*Zootaxa* 5528 (1): 017–037
https://www.mapress.com/zt/


**Article**

ISSN 1175-5326 (print edition)
**ZOOTAXA**
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5528.1.5
http://zoobank.org/urn:lsid:zoobank.org:pub:90D540A7-2B15-4926-B838-992EE257C251

# Family-level diversity of Coleoptera (Insecta) from the Nanling Mountains and the Greater Bay Area, China

ZHEN-HUA LIU[1,2] & ZHI-QIANG LI[1,*]

[1]*Guangdong Key Laboratory of Animal Conservation and Resource Utilization, Guangdong Public Laboratory of Wild Animal Conservation and Utilization, Institute of Zoology, Guangdong Academy of Sciences, Guangzhou 510260, China*

[2] *liuzhh_beetle@giz.gd.cn; https://orcid.org/0000-0002-2739-3305*

[*]*Corresponding author: lizq@giz.gd.cn; https://orcid.org/0000-0003-0064-7165*

## Abstract

Coleoptera comprise 198 families and over 440,000 species to date, of which 143 families and over 35,000 species are known in China. Of these, only 64 families have been recorded in Guangdong Province, fewer than in Hong Kong. To investigate the insect diversity of Guangdong, numerous specimens were collected from the Nanling Mountains and the Greater Bay Area using various methods, and over 200,000 specimens of Coleoptera were assigned to families. Thus, a preliminary study of beetles at the family-level in Guangdong is carried out based on the examined specimens and historical records. An updated checklist of beetle families in Guangdong increases the number of families from 64 to 111, in which Eupsilobiidae is recorded for the first time in China and a new species, *Eidoreus haizhuensis* **sp. nov.** is described here, demonstrating the importance of persistent collecting with different methods for the study of insect diversity. Habitus images of most of the beetle families occurring in Guangdong are provided. And the updated records are compared in detail with the published records, showing that more families may potentially be found in Guangdong, requiring further field work and taxonomists working on niche groups.

**Key words:** beetle, Guangdong, new record, checklist

## Introduction

Beetles are the most diverse group of all animals on Earth, with over 440,000 species known to science and nearly 1500,000 undescribed species at present (Stork 2018; Nie *et al.* 2019; Cai *et al.* 2022, Goczał *et al.* 2024), making a significant contribution to the biodiversity. The higher-level diversity of Coleoptera is still controversial, from which there are 198 families (Appendix 1) according to the results of recent phylogenetic and taxonomy work (Robertson *et al.* 2015; Bocak *et al.* 2018; Mckenna *et al.* 2019; Gimmel *et al.* 2019; Duran & Gough 2020; Kusy *et al.* 2020; Rosa *et al.* 2020; Cai *et al.* 2022; Lawrence *et al.* 2023; Arriaga-Varela *et al.* 2023). In contrast, more than 35,000 species within 143 families (Table 1) are currently known from China (Jia & Wu 1999; Nie *et al.* 2019; Liu *et al.* 2021). While the field work on beetles in mainland China in the past 70 years has mainly focused on Qinghai-Tibet Plateau and Yunnan-Guizhou Plateau (Nie *et al.* 2019), the beetle diversity of the remaining areas has generally been underexplored for a long time. As a result, the beetle diversity data of some provinces appears to be inconsistent with the real situation. For example, according to the checklist published recently (Li *et al.* 2023), only 64 families (Table 1) of Coleoptera are recorded in Guangdong Province, which is less than half the number of families in China, and even significantly less than 81 families in Hong Kong (Lau 2019).

The Nanling Mountains in southern China have been shown to be a key refuge for animals and plants (López-Pujol *et al.* 2011; Hu *et al.* 2021; Mi *et al.* 2021; Wang *et al.* 2023), and also act as a barrier between the central and southern China biota (Chen & Chang 1956). The Guangdong-Hong Kong-Macao Greater Bay Area, or simply the Greater Bay Area was initiated in 2015 mainly for economic development (Hui *et al.* 2020), covering 9 mainland cities in Guangdong near the Pearl River Delta and 2 special administrative regions (Hong Kong and Macau). Since 2020, two projects have been proposed to investigate insect diversity of the Nanling Mountains and the

*Accepted by Z.-W. Yin: 27 Aug. 2024; published: 23 Oct. 2024*

Greater Bay Area in Guangdong and parts of neighboring provinces, with the aim of providing background data on biodiversity in these two important areas for future ecological construction. Since then, a series of field surveys have been carried out and numerous specimens have been collected. Our team is mainly responsible for the areas of the Nanling Mountains in Guangdong and the Greater Bay Area, with over 2000,000 insect specimens assigned to orders to date, of which over 200,000 of them are beetles, providing us with an opportunity to explore the true diversity of beetles in Guangdong.


**FIGURE 1.** Examples of passive acquisition methods. **A.** Malaise trap. **B.** Flight intercept trap.

## Material and methods

### Collecting methods

The specimens included in this study were mostly collected using passive methods following Zhao *et al.* (2022), namely Malaise traps (Fig. 1A), flight intercept traps (Fig. 1B) and pitfall traps. In the Greater Bay Area, 66 Malaise traps, 46 flight intercept traps and 31 pitfall traps at 88 sampling sites in 8 cities; and 63 sampling sites were set up in the Nanling Mountains, with 1 flight intercept trap, 1 malaise trap and 10 pitfall traps at each site. Flight intercept traps and pitfall traps were collected once every two to three days, Malaise traps were collected once every half month or every month during 2020–2022. Some manual collecting methods such as net sweeping and beating were also used, as several mass trapping activities were organized in the same areas, light traps were used at the same time. The specimens involved in this paper are housed in the Institute of Zoology, Guangdong Academy of Sciences (IZGA), Guangzhou, China.

### Identification and counting methods

Specimens were examined under a Leica SAPO microscope and assigned to different families based on morphological information (Leschen & Beutel 2010, 2014; Beutel & Leschen 2016). The Nanling Mountains in Guangdong and the Greater Bay Area occupy most of the ecosystems present in Guangdong Province, and the specimens examined in this study were mostly collected in Guangdong. Therefore, an updated checklist of beetle families in Guangdong (Guangdong-updated) is proposed for the combination of literature records and examined specimens, corresponding to the checklist from historical records (Guangdong-historical).

### Photographing methods

Good quality specimens of different families were selected as representatives for photography, which were stretched with forceps and immobilized with insects pins on foam boards until dry, then placed on a thick quartz plate for photography. Montage images of the habitus were taken using a Canon 7D DSLR camera with a Canon MPE-65 mm macro lens or a Mitutoyo 5×/10× objective, mounted on a Wemacro Focus Stacking Rail, using Helicon Remote (v. 3.9.10 M) and WeMacro Control software, with a dual head flash for supplementary lighting. The images were stacked in Helicon Focus v. 8.1.1 and edited in Photoshop CC 2022. The specimen of Pterogeniidae was lent to another researcher for study, so the image of this family is provided by that researcher.

## Results

(Figs 2–12)

The number of beetle families in the Nanling Mountains and the Greater Bay Area reaches 111 when data from the literature and examined specimens are combined (Table 1), with most families are shown in Figures 4–12. Compared with the historical records, Torridincollidae, Eucinetidae, Clambidae, Ptiliidae, Passalidae, Trogidae, Bolboceratidae, Ochodaeidae, Hybosoridae, Byrrhidae, Dryopidae, Limnichidae, Heteroceridae, Chelonariidae, Callirhipidae, Throscidae, Lycidae, Rhagophthalmidae, Omethidae, Byturidae, Biphyllidae, Lophocateridae, Bothrideridae, Teredidae, Euxestidae, Cerylonidae, Discolomatidae, Anamorphidae, Eupsilobiidae, Corylophidae, Lymexylidae, Mycetophagidae, Archeocrypticidae, Pterogeniidae, Ciidae, Tetratomidae, Melandryidae, Mycteridae, Pyrochroidae, Salpingidae, Ischaliidae, Aderidae, Scraptiidae, Sphindidae, Monotomidae, Passandridae, Phalacridae are recorded for the first time in Guangdong, where Eupsilobiidae (Fig. 6J) is new to China. In addition, Noteridae, Hydrochidae, Hydraenidae, Trogossitidae, Thanerocleridae and Disteniidae, which are reported in the literature, are not found in the examined specimens.

**TABLE 1.** Checklist of beetle families recorded in China, Guangdong-Historical and Guangdong-updated.

| Families of Coleoptera in China | Guangdong-historical | Guangdong-updated | Families of Coleoptera in China | Guangdong-historical | Guangdong-updated |
|---|---|---|---|---|---|
| Cupedidae | √ | √ | Byturidae | | √ |
| Micromalthidae | | | Biphyllidae | | √ |
| Torridincolidae | | √ | Peltidae | | |
| Sphaeriusidae | | | Trogossitidae | √ | √ |
| Hydroscaphidae | | | Lophocateridae | | √ |
| Gyrinidae | √ | √ | Thymalidae | | |
| Haliplidae | √ | √ | Thanerocleridae | √ | √ |
| Noteridae | √ | √ | Cleridae | √ | √ |
| Amphizoidae | | | Acanthocnemidae | | |
| Hygrobiidae | | | Prionoceridae | √ | √ |
| Dytiscidae | √ | √ | Rhadalidae | | |
| Aspidytidae | | | Melyridae | √ | √ |
| Carabidae | √ | √ | Bothrideridae | | √ |
| Cicindelidae | √ | √ | Teredidae | | √ |
| Eucinetidae | | √ | Euxestidae | | √ |
| Clambidae | | √ | Murmidiidae | | |
| Scirtidae | √ | √ | Cerylonidae | | √ |
| Derodontidae | | | Discolomatidae | | √ |
| Dascillidae | √ | √ | Endomychidae | √ | √ |
| Rhipiceridae | | | Anamorphidae | | √ |
| Hydrophilidae | √ | √ | | | Eupsilobiidae |
| Helophoridae | | | Coccinellidae | √ | √ |
| Epimetopidae | | | Corylophidae | | √ |
| Georissidae | | | Latridiidae | √ | √ |
| Hydrochidae | √ | √ | Lymexylidae | | √ |
| Spercheidae | | | Mycetophagidae | | √ |
| Nosodendridae | | | Archeocrypticidae | | √ |
| Sphaeritidae | | | Pterogeniidae | | √ |
| Syntellidae | | | Ciidae | | √ |
| Histeridae | √ | √ | Tetratomidae | | √ |
| Jacobsoniidae | | | Melandryidae | | √ |
| Hydraenidae | √ | √ | Mordellidae | √ | √ |
| Ptiliidae | | √ | Ripiphoridae | √ | √ |
| Agyrtidae | | | Zopheridae | √ | √ |
| Leiodidae | √ | √ | Tenebrionidae | √ | √ |
| Staphylinidae | √ | √ | Prostomidae | | |
| Lucanidae | √ | √ | Synchroidae | | |
| Passalidae | | √ | Stenotrachelidae | | |
| Trogidae | | √ | Oedemeridae | √ | √ |
| Glaresidae | | | Meloidae | √ | √ |

*.....Continued on the next page*

**TABLE 1.** (Continued)

| Families of Coleoptera in China | Guangdong-historical | Guangdong-updated | Families of Coleoptera in China | Guangdong-historical | Guangdong-updated |
|---|---|---|---|---|---|
| Bolboceratidae | | √ | Mycteridae | | √ |
| Geotrupidae | √ | √ | Trictenotomidae | √ | √ |
| Ochodaeidae | | √ | Pythidae | | |
| Hybosoridae | | √ | Pyrochroidae | | √ |
| Glaphyridae | √ | √ | Salpingidae | | √ |
| Scarabaeidae | √ | √ | Ischaliidae | | √ |
| Buprestidae | √ | √ | Anthicidae | √ | √ |
| Byrrhidae | | √ | Aderidae | | √ |
| Elmidae | √ | √ | Scraptiidae | | √ |
| Dryopidae | | √ | Helotidae | √ | √ |
| Limnichidae | | √ | Sphindidae | | √ |
| Heteroceridae | | √ | Erotylidae | √ | √ |
| Psephenidae | √ | √ | Monotomidae | | √ |
| Ptilodactylidae | √ | √ | Cryptophagidae | √ | √ |
| Chelonariidae | | √ | Silvanidae | √ | √ |
| Eulichadidae | √ | √ | Cucujidae | √ | √ |
| Callirhipidae | | √ | Passandridae | | √ |
| Artematopodidae | | | Phalacridae | | √ |
| Eucnemidae | √ | √ | Laemophloeidae | √ | √ |
| Throscidae | | √ | Kateretidae | | |
| Elateridae | √ | √ | Nitidulidae | √ | √ |
| Sinopyrophoridae | | | Cybocephalidae | √ | √ |
| Plastoceridae | | | Vesperidae | √ | √ |
| Lycidae | | √ | Disteniidae | √ | √ |
| Rhagophthalmidae | | √ | Cerambycidae | √ | √ |
| Lampyridae | √ | √ | Megalopodidae | √ | √ |
| Omethidae | | √ | Orsodacnidae | | |
| Cantharidae | √ | √ | Chrysomelidae | √ | √ |
| Dermestidae | √ | √ | Anthribidae | √ | √ |
| Endecatomidae | | | Attelabidae | √ | √ |
| Bostrichidae | √ | √ | Brentidae | √ | √ |
| Ptinidae | √ | √ | Curculionidae | √ | √ |

At the suborder level, one family of Myxophaga and 46 families of Polyphaga were newly recorded in Guangdong, while the family numbers of Archostemata and Adephaga remained the same (Fig. 2). At the superfamily level (Fig. 3), the family numbers of Scarabaeoidea, Dryopoidea, Coccinelloidea and Tenebrionoidea are apparently increased, which are more than double the historical records. While it remains the same in Hydrophiloidea, Bostrichoidea, Chrysomeloidea and Cucrculionoidea which comprise more than three families. The number of families in these superfamilies is equal to or only one family less than the Chinese record, except for Hydrophiloidea, which has six families recorded in China but only two in Guangdong. In Elateroidea and Cucujoidea, four families are recorded in Guangdong for the first time.

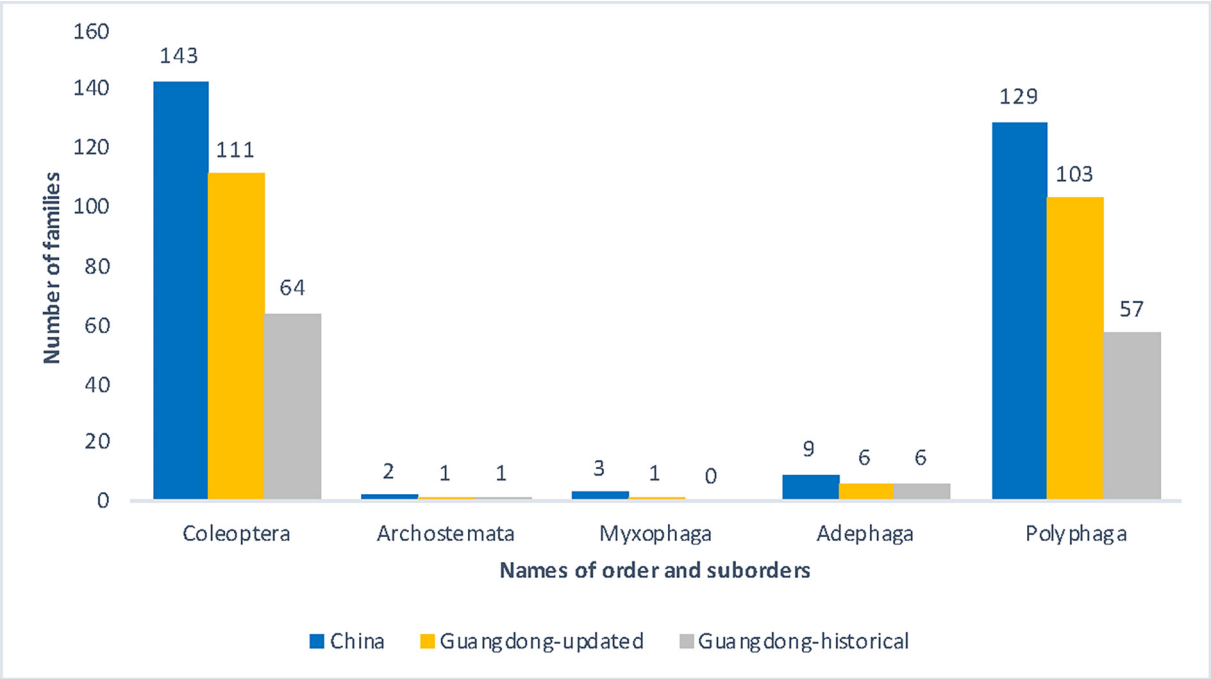


**FIGURE 2.** Comparation of family numbers in suborder-level between China. Guangdong-updated and Guangdong-historical.

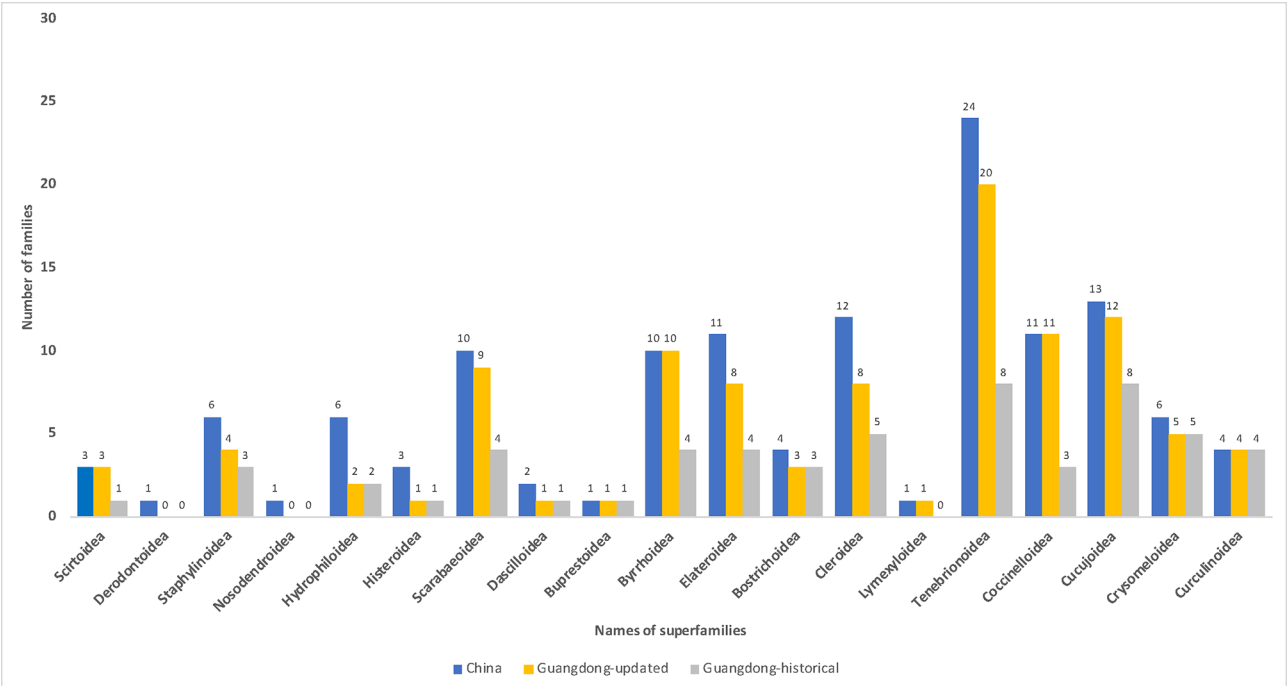


**FIGURE 3.** Comparation of family numbers in superfamily-level between China, Guangdong-updated and Guangdong-historical.

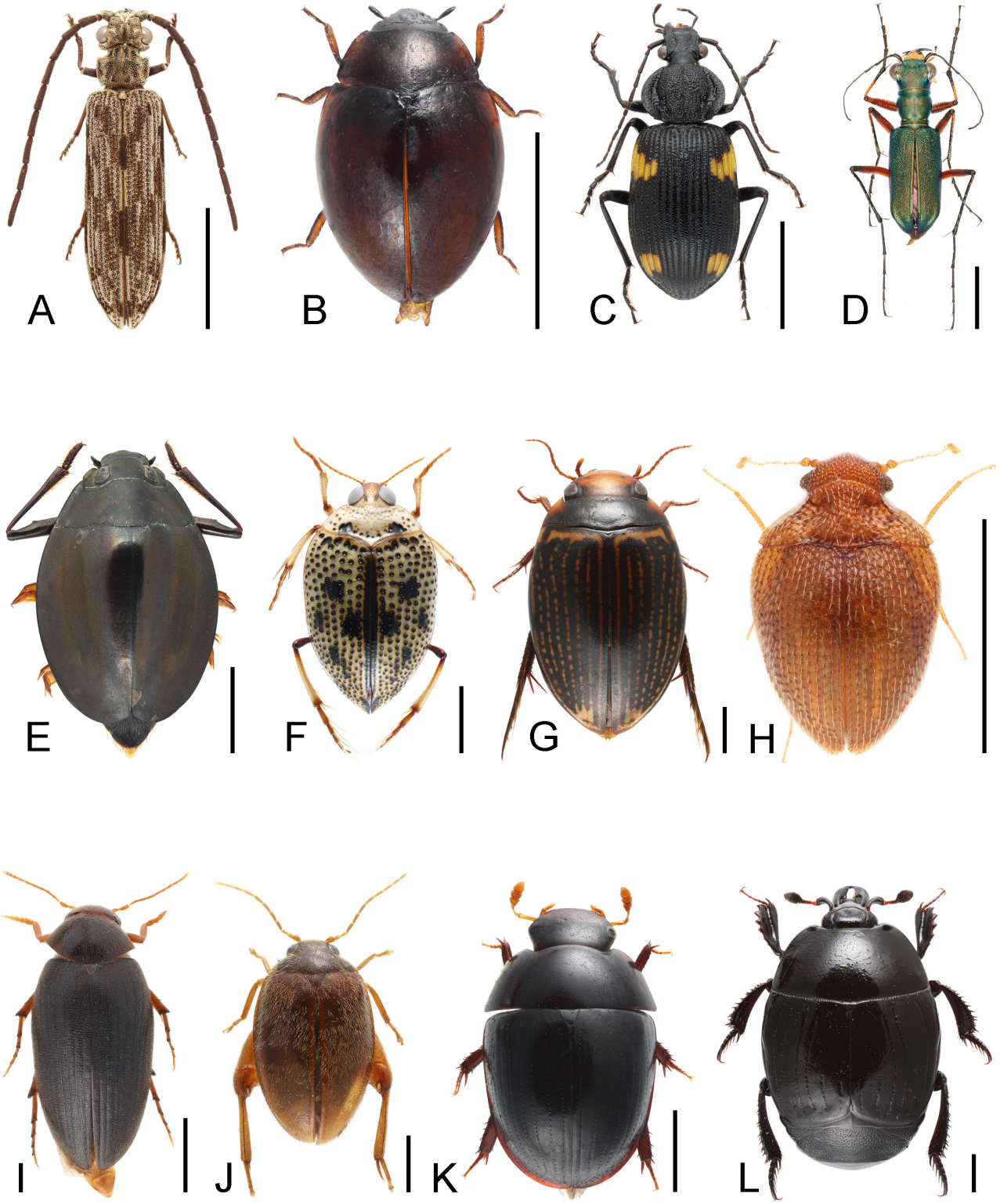


**FIGURE 4.** Habitus of Coleoptera families. **A.** Cupedidae. **B.** Torridincollidae. **C.** Carabidae. **D.** Cicindellidae. **E.** Gyrinidae. **F.** Haliplidae. **G.** Dytiscidae. **H.** Clambiidae. **I.** Eucinetidae. **J.** Scirtidae. **K.** Hydrophilidae. **L.** Histeridae. Scale bars: 1 mm except for 5 mm in A and C–E.

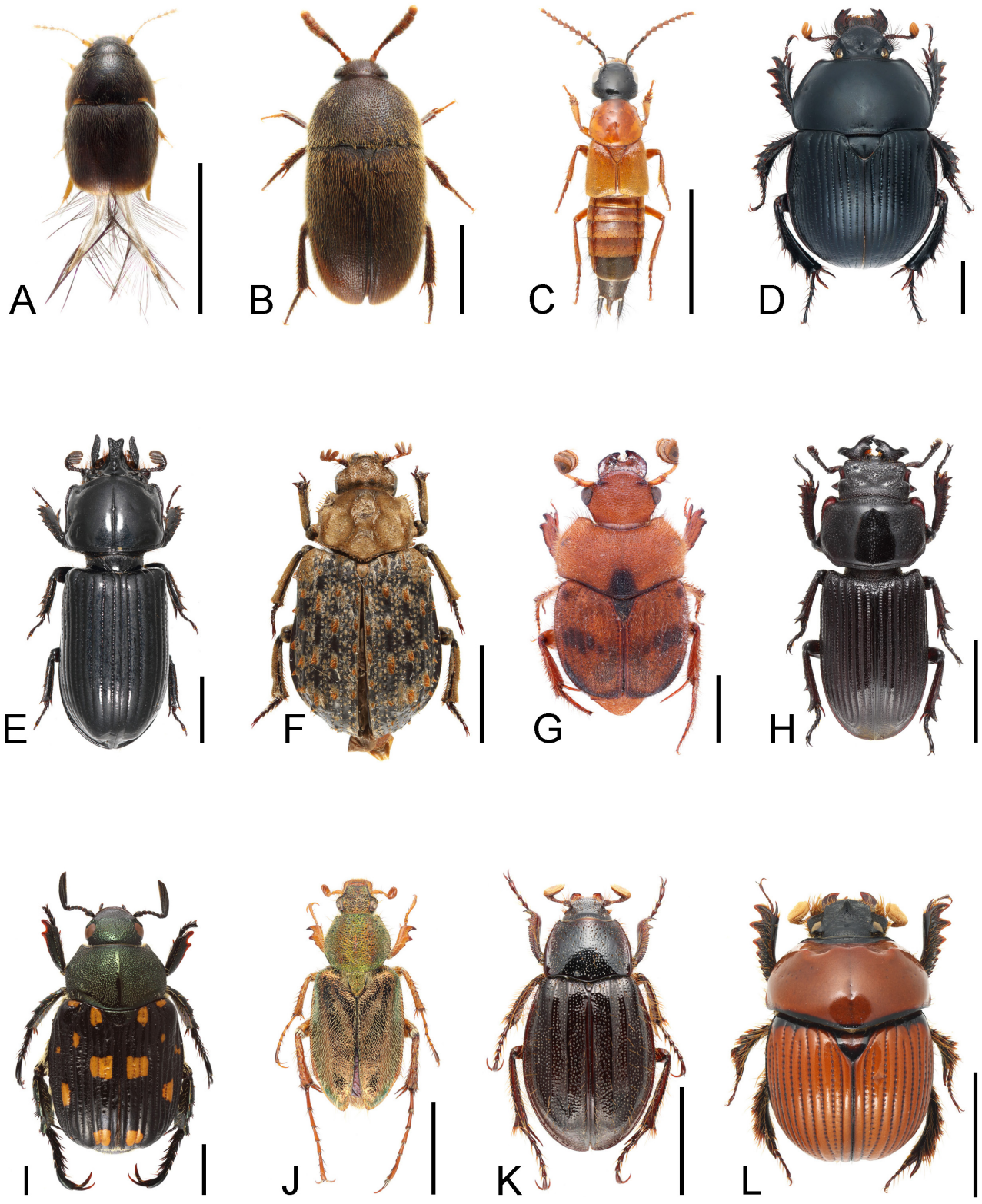


**FIGURE 5.** Habitus of Coleoptera families. **A.** Ptiliidae. **B.** Leiodidae. **C.** Staphylinidae. **D.** Geotrupidae. **E.** Passalidae. **F.** Trogidae. **G.** Ochodaeidae. **H.** Lucanidae. **I.** Scarabaeidae. **J.** Glaphyridae. **K.** Hybosoridae. **L.** Bolboceratidae. Scale bars: 5 mm except 1 mm in A and B.

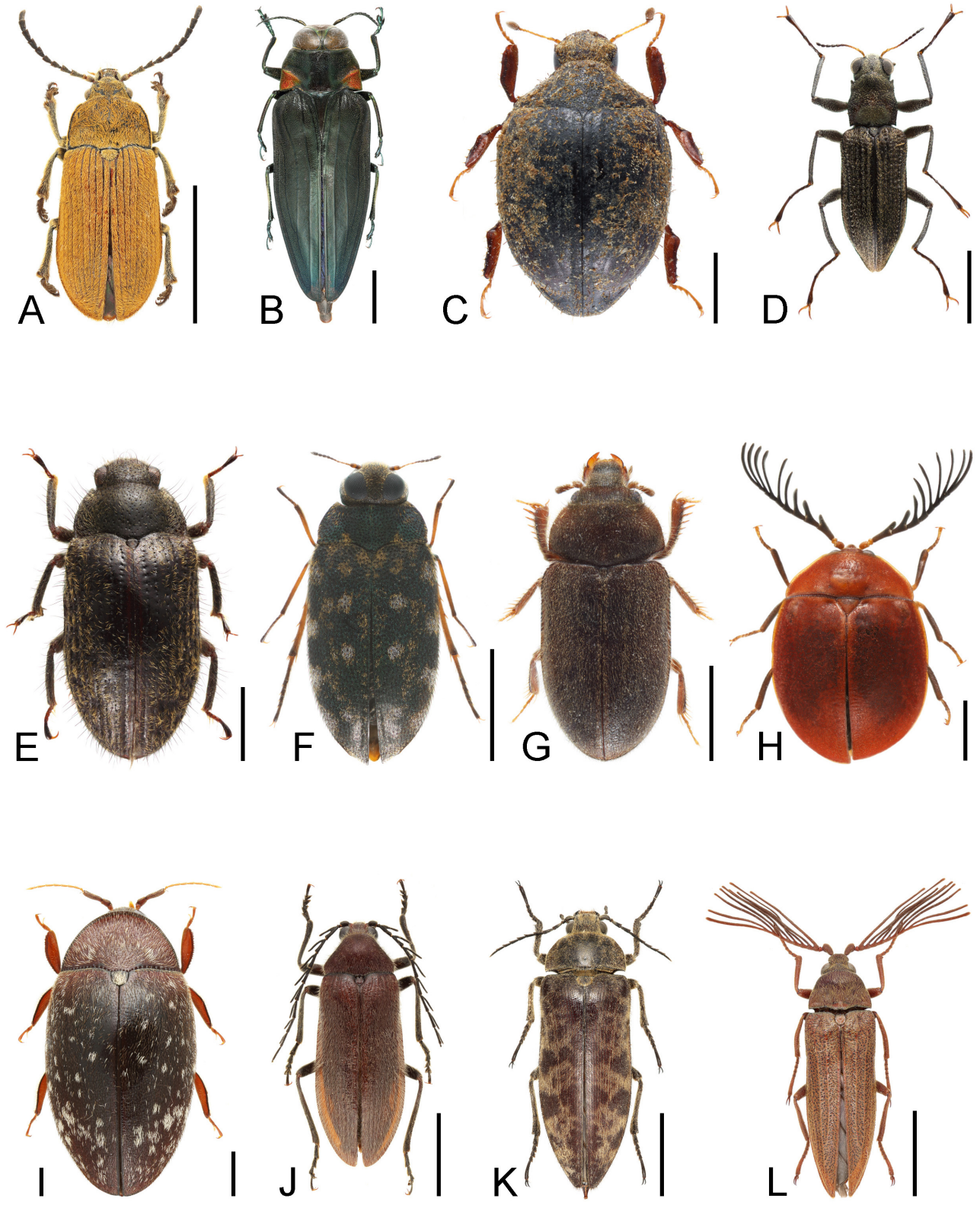


**FIGURE 6.** Habitus of Coleoptera families. **A.** Dascllidae. **B.** Buprestidae. **C.** Byrrhidae. **D.** Elmidae. **E.** Dryopidae. **F.** Limnichidae. **G.** Heteroceridae. **H.** Psephenidae. **I.** Chelonariidae. **J.** Ptilodactylidae. **K.** Eulichadidae. **L.** Callirhipidae. Scale bars: 1 mm except 5 mm in A–B and J–L.

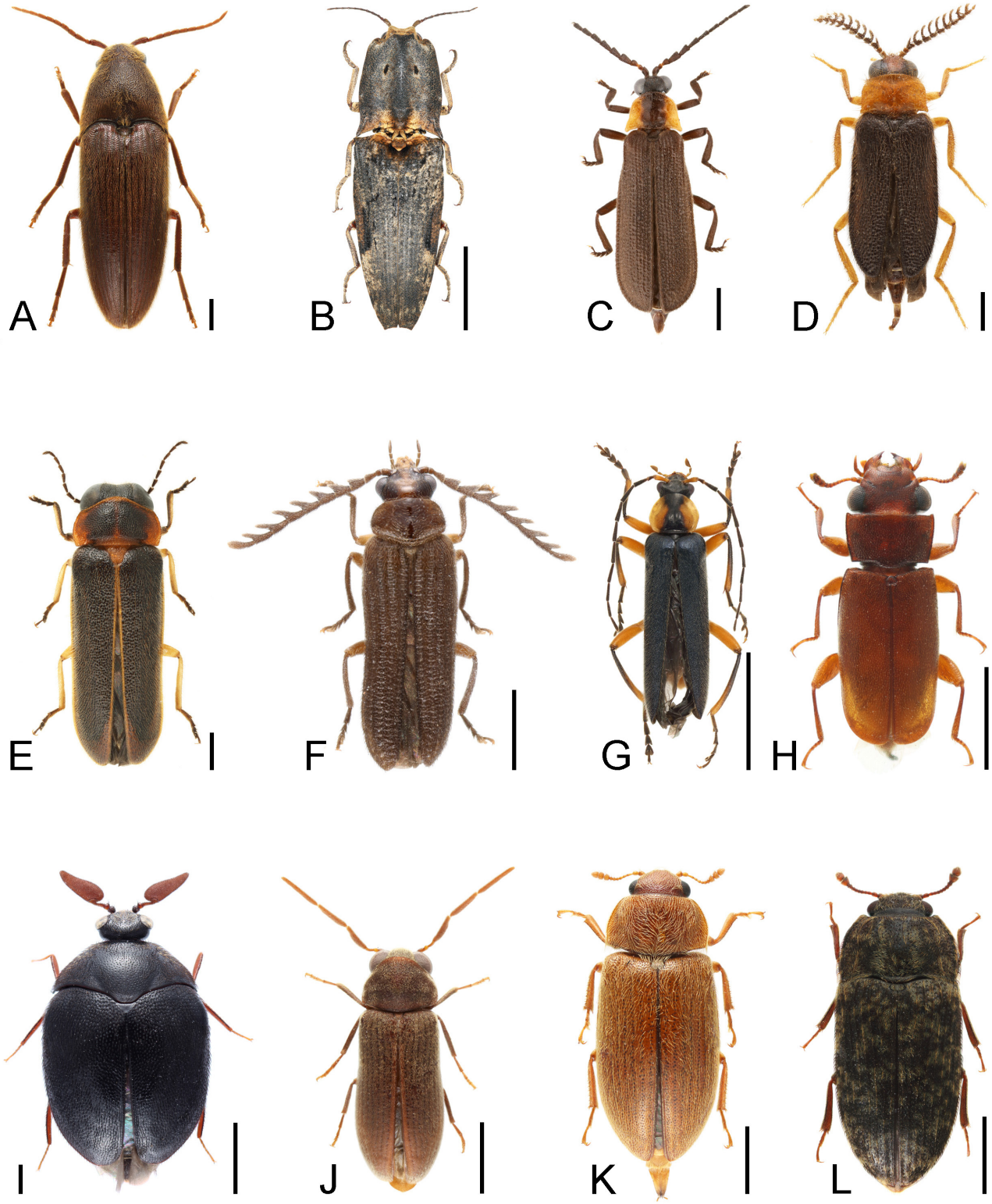


**FIGURE 7.** Habitus of Coleoptera families. **A.** Eucnemidae. **B.** Elateridae. **C.** Lycidae. **D.** Rhagophthalmidae. **E.** Lampyridae. **F.** Omethidae. **G.** Cantharidae. **H.** Bostrichidae. **I.** Dermestidae. **J.** Ptinidae. **K.** Byturidae. **L.** Biphyllidae. Scale bars: 1 mm except 5 mm in B and G.

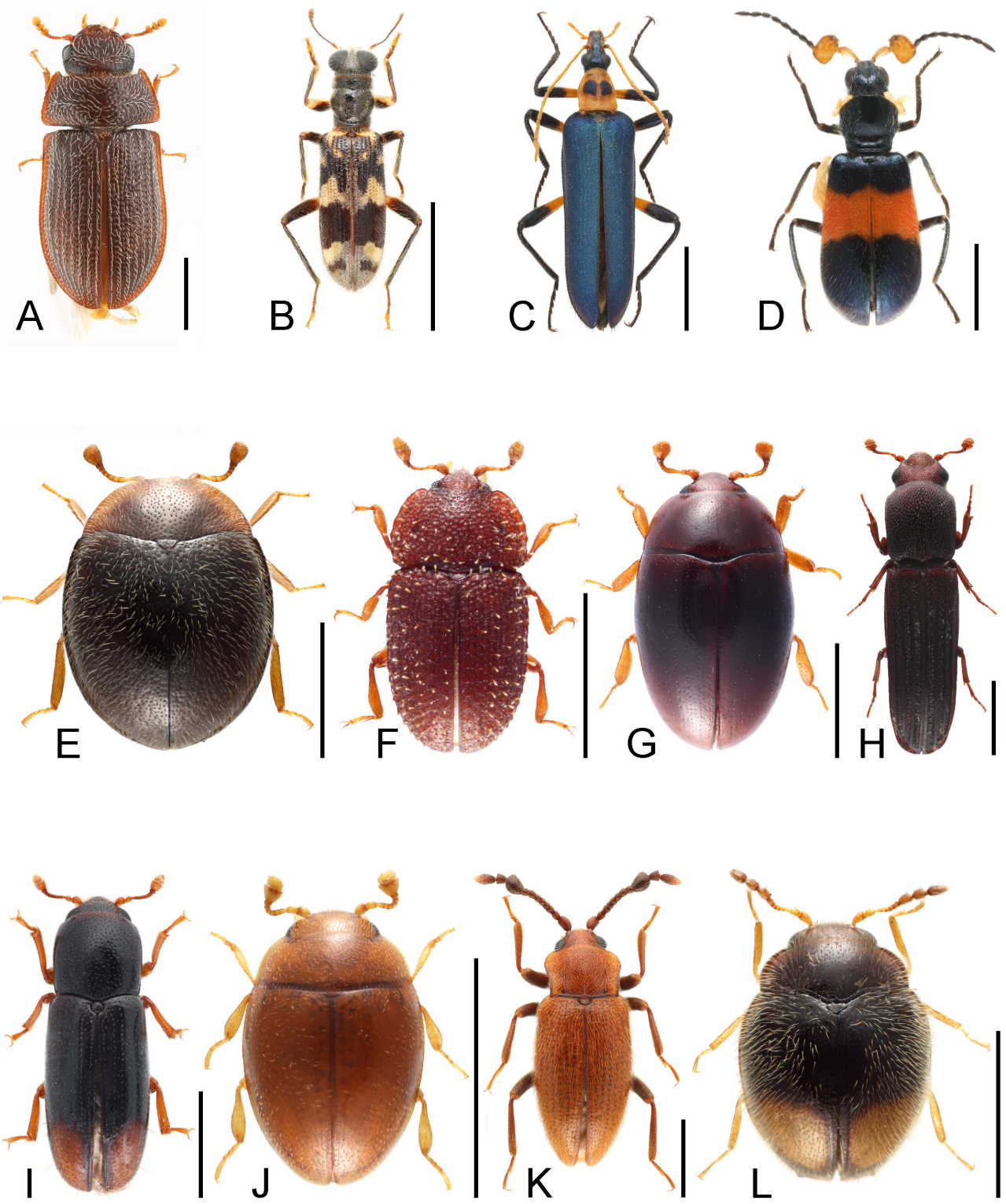


**FIGURE 8.** Habitus of Coleoptera families. **A.** Lophocateridae. **B.** Cleridae. **C.** Prionoceridae. **D.** Melyridae. **E.** Discolomatidae. **F.** Cerylonidae. **G.** Euxestidae. **H.** Bothrideridae. **I.** Teretidae. **J.** Eupsilobiidae. **K.** Endomychidae. **L.** Anamorphidae. Scale bars: 1 mm except 5 mm in B and C.

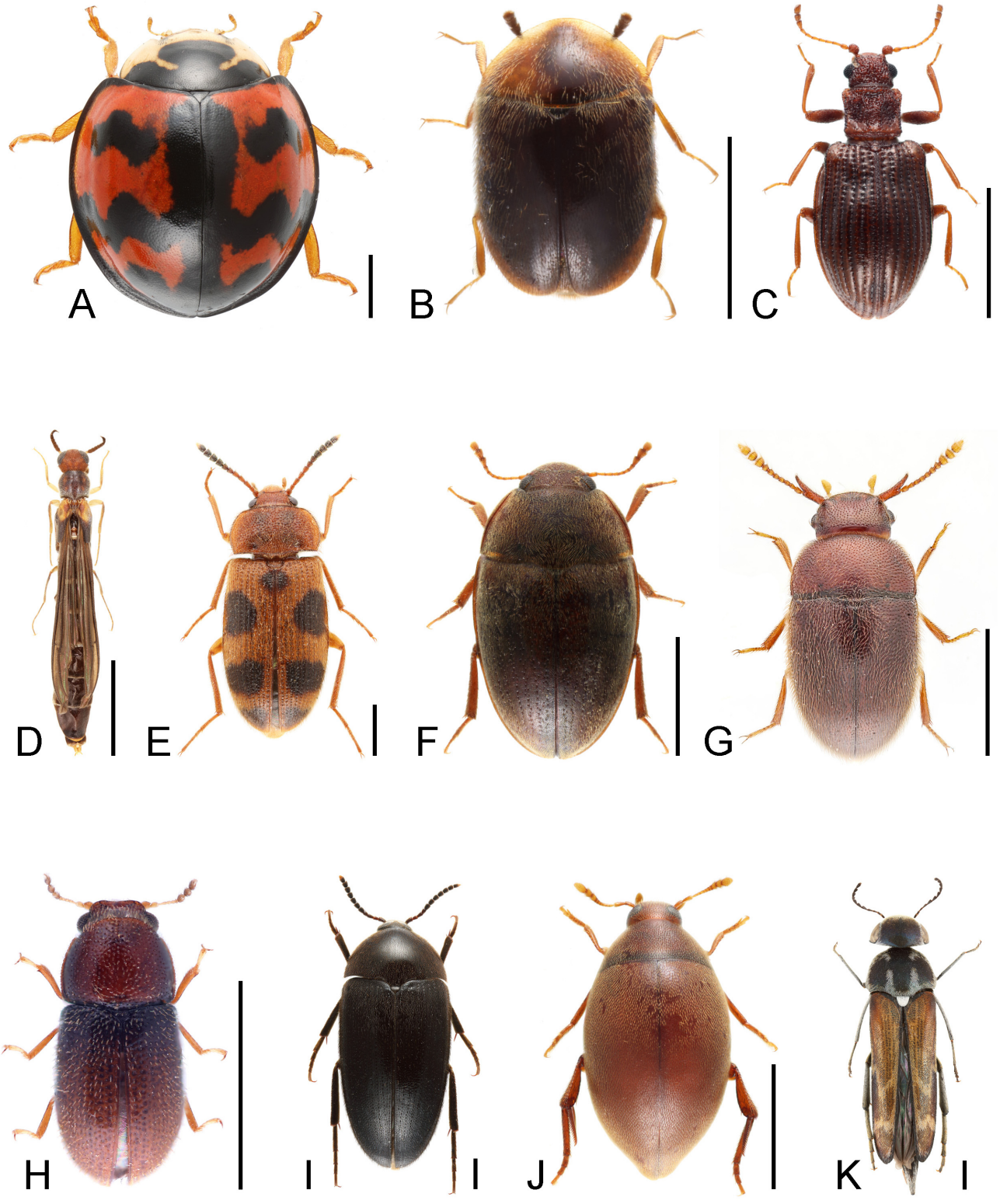


**FIGURE 9.** Habitus of Coleoptera families. **A.** Coccinellidae. **B.** Corylophidae. **C.** Latridiidae. **D.** Lymexylidae. **E.** Mycetophagidae. **F.** Archeocrypticidae. **G.** Pterogeniidae. **H.** Ciidae. **I.** Tetratomidae. **J.** Melandryidae. **K.** Mordellidae. Scale bars: 1 mm except 5 mm in D.

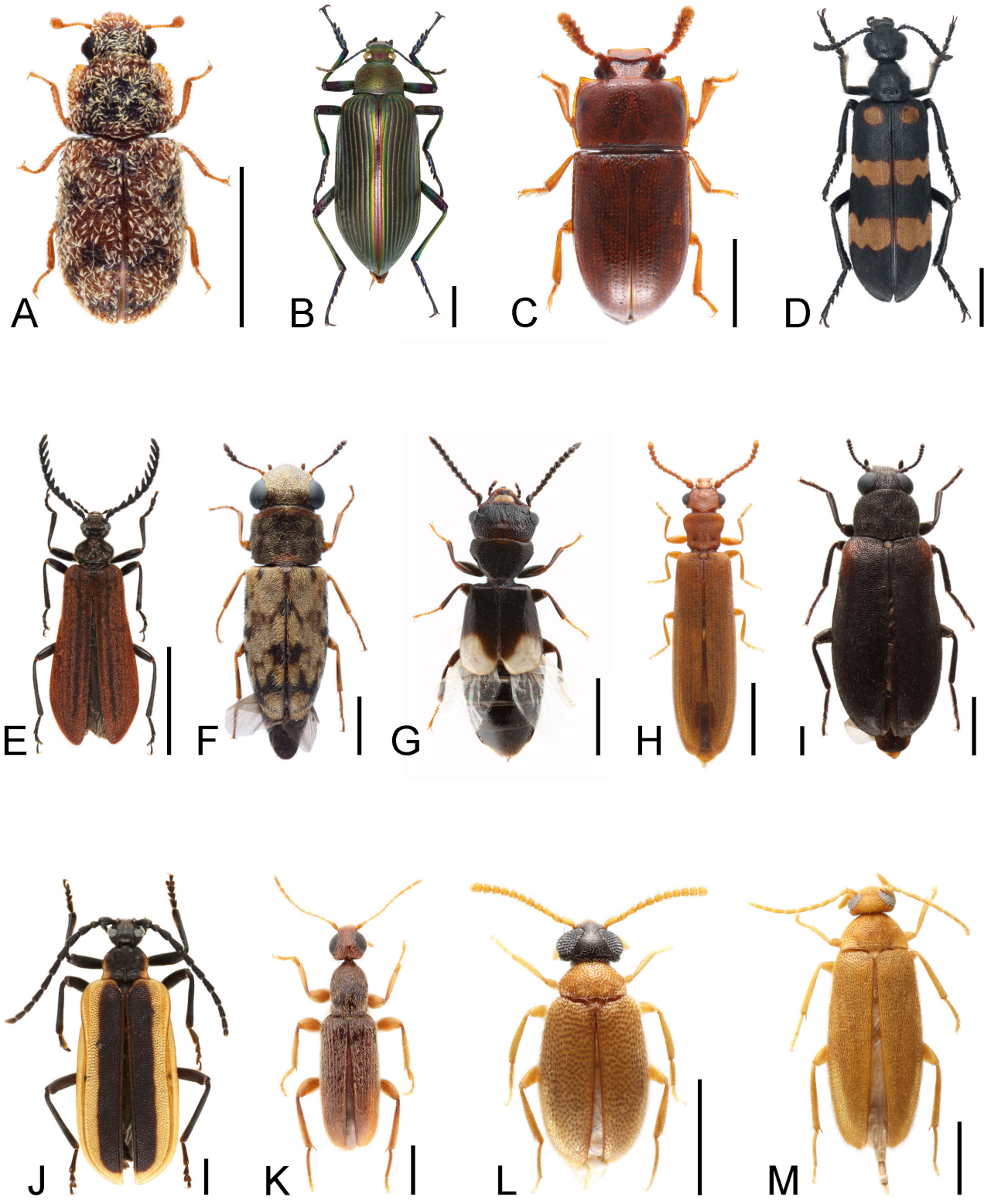


**FIGURE 10.** Habitus of Coleoptera families. **A**. Zopheridae. **B, C.** Tenebrionidae. **D.** Meloidae. **E.** Pyrochroidae. **F, G.** Salpingidae. **H, I.** Mycteridae. **J.** Ischaliidae. **K.** Anthicidae. **L.** Aderidae. **M.** Scraptiidae. Scale bars: 1 mm except 5 mm in B and D–E.

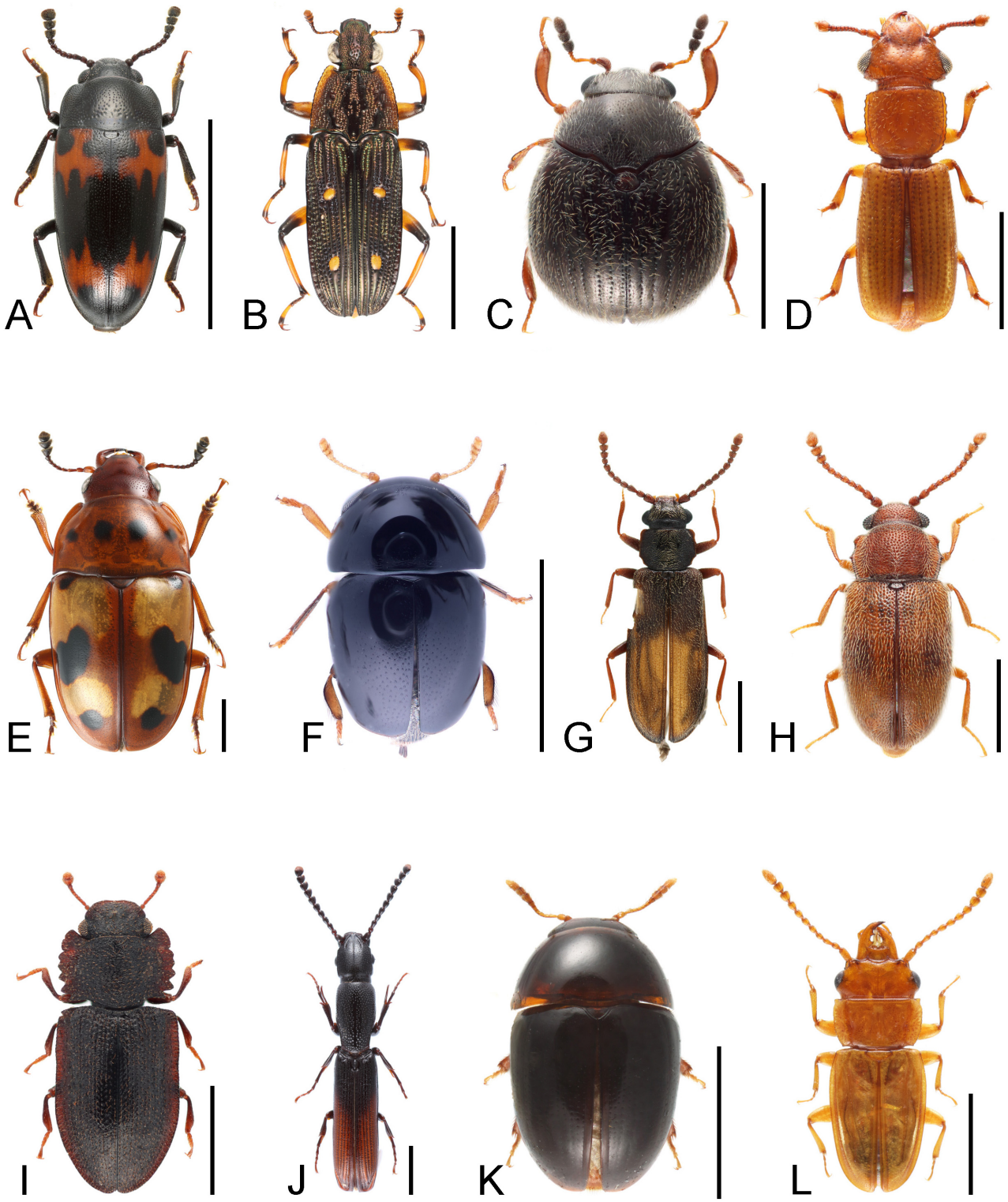


**FIGURE 11.** Habitus of Coleoptera families. **A.** Erotylidae. **B.** Helotidae. **C.** Sphindidae. **D.** Monotomidae. **E.** Nitidulidae. **F.** Cybocephalidae. **G.** Cucujidae. **H.** Cryptophagidae. **I.** Silvanidae. **J.** Passandridae. **K.** Phalacridae. **L.** Laemophloeidae. Scale bars: 1 mm except 5 mm in A and B.

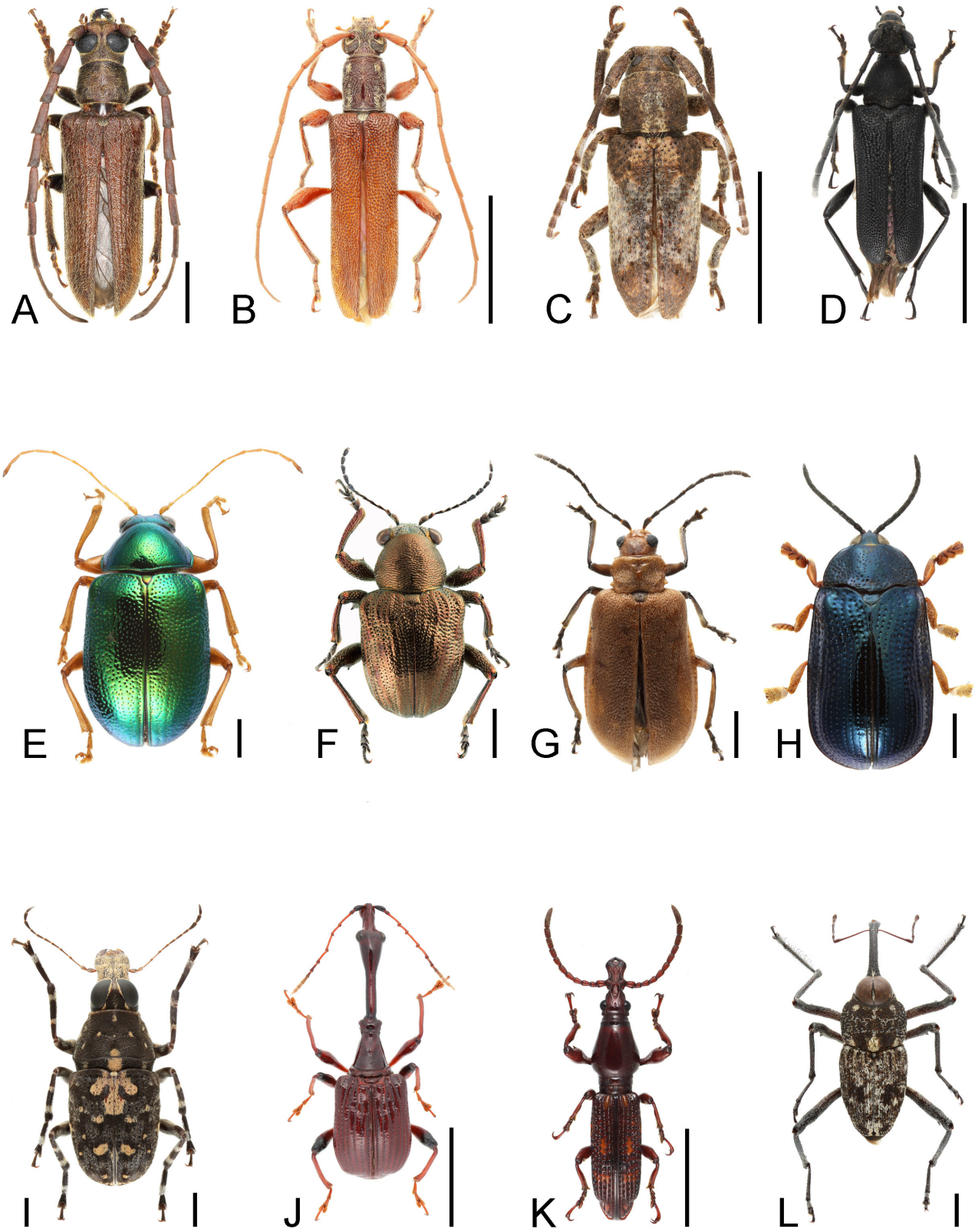


**FIGURE 12.** Habitus of Coleoptera families. **A.** Vesperiae. **B–D.** Cerambycidae. **E–H.** Chrysomelidae. **I.** Anthribidae. **J.** Atellabidae. **K.** Brentidae. **L.** Curculionidae. Scale bars: 1 mm except 5 mm in A–D and J–K.

## Taxonomy

### Eupsilobiidae Casey, 1895

Eupsilobiidae is a poorly known family, represented by seven genera and 19 species (Tomaszewska 2011; Robertson *et al.* 2015). Traditionally treated as a subfamily of Endomychidae, it has been elevated to family level based on molecular data (Robertson *et al.* 2015). Most of the genera and species are restricted to endemic islands in Central America, South America and South Africa (Pakaluk & Ślipiński 1990; Tomaszewska 2011), with *Eidoreus* Sharp having three species distributed mainly on scattered tropical islands, while *E. japonicus* Sasaji, 1991 is also known from the mountains of Japan (Sasaji 1986).

### *Eidoreus haizhuensis* sp. nov.

(Fig. 13)

**Type material. HOLOTYPE: CHINA: Guangdong:** ♂, Guangzhou, Haizhu Wetland, E113°21'1.55" N23°3'33.33", 2022.iii.22-iv.22, Malaise trap (IZGA). **PARATYPES: CHINA: Guangdong:** same date as Holotype (1 IZGA); Guangzhou, Haizhu Wetland, E113°20'7.83" N23°3'51.42", 2022.ii.22-iii.22, Malaise trap (1 IZGA); Zhongshan, Zhongshan Arboretum, E113°22′4.4832″ N22°29′6.5292″, 2024.vi.26, leg. Zhenhua Liu (1 IZGA).

**Diagnosis.** The new species is mainly distinguished from the congeners by the following characters: anterior margin of metaventral process between mesocoxae nearly truncate (Fig. 13B); elytra with indistinct furrow along suture and lateral margin; male genitalia (Fig. 13D) with tegmen distinctly twisted at about apical third, median lobe sinuate, expanded to T-shaped at base.

**Description.** Length 1.2–1.3 mm. Body oval, convex both dorsally and ventrally (Fig. 13C). Colour reddish brown, with legs and antennae lighter. Surface glabrous, covered with sparse and short yellow setae (Fig. 13A).

Head prognathous, distinctly inserted inside prothorax, moderately constricted behind eyes; dorsal surface smooth, frontoclypeal suture present and curved inwardly; ventral side with short sub-antennal grooves, gular area wide. Eyes small and coarsely facetted, laterally inserted and slightly protruding. Antennae inserted on genal area between eyes, insertions not exposed from above. Antenna (Fig. 13A, B) 10-segmented with 2-segmented club; scape enlarged, pedicel a little smaller, antennomere 3 longer than antennomere 4, antennomeres 4–8 almost equal in length, antennomere 9 trapezoid, antennomere 10 transversely elliptical. Maxillary palps with terminal segment elongate and conical; labial palps with terminal segment enlarged and sub-triangular.

Pronotum (Fig. 13A) transverse, about 0.4 times as long as wide, widest at base; lateral margins arcuate. Anterolateral angles slightly extending forwardly; posterior margin weakly bisinuate. Prosternum small and T-shaped, forming pair of anterolateral excavation with epipleura of pronotum to receive antennal clubs; prosternal process wide and slightly expanded to lateral apically, posterior margin emarginate, meeting with intercoxal process of metaventrite over mesoventrite. Procoxal cavities oval, externally open; procoxae oval, protrocantins exposed. Scutellum small and sub-triangular.

Elytra only slightly longer than wide, widest at about anterior third; lateral margins curved. Dorsal surface smooth, without distinct punctation, with indistinct furrows along suture and lateral margin (Fig. 13A, C); humeral areas with pair of short and slightly curved markings. Epipleura incomplete, broad at base, gradually narrowed to terminal abdominal ventrite. Mesoventrite almost completely covered by prosternal process and intercoxal process of metaventrite. Metaventrite transverse, discrimen absent, with pair of post coxal lines almost extending to lateral margins; intercoxal process large, extending to front of mesocoxae, apical margin nearly truncate. Metepisternum nearly rectangular, narrow. Mesocoxae cavities widely separated, laterally open to mesepimeron. Mesocoxae oval, mesotrocantins concealed. Metacoxae transverse and widely separated. Legs with femora enlarged at middle; tibiae flattened, expanded anteriorly; tarsal formula 4-4-4, tarsomeres simple.

Abdomen (Fig. 13E) with five freely articulated ventrites; ventrite 1 longest, with pair of curved post coxal lines, not extending to posterior margin; ventrites 2–4 short, sub-equal in length; ventrite 5 sub-trapezoid, posterior margin slightly emarginate. Spicular gastrale V-shaped, articulated to tergite IX posteriorly (Fig. 13F). Aedeagus (Fig. 13D) with tegmen distinctly twisted at about apical third, articulated to slender strut at base; median lobe thin and long, sinuate at middle, basal area expanded and T-shaped.

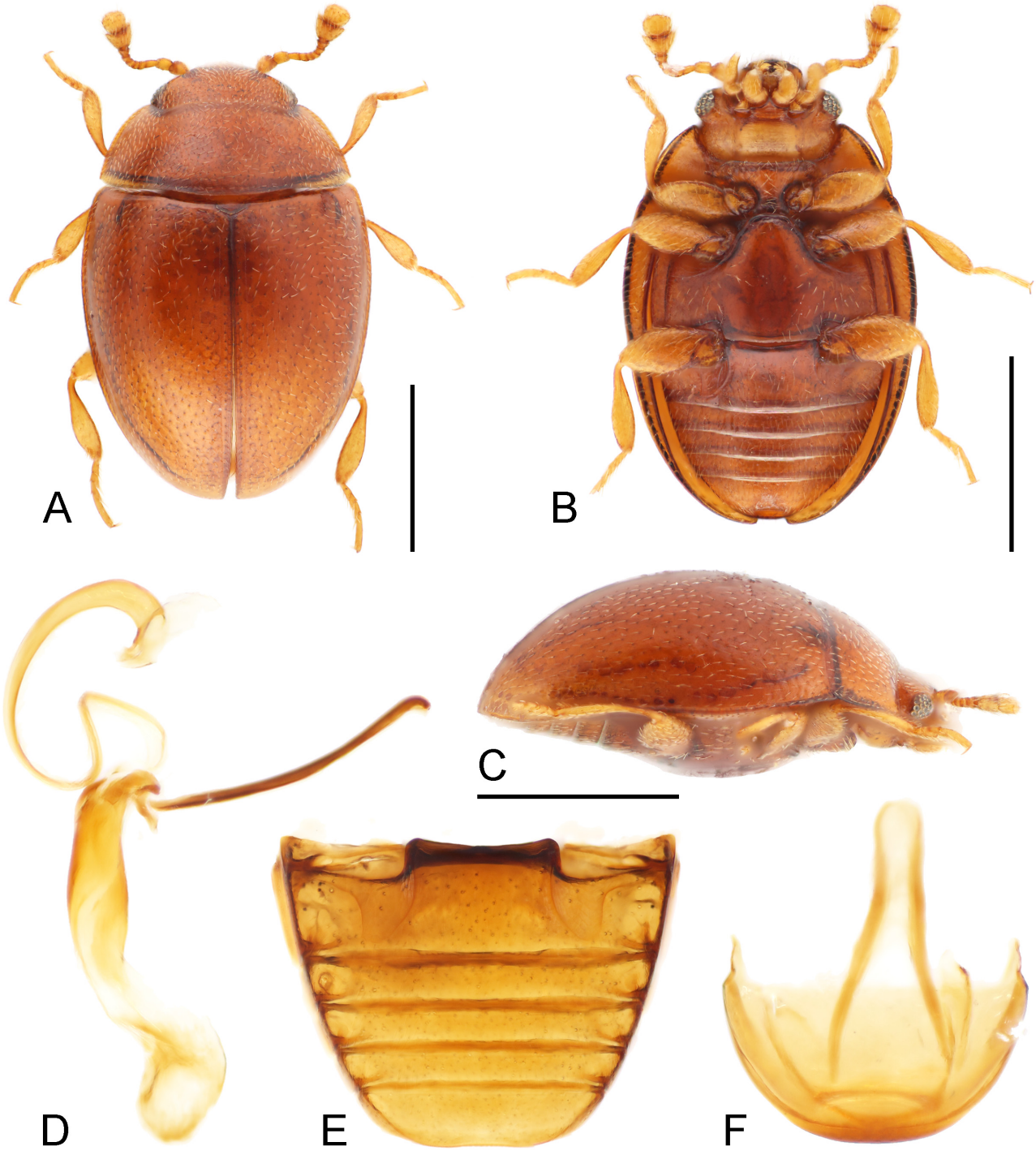


**FIGURE 13.** *Eidoreus haizhuensis* **sp. nov. A.** Dorsal habitus, holotype. **B.** Ventral habitus, paratype. **C.** Lateral habitus, paratype. **D.** Aedeagus, holotype. **E.** Abdominal ventrites, ventral view. **F.** Terminal abdominal segments. Scale bars: 0.5 mm.

**Distribution.** China (Guangdong).

**Etymology.** The specific epithet is derived from the name of the type locality, Haizhu Wetland, where Haizhu also refers to a district in Guangzhou.

## Discussion

The number of beetle families in Guangdong increased from 64 to 111 after the survey, accounting for about 44% and 75% of the number in China, respectively, indicating that the background data on beetle diversity or even insect diversity in Guangdong is highly deficient even at higher taxonomic level. This may be due not only to the lack of systematic field work, but also to the lack of attention from the researchers. No project on the insect fauna of Guangdong Province has been proposed until 2020, because the insect fauna of the Nanling Mountains and that of Guangdong Province are both under compilation now, which are highly dependent on the projects in the Nanling Mountains and the Greater Bay Area. Also, the statistical result in this paper highlights the importance of different collection methods and persistent collecting for the study of insect diversity, as different groups of insects may have distinctly different habitats and habits (Devigne & Biseau 2014; Nie *et al.* 2017; Uhler *et al.* 2022; Zhao *et al.* 2022; Chen *et al.* 2022).

Although up to 111 families have been found in Guangdong, some families of water beetles such as Sphaeriusidae, Hydroscaphidae, Epimetopidae, Spercheidae which have been recorded in the neighboring provinces and have relatively wide distribution, are not included in the checklist (Ryndevich 2011; Edwards *et al.* 2015; Liang & Jia 2018; Fikáček *et al.* 2021). This may be due to aquatic habits of these families, which require sifting the sands and muds near the water for collection, whereas it was rarely used during the filed works. In addition, some unrecorded families such as Dedrodontidae, Artematopodidae, Thymalidae, Murmidiidae and Prostomidae, which are usually rare in the collection, might also be present in Guangdong according to their distribution (Háva 2010; Kundrata *et al.* 2013; Schawaller 2019; Asakawa *et al.* 2020; Wang & Liu 2021; Jałoszyński & Ślipiński 2022). Therefore, the results of the current study are preliminary, and it is expected that more beetle families will be found in Guangdong.

Among the newly recorded families, most of them have not been studied for a long time or only occasionally in mainland China, such as Clambidae, Ptiliidae, Heteroceridae, Chelonariidae, Omethidae, Byturidae, Cerylonidae, Corylophidae, Mycetophagidae, Archeocrypticidae, Mycteridae, Sphindidae and others, and massive specimens were collected from some newly recorded families such as Passalidae, Dryopidae, Limnichidae, Monotomidae, Biphyllidae, Bothrideridae, Mycetophagidae *et al*. It shows that the taxonomic work on Coleoptera in China is highly unbalanced, mainly focusing on the more concerned families such as Chrysomelidae, Staphylinidae, Scarabaeidae, Cerambycidae, Carabidae, Curculionidae *et al.* (Nie *et al.* 2019; Zhang *et al.* 2023).

Overall, not only more field work with different collecting methods, but also more researchers working on the niche families are needed to further explore the diversity of beetles in Guangdong or even in the country.

## Acknowledgements

This project is supported by the following grants and projects: GDAS Special Project of Science and Technology Development (2022GDASZH-2022010106, 2020GDASYL-20200102021). We appreciate Dr. Yandong Chen for providing the habitus image of Pterogeniidae and Haidong Yang for his introductions on the setting of sampling sites, and the first author thanks Adam Ślipiński for his suggestions on the study of Eupsilobiidae. We are also grateful for the kindly reviews by Richard Leschen, Rolf Beutel and another anonymous reviewer.

## References

Arriaga-Varela, E., Tomaszewska, W., Szawaryn, K., Robertson, J., Seidel, M., Ślipiński, A. & Fikáček, M. (2023) The resurrection of Cerasommatidiidae, an enigmatic group of coccinelloid beetles (Coleoptera: Coccinelloidea) based on molecular and morphological evidence. *Zoological Journal of the Linnean Society*, 197 (4), 1078–1115. https://doi.org/10.1093/zoolinnean/zlac082

Asakawa, D., Senda, Y. & Yoshitomi, H. (2020) Revision of the Genus *Thymalus* (Coleoptera: Cleroidea: Thymalidae) of Japan. *Japanese Journal of Systematic Entomology*, 26 (1), 69–83.

Bocak, L., Kundrata, R., Fernández, C.A. & Vogler, A.P. (2016) The discovery of Iberobaeniidae (Coleoptera: Elateroidea): a new family of beetles from Spain, with immatures detected by environmental DNA sequencing. *Proceedings of the Royal Society B: Biological Science*s, 283, 20152350. https://doi.org/10.1098/rspb.2015.2350

Beutel, R.G. & Leschen, R.A. (2016) *Arthropoda: Insecta: Coleoptera. Vol. 1. Morphology and Systematics (Archostemata,*

*Adephaga, Myxophaga, Polyphaga Partim)*. De Gruyter, Berlin, Boston, 684 pp.
Cai, C., Tihelka, E., Giacomelli, M., Lawrence, J.F., Ślipiński, A., Kundrata, R., Yamamoto, S., Thayer, M.K., Newton, A.F., Leschen, R.A.B., Gimmel, M.L., Lü, L., Engel, M.S., Bouchard, P., Huang, D., Pisani, D. & Donoghue, P.C.J. (2022) Integrated phylogenomics and fossil data illuminate the evolution of beetles. *Royal Society Open Science*, 9, 211771. https://doi.org/10.1098/rsos.211771
Cheng, T.-H. & Chang, Y.-T. (1956) On tentative scheme for dividing zoogeographical regions of China. *Acta Geographica Sinica*, 22 (1), 93–109.
Chen, Y.-D., Yang, H.-D., Leung, M.-H., Cheung, K.-H., Lee, Y.-M., He, X., Huang, Z.-Z & Bai, M. (2022) Evaluation of efficiency of flight interception trap (FIT) in collecting rare beetles and application potential of fit in biodiversity research; a case study in Hong Kong. *Journal of Enviromental Entomology*, 44 (5), 1113–1123. [in Chinese] https://doi.org/10.3969/j.issn.1674-0858.2022.05.6
Devigne, C. & De Biseau, J.C. (2014) Urban ecology: comparison of the effectiveness of five traps commonly used to study the biodiversity of flying insects. *Biodiversity Journal*, 5 (2), 165–174.
Duran, D.P. & Gough, H.M. (2020) Validation of tiger beetles as distinct family (Coleoptera: Cicindelidae), review and reclassification of tribal relationships. *Systematic Entomology*, 45 (4), 723–729. https://doi.org/10.1111/syen.12440
Fikáček, M., Keita, M., Philip, P., Alexander, P., Alexey, S., Stanislav, L. & Manfred, A.J. (2021) The family Epimetopidae (Coleoptera: Hydrophiloidea): review of current knowledge, genus-level phylogeny, and taxonomic revision of *Eupotemus*. *Acta Entomologica Musei Nationalis Pragae*, 61 (1), 1–34. https://doi.org/10.37520/aemnp.2021.001
Goczał, J., Beutel, R.G., Gimmel, M.L. & Kundrata, R. (2024) When a key innovation becomes redundant: Patterns, drivers and consequences of elytral reduction in Coleoptera. *Systematic Entomology*, 49 (2), 193–220. https://doi.org/10.1111/syen.12617
Háva, J. & Háva, J. (2010) *Laricobius jizu* sp. n., a new species from China (Coleoptera: Derodontidae: Laricobinae) with check-list of Chinese species. *Calodema*, 112, 1–4.
Hu, Y.-B., Fan, H.-Z., Chen, Y.-H., Chang, J., Zhan, X.-J., Wu, H., Zhang, B.-W., Wang, M., Zhang, W.-Y., Yang, L., Hou, X., Shen, X., Pan, T., Wu, W., Li, J., Hu, H.-H. & Wei, F.-W. (2021) Spatial patterns and conservation of genetic and phylogenetic diversity of wildlife in China. *Science Advances*, 7, eabd5725. https://doi.org/10.1126/sciadv.abd5725
Hui, E.-C., Li, X., Chen, T. & Lang, W. (2020) Deciphering the spatial structure of China's megacity region: A new bay area—The Guangdong-Hong Kong-Macao Greater Bay Area in the making. *Cities*, 105, 102168. https://doi.org/10.1016/j.cities.2018.10.011
Jia, F.-L., Wu, W. (1999) Notes on Hydrochidae of China, with description of a new species (Coleoptera: Hydrophiloidea). *Acta Entomologica Sinica*, 42 (3), 307–310. [in Chinese]
Jałoszyński, P. & Ślipiński, A. (2022) Revision of the family Murmidiidae (Coleoptera: Coccinelloidea). *Zootaxa*, 5109 (1), 1–102. https://doi.org/10.11646/zootaxa.5109.1.1
Kusy, D., He, J.-W., Bybee, S.M., Motyka, M., Bi, W.-X., Podsiadlowski, L., Li, X.-Y. & Bocak, L. (2021) Phylogenomic relationships of bioluminescent elateroids define the 'lampyroid' clade with clicking Sinopyrophoridae as its earliest member. *Systematic Entomology*, 46 (1), 111–123. https://doi.org/10.1111/syen.12451
Kundrata, R., Bocakova, M. & Bocak, L. (2013) The phylogenetic position of Artematopodidae (Coleoptera: Elateroidea), with description of the first two Eurypogon species from China. *Contributions to Zoology*, 82 (4), 199–221. https://doi.org/10.1163/18759866-08204004
Lau, S.-K. (2019) *Checklis of Insects of Hong Kong*. Agriculture, Fisheries and Conservation Department, Hong Kong, 1056 pp.
Leschen, R.A. & Beutel, R.G. (2010) *Arthropoda: Insecta: Coleoptera. Vol.e 2. Morphology and Systematics (Elateroidea, Bostrichiformia, Cucujiformia partim)*. De Gruyter, Berlin and Boston, 786 pp.
Leschen, R.A. & Beutel, R.G. (2014) *Arthropoda: Insecta: Coleoptera. Vol. 3. Morphology and Systematics (Phytophaga)*. De Gruyter, Berlin and Boston, 675 pp. https://doi.org/10.1515/9783110274462
Li, Z.-Q., Liang, X.-D., Yang, X.-K. & Lin, X.-P. (2024) *A Checklist of Insects in Guangdong.* Guangdong Science & Technology Press, Guangzhou, 1068 pp.
Liang, Z.-L. & Jia, F.-L. (2018) A new species of *Sphaerius* Waltl from China (Coleoptera, Myxophaga, Sphaeriusidae). *ZooKeys*, 808, 115–121 https://doi.org/10.3897/zookeys.808.30600
Liu, Z.-H., Lin,W. & Li, Z.-Q. (2021) The First Record of Teredidae (Coleoptera, Coccinelloidea) from China, with Description of a New Species of *Teredus* Dejean, 1835. *Insects*, 12, 1028. https://doi.org/10.3390/insects12111028
López-Pujol, J., Zhang, F.-M., Sun, H.-Q., Ying, T.-S. & Ge, S. (2011) Mountains of southern China as "plant museums" and "plant cradles": Evolutionary and conservation insights. *Mountain Research and Development*, 31 (3), 261–269.

https://doi.org/10.1659/MRD-JOURNAL-D-11-00058.1
McKenna, D.D., Shin, S., Ahrens, D., Balke, M., Beza-Beza, C., Clarke, D.J., Donath, A., Escalona, H.S., Friedrich, F., Letsch, H., Liu, S., Maddison, D., Mayer, C., Misof, B., Murin, P.J., Niehuis, O., Peters, R.S., Podsiadlowski, L., Pohl, H., Scully, E.D., Yan, E.V., Zhou, X. Ślipiński, A. & Beutel, R. (2019) The evolution and genomic basis of beetle diversity. *Proceedings of the National Academy of Sciences*, 116 (49), 24729–24737.
https://doi.org/10.1073/pnas.1909655116
Mi, X.-C., Feng, G., Hu, Y.-B., Zhang, J., Chen, L., Corlett, R.T., Hughes, A.C., Pimm, S., Schmid, B., Shi, S.-H., Svenning, J.C. & Ma, k.P. (2021) The global significance of biodiversity science in China: an overview. *National Science Review*, 8 (7), nwab032.
https://doi.org/10.1093/nsr/nwab032
Nie, R.-E., Yang M.-X, Xue, H.-J., Yang, Y.-R., Tong, Y.-J., Qiu T.-F., Bai, M. & Yang X.-K. (2017) The application and effectiveness of a flight interception trap for insect collecting. *Chinese Journal of Applied Entomology*, 54 (3), 530–535. [in Chinese]
https://doi.org/10.7679/j.issn.2095–1353.2017.065
Nie, R.-E., Bai, M. & Yang, X.-K. 2019. Seventy years of Chinese beetle research. *Chinese Journal of Applied Entomology*, 56(5), 884–906. [in Chinese]
https://doi.org/10.7679/j.issn.2095–1353.2019.100
Pakaluk, J. & Ślipiński, S. A. (1990) Review of Eupsilobiinae (Coleoptera: Endomychidae) with descriptions of new genera and species from South America. *Revue Suisse de Zoologie*, 97 (3), 705–728.
https://doi.org/10.5962/bhl.part.79759
Robertson, J.A., Ślipiński, A., Moulton, M., Shockley, F.W., Giorgi, A., Lord, N.P., Mckenna, D.D., Tomaszewska, W., Forrester, J., Miller, K.B., Whiting, M.F. & Mchugh, J.V. (2015) Phylogeny and classification of Cucujoidea and the recognition of a new superfamily Coccinelloidea (Coleoptera: Cucujiformia). *Systematic Entomology*, 40 (4), 745–778.
https://doi.org/10.1111/syen.12138
Rosa, S.P., Costa, C., Kramp, K. & Kundrata, R. (2020) Hidden diversity in the Brazilian Atlantic rainforest: The discovery of Jurasaidae, a new beetle family (Coleoptera, Elateroidea) with neotenic females. *Scientific Reports*, 10 (1), 1544.
https://doi.org/10.1038/s41598-020-58416-6
Ryndevich, S.K. (2011) New data on Holarctic and Oriental Spercheidae and Hydrophilidae (Coleoptera, Hydrophiloidea). *Euroasian Entomological Journal*, 10 (3), 337–340.
Sasaji, H. (1986) Systematic position of the genus *Eidoreus* Sharp (Coleoptera: Clavicornia). *Prof. Takehiko Nakane in commemoration of his retirement Special Bulletin of the Japanese Society of Coleopterology*, 2, 229–235.
Schawaller, W. (2019) *Prostomis elburica* Fleischer upranked to valid species, and additional distributional data of Palaearctic and Oriental species of *Prostomis* Latreille (Insecta: Coleoptera: Prostomidae). *Vernate*, 38, 221–224.
Short, A.E.Z., Joly, L.J., Garcia, M., Wild, A.L., Bloom, D.D. & Maddison, D.R. (2015) Molecular phylogeny of the Hydroscaphidae (Coleoptera: Myxophaga) with description of a remarkable new lineage from the Guiana Shield. *Systematic Entomology*, 40 (1), 214–229.
https://doi.org/10.1111/syen.12097
Stork, N.E. (2018) How many species of insects and other terrestrial arthropods are there on Earth? *Annual review of entomology*, 63 (1), 31–45.
https://doi.org/10.1146/annurev-ento-020117-043348
Tomaszewska, W. (2011) On African Eupsilobiinae (Coleoptera: Endomychidae) with descriptions of a new genus and species. *Journal of Insect Science*, 11 (1), 166.
https://doi.org/10.1673/031.011.16601
Uhler, J., Haase, P., Hoffmann, L., Hothorn, T., Schmidl, J., Stoll, S., Welti, E.A.R., Buse, J. & Müller, J. (2022) A comparison of different Malaise trap types. *Insect Conservation and Diversity*, 15 (6), 666–672.
https://doi.org/10.1111/icad.12604
Wang, C.-B. & Liu, H.-Y. (2021) *Eurypogon sanzang* sp. n. from Henan, China (Coleoptera: Artematopodidae: Artematopodinae). *Japanese Journal of Systematic Entomology*, 27 (1), 37–42.
Wang, Z.-Z., Zhang, M., Zhao, X.-B., Xie, J.-M., Peng, Y.-G., Sheldon, F.H. & Zou, F.-S. (2024) The Nanling Mountains of southern China played a variable role as a barrier and refuge for birds depending upon landscape structure and timing of events. *Journal of Avian Biology*, 2024 (5–6), e03131.
https://doi.org/10.1111/jav.03131
Zhao, S.-Z., Tong, Y.-J., Teng, B., Chen, X., Yang, X.-K., Li, J. & Bai, M. (2022) A species diversity dataset of beetles by three passive acquisition methods in Tei Tong Tsai (Hong Kong). *Scientific Data*, 9 (1), 210.
https://doi.org/10.1038/s41597-022-01310-9
Zhang, L.-J., Ruan, Y.-Y., Li, Z.-Q., Yang, X.-K., Chen, Y. & Liu, Y. (2023) International, and local, trends in research on coleopteran taxonomy. *Chinese Journal of Applied Entomology*, 60 (3), 1000–1015. [in Chinese]
https://doi.org/10.7679/j.issn.2095-1353.2023.093

# 南岭山脉及大湾区鞘翅目科级阶元多样性

刘振华[1,2]，李志强[1,*]
[1]广东省科学院动物研究所，广东省动物保护与资源利用重点实验室，广东省野生动物保护与利用公共实验室，海珠区，广州510260，中国
[2] liuzhh_beetle@giz.gd.cn; https://orcid.org/0000-0002-2739-3305
[*]通讯作者：lizq@giz.gd.cn; https://orcid.org/0000-0003-0064-7165

**摘要：**鞘翅目包含198科超过44万种，其中在中国分布有143科超过3.5万种。但广东省目前仅记录有64个科，这一数量甚至少于香港。为了调查广东省昆虫多样性的本地数据，使用多种采集方法在南岭山脉和大湾区采集了大量标本，其中已有超过20万头甲虫被鉴定到科。基于采集的标本及历史文献记录进行了广东省甲虫科级多样性的初探，统计结果将广东省鞘翅目科的数量从64科提升到了111科，并提供了大多数科的整体图；其中还包含1中国新纪录科微瓢虫科Eupsilobiidae，并描述1新种即海珠微瓢虫*Eidoreus haizhuensis* **sp. nov.**。这一结果突出了使用多种采集方法的持续性采集对调查昆虫的多样性的重要性。更新后的广东省甲虫科级名录与历史记录进行了详细对比及讨论，推测还有更多科可能分布于广东省，但这需要更详尽的采集和更多研究小众类群的分类学家。

**关键词：**甲虫；广东省；新记录；名录