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New records of Japanese robber flies (Diptera: Asilidae) deposited at the ZFMK collections

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Abstract. Robber flies are a species-rich family of insects and, therefore, pose a challenge for biodiversity research. Museum collections can help to shed light on diversity patterns and to tackle ecological questions. However, in order to be used by the scientific community, collections need to be visible and accessible. Here we present the previously unidentified Asilidae specimens collected in Japan held in the collections of the Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany. Our material was collected by Bradley Sinclair during the 1990ies using a hand net and by Alexander Blanke between 2014 and 2016 using Malaise traps. We identified 334 individuals belonging to 20 named species and one unnamed taxon. Altogether, these holdings represent 19.4% of the known Japanese asilid fauna. Malaise traps used by Blanke were placed at the Sugadaira Research Station of the University of Tsukuba, Ueda, Nagano, and they sampled 16 species (15.4% of the Japanese fauna). The collection of Sinclair stems mainly from Kyushu Island. *Stichopogon gracilifemur* Nagatomi, 1983 is recorded for the first time from the island of Kyushu. All recorded species are featured with high-quality color images and information on synonymy, types, literature and distribution is also provided.

Key words. Assassin flies, Japan, Kyushu, Sugadaira Research Station, malaise trap, ZFMK Collections.

INTRODUCTION

Commonly known as robber flies or assassin flies, the Asilidae (Insecta: Diptera: Brachycera) form one of the largest families of Diptera, with more than 7,500 described species worldwide (Dikow 2020). Within the suborder Brachycera, they belong to the infraorder Muscomorpha and the superfamily Asiloidea, in which they are most closely related to Mydidae, Apioceridae and Therevidae (Dikow 2009). Because of their comparably large size and their conspicuous behavior as sit-and-wait predators, robber flies have caught the interest of many dipterists and naturalists. Asilids inhabit every continent except Antarctica and occupy diverse habitats (Hull 1962). Although they are most diverse in hot and dry environments with sandy soils, they can be found from tropical lowland forests up to alpine regions at 4,500m altitude (Hull 1962).

All robber fly larvae and adults are predatory on arthropods. Adults usually catch the prey in flight, except members of Leptogastrinae, who actively search and catch also substrate bound prey (Wolff et al. 2018). Because of their predatory behavior, a few authors have analyzed the potential ecosystem services provided by robber flies and hereby mainly focused on their ability to feed on arthropods harmful to forestry (Kinoshita 1940; Wichmann 1956). Wei et al. (1995) found significant effects of larvae of *Promachus yesonicus* Bigot, 1887 on wheat-feeding scarabaeid beetles. Furthermore, robber flies are interwoven into complex food webs and may help to stabilize them and they can serve as indicator species for different habitat qualities (Wolff et al. 2018).

In the present study we identified the Asilidae specimens from Japan present in the collections of the Zoologisches Forschungsmuseum Alexander Koenig (ZFMK) in Bonn (Germany). Japan is formed by over 6,800 large to very small islands and extends in a 3,800 km long arch from the Sea of Okhotsk in the north to the East China Sea in the south (Embassy of Japan 2020). Therefore, it contains a wide variety of climates and a habitat diversity that is even enlarged by the strong altitudinal differences between the coastline and the mountainous regions. Our samples only cover a small part of the geographical range and are mainly taken from or nearby woodlands, which cover approximately 73% of the country (Embassy of Japan 2020). For Japan, Utsuki (2014) lists 104 species of robber flies, which are classified in 41 genera from 13 subfamilies.

The present study aims to increase the visibility of the Asilidae collection at the ZFMK and help towards a bet-

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ter understanding of the Japanese robber fly fauna. We provide high-quality images for at least one sex of every studied species to facilitate the identification of the taxa in future studies.

MATERIAL AND METHODS

Material

The material was collected in the last 30 years by Alexander Blanke and Bradley Sinclair. We examined all previously unidentified Japanese asilid specimens deposited in the ZFMK collections. A total of 334 specimens were examined. Out of these, 314 were collected by Alexander Blanke from 2014 to 2015, using Malaise traps. Trapping took place from 21 Jul. 2014 to 2 Sep. 2014, from 19 Apr. 2015 to 7 Jun. 2015, and from 26 Apr. 2016 to 3 May 2016. The traps were set at two locations in the property of the Sugadaira Research Station of the University of Tsukuba (Ueda, Nagano Prefecture) (see Table 1). The first site (B1) is located on a six-hectare semi-natural grassland with an Andosol soil that is managed by the research station by harvesting the grass once a year in autumn (SMRC 2020). The second site (B2) at the Sugadaira Research Station is located ca. 200 m from the first site in an approximately 50 years old succession forest that is dominated by red pine, *Pinus densiflora* Siebold & Zucc. and covers an area of 8.5 hectares (SMRC 2020). The Malaise traps operated with 96% ethanol. Collected specimens were preserved in 96% ethanol and subsequently dried with a critical point drier in order to be mounted on a pin.

The other 20 studied specimens were collected by Bradley Sinclair in the years 1997 and 1999. All but one stem from Kyushu Island, either from Fukuoka Prefecture or Kumamoto Prefecture (see Table 1). One specimen was collected on Okinawa. According to Sinclair, all specimens were collected with a sweep net at a stream or the nearby vegetation when he was collecting aquatic Empididae. Most of them were collected in forested areas. For a list of all locations see Table 1.

Terminology and literature

Terminology follows Cumming & Wood (2017) and the systematic classification of Asilidae follows Dikow (2009). Faunistic information is mainly taken from Utsuki (2014). Sampling localities are listed in Table 1. The literature used for species identification is listed under the respective species (see Results). Synonymy information and information on the type locality are mostly taken from Lehr (1988). Information on collections holding types were kindly provided by Fritz Geller-Grimm (unpublished, abbreviated as GG) or taken from Evenhuis & Pape (2020) (*Sytema Dipterorum* database at http://diptera.org/, abbreviated as SD).

Institutional abbreviations

BMNH = The Natural History Museum, London, UK
EIHU = Hokkaido University, Sapporo, Japan

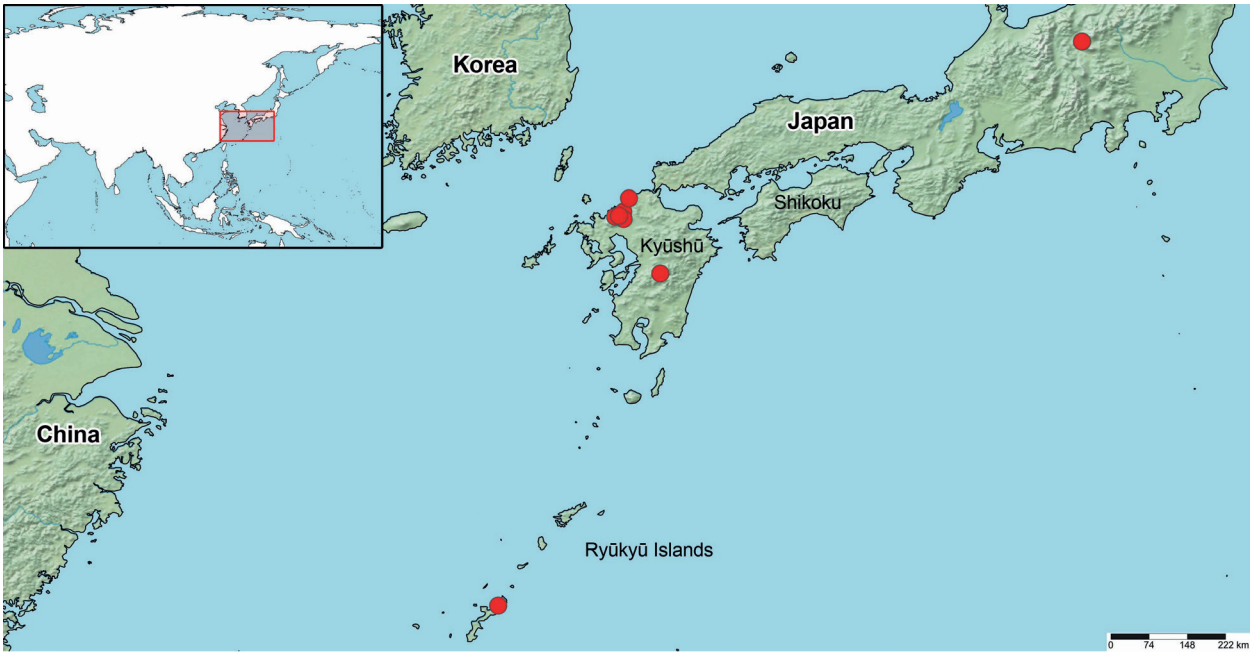

Fig. 1. Distribution map of the sampling localities in Japan.

Table 1. List of sampling localities In Japan by Sinclair and Blanke (see Fig. 1).

Area/State	City	Locality	Lat	Long	Ecology	Altitude	Collector
Nagano Prefecture	Ueda	Sugadaira Kogen, near SMRC	36,52389	138,34944	Grassland (B1)	1330 m	Blanke A.
Nagano Prefecture	Ueda	Sugadaira Kogen, near SMRC	36,52167	138,35083	Forest (B2)	1335 m	Blanke A.
Fukuoka Prefecture	Fukuoka	Chayama	33,56138	130,36638			Sinclair B.J.
Fukuoka Prefecture		Mount Sefuri			Beech	1000 m	Sinclair B.J.
Fukuoka Prefecture	Fukuoka	Nogochi			Forest	260 m	Sinclair B.J.
Kumamoto Prefecture		Itsuki-mura					Sinclair B.J.
Kumamoto Prefecture		Mt Raizan, Maebaru-shi				500-600 m	Sinclair B.J.
Kumamoto Prefecture		Izumi-mura, Siibagoe			Hardwood forest	1250 m	Sinclair B.J.
Kumamoto Prefecture		Shiiba-goe			Hardwood forest	1250 m	Sinclair B.J.
Okinawa		Hiji Falls			Hardwood forest		Sinclair B.J.

EUMJ = Laboratory of Environmental Entomology, Faculty of Agriculture, Ehime University, Matsuyama, Japan
PAN = Polish Academy of Science, Museum of the Institute of Zoology, Wilcza 64, Warsaw 00-679, Poland
TMUZ = Department of Biological Sciences, Tokyo Metropolitan University, Tokyo, Japan
USNM = National Museum of Natural History, Washington D.C., USA
ZMUC = Zoological Museum, Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark
ZSMC = Zoologische Staatssammlung München, Munich, Germany

Technical equipment

Specimens were examined using a Nikon SMZ1500 stereo microscope. For photography we used a Canon EOS 7D® mounted on a P-51 Cam-Lift (Dun Inc., VA, USA), supported by Adobe Lightroom® ver. 5.6. Serial photographs were stacked using Zerene Stacker® ver. 1.04 software (Richland, WA, USA). Maps were created with Simple-Mappr (Shorthouse 2010).

RESULTS

We studied a total of 334 specimens, belonging to 20 species and one unnamed taxon (see Appendix I). They represent 15 genera from eight subfamilies. The Malaise traps at Sugadaira-Kogen yielded 314 robber fly specimens belonging to 16 species. No robber fly was collected in 2016. The remaining 20 specimens of seven species were collected by Sinclair. Detailed information and unique identifiers are provided for each specimen in the Appendix 1. Under each species, we mention the locality, the date and the number of studied specimens between brackets (see New records).

The three species with the largest number of individuals were *Molobratia sapporensis* (Matsumura, 1916) (110), *Neoitamus angusticornis* (Loew, 1858) (68) and *Eutolmus koreanus* Hradský & Hüttinger, 1985 (25). All of these were collected in the Malaise traps at the Sugadaira Research Station, with the exception of four specimens of *Neoitamus angusticornis* that were collected by Bradley Sinclair. 103 specimens from 13 species were sampled in the forest site and 210 specimens of 13 species came from the grassland site. *Cyrtopogon pictipennis* Coquillett, 1898, *Trichomachimus scutellaris* (Coquillett, 1898) and *Neoitamus ishiharai* Tagawa, 1981 were sampled exclusively from the forest site, while *Choerades* sp., *Philonicus nagatomii* Utsuki, 2008 and *Promachus yesonicus* Bigot, 1887 were sampled only in the grassland site.

All studied records (Fig. 1) lay inside the previously known distribution ranges of the taxa, except the record of *Stichopogon gracilifemur* Nagatomi, 1983 from Itsuki-mura, which is a new distribution record for Kyushu.

A list of our records follows organized by alphabetical order of the subfamilies and genera. Ambiguous identi-

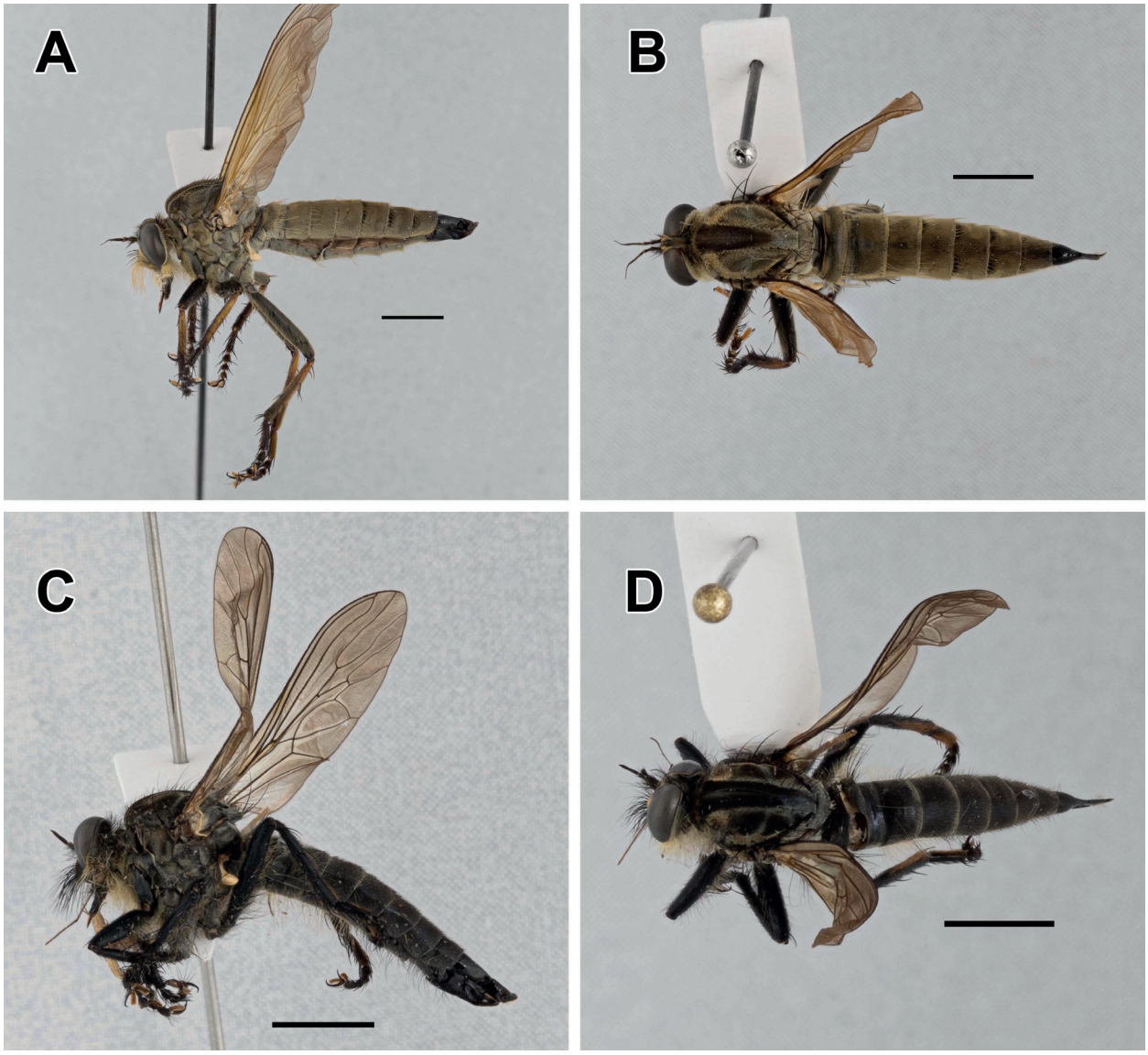

Fig. 2. A–B. *Eutolmus brevistylus* (Coquillett, 1898), female habitus. **A.** Lateral view. **B**. Dorsal view. **C–D**. *Eutolmus koreanus* Hradský & Hüttinger, 1985, female habitus. **C**. Lateral view. **D**. Dorsal view. Scale bars = 2 mm.

fications and observations are discussed under each species (see Remarks) if necessary.

Asilinae

Eutolmus Loew, 1848
Eutolmus brevistylus (Coquillett, 1898)
Fig. 2A–B
Asilus brevistylus Coquillett, 1898. Proc. U.S. Natl. Mus. 21: 314 – Type locality: Japan – Type collection: USNM [SD].
Eutolmus ussuriensis Engel, 1928. Fliegen pal. Reg., 4 (2): 148 – Type-locality: "Kolowska am Ussuri" (Russia, Far East) – Type collection: unknown.

References for identification. Young (2006), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 29 Jun.–05 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (3); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (10); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–2 Aug. 2014 (7); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 2–11 Aug. 2014 (2).

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu; Russian Far East; China; Korean Peninsula.

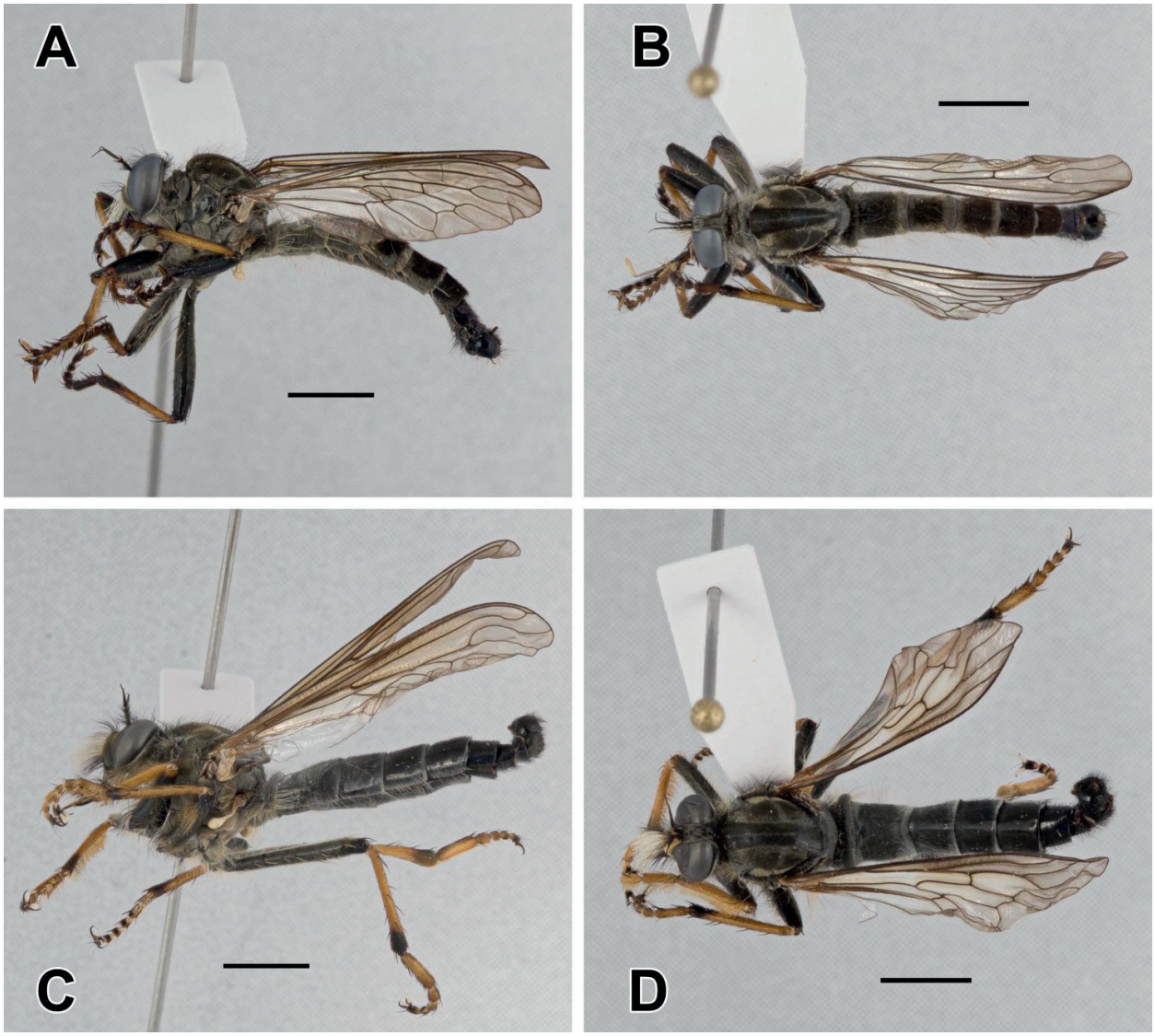

Fig. 3. A–B. *Neoitamus angusticornis* (Loew, 1858), male habitus. **A**. Lateral view. **B**. Dorsal view. **C–D**. *Neoitamus castaneipennis* Tagawa, 1981, male habitus. **C**. Lateral view. **D**. Dorsal view. Scale bars = 2 mm.

Eutolmus koreanus Hradský & Hüttinger, 1985
Fig. 2C–D

Eutolmus koreanus Hradský & Huttinger, 1985. Entomofauna 6: 170 – Type locality: South Korea: Myohyang Mts. & Onpho an Chongjin – Type collection: PAN.

References for identification. Hradský & Hüttinger (1985), Young (2006), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 21–29 Jun. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 29 Jun.–5 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (2); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (13); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–02 Aug. 2014 (4); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 19 Jul.–2 Aug. 2014 (3); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 2–11 Aug. 2014 (1).

Distribution. Japan: Honshu; Korean Peninsula.

Neoitamus Osten-Sacken, 1878

Neoitamus angusticornis (Loew, 1858)
Fig. 3A–B

Itamus angusticornis Loew, 1858. Wiener Entomol. Mon. 2: 106 – Type locality: "Japan" – Type collection: unknown.

References for identification. Ohishi & Tagawa (1997), Young (2006), Tagawa (2020).

New records. Fukuoka Pref., Fukuoka, Nogochi: 7 Jun. 1997 (1); Kumamoto Pref., Mt Raizan, Maebaru-shi: 14 Jun. 1997 (2); Nagano Pref., Ueda, Sugadaira

Research Station, grassland (B1): 21–29 Jun. 2014 (3); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 21–29 Jun. 2014 (3); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 29 Jun.–05 Jul. 2014 (16); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (15); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (7); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–2 Aug. 2014 (6); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 19 Jul.–2 Aug. 2014 (8); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 2–11 Aug. 2014 (6); Kumamoto Pref., Shiiba-goe: 24 Aug. 1997 (1).

Distribution. Japan: Hokkaido, Honshu, Shikoku, Shikoku, Kyushu; Russia: Sakhalin.

Neoitamus castaneipennis Tagawa, 1981
Figs 3C–D

Neoitamus castaneipennis Tagawa, 1981. Trans. Shikoku Entomol. Soc. 15: 195 – Type locality: Japan: Ehime Pref., Matsuyama, Komenono – Type collection: EUMJ.

References for identification. Ohishi & Tagawa (1997), Tagawa (1981), Young (2006), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 17–24 May 2015 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 24–31 May 2015 (7); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 21–29 Jun. 2014 (6); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 21–29 Jun. 2014 (2); Nagano Pref., Ueda, Suga-

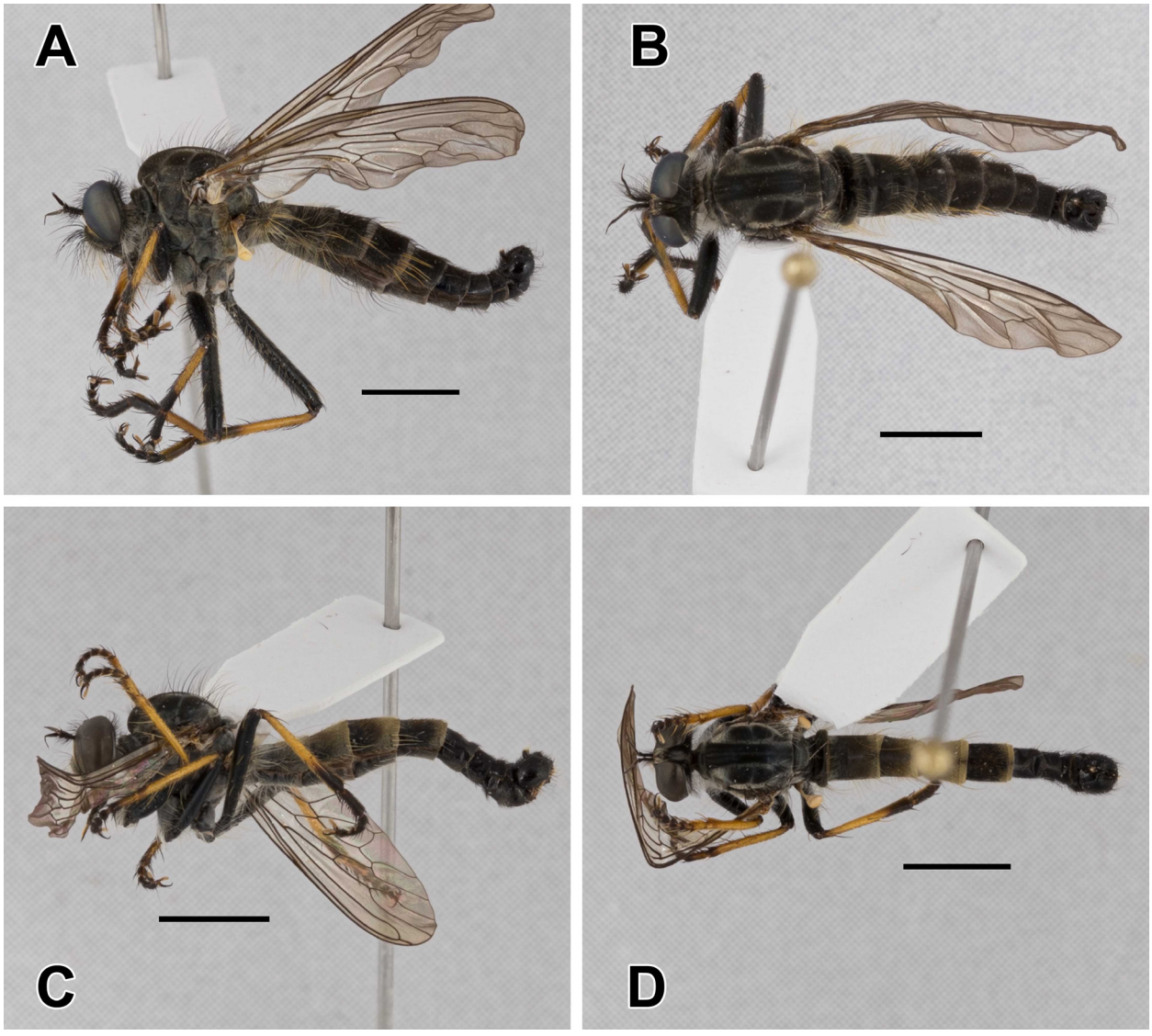

Fig. 4. A–B. *Neoitamus univittatus* (Loew, 1871), male habitus. **A**. Lateral view. **B**. Dorsal view. **C–D**. *Neoitamus ishiharai* Tagawa, 1981, male habitus. **C**. Lateral view. **D**. Dorsal view. Scale bars = 2 mm.

daira Research Station, grassland (B1): 29 Jun.–5 Jul. 2014 (4).

Distribution. Japan: Honshu, Shikoku.

Neoitamus univittatus (Loew, 1871)
Fig. 4A–B

Itamus univittatus Loew, 1871. Syst. Besch. 9 Theil, 2 Band: 183 – Type locality: Russia: Irkutsk – Type collection: unknown.

References for identification. Ohishi & Tagawa (1997), Young (2006), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 21–29 Jun. 2014 (7): Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 29 Jun.–5 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (6).

Distribution. Japan: Honshu, Shikoku; Russia; Kazakhstan; Mongolia.

Neoitamus ishiharai Tagawa, 1981
Fig. 4C–D

Neoitamus ishiharai Tagawa, 1981. Trans. Shikoku Entomol. Soc. 15: 201 – Type locality: Japan: Tokushima Pref., Mt Tsurugi – Type collection: EUMJ.

References for identification. Ohishi & Tagawa (1997), Tagawa (1981), Young (2006), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (1).

Distribution. Japan: Honshu, Shikoku.

Philonicus Loew, 1849
Philonicus nagatomii Utsuki, 2008
Fig. 5A–B

Philonicus nagatomii Utsuki, 2008. Jpn. J. Syst. Ent.: 53 – Type locality: Japan: Honshu, Tochigi Pref., side of River Kinu-gawa, Ishii-machi, Utsunomiya-shi – Type collection: TMUZ.

References for identification. Young (2006), Utsuki (2008).

New records. Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 11–23 Aug. 2014 (1).

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu.

Remarks. Utsuki (2008) described *P. nagatomii* as very similar to *Philonicus albiceps* (Meigen, 1820), except that it possesses a longer distiphallus. The distiphallus of our specimen matches the description of the one of *P. nagatomii.*

Promachus Loew, 1848
Promachus yesonicus Bigot, 1887
Fig. 6A–B

Promachus yesonicus Bigot, 1887. Bull. Soc. entomol. Fr. (6) 7: lxxix – Type locality: Japan: north of Yeso – Type collection: unknown.

Promachus jesonicus: Paramonov (1931): 228, misspelling.

References for identification. Paramonov (1931), Young & Hradský (2008).

New records. Fukuoka Pref., Fukuoka, Chayama: 20 Jun. 1999 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 2–11 Aug. 2014 (2); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 11–23 Aug. 2014 (4); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1):

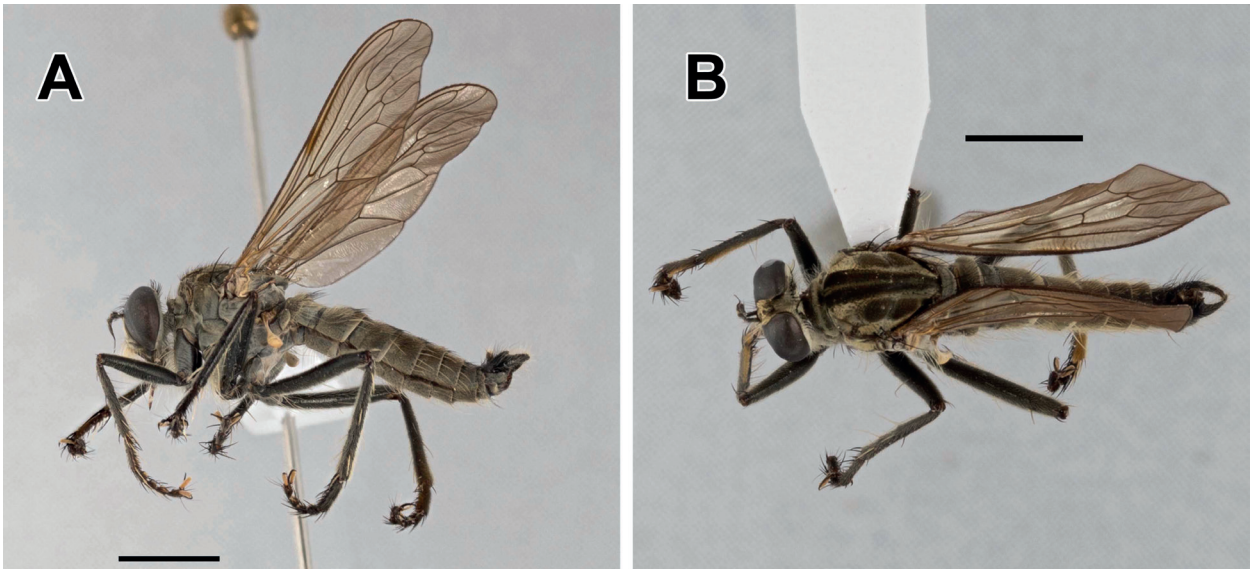

Fig. 5. *Philonicus nagatomii* Utsuki, 2008, male habitus. **A**. Lateral view. **B**. Dorsal view. Scale bars = 2 mm.

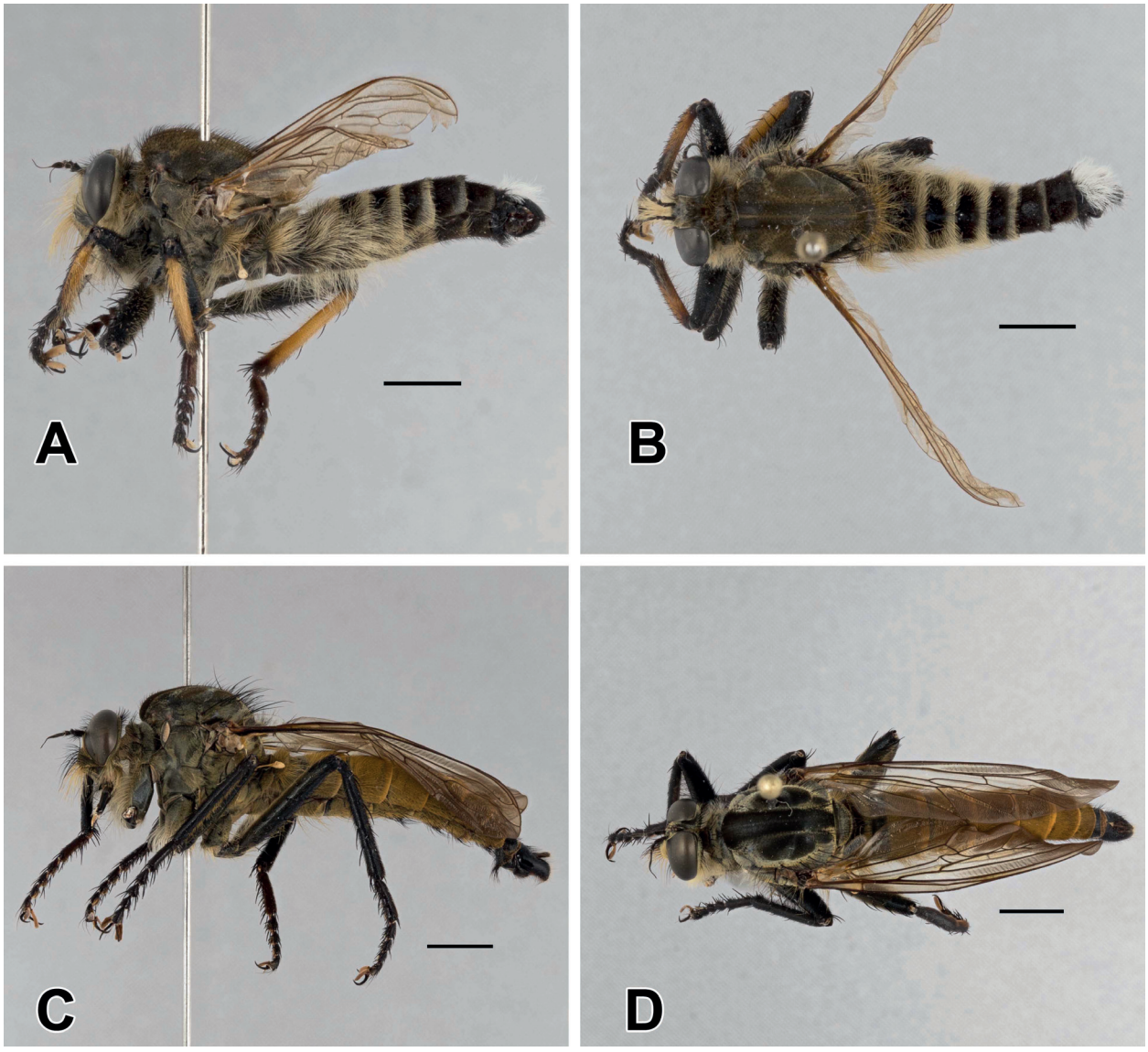

Fig. 6. A–B. *Promachus yesonicus* Bigot, 1887, male habitus. **A.** Lateral view. **B**. Dorsal view. **C–D**. *Trichomachimus scutellaris* (Coquillett, 1989), male habitus. **C**. Lateral view. **D**. Dorsal view. Scale bars = 2 mm.

23 Aug.–2 Sep. 2014 (1); Fukuoka Pref., Fukuoka, Nogochi: 17 Aug. 1997 (1).

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu; Korean Peninsula.

Trichomachimus Engel, 1934

Trichomachimus scutellaris (Coquillett, 1989)

Fig. 6C–D

Asilus scutellaris Coquillett, 1898. Proc. U.S. Natl. Mus. 21: 315 – Type locality: "Japan" – Type collection: USNM [SD].

References for identification. Tagawa (1981), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 05–19 Jul. 2014 (1).

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu; Russian Far East; China.

Brachyrhopalinae

Cyrtopogon Loew, 1847

Cyrtopogon pictipennis Coquillett, 1898

Fig. 7A–B

Cyrtopogon pictipennis Coquillett, 1898. Proc. U.S. Natl. Mus. 21: 311 – Type locality: Japan – Type collection: USNM [SD].

References for identification. Tagawa (2001).

New records. Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 24–31 May 2015 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 21–29 Jun. 2014 (2).

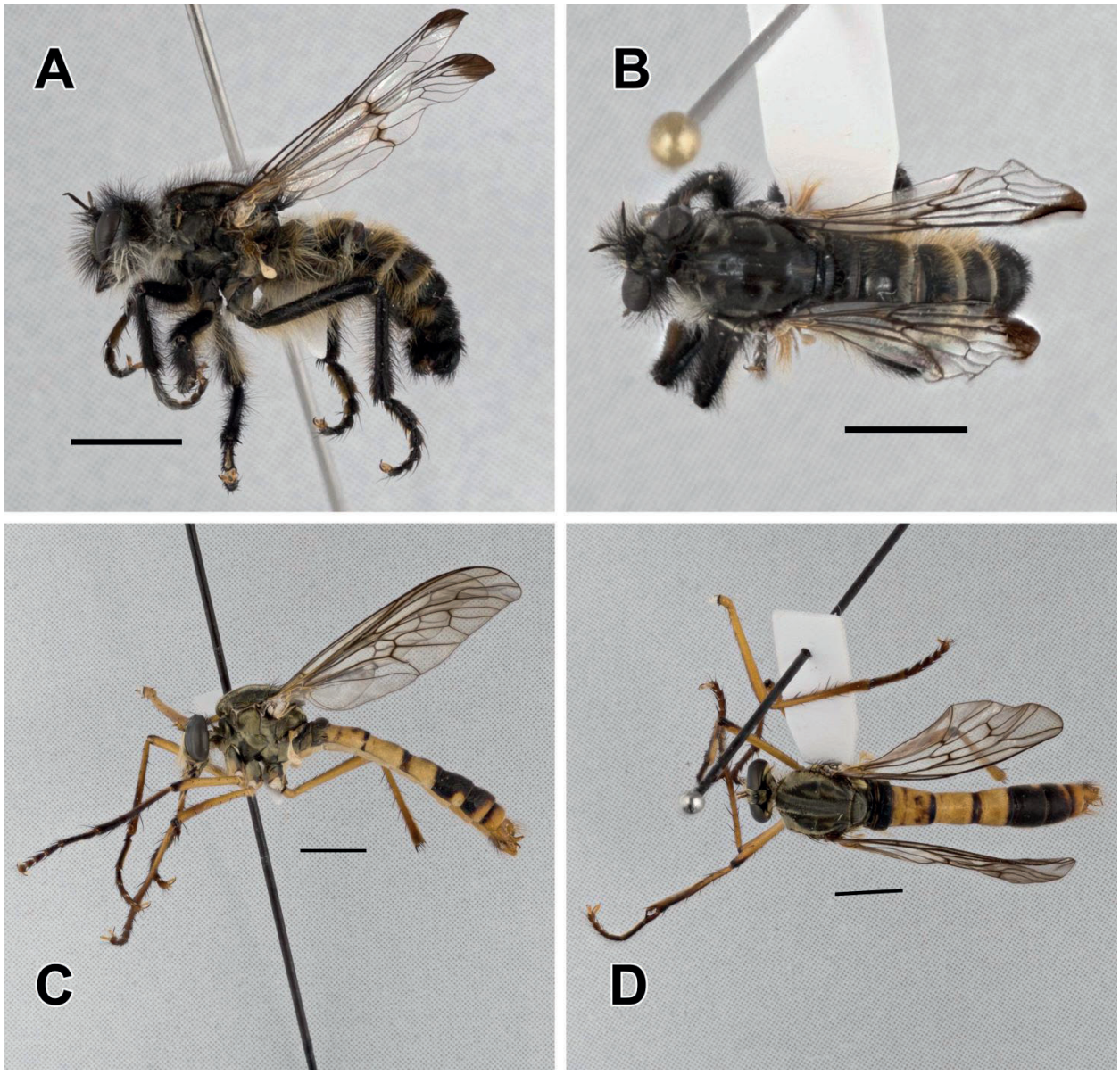

Fig. 7. A–B. *Cyrtopogon pictipennis* Coquillett, 1898, male habitus. **A**. Lateral view. **B**. Dorsal view. **C–D**. *Molobratia sapporensis* (Matsumura, 1916), male habitus. **C**. Lateral view. **D**. Dorsal view. Scale bars = 2 mm.

Distribution. Japan: Honshu, Shikoku, Kyushu.

Dasypogoninae

Molobratia Hull, 1958
Molobratia sapporensis (Matsumura, 1916)
Fig. 7C–D
Dasypogon sapporensis Matsumura, 1916. Thous. Ins. Jpn. Vol. 2: 289 – Type locality: Japan: Hokkaido – Type collection: EIHU [GG].

References for identification. Nagatomi et al. (1989).

New records. Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 29 Jun.–5 Jul. 2014 (8); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (7); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (43); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–2 Aug. 2014 (43): Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 19 Jul.–2 Aug. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 2–11 Aug. 2014 (5); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 11–23 Aug. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 11–23 Aug. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 23 Aug.–2 Sep. 2014 (1).

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu.

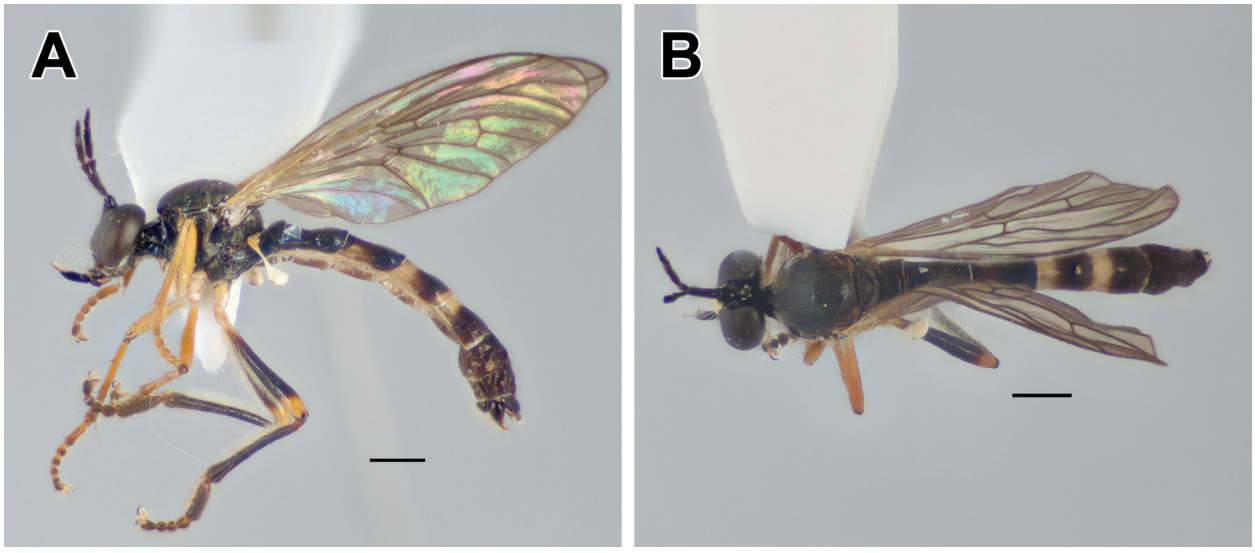

Fig. 8. *Dioctria nakanensis* Matsumura, 1916, male habitus. **A**. Lateral view. **B**. Dorsal view. Scale bars = 1 mm.

Dioctriinae

Dioctria Meigen, 1803
Dioctria nakanensis Matsumura, 1916
Fig. 8A–B
Dioctria nakanensis Matsumura, 1916. Thous. Ins. Jpn. Vol. 2: 294 – Type locality: Japan: Honshu & Kyushu – Type collection: EIHU [GG].

References for identification. Lehr (2002), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (2); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–2 Aug. 2014 (5); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 19 Jul.–2 Aug. 2014 (12); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 2–11 Aug. 2014 (4); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 23 Aug.–2 Sep. 2014 (1).

Distribution. Japan: Honshu, Shikoku, Kyushu; Taiwan.

Laphriinae

***Choerades* Walker, 1851**
Choerades komurae (Matsumura, 1911)
Fig. 9A–B
Laphria komurae Matsumura, 1911. J. Fac. Agric. Hokkaido Univ. 4: 70 – Type locality: "Kusunnai" [= Iljinskiy, Sakhalin] (Russia) – Type collection: EIHU [GG].
Choerades lubarskii Esipenko, 1969. Uchen. Zap. Khabarovsk, gos. pedagog. Inst. 18: 63. Type locality: Sakhalin, Novo-Aleksandrovsk (Russia).

References for identification. Hua (1989), Young & Hradský (2007), Tagawa (2020).

New records. Fukuoka Pref., Fukuoka, Nogochi: 07 Jun. 1997 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 19 Jul.–2 Aug. 2014 (3).

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu; Russia: Kuril Island, Sakhalin.

Choerades sp.
Fig. 9C–D

References for identification. Hua (1989), Young & Hradský (2007), Tagawa (2020).

Records. Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–2 Aug. 2014 (1).

Distribution. Tagawa (2020) records this unnamed taxon from Honshu and Shikoku.

Remarks. Our specimen belongs to the species named "*Choerades* sp.2" in Tagawa (2020). According to Tagawa (personal communication), this taxon is a new species that he plans to describe.

Laphria Meigen, 1806
Laphria rufa Röder, 1887
Fig. 10A–D
Laphria rufa Röder, 1887. Mitt. Schweiz. entomol. Ges. 7: 192 – Type locality: "Japan" – Type collection: unknown.

References for identification. Hua (1989), Young & Hradský (2007), Tagawa (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 29 Jun.–5 Jul. 2014 (3); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–2 Aug. 2014 (2); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 19 Jul.–2 Aug. 2014 (1).

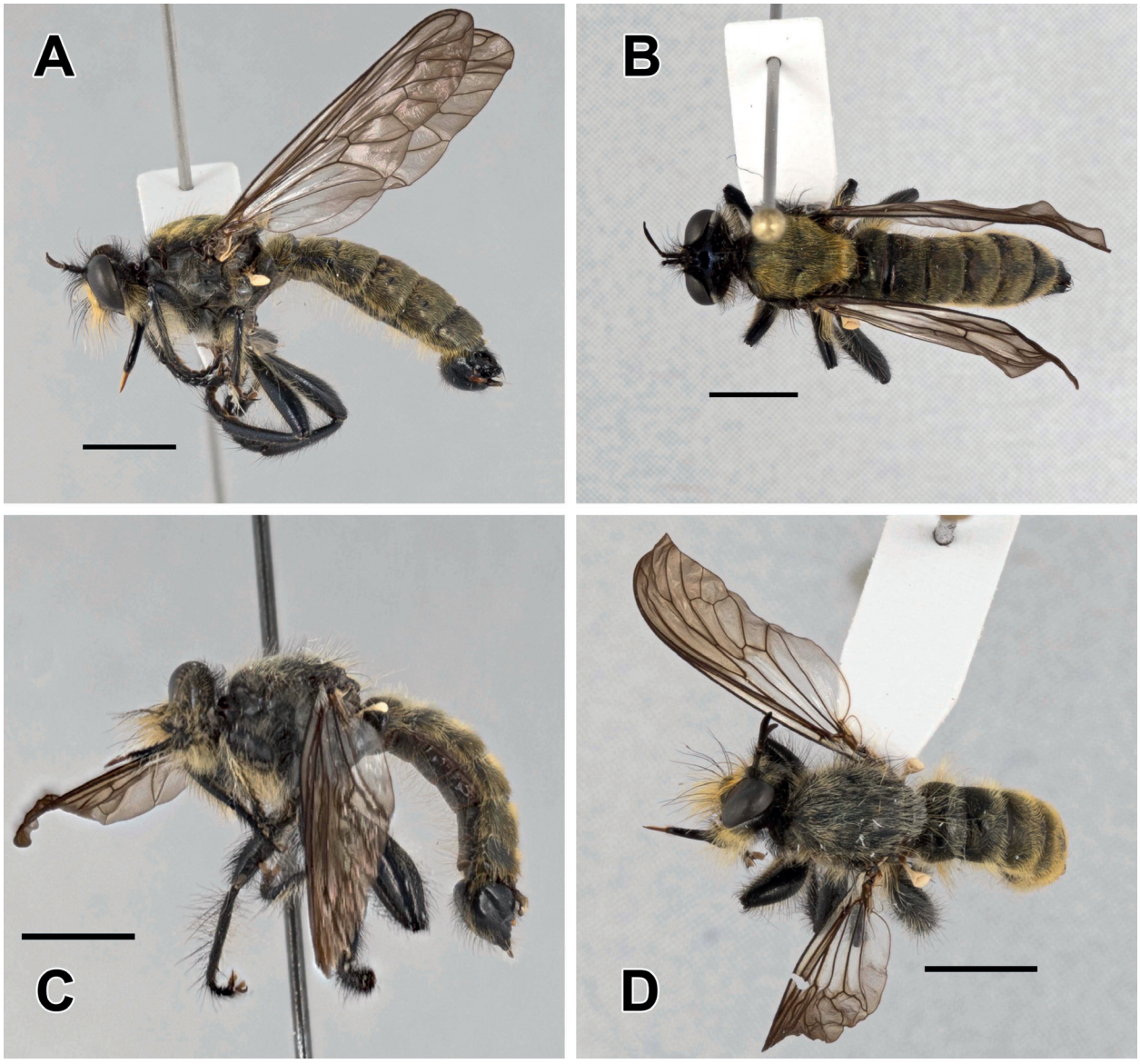

Fig. 9. A–B. *Choerades komurae* (Matsumura, 1911), male habitus. **A.** Lateral view. **B**. Dorsal view. **C–D**. *Choerades* sp., male habitus. **C**. Lateral view. **D**. Dorsal view. Scale bars = 2 mm.

Distribution. Japan: Hokkaido, Honshu, Shikoku, Kyushu; Russia: Kuril Islands, Sakhalin; China.

Remarks. Species very similar to *Laphria mitsukurii* Coquillet, 1898. According to Young & Hradský (2007), *L. rufa* has yellow hairs on mesoscutum posterior to the scutellar suture, yellow hairs on tergites 1–3 and long mats of yellow hairs on tergites 4–6; whereas *L. mitsukurii* has black hairs posterior to the scutellar suture, black hairs on tergites 1–3 and long mats of orange hairs on tergites 5–6. Some of our specimens are somewhat intermediate in having yellow to orange hairs on the posterior mesoscutum but black hairs on tergites 1-3 and orange hairs on tergites 4–6 (compare Fig. 3A–B to Fig. 3C–D). Our identification as *L. rufa* is justified by the presence of yellowish hair on the posterior mesoscutum. Young & Hradský (2007) stated that. "The two species (*L. mitsukurri* and *L. rufa*) are, in their numerous variations, externally different, but uncharacteristically for asilids, the males show almost identical features in the internal structures of the genitalia (gonopod, gonostylus, gonocoxite)". Hence, further investigations on the morphological and/or molecular separation of the two species seem necessary.

Maira Schiner 1866

Maira aterrima Hermann, 1914

Fig. 10E–F

Maira aterrima Hermann, 1914. Entomol. Mitt. 3: 110 – Type locality: China: Guangdong, Guangzhou [= Canton]; Taiwan: Taihorinsho – Type collection: unknown.

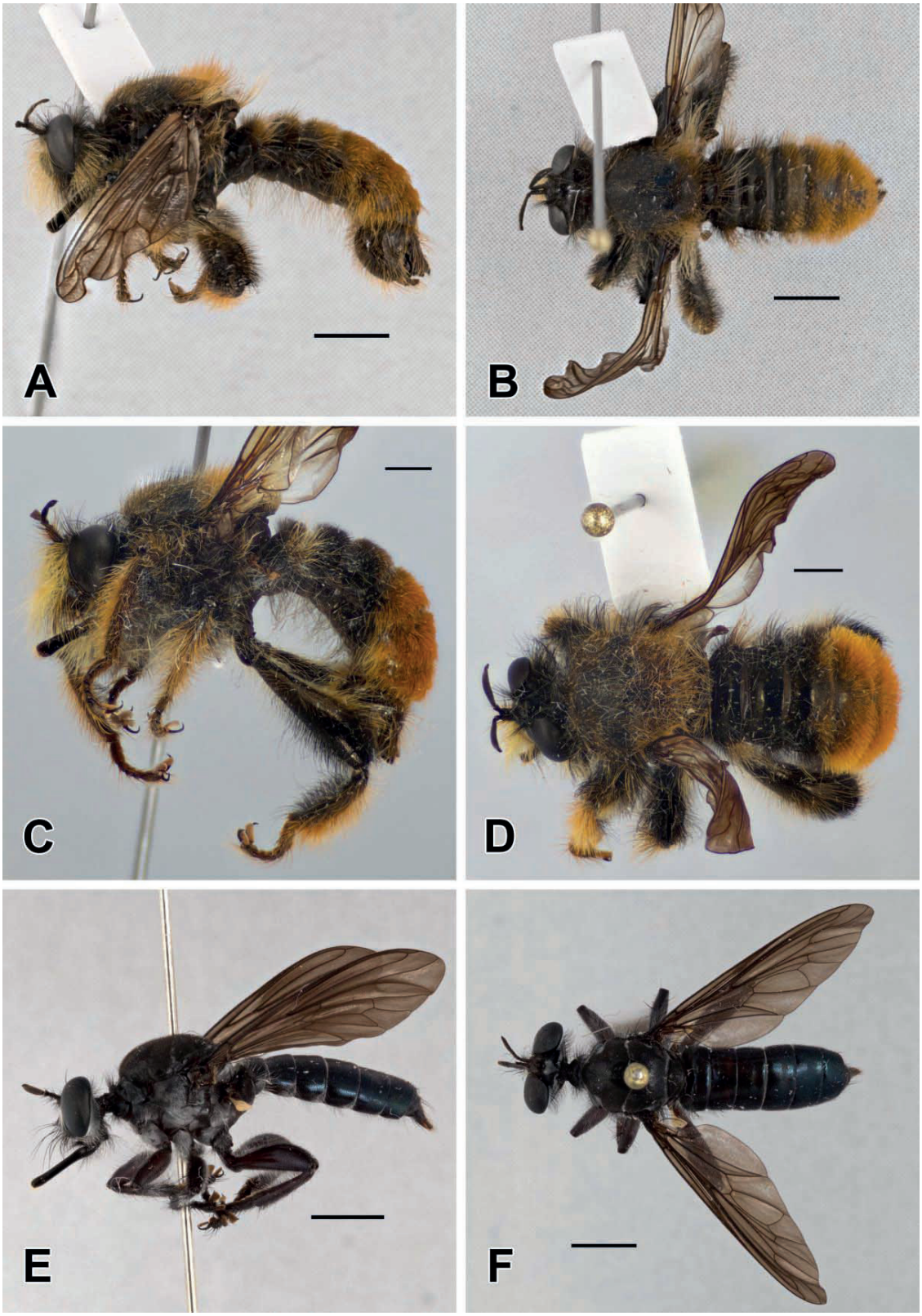

Fig. 10. A–D. *Laphria rufa* Röder, 1887, male habitus. **A**. Lateral view of a light-coloured male. **B**. Dorsal view of a light-coloured male. **C**. Lateral view of a dark-coloured male. **D**. Dorsal view of a dark-coloured male. **E–F**. *Maira aterrima* Hermann, 1914, female habitus. **E**. Lateral view. **F**. Dorsal view. Scale bars: A–B, E–F = 2 mm; C–D = 1 mm.

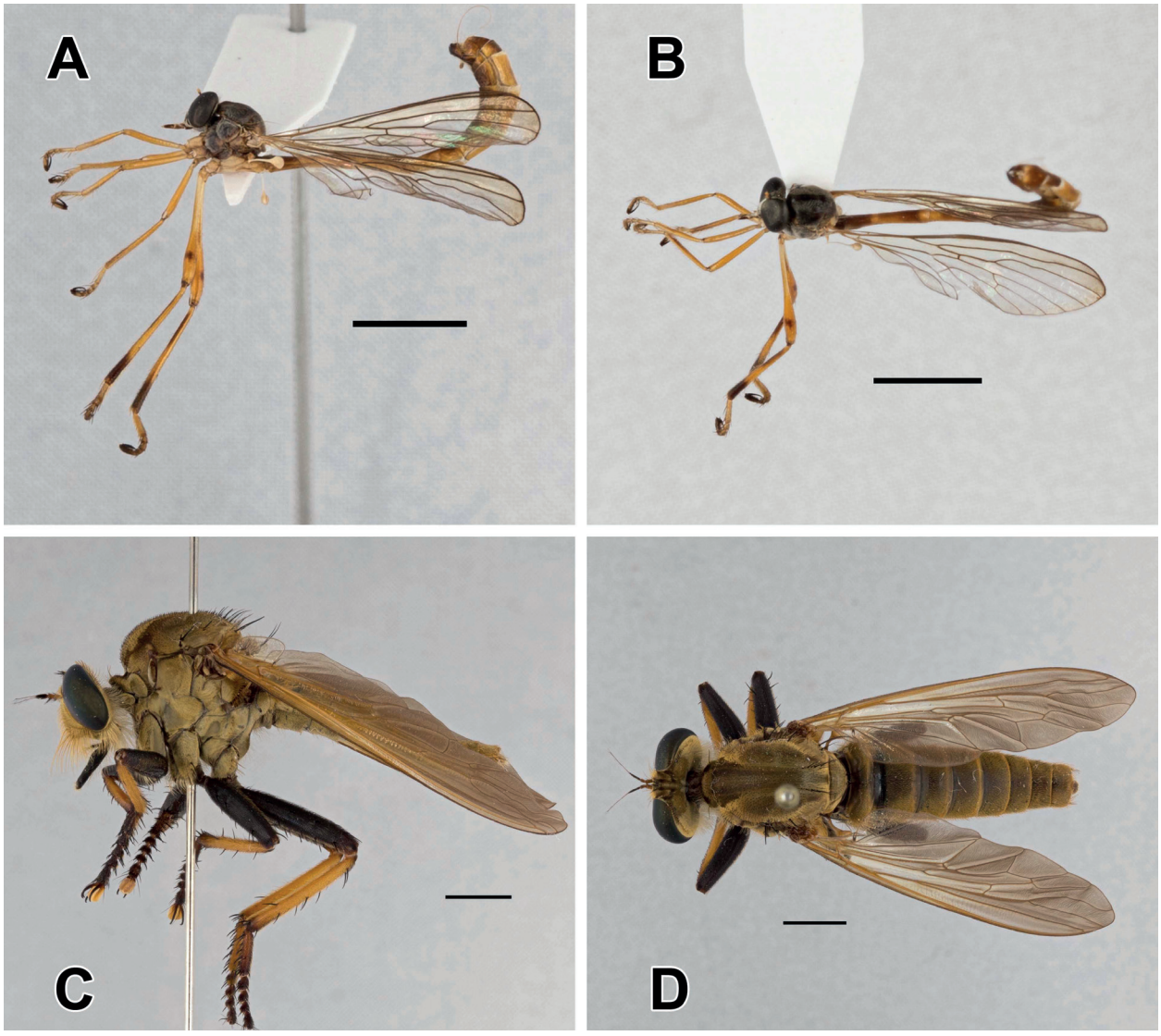

Fig. 11. A–D. *Leptogaster humeralis* (Hsia, 1949), male habitus. **A**. Lateral view. **B**. Dorsal view. **C–D**. *Cophinopoda chinensis* (Fabricius, 1794), female habitus. **C**. Lateral view. **D**. Dorsal view. Scale bars = 2 mm.

References for identification. Hermann (1914), Hua (1986), Weinberg & Parvu (1999), Young & Hradský (2007).

New records. Okinawa, Hiji Falls: 11 May 1999 (1).

Distribution. Japan: Kyushu, Ryukyu Islands; Taiwan; China.

Remarks. Not listed in Lehr (1988).

Leptogastrinae

Leptogaster Meigen, 1803

Leptogaster humeralis (Hsia, 1949)

Fig. 11A–B

Psilonyx humeralis Hsia, 1949. Sinensia 19: 25 294 – Type locality: China: Zhejiang, Tienmushan – Type collection: unknown.

References for identification. Lehr (1961), Kuroda (2020).

New records. Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 29 Jun.–5 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 29 Jun.–5 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 5–19 Jul. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 19 Jul.–2 Aug. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 2–11 Aug. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, forest (B2): 2–11 Aug. 2014 (1); Nagano Pref., Ueda, Sugadaira Research Station, grassland (B1): 11–23 Aug. 2014 (1), Kumamoto Pref., Izumi-mura, Siibagoe: 24 Aug. 1997 (1).

Distribution. Japan: Hokkaido, Honshu, Shikoku; Russia: Primorsky Krai; China: Zhejiang Province.

Ommatiinae

Cophinopoda *Hull*, 1958
Cophinopoda chinensis (Fabricius, 1794)
Fig. 11C–D
Asilus chinensis Fabricius, 1794. Entomol. syst. Tome IV: 383 – Type locality: "China" – Type collection: ZMUC [SD].
Dasypogon flavescens Fabricius, 1805. Syst. Antl.: 169 – Type locality: Indonesia: Sumatra – Type collection: ZMUC [SD].
Ommatius fulvidus Wiedemann, 1821. Dipt. exot. [Ed.2] Pars I: 214 – Type-locality: Indonesia: Java – Type collection: ZMUC [SD].
Ommatius coryphe Walker, 1849. List Dipt. Brit. Mus., part 2: 469 – Type locality: not given – Type collection: BMNH [SD].
Ommatius chinensis: Matsumura (1931): Illustr. ins. Japan: 325.

References for identification. Tsacas & Artigas (1994).

New records. Fukuoka Pref., Fukuoka, Chayama: 20 Jun. 1999 (1); Fukuoka Pref., Fukuoka, Chayama: 16 Jul. 1999 (1).

Distribution. Japan: Honshu; India; Sri Lanka; China; Vietnam; Java; Sumatra.

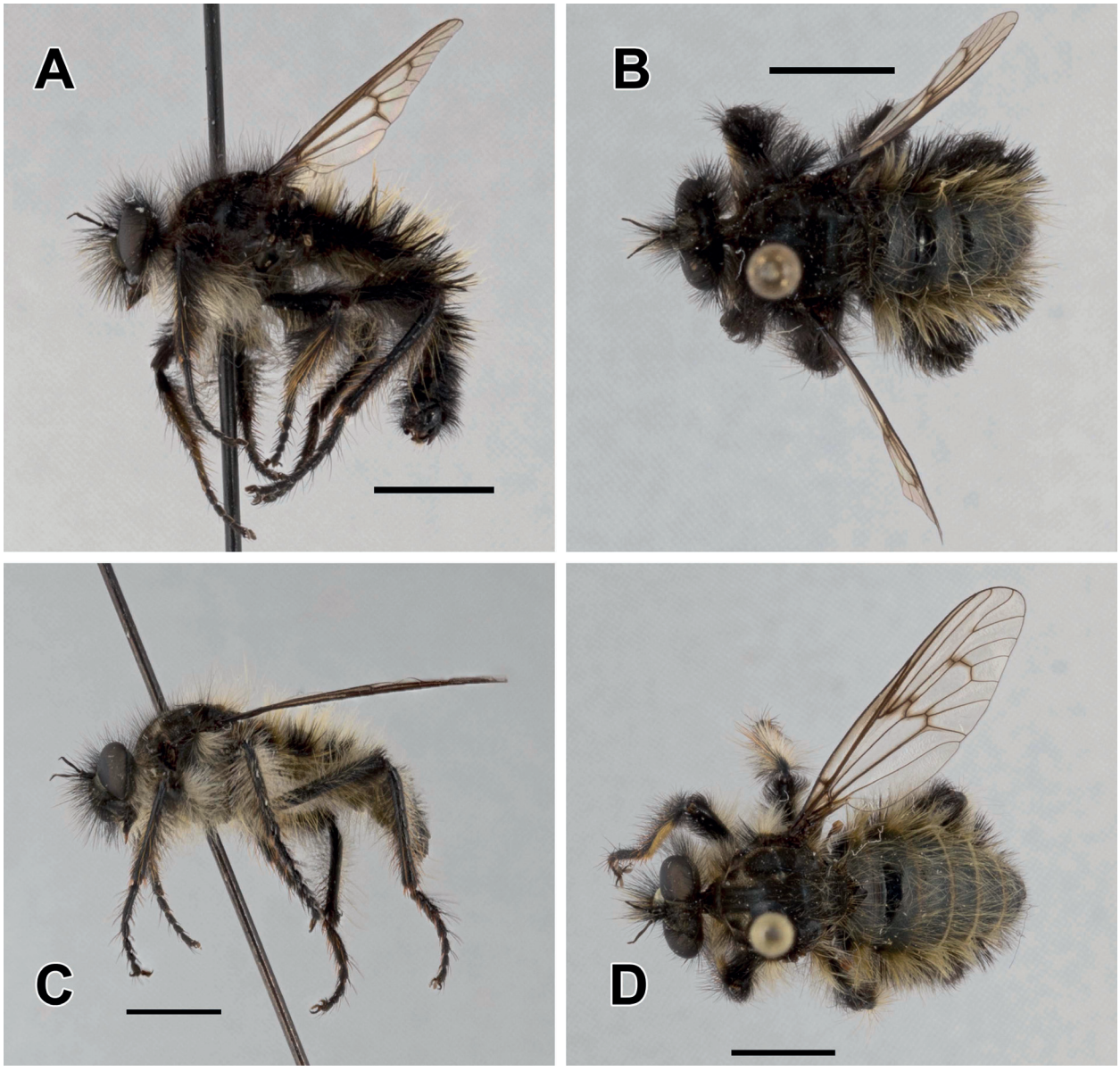

Fig. 12. *Grypoctonus aino* Speiser, 1928. **A–B**. Male habitus. **A**. Lateral view. **B**. Dorsal view. **C–D**. Female habitus. Scale bars = 2 mm.

Remarks. According to Tsacas & Artigas (1994), *C. chinensis* and *C. oldroydi* have very similar female genitalia. Their key mentions the structure of sternite VIII to distinguish both. Our specimens clearly key to *C. chinensis* and lack the patch of black bristles on sternite III mentioned in the description of *C. oldroydi* and not mentioned in the redescription of the female holotype of *C. chinensis*. Tsacas & Artigas (1994) described *C. oldroydi* from Japan and recorded *C. chinensis* from the Asian mainland. However, according to Tagawa (2020) the separation of both species is doubtful.

Stenopogoninae

Grypoctonus Speiser, 1928
Grypoctonus aino Speiser, 1928
Fig. 12A–D
Grypoctonus aino Speiser, 1928. Schr. phys.-okon. Ges. Konigsberg 65: 156 – Type locality: Japan: Nagasaki – Type collection: ZSMC [Hradský & Geller-Grimm (1999)].

References for identification. Hradský & Geller-Grimm (1999), Tagawa (2020).

New records. Fukuoka Pref., Mount Sefuri: 25 Oct. 1997 (4).

Distribution. Japan: Honshu, Shikoku, Kyushu.

Remarks. Lehr (1988) listed *G. aino* as synonym of *Grypoctonus hatakeyamae* (Matsumura, 1916), but Hradský & Geller-Grimm (1999) studied the types of Speiser and concluded that *G. aino* is a valid species based on the wing venation and the morphology of the male genitalia.

Stichopogoninae

Stichopogon Loew, 1847
***Stichopogon gracilifemur* Nagatomi, 1983**
Fig. 13A–B
Stichopogon gracilifemur Nagatomi, 1983. Kontyû 51: 476 – Type locality: Japan: Nagano Pref., Takato – Type collection: unknown [Nagatomi (1983) stated that the holotype was temporarily deposited at the Faculty of Agriculture, Kagoshima University, Kagoshima, Japan].

References for identification. Nagatomi (1983), Tagawa (2020).

New records. Kumamoto Pref., Itsuki-mura: 25 Aug. 1998 (5).

Distribution. Japan: Honshu, Kyushu.

Remarks. These are the first distribution records of this species for Kyushu.

DISCUSSION

All reported species here were already listed for Japan by Utsuki (2014). Nevertheless, we provide the first published records of *Stichopogon gracilifemur* Nagatomi, 1983 from Kyushu. The majority of our studied material was collected by Malaise traps at the Sugadaira Research Station, where 16 species were collected. The relatively high species number despite the low spatial coverage is probably best explained by the high habitat diversity at Sugadaira-Kogen as well as the relatively high sampling effort (two years of Malaise trap sampling during the flight season, yielding 314 specimens). In contrast, the

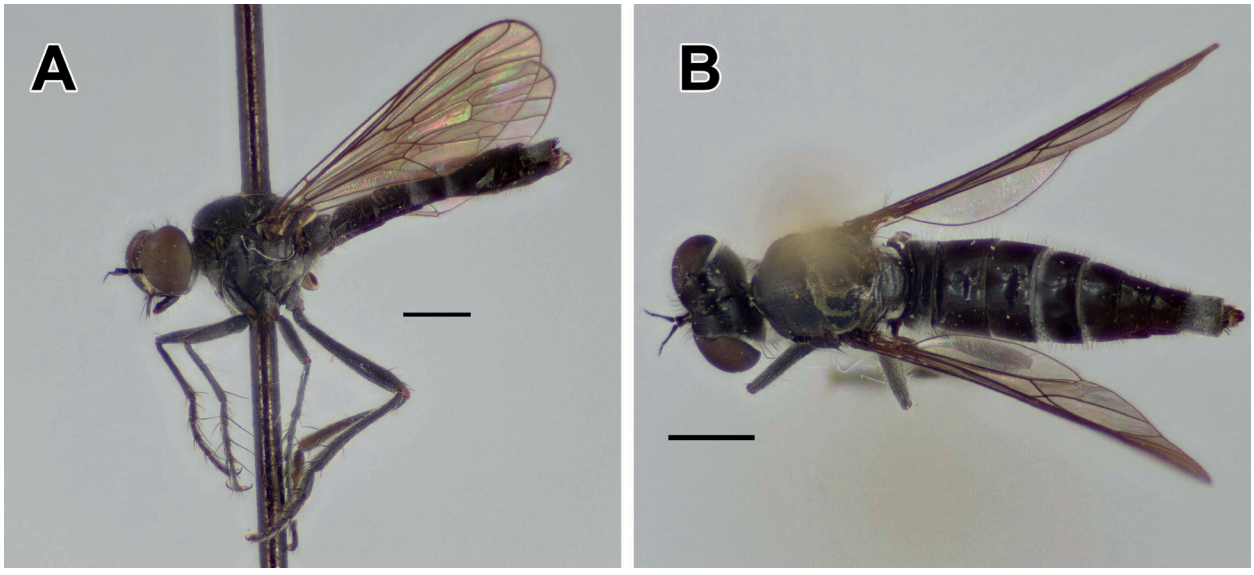

Fig. 13. *Stichopogon gracilifemur* Nagatomi, 1983, female habitus. **A**. Lateral view. **B**. Dorsal view. Scale bars = 1 mm.

material collected by hand-net has a greater spatial coverage (eight sites from Kyushu, one from Okinawa). The fact that no robber fly was sampled in 2016 is probably due to the timing. Firstly, the traps were set up only for eight days and, secondly, the traps were set quite early in the year.

At least since the work of Shōnen Matsumura in the early 20th century, asilidology is an established research field in Japan. Hence, the Japanese asilid fauna can be considered fairly well researched. Yet, there are still some challenges to overcome. Although there is detailed and illustrated literature for most species that occur in Japan, many publications are older than 40 years or focus on different geographical regions than Japan and a comprehensive key is only present for a handful of genera. We hope that our work, presenting high quality images and detailed information on synonymy, distribution and literature contributes to increase the accessibility of the Japanese Asilidae fauna for future studies.

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APPENDIX I

(*electronic supplement, available at www.zoologicalbulletin.de*)

Table S1. Systematic and identification data for the specimens studied in the present work.