92–1.06 (1.01). Eyes slender, convex, sub-reniform, narrowed below. Labrum emarginate widely in anterior margin. Antennomeres (Fig. 7C, J, S) I, III and VIII–XI sub-cylindrical; I shorter than II–IV combined; II sub-globose, smallest; III distinctly longer than wide, longer than IV; IV globose; V rounded trapezoidal, apical part arcuate strongly in anterior view, wider than length (W/L 1.54); VI transversal rectangular, angulated in apico-ventral margin, shallowly concave in anterior surface; VII sub-reniform, slightly projecting apically, widely concave in anterior surface; VIII–XI sub-filiform; XI sub-cylindrical over middle and conically narrowed to apex and slightly curved.

Pronotum: Pronotum (Fig. 4K) sinuate at side, widest at anterior 1/3, converging anteriorly and narrowest at anterior margin; sparsely to moderately covered with small punctures bearing short blackish setae; posterior margin emarginate triangular at middle, very strictly bordered and not depressed along base. PW/PL 0.87–0.97 (0.92).

Scutellum: Scutellum (Fig. 5C) densely covered with punctures and brownish setae; posterior margin protruded at two points, longitudinal groove at center, but unclear in small individual.

Elytra: Elytra (Fig. 6C) covered with week wrinkles; EL/EW 3.51–4.54 (4.02).

Abdomen: Terga covered with very week wrinkles; sternite very closely covered with punctures bearing long hairy setae. Last ventrite broadly emarginate, bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9G–I): Gonostyli bilobed in apical 1/3 (apical lobes), tapering apically, very weakly arcuate in lateral margin, pointed at apices; dorsal side of gonostyli convex at basal 2/3, evenly slender to apically apical 1/3 in lateral view. Gonocoxal plate widest at middle, distinctly convex laterally in middle, shorter than gonostyli, arcuate or weekly angulated in lateral margins. Aedeagus with two short apical hooks on ventral side and movable one small endophallic hook on dorsal side; arcuate weakly between apex of aedeagus and apex of distal hook; aedeagal hooks parallel, angle of proximal hook relatively acutely.

Female (Fig. 1F). TL 9.2–23.0 mm. External features of head, pronotum, and elytra same as in male. HL/HW 0.97–1.20 (1.05); PW/PL 0.57–1.05 (0.90); EL/EW 3.16–5.83 (4.29); EL/PL 2.03–2.81 (2.58); EW/PW 0.50–1.12 (0.69). Antennae (Fig. 8C, I) sub-filiform; antennomere V–VII unmodified and almost same width of others in lateral view. Last ventrite emarginate very feebly in middle of posterior margin.

Type locality. Hyogo, Osaka (Marseul 1876); the holotype is labeled "Osaka" (Pan & Bologna 2021).

Distribution (after Pan & Bologna 2021). Japan, Korea Peninsula (?).

Distribution in Japan. Hokkaido, Honshu, Shikoku, Kyushu, Shimokoshiki-jima (new record).

Remarks. This species resembles *Meloe* (*Meloe*) *coarctatus*, but differs from it by the following characteristics: antennomere I shorter than II–IV combined; antennomere III longer.

Kurosawa (1963, 1985) noted that *M. menoko* and *M. auriculatus* were distributed parapatrically, e.g. the former in Hokkaido to eastern part of Honshu and the latter in western part of Honshu to Kyushu, and they were distinguishable by the ratio of their antennomeres II and III. Kurosawa (1963), however, noticed that *Meloe menoko* may be the "northern type" of *M. auriculatus*. As a results of our molecular analysis (Ohnishi *et al*., 2021) and morphological comparison of many specimens, we concluded that they are same species, and treated *M. menoko* as a junior synonym of *M. auriculatus*.

This species was recorded from several areas of China, but these are probably misidentification of *M. lobatus*, a very close species (Pan & Bologna, 2021).

Kôno (1934, 1935) recorded *M. lobatus* from Hokkaido, but later Kôno (1936a, 1940) omitted this species from Japanese fauna. Bologna (2008, 2020) listed errourously *Meloe* (*Meloe*) *lobatus* Gebler, 1832 from Japan. *Meloe* (*M.*) *lobatus* wasn't found from Japan in this study.

Meloe (*M.*) *lobatus* is closely related to *M.* (*M.*) *auriculatus* and is distinguished as following characteristics (Pan & Bologna, 2021): larger and more densely punctate in head and pronotum; antenomere VIII shorter. These differences could be included in individual variations, so it will be necessary to study based on many specimens of *M.* (*M.*) *lobatus*.

Bionomics. This species is populating from plains to mountainous regions, and active mainly in late fall. Many specimens were collected in fall, but some specimens were collected in spring.

Some parts of ecology have been revealed in the following study: Miyatake (1988, 1989); Sakuratani (1988); Miyatake *et al*. (1988); Yamashita *et al*. (1989); Nakatani (1989). In these observations in Osaka, it has been confirmed that adults are mainly active in winter and lay eggs to underground in December and February (Miyatake, 1988, 1989; Miyatake *et al*., 1988; Yamashita *et al*., 1989).

The egg was described; the length is 0.8 mm, and the side with larval head is slightly wider (Miyatake, 1988).

This species was observed that impaled at a branch by shrikes (Miyatake, 1988). Species were not identified whether it was *M. auriculatus*, but a pellet of the shrike in the same area contained parts of *Meloe* (Yamashita *et al*., 1989). From these observations, it is certain that shrike (*Lanius bucephalus* Temminck & Schlegel, 1847) eats *Meloe* beetles (Yamashita *et al*., 1989).

Meloe* (*Meloe*) *coarctatus Motschulsky, 1858

[Japanese name: Hime-tsuchihanmyou]

(Figs. 2A, D; 4D, L; 5D; 6D; 7D, K, T; 8D, J; 9J–L; 12A; 14D)

Meloë coarctata Motschulsky, 1857: 25–41; Motschulsky, 1860: 19.

Meloe coarctatus: Marseul, 1876: 481–482; Borchmann, 1917: 121 [catalog]; Miwa, 1928: 63–78; Kurosawa, 1985: 413, pl. 70, fig. 6; Satô, 1989: 414–415 [catalog]; Ohnishi *et al*., 2021: 122–139.

Meloë coarctatus: Harold, 1877: 389 [catalog]; Lewis, 1879: 20; Pagenstecher, 1887: 139 [catalog]; Matsumura, 1906: 19, pl. 57, fig. 5; Kurosawa, 1963: 261–262, pl. 131, fig. 3.

Meloe (*Proscarabaeus*) *coarctatus*: Kôno, 1936a: 87–98; Kôno, 1936b: 52–62.
Meloe (*Meloe*) *coarctatus*: Kifune *et al*., 1973: 47–65 [ecology and first instar larva etc.]; Maeta, 2000: 126–146 [ecology etc.]; Bologna, 2008: 402 [catalog]; Okano *et al*., 2015: 44–49 [mating behavior]; Tateno, 2016a: 10–19 [ecology etc.]; Tateno, 2016b: 28–39 [ecology etc.]; Tateno, 2016c: 1–40 [ecology etc.]; Bologna, 2020: 547 [catalog]; Pan & Bologna, 2021: 34-35.
Meloe (*Proscarabaeus*) *auriculatus*: Kôno, 1936a: 87–98; Kôno, 1936b: 52–62.

Specimens examined. 22 exs. from Hokkaido; 409 exs. from Honshu (including 4exs. from Sadogashima, 4 exs. from Dogo, 1 ex. from Hashira-jima, 2 exs. from Yashiro-jima); 136 exs. from Izu Islands; 322 exs. from Shikoku (including 1ex. from Akahone-jima, 2exs. Okino-shima); 69 exs. from Kyushu (including 36 exs. from Tsushima).

Redescription. Male. TL 13.5–30.0 mm.

Color: Body (Fig. 2A) black to blackish blue, often tinged with bluish green or dark blue, sometimes tinged with dark purple; surface slightly to strongly shiny.

Head: Head (Fig. 4D) subparallel-sided or converging posteriorly in small individual, sparsely to moderately covered with small punctures and short blackish setae, smooth between punctures; vertex flat or weakly emarginate in middle; frons relatively impunctate in center, with two indistinct depressions above antennal socket; fronto-clypeal suture angulated in middle; frontal furrow short and indistinct, extended from fronto-clypeal suture to level of 1/2 eyes; HL/HW 0.95–1.046 (1.00). Eyes wide, convex, subbean-shaped, narrowed below slightly. Anterior margin of labrum emarginate widely and arcuately in middle. Antennomeres (Fig. 7D, K, T) I and VIII–XI sub-cylindrical; I as long as II–IV combined; II–III moniliform; II globose, smallest; III wider than long, longer than IV; IV globose, clearly prominent to dorsal side in lateral view; V angularity, transversal trapezoidal, protruded to apico-dorsal margin in lateral view, very wider than long (W/L 1.84); VI transversal rectangular, angulated at apico-ventral margin, distinctly concave in anterior surface; VII widely heart-shaped (rounded triangular), projecting apically, anterior surface deeply and widely concave, apical part of anterior side covered with punctures and blackish setae; VIII–XI subfiliform; XI sub-cylindrical over middle and conically narrowed to apex and slightly curved.

Pronotum: Pronotum (Fig. 4L) sinuate at side, widest at anterior 1/4, narrowest at anterior margin, sparsely to moderately covered with small punctures which have short blackish setae, posterior margin emarginate triangular in middle. PW/PL 0.86–0.94 (0.90)

Scutellum: Scutellum (Fig. 5D) covered with punctures and long brownish setae, median part especially densely; posterior margin angulated weakly at one point.

Elytra: Elytra (Fig. 6D) covered with weakly wrinkles. EL/EW 4.16–5.90 (4.64)

Abdomen: Terga covered with very weak wrinkles; sternites closely covered with punctures bearing long hairy setae. Last ventrite broadly emarginate; bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9J–L): Gonostyli bilobed in apical 1/4 (apical lobe), evenly tapering apically, pointed at apices; dorsal side of gonostyli convex at basal 3/4, evenly slender at apical 1/4 in lateral view. Gonocoxal plate widest at middle, distinctly convex laterally in middle part, shorter than gonostyli, weakly angulated to arcuate in lateral margins. Aedeagus with two short apical hooks on ventral side and movable one small endophallic hook on dorsal side; arcuate weakly between apex of aedeagus and apex of distal hook; aedeagal hooks parallel, angle of proximal hook relatively acutely.

Female (Fig. 2D). TL 11.3–32.8mm. External features of head, pronotum, and elytra same as in male. HL/HW 0.97–1.05 (1.01); PW/PL 0.89–0.95 (0.92); EL/EW 4.17–5.01 (4.49). Antennae (Fig. 8D, J) subfiliform; antennomere V–VII unmodified but distinctly wider than others in lateral view. Last ventrite emarginate very feebly in middle of posterior margin.

Type locality. Japan (Motschulsky 1858).

Distribution. Japan (Hokkaido (new record based on specimens), Honshu, Izu Islands (Izu-Ôshima, Miyake-jima, Kozu-shima, Mikura-jima), Sadogashima, Dogo (Oki Islands), Hashira-jima (new record), Yashiro-jima (new record), Shikoku, Akahone-jima (new record), Okino-shima (new record), Kyushu, Tsushima).

Remarks. This species has the most various body colors in Japanese species. This species is the most closely related and resembles *Meloe* (*Meloe*) *auriculatus* and *M*. (*M*.) *hachijoensis* in Japan, but differs as the following points: antennomere I longer, III shorter than *M*. (*M*.) *auriculatus* and *M*. (*M*.) *hachijoensis*.

This species is recorded only from Japan and has very distinctive character in antennae. Miwa (1928) recorded this species from Hokkaido (Sapporo and Jouzankei), but Kono (1936) stated that "all species recorded from Hokkaido as *M. auriculatus* or *M. coarctatus* were misidentification of *M. menoko*" and erased the record from Hokkaido. This treatment was also followed in Kurosawa (1963, 1985) or other studies, and this species was considered not to have a distribution in Hokkaido. This study records this species from Hokkaido, based on specimens. The distribution in Hokkaido is limited, only Donan, Doto and Dohoku regions. Many specimens from Hokkaido are recent, and the oldest specimens was collected in 1971.

Bionomics. This species is populating from plains to mountainous regions, and is the most common in Japan. This species is active mainly in spring and late fall, and often feed on weeds in groups. Due to the cantharidin contained in the body of *M. coarctatus*, *Macratria serialis* Marseul, 1876 (Coleoptera: Anthicidae) and *Pseudopyrochroa japonica* (Heyden, 1879) (Coleoptera: Pyrochroidae) are known to gather to the carcasses (Hashiomoto 2018). Detail ecology has been observed as the following study: Maeta (2000); Tateno (2016a, b, c).

Courtship behavior: Okano *et al*. (2015). See also Okano (2014a) for movie.

Host record: *Lasioglossum* (*Evylaeus*) *affine* (Smith, 1853): Maeta (2000); *Andrena* (*Calomelissa*) *prostomias* Pérez, 1905: Maeta (2000), Tateno (2016a, b); Andrenidae sp.:

Masuda (1947) and Kifune *et al*. (1973).

Meloe* (*Meloe*) *hachijoensis sp. nov.

[Japanese name: Hachijo-tsuchihanmyou]

(Figs. 2B, E; 4E, M; 5E; 6E; 7E, F, L, M, U, V; 8E, K; 9M–O; 12E–G; 15A)

Meloe (*Meloe*) *coarctatus*: Kawabata, 2010: 21–30 [misidentification].

Meloe sp.2: Ohnishi *et al*., 2021: 122–139.

Type materials. Holotype: ♂, "Sueyoshi, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 東京都八丈町末吉(八丈島), 33°06'23.60"N 139°50'40.64"E, Alt. 377m, 16–III–2016, Ryosuke Okano leg." (EUMJ).

Paratypes: 3♂4♀, same data as for the holotype (EUMJ); 2♂2♀, Sueyoshi, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°06'26.02"N 139°50'35.90"E, Alt. 402m, 16. III. 2016, Ryosuke Okano leg. (EUMJ); 9♂5♀, Sueyoshi, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°06'33.08"N 139°50'24.12"E, Alt. 386m, 16. III. 2016, Ryosuke Okano leg. (EUMJ); 4♂2♀, Nakanogou, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°04'58.01"N 139°48'39.82"E, Alt. 440m, 18. III. 2016, Ryosuke Okano leg. (EUMJ); 6♂6♀, Mt. Miharayama, Nakanogou, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°05'00.59"N 139°48'56.08"E, Alt. 490m, 18. III. 2016, Ryosuke Okano leg. (EUMJ); 1♂2♀, Mt. Miharayama, Nakanogou, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°05'16.37"N 139°49'19.15"E, Alt. 566m, 18. III. 2016, Ryosuke Okano leg. (EUMJ); 2♀, Kashitate, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°04'32.35"N 139°48'17.81"E, Alt. 215m, 20. III. 2016, Ryosuke Okano leg. (EUMJ); 2♂1♀, Kashitate, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°05'20.99"N 139°47'24.99"E, Alt. 228m, 20. III. 2016, Ryosuke Okano leg. (EUMJ); 1♂1♀, Noboryou-toge, Mitsune, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°06'48.46"N 139°50'07.92"E, Alt. 311m, 15. III. 2016, Ryosuke Okano leg. (EUMJ); 4♂5♀, ditto, but 16. III. 2016, Ryosuke Okano leg. (EUMJ); 7♂4♀, Mt. Hachijofuji, Ookagou, Hachijo-machi, Is. Hachijo-jima, Tokyo Pref., Japan, 33°08'17.50"N 139°44'53.31"E, Alt. 317m, 20. III. 2016, Ryosuke Okano leg. (EUMJ); ♂, Mt. Hachijofuji, Ookagou-mura, Hachijo-machi, Tokyo Pref., Japan, alt. 200m, 22. III. 2015, Naomichi Tsuji leg. (EUMJ); 10♂5♀, Mitsune, Is. Hachijo-jima, 16. III. 1986, M. Takakuwa leg. (KPMCH); ♀, Kashitate, Is. Hachijo-jima, 9. III. 1996, M. Muramatsu leg. (KMNH).

Description. Male. TL 13.0–20.4 mm, 16.7 mm in holotype.

Color: Body (Fig. 2B) black, tinged with blackish green; surface shiny.

Head: Head (Fig. 4E) subparallel–sided, moderately covered with medium punctures and short blackish setae, smooth between punctures; vertex arcuate strongly; frons relatively impunctate in center, with two large depressions on insides of antennal socket; fronto-clypeal suture distinctly angulated in middle; frontal furrow extended from fronto-clypeal suture to level of 3/4 eyes; HL/HW 0.97–1.08 (1.03). Eyes large, bean-shaped, strongly convex and emarginate internal margin. Labrum emarginate widely in anterior margin. Antennomeres (Fig. 7E, F, L, M, U, V) I and VIII–XI sub-cylindrical; I shorter than II–IV combined; II sub-globose; III longer than wide, longer than IV; IV sub-globose, smallest; V trapezoidal, a little wider than length (W/L 1.28); VI transversal rectangular, weakly angulated in apico-ventral margin, shallowly concave in anterior surface; VII wide sub-bean-shaped, projecting apically at antennal socket with constriction above antennal socket, but constriction inconspicuous in small individual(Fig. 7F, M); anterior margin projecting apically, concave widely in anterior side; VIII–XI sub-filiform; XI sub-cylindrical over middle and conically narrowed to apex and slightly curved.

Pronotum: Pronotum (Fig. 4M) sinuate strongly at sides, widest in anterior 1/3, narrowest in posterior 1/4, sparsely covered with small punctures bearing very short blackish setae, posterior margin emarginate triangularly in middle. PW/PL 0.87–0.91 (0.88).

Scutellum: Scutellum (Fig. 5E) covered with punctures densely and bearing long hairy brownish setae; posterior margin angulated at one point.

Elytra: Elytra (Fig. 6E) covered with week wrinkles; EL/EW 2.67–4.31 (3.31).

Abdomen: Terga covered with very week wrinkles. Sternites closely covered with punctures bearing long hairy setae; last ventrite broadly emarginate; bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9M–O): Gonostyli bilobed in apical 1/3 (apical lobes), evenly tapering apically at apical 1/3, subparallel-sided in apical 1/3 to 3/3; in dorsal view apical lobes evenly thick, but pointed at apices; dorsal side convex weakly at basal 3/4, evenly slender at apical 1/4 towards apices. Gonocoxal plate widest at middle, distinctly convex laterally in middle part, as long as gonostyli, weakly angulated in lateral margins. Aedeagus with two short apical hooks on ventral side and movable one small endophallic hook on dorsal side; arcuate weakly between apex of aedeagus and apex of distal hook; aedeagal hooks sub-parallel.

Female (Fig. 2E). TL 16.8–25.0 mm. External features of head, pronotum, and elytra same as in male. HL/HW 0.99–1.02 (1.00); PW/PL 0.88–0.88 (0.88); EL/EW 2.49–3.72 (3.14); EL/PL 2.40–2.73 (2.60); EW/PW 0.84–1.10 (0.96). Antennae (Fig. 8E, K) subfiliform; antennomere V–VII unmodified but slightly wider than others in lateral view. Last ventrite emarginate very feebly in middle of posterior margin.

Distribution. Hachijo-jima (Izu Islands).

Remarks. This species has distinctly individual variation in male antennomere between large and small individuals, on the other hands, the shape of the male genitalia is stable. This species is the most closely related and resembles *Meloe* (*Meloe*) *auriculatus* in Japan, but differs as the following points: antennomere VII of male wider, wide sub-bean-shaped to rounded triangular; basal 2/3 of gonostyli subparallel-sided; apical lobe thicker in ventral view. *Meloe* (*M*.) *hachijoensis* is morphologically similar to *M*. (*M*.) *gracilior* Fairmaire, 1891 and *M*. (*M*.) *formosensis* Miwa, 1930, which are distributed in China and Taiwan, and is known to be genetically very closely

related to them (Bologna 2020, personal communication). *M. hachijoensis* resembles *M. gracilior* in the punctures on the head and pronotum, and gonostyli resembles *M. formosensis* in its narrow features, but can be distinguished by the following characters: male antennomere VII is distinctly projecting at the apical antennal socket; basal part of gonostyli is subparallel-sided and apical lobes is thicker. Other closely related species of *M. gracilior* and *M. formosensis* are not distributed in Japan.

Bionomics. This species is populating widely on Hachijo-jima and active in late fall and spring. When we observed in March, this species was active mainly at night, mating and laying eggs at night (Fig. 11E, F, G).

The ***subcordicollis*** subgroup (sensu Pan & Bolohna 2021)

The antennae are robust, the male antennomere VI is slightly wider than VII, VII is sub-trapezoidal, slightly wider than long in anterior view (but transverse in *M. chinensis*), VIII is widened apically, but slightly slender in *M. shapovalovi*. The head and pronotum with dense, large and deep punctures (Pan & Bologna, 2021).

Meloe nipponicus sp. nov. is not fit the definition of this subgroup as following characteristics: the punctation of the head and pronotum is finely and sparsely; antennae are not robust clearly, especially antennomere VIII–XI are sub-cylindrical and sub-filiform (not sub-moniliform). However, the characteristic of male antennomere VII fit the definition of this subgroup and can be easily distinguished from the *lobatus* subgroup, so we locate this species in the *subcordicollis* subgroup. Therefore, it is difficult to distinguish these subgroups based on the puncture of head and pronotum; antennae are slender or robust.

Meloe* (*Meloe*) *nipponicus sp. nov.

[Japanese name: Takane-tsuchihanmyou]

(Figs. 2C, F; 4F, N; 5F; 6F; 7G, N, W; 8F, L; 9P–R; 15B)

Meloe sp.1: Ohnishi *et al*., 2021: 122–139.

Type materials. Holotype (EUMJ): ♂, "Chugushi, Nikko-city, Tochigi Pref., Japan, 栃木県日光市中宮祠, 29–X–2014, Ohjiro Ohnishi leg.".

Paratypes: [Honshu] <Tochigi Pref.> 1♂2♀, same data as for the holotype (EUMJ); <Saitama Pref.> 2♂1♀, Okuchichibu, 21~23. X. 1967, H. Hasegawa leg. (NIAES); <Kanagawa Pref.> 1♀, Tanzawa, 2. VII. 1967, M. Hori leg. (OMNH); <Yamanashi Pref.> 1♂, Mt. Misyoutai-yama, Doushi-mura, 11. XI. 2000, M. Nonaka leg. (EUMJ); <Nara Pref.> 1♂, Houriki-toge ~ Inamura-goya, Mts. Ohmine, Inamuragatake, Yoshino-gun, 13. VI. 1982, K. Harusawa leg. (OMNH); 1♀, Mt. Ohmine, Dorogawa ~ Houriki-toge, Tenkawa-v., Yoshino-gun, alt. 900 ~ 1,210 m, 10. VI. 1973, K. Harusawa leg. (OMNH); 1♂, Top of Mt. Dainichi-dake, Tenkawa, Yoshino-Co., 10~14. VI. 1973, "trap", K. Harusawa leg. (OMNH); 1♂, Mt. Wasamata-yama, Yamato, 14~15. VI. 1997, Y. Hayashi leg. (EUMJ).

Description. Male (Fig. 2C). TL 16.5–22.8 mm; 16.8 mm (holotype).

Color: Body blackish blue, tinged with dark blue; surface moderately shiny.

Head: Head (Fig. 4F) subparallel-sided, sparsely covered with small punctures and short blackish setae, smooth between punctures; vertex vaguely emarginate in middle; frons relatively impunctate in center, with two depressions on insides of antennal socket; fronto-clypeal suture distinctly angulated in middle; frontal furrow extended from fronto-clypeal suture to level of 3/4 eyes; HL/HW 0.92–1.06 (1.00). Eyes wide, convex, sub-reniform. Labrum emarginate widely in anterior margin. Antennomeres (Fig. 7G, N, W) I, III and VIII–XI sub-cylindrical; I shorter than II–IV combined; II sub-globose, longer than wide; III distinctly longer than wide, clearly thicker toward apically; IV globose, shortest; V rounded rectangular, wider than long (W/L 1.81); VI widest, transversal rectangular, angulated distinctly in apico-ventral margin, shallowly concave in anterior side; VII rounded isosceles trapezoidal, slightly protruded in ventral portion of apical antennal socket, distinctly smaller than VI, weakly concave in anterior surface; VIII–XI sub-filiform; XI sub-cylindrical over middle and conically narrowed to apex and curved.

Pronotum: Pronotum (Fig. 4N) sinuate at side, widest at anterior 1/3, narrowest at posterior 1/5, sparsely covered with small punctures bearing short blackish setae, posterior margin emarginate triangularly in middle. PW/PL 0.84–0.96 (0.90).

Scutellum: Scutellum (Fig. 5F) covered with punctures densely and irregularly, covered with long dark brownish setae, median line especially densely; posterior margin of scutellum protruded at one point.

Elytra: Elytra (Fig. 6F) covered with small but clear wrinkles; luster week. EL/EW 2.78–3.23 (2.97).

Abdomen: Terga covered with strong wrinkles; sternites densely covered with punctures bearing long hairy setae. Last ventrite broadly emarginate, bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9P–R): Gonostyli bilobed in apical 1/3 (apical lobe), tapering apically, tapering stronger in apical 1/3, pointed at apices, basal part of about 2/3 sub-parallel in lateral view. Gonocoxal plate widest in middle, weekly angulated in middle of lateral margins, distinctly convex ventro-laterally in middle part, slightly longer than gonostyli. Aedeagus with two short apical hooks on ventral side and movable one small endophallic hook on dorsal side; apical hooks sub-parallel, angle of apical hooks relatively acutely.

Female (Fig. 2F). TL 12.5–17.3 mm. External features of head, pronotum, and elytra same as in male. HL/HW 0.98–1.05 (1.00); PW/PL 0.89–0.99 (0.93); EL/EW 2.45–3.06 (2.73). Antennae (Fig. 8F, L) subfiliform; antennomere V–VII unmodified but slightly wider than others in lateral view; antennomere III thicker clearly than II. Last ventrite emarginate very feebly.

Distribution. Honshu: (Tochigi, Saitama, Kanagawa, Yamanashi and Nara prefs.).

Remarks. This species resembles *Meloe* (*Meloe*) *auriculatus* among Japanese species, but differs as the following points: antennomere III thicker, VII of male smaller; posterior margin of scutellum protruded at one point; elytral wrinkles more clearly and elytral luster weaker. This

species is related to *M. shapovalovi* and *M. subcoridicollis* in the *subcoridicollis* subgroup because of the shapes of antennomere VII, and sparsely punctation of head and pronotum, luster relatively strong. However, the following points can be distinguished them: antennomeres VIII–XI are more sub-filiform; VI of male protruded distinctly at apico-ventral side in lateral view.

Bionomics. This species is populating only mountainous regions of Honshu and active mainly in late fall, but some specimens were collected in spring. This species was collected with *Meloe* (*Meloe*) *coarctatus* and *M.* (*M.*) *auriculatus* at same area and season in Saitama, with *M.* (*M.*) *coarctatus* in Tochigi (type locality). This species is the rarest species in Japan.

Subgenus ***Eurymeloe*** Reitter, 1911

Eurymeloe Reitter, 1911: 391. Type species: *Meloe brevicollis* Panzer, 1793, by subsequent designation (Pinto & Selander, 1970: 107–108).

Complete synonymies and description see Pinto & Selander (1970), Bologna & Pinto (2002) and Bologna (1991).

Remarks (based on Pinto & Selander, 1970). Body black to moderately metallic blue, without red or yellow markings on body. Sexual dimorphism of antenna and tarsal pad absent. Mandibles lacking an accessory tooth; prosthecal emargination small. Male antennae straight, unmodified. Pronotum transverse, about 2/3 as long as wide. Mesepisterna not meeting at midline.

Key to the Japanese species of the subgenus *Eurymeloe*

1. Head and pronotum punctate roughly and prominent between punctures, luster weakly, elytral wrinkles rough……*Meloe* (*Eurymeloe*) *corvinus* Marseul, 1876
– Head and pronotum punctate clearly and flat between punctures, luster moderately, elytral wrinkles more smooth…….*Meloe* (*Eurymeloe*) *kurosawai* sp. nov.

Meloe* (*Eurymeloe*) *corvinus Marseul, 1876

[Japanese name: Marukubi-tsuchihanmyou]
(Figs. 3A, B, D, E; 4G, O; 5G; 6G; 7O, X; 9S–U; 13A, C; 15C)

Meloe corvinus Marseul, 1876: 482–483; Borchmann, 1917: 121 [catalog]; Miwa, 1928: 63–78; Kôno, 1934: 27–40; Masuda, 1947: 61–76, tab. 2–4; Kurosawa, 1985: 413, pl. 70, fig. 9; Satô, 1989: 414–415 [catalog]; Ohnishi *et al*., 2021: 122–139.

Meloë corvinus: Lewis, 1879: 20; Pagenstecher, 1887: 139 [catalog]; Matsumura, 1906: 18, pl. 57, fig. 3; Kurosawa, 1963: 261, pl. 131, fig. 6.

Meloe (*Eurymeloe*) *corvinus*: Kôno, 1936b: 52–62; Maeta, 2000: 126–146 [biology]; Bologna, 2008: 400 [catalog]; Di Giulio *et al*., 2013: 242–254; Okano *et al*., 2015: 44–49 [mating behavior]; Bologna, 2020: 544 [catalog].

Meloë brevicollis: Harold, 1877: 359 [catalog, misidentification]; Lewis, 1879: 20 [misidentification].

Specimens examined. 42 exs. from Hokkaido (including 1ex. from Etorofu-tou); 149 exs. from Honshu; 8 exs. from Izu Islands; 70 exs. from Shikoku; 55 exs. from Kyushu (including 14exs. from Tsushima); 18 exs. from the Ryukyu Islands.

Redescription. Male (Fig. 3A, B). TL 12.7–21.3 mm.

Color: Body black, often tinged with dark blue or slightly blackish green; surface slightly shiny.

Head: Head (Fig. 4G) narrowed ventrally strongly, irregularly punctate; interpunctal surface rugose and raised; vertex clearly arcuate; frons punctate irregularly, with two depressions on insides of antennal socket; frontoclypeal suture slightly angulated in middle; frontal furrow extended from frontoclypeal suture unclear; HL/HW 0.82–0.91 (0.87). Eyes small, slightly convex, slender sub-reniform, narrowed below. Labrum emarginate widely and deeply in anterior margin. Antennae (Fig. 7O, X) submoniliform; antennomere II–X globose; antennomere XI narrowed diagonally from dorsal to ventral, trapezoidal in lateral view.

Pronotum: Pronotum (Fig. 4O) rounded transversal rectangular, subparallel in lateral margins and arcuate in anterolateral margins, widest at anterior 2/4–4/4, emarginate at posterior margin, covered with punctures strongly and densely; PW/PL 1.50–1.74 (1.62).

Elytra: Elytra (Fig. 6G) covered with rough wrinkles. EL/EW 3.37–3.73 (3.47).

Scutellum: Scutellum (Fig. 5G) covered with punctures densely and irregularly; posterior margin emarginate arcuately, not protruded posteriorly.

Abdomen: Terga tending to degenerate; covered with wrinkles and short hairy setae. Dorsal laterotergites sparsely covered with very short blackish setae, sternites closely covered with punctures bearing long hairy setae. Last ventrite broadly emarginate; bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9S–U): Gonostyli triangular, bilobed in apical 1/3–1/2 (apical lobe), evenly tapering apically and strongly tapering in apical 1/3–1/2, pointed at apices, in lateral view projected trapezoidal into dorsal at basal 3/4 and narrowed suddenly at apical 1/4. Gonocoxal plate inverted sub-oval and convex strongly in lateral side, widest at middle, almost same length of gonostyli, arcuate in lateral margins, anterior margin arcuate and covering on basal part of gonostyli, evenly thin to basally at basal 1/2, in lateral view pointed at posterior part. Aedeagus with two short apical hooks on ventral side and movable one small endophallic hook on dorsal side; apical hooks parallel and robust, angle of apical hooks acutely.

Female (Fig. 3D, E). TL 13.7–24.6 mm. External features of head, pronotum, and elytra same as in male; terga tending to degenerate more than male. HL/HW 0.82–0.91 (0.87); PW/PL 1.34–1.85 (1.56); EL/EW 2.72–3.58 (3.11); EL/PL 3.20–4.10 (3.66); EW/PW 0.69–0.85 (0.76). Antennae submoniliform, slightly shorter than male. Last ventrite isosceles trapezoidal.

Type locality. Nagasaki, Hyogo (Marseul, 1876).

Distribution. Japan, Russia (Far East), China (Northeast Korea), Korea (Bologna 2020).

Distribution in Japan. Hokkaido, Etorofu-tou (new record), Honshu, Izu Islands (Izu-Ôshima, Miyake-jima; new record), Shikoku, Kyushu, Kuchino-shima (Tokara Islands; new record),

Tokuno-shima and Okinoerabu-jima (Amami Islands; new record), Yonaguni-jima (Yaeyama Islands; new record).

Remarks. This species is the most closely related and resembles *Meloe* (*Eurymeloe*) *kurosawai* in Japan, but differs as the following points: punctures of head and pronotum larger and coarser; elytral wrinkles stronger; antenna shorter than *M*. (*E*.) *kurosawai*.

This is the first record from Etorofu-tou, Izu-Ôshima, Miyake-jima, Kuchino-shima, Tokuno-shima, Okinoerabu-jima and Yonaguni-jima. All the specimens from Izu–islands were collected before 1961 and there are no recent specimens from the area. The records from Kuchino-shima, Tokuno-shima, Okinoerabu-jima and Yonaguni-jima are amazing because *Meloe* species have not been recorded from the Ryukyu Islands. These islands are located in the subtropical region (south region of Watase line), and absent high altitude areas (the highest altitude: 628.5 m on Kuchino-shima; 644.9 m on Tokuno-shima; 239.9 m on Okinoerabu-jima; 231.4 m on Yonaguni-jima). Yonaguni-jima is the westernmost island of Japan and very close to Taiwan, so it suggests that this species is probably distributed in Taiwan. The subgenus *Eurymeloe*, including this species, is not recorded from Taiwan.

The first instar larva of this species was described and compared with *M*. (*E*.) *brevicollis* (Di Giulio *et al*. 2013). This result suggested that these species are very closely related and a co-specificity of these taxa is suspected (Di Giulio *et al*., 2013). *Meloe* (*E*.) *brevicollis* is distributed wider in Palearctic, and 3 subspecies have been described: *M*. (*E*.) *b*. *algiricus*, *M*. (*E*.) *b*. *curticornis* and *M*. (*E*.) *b*. *mistaniensis* (Bologna, 2008; Bologna, 2020). As mentioned above, *M*. (*E*.) *brevicollis* is a polymorphic species. In order to clarify the relationship between these taxa, it is necessary to compare with many specimens of *M*. (*E*.) *brevicollis* from especially East Asia region and *M*. (*E*.) *corvinus*. However sufficient specimens of these species have not been obtained in this study, we avoid estimating the relationship of them.

Bionomics. This species is inhabiting from plains to mountainous regions, and was common species almost as same as *Meloe* (*Meloe*) *coarctatus* in Japan, but this species decreases recently. This species is active in spring.

Courtship behavior: Okano *et al*. (2015). See also Okano (2014b) for movie.

Host records: *Anthophora villosula* Smith, 1854 (= *Anthophora* (*Anthophora*) *plumipes* (Pallas, 1772)): Torigata (1931); *Eucera sociabilis* Smith, 1873: Kôno (1936b); *Eucera spurcatipes* Pérez, 1905: Masuda (1947); *Osmia jacoti* Cockerell, 1929: Maeta (2000); *Andrena* (*Calomelissa*) *prostomias* Pérez, 1905: Maeta (2000).

Meloe* (*Eurymeloe*) *kurosawai sp. nov.

[Japanese name: Miyama-tsuchihanmyou]

(Figs. 3C, F; 4H, P; 5H; 6H; 7P, Y; 9V–X; 13E; 15D)

Meloë brevicollis: Kurosawa, 1963: 261, pl. 131, fig. 6 [new record from Japan; misidentification].

Meloe (*Eurymeloe*) *brevicollis*: Kurosawa, 1985: 413–414, pl. 70, fig. 10.

Meloe brevicollis: Satô, 1989: 414–415 [catalog].

Type materials. Holotype: ♂, "Mt. Tanigawa-dake, Minakami-machi, Tone-gun, Gunma Pref., Japan, 群馬県利根郡みなかみ町谷川岳 , 15–VII–2015, Ryosuke Okano leg." (EUMJ). Paratypes: 11♂13♀, same data as for the holotype (EUMJ).

Additional specimens examined. [Honshu] <Yamagata Pref.> 1 ex., Mt. Ihde, 8. VIII. 1943, Y. Kurosawa leg., (NSMT); 1♀ & 2 exs., Mt. Asahidake, 25. VII. 1951, T. Yoneyama leg. (NSMT); 2exs., Mt. Asahidake, 25. VII. 1951, K. Nagayama leg. (NSMT); 1♂ & 2exs., Omatayama, Mt. Kanmuro, 17. VII. 1977, K. Shirahata leg. (NSMT); 4exs., Jigami-yama, Oguni-machi, 1. VIII. 2005, Y. Nagahata leg. (KACM); <Fukushima Pref.> 2♂2♀ & 1ex., Aizu C., K. Nagayama leg. (SEHU); 1ex., Asahidake, K. Nagayama leg. (SEHU); <Tochigi Pref.> 1♀, Nasu, 11 VI. 1946, S. Hisamatsu leg. (EUMJ); 1ex., Chuzenji, Nikko, 6~31. VI. 1911, Matsumura leg. (SEHU); 1♂, Mae-sirane, Nikko, 24 VII. 1930. (NSMT); <Gunma Pref.> 8 exs., same data as for the holotype, [bad condition corpses] (EUMJ); 1♀, Mt. Tanigawa-dake, 10. VII. 1955, S. Higuma leg. (NSMT); <Toyama Pref.> 1ex., Murodoudaira, Tateyama, 23. VII. 1991, H. Negoro leg. (TSM); 1 ex., Murodou, Tateyama, 23. V. 1998, H. Negoro leg. (TSM); <Nagano Pref.> 1♂1♀, Mt. Choogatake, Japan Alps., 5. VIII. 1955, I. Hattori leg. (NIAES); 1♀, Mt. Jonen, 16. VII. 1963, K. Kondo leg. (SEHU); 1♀, Tateshina. (MNHA); <Gifu Pref.> 2exs., Nr. Ookurayama, Mt. Hakusan, Shirakawamura, alt. 1,900–2,200 m, 14~17. VII. 1989, T. Goto & T. Nakajima leg. (NSMT); <Pref. Unknown> 2♀, Nyoubo-san, 27. VII. 1931, ganzii leg. (NSMT).

Description. Male (Fig. 3C). TL 16.0–20.5 mm, 18.0 mm in holotype.

Color: Body black, tinged with dark blue; surface shiny.

Head: Head (Fig. 4H) narrowed to ventral, widest at temples, covered densely with fine punctures and very short setae; interpunctal surface smooth; vertex weakly arcuate; frons covered with punctures more densely, with two depressions on insides of antennal socket; frontoclypeal suture slightly angulated in middle; frontal furrow extended from frontoclypeal suture to level of 3/4 eyes; HL/HW 0.56–0.96 (0.84). Eyes small, narrowed below, slightly convex, slender and long sub-reniform. Antennae (Fig. 7P, Y) long, sub-filiform with punctures and dark brownish setae densely, slightly thicker toward apical, reaching basal part of elytra enough; antennomere II–X subcylindrical, antennomere XI narrowed diagonally from dorsal to ventral in 3/5, pointed apically, trapezoidal in lateral view.

Pronotum: Pronotum (Fig. 4P) subparallel in lateral sides and rounded in anterior lateral margins, widest at anterior 2/4–4/4, emarginate arcuately at posterior margin, densely covered with clear punctures and very short setae; interpunctal surface smooth. PW/PL 1.36–1.43 (1.41).

Elytra: Elytra (Fig. 6H) covered with weakly wrinkles. EL/EW 2.58–3.54 (3.16).

Scutellum: Scutellum (Fig. 5H) covered with obscure punctures irregularly; posterior margin emarginate arcuately, not protruded posteriorly.

Abdomen: Terga tended to degenerate; covered with wrinkles and short hairy setae; sternites closely covered

with punctures bearing long hairy setae. Last ventrite broadly weakly emarginate; bearing blackish long setae in posterolateral corners.

Male genitalia (Fig. 9V–X): Gonostyli slender, bilobed in apical 1/2 (apical lobe), pointed roundly at apices, in ventral view sub-parallel sided in basal 1/2 and strongly tapering in apical 1/2, in lateral view sub-parallel in basal 1/2, tapering apically in basal 3/4, sub-parallel in apical 1/4. Gonocoxal plate sub-oval, rounded in lateral margin and convex in lateral side, widest in middle, shorter than gonostyli, anterior margin arcuate strongly and covering on basal part of gonostyli, in lateral view basal 1/3 of ventral margin arcuate weakly, truncate at posterior part. Aedeagus with two short apical hooks on dorsal side and movable one small endophallic hook on ventral side, forming straightly between aedeagal apex and apex of distal hook; apical hooks small, parallel; angle of apical hooks acutely.

Female (Fig. 3F). TL 21.9–27.0 mm. External features of head, pronotum, and elytra same as in male; terga degenerated more than male. HL/HW 0.89–0.98 (0.94); PW/PL 1.33–1.45 (1.37); EL/EW 2.85–3.80 (3.28); EL/PL 2.82–3.54 (3.21); EW/PW 0.69–0.74 (0.72). Antennomeres submoniliform, slightly shorter than male. Last ventrite isosceles trapezoidal.

Distribution in Japan. Honshu (Yamagata, Fukushima, Tochigi, Gunma, Toyama, Nagano and Gifu prefs.).

Remarks. This species is closely related *Meloe* (*Eurymeloe*) *corvinus* in Japan, but differs from the following points: punctures of head and pronotum clearly and smooth between punctures; elytral wrinkles weaker than *M*. (*E*.) *corvinus*.

This species was treated as *Meloe* (*Eurymeloe*) *brevicollis* Panzer, 1793 (Kurosawa, 1963, 1985). It is easy to distinguish *M*. (*E*.) *kurosawai* from *M*. (*E*.) *brevicollis*, because *M*. (*E*.) *brevicollis* is similar to *M*. (*E*.) *corvinus*. *Meloe* (*E*.) *brevicollis* is widely distributed in the Palearctic. As our result of the specimens' survey, *M*. (*E*.) *kurosawai* is distributed only in limited areas of Japan and is likely to be endemic to Japan.

Bionomics. This species inhabits limited mountainous regions in Honshu and is a rare species in Japan. Adults are active in summer, walk the side of the remaining snow and often feed on weeds.

Discussion

The fauna of genus *Meloe* in Japan

The genus *Meloe* in Japan comprises 2 subgenera and 8 species (including 3 new species described herein). *Meloe corvinus* is widely distributed from Hokkaido to the Ryukyu Islands, while others (e.g. *M*. *nipponicus*, *M*. *kurosawai* etc.) are restricted to high altitudes, and there are significant differences in distribution patterns among species. Through the examination of numerous specimens, various individual differences have been identified and organized in the descriptions.

Distribution of *Meloe* in Izu Islands

Izu Islands are located in the Pacific Ocean. *Meloe* species are recorded from Izu-Ôshima, Kozu-shima, Miyake-jima, Mikura-jima, and Hachijo-jima. The closest island to Honshu is Izu-Ôshima, located approximately 25 km southeast of the Izu Peninsula. The southern distributional limit of *Meloe* in the Izu Islands is Hachijo-jima, situated about 290 km south of Honshu. Hachijo-jima is known for its unique fauna, which includes endemic species and subspecies such as *Prosopocoilus hachijoensis* Nomura, 1960 (Lucanidae) and *Xylotrechus greyii hachijyoensis* Takakuwa, 1984 (Cerambycidae).

As the Izu Islands are oceanic islands, it is believed that *Meloe* spread to these islands by piggybacking on host bees. The distribution of *Meloe* in the Izu Islands is as follows:

Izu-Ôshima: *Meloe* (*Meloe*) *coarctatus*, *M*. (*M*.) *proscarabaeus exaratus*, *M*. (*Eurymeloe*) *corvinus*
Kozu-shima: *M*. (*M*.) *coarctatus*
Miyake-jima: *M*. (*M*.) *coarctatus*, *M*. (*Eurymeloe*) *corvinus*
Mikura-jima: *M*. (*M*.) *coarctatus*
Hachijo-jima: *M*. (*M*.) *hachijoensis*

Among the Izu Islands, *M*. (*M*.) *coarctatus* has the widest distribution, while the others are limited. Generally, species diversity decreases with increasing distance from Honshu. The most intriguing species is *M*. (*M*.) *hachijoensis*, which is exclusively found on Hachijo-jima. Mitochondrial and nuclear DNA analyses suggest that *M*. (*M*.) *hachijoensis* is genetically closer to *M*. (*M*.) *auriculatus* (according to mitochondrial DNA analysis) or *M*. (*M*.) *nipponicus* (according to nuclear DNA analysis) than to *M*. (*M*.) *coarctatus* (Ohnishi *et al*., 2021). Morphologically and genetically, *M*. (*M*.) *hachijoensis* is similar to *M*. (*M*.) *gracilior* and *M*. (*M*.) *formosensis*, which are found in China and Taiwan (Bologna, 2020; personal communication). No other species related to *M*. *gracilior* and *M*. *formosensis* are distributed in Japan, making the distribution of *M*. (*M*.) *hachijoensis* particularly interesting.

The Izu Islands are known for their species with peculiar distributions. For instance, *Lucanus gamunus* Sawada et Y. Watanabe, 1960 is only found on Mikura-jima and Kozu-shima, while its closest relative occur in China and not in Japan (Kurosawa, 1978). Consequently, the evolutionary development of fauna in the Izu Islands remains mysterious. It is believed that the distribution of *Meloe* is restricted by the host bee' fauna, so it is necessary to understand the host bees and bee fauna in the Izu Islands to elucidate this further.

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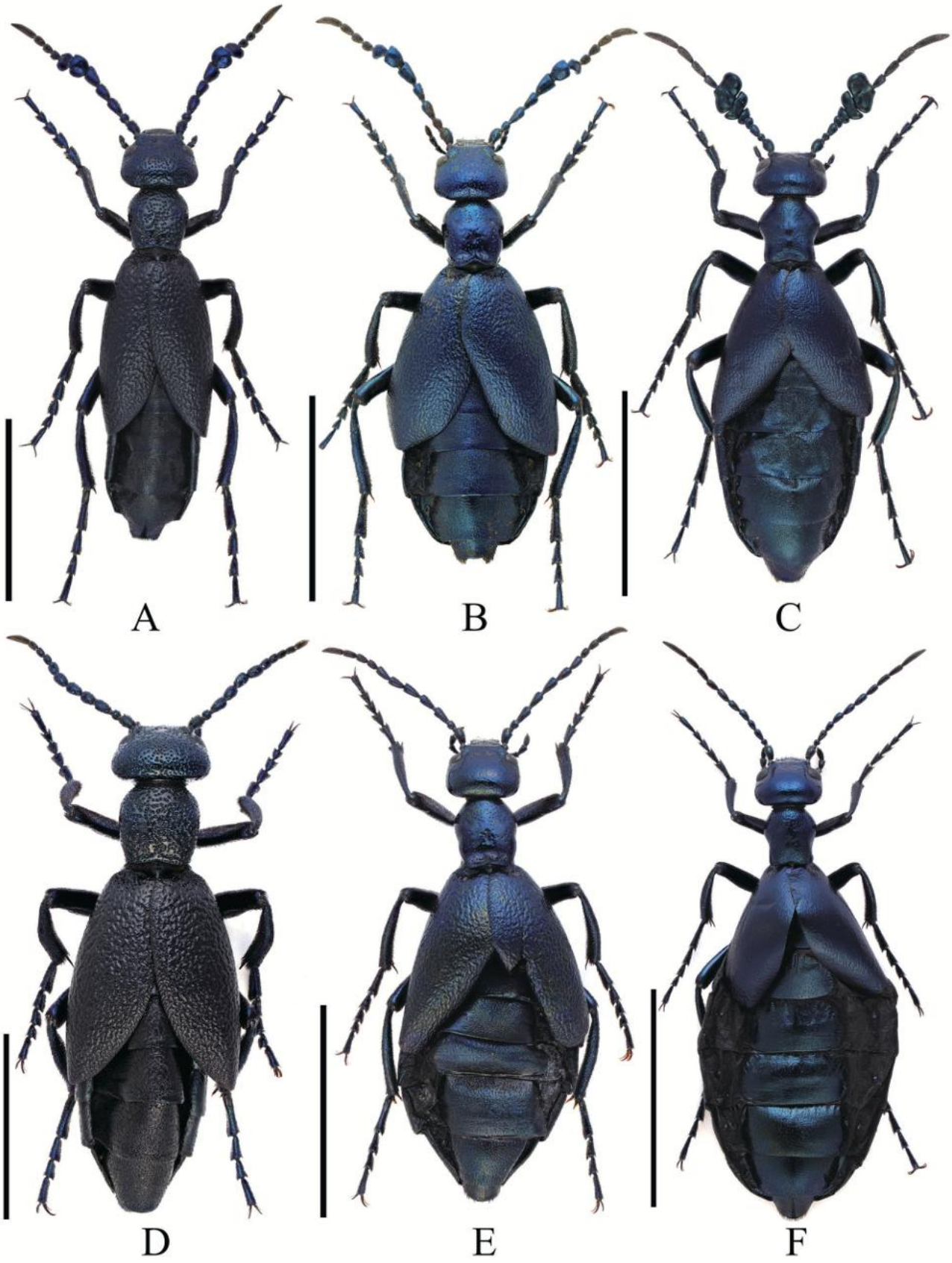

Fig. 1. Habitus of subgenus *Meloe* spp. A, D) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832, B, E) *M.* (*M.*) *violaceus* Marsham, 1802, C, F) *M.* (*M.*) *auriculatus* Marseul, 1876. A–C) males, D–F) females. Scale bars: 10.0 mm.

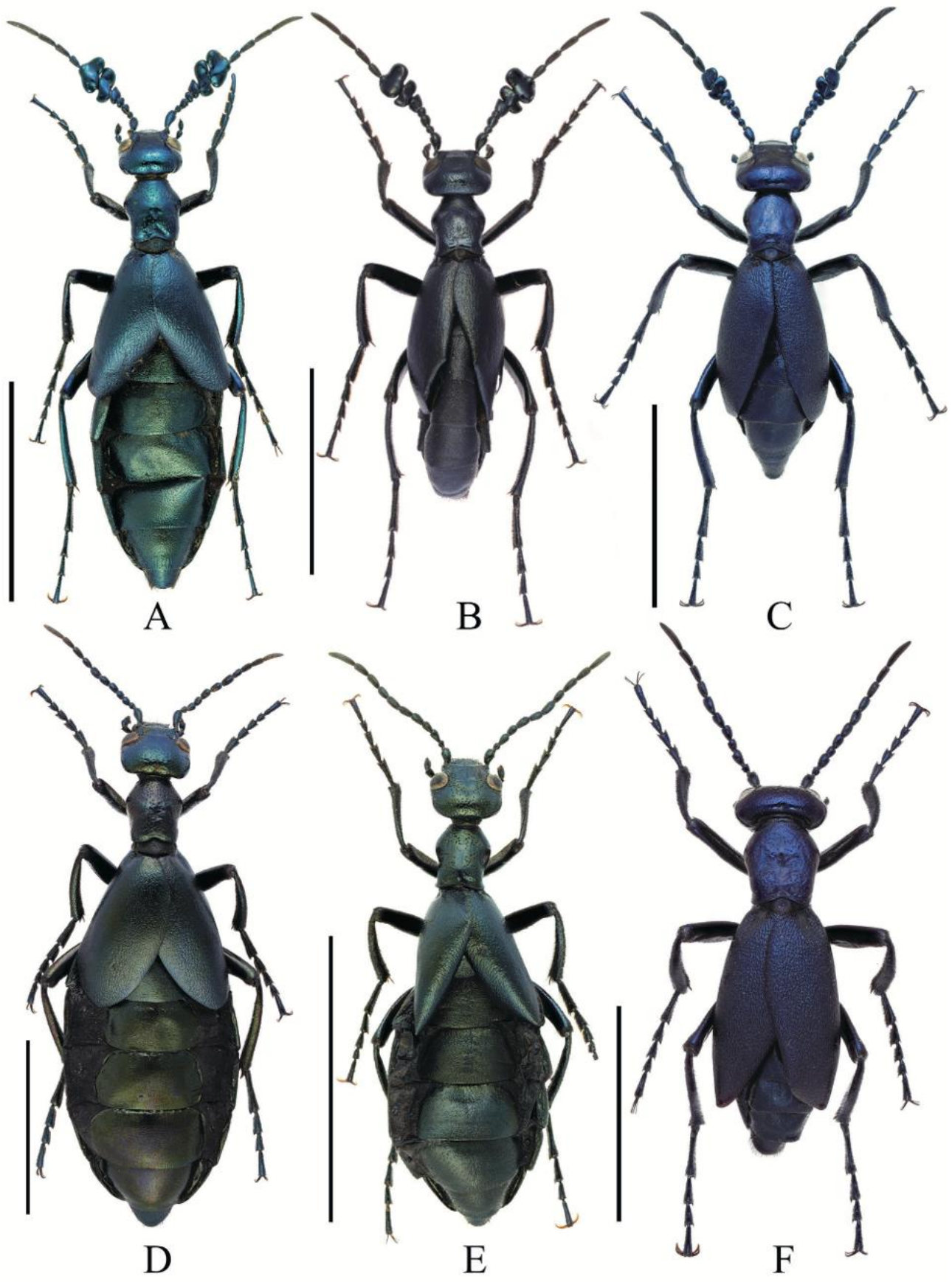

Fig. 2. Habitus of subgenus *Meloe* spp. A, D) *Meloe* (*Meloe*) *coarctatus* Motschulsky, 1858, B, E) *M.* (*M.*) *hachijoensis* sp. nov., C, F) *M.* (*M.*) *nipponicus* sp. nov. A–C) males, D–F) females, B, C) holotypes, E, F) paratypes. Scale bars: 10.0 mm.

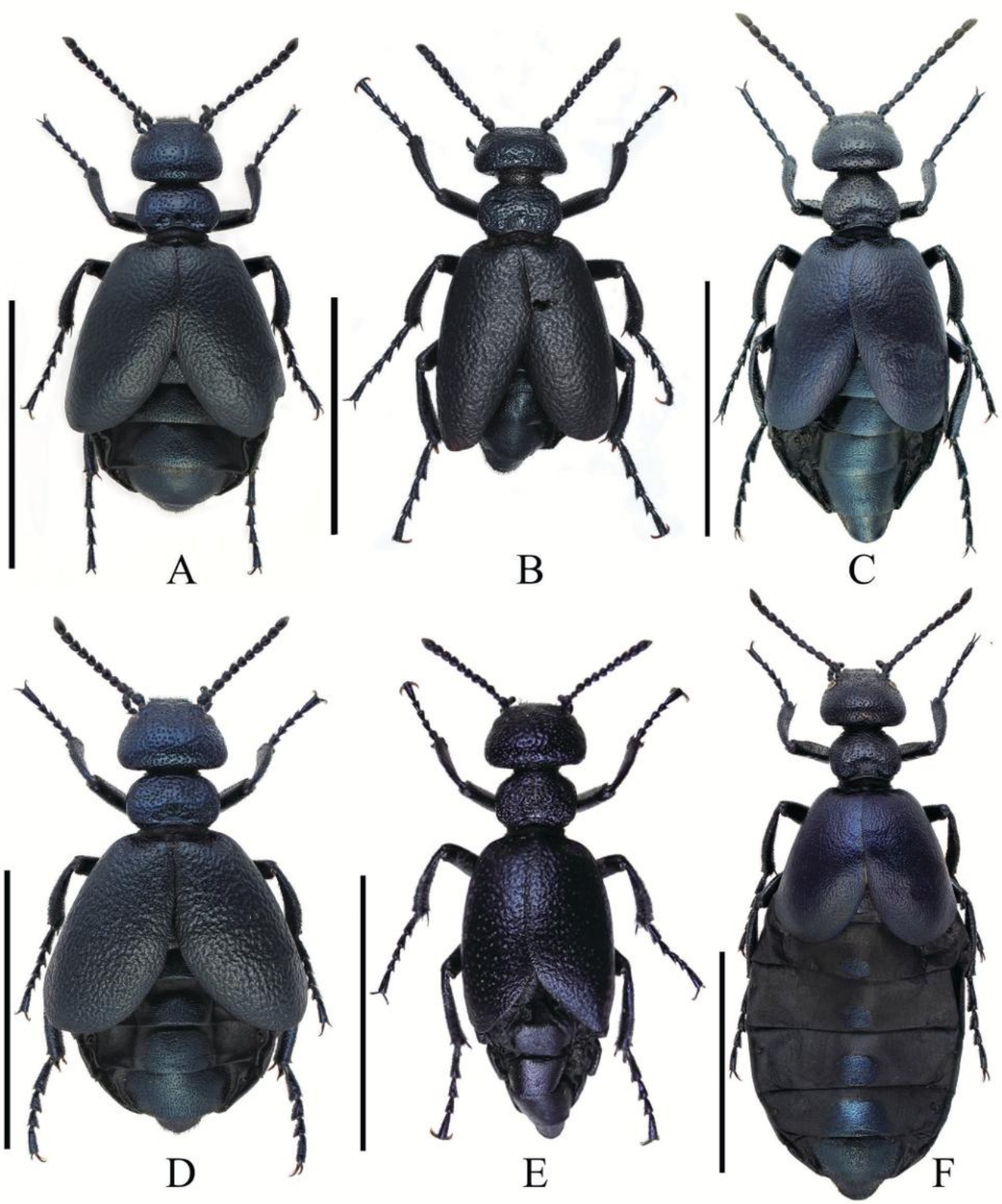

Fig. 3. Habitus of subgenus *Eurymeloe* spp. A, B, D, E) *Meloe* (*Eurymeloe*) *corvinus* Marseul, 1876, C, F) *M*. (*E*.) *kurosawai* sp. nov. A–C) males, D–F) females, B) from Okinoerabu-jima, E) from Yonaguni-jima, C) holotype, F) paratype. Scale bars: 10.0 mm.

Fig. 4. Head (A–H) and pronotum (I–P) of *Meloe* spp. A, I) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832, B, J) *M*. (*M*.) *violaceus* Marsham, 1802, C, K) *M*. (*M*.) *auriculatus* Marseul, 1876, D, L) *M*. (*M*.) *coarctatus* Motschulsky, 1858, E, M) *M*. (*M*.) *hachijoensis* sp. nov. (holotype), F, N) *M*. (*M*.) *nipponicus* sp. nov. (holotype), G, O) *M*. (*Eurymeloe*) *corvinus* Marseul, 1876, H, P) *M*. (*E*.) *kurosawai* sp. nov. (holotype). Scale bars: 1.0 mm.

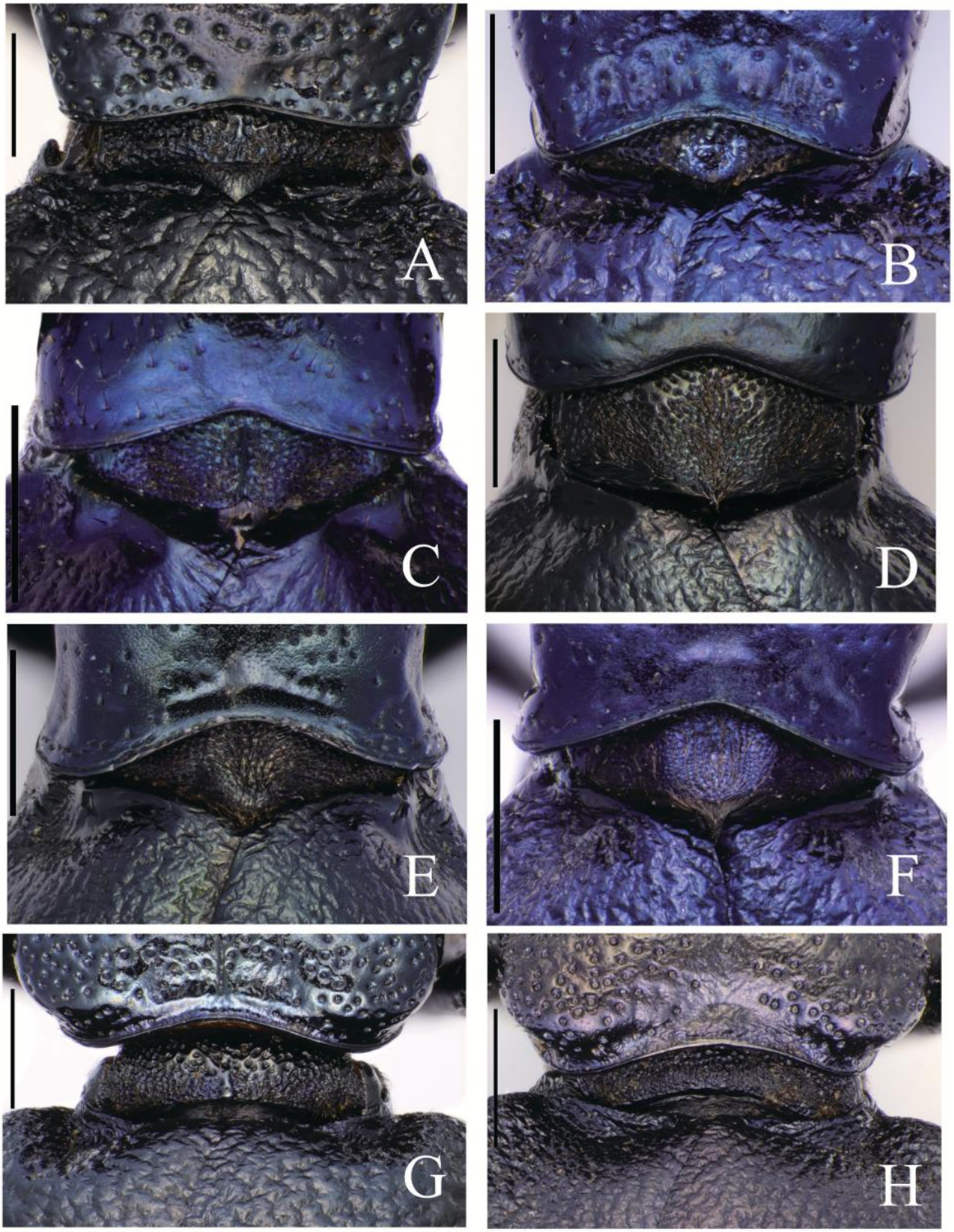

Fig. 5. Scutella of *Meloe* spp. A) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832; B) *M*. (*M*.) *violaceus* Marsham, 1802; C) *M*. (*M*.) *auriculatus* Marseul, 1876; D) *M*. (*M*.) *coarctatus* Motschulsky, 1858; E) *M*. (*M*.) *hachijoensis* sp. nov. (paratype); F) *M*. (*M*.) *nipponicus* sp. nov. (holotype); G) *M*. (*Eurymeloe*) *corvinus* Marseul, 1876; H) *M*. (*E*.) *kurosawai* sp. nov. (holotype). Scale bars: 1.0 mm.

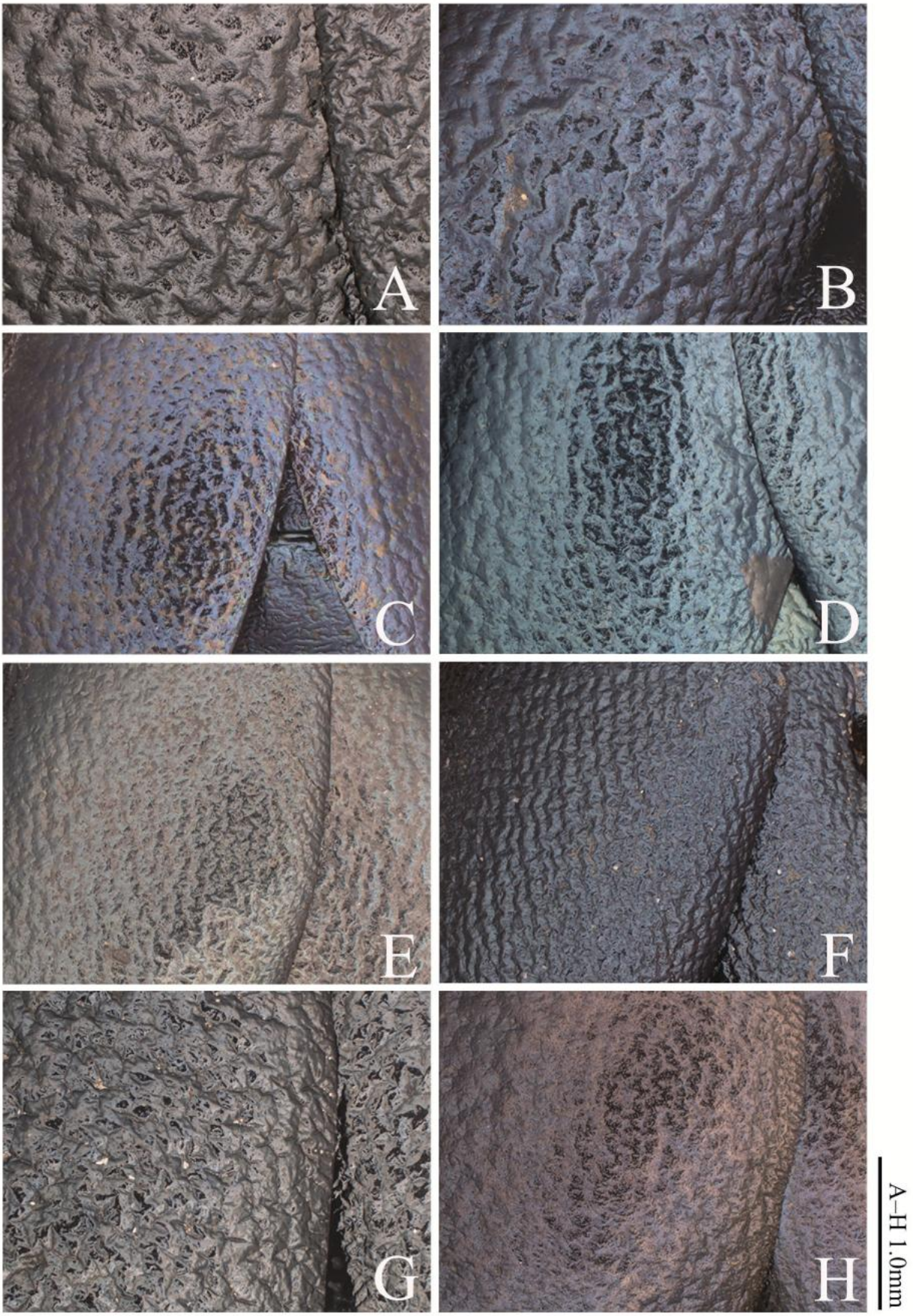

Fig. 6. Left elytra of *Meloe* spp. showing its wrinkles. A) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832; B) *M*. (*M*.) *violaceus* Marsham, 1802; C) *M*. (*M*.) *auriculatus* Marseul, 1876; D) *M*. (*M*.) *coarctatus* Motschulsky, 1858; E) *M*. (*M*.) *hachijoensis* sp. nov.; F) *M*. (*M*.) *nipponicus* sp. nov.; G) *M*. (*Eurymeloe*) *corvinus* Marseul, 1876; H) *M*. (*E*.) *kurosawai* sp. nov.

Fig. 7. Male left antennae of *Meloe* spp. A, H, Q) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832; B, I, R) *M*. (*M*.) *violaceus* Marsham, 1802; C, J, S) *M*. (*M*.) *auriculatus* Marseul, 1876; D, K, T) *M*. (*M*.) *coarctatus* Motschulsky, 1858; E, F, L, M, U, V) *M*. (*M*.) *hachijoensis* sp. nov. (E, L, U: holotype; F, M, V: paratype); G, N, W) *M*. (*M*.) *nipponicus* sp. nov. (holotype); O, X) *M*. (*Eurymeloe*) *corvinus* Marseul, 1876; P, Y) *M*. (*E*.) *kurosawai* sp. nov. (holotype). A–G) posterior view; H–P) anterior view; Q–Y) dorsal view. Scale bars: 1.0 mm.

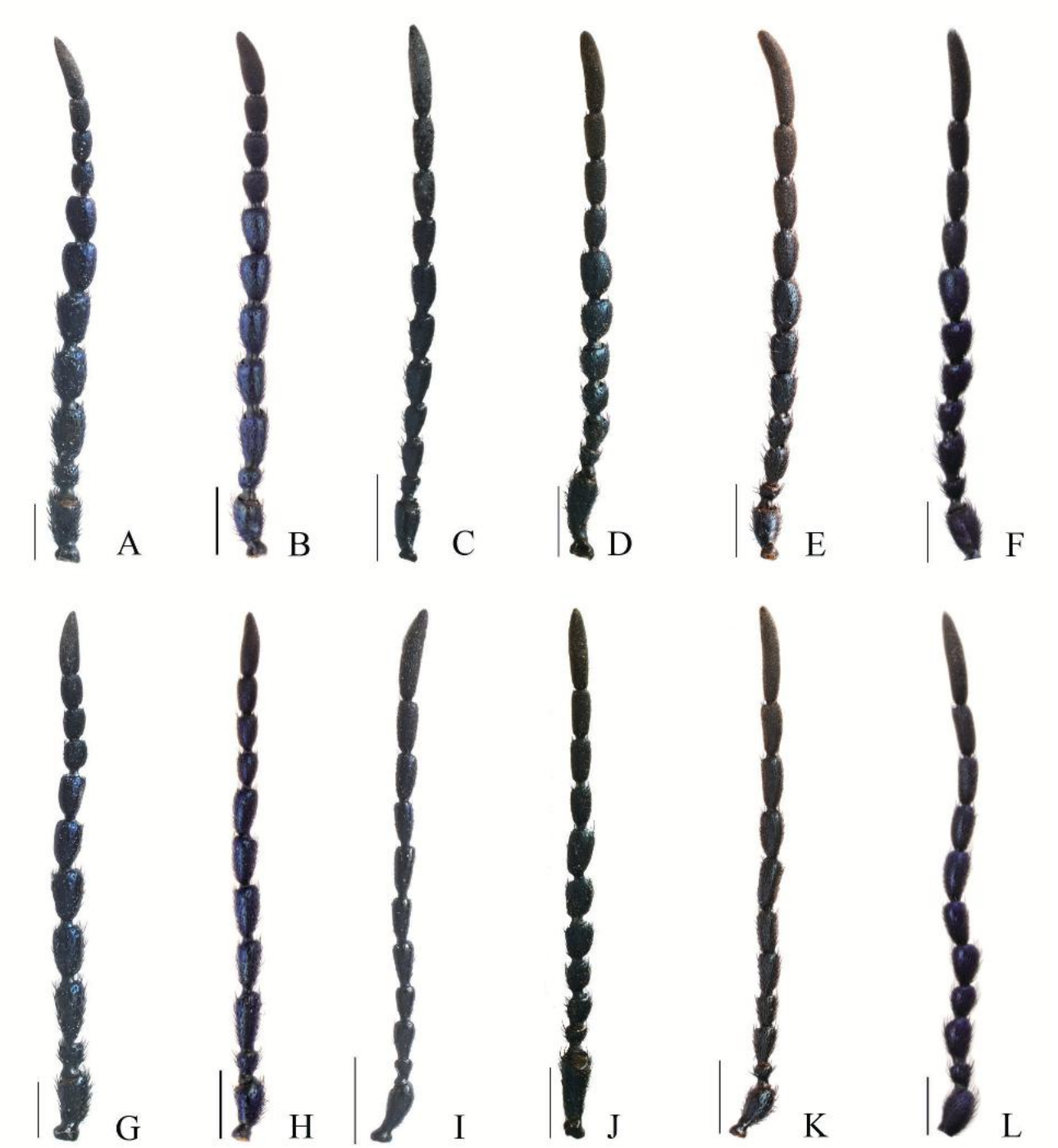

Fig. 8. Female left antennae of *Meloe* spp. A, G) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832; B, H) *M*. (*M*.) *violaceus* Marsham, 1802; C, I) *M*. (*M*.) *auriculatus* Marseul, 1876; D, J) *M*. (*M*.) *coarctatus* Motschulsky, 1858; E, K) *M*. (*M*.) *hachijoensis* sp. nov. (paratype); F, L) *M*. (*M*.) *nipponicus* sp. nov. (paratype). A–F) posterior view; G–L) dorsal view. Scale bars: 1.0 mm.

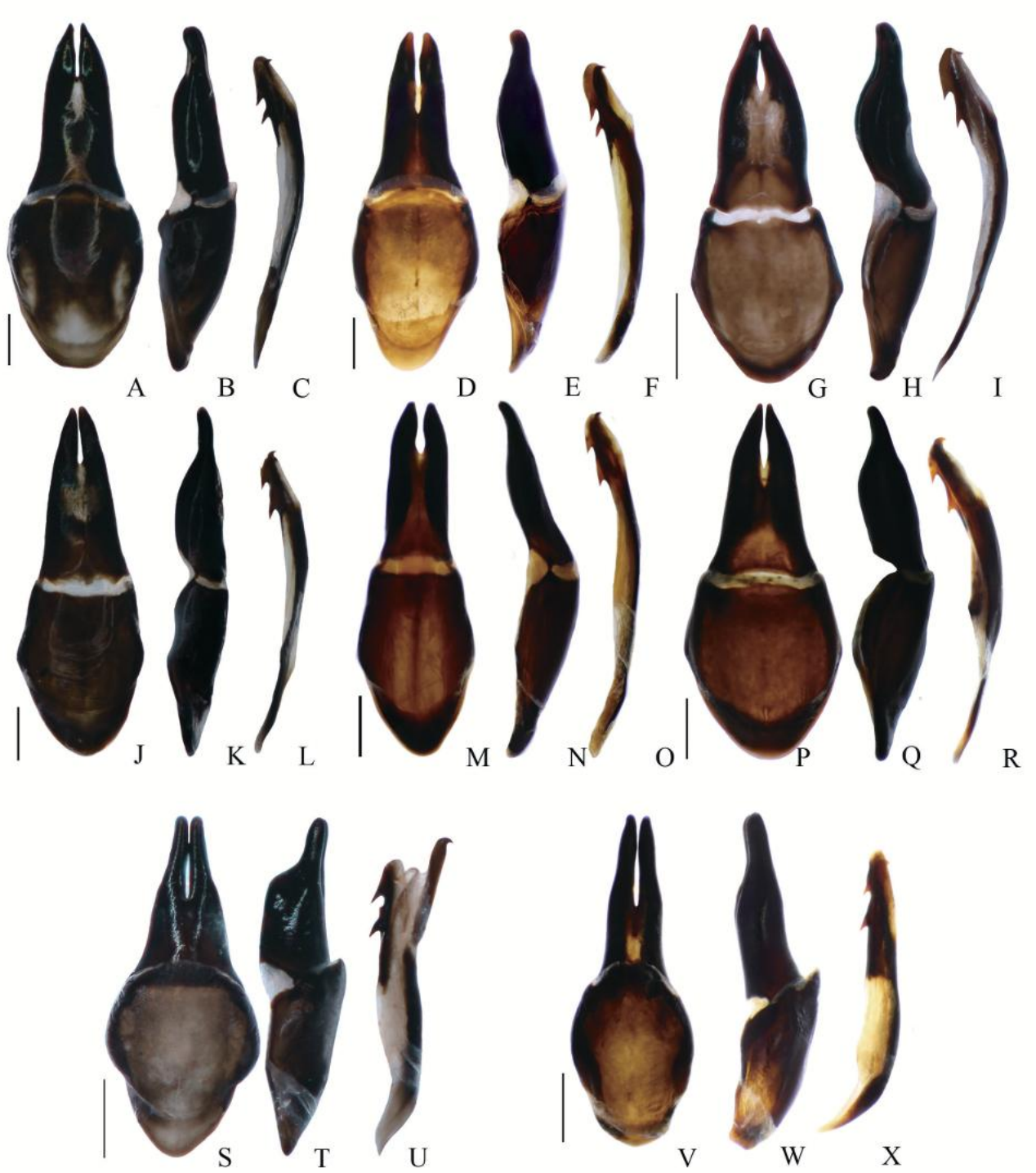

Fig. 9. Male genitalia of *Meloe* spp. A–C) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832; D–F) *M*. (*M*.) *violaceus* Marsham, 1802; G–I) *M*. (*M*.) *auriculatus* Marseul, 1876; J–L) *M*. (*M*.) *coarctatus* Motschulsky, 1858; M–O) *M*. (*M*.) *hachijoensis* sp. nov. (holotype); P–R) *M*. (*M*.) *nipponicus* sp. nov. (holotype); S–U) *M*. (*Eurymeloe*) *corvinus* Marseul, 1876; V–X) *M*. (*E*.) *kurosawai* sp. nov. (holotype). A, D, G, J, M, P, S, V) gonostyli and gonocoxal plate in ventral view; B, E, H, K, N, Q, T, W) ditto in lateral view; C, F, I, L, O, R, U, X) aedeagus in lateral view. Scale bars: 0.5 mm.

Fig. 10. Holotype of *Meloe menoko* Kôno, 1936.

Fig. 11. Holotype of *Meloe sapporensis* Kôno, 1936.

Fig. 12. Habitus and habitats of *Meloe* spp. A) *Meloe* (*Meloe*) *coarctatus* Motschulsky, 1858; B) *M*. (*M*.) *auriculatus* Marseul, 1876 and *M*. (*M*.) *proscarabaeus exaratus* Faldermann, 1832; C) mating behavior of *M*. (*M*.) *proscarabaeus exaratus* Faldermann, 1832; D) habitat of *M*. (*M*.) *coarctatus* Motschulsky 1858, *M*. (*M*.) *auriculatus* Marseul, 1876, *M*. (*M*.) *proscarabaeus exaratus* Faldermann, 1832 and *M*. (*Eurymeloe*) *corvinus* Marseul, 1876 in Shikoku (Ehime Pref.); E–H) *M*. (*M*.) *hachijoensis* sp. nov. in Hachijo-jima (Tokyo); E–F) mating behavior; G) laying eggs; H) habitat.

Fig. 13. Habitus and habitats of *Meloe* spp. A) *Meloe* (*Eurymeloe*) *corvinus* Marseul, 1876 in Shikoku (Ehime Pref.); B) *M.* (*E.*) *corvinus* Marseul, 1876 in Honshu (Toyama Pref.); C, D) *M.* (*E.*) *corvinus* Marseul, 1876 in Yonaguni-jima (Okinawa Pref.); E–F) *M.* (*E.*) *kurosawai* sp. nov. on Mt. Tanigawa-dake (Gunma Pref.).

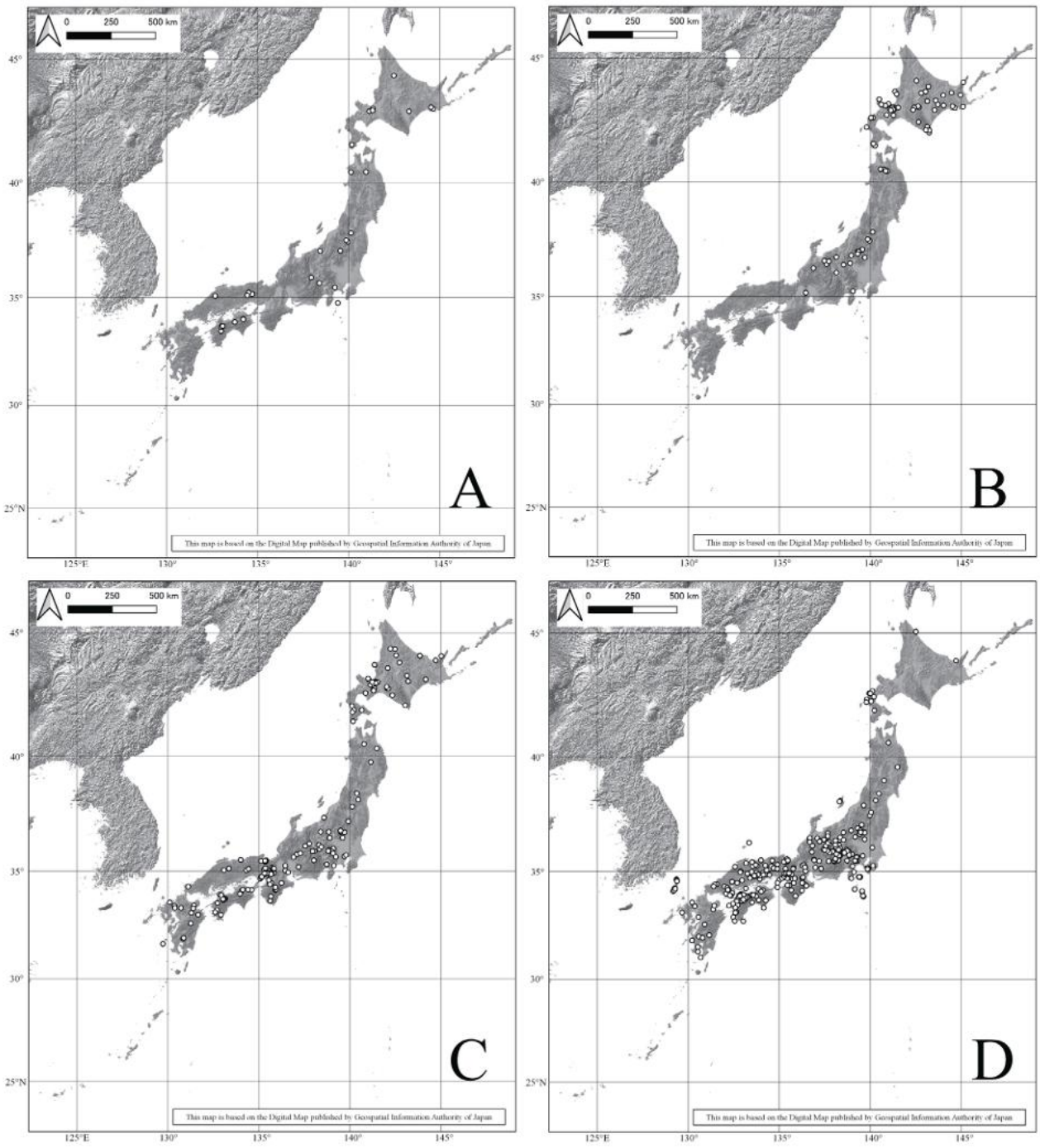

Fig. 14. Distribution of *Meloe* spp. in Japan. A) *Meloe* (*Meloe*) *proscarabaeus exaratus* Faldermann, 1832; B) *M*. (*M*.) *violaceus* Marsham, 1802; C) *M*. (*M*.) *auriculatus* Marseul, 1876; D) *M*. (*M*.) *coarctatus* Motschulsky, 1858.

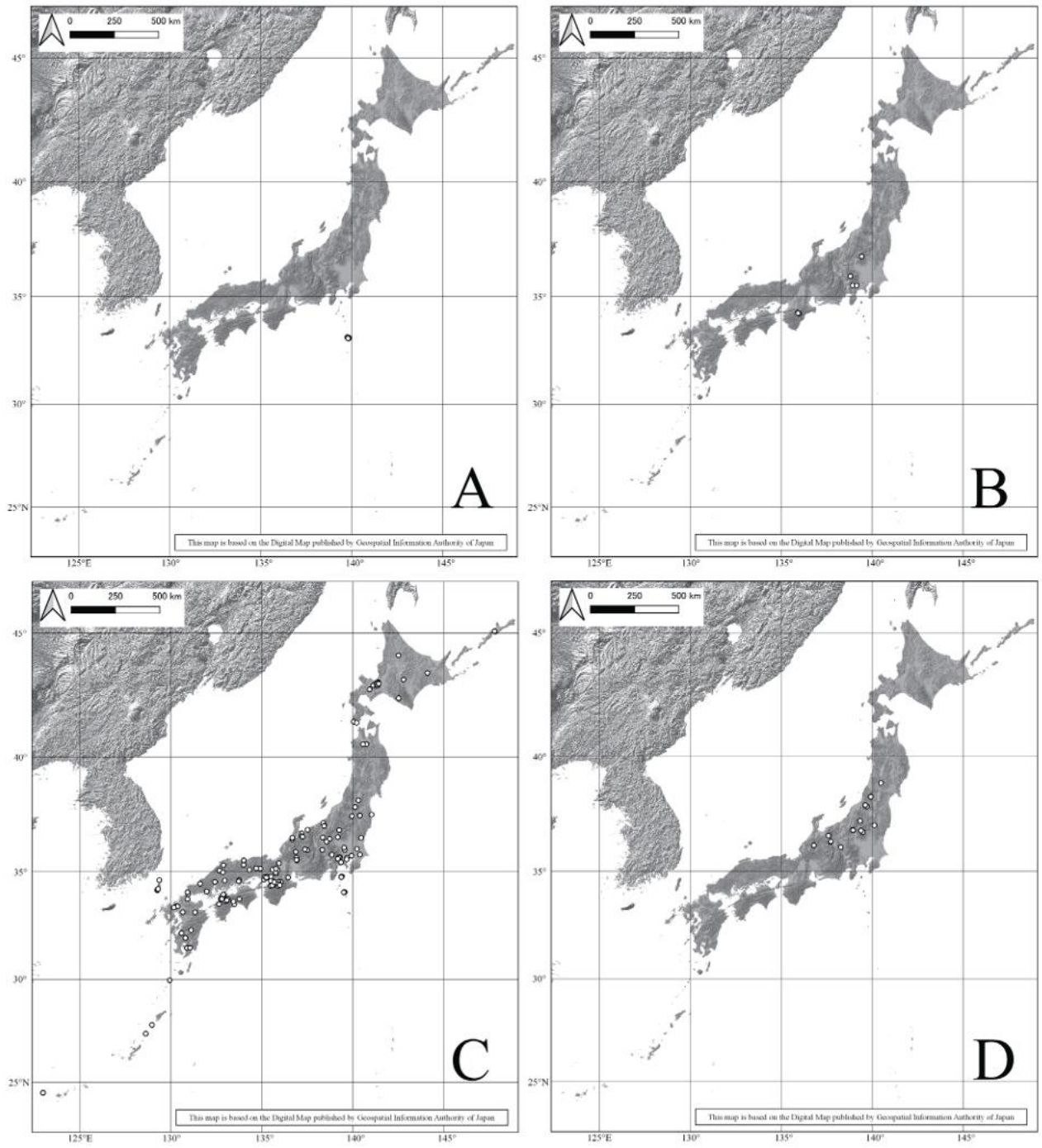

Fig. 15. Distribution of *Meloe* spp. in Japan. A) *Meloe* (*Meloe*) *hachijoensis* sp. nov.; B) *M*. (*M*.) *nipponicus* sp. nov.; C) *M*. (*Eurymeloe*) *corvinus* Marseul, 1876; D) *M*. (*E*.) *kurosawai* sp. nov.