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New species of the genera *Bracon* Fabricius and *Syntomernus* Enderlein (Hymenoptera, Braconidae, Braconinae) from South Korea

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Abstract

Six new species, *Bracon* (*Bracon*) *kimchanghyoi* **sp. nov.**, *B.* (*B.*) *yeogisanensis* **sp. nov.**, *B.* (*Habrobracon*) *allevatus* **sp. nov.**, *B.* (*Osculobracon*) *perspicillatus* **sp. nov.**, *Syntomernus flavus* **sp. nov.**, and *S. scabrosus* **sp. nov.** are described from South Korea and short keys for their identification are presented. The genus *Ficobracon* van Achterberg & Weiblen, 2000, **syn. nov.** is considered a junior synonym of *Syntomernus* Enderlein, 1920 and new combinations are proposed for *Syntomernus asphondyliae* (Watanabe, 1940), **comb. nov.**, *S. brusi* (van Achterberg & Weiblen, 2000), **comb. nov.**, *S. codonatus* (Huang & van Achterberg, 2013), **comb. nov.**, *S. kashmirensis* (Maqbool, Akbar & Wachkoo, 2018), **comb. nov.**, *S. rhiknosus* (Huang & van Achterberg, 2013), **comb. nov.**, *S. sunosei* (Maeto, 1991), **comb. nov.** (= *Bracon flaccus* Papp, 1996, **syn. nov.**), and *S. tamabae* (Maeto, 1991), **comb. nov.**

Keywords

Ficobracon, *Habrobracon*, new combination, new synonym, *Osculobracon*, Palaearctic, taxonomy

Introduction

With more than 3000 described species, the Braconinae is one of the largest subfamilies of Braconidae (Chen and van Achterberg 2019). As common members of ecosys-

tems, braconines have high species diversity in Palaearctic, but because most of the Palaearctic species belong to the "dustbin" genus *Bracon* Fabricius (Belshaw et al. 2001) their study has been hampered. The Eastern Palaearctic fauna of the subfamily may be more diverse than its European fauna, because being much less studied it already includes a comparable number of known species (Yu et al. 2016).

The fauna of Braconidae of the Korean Peninsula has been intensively investigated (Papp 2009, 2013; Kim et al. 2016; Lee et al. 2016, 2018, 2020a, 2020b; Ku et al. 2020). However, the work on the Braconinae is still complicated. Most of the recent studies on the group were carried out by Jenő Papp (Papp 1996, 1998, 2018) and occasionally by Korean scientists (Ku et al. 2001; Lee et al. 2018; Kang et al. 2019). The present article provides new results based on the extensive Braconinae material collected by the second author in South Korea.

Materials and methods

Terminology

Morphological nomenclature follows Quicke (1987) and van Achterberg (1993); the transverse pronotal sulcus is included after Karlsson and Ronquist (2012). Abbreviations of morphological terms:

Od maximum diameter of lateral ocellus;
OOL ocular-ocellar distance;
POL postocellar distance.

Museum acronyms:

EIHU Hokkaido University Museum (Sapporo, Japan);
HNHM Hungarian Natural History Museum (Budapest, Hungary);
MIIZ Museum and Institute of Zoology, Polish Academy of Sciences (Warszawa, Poland);
MNB Museum für Naturkunde (Berlin, Germany);
NIBR National Institute of Biological Resources (Incheon, South Korea);
SMNE Science Museum of Natural Enemies (Geochang, South Korea);
ZISP Zoological Institute of the Russian Academy of Sciences (Saint Petersburg, Russia).

List of collection localities in South Korea (numbers in brackets correspond to the numbers of points on the map in Fig. 1)

Gangwon-do: Goseong-gun: [1] Hyeonnae-myeon, Baebong-ri; [2] Hyeonnae-myeon, Machajin-ri; [3] Ganseong-eup: [5] Jinbu-ri; [4] Geojin-eup, Naengcheon-ri, Geonbongsa Temple; [6] Toseong-myeon, Sinpyeong-ri, Seoraksan Mountain (Sinseonbong,

or Sinseon-Peaks); Cheorwon-gun, [7] Geunnam-myeon, Yukdan-ri; Inje-gun, [8] Buk-myeon, Yongdae-ri, Seoraksan Mountain, Baekdamsa Temple; Hongcheon-gun, [9] Duchon-myeon, Jangnam-ri (Corn Experimantal Station); Chuncheon-si, [10] Sinbuk-eup, Cheonjeon-ri, Cheonjeon 5-ri; Yeongwol-gun, [11] Kimsatgat-myeon, Nae-ri, Town Gijeon; Taebaek-si: [12] Cheoram-dong: [13] Taebaeksan Mountain.

Gyeonggi-do: Gapyeong-gun, [14] Cheongpyeong-myeon, Cheongpyeong-ri, Cheongpyeong Amusement Park; Suwon-si, Gwonseon-gu: [16] Seodun-dong: [15] Yeogisan Mountain; Hwaseong-si, [17] Bibong-myeon.

Gyeongsangbuk-do: Bonghwa-gun, [18] Myeongho-myeon, Gwanchang-ri; Mungyeong-si, [19] Buljeong-dong.

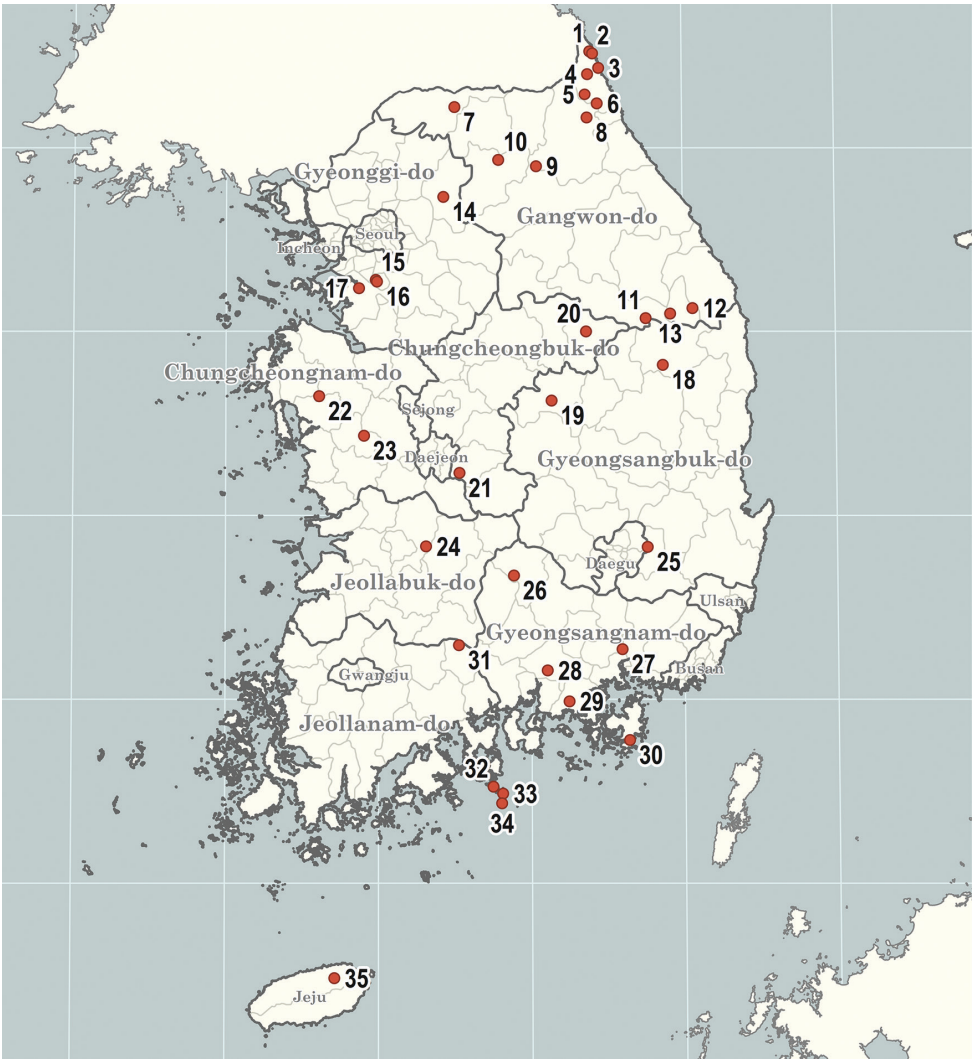


Figure 1. Collecting localities of the material on the described species. Point numbers correspond with numbers in brackets in text.

Chungcheongbuk-do: Danyang-gun, [20] Danyang-eup, Dodam-ri.
Chungcheongnam-do: Geumsan-gun, [21] Chubu-myeon, Seongdang-ri, Gaedeoksa Temple; Yesan-gun, [22] Deoksan-myeon, Sudeoksa Temple; Cheongyang-gun, [23] Jeongsan-myeon, Machi-ri.
Jeollabuk-do: Jinan-gun, [24] Bugwi-myeon, Sedong-ri, Moraejae Tunnel.
Gyeongsangbuk-do: Gyeongsan-si, [25] Yeongnam University.
Gyeongsangnam-do: Geochang-gun, [26] Geochang-eup, Songjeong-ri, 35.6712, 127.885; Changwon-si, [27] Uichang-gu, Sogye-dong, Cheonjusan Mountain; Jinju-si, [28] Gajwa-dong; Goseong-gun, [29] Sangni-myeon, Bupo-ri; Geoje-si, [30] Dongbu-myeon, Hakdong-ri.
Jeollanam-do: Gurye-gun, [31] Sandong-myeon, Jwasa-ri, Jirisan Mountain (Simwon); Yeosu-si, Nam-myeon: [32] Dumo-ri, Town Moha; [33] Ando Island, Ando-ri; [34] Yeondo Island, Yeondo-ri.
Jeju-do: Jeju-si, [35] Jocheon-eup, Seonheul-ri.

The distribution map is generated in R using the packages *sf*, *ggplot2* and *shadowtext* based on the data from https://gadm.org/.

Material of related species used in diagnoses of taxa and illustrations

Bracon (*Bracon*) *acunens* Papp, 2018

Holotype. South Korea – **Gyeongsangnam-do** • female; Jinju-si, Chojeon-dong [Chojang-dong]; 1 Jul. 1993; D.-S. Ku leg.; at light; 12266/153334; HNHM.

Other material. South Korea – **Gyeongsangnam-do** • 1 male; same data as for holotype; 7–8 Jul. 1993; SMNE • 1 female; same data as for holotype; 18–19 Aug. 1993; SMNE • 1 female; Jinju-si, Gajwa-dong; 19 Jun. 1993; D.-S. Ku leg.; SMNE • 1 female; Jinju-si, Naedong-myeon, Doksan-ri; 5–20 May 2003; Tea-Ho Ahn leg.; around the forest road; Malaise trap; SMNE. – **Jeollanam-do** • 1 male; Yeosu-si, Nam-myeon, Ando Island, Ando-ri; 4 Aug. 1993; D.-S. Ku leg.; SMNE.

Bracon (*Bracon*) *kasparyani* Samartsev, 2018

Holotype. Russia – **Primorskiy Kray** • female; Partizansky District, 10 km SE of Partizansk, Novitskoye; 3–4 Aug. 2013; S.A. Belokobylskij leg.; forest, glades; A0065; ZISP.

Paratypes. Russia – **Amur Oblast** • 1 female; Arkharinsky District, Khingan Nature Reserve; S.A. Belokobylskij leg.; 17–20 Jul. 2003; forest, forest edges, glades; A0040; ZISP. – **Primorskiy Kray** • 1 male; Khasansky District, env. Lake Khasan, Golubiny Utes; 27 May 1979; S.A. Belokobylskij leg.; forest; A0070; ZISP • 1 female; Nadezhdinsky District, env. Tavrichanka; shrubs; S.A. Belokobylskij leg.; 26 Aug. 1978; A0067; ZISP • 1 female; Nakhodka Urban Okrug, 20 km SW of Nakhodka, Dushkino; S.A. Belokobylskij leg.; 1 Aug. 2013; forest, glades; A0066; ZISP

• 1 male; Shkotovsky District, Ussurisky Nature Reserve; 12 Jul. 1973; A.S. Lelej leg.; A0069; ZISP • 1 female; Spassky District, 30 km N of Spassk-Dalny; 4 Sep. 1979; S.A. Belokobylskij leg.; forest; A0006; ZISP • 1 female; Ussuriysk Urban Okrug, env. Ussuriysk, Gornotayozhnaya centre; 2 Aug. 1963; I.M. Kerzhner leg.; A0014; ZISP • 1 female; Vladivostok, Okeanskaya; 11 Aug. 1963; I.M. Kerzhner leg.; A0068; ZISP.

Bracon (*Bracon*) *kotenkoi* Samartsev, 2018

Holotype. Russia – **Primorskiy Kray** • female; Spassky District, Santacheza [now Novoselskoye]; 29 Aug. 1971; Pineker leg.; rice field; sweeping; A0013; ZISP.

Paratypes. Russia – **Primorskiy Kray** • 1 female; same data as for holotype; 23 Jul. 1971; A0011; ZISP • 1 female; Spassky District, 20 km SW of Spassk-Dalny, Lake Khanka; 25 Jul. 1998; S.A. Belokobylskij leg.; shore, meadow; A0012; ZISP.

Bracon (*Bracon*) *kunashiricus* Tobias, 2000

Holotype. Russia – **Sakhalin Oblast** • female; Kunashir Island, 6 km N of Mendeleyevo; 4 Aug. 1975; A. Berezantsev leg.; ZISP.

Bracon (*Bracon*) *sculptithorax* Tobias, 2000

Holotype. Russia – **Primorskiy Kray** • female; 80 km NE of Chuguyevka; 28 Jun. 1979; S.A. Belokobylskij leg.; forest; ZISP.

Bracon (*Bracon*) *sulciferus* Tobias, 2000

Paratype. Japan – **Kumamoto Prefecture** • 1 female; Yatsushiro-shi, Izumimachi Momigi; 20 Jul. 1992; V. Makarkin leg.; 700 m; ZISP.

Bracon (*Habrobracon*) *variegator* Spinola, 1808

Other material. Russia – **Saratov Oblast** • 1 male; Krasnokutsky District, near Dyakovka; 14 May 2011; K. Samartsev leg.; fixed sands, shrubs; B0065; ZISP. – **Tyva Republic** • 3 females; env. Uvs Lake; 23–24 Jul. 2009; S.A. Belokobylskij leg.; steppe, flowers; A0101, B0059, B0066; ZISP • 1 female; Tyva Rep., Shara-Nur Lake, 40 km W of Erzin; 26 Jul. 2009; B0060; ZISP – **Volgograd Oblast** • 1 male; Pallasovsky District, Lake Elton, Khara River, Chernyavka area; 15–17 Jun. 2004; S.A. Belokobylskij leg.; steppe, srubs; B0069; ZISP.

Tajikistan – **Khatlon Region** • 1 female, Jilikul, on Vakhsh River; 12 Jun. 1934; V.V. Gussakovskij leg.; B0068; ZISP. – **Region of Republican Subordination** •1 female; Rudaki District, Aruktau Ridge, 15 km W of Gandzhina [= Aktau Ridge?]; 16–17 May 1970; V.I. Tobias leg.; 1800–2000 m; B0067; ZISP.

Bracon (*Osculobracon*) *cingulator* Szépligeti, 1901

Holotype. Russia – **Tatarstan** • female; Kazan; 13 Jun. 1898; E. Csiki leg.; "Exp. Zichy"; 1327/153353; HNHM.

Bracon (*Osculobracon*) *koreanus* Papp, 1998

Holotype. North Korea – **Pyeongannam-do** • female; "Pyong-sung, Bek-sung-li, Za-mo san, 60 km NE from Pyongyan" [Pyeongseong-si, Baeksong-ri, Jamosan Mountain]; 1–10 Aug. 1975; J. Papp and A. Vojnits leg.; 7744/153419; HNHM.

Other material. South Korea – **Gyeonggi-do** • 1 female; Paju-si, Gunnae-myeon, Jeomwon-ri; 3 Jun. 1998; Heung-Sik Lee leg.; ZISP. – **Seoul-si** • 1 female; Seongbuk-gu, Anam-dong, Korea University; 1992; D.-S. Ku leg.; ZISP.

Bracon (*Osculobracon*) *osculator* Nees, 1811

Other material. Germany – **Thuringia** • 1 female (lectotype of *B. coniferarum* Fahringer, 1928); Bad Blankenburg; 1898; MNB.

Syntomernus asphondyliae (Watanabe, 1940), comb. nov.

Paratypes. Japan – **Tokyo** • 2 females; Hachioji-shi, Takaosan Mountain; emerged 22–23 Sep. 1930; N. Fujita leg.; A0966, A0967; EIHU.

Syntomernus pusillus Enderlein, 1920

Lectotype. China – **Taiwan** • female; "Formosa, Takao"; 2 Nov. 1907; H. Sauter leg.; MIIZ.

Syntomernus sunosei (Maeto, 1991), comb. nov.

Other material. North Korea – **Hwanghaebuk-do** • 1 female (holotype of *Bracon flaccus* Papp, 1996); "Kaesong, Mts. Pakyon, Pakyon popo, 27 km NE from Kaesong"

[13 km NNE of Gaesong, Bakyeonsan = Pakyeon-san Mountain, Bakyeon Pokpo = Pakyeon Falls]; 9 Sep. 1971; S. Horvatovich and J. Papp leg.; 7710/153340; HNHM.

Russia – **Primorskiy Kray** • 1 female; Partizansky District, 10 km SE of Partizansk, Novitsskoe; 3–4 Aug. 2013; S.A. Belokobylskij leg.; forest, glades; A0107; ZISP • 1 female; Spassky District, 20 km SE of Spassk-Dalny, Evseevka; 2 Jul. 2013; S.A. Belokobylskij; forest, forest edges; B0085; ZISP • 1 female; Vladivostok, 10 km SW of Artem; 31 Jul. 2001; S.A. Belokobylskij leg.; forest, forest edges; B0084; ZISP.

Syntomernus tamabae **(Maeto, 1991), comb. nov.**

Other material. Japan – **Hyogo Prefecture** • 2 females; Rokko Mts, Mt. Maya; 5 Nov. 2005; S.A. Belokobylskij leg.; forest; A0139, B0083; ZISP.

Taxonomy

Genus *Bracon* Fabricius, 1804

The taxonomic history of the genus has been reviewed by van Achterberg and Polaszek (1996: 25) and Papp (2012: 3); literature summarised in Shenefelt (1978: 1459) and Yu et al. (2016).

***Bracon* (*Bracon*) *kimchanghyoi* sp. nov.**
http://zoobank.org/5834B7B8-FBD5-4A83-9AD3-9AFB38ACC0E2
Figs 2–19

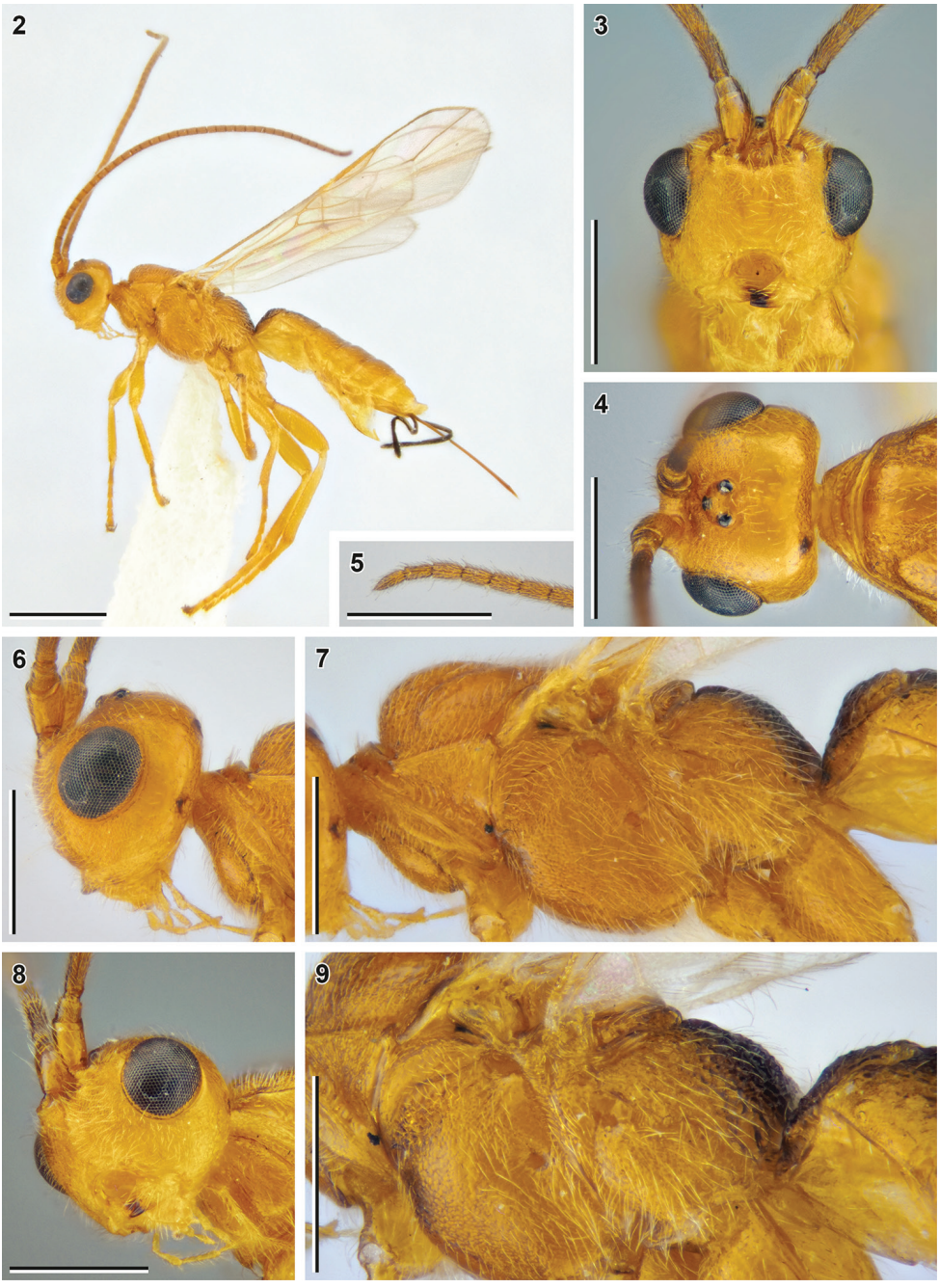
Type material. ***Holotype.*** South Korea – **Jeollanam-do** • 1 female; Yeosu-si, [34] Nam-myeon, Yeondo Island, Yeondo-ri; 20 Jul. 1993; D.-S. Ku leg.; 324; NIBR.

Paratypes. 5 males. South Korea – **Jeollanam-do** • 3 males; same data as for holotype; 323, 326, 327; SMNE • 1 male; same data as for holotype; 325; ZISP • 1 male; Jeju-si, [35] Jocheon-eup, Seonheul-ri; 26 Aug. 1997; D.-S. Ku leg.; 328; SMNE.

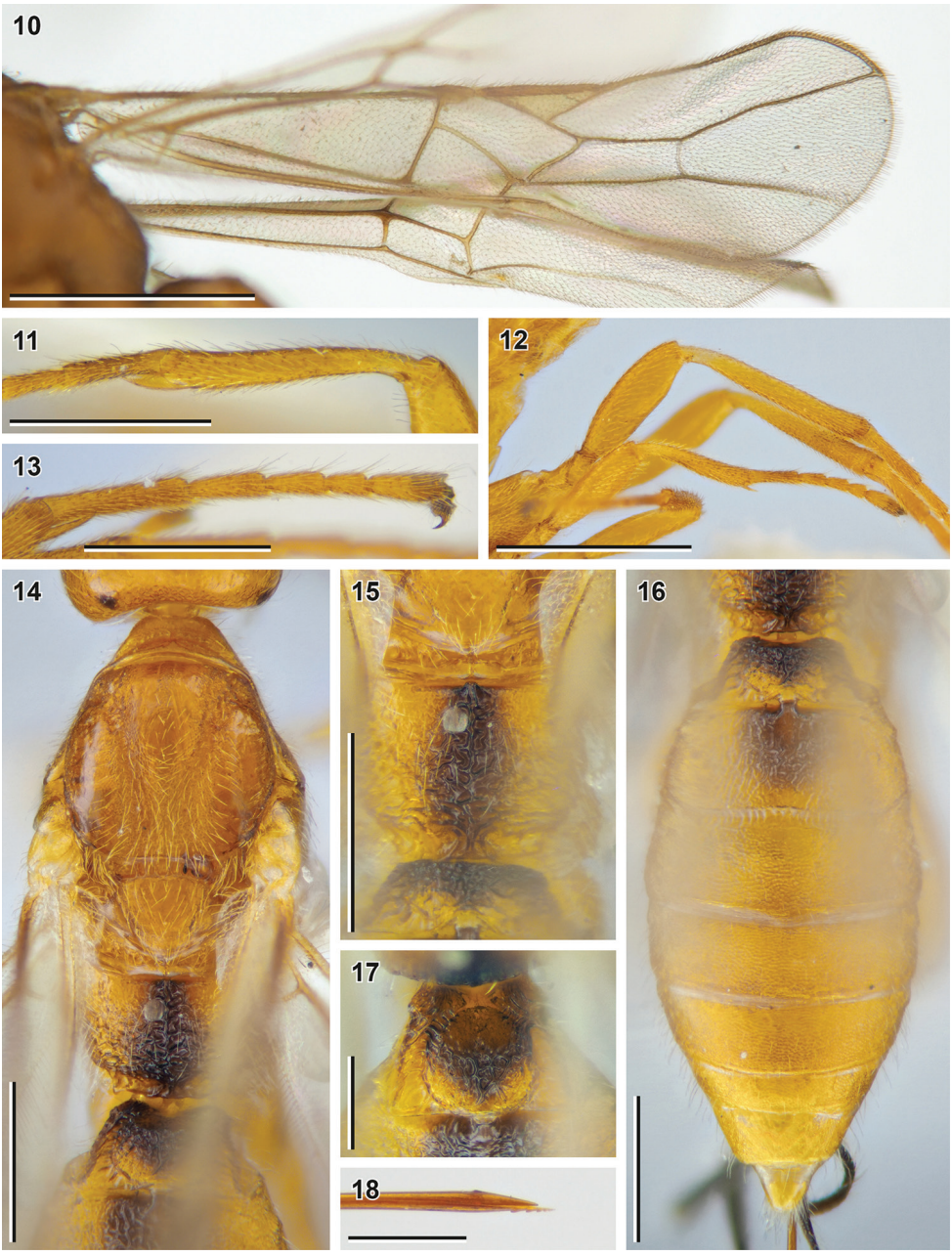
Etymology. This species is named in honour of the retired Korean entomologist Prof. Dr. Chang-Hyo Kim.

Description. Female. Body length 4.1 mm; fore wing length 3.5 mm.

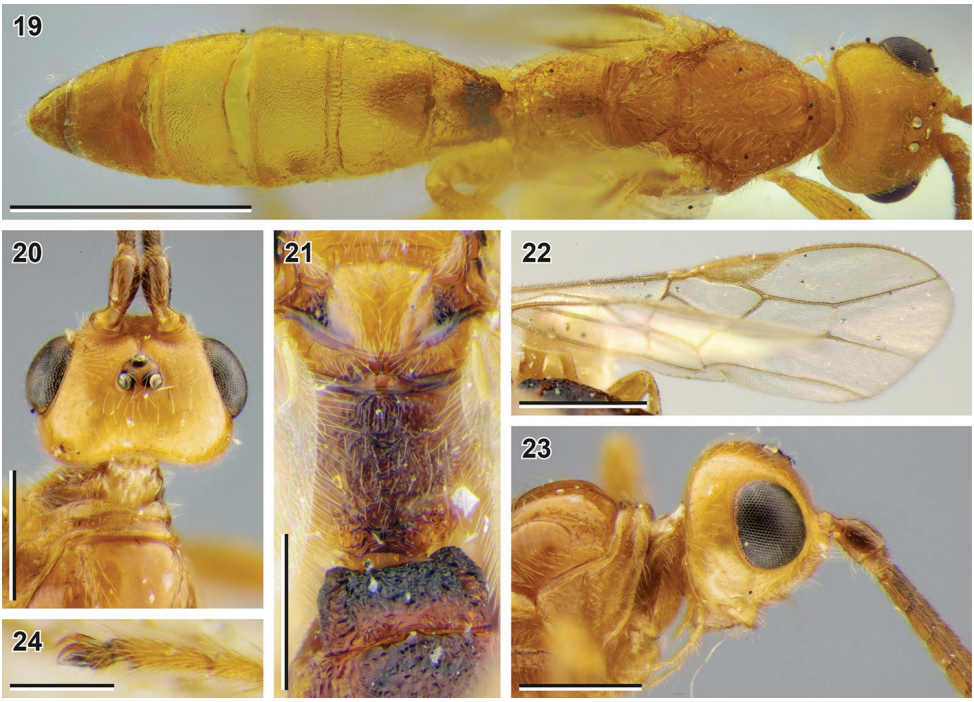
Head. Width of head (dorsal view) 1.6× its median length. Transverse diameter of eye (dorsal view) 1.4× longer than temple. Eyes with sparse, short setae. OOL 3.8× Od; POL 1.8× Od; OOL 2.1× POL. Frons with deep mid-longitudinal groove. Longitudinal diameter of eye in lateral view 1.3× larger than its transverse diameter. Transverse diameter of eye (lateral view) 1.4× longer than minimum width of temple, hind margins of eye and temple broadened downwards. Face width 1.5× combined height of face and clypeus; 2.2× larger than width of hypoclypeal depression. Longitudinal diameter of eye 1.5× longer than malar space (front view); malar space 1.1× base of man-



Figures 2–9. *Bracon* (*Bracon*) *kimchanghyoi* sp. nov. (holotype, NIBR) **2** habitus, lateral view **3** head, front view **4** head, dorsal view **5** Apex of antenna **6** head, lateral view **7** mesosoma, lateral view **8** head, ventrolateral view **9** mesosoma, lateroposterior view. Scale bars: 1 mm (**2**); 0.5 mm (**3–9**).



Figures 10–18. *Bracon* (*Bracon*) *kimchanghyoi* sp. nov. (holotype, NIBR) **10** fore wing **11** fore tibia **12** hind leg, front view **13** hind tarsus **14** mesosoma, dorsal view **15** Propodeum, dorsal view **16** Metasoma, dorsal view **17** first metasomal tergite, dorsal view **18** apex of ovipositor. Scale bars: 1 mm (**10, 12**); 0.5 mm (**11, 13–17**); 0.25 mm (**18**).



Figures 19–24. *Bracon* (*Bracon*) *kimchanghyoi* sp. nov. (**19** male paratype, NIBR) and *Bracon kotenkoi* Samartsev, 2018 (**20–24** holotype, ZISP) **19** body, dorsal view **20** head, dorsal view **21** propodeum, dorsal view **22** fore wing **23** head, lateral view **24** apex of hind tarsus. Scale bars: 1 mm (**19, 22**), 0.5 mm (**20, 21, 23**); 0.25 mm (**24**).

dible. Malar suture absent. Width of hypoclypeal depression 1.1× larger than distance from depression to eye. Clypeus not separated from face by dorsal carina, clypeal sulcus absent, dorsal clypeal margin smoothened. Clypeus flattened, with strongly protruding ventral rim, height of clypeus 0.32× width of hypoclypeal depression. Maxillary palp longer than eye, but shorter than head.

Antenna 1.3× longer than fore wing, with 38 antennomeres. First flagellomere 2.7× longer than its apical width, 1.3× longer than second flagellomere. Middle and penultimate flagellomeres 1.8× and 2.3× longer than wide, respectively. Apical flagellomere pointed.

Mesosoma 1.7× longer than its maximum height. Transverse pronotal sulcus deep and wide, crenulate. Notauli very deep and crenulate anteriorly, impressed and rugulose posteriorly, united near scutellum. Mesoscutum densely setose on notauli, sparsely and widely setose mid-longitudinally. Scutellar sulcus crenulate. Mesepimeral sulcus weakly crenulate, mesopleural pit deep, separated from mesepimeral sulcus. Median area of metanotum (dorsal view) with complete median carina. Metapleural sulcus crenulate. Mid-longitudinal keel on propodeum weak, but complete.

Wings. Fore wing 0.85× as long as body. Pterostigma 4.1× longer than wide. Vein r arising from 0.45 of pterostigma length. Vein 1-R1 1.9× longer than pterostigma. Marginal cell reaching apex of wing. Vein 3-SR 2.8× longer than vein r, 0.50× as long as vein SR1, 1.4× longer than vein 2-SR. Vein 1-M 0.7× vein 1-SR+M, 1.4× vein m-cu, 2.1× longer than vein cu-a. Vein 2-SR+M 0.15× as long as vein 2-SR, 0.20× as long as vein m-cu. Vein 1-CU1 (posterior margin of discal cell) 2.7× longer than vein cu-a. Vein cu-a weakly postfurcal. Vein 2-1A of hind wing absent; vein r-m strongly antefurcal.

Legs. Fore tibia with wide row of long thick setae. Hind femur 3.1× longer than wide. Hind tibia 1.5× longer than hind femur, with subapical transverse row of spiny setae, its inner spur 0.4× as long as hind basitarsus. Hind tarsus as long as hind tibia. Fifth segment (without pretarsus) of hind tarsus 0.5× as long as hind basitarsus and almost as long as second segment. Claws with small almost right-angled basal lobe.

Metasoma 1.3× longer than mesosoma. Median length of first tergite (measured from petiolar tubercle) 0.7× as large as its apical width. First metasomal tergite with developed dorsolateral carinae, incomplete dorsal carinae and distinct mid-longitudinal impression. Median area of first tergite separated by areolate-rugose furrow, 0.6× apical width of tergite. Second tergite medially 0.9× as long as third tergite and 0.7× as large as apical width of first tergite, with weakly impressed s-shaped dorsolateral crenulated impressions. Basal width of second metasomal tergite 1.7× larger than its median length. Suture between second and third tergites deep, weakly curved and crenulate. Apical margins of third to sixth tergites thin, without transverse subapical grooves. Ovipositor sheath 1.4× longer than hind tibia and 0.43× as long as fore wing. Apex of ovipositor with developed dorsal nodus and ventral serration.

Sculpture. Face and frons granulate, vertex weakly granulate, gena weakly coriaceous. Most of mesosoma weakly granulate; metanotum rugose; propodeum anteriorly rugulose, posteriorly rugose, with long transverse rugae along median keel. First metasomal tergite laterally rugulose, its median area weakly rugulose to areolate-rugose; second tergite areolate-rugose to rugose, third–sixth tergites with papillary-like sculpture.

Colour. Body mainly reddish yellow with dark brown patches on propodeum and first and second metasomal tergites. Scape reddish yellow, flagellum yellowish brown. Maxillary palps yellow. Tegulae pale yellow. Wing membrane weakly darkened; pterostigma yellow, wing veins yellowish brown.

Male. Body length 2.4–3.8 mm; fore wing length 2.0–3.0 mm.

Head. Width of head (dorsal view) 1.5× its median length. Transverse diameter of eye (dorsal view) 1.3–1.5× longer than temple. OOL 3.5–4.0× Od; POL 1.3–2.4× Od; OOL 1.6–2.6× POL. Longitudinal diameter of eye in lateral view 1.2–1.4× larger than its transverse diameter. Transverse diameter of eye (lateral view) 1.2–1.8× longer than minimum width of temple, hind margins of eye and temple broadened downwards or almost parallel. Face width 1.7–1.9× larger than width of hypoclypeal depression. Longitudinal diameter of eye 1.7–1.8× longer than malar space (front view); malar space 0.85–1.05× base of mandible. Width of hypoclypeal depression 1.1–1.4× larger than distance from depression to eye. Dorsal clypeal margin sharp.

Antenna 1.4–1.5× longer than fore wing, with 29–36 antennomeres. First flagellomere 2.6–3.0× longer than its apical width, 1.1–1.2× longer than second flagellomere. Middle and penultimate flagellomeres 1.9–2.6× and 2.0–2.8× longer than wide, respectively.

Mesosoma 1.8–2.0× longer than its maximum height. Median lobe of mesoscutum some× widely glabrous anteromedially.

Wings. Pterostigma 4.4–4.8× longer than wide. Vein r arising from 0.45–0.50 of pterostigma length. Vein 1-R1 1.8–1.9× longer than pterostigma. Vein 3-SR 1.9–3.1× longer than vein r, 0.45–0.60× as long as vein SR1, 1.1–1.7× longer than vein 2-SR. Vein 1-M 0.7–0.8× vein 1-SR+M, 1.7× vein m-cu. 2.4–3.1× longer than vein cu-a. Vein 2-SR+M 0.10–0.15× as long as vein 2-SR, 0.20–0.25× as long as vein m-cu. Vein 1-CU1 (posterior margin of discal cell) 2.6–3.4× longer than vein cu-a. Vein cu-a weakly postfurcal.

Legs. Hind femur 3.4–4.3× longer than wide. Inner spur of hind tibia 0.3–0.4× as long as hind basitarsus. Fifth segment (without pretarsus) of hind tarsus 0.48–0.53× as long as hind basitarsus and 0.85–0.95× as long as second segment.

Metasoma 1.5–1.7× longer than mesosoma. Median length of first tergite (measured from petiolar tubercle) 0.9–1.0× as large as its apical width. Second tergite medially as long as third tergite and 1.0–1.2× larger than apical width of first tergite. Basal width of second tergite 1.1–1.2× larger than its median length.

Diagnosis. *Bracon kimchanghyoi* sp. nov. is very similar to recently described *B. kotenkoi* Samartsev, 2018, which also has an elongate body, the long malar space, the widely sculptured propodeum and more or less completely sculptured metasoma. The differences between two species are presented in the dichotomy below.

1 Vertex, propleuron, scutellum and gena smooth (Figs 20, 21, 23); mesoscutum smooth with weak rugulosity along notauli; mesopleuron weakly coriaceous to smooth. Median area of metanotum (dorsal view; Fig. 21) with incomplete median carina (not crossing posterior elevation). Mid-longitudinal keel on propodeum mostly absent, distinct only basally and apically (Fig. 21). Median lobe of mesoscutum anteromedially glabrous (in females; Figs 20, 23; males unknown). Vein 2-SR+M 0.45–0.55× as long as vein m-cu (Fig. 22). Vein 3-SR 3.4–3.6× longer than vein r. Vein 1-R1 1.5–1.6× longer than pterostigma. Tarsal claws with rounded, not protruding basal lobes (Fig. 24). Antenna 0.82–0.96× as long as fore wing..... ***Bracon* (*Bracon*) *kotenkoi* Samartsev, 2018**

– Vertex, propleuron, mesoscutum, scutellum and mesopleuron widely and weakly granulate (Fig. 4, 7, 14); gena weakly coriaceous (Fig. 6). Median area of metanotum (dorsal view; Fig. 15) with complete median carina. Mid-longitudinal keel on propodeum complete (Fig. 15, 19). Median lobe of mesoscutum anteromedially sparsely and widely setose (in females; Fig. 14). Vein 2-SR+M 0.20× (males: 0.20–0.25×) as long as vein m-cu (Fig. 10). Vein 3-SR 2.8× (males: 1.9–3.1×) longer than vein r. Vein 1-R1 1.9× (males: 1.8–1.9×) longer than pterostigma. Tarsal claws with rectangular, somewhat protruding basal lobes (Fig. 13). Antenna 1.3× (males: 1.4–1.5×) longer than fore wing..... ***B.* (*B.*) *kimchanghyoi* sp. nov.**

***Bracon* (*Bracon*) *yeogisanensis* sp. nov.**
http://zoobank.org/B63522FE-BBD6-482B-92BC-7544BFF88248
Figs 25–40

Type material. ***Holotype.*** South Korea – **Gyeonggi-do** • female; Suwon-si, [15] Gwonseon-gu, Seodun-dong, Yeogisan Mountain; 11 May 1994; D.-S. Ku leg.; 867; NIBR.

Paratypes. (21 females, 9 males). South Korea – **Gangwon-do** • 1 female; Goseong-gun, [6] Toseong-myeon, Sinpyeong-ri, Seoraksan Mountain; 2 Aug. 2002–19 Oct. 2002; D.-S. Ku leg.; Malaise trap; 888; SMNE. – **Gyeonggi-do** • 4 males; same data as for holotype; 22 Apr. 1994; 891, 892, 893, 895; SMNE • 1 female; same data as for holotype; 29 Apr. 1994; 874; ZISP • 4 females; same data as for holotype; 864, 866, 868, 873; SMNE • 3 males; same data as for holotype; 869, 871, 872; SMNE • 1 male; same data as for holotype; 870; ZISP • 1 female; same data as for holotype; 11–19 May 1994; 879; SMNE • 1 female; same data as for holotype; 19–26 May 1994; 878; SMNE • 1 female; same data as for holotype; 27 May 1996; June-Yeol Choi leg.; Malaise trap; 882; SMNE • 1 female; same data as for holotype; 29 May–6 Jul. 1994; Malaise trap; 877; SMNE • 1 female; same data as for holotype; 16–23 Jun. 1994; 889; SMNE • 1 female; same data as for holotype; 23–29 Jun. 1994; Malaise trap; 890; SMNE • 2 females; same data as for holotype; 10 Jul. 1995; June-Yeol Choi leg.; Malaise trap; 885, 886; SMNE • 1 female; same data as for preceding; 887; ZISP • 1 female; same data as for preceding; 11 Jul. 1997; 884; SMNE • 1 female; same data as for preceding; 14 Aug. 1995; 883; SMNE • 2 females; Suwon-si, [16] Gwonseon-gu, Seodun-dong; 3–11 May 1994; D.-S. Ku leg.; 875, 876; SMNE • 1 male; same data as for preceding; 15 Jun. 1994; 894; SMNE • 1 female; Hwaseong-si, [17] Bibong-myeon; 1 Jun. 1994; D.-S. Ku leg.; 880; SMNE. – **Jeollabuk-do** • 1 female; Jinan-gun, [24] Bugwi-myeon, Sedong-ri, Moraejae Tunnel; 16 Jun. 1996; D.-S. Ku leg.; 881; SMNE.

Etymology. The name refers to Yeogisan Mountain, the type locality of the species.

Description. Female. Body length 2.5–3.1 mm; fore wing length 2.9–3.3 mm.

Head. Width of head (dorsal view) 1.7–1.9× its median length. Transverse diameter of eye (dorsal view) 1.7–1.9× longer than temple. Eyes with sparse, short setae. OOL 2.2–2.5× Od; POL 1.2–1.5× Od; OOL 1.6–1.9× POL. Frons with weak mid-longitudinal groove. Longitudinal diameter of eye in lateral view 1.3× larger than its transverse diameter. Transverse diameter of eye (lateral view) 2.1–2.3× longer than minimum width of temple, hind margins of eye and temple parallel or slightly broadened downwards or upwards. Face width 1.6–1.8× combined height of face and clypeus; 1.8–2.2× larger than width of hypoclypeal depression. Longitudinal diameter of eye 3.2–3.5× longer than malar space (front view); malar space 0.6–0.7× base of mandible. Malar suture absent. Width of hypoclypeal depression 1.5–1.9× larger than distance from depression to eye. Clypeus not separated from face by dorsal carina, clypeal sulcus impressed, dorsal clypeal margin sharp. Clypeus prominent, with protruding ventral rim, height of clypeus 0.2–0.3× width of hypoclypeal depression. Maxillary palp longer than eye, but shorter than head.

Antenna 0.77–0.82× as long as fore wing, with 23–25 antennomeres. First flagellomere 2.1–2.9× longer than its apical width, 1.1–1.3× longer than second flagel-

lomere. Middle and penultimate flagellomeres 1.7–2.2× and 1.5–2.0× longer than wide, respectively. Apical flagellomere spiculate.

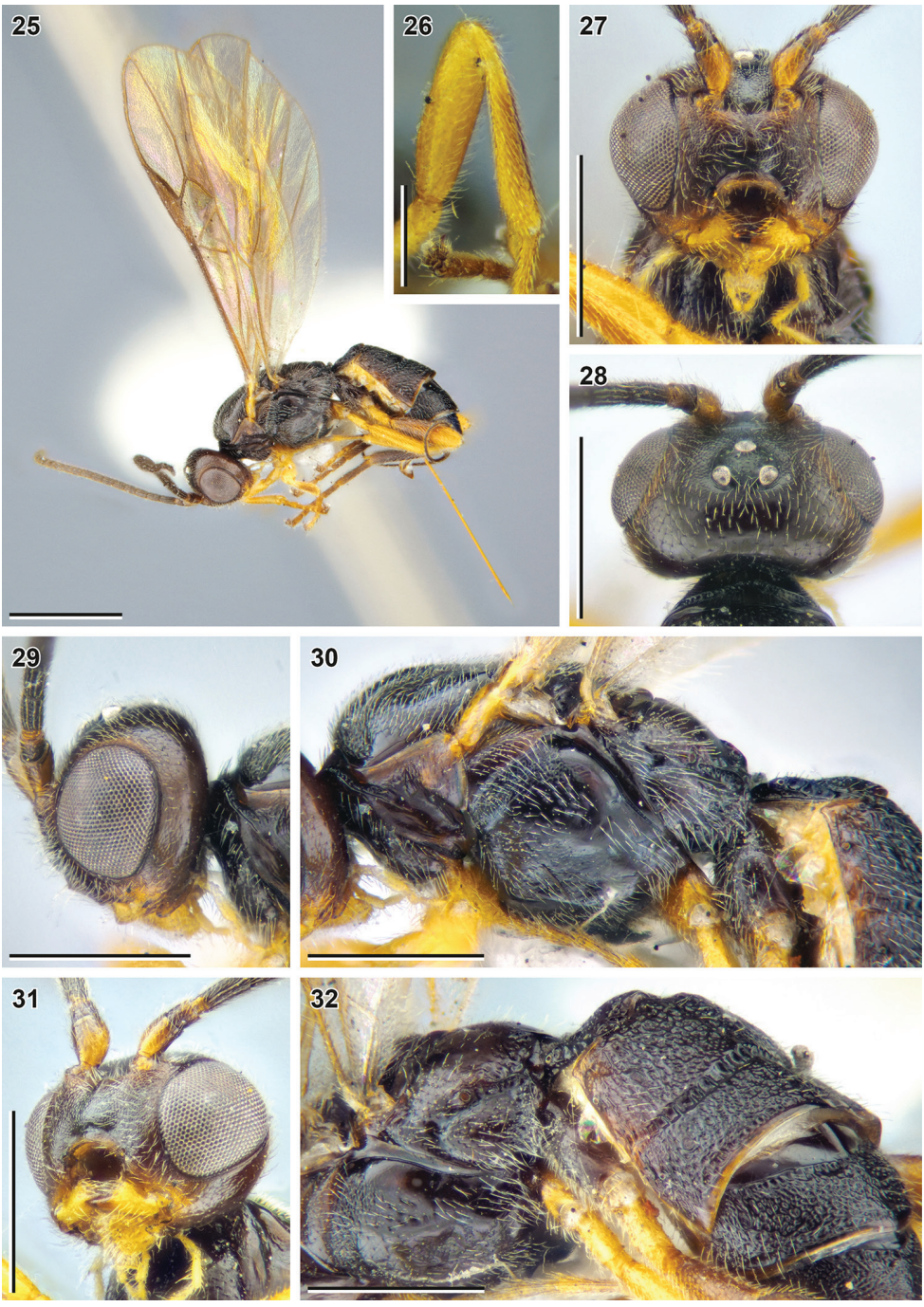
Mesosoma 1.5–1.6× longer than its maximum height. Transverse pronotal sulcus deep and anteriorly crenulate. Notauli very deep and crenulate anteriorly, shallowly impressed and smooth posteriorly. Mesoscutum widely setose mid-longitudinally, on notauli and laterally and evenly setose medioposteriorly. Scutellar sulcus crenulate, mesepimeral sulcus weakly crenulate, metapleural sulcus crenulate. Mesopleural pit small or weakly impressed and separated from mesepimeral sulcus. Median area of metanotum (dorsal view) with incomplete median carina. Propodeum with short and branching mid-longitudinal keel apically and weakly foveate or crenulated mid-longitudinal impression in basal half.

Wings. Fore wing 1.1–1.2× longer than body. Pterostigma 2.3–2.8× longer than wide. Vein r arising from basal 0.35–0.45 of pterostigma length. Vein 1-R1 1.7–1.8× longer than pterostigma. Marginal cell ca. 10–20× longer than distance from its apex to apex of wing. Vein 3-SR 1.7–2.0× longer than vein r, 0.42–0.46× as long as vein SR1, 1.1× longer than vein 2-SR. Vein 1-M 0.74–0.77× vein 1-SR+M, 2.3–2.6× vein m-cu. 2.0–2.4× longer than vein cu-a. Vein 2-SR+M 0.08–0.16× as long as vein 2-SR, 0.20–0.45× as long as vein m-cu. Vein 1-CU1 (posterior margin of discal cell) 2.4–2.7× longer than vein cu-a. Vein cu-a interstitial or weakly postfurcal. Vein 2-1A of hind wing absent or very short; vein r-m antefurcal.

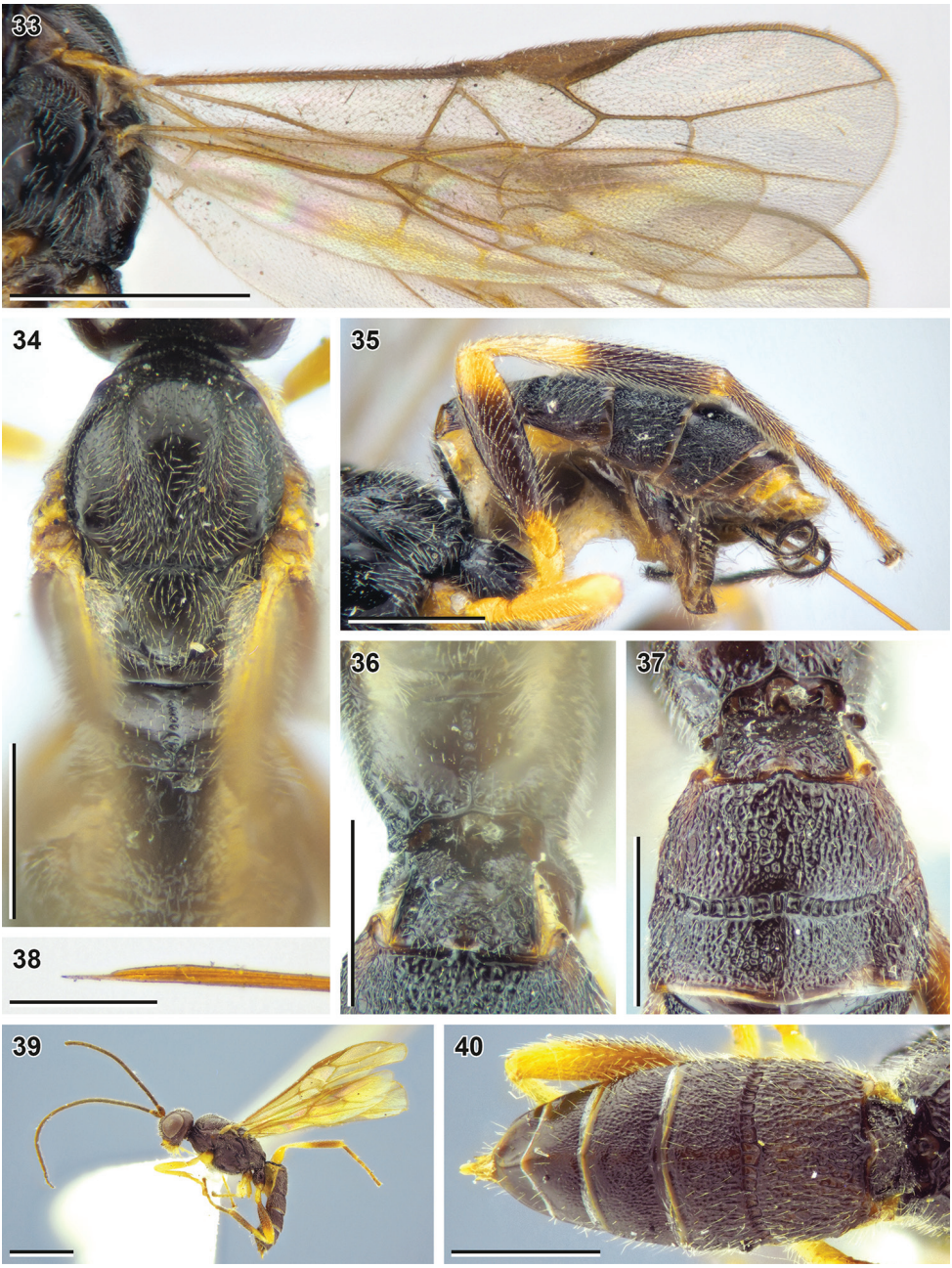
Legs. Fore tibia with wide row of long thick setae and transverse apical row of thick setae. Hind femur 3.0–3.8× longer than wide. Hind tibia without subapical row of thick setae, 1.4–1.5× longer than hind femur, its inner spur 0.35–0.37× as long as hind basitarsus. Hind tarsus almost as long as hind tibia, its fifth segment (without pretarsus) 0.37–0.43× as long as hind basitarsus and 0.75–0.80× as long as second segment. Claws with acute angularly protruding basal lobe.

Metasoma 1.0–1.2× longer than mesosoma. Median length of first tergite (measured from petiolar tubercle) 0.7–0.8× as large as its apical width. Dorsolateral carinae of first metasomal tergite developed; dorsal carinae incomplete and weakly curved toward apex of tergite. Median area of first tergite separated by rugose furrow, 0.6–0.7× apical width of tergite. Second tergite medially 1.00–1.15× as long as third tergite and 0.7–0.9× as large as apical width of first tergite, with shallow s-shaped dorsolateral crenulated impressions. Basal width of second metasomal tergite 1.4–1.6× larger than its median length. Suture between second and third tergites deep and wide, curved and crenulate. Apical margins of third to sixth tergites thick, with deep crenulate transverse subapical grooves. Ovipositor sheath 1.2–1.4× longer than hind tibia and 0.33–0.47× as long as fore wing. Apex of ovipositor with weak nodus and weak ventral serration.

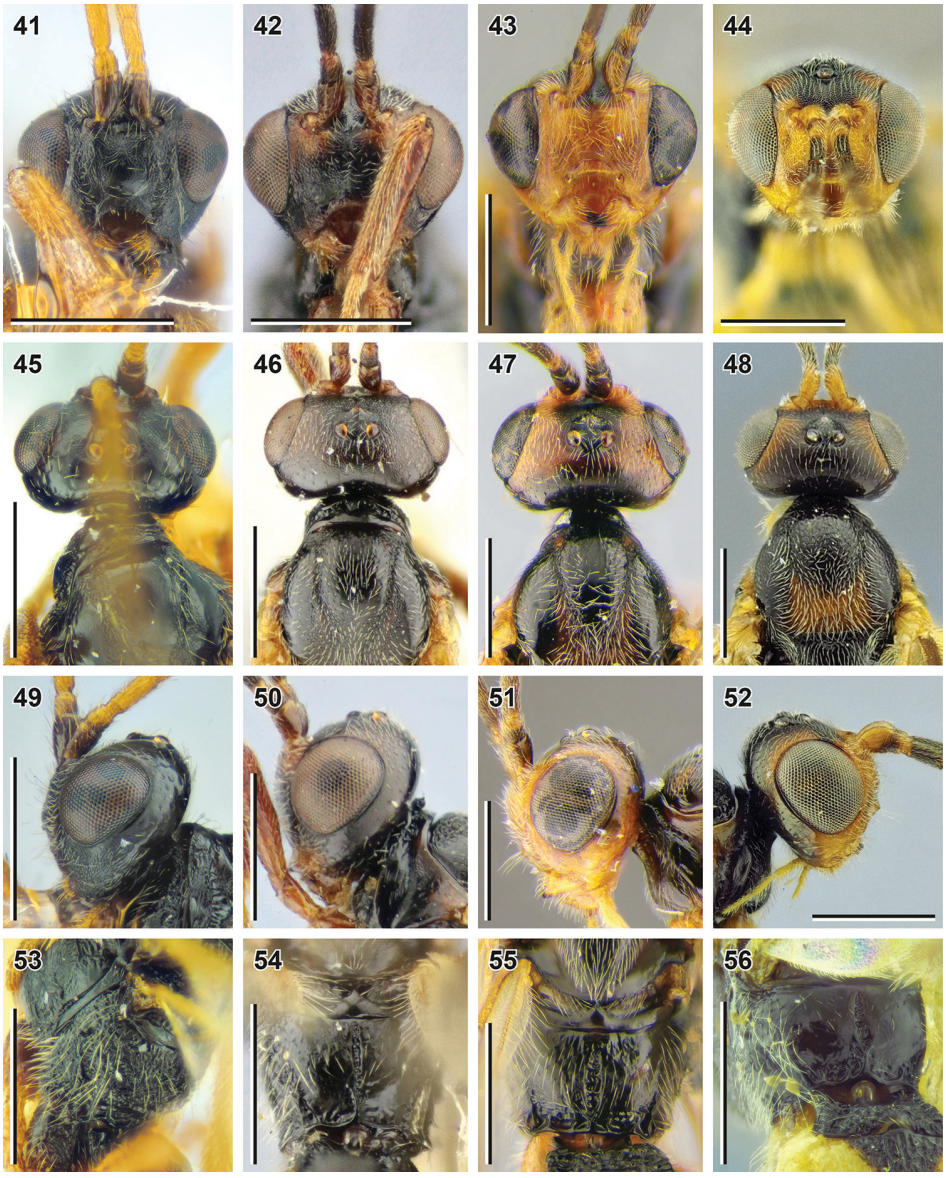
Sculpture. Face and frons granulate. Gena and anterior half of vertex coriaceous. Mesopleuron almost smooth, weakly coriaceous or weakly granulate. Mesoscutum medio-posteriorly weakly granulate. Scutellum and metanotum smooth. Propodeum hardly coriaceous to smooth, with short rugae apically. First metasomal tergite laterally and posteriorly rugose; second to fifth tergites areolate-rugose or foveolate-rugose to rugulose-punctate or irregularly punctate; sixth tergite weakly irregularly punctate or almost smooth.



Figures 25–32. *Bracon* (*Bracon*) *yeogisanensis* sp. nov. (holotype, NIBR) **25** habitus, lateral view **26** fore femur and tibia, front view **27** head, front view **28** head, dorsal view **29** head, lateral view **30** mesosoma, lateral view **31** head, ventrolateral view **32** mesosoma, lateroposterior view. Scale bars: 1 mm (**25**); 0.5 mm (**27–32**); 0.25 mm (**26**).



Figures 33–40. *Bracon* (*Bracon*) *yeogisanensis* sp. nov. (**33–37** holotype, NIBR, **19, 40** male paratype, SMNE) **33** wings **34** mesosoma, dorsal view **35** hind leg, front view **36** propodeum and first metasomal tergite, dorsal view **37** Second and third metasomal tergites, dorsal view **38** apex of ovipositor, lateral view **39** habitus, lateral view **40** metasoma, dorsal view. Scale bars: 1 mm (**33, 39**); 0.5 mm (**34–37, 40**); 0.25 mm (**38**).



Figures 41–56. *Bracon sculptithorax* Tobias, 2000 (**41, 45, 49, 53** holotype, ZISP), *B. kunashiricus* Tobias, 2000 (**42, 46, 50, 54** holotype, ZISP), *B. sulciferus* Tobias, 2000 (**43, 47, 51, 55** paratype, ZISP) and *B. acunens* Papp, 2018 (**44, 48, 52** holotype, HNHM **56** female, SMNE) **41–44** head, front view **45–48** head and mesoscutum, dorsal view **49–52** head, lateral view **53–56** propodeum, dorsal view. Scale bars: 0.5 mm.

Colour. Body mainly dark brown. Most of scape, mandible, tegulae, fore and middle legs, trochanter and apex of femur of hind leg brownish yellow or yellowish brown. Maxillary palp and base of hind tibia pale yellow. Lateral margins of second and third meta-

somal tergite and seventh tergite brown or yellowish brown. Wing membrane brownish darkened; pterostigma brown, basally with small pale brown patch; wing veins brown.

Male. Body length 2.5–3.2 mm; fore wing length 2.5–3.1 mm. OOL 1.8–2.0× Od, 1.3–1.5× POL. Hind margins of eye and temple broadened upwards (lateral view). Longitudinal diameter of eye 3.9× longer than malar space (front view). Mid-longitudinal keel developed in apical third of propodeum. Vein r-m of hind wing interstitial. Fifth segment (without pretarsus) of hind tarsus ca. 0.9× as long as second segment. Median length of first tergite (measured from petiolar tubercle) 0.90–0.95× as large as its apical width. Second tergite medially 1.1× as large as apical width of first tergite. Basal width of second metasomal tergite 1.3–1.4× larger than its median length. Apical metasomal segments as dark as proximal segments. Otherwise similar to female.

Diagnosis. The new species belongs to a distinct species group including five species known from the Russian Far East, the Korean Peninsula and Japan (*Bracon acunens* Papp, 2018, *B. kunashiricus* Tobias, 2000, *B. sculptithorax* Tobias, 2000, *B. sulciferus* Tobias, 2000, and *B. yeogisanensis* sp. nov.). The species share the following common characters: malar suture absent; face and frons granulate; gena, vertex, mesopleuron and mesoscutum partly with weak granulate or coriaceous sculpture; mesosoma elongate, 1.5–1.7× longer than its maximum height; mesoscutum widely setose medially; notauli deep anteriorly and shallow posteriorly; precoxal sulcus vaguely or shallowly impressed; propodeum with crenulated or foveate mid-longitudinal impression in basal half and with branching mid-longitudinal keel in its apical half; marginal cell of fore wing not shortened, 6–25× longer than distance from its apex to apex of wing; vein r arising distinctly before middle of pterostigma; vein 1-SR+M more or less curved anteriorly; vein cu-a interstitial or weakly postfurcal; wing membrane weakly brownish darkened; coxae without granulate sculpture; hind tibia without transverse apical row of thick setae apically; second segment of hind tarsus 1.1–1.3× longer than fifth segment; claws with acute basal lobes; dorsolateral carinae of first metasomal tergite developed; median area of second tergite absent or very short and weak; dorsolateral s-shaped impressions of second tergite more or less distinct; suture between second and third tergites deep and crenulate; apical margins of third to sixth tergites thick; metasoma completely sculptured (areolate-rugose to irregularly punctate); ovipositor sheath 1.0–1.5× as long as hind tibia, 0.3–0.5× as long as fore wing. Differences between these species are listed in the key below.

1 Propodeum entirely rugose (Fig. 53). Face weakly, but widely elevated medially (Figs 41, 49), its width 1.4× combined height of face and clypeus. Longitudinal diameter of eye 2.0× longer than malar space (front view; Fig. 41); malar space 1.2× base of mandible. Hind coxa dorsally rugose (Fig. 53). Maxillary palp shorter than eye, brownish yellow. Flagellum bicolored, rusty brown, becoming darker apically (Figs 41, 49). Hind femur 4.6× longer than wide. Ovipositor sheath almost as long as hind tibia. Vein 3-SR 2.5× longer than vein r. Scape brown..... ..... ***Bracon* (*Bracon*) *sculptithorax* Tobias, 2000**

– Propodeum at least anteriorly widely smooth (Figs 36, 54–56). Face not elevated medially (Figs 27, 42–44), its width 1.6–1.8× combined height of face and

clypeus. Longitudinal diameter of eye more than 2.5× longer than malar space (front view); malar space 0.55–0.75× base of mandible. Hind coxa smooth (Figs 32, 35). Maxillary palp as long or longer than eye, (pale) yellow. Flagellum unicoloured, brown or reddish brown **2**

2 Suture between second and third metasomal tergites almost straight (Fig. 62). Apical margins of third to sixth metasomal tergites not separated by transverse subapical grooves. Fifth metasomal tergite foveolate-rugose. Scape darker, reddish brown (Fig. 42) ..... ***B.* (*B.*) *kunashiricus* Tobias, 2000**

– Suture between second and third metasomal tergites more or less curved (Figs 37, 63, 64). Apical margins of third to sixth tergites with deep crenulate transverse subapical grooves. Fifth metasomal tergite without foveolate sculpture, shagreen, irregularly punctate, rugulose-punctate or (in *B. acunens*) areolate-rugose. Scape lighter-coloured, reddish yellow or brownish yellow, often laterally brown (Figs 31, 43, 52) **3**

3 Hind margins of eye and temple (in lateral view) weakly broadened downwards (Fig. 51). Second metasomal tergite longitudinally rugose (Fig. 63). Suture between second and third tergites weakly curved. Pterostigma without small pale brown patch basally. Vein cu-a postfurcal (Fig. 67). Longitudinal diameter of eye 3.0× longer than malar space (front view; Fig.43). Transverse diameter of eye (lateral view) 2.7× longer than minimum width of temple. Hind basitarsus 1.9× longer than second tarsal segment, 2.4× longer than fifth tarsal segment. Second metasomal tergite with weak dorsolateral impressions (Fig. 63). Basal width of second metasomal tergite 1.5× larger than its median length .... ***B.* (*B.*) *sulciferus* Tobias, 2000**

– Hind margins of eye and temple (in lateral view) almost parallel (Figs 29, 52). Suture between second and third tergites curved (Figs 37, 64). Second metasomal tergite without longitudinal rugosity. Pterostigma with small pale brown patch basally (Fig. 68). Vein cu-a (almost) interstitial..... **4**

4 Second metasomal tergite laterally pale yellow, face and mesoscutum with rusty-brown pattern (Figs 44, 48, 60, 64). Dorsolateral impressions of second metasomal tergite deep (Fig. 64). Hind basitarsus 1.6× longer than second tarsal segment, 1.9–2.1× longer than fifth segment. Basal width of second metasomal tergite 1.7–1.9× larger than its median length. Longitudinal diameter of eye 3.5–3.6× (males: 4.2–4.4×) longer than malar space (front view; Fig. 44). Transverse diameter of eye (lateral view) 2.4–2.5× (males: 2.8–2.9×) longer than minimum width of temple (Fig. 52) ..... ***B.* (*B.*) *acunens* Papp, 2018**

– Head, mesosoma and metasoma evenly dark-brown or brownish black (Figs 27, 30, 34). Dorsolateral impressions of second metasomal tergite almost indistinct (Figs 37, 40). Hind basitarsus 1.8–2.1× longer than second tarsal segment, 2.3–2.7× longer than fifth segment (Fig. 35). Basal width of second metasomal tergite 1.4–1.6× larger than its median length (Fig. 37). Longitudinal diameter of eye 3.2–3.5× (males: 3.9×) longer than malar space (front view; Fig. 27). Transverse diameter of eye (lateral view) 2.1–2.3× (males: 2.3–2.4×) longer than minimum width of temple (Figs 29, 39) ..... ***B.* (*B.*) *yeogisanensis* sp. nov.**

***Bracon* (*Habrobracon*) *allevatus* sp. nov.**
http://zoobank.org/CD0B26C9-A677-45B0-9C10-74682E9D0929
Figs 69–85

Type material. ***Holotype.*** South Korea – **Jeollanam-do** • female; Yeosu-si, [33] Nam-myeon, Ando Island, Ando-ri; 4 Aug. 1993; D.-S. Ku leg.; 629; NIBR.

Paratypes. 23 females, 14 males. South Korea – **Gangwon-do** • 2 females; Goseong-gun, [1] Hyeonnae-myeon, Baebong-ri; 26 May 1993; D.-S. Ku leg.; 632, 634; SMNE • 1 male; same data as for preceding; 633; SMNE • 1 male; Goseong-gun, [2] Hyeonnae-myeon, Machajin-ri; 25 May 1993; D.-S. Ku leg.; 661; SMNE • 1 male; Goseong-gun, [3] Ganseong-eup; 25 May 1993; D.-S. Ku leg.; 635; SMNE • 2 females; Goseong-gun, [4] Geojin-eup, Naengcheon-ri, Geonbongsa Temple; 25 May 1993; D.-S. Ku leg.; 637, 638; SMNE • 1 female; same data as for preceding; 639; ZISP • 1 male; same data as for preceding; 636; SMNE• 1 male; Cheorwon-gun, [7] Geunnam-myeon, Yukdan-ri; 13 Jun. 1992; D.-S. Ku leg.; 666; SMNE • 1 female; Inje-gun, [8] Buk-myeon, Yongdae-ri, Seoraksan Mountain, Baekdamsa Temple; 25 May 1993; D.-S. Ku leg.; 641; SMNE • 1 female; Hongcheon-gun, [9] Duchon-myeon, Jangnam-ri (Corn Experimantal Station); 3 Jun. 1996; June-Yeol Choi leg.; 653; SMNE • 1 male; Chuncheon-si, [10] Sinbuk-eup, Cheonjeon-ri, Cheonjeon 5-ri; 25 May 1993; D.-S. Ku leg.; 654; SMNE • 1 male; Taebaek-si, [12] Cheoram-dong; 22 Jun. 1991; D.-S. Ku leg.; 645; SMNE • 1 female; Taebaek-si, [13] Cheoram-dong, Taebaeksan Mountain; 13 May 1993; D.-S. Ku leg.; 658; SMNE. – **Gyeonggi-do** • 1 female; Gapyeong-gun, [14] Cheongpyeong-myeon, Cheongpyeong-ri, Cheongpyeong Amusement Park; 14 Jun. 1992; D.-S. Ku leg.; 652; SMNE • 2 females; Bonghwa-gun, [18] Myeongho-myeon, Gwanchang-ri; 28 May 1993; D.-S. Ku leg.; 648, 650; SMNE • 2 males; same data as for preceding; 649, 651; SMNE • 1 female; Mungyeong-si, [19] Buljeong-dong; 9 Jun. 1992; D.-S. Ku leg.; 631; SMNE. – **Chungcheongbuk-do** • 1 female; Danyang-gun, [20] Danyang-eup, Dodam-ri; 13 May 1991; D.-S. Ku leg.; 657; SMNE. – **Chungcheongnam-do** • 1 female; Geumsan-gun, [21] Chubu-myeon, Seongdang-ri, Gaedeoksa Temple; 22 May 1993; D.-S. Ku leg.; 640; SMNE • 2 males; same data as for preceding; 642, 643; SMNE • 1 male; same data as for preceding; 644; ZISP • 1 female; Yesan-gun, [22] Deoksan-myeon, Sudeoksa Temple; 11 Aug. 1991; D.-S. Ku leg.; 630; SMNE • 1 male; Cheongyang-gun, [23] Jeongsan-myeon, Machi-ri; 15 Jun. 1992; D.-S. Ku leg.; 665; SMNE. – **Gyeongsangbuk-do** • 1 female; Gyeongsan-si, [25] Yeongnam University; 19 Apr. 1991; J.-W. Lee leg.; 663; SMNE. – **Gyeongsangnam-do** • 1 female; Changwon-si, [27] Uichang-gu, Sogye-dong, Cheonjusan Mountain; 18 Jun. 1992; D.-S. Ku leg.; 659; SMNE • 1 male; Jinju-si, [28] Gajwa-dong; 18 May 1993; D.-S. Ku leg.; 660; SMNE • 1 female; Goseong-gun, [29] Sangni-myeon, Bupo-ri; 3 May 1993; D.-S. Ku leg.; 664; SMNE. – **Jeollanam-do** • 1 female; Gurye-gun, [31] Sandong-myeon, Jwasa-ri, Jirisan Mountain (Simwon); 5 May 1993; D.-S. Ku leg.; 662; SMNE • 2 females; Yeosu-si, [32] Nam-myeon, Dumo-ri, Town Moha; 20 Jul. 1993; D.-S. Ku leg.; 646, 647; SMNE • 1 female; Yeosu-si, [34] Nam-myeon, Yeondo Island, Yeondo-ri; 21 Jul. 1993; D.-S. Ku leg.; 656; SMNE • 1 female; same data as for preceding; 655; ZISP.

Etymology. The Latin adjective *allevatus* (smoothed off) refers to the strongly reduced sculpture of the body discriminating the new species from *B. variegator* Spinola.

Description. Female. Body length 2.4–3.1 mm; fore wing length 2.4–3.1 mm.

Head. Width of head (dorsal view) 1.9–2.0× its median length. Transverse diameter of eye (dorsal view) 1.6–2.0× longer than temple. Eyes with dense, short setae. OOL 2.3–2.8× Od; POL 1.4–1.9× Od; OOL 1.4–1.8× POL. Frons with deep mid-longitudinal groove. Longitudinal diameter of eye in lateral view 1.5–1.6× larger than its transverse diameter. Transverse diameter of eye (lateral view) 1.7–2.0× longer than minimum width of temple, hind margins of eye and temple broadened downwards or more or less parallel. Face width 1.6–1.8× combined height of face and clypeus; 2.4–2.9× larger than width of hypoclypeal depression. Longitudinal diameter of eye 2.2–2.5 (but 3.4× in the smallest measured female) × longer than malar space (front view); malar space 0.8–0.9× base of mandible; malar suture absent. Width of hypoclypeal depression 0.95–1.25× as large as distance from depression to eye. Clypeus not separated from face by dorsal carina, clypeal sulcus absent, dorsal clypeal margin sharp. Clypeus prominent, with protruding ventral rim, height of clypeus 0.30–0.45× width of hypoclypeal depression. Maxillary palp as long as eye height.

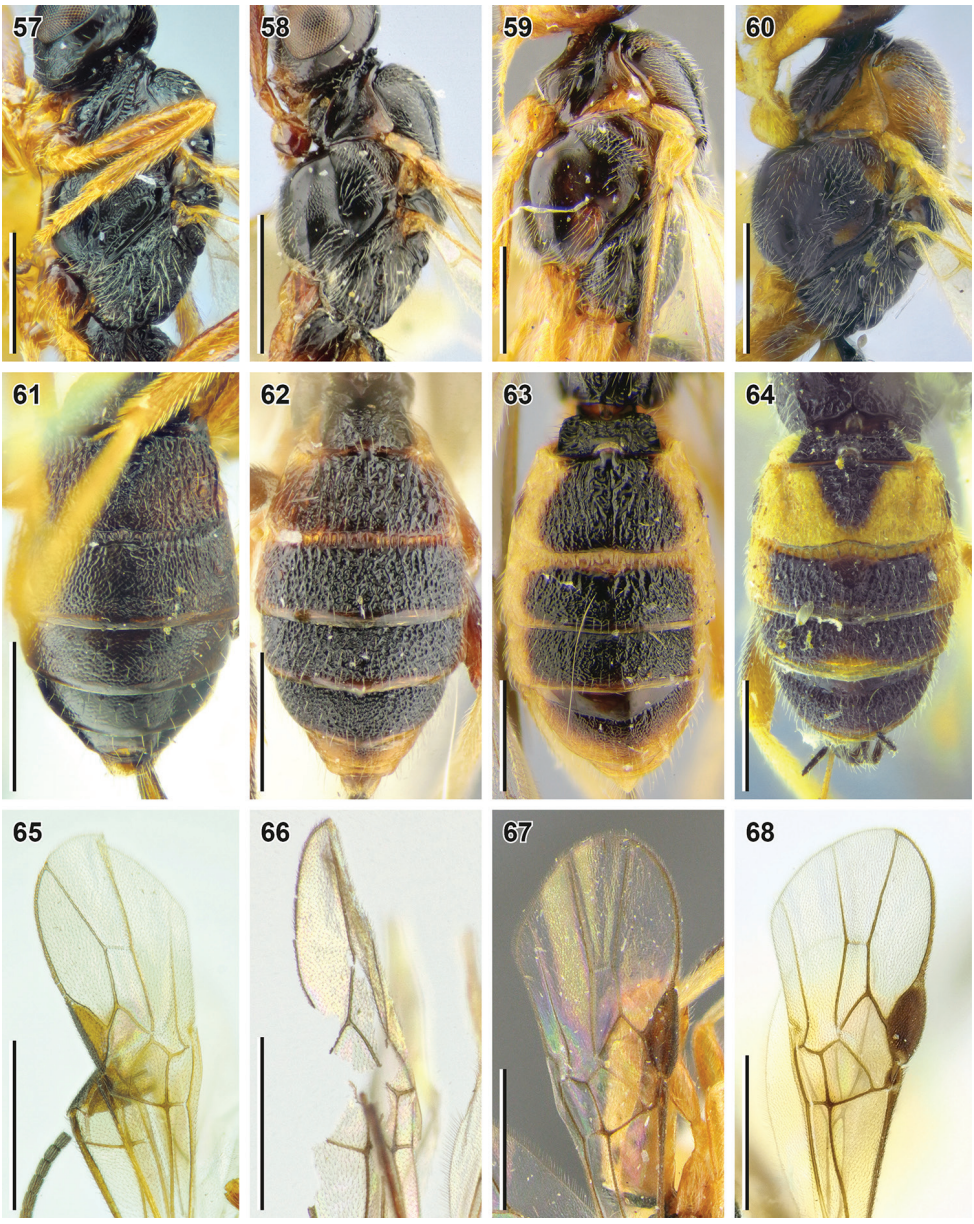
Antenna 0.86–0.91× as long as fore wing, with 24–29 antennomeres. First flagellomere 1.6–2.0× longer than its apical width, 0.95–1.15× as long as second flagellomere. Middle and penultimate flagellomeres 1.3–1.9× and 1.6–2.0× longer than wide, respectively. Apical flagellomere spiculate.

Mesosoma 1.4–1.6× longer than its maximum height. Transverse pronotal sulcus smooth, deep anteriorly and posteriorly, shallow medially. Notauli impressed, not united posteriorly, smooth. Mesoscutum widely setose on notauli and anterolaterally, widely smooth medially and latero-posteriorly. Scutellar sulcus crenulate. Mesepimeral sulcus smooth. Mesopleural pit deep, separated from mesepimeral sulcus. Median area of metanotum with incomplete median carina. Metapleural sulcus smooth or weakly crenulate. Propodeum with simple mid-longitudinal keel in apical third.

Wings. Fore wing 0.95–1.10× as long as body. Pterostigma 2.4–3.6× longer than wide. Vein r arising from basal 0.4–0.5 of pterostigma length. Vein 1-R1 1.3–1.4× longer than pterostigma. Marginal cell 3.5–7.0× longer than distance from its apex to apex of wing. Vein 3-SR 1.6–2.1× longer than vein r, 0.50–0.65× as long as vein SR1, 1.1–1.4× longer than vein 2-SR. Vein 1-M 0.75–0.90× vein 1-SR+M, 1.7–2.3× vein m-cu. 2.5–3.0× longer than vein cu-a. Vein 2-SR+M 0.35–0.55× as long as vein 2-SR, 0.65–0.85× as long as vein m-cu. Vein 1-CU1 (posterior margin of discal cell) 2.6–3.2× longer than vein cu-a. Vein cu-a interstitial. Vein 2-1A of hind wing absent; vein r-m antefurcal.

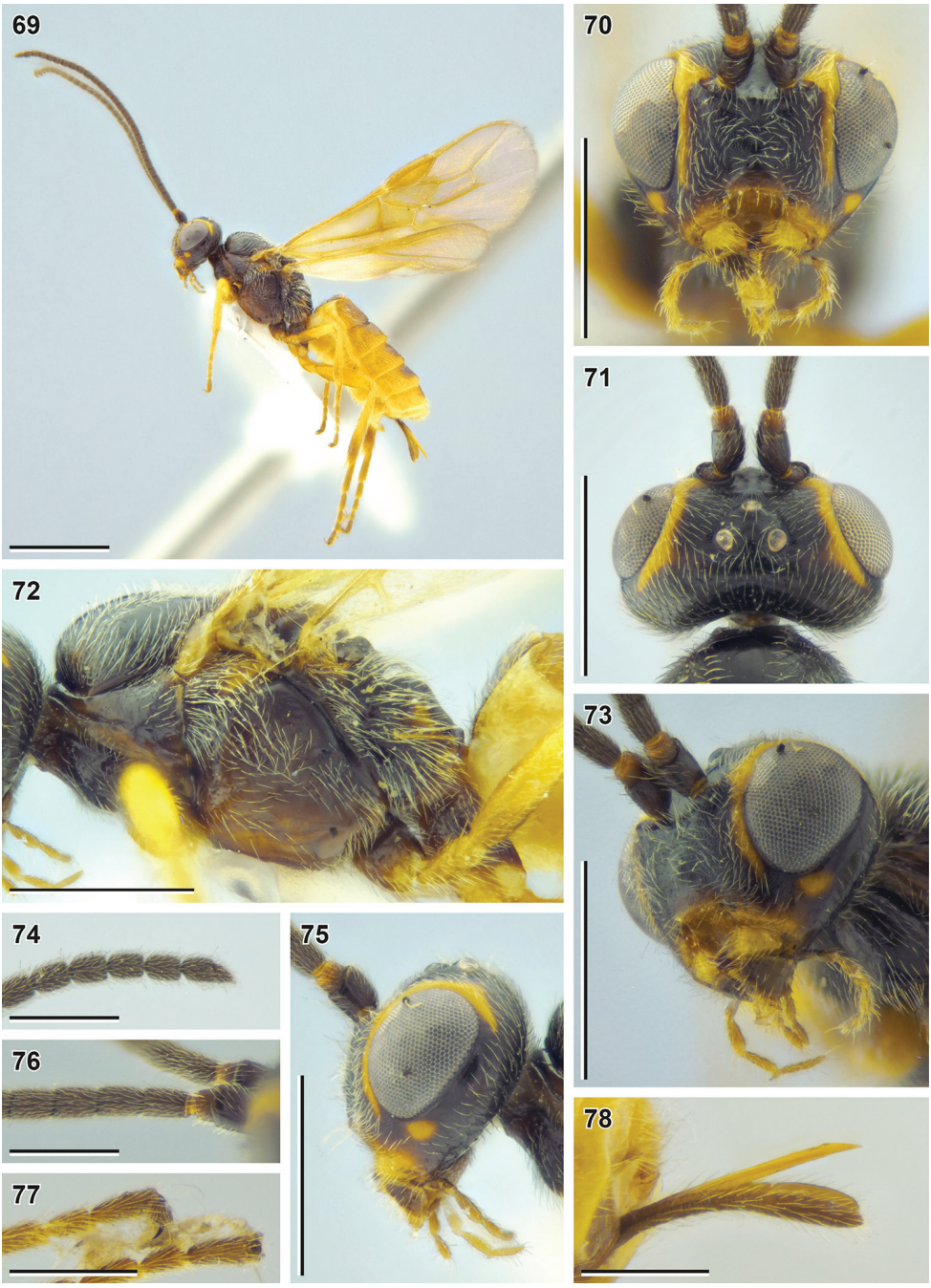
Legs. Fore tibia with thick setae subapically. Hind femur 3.4–4.0× longer than wide. Hind tibia ca. 1.5× longer than hind femur, without subapical row of thick setae, its inner spur 0.40–0.45× as long as hind basitarsus. Hind tarsus 0.87–0.99× as long as hind tibia. Fifth segment (without pretarsus) of hind tarsus 0.40–0.45× as long as hind basitarsus and 0.75–0.85× as long as second segment. Claws with small rectangular basal lobe.

Metasoma 1.2–1.3× longer than mesosoma. Median length of first tergite (measured from petiolar tubercle) 0.90–1.15× as large as its apical width. Dorsal and dorsolateral carinae of first metasomal tergite absent. Median area of first tergite separated

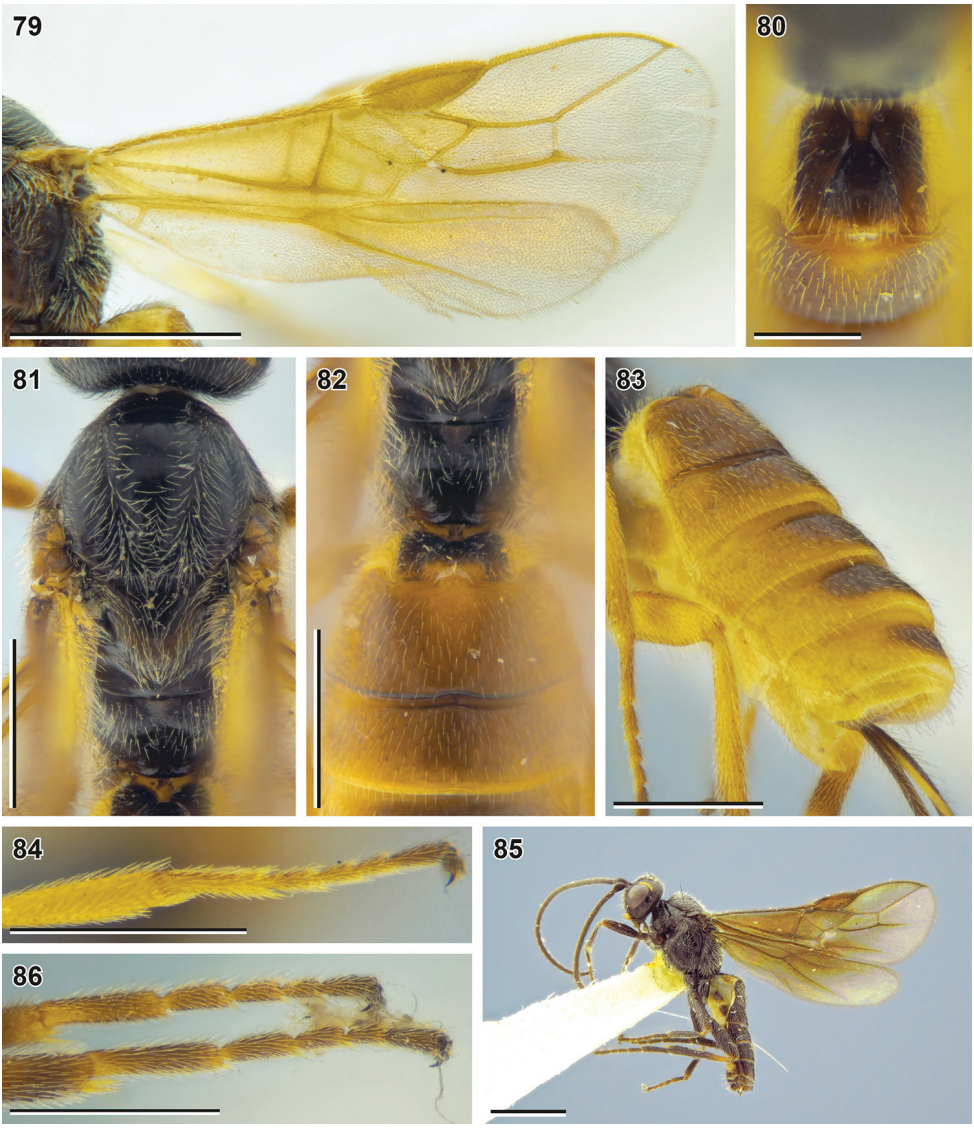


Figures 57–68. *Bracon sculptithorax* Tobias, 2000 (**57, 61, 65** holotype, ZISP), *B. kunashiricus* Tobias, 2000 (**58, 62, 66** holotype, ZISP), *B. sulciferus* Tobias, 2000 (**59, 63, 67** paratype, ZISP) and *B. acunens* Papp, 2018 (**60, 64** female, SMNE **68** holotype, HNHM) **57–60** mesosoma, lateral view **51–64** metasoma, dorsal view **65–68** fore wing apex. Scale bars: 0.5 mm (**57–64**); 1 mm (**65–68**).

by smooth or weakly crenulate furrow, 0.6–0.7× apical width of tergite. Second tergite medially 1.0–1.2× as long as third tergite and 0.9–1.0× as large as apical width of first tergite, without dorsolateral impressions. Basal width of second metasomal tergite 1.3–1.8× larger than its median length. Suture between second and third tergites deep,



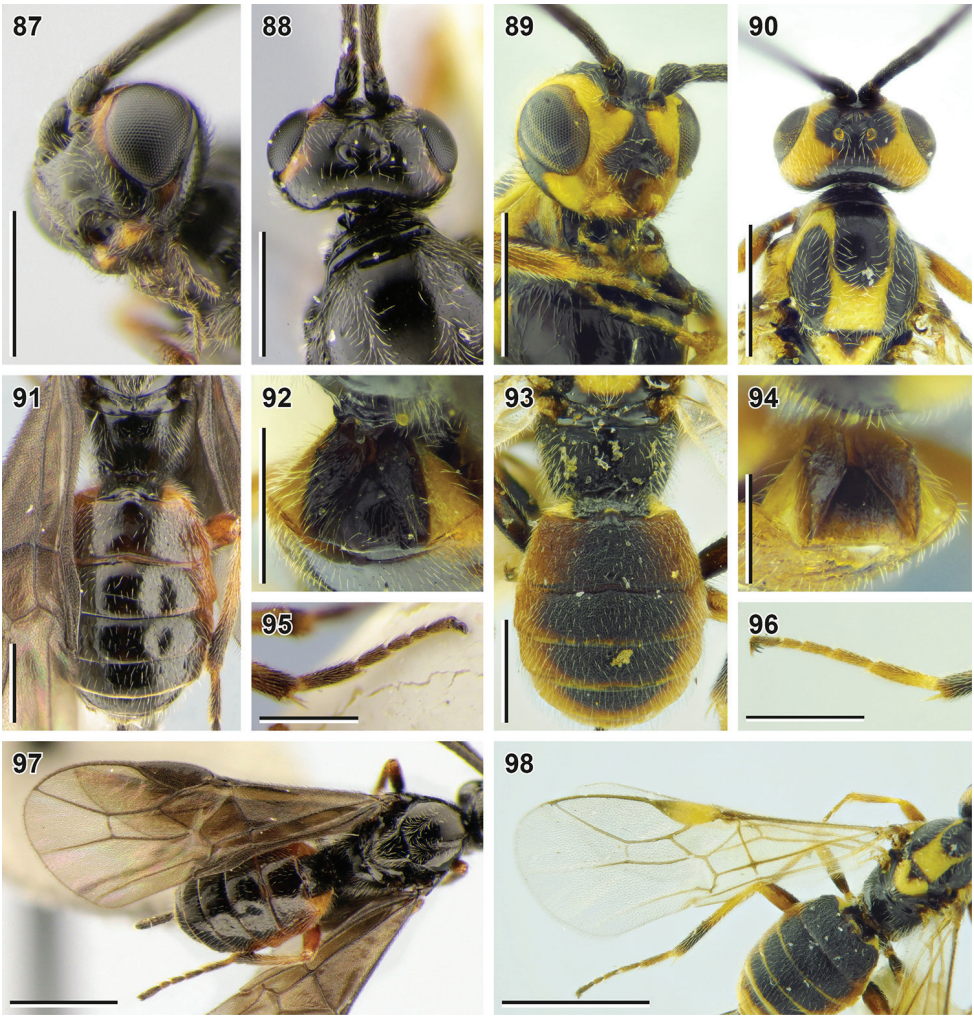
Figures 69–78. *Bracon* (*Habrobracon*) *allevatus* sp. nov. (holotype, NIBR) **69** habitus, lateral view **70** head, front view **71** head, dorsal view **72** mesosoma, lateral view **73** head, ventrolateral view **74** apex of antenna **75** head, lateral view **76** base of antenna **77** apex of hind tarsus **78** ovipositor. Scale bars: 1 mm (**69**); 0.5 mm (**70–73, 75**); 0.25 mm (**74, 76–78**).



Figures 79–85. *Bracon* (*Habrobracon*) *allevatus* sp. nov. (**79–84** holotype, NIBR **85** male paratype, SMNE) **79** wings **80** first metasomal tergite, dorsal view **81** mesosoma, dorsal view **82** propodeum and base of metasoma, dorsal view **83** metasoma, dorsolateral view **84** fore tibia and tarsus **85** habitus, lateral view **86** hind tarsus. Scale bars: 1 mm (**79, 85**); 0.5 mm (**81–84, 86**); 0.25 mm (**80**).

curved and smooth or weakly crenulate. Apical margins of third to sixth tergites thick, without transverse subapical grooves. Ovipositor sheath 0.55–0.65× as long as hind tibia and 0.17–0.20× as long as fore wing. Apex of ovipositor with (sometimes weak) nodus and weak or indistinct ventral serration.

Sculpture. Face granulate, frons weakly granulate, gena hardly coriaceous to smooth. Vertex, most of mesosoma and coxae smooth. Propodeum smooth, sometimes



Figures 87–98. *Bracon kasparyani* Samartsev, 2018 (**87, 91, 97** holotype, ZISP **88, 92, 95** female paratype, ZISP), *Bracon variegator* Spinola, 1808 (**89, 90, 93, 94, 96, 98** female, ZISP) **87, 89** head, ventrolateral view **88, 90** head and mesoscutum, dorsal view **91, 93** metasoma, dorsal view **92, 94** first metasomal tergite, dorsal view **95, 96** hind tarsus **97, 98** fore wing. Scale bars: 1 mm (**97, 98**); 0.5 mm (**87–93, 95, 96**); 0.25 mm (**87–93, 95, 96**).

with short rugae apically. Metasoma entirely smooth or with weak granulate sculpture at most on second tergite.

Colour. Body mainly brownish black, metasomal tergites sometimes brown, ventral side of metasoma pale yellow. Head with yellowish brown patches along eyes on vertex and in lower part of gena, mandible and maxillary palps yellowish brown. Apices of femora and bases of tibiae of all legs (half of hind tibia) brownish yellow. Apical margins of metasomal tergites 3–7 light-coloured. Tegulae dark brown. Wing membrane brownish darkened, lighter apically; pterostigma brown or yellowish brown, with small pale yellow patch basally, wing veins yellowish brown.

Male. Body length 2.0–2.4 mm; fore wing length 2.1–2.5 mm. OOL 1.1–1.3× POL. Mid-longitudinal keel developed on apical half of propodeum. Median length of first tergite (measured from petiolar tubercle) 1.2–1.3× larger than its apical width. Face sometimes smooth medially on narrow area. Maxillary palps brown or brownish yellow. Otherwise similar to female.

Diagnosis. *Bracon allevatus* sp. nov. is most similar to *B. variegator* Spinola. The latter species was classified within the nominative subgenus of *Bracon* (Papp 1968, 2012) or its subgenus *Habrobracon* (Tobias 1986; Tobias and Belokobylskij 2000). It seems best to consider both species in *Habrobracon* because they share a number of characteristic character states (the malar suture is absent; basal lobes of tarsal claws not protruding or acutely protruding (not lamelliform); in the fore wing, the vein 1-SR+M is straight, the vein 3-SR usually is no longer than vein 2-SR (0.6–1.2×), the vein 2-SR+M is long, 0.6–1.2× as long as vein 3-SR; the dorsal carinae of the first metasomal tergite are absent, the lateral carinae are absent or very weakly defined; the ovipositor sheath is at most somewhat longer than the hind tibia, shorter than half of the fore wing length; the granulate sculpture tends to be more or less developed on body). In addition, *Habrobracon* was considered either a separate genus (Quicke 1987; Papp 2012; Kittel and Maeto 2019) or a subgenus of *Bracon* (Tobias 1986; van Achterberg and Polaszek 1996; Tobias and Belokobylskij 2000). Here the latter hypothesis is accepted because a number of very similar species are known in the subgenera *Sculptobracon* (*B. yakui* Watanabe, 1937 and *B. obsoletus* Li, He & Chen, 2016) and *Bracon* s. str. (*B. concavus* species group). Until the differences between the latter taxa and *Habrobracon* are sorted out, we prefer to keep *Habrobracon* as a subgenus of *Bracon*. *B. allevatus* sp. nov. maybe also compared with *B. kasparyani* distributed in the same region. The differences between three species are listed in the key below.

1 Malar suture weakly impressed (Fig. 87). Face (almost) smooth. Notauli deep or impressed anteriorly, smoothened posteriorly (Fig. 88). Claws with acute angularly protruding basal lobe. Vein 2-SR+M 0.2–0.3× as long as vein 2-SR (Fig. 97). Body almost entirely smooth. Dorsolateral carinae of first metasomal tergite distinctly separated (Fig. 92) ..... ***Bracon* (*Bracon*) *kasparyani* Samartsev, 2018**

– Malar suture absent (Figs 73, 89). Face distinctly granulate. Notauli absent or shallowly impressed (Figs 81, 90). Claws with rectangular, not protruding basal lobe (Fig. 84). Vein 2-SR+M 0.35–0.80× as long as vein 2-SR (Figs 79, 98)..... **2**

2 Metasoma entirely, vertex and frons distinctly granulate (Figs 90, 93). Propodeum granulate, without mid-longitudinal keel (Fig. 93). Marginal cell 2.0–3.5× longer than distance from its apex to apex of wing (Fig. 98). Propodeal spiracle located behind middle of propodeum (lateral view). Notauli not impressed (Fig. 90)..... ..... ***B.* (*Habrobracon*) *variegator* Spinola, 1808**

– Metasoma mainly smooth, with weak granulate sculpture only on second tergite (Fig. 80, 82, 83); vertex smooth, frons weakly granulate (Fig. 71). Propodeum smooth, usually with simple mid-longitudinal keel in its apical half (Figs 81, 82). Marginal cell 3.5–7.0× longer than distance from its apex to apex of wing (Fig. 79). Propodeal spiracle located in middle of propodeum (lateral view; Fig. 72). Notauli shallowly impressed (Fig. 81) ..... ***B.* (*H.*) *allevatus* sp. nov.**

***Bracon* (*Osculobracon*) *perspicillatus* sp. nov.**
http://zoobank.org/5AFDBB69-7E49-460D-9A33-A7841DB329D5
Figs 99–114

Type material. ***Holotype.*** South Korea – **Gangwon-do** • female; Goseong-gun, [5] Ganseong-eup, Jinbu-ri; 12 Jun. 1992; D.-S. Ku leg.; 306; NIBR.

Paratypes. 2 females, 4 males. South Korea – **Gangwon-do** • 1 male; same data as for holotype; 307; ZISP • 1 male; same data as for holotype; 308; SMNE • 1 female; Goseong-gun, [4] Geojin-eup, Naengcheon-ri, Geonbongsa Temple; 25 May 1993; D.-S. Ku leg.; 278; SMNE • 2 males; same data as for preceding; 313, 314; SMNE • 1 female; same data as for preceding; 304; ZISP.

Etymology. The name *perspicillatus* (from Latin *perspicillum* for spectacles) refers to a pair of light patches on the face below toruli which characterise the species.

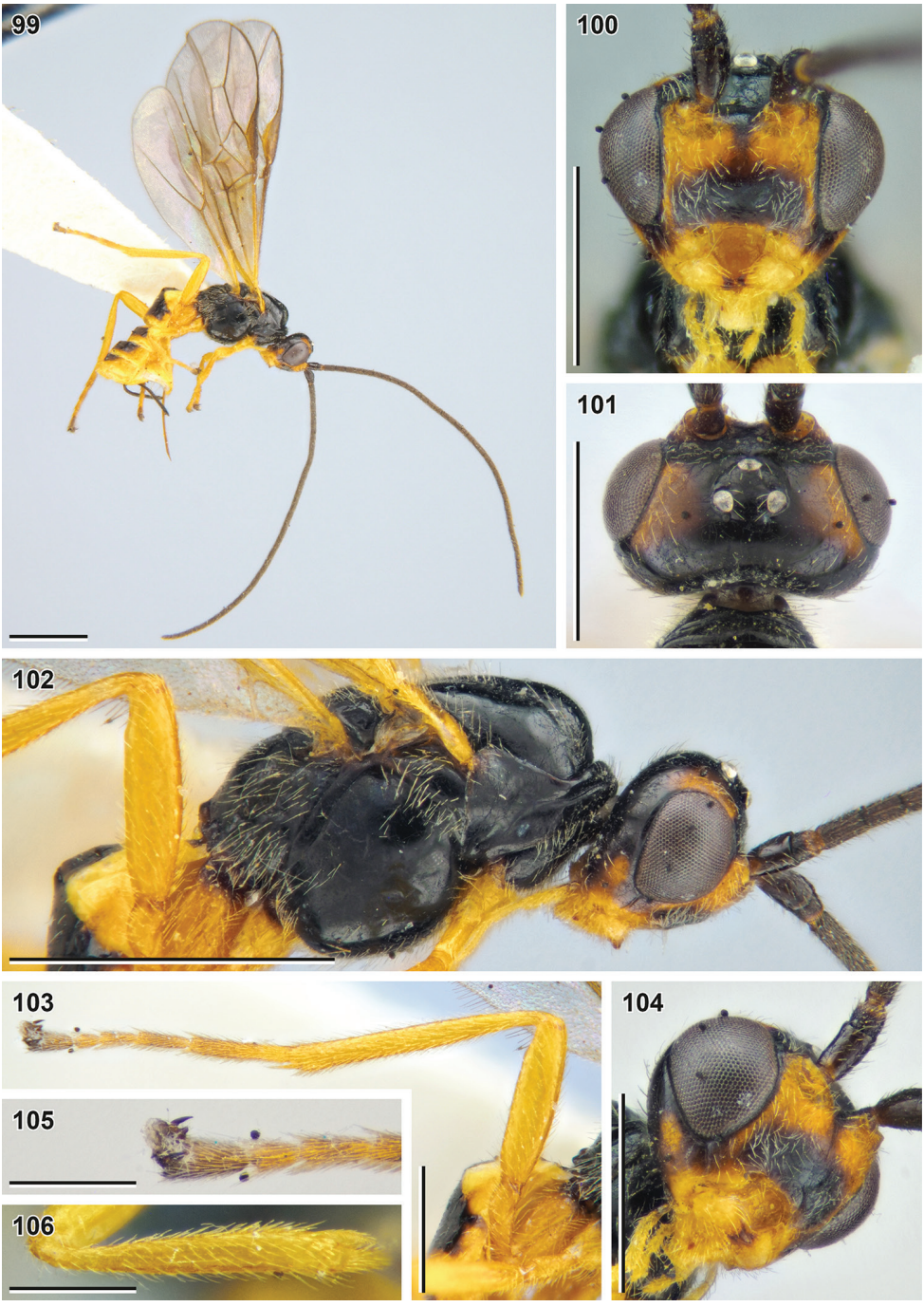
Description. Female. Body length 2.3–3.4 mm; fore wing length 2.6–3.7 mm.

Head. Width of head (dorsal view) 1.8–1.9× its median length. Transverse diameter of eye (dorsal view) 1.7–1.8× longer than temple. Eyes with sparse, short setae. OOL 2.4–3.0× Od; POL 1.3–1.9× Od; OOL 1.5–1.8× POL. Frons with deep mid-longitudinal groove. Longitudinal diameter of eye in lateral view 1.4–1.5× larger than its transverse diameter. Transverse diameter of eye (lateral view) 1.8–2.4× longer than minimum width of temple, hind margins of eye and temple broadened downwards. Face width 1.4–1.5× combined height of face and clypeus; 2.3–2.6× larger than width of hypoclypeal depression. Longitudinal diameter of eye 2.4–2.8× longer than malar space (front view); malar space 0.87–0.92× base of mandible. Malar suture deep and smooth. Width of hypoclypeal depression 1.0–1.3× larger than distance from depression to eye. Clypeus not separated from face by dorsal carina, flattened, with not protruding ventral rim, height of clypeus 0.30–0.35× width of hypoclypeal depression; clypeal sulcus smoothened. Maxillary palp longer than eye, but shorter than head.

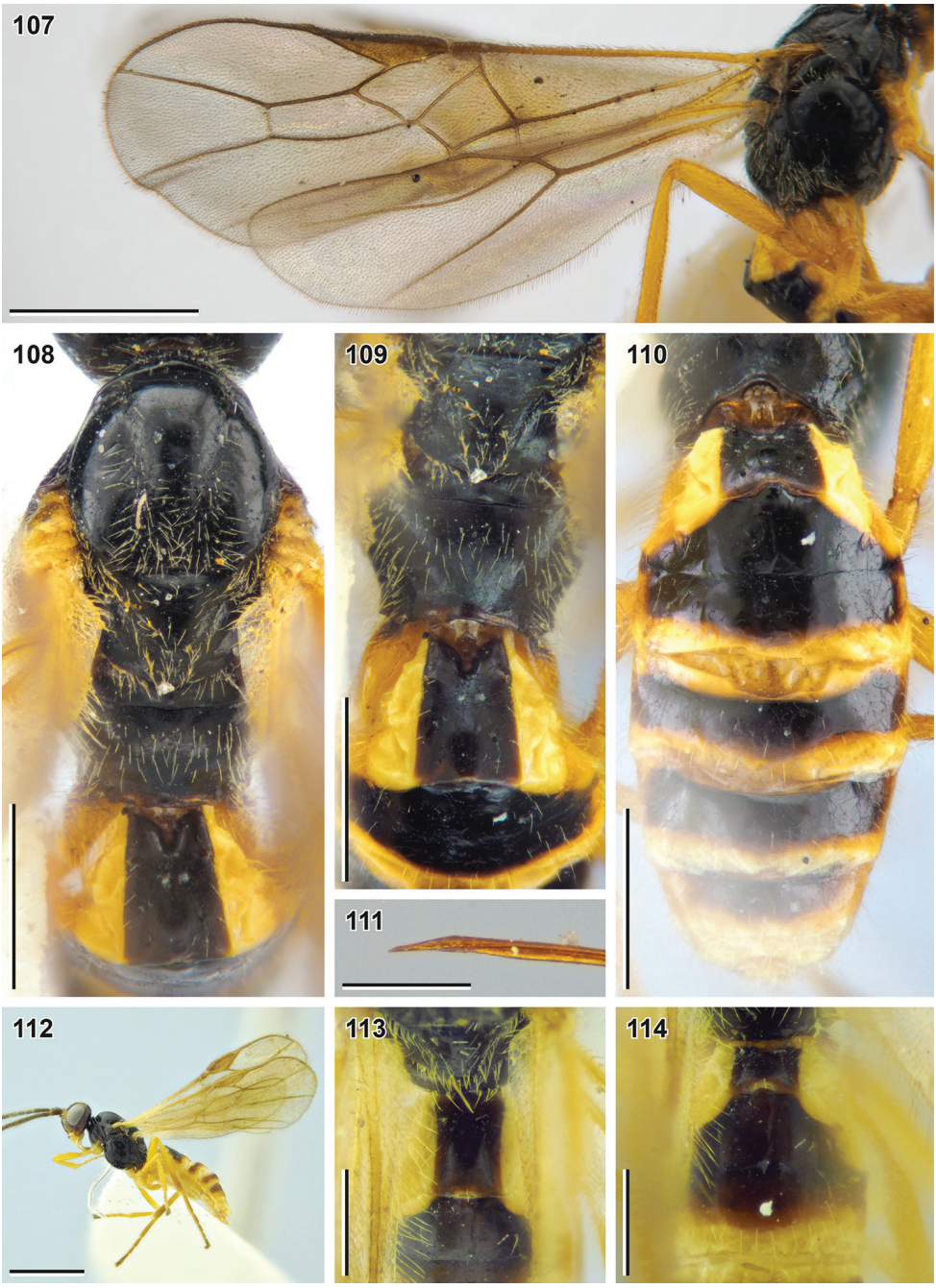
Antenna ca. 1.2× longer than fore wing, with 32–40 antennomeres. First flagellomere 2.0–2.2× longer than its apical width, 1.0–1.1× longer than second flagellomere. Middle and penultimate flagellomeres 1.6–2.0× and 1.8–2.2× longer than wide, respectively. Apical flagellomere spiculate.

Mesosoma ca. 1.6× longer than its maximum height. Transverse pronotal sulcus smoothened. Notauli smooth, impressed anteriorly, smoothened and not united posteriorly. Mesoscutum setose only on notauli. Scutellar, mesepimeral and metapleural sulci smooth, mesopleural pit indistinct. Median area of metanotum with incomplete median carina. Mid-longitudinal keel on propodeum absent.

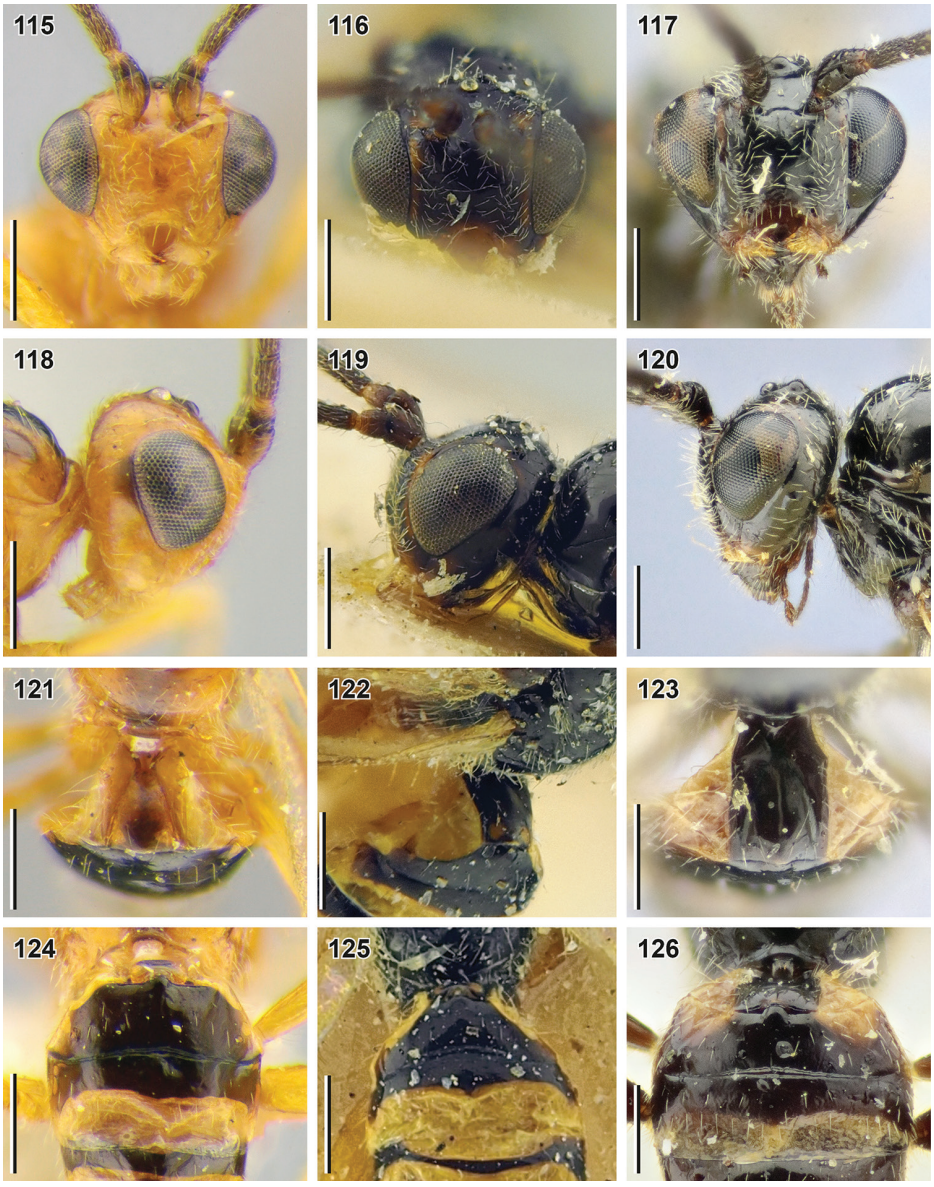
Wings. Fore wing 1.0–1.1× longer than body. Pterostigma 3.2–3.7× longer than wide. Vein r arising from basal 0.40–0.45 of pterostigma length. Vein 1-R1 1.3–1.6× longer than pterostigma. Marginal cell 7.5–9.7× longer than distance from its apex to apex of wing. Vein 3-SR 2.3–2.7× longer than vein r, 0.60–0.65× as long as vein SR1, 1.5–1.7× longer than vein 2-SR. Vein 1-M 0.75–0.85× vein 1-SR+M, 1.5–1.7× vein m-cu. 2.1–2.2× longer than vein cu-a. Vein 2-SR+M 0.16–0.22× as long as vein 2-SR, 0.23–0.38× as long as vein m-cu. Vein 1-CU1 (posterior margin of discal cell)



Figures 99–106. *Bracon* (*Osculobracon*) *perspicillatus* sp. nov. (holotype, NIBR) **99** habitus, lateral view **100** head, front view **101** head, dorsal view **102** head and mesosoma, lateral view **103** hind leg **104** head, ventrolateral view **105** apex of hind tarsus **106** fore tibia. Scale bars: 1 mm (**99, 102**); 0.5 mm (**100, 101, 103, 104**); 0.25 mm (**105, 106**).



Figures 107–114. *Bracon* (*Osculobracon*) *perspicillatus* sp. nov. (**107–111** holotype, NIBR, **112–114** male paratype, SMNE) **107** wings **108** mesosoma, dorsal view **109** propodeum and first metasomal tergite, dorsal view **110** metasoma, dorsal view **111** apex of ovipositor **112** habitus, lateral view **113** first metasomal tergite, dorsal view **114** second and third metasomal tergites, dorsal view. Scale bars: 1 mm (**107, 112**); 0.5 mm (**108–110**); 0.25 mm (**111, 113, 114**).



Figures 115–126. *Bracon* (*Osculobracon*) *koreanus* Papp, 1998 (**115, 118, 121, 124** holotype, HNHM), *B.* (*O.*) *cingulator* Szépligeti, 1901 (**116, 119, 122, 125** holotype, HNHM) and *B.* (*O.*) *osculator* Nees, 1811 (**117, 120, 123, 126** lectotype of *B. coniferarum* Fahringer, 1928, MNB) **115–117** head, front view **118–120** head, lateral view **121–123** first metasomal tergite **124–126** second and third metasomal tergites, dorsal view. Scale bars: 0.25 mm.

2.3–2.8× longer than vein cu-a. Vein cu-a interstitial. Vein 2-1A of hind wing absent or very short; vein r-m strongly antefurcal.

Legs. Fore tibia with sparse longitudinal and dense transverse apical rows of thick setae. Hind femur 3.8–3.9× longer than wide. Hind tibia 1.5–1.7× longer than hind

femur, without subapical row of thick setae, its inner spur 0.23–0.30× as long as hind basitarsus. Hind tarsus 0.95–1.00× as long as hind tibia. Fifth segment (without pretarsus) of hind tarsus 0.45–0.50× as long as hind basitarsus and 0.80–0.85× as long as second segment. Claws with large, protruding and blunt basal lobes.

Metasoma 1.2–1.4× longer than mesosoma. Median length of first tergite (measured from petiolar tubercle) 1.3–1.5× larger than its apical width. Dorsolateral and dorsal carinae of first metasomal tergite absent. Median area of first tergite separated by smooth furrow, 0.6–0.7× apical width of tergite. Second tergite sclerotised in anterior 0.85–0.95, medially 0.9–1.0× as long as third tergite and 0.85–1.05× as large as apical width of first tergite. Basal width of second metasomal tergite 1.8–1.9× larger than its median length. Anterolateral margin of second metasomal tergite shortly de-sclerotised. Suture between second and third tergites thin, shallow, weakly curved and smooth. Apical margins of third to sixth tergites largely de-sclerotised. Ovipositor sheath 0.50–0.75× as long as hind tibia and 0.16–0.21× as long as fore wing. Apex of ovipositor with weak nodus and weak or absent ventral serration.

Sculpture. Body completely smooth.

Colour. Body brownish black or brown. Head with more or less developed brownish yellow patches near eyes (on face, vertex and in lower part of gena), below toruli and on oral parts. Maxillary palps yellow. Tegulae, legs and de-sclerotised parts of metasoma yellow to brownish yellow or yellowish brown. Wing membrane weakly darkened, basally yellowish; pterostigma and wing veins brown or yellowish brown.

Male. Body length 2.1–2.6 mm; fore wing length 2.5–2.7 mm. Width of head (dorsal view) 1.6–1.8× its median length. Transverse diameter of eye (dorsal view) 1.8–2.2× longer than temple. Hind margins of eye and temple less broadened downwards (subparallel). Mesosoma 1.5–1.8× longer than its maximum height. Fore wing vein 3-SR 2.7–2.9× longer than vein r, 0.61–0.74× as long as vein SR1, 1.6–1.9× longer than vein 2-SR. Second tergite sclerotised in anterior 0.75–0.90, its basal width 1.2–1.8× larger than median length. Otherwise similar to female.

Diagnosis. The new species is most similar to *Bracon cingulator* Szépligeti, *B. koreanus* Papp, and *B. osculator* Nees, which also have the entirely smooth body and not shortened marginal cell of the fore wing. The differences between these species are listed in the key below (the characters for *B. cingulator* and *B. osculator* are given on the basis of an unpublished dataset).

1 Median length of first metasomal tergite (measured from spiracle) 0.6–0.9× as large as its apical width (being measured from petiolar tubercle 0.85–1.20× as large as its apical width; Fig. 121). Malar space 0.90–1.05× base of mandible (Fig. 115). Basal width of second metasomal tergite 1.0–1.8× larger than its median length (Fig. 124). Head and most of mesosoma reddish yellow. Pterostigma yellow with brown patch apically. Longitudinal diameter of eye 2.3–2.4× longer than malar space (front view). Second metasomal tergite medially 0.60–0.75× as long as third tergite. Longitudinal diameter of eye 0.85–0.90× as large as face width (front view). Antenna ca. 1.1× longer than fore wing .....
.....***Bracon* (*Osculobracon*) *koreanus* Papp, 1998**

– Median length of first metasomal tergite (measured from spiracle) 0.95–1.15× as large as its apical width (being measured from petiolar tubercle 1.2–1.6× larger than its apical width; Figs 108, 122, 123). Malar space 0.70–0.95× base of mandible (Figs 100, 116, 117). Basal width of second metasomal tergite 1.8–2.8× larger than its median length (Figs 110, 125, 126). Head and most of mesosoma usually black. Pterostigma entirely brown or yellow..... **2**

2 Second metasomal tergite medially 0.9–1.0× as long as third tergite (Fig. 110). Antenna with 32–40 antennomeres, ca. 1.2× longer than fore wing (Fig. 99). Mesosoma ca. 1.6× longer than its maximum height (Fig. 102). Face with light-coloured patches below toruli (Fig. 100). Sclerotised part of third metasomal tergite 0.87–0.95× as long as second metasomal tergite medially. Vein 3-SR 1.5–1.7× longer than vein 2-SR. Longitudinal diameter of eye 2.4–2.8× longer than malar space (front view) ..... ***B.* (*O.*) *perspicillatus* sp. nov.**

– Second metasomal tergite medially 0.70–0.75× as long as third tergite (Figs 125, 126). Antenna with 25–28 antennomeres, 0.97–1.13× as long as fore wing. Mesosoma 1.4–1.5× longer than its maximum height. Face without light-coloured patches below toruli (Figs 116, 117) **3**

3 Median length of first metasomal tergite (measured from spiracle) usually 1.0–1.2× as large as its apical width (Fig. 122). Width of hypoclypeal depression usually 1.15–1.30× as large as distance from depression to eye (Fig. 116). Longitudinal diameter of eye usually 2.9–3.4× longer than malar space (front view). Basal width of second metasomal tergite usually 1.9–2.4× larger than its median length (Fig. 125) ..... ***B.* (*O.*) *cingulator* Szépligeti, 1901**

– Median length of first metasomal tergite (measured from spiracle) usually 0.9–1.0× as large as its apical width (Fig. 123). Width of hypoclypeal depression usually 1.00–1.15× larger than distance from depression to eye (Fig. 117). Longitudinal diameter of eye usually 2.4–2.8× longer than malar space (front view). Basal width of second metasomal tergite usually 2.3–2.8× larger than its median length (Fig. 126) .....***B.* (*O.*) *osculator* Nees, 1811**

Genus *Syntomernus* Enderlein, 1920

Syntomernus Enderlein 1920: 121 (type species: *Syntomernus pusillus* Enderlein, 1920). Shenefelt 1978: 1728; Quicke 1987: 89 (in key); 132; van Achterberg et al. 2009: 664.

Ficobracon van Achterberg & Weiblen, 2000: 52 (type species: *Ficobracon brusi* van Achterberg & Weiblen, 2000). Wei et al. 2013: 466; syn. nov. *Syntomernus brusi* (van Achterberg & Weiblen, 2000), comb. nov.

Remarks. The members of the *Bracon asphondyliae* species group (Maetô 1991) fit well the diagnosis of *Ficobracon*, while the latter genus must be synonymised with the genus *Syntomernus*. Most characters indicated as diagnostic for two latter genera (van Achterberg and Weiblen 2000) show an overlap. The only exception is the difference

in the setosity of mesoscutum (the median lobe of mesoscutum medially setose in *Syntomernus* and glabrous in *Ficobracon*), but this character is not considered strong enough to warrant generic status of *Ficobracon*. In addition, members of the species attributed here to the genus *Syntomernus* parasitise ecologically similar hosts. Braconid wasps of the *asphondyliae* species group attack cecidomiid gall midges (Maetô 1991; Matsuo et al. 2016), *Syntomernus shoreatus* van Achterberg & Ng, 2009 uses larvae inside dipterocarp fruits (van Achterberg et al. 2009), the members of *Ficobracon* have been reared from fig syconia (van Achterberg and Weiblen 2000; Wei et al. 2013) and *Syntomernus kashmirensis* (Maqbool, Akbar & Wachkoo, 2018), comb. nov. is known to be phytophagous on the syconium tissues (Maqbool et al. 2018). The main character separating *Syntomernus* from *Bracon* is the presence of anterolateral areas on third metasomal tergite. The full diagnosis of the genus is presented below.

Diagnosis. ***Head*** transverse, its width (dorsal view) 1.7–2.1× its median length, with transverse diameter of eye 1.7–3.0× longer than temple. Clypeus without or with weak dorsal carina, clypeal sulcus absent, dorsal clypeal margin sharp or smoothened. Vertex without mid-longitudinal sulcus. Malar suture absent or weakly impressed. Hind margins of eye and temple (in lateral view) more or less broadened downwards.

Antenna. Dorsal side of scape (lateral view) longer than its ventral side. Antennae with elongate segments, first flagellomere 2–4× longer than its apical width, middle and penultimate flagellomeres 1.7–2.5× longer than wide.

Mesosoma 1.1–1.5× longer than its maximum height. Median lobe of mesoscutum evenly setose or setose only on notauli and posteriorly. Notauli usually deep anteriorly, smoothened or absent and not united posteriorly. Precoxal sulcus absent or vaguely impressed. Mesopleural pit weak or almost indistinct. Mesepimeral sulcus smooth or weakly crenulate, metapleural sulcus smooth. Propodeum with simple and high mid-longitudinal keel developed at least in its apical half and with mid-longitudinal impression in its basal half.

Legs. Hind tibia without subapical row of thick setae (at most with two thick setae subapically). Claws with moderately large, not protruding (rounded) or angularly protruding (acute or blunt) basal lobe.

Wings. Angle between veins C+SC+R and 1-SR ca. 50–70 degrees. Marginal cell of fore wing not shortened, 7–24× longer than distance from its apex to apex of wing. Vein SR1 distinctly elongate. Vein 3-SR 0.22–0.42× as long as vein SR1, 0.75–1.50× as long as vein 2-SR. Vein 1-SR+M more or less curved anteriorly. Hind wing with basally evenly setose membrane. Vein 2-1A of hind wing absent or very short.

Metasoma with six coarsely sculptured tergites. First metasomal tergite with distinct, often deep crenulate mid-longitudinal impression and more or less developed dorsal and dorsolateral carinae. Second metasomal tergite without anterolateral, posteriorly diverging grooves; with dorsolateral impressions more or less deep, crenulated, usually with strong posteriorly converging carinae along their proximal margin. Median area of second metasomal tergite elongate-triangle or longitudinal, with sharp margin. Spiracle of second metasomal tergite located in middle or behind middle of tergite. Suture between second and third tergites deep and curved. Anterolateral areas of third tergite always developed, large and separated by crenulate suture. Apical mar-

gins of third to sixth tergites thick, with deep crenulate transverse subapical grooves. Ovipositor sheath 1.4–3.6× longer than hind tibia, 0.4–1.0× as long as fore wing. Apex of ovipositor with developed nodus and ventral serration.

A key to the species of the genus *Syntomernus* from Eastern Palaearctic is presented below. *Syntomernus codonatus* and *S. rhiknosus* from the Oriental part of China were also included there while five species described in Chen and Yang (2006) could not be included because the types were not available, and the descriptions are insufficient for inclusion.

1 Ovipositor sheath ca. 0.4× as long as fore wing (Fig. 157). Longitudinal diameter of eye 2.0× longer than malar space (front view; Fig. 158). Vertex weakly granulate. Median lobe of mesoscutum anteriorly evenly setose (Fig. 159) ..... ***Syntomernus pusillus* Enderlein, 1920**

– Ovipositor sheath 0.60–0.95× as long as fore wing (Figs 127, 142, 165, 176). Longitudinal diameter of eye 2.2–3.8× longer than malar space (front view; Figs 128, 143, 164, 169, 175). Vertex smooth. Median lobe of mesoscutum anteriorly glabrous **2**

2 Ovipositor sheath 2.2× longer than hind tibia, 0.6× as long as fore wing (Fig. 142). Third–sixth metasomal tergites rugose (Figs 155, 156). Suture between second and third tergites strongly curved medially. Fifth segment (without pretarsus) of hind tarsus 1.2× longer than second segment (Fig. 148) ..... ***S. scabrosus* sp. nov.**

– Ovipositor sheath 2.7–3.6× longer than hind tibia, 0.67–0.95× as long as fore wing. Third–sixth metasomal tergites with weak papillary-like sculpture or almost smooth (only third tergite longitudinally rugose in some *S. asphondyliae* ; Figs 136, 173, 178). Suture between second and third tergites weakly curved medially **3**

3 Second metasomal tergite medially 0.85–1.05× as long as third tergite (Fig. 166). Basal width of second metasomal tergite 2.2–2.5× larger than its median length. Third and following metasomal tergites (almost) smooth. Frons and vertex black (Fig. 163). – Dorsolateral impressions of second tergite shallow .... ***S. sunosei* (Maeto, 1991), comb. nov. (*B. flaccus* Papp, 1996, syn. nov.)**

– Second metasomal tergite medially 1.1–1.3× longer than third tergite (Figs 136, 173, 178). Basal width of second metasomal tergite 1.3–2.0× larger than its median length. Third and following metasomal tergites distinctly sculptured, with weak papillary-like sculpture. Frons and vertex light-coloured (Figs 131, 170, 174) **4**

4 Fifth segment (without pretarsus) of hind tarsus 0.75–0.95× as long as second segment (Fig. 135) **5**

– Fifth segment (without pretarsus) of hind tarsus 1.0–1.2× longer than second segment (Fig. 172) **6**

5 Antenna with 34–36 antennomeres. Face width 2.1–2.2× larger than width of hypoclypeal depression (Fig. 128). Pterostigma brown with large yellow

patch basally (Fig. 134). Anterolateral areas of second metasomal tergite smooth (Fig. 136). Body entirely yellow. – Antenna 1.0–1.1× longer than fore wing..... ***S. flavus* sp. nov.**

– Antenna with 20–23 antennomeres. Face width ca. 2.5× larger than width of hypoclypeal depression. Pterostigma brown (fig. 7 in Wei et al. 2013). Anterolateral areas of second metasomal tergite rugulose (ibid, fig. 6). Body with developed dark pattern, hind tibia apically and first metasomal tergite black... ..... ***S. codonatus* (Huang & van Achterberg, 2013), comb. nov.**

6 Median area of second metasomal tergite narrower, parallel-sided and weakly elevated (Figs 171, 173); dorsolateral impressions of second tergite weak. Longitudinal diameter of eye 3.4–3.8× longer than malar space (front view; Fig. 169). Malar suture absent. Ovipositor sheath ca. 3× longer than hind tibia ..... ***S. tamabae* (Maeto, 1991), comb. nov.**

– Median area of second metasomal tergite wider, elongate-triangle and strongly elevated (Figs 177, 178; fig. 25 in Wei et al. 2013); dorsolateral impressions deep. Longitudinal diameter of eye 2.4–3.0× longer than malar space (front view; Fig. 175). Malar suture usually weakly impressed. Ovipositor sheath 3.3–3.6× longer than hind tibia 7

7 Vein 3-SR 0.94–1.17× as long as vein 2-SR (Fig. 176). Vein 2-SR 1.8–2.0× longer than vein r..... ***S. asphondyliae* (Watanabe, 1940), comb. nov.**

– Vein 3-SR ca. 1.5× longer than vein 2-SR (fig. 22 in Wei et al. 2013). Vein 2-SR ca. 1.1× longer than vein r..... .....***S. rhiknosus* (Huang & van Achterberg, 2013), comb. nov.**

***Syntomernus flavus* sp. nov.**

http://zoobank.org/D0039386-8036-49EB-BDE3-F80D39FF1FA9

Figs 127–141

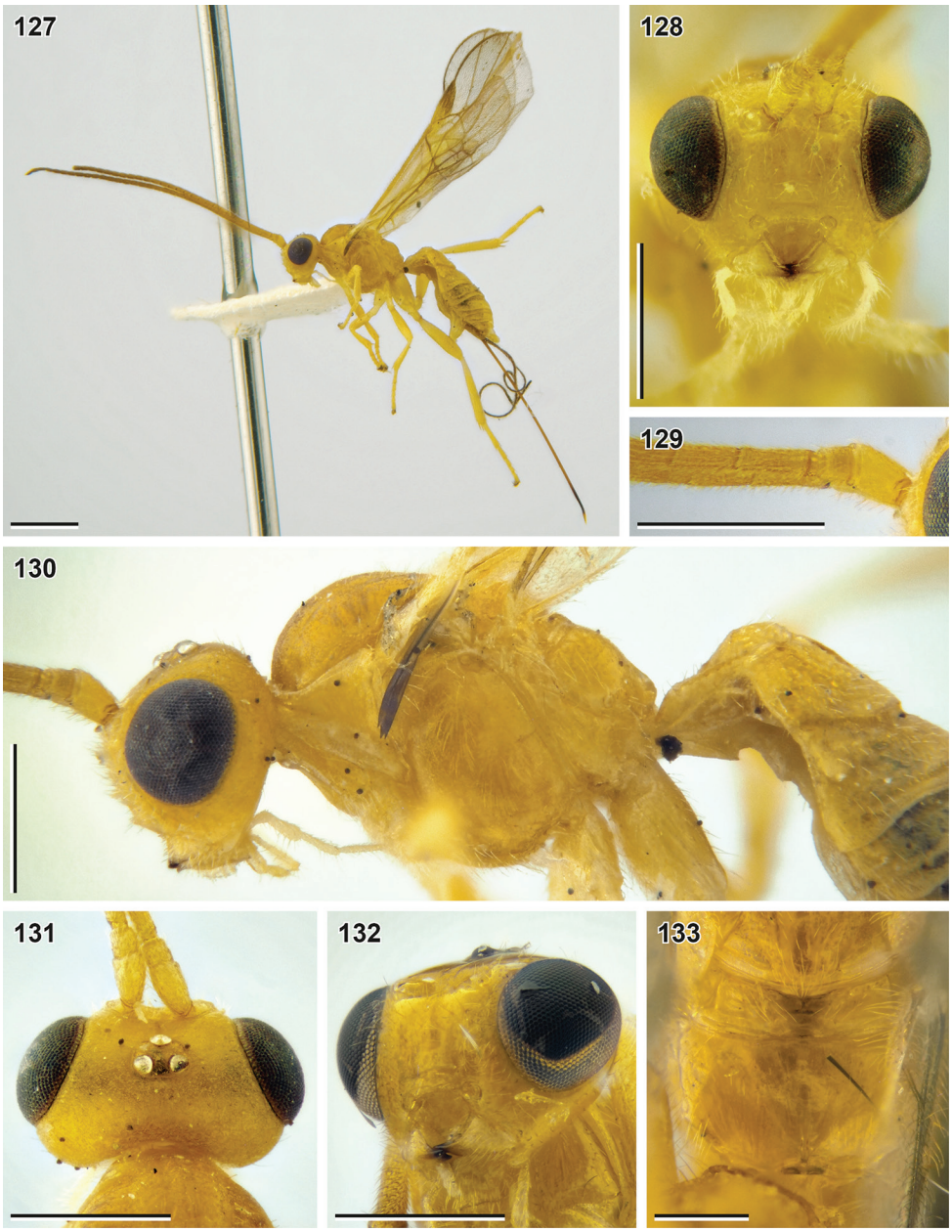
Type material. ***Holotype.*** South Korea – **Gyeonggi-do** • female; Gapyeong-gun, [14] Cheongpyeong-myeon, Cheongpyeong-ri, Cheongpyeong Amusement Park; 14 Jun. 1992; D.-S. Ku leg.; 541; NIBR.

Paratypes. 3 females, 1 male. South Korea – **Gangwon-do** • 1 female; Yeongwol-gun, [11] Kimsatgat-myeon, Nae-ri, Town Gijeon; 28 May 1998; Jeong-Gyu Kim leg.; 20; SMNE. – **Gyeonggi-do** • 1 female; Suwon-si, [15] Gwonseon-gu, Seodun-dong, Yeogisan Mountain; 14 Aug. 1995; J.Y. Choi leg.; Malaise trap; 1201; SMNE. – **Gyeongsangnam-do** • 1 female; Geochang-gun, [26] Geochang-eup, Songjeong-ri; 35.6712, 127.885; 3 Jun. 2019; K. Samartsev leg.; forest on a mountain; B0080; ZISP • 1 male; Geoje-si, [30] Dongbu-myeon, Hakdong-ri; 23 Jun. 1990; D.-S. Ku leg.; 18; SMNE.

Etymology. The Latin *flavus* for (pale) yellow refers to entirely light-coloured body characterising the new species.

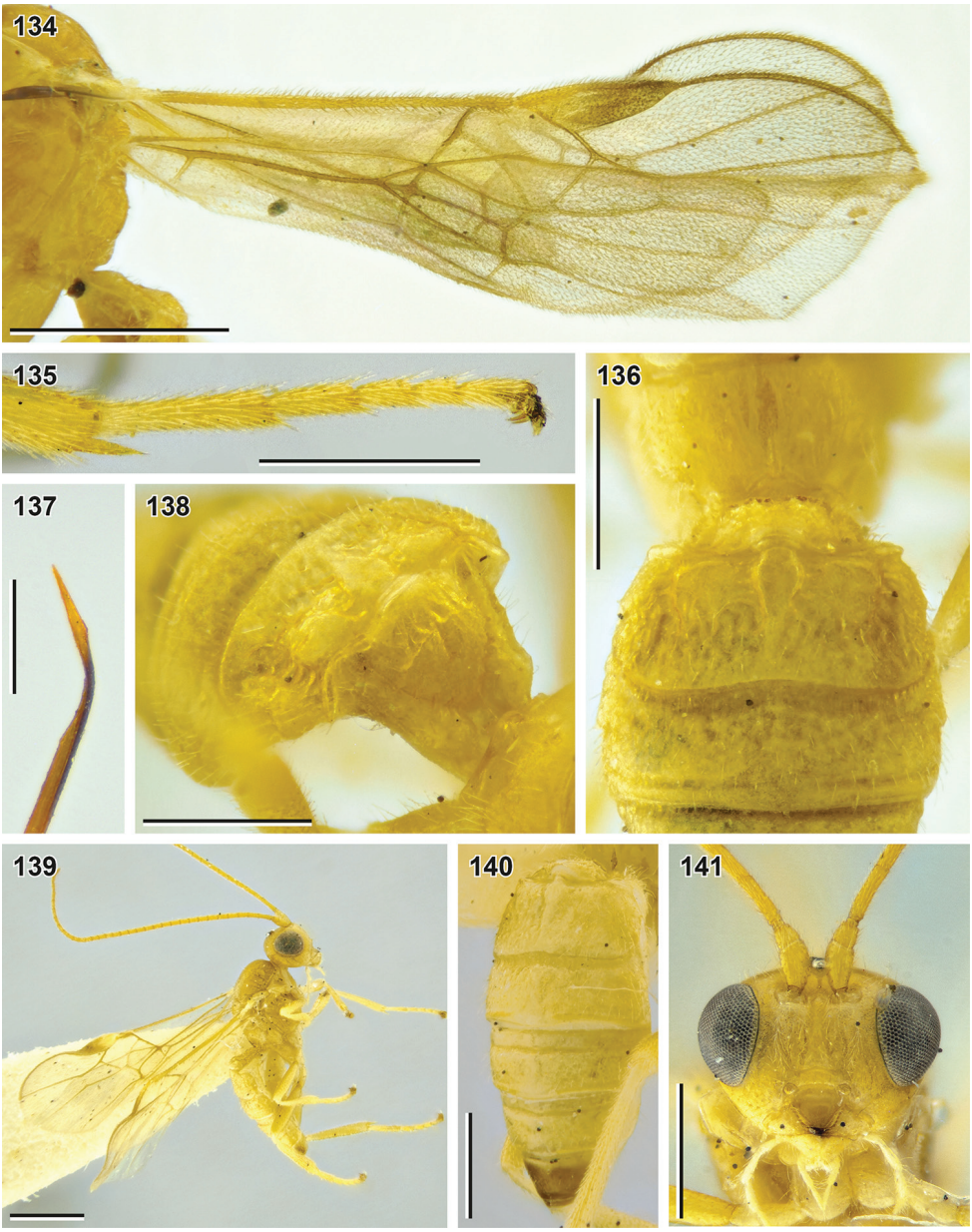
Description. Female. Body length 3.3–3.8 mm; fore wing length 3.9–4.0 mm.

Head. Width of head (dorsal view) 2.0–2.1× its median length. Transverse diameter of eye (dorsal view) 2.2–2.8× longer than temple. Eyes with sparse, short setae. OOL



Figures 127–133. *Syntomernus flavus* sp. nov. (**127–131** holotype, NIBR **132, 133** paratype, female, SMNE) **127** habitus, lateral view **128** head, front view **129** base of antenna **130** head and mesosoma, lateral view **131** head, dorsal view **132** head, ventrolateral view **133** propodeum, dorsal view. Scale bars: 1 mm (**127**); 0.5 mm (**128–132**); 0.25 mm (**133**).

2.7–3.1× Od; POL 1.0–1.1× Od; OOL 2.5–2.8× POL. Frons with deep mid-longitudinal groove. Longitudinal diameter of eye in lateral view 1.2–1.3× larger than its transverse diameter. Transverse diameter of eye (lateral view) 2.2–2.9× longer than minimum



Figures 134–141. *Syntomernus flavus* sp. nov. (**134–136** holotype, NIBR **139–141** male paratype, SMNE) **134** wings **135** hind tarsus **136** second and third metasomal tergites, dorsal view **137** apex of ovipositor **138** first and second metasomal tergites, dorsolateral view **139** habitus, lateral view **140** metasoma, dorsolateral view **141** head, front view. Scale bars: 1 mm (**134, 139**); 0.5 mm (**135–138, 140, 141**); 0.25 mm (**137**).

width of temple, hind margins of eye and temple parallel to broadened downwards. Face width 1.3–1.5× combined height of face and clypeus; 2.1–2.2× larger than width of hypoclypeal depression. Longitudinal diameter of eye 2.5–2.7× longer than malar space

(front view); malar space 0.85–0.92× base of mandible. Malar suture absent. Width of hypoclypeal depression 1.1–1.2× larger than distance from depression to eye. Clypeus separated from face by weak dorsal carina, flattened, with protruding ventral rim, height of clypeus 0.3–0.4× width of hypoclypeal depression, clypeal sulcus absent, dorsal clypeal margin sharp. Maxillary palp longer than eye, but shorter than head.

Antenna 1.0–1.1× longer than fore wing, with 34–36 antennomeres. First flagellomere 3.0–3.2× longer than its apical width, 1.2–1.3× longer than second flagellomere. Middle and penultimate flagellomeres 1.8–1.9× and 1.9–2.1× longer than wide, respectively. Apical flagellomere spiculate.

Mesosoma 1.4× longer than its maximum height. Transverse pronotal sulcus smooth, deep anteriorly and posteriorly, smoothened medially. Notauli deep anteriorly, smoothened or absent posteriorly, not united. Mesoscutum setose on notauli and medio-posteriorly, anteromedially widely glabrous. Scutellar sulcus crenulate. Mesepimeral sulcus smooth or weakly crenulate, mesopleural pit weak, furrow-like. Median area of metanotum (dorsal view) with incomplete median carina. Metapleural sulcus smooth. Mid-longitudinal keel developed in apical half of propodeum, simple and high. Propodeal spiracle round, located behind middle of propodeum.

Wings. Fore wing 1.1–1.2× longer than body. Pterostigma 3.1–3.7× longer than wide. Vein r arising from basal 0.35–0.40 of pterostigma. Vein 1-R1 1.4–1.6× longer than pterostigma. Marginal cell 10–25× longer than distance from its apex to apex of wing. Vein 3-SR 1.4–2.1× longer than vein r, 0.24–0.27× as long as vein SR1, 0.8–1.1× as long as vein 2-SR. Vein 1-M 0.65–0.70× vein 1-SR+M, 1.9–2.5× vein m-cu. 1.9–2.4× longer than vein cu-a. Vein 2-SR+M 0.10–0.25× as long as vein 2-SR, 0.25–0.50× as long as vein m-cu. Vein 1-CU1 (posterior margin of discal cell) 2.8–3.6× longer than vein cu-a. Vein cu-a interstitial or weakly postfurcal. Vein 2-1A of hind wing absent or very short; vein r-m weakly antefurcal.

Legs. Fore tibia with weakly thickened longitudinal and transverse apical rows of long setae. Hind femur 3.8–4.2× longer than wide. Hind tibia 1.3× longer than hind femur, without subapical row of thick setae, its inner spur 0.4–0.5× as long as hind basitarsus. Hind tarsus 0.90–0.95× as long as hind tibia. Fifth segment (without pretarsus) of hind tarsus 0.40–0.45× as long as hind basitarsus and 0.87–0.94× as long as second segment. Claws with large, protruding and blunt basal lobes.

Metasoma 1.2–1.4× longer than mesosoma. Median length of first tergite (measured from petiolar tubercle) 0.75–0.90× as large as its apical width. Dorsolateral carinae of first metasomal tergite developed, dorsal carinae complete. Median area of first tergite separated by rugose furrow, 0.6–0.7× apical width of tergite, with distinct mid-longitudinal impression. Second tergite medially 1.1–1.2× longer than third tergite and 0.65–0.85× as large as apical width of first tergite. Basal width of second metasomal tergite 1.7–2.0× larger than its median length. Median area of second tergite strongly elevated, elongate triangular, with sharp crenulate margin. Anterolateral areas of second tergite wide, transverse, rounded, weakly elevated, with crenulated margin. Dorsolateral impressions of second tergite deep, s-shaped, crenulated. Spiracle of second metasomal tergite located in middle of tergite. Suture between second and third tergites deep and wide, curved and rugose. Apical margins of third to sixth tergites

thick, with deep, weakly crenulate transverse subapical grooves. Ovipositor sheath 2.7–3.1× longer than hind tibia and 0.79–0.86× as long as fore wing. Apex of ovipositor with developed nodus and ventral serration.

Sculpture. Most of head and mesosoma smooth. Face weakly granulate; gena smooth or weakly granulate in lower part, malar space granulate, frons smooth or weakly granulate. First metasomal tergite laterally smooth, its median area posteriorly rugose. Second tergite medially areolate-rugose, with smooth hind margin and elevated areas. Third–sixth tergites with weak papillary-like sculpture.

Colour. Body brownish yellow. Scape yellow, flagellum yellowish brown, apically darkening. Maxillary palps, fore coxa and tegulae pale yellow or yellow. Wing membrane weakly darkened, darker apically; pterostigma brown with large yellow patch basally, wing veins yellowish brown.

Male. Body length 3.2 mm; fore wing length 3.3 mm. Longitudinal diameter of eye 2.2× longer than malar space (front view); malar space 0.8× base of mandible. Antenna 1.3× longer than fore wing, with 35 antennomeres. First flagellomere 4.1× longer than its apical width. Middle flagellomeres 2.5× longer than wide. Pterostigma 2.4× longer than wide. Median length of first tergite (measured from petiolar tubercle) 0.95× as large as its apical width.

Diagnosis. The new species is remarkable by the light colouration of body, basally yellow and apically brown pterostigma, weakly sculptured elevated areas of second metasomal tergite and glabrous median lobe of mesoscutum.

***Syntomernus scabrosus* sp. nov.**

http://zoobank.org/3ADBA024-0B63-4636-A909-C99333A5E75B

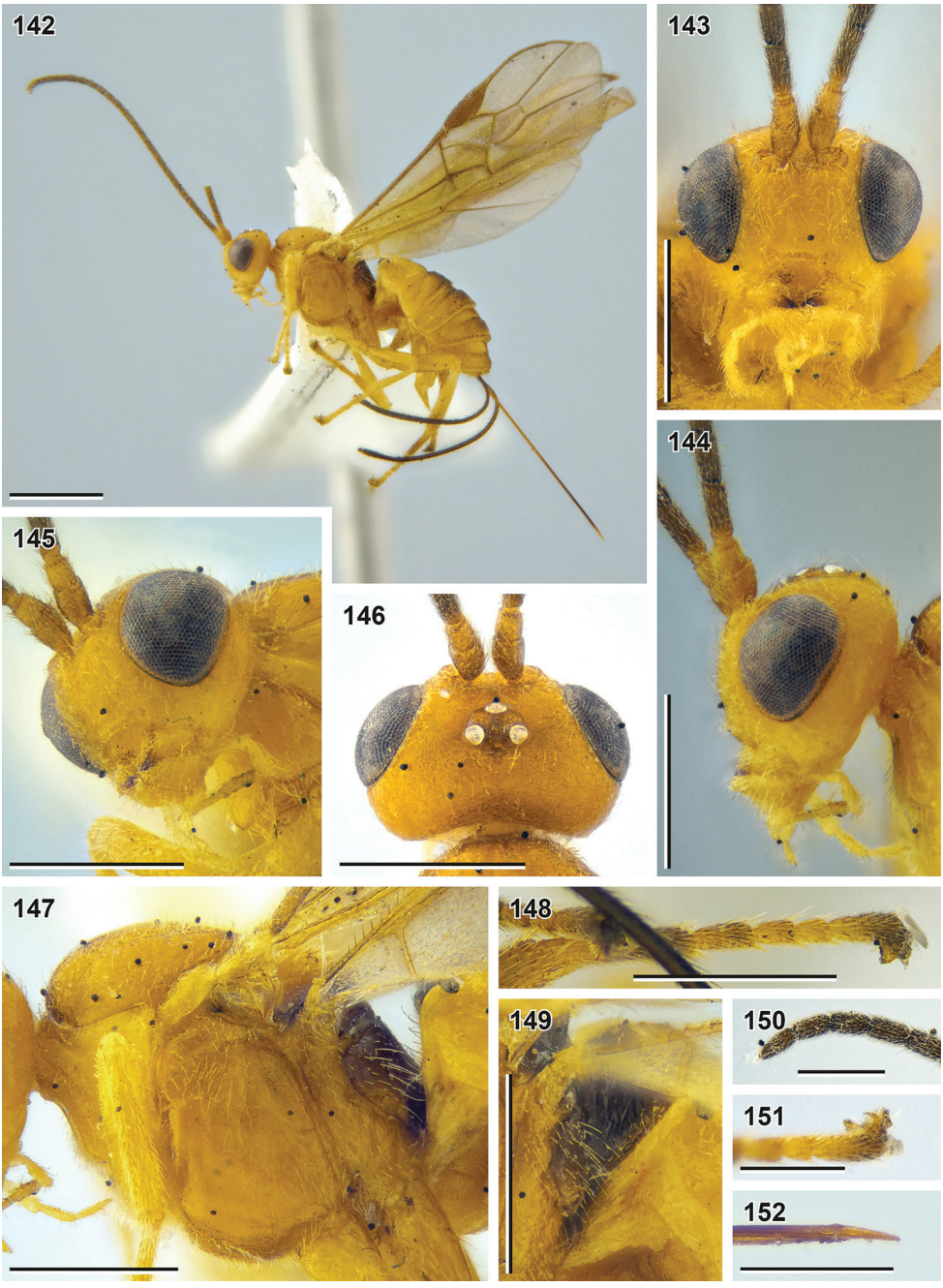
Figs 142–156

Type material. ***Holotype.*** South Korea – **Gangwon-do** • 1 female; Yeongwol-gun, [12] Kimsatgat-myeon, Nae-ri, Town Gijeon; 28 May 1998; Jeong-Gyu Kim leg.; 540; NIBR.

Etymology. The adjective *scabrosus* (Latin for scabrous) refers to the roughly sculptured metasoma of the species.

Description. Female. Body length 3.1 mm; fore wing length 3.7 mm.

Head. Width of head (dorsal view) 1.7× its median length. Transverse diameter of eye (dorsal view) 2.0× longer than temple. Eyes with sparse, short setae. OOL 2.4× Od; POL 1.2× Od; OOL 2.1× POL. Frons with deep mid-longitudinal groove. Longitudinal diameter of eye in lateral view 1.4× larger than its transverse diameter. Transverse diameter of eye (lateral view) 1.9× longer than minimum width of temple, hind margins of eye and temple parallel to broadened downwards. Face width 1.3× combined height of face and clypeus; 2.0× larger than width of hypoclypeal depression. Longitudinal diameter of eye 2.9× longer than malar space (front view); malar space 0.75× base of mandible. Malar suture absent. Width of hypoclypeal depression 1.3× larger than distance from depression to eye. Clypeus not separated from face by dorsal carina, flattened, with strongly protruding ventral rim, height of clypeus 0.32× width



Figures 142–152. *Syntomernus scabrosus* sp. nov. (holotype, NIBR) **142** habitus, lateral view **143** head, front view **144** head, lateral view **145** head, ventrolateral view **146** head, dorsal view **147** mesosoma, lateral view **148** hind tarsus **149** first metasomal tergite **150** apex of antenna **151** apex of hind tarsus **152** apex of ovipositor. Scale bars: 1 mm (**142**); 0.5 mm (**143–149**); 0.25 mm (**150–152**).

of hypoclypeal depression, clypeal sulcus smoothened. Maxillary palp longer than eye, but shorter than head.

Antenna 0.87× as long as fore wing, with 26 antennomeres. First flagellomere 2.5× longer than its apical width, 1.1× longer than second flagellomere. Middle and penultimate flagellomeres 1.7× and 2.0× longer than wide, respectively. Apical flagellomere spiculate.

Mesosoma 1.3× longer than its maximum height. Transverse pronotal sulcus deep and smooth. Notauli smooth, deep anteriorly, smoothened and not united posteriorly. Mesoscutum widely setose on notauli and anterolaterally, medially and latero-posteriorly widely glabrous. Scutellar sulcus crenulate. Mesepimeral sulcus smooth, mesopleural pit weak, furrow-like. Median area of metanotum (dorsal view) with incomplete median carina. Metapleural sulcus smooth. Mid-longitudinal keel developed in apical half of propodeum, simple and high. Propodeal spiracle vertical, located in middle of propodeum.

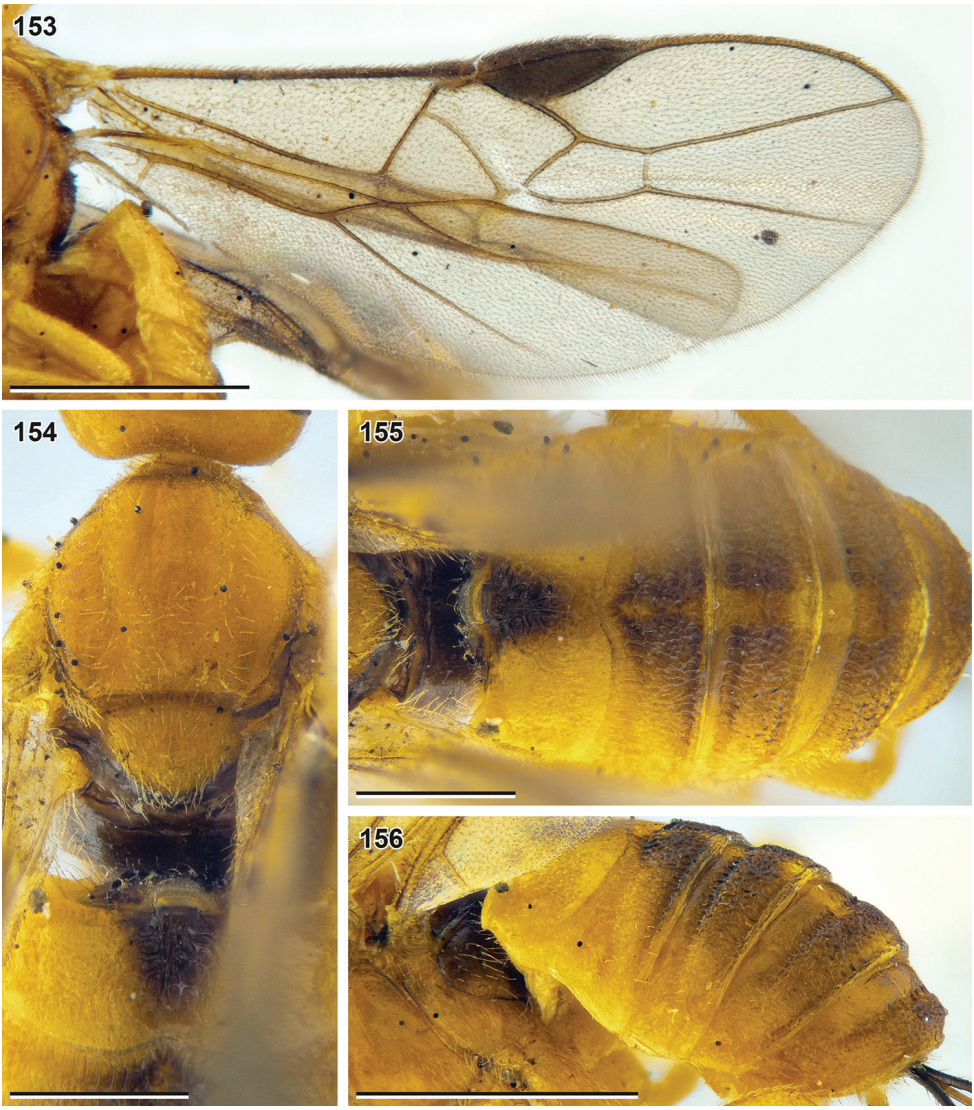
Wings. Fore wing 1.2× longer than body. Pterostigma 2.6× longer than wide. Vein r arising from basal 0.38 of pterostigma. Vein 1-R1 1.6× longer than pterostigma. Marginal cell 8.3× longer than distance from its apex to apex of wing. Vein 3-SR 1.3× longer than vein r, 0.26× as long as vein SR1, 0.83× as long as vein 2-SR. Vein 1-M 0.67× vein 1-SR+M, 2.1× vein m-cu, 1.8× longer than vein cu-a. Vein 2-SR+M 0.21× as long as vein 2-SR, 0.48× as long as vein m-cu. Vein 1-CU1 (posterior margin of discal cell) 2.5× longer than vein cu-a. Vein cu-a interstitial. Vein 2-1A of hind wing very-very short; vein r-m strongly antefurcal.

Legs. Fore tibia with longitudinal and transverse apical rows of thick setae. Hind femur 3.5× longer than wide. Hind tibia 1.4× longer than hind femur, with 2 thick setae subapically, its inner spur 0.4× as long as hind basitarsus. Hind tarsus 0.85× as long as hind tibia. Fifth segment (without pretarsus) of hind tarsus 0.6× as long as hind basitarsus and 1.2× longer than second segment. Claws with protruding blunt basal lobe.

Metasoma 1.4× longer than mesosoma. Dorsolateral carinae of first metasomal tergite developed, dorsal carinae complete. Median area of first tergite separated by rugose furrow. First metasomal tergite with deep, crenulate mid-longitudinal impression. Second tergite medially 1.1× longer than third tergite. Basal width of second metasomal tergite 2.3× larger than its median length. Median area of second tergite weakly elevated, elongate triangular, separated by crenulate furrows, with complete sharp margin. Anterolateral areas of second tergite weakly elevated, with smoothened sculpture. Dorsolateral impressions of second tergite deep, s-shaped, crenulated. Spiracle of second metasomal tergite located behind middle of tergite. Suture between second and third tergites deep and wide, strongly curved and rugose. Apical margins of third to sixth tergites thick, with deep, crenulate transverse subapical grooves. Ovipositor sheath 2.2× longer than hind tibia and 0.6× as long as fore wing. Apex of ovipositor with developed nodus and ventral serration.

Sculpture. Most of head and mesosoma smooth. Face weakly granulate, malar space granulate. First metasomal tergite laterally rugose, its median area weakly rugulose to rugose. Second–sixth tergites rugose.

Colour. Head, scape, most of mesosoma and ground colour of legs and metasoma brownish yellow. Malar space, maxillary palps, pronotum laterally, tegulae, fore and

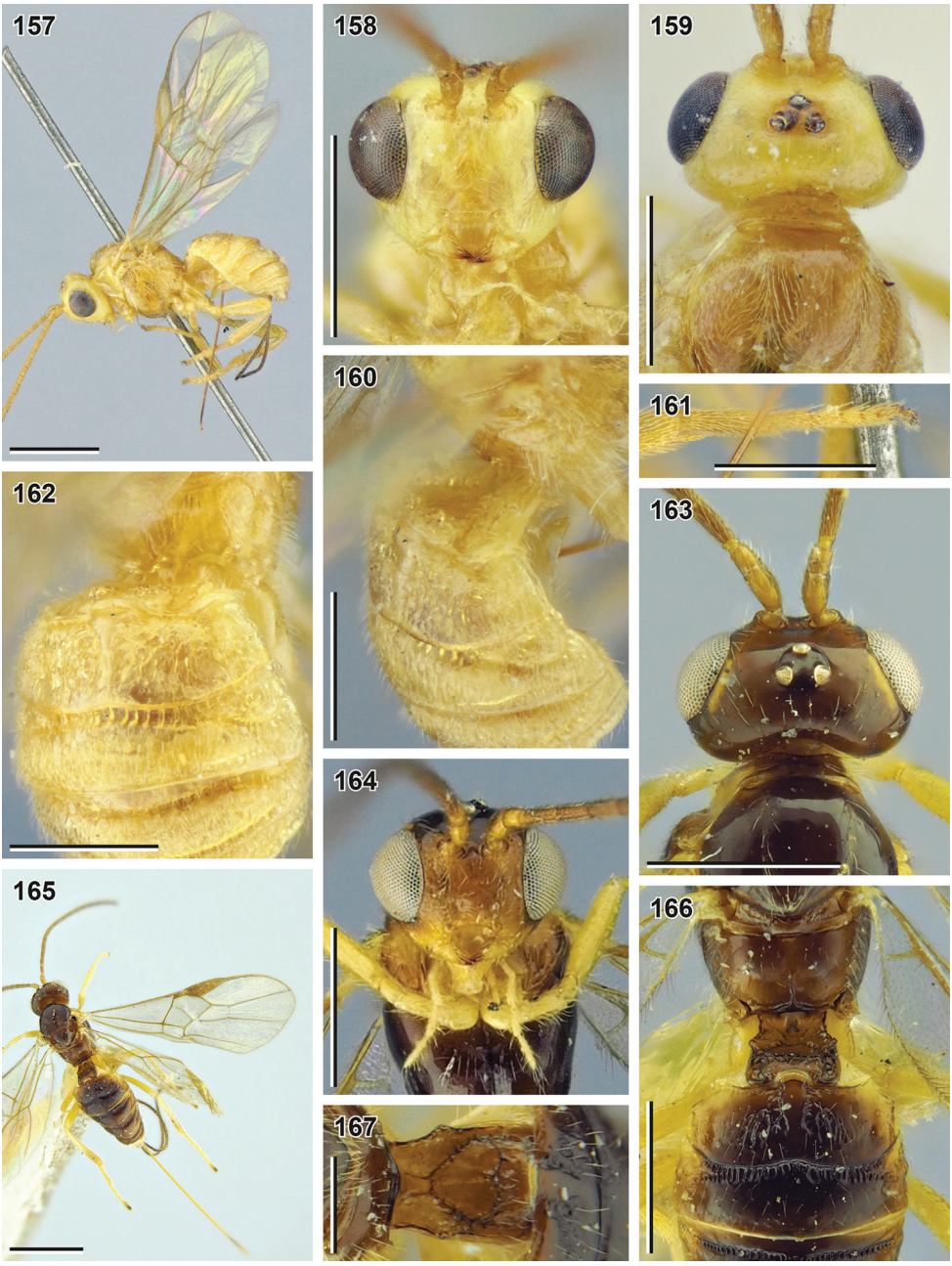


Figures 153–156. *Syntomernus scabrosus* sp. nov. (holotype, NIBR) **153** wings **154** mesosoma, dorsal view **155** metasoma, dorsal view **156** metasoma, dorsolateral view. Scale bars: 1 mm (**153, 156**); 0.5 mm (**154, 155**).

most of middle leg, basal part of hind tibia yellow. Flagellum, apices of tarsi of legs, apex of hind tibia, hind basitarsus and third–sixth metasomal tergites brown. Metanotum, propodeum, first metasomal tergite and anteromedian patch on second metasomal tergite dark brown. Wing membrane weakly darkened; pterostigma and veins brown.

Male. Unknown.

Diagnosis. The new species is easily recognisable by the entirely rugose metasoma, relatively short ovipositor, and enlarged fifth segment of the hind tarsus.



Figures 157–166. *Syntomernus pusillus* Enderlein, 1920 (**159–162** lectotype, MIIZ) and *S. sunosei* (Maeto, 1991) (**163–167** holotype of *Bracon flaccus* Papp, 1996, HNHM) **157** habitus, lateral view **158, 164** head, front view **159, 163** head, dorsal view **162, 160** propodeum and first–third metasomal tergites, dorsolateral view **161** hind tarsus **165** habitus, dorsal view **166** propodeum and first–third metasomal tergites, dorsal view **167** first metasomal tergite, dorsal view. Scale bars: 1 mm (**157, 165**); 0.5 mm (**158–164, 166**); 0.25 mm (**167**).

Figures 168–178. *Syntomernus tamabae* (Maeto, 1991) (**168–173** female, ZISP) and *S. asphondyliae* (Watanabe, 1940) (**174–178** paratype, EIHU) **168** fore wing **169, 175** head, front view **170, 174** head, dorsal view **173, 178** metasoma, dorsal view **172** hind tarsus **171, 177** first metasomal tergite, dorsal view **176** habitus, lateral view. Scale bars: 1 mm (**168, 176**); 0.5 mm (**169–175, 178**); 0.25 mm (**177**).

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RESEARCH ARTICLE

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First checklist of the chrysidid wasps (Hymenoptera, Chrysididae) of Mongolia, with description of new species

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Abstract

An annotated checklist of the Chrysididae from Mongolia is provided. A revision of the bibliographical data is provied, since most of the collecting localities published for "Mongolia" refer to places currently located in China. The known Mongolian cuckoo wasp fauna counts 90 species in 18 genera and two subfamilies. Four genera and 57 species are recorded for the first time, including two species here described as new for science: *Cleptes mongolicus* Rosa, Halada & Agnoli, **sp. nov.** (Dornod) and *Spinolia spinosa* Rosa & Halada, **sp. nov.** (Bayankhongor).

Keywords

Catalogue, Central Asia, new records, Palaearctic region

Introduction

Mongolia is a large landlocked country in eastern Central Asia, covering 1,564,100 km². Politically, Mongolia is divided into 21 provinces named "aimags" with the capital Ulaanbaatar (Fig. 1). It is bordered by Russia to the north and China

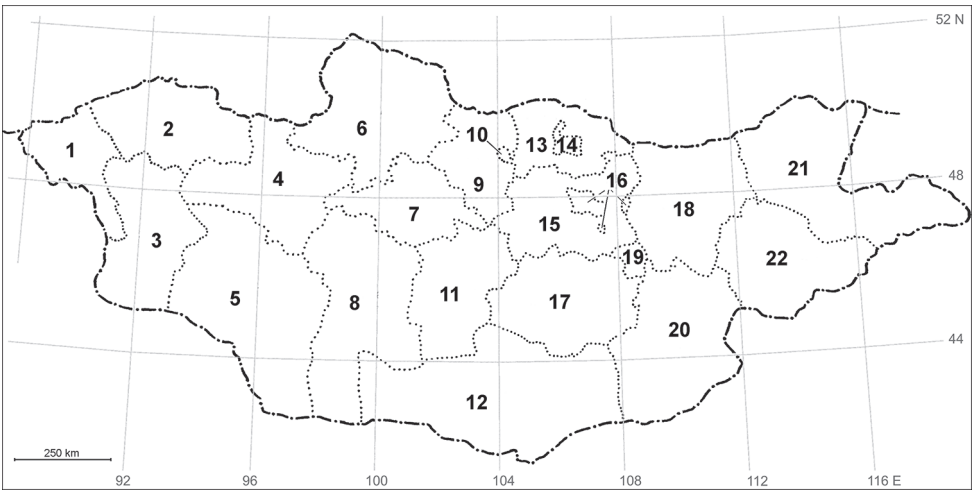

Figure 1. Administrative map of Mongolia (from Dathe and Proshchalykin (2016) and Proshchalykin (2017) modified). Aimags: **1** Bayan-Ulgii **2** Uvs **3** Khovd **4** Zavkhan **5** Govi-Altai **6** Khuvsgul **7** Arkhangai **8** Bayankhongor **9** Bulgan **10** Orkhon **11** Uvurkhangai **12** Umnugovi **13** Selenge **14** Darkhan-Uul **15** Tuv **16** Ulaanbaatar **17** Dundgovi **18** Khentii **19** Govi-Sümber **20** Dornogovi **21** Dornod **22** Sukhbaatar.

to the south, east, and west. Geographically and climatologically, it is an area of contrasts and extremes, between cold mountainous regions up to 4,000 m a.s.l. to the north and west and one of the largest deserts of the world in the south, the Gobi Desert. Most of the country is located on high plateaus, covered by steppes and extensive forested areas. It has an extreme continental climate with long, cold winters and short hot summers, during which most of its annual precipitation falls (Lavrenko 1979; Dathe and Proshchalykin 2016).

Mongolian cuckoo wasps are scarcely known and a few occasional records are found in the literature (Rosa 2017a). Only one article (Móczár 1967) deals with Mongolian material collected by Dr Z. Kaszab during his entomological excursions in this country (1963–1968). Other scattered findings have been published (du Buysson 1901; Semenov-Tian-Shanskij 1912, 1932, 1967; Semenov-Tian-Shanskij and Nikol'skaya 1954; Linsenmaier 1997a; Rosa et al. 2017a, b), while most of the remaining bibliographical data recorded for "Mongolia" actually refer to localities currently included in China (Inner Mongolia, Xinjiang, Gansu) (du Buysson 1893; Radoszkowski 1877, 1891; Mocsáry 1890; Dalla Torre 1892; Bischoff 1913; Hammer 1936; Tsuneki 1947, 1953a; Linsenmaier 1959, 1968; Semenov-Tian-Shanskij 1967; Kimsey and Bohart 1991; Rosa et al. 2014, 2015). Approximately 30 species were properly recorded from Mongolia so far (Rosa 2017a) and we here add 57 new records for this country, mostly based on the materials collected by Czech entomologists (M. Halada, J. Halada, J. Straka, and M. Kadlecová) in 2003–2007 and mainly housed in the private collections of MH (České Budějovice, Czech Republic) and PR (Bernareggio, Italy). Other new records were found during the examination of the Chrysididae collection housed at the Zoological Institute in St. Petersburg (Russia,

ZIN) and based on the material collected during the expeditions of V. Roborovskij and P. Kozlov in 1895 and P. Kozlov in 1926. Finally, a few specimens were examined from the material collected in Mongolia by Soviet-Mongolian expeditions in 1967–1982. Soviet-Mongolian expedition were conducted from 1967 to 1983 and led to the collection of extensive entomological material, which became the basis for the publication of numerous articles and books (including Insects of Mongolia in eleven volumes), devoted to the study of various insects families (Proshchalykin and Kuhlmann 2015), although the Chrysididae were never examined by anyone. Large part of the cuckoo wasps collected during these entomological expeditions is still unprepared and unidentified.

Unpublished distributional records from Mongolia were recently published in the volume on Russian Chrysididae (Rosa et al. 2019), for a better understanding of the distribution of the Asian species, but exact localities were omitted because they were not of interest for that publication. We here report the precise data of species recorded for the first time in Rosa et al. 2019, which are mostly based on material housed in the Linsenmaier collection (Luzern, Switzerland).

In the present paper, based on a comprehensive study of specimens (including primary types) deposited in various collections, we report additional records of 72 species, with two species described as new and 55 species recorded from Mongolia for the first time, resulting in a total number of 90 cuckoo wasps species known from this country (Table 1).

Materials and methods

Terminology follows Lanes et al. (2020), Hymenoptera Anatomy Ontology (HAO 2020), and partly Kimsey and Bohart (1991). Abbreviations used in the descriptions are as follows:

F1, F2, F3, etc.	flagellomeres 1, 2, 3, etc., respectively;
l/w	length/width;
MOD	anterior ocellus diameter;
MS	malar space, the shortest distance between base of mandible and lower margin of compound eye;
OOL	the shortest distance between posterior ocellus and compound eye;
P	pedicel;
PD	puncture diameter;
POL	the shortest distance between posterior ocelli;
T1–T5	metasomal terga numbered consecutively, starting with 1 at the second abdominal segment.

Pictures of the types were taken with Nikon D700 connected to the microscope Togal SCZ and stacked with the software Combine ZP.

Table 1. Records of Mongolian cuckoo wasp species by aimags.

No.	Species	Aimags
1.	*Chrysis aestiva* Dahlbom, 1854	7
2.	*Chrysis angustula* Schenck, 1856	7, 15
3.	*Chrysis asahinai* Tsuneki, 1950	8, 9, 12, 15, 20, 22
4.	*Chrysis belokobylskiji* Rosa, 2019	4, 12, 15
5.	*Chrysis brevitarsis* Thomson, 1870	9
6.	*Chrysis castigata* Linsenmaier, 1959	13, 15
7.	*Chrysis chinensis* Mocsáry, 1912	7, 13, 15
8.	*Chrysis consanguinea* Mocsáry, 1889	4, 7, 9, 13, 15, 16, 18, 21, 22
9.	*Chrysis dauriana* Linsenmaier, 1959	4, 7–9, 13, 18
10.	*Chrysis equestris* Dahlbom, 1854	7, 13
11.	*Chrysis fulgida* Linnaeus, 1761	7, 13, 15
12.	*Chrysis ignita* (Linnaeus, 1758)	9
13.	*Chrysis illecebrosa* Semenov, 1967	12
14.	*Chrysis illigeri* Wesmael, 1839	13, 15
15.	*Chrysis ismaeli* Semenov, 1967	12, 20, 21
16.	*Chrysis jaxartis* Semenov, 1910	12, 13, 15, 18, 21
17.	*Chrysis leptomandibularis* Niehuis, 2000	15
18.	*Chrysis mane* Semenov, 1912	15
19.	*Chrysis matutina* Semenov, 1967	7
20.	*Chrysis mediata* Linsenmaier, 1951	15
21.	*Chrysis mocsaryi* Radoszkowski, 1889	3
22.	*Chrysis mysticalis* Linsenmaier, 1959	4, 7, 9, 15, 20
23.	*Chrysis nox* Semenov, 1954	5, 15
24.	*Chrysis pavesii* Rosa, 2017	5, 15
25.	*Chrysis priapus* Rosa, 2018	5
26.	*Chrysis pseudobrevitarsis* Linsenmaier, 1951	7, 15
27.	*Chrysis pupilla* Semenov, 1967	12
28.	*Chrysis rutilans* Olivier, 1791	15
29.	*Chrysis schencki* Linsenmaier, 1968	7, 9
30.	*Chrysis sibirica* Rosa, 2017	7
31.	*Chrysis solida* Haupt, 1957	21
32.	*Chrysis splendidula unica* Radoszkowski, 1891	7
33.	*Chrysis subcoriacea* Linsenmaier, 1959	7
34.	*Chrysis viridula* Linnaeus, 1761	15
35.	*Chrysura dichroa* (Dahlbom, 1854)	4
36.	*Chrysura ignifrons* (Brullé, 1833)	4
37.	*Cleptes dauriensis* Móczár, 1997	3, 8, 11
38.	*Cleptes mongolicus* Rosa, Halada, & Agnoli, sp. nov.	21
39.	*Colpopyga nesterovi* Rosa, 2017	21
40.	*Elampus albipennis* (Mocsáry, 1889)	7, 20
41.	*Elampus coloratus* Rosa, 2017	22
42.	*Elampus montanus* (Mocsáry, 1890)	20
43.	*Elampus panzeri* (Fabricius, 1804)	4, 7
44.	*Elampus sanzii* Gogorza, 1887	15
45.	*Elampus spinifemoris* (Móczár, 1967)	11
46.	*Euchroeus mongolicus* Tsuneki, 1947	5, 11, 12
47.	*Euchroeus orientis* Semenov, 1910	22
48.	*Hedychridium ardens* (Coquebert, 1801)	4, 7, 8, 11, 13, 16, 18, 21, 22
49.	*Hedychridium asianum* Linsenmaier, 1997	7–9, 16
50.	*Hedychridium belokobylskiji* Rosa, 2017	15
51.	*Hedychridium cupreum* (Dahlbom, 1845)	4, 5, 8, 11, 12, 15, 20
52.	*Hedychridium gabriellae* Rosa, 2017	8, 15, 20
53.	*Hedychridium longigena* Rosa, 2017	8, 9, 13, 15, 18, 20, 21
54.	*Hedychridium propodeale* Rosa, 2017	5
55.	*Hedychridium roseum* (Rossi, 1790)	7, 20–22
56.	*Hedychrum chalybaeum* Dahlbom, 1854	5, 8, 13, 15, 16, 21, 22
57.	*Hedychrum gerstaeckeri* Chevrier, 1869	13, 15, 18
58.	*Hedychrum lama* du Buysson, 1891	3

No.	Species	Aimags
59.	*Hedychrum longicolle* Abeille de Perrin, 1877	9, 12, 15, 21, 22
60.	*Hedychrum nobile* (Scopoli, 1763)	4, 7, 13, 15
61.	*Hedychrum rutilans ermak* Semenov, 1967	7, 13, 15, 21, 22
62.	*Holopyga generosa asiatica* Trautmann, 1926	13
63.	*Holopyga kaszabi* Móczár, 1967	11, 12, 20
64.	*Holopyga minuma* Linsenmaier, 1959	21, 22
65.	*Omalus aeneus* (Fabricius, 1787)	15, 16
66.	*Omalus berezovskii* (Semenov, 1932)	16
67.	*Omalus margianus* (Semenov, 1932)	7–9, 15, 22
68.	*Omalus miramae* (Semenov, 1932)	8, 20, 22
69.	*Omalus stella* (Semenov, 1932)	7, 11, 15
70.	*Parnopes glasunowi* Semenov, 1901	3
71.	*Parnopes popovii* Eversmann, 1858	7, 9, 12, 15, 20–22
72.	*Pentachrysis amoena* (Eversmann, 1858)	without locality
73.	*Philoctetes bogdanovii* (Radoszkowski, 1877)	7
74.	*Philoctetes cynthiae* Rosa, 2017	8, 11, 16, 22
75.	*Philoctetes diakonovi* (Semenov, 1932)	20
76.	*Philoctetes lyubae* Rosa, 2017	20
77.	*Philoctetes mongolicus* (du Buysson, 1901)	7, 8, 11, 15, 16, 18, 22
78.	*Philoctetes shokalskii* (Semenov, 1932)	8, 11, 12, 15, 16, 18–22
79.	*Pseudochrysis gengiskhan* Rosa, 2017	8, 9, 13, 15, 21, 22
80.	*Pseudochrysis neglecta* (Shuckard, 1837)	15
81.	*Pseudomalus auratus nigridorsus* (Tsuneki, 1953)	4, 9, 15, 18
82.	*Pseudomalus corensis* (Uchida, 1927)	9, 13, 15, 16, 18, 21
83.	*Pseudomalus punctatus* (Uchida, 1927)	9, 15, 18, 21
84.	*Pseudomalus pusillus* (Fabricius, 1804)	8, 9, 11–13, 15, 18, 21
85.	*Spinolia spinosa* Rosa & Halada, sp. nov.	8
86.	*Spinolia unicolor* (Dahlbom, 1831)	5
87.	*Stilbum calens* (Fabricius, 1781)	7, 9, 11, 15, 20
88.	*Trichrysis cyanea* (Linnaeus, 1758)	8, 13, 15
89.	*Trichrysis pellucida* (du Buysson, 1887)	without locality
90.	*Trichrysis secernenda* (Mocsáry, 1912)	13

Comment. Aimag designation as in Fig. 1.

The checklist follows the genera subdivision proposed by Kimsey and Bohart (1991), with few exceptions for some genera (e.g., *Euchroeus* Latreille, 1809, *Pseudochrysis* Semenov, 1891 and *Colpopyga* Semenov, 1954). The species are listed alphabetically. We have used the following abbreviations for collectors: **JH** – J. Halada; **JS** – J. Straka; **MH** – M. Halada; **MK** – M. Kadlecová. An asterisk (*) marks the new records.

Types and other specimens are deposited in the following Institutions and private collections:

EIHU Entomology Institute, Hokkaido University (Japan);
HNHM Hungarian Natural History Museum, Zoological Department, Budapest (Hungary);
ISEA-PAS Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków (Poland);
LSL Linnean Society, London (England);
MCNM Museo National de Ciencias Naturales, Madrid (Spain);
MFN Museum für Naturkunde, Berlin (Germany);

MHNG Museum d'Histoire Naturelle, Geneva (Switzerland);
MNHN National Museum of Natural History, Paris (France);
MSNG Museo di Storia Naturale, Genova (Italy);
NHMUK British Museum of Natural History, London (UK);
NHMW Museum of Natural History, Vienna (Austria);
NIAS National Institute of Agro-Environmetal Science, Tsukuba (Japan);
NMLS Natur Museum, Luzern (Switzerland);
OMNH Osaka Museum of Natural History, Osaka (Japan);
ZIN Zoological Institute, Russian Academy of Sciences, St. Petersburg (Russia);
ZMMU Zoological Museum of Moscow Lomonosov State University (Russia);
ZMUL Zoologiska Museet, Lund Zoological Museum, University of Lund (Sweden);
GLAC G.L. Agnoli collection (Bologna, Italy);
MHC M. Halada collection (České Budějovice, Czech Republic);
PRC P. Rosa collection (Bernareggio, Italy);
UKC U. Koschwitz collection (Eppenbraun, Germany).

Results

Taxa from Mongolia

Subfamily Cleptinae

Genus *Cleptes* Latreille, 1802

Cleptes Latreille, 1802: 316. Type species: *Sphex semiaurata* Linnaeus, 1761 [= *Cleptes semiauratus* (Linnaeus, 1761)], by monotypy.

***Cleptes dauriensis* Móczár, 1997**

Cleptes (*Cleptes*) *dauriensis* Móczár, 1997: 36. Holotype ♀: Russia: Dauria, leg. F. Sahlb., "*Cleptes* n. sp. *nitidulo* Fbr. aff.", Holotype *Cleptes dauriensis* ♀ Móczár n. sp. det. Móczár 1995" (Hym. Typ. No. 3845 Mus. Budapest) (HMNH).
Cleptes dauriensis: Rosa 2017a: 288. Rosa et al. 2019: 310 (Mongolia, Figs 4, 5).

Material examined. Mongolia: *Khovd*, 1 ♂, Bodongin-Gol River, 12 km SW Altai, 22.VII.1970, leg. M. Kozlov (ZIN); *Uvurkhangai*, 1 ♀, 12 km E of Arvaykheer, 46°22'N, 102°49'E, 1800 m, 3.VII.2004, leg. JH (GLAC); *Bayankhongor*, 1 ♂, 16 km SW of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JH (GLAC).

Distribution. Mongolia (Bayankhongor, Khovd, Uvurkhangai); Russia (Zabaikalskii Terr.) (Rosa 2017a).

***Cleptes mongolicus* Rosa, Halada & Agnoli, sp. nov.**
http://zoobank.org/73389B93-F683-41CC-84AC-3E16ED9B3000
Figures 2, 3

Type material. *Holotype*: ♀, Mongolia: *Dornod*, 100 km W of Choibalsan, 820 m, 23.VII.2007, leg. M. Halada (ZIN). ***Paratypes*:** 1 ♂, same collecting locality and date (GLAC); 1 ♂, 20 km W of Choibalsan, 48°01'N, 114°14'E, 800 m, 24.VII.2007, leg. M. Halada (PRC).

Diagnosis. *Cleptes mongolicus* sp. nov. belongs to the *C. nitidulus* species group, based on the pronotum without posterior pit row and without longitudinal median sulcus or posterior median keel. It is closely related only to *C. margaritae* Móczár, 2000 from Tajikistan, for its general habitus and colouration. The latter belongs to the *C. satoi* group (Móczár 2000), for the modified pronotal structure, without posterior transversal groove, but with a posteromedian longitudinal keel. Besides the unmodified pronotum, the female of *C. mongolicus* sp. nov. can be easily separated from the female of *C. margaritae* by: a) pubescence whitish, shorter on metasoma (max 2.5 MOD) (vs. blackish, longer on metasoma, up to 3 MOD); b) punctation on metasoma with polished T1, shallow and sparse tiny punctures on T2, double punctures on T3 (vs. scattered punctate on T1, densely and evenly punctate on T2 and T3); c) colouration: head entirely black; propodeum entirely blue; T3 and T4 laterally blue; pedicel and F1 yellow; femora apically, tibiae and tarsi yellow (vs. head blue; propodeum black with median blue spot; T3 and T4 fully black; pedicel and flagellum dark brown). The male of *Cl. margaritae* is currently unknown.

Description. Female. Holotype (Fig. 2A–F). Body length 4.6 mm. Forewing length 2.7 mm. POL = 2.2 MOD; OOL = 2.7 MOD. MS = 2.0 MOD. P:F1:F2:F3 = 1.0:1.0:0.7:0.7. F1 1.5 × as long as wide, F2 1.1 × as long as wide. ***Head*.** Head in frontal view 1.2 × as broad as long between lower edge of clypeus and vertex. Face and vertex with small, even, and sparse punctures (1–4 PD) (Fig. 2B). Clypeal lower margin simple, unmodified, 2 MOD width, without acute teeth at corners; lateral edges subparallel. Frontal sulcus broad and deep in the first part, from anterior ocellus to mid of face, faint in the second half, from mid-face to the clypeal margin (Fig. 2B). Mandibles tridentate. Ocellar triangle isosceles, without post-ocellar sulcus. Postero-lateral pits close to posterior ocelli deep and elongate. Pedicel as long as F1. Malar spaces elongate (2.0 MOD). ***Mesosoma*.** Pronotum unmodified; pronotal neck finely striated transversally; posterior margin of pronotum simple, without transverse row of pits or median keel. Pronotum with small punctures similar to those on vertex. Mesoscutum and mesoscutellum scarcely punctate, with tiny and scattered punctures (Fig. 2C), largely impunctate; notauli and parapsidal lines deep and complete. Mesopleuron with small, deep punctures; transversely aligned medially; with short, deep scrobal sulcus on posterior half (Fig. 2D). Metascutellum noticeably reduced by large metanotal trough and by deep and large anteromedian suture. Metapleuron transversely striate. Metapostnotum (dorsal surface of metapectal-propodeal complex) short, irregularly

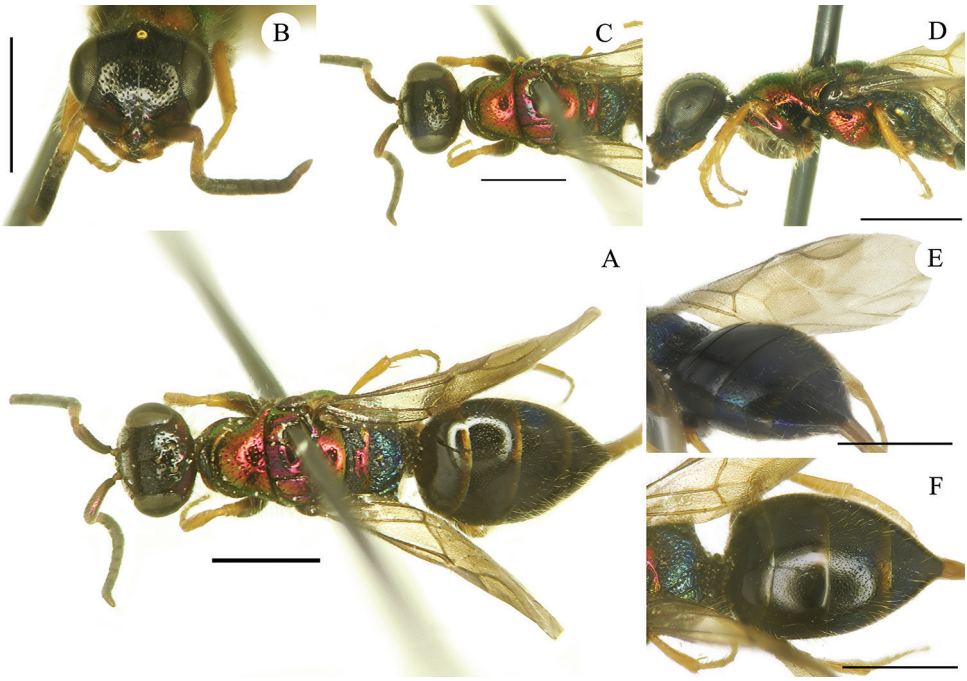

Figure 2. *Cleptes mongolicus* sp. nov., female, holotype **A** habitus, dorsal view **B** head, frontal view **C** head and mesosoma, dorsal view **D** head and mesosoma, lateral view **E** metasoma, postero-lateral view **F** metasoma, dorso-lateral view. Scale bars: 1.0 mm.

reticulate, with large foveae along posterior margin, before the propodeal declivity. Propodeal posterior projections short, stout, and divergent. Wing veins and cells unmodified. ***Metasoma.*** All metasomal terga with impunctate, brownish stripe along posterior margin (Fig. 2F); T1 mostly impunctate, with a few, sparse, tiny punctures; T2 with even, sparse, small punctures (3–5 PD), posteromedially polished; T3 with dense, irregular and double punctation; scattered to polished toward the apical margin; T4 with large, scattered punctures. ***Colouration.*** Head black, with violet reflections medially on clypeus; scapus dorsally violet, ventrally brownish without metallic reflections; P light brown and F1 yellow; other flagellomeres dark brown to blackish. Mandible dark brown, medially yellowish. Pronotal neck medially black; pronotum, mesonotum, mesopleuron, metanotum (excluding black anterior suture and axillary trough), metapleuron metallic red with purple reflections dorsally; propodeum dorsally blue, propodeal declivity black; body ventrally black. Metasoma entirely black; apical margin of each tergum with brownish stripe; laterally on T3 with feeble green reflections; laterally on T4 with extended blue reflections (Fig. 2E). Tegulae brown. Legs with tibiae and tarsi yellowish; coxae red to golden; profemur anteriorly metallic red excluding distal joint; metafemur posteriorly metallic; other parts brown.

Male. Paratypes. Body length 4.0–4.2 mm. POL = 1.6 MOD; OOL = 1.0 MOD. MS = 1.9 MOD. P:F1:F2:F3 = 1.0:1.4:0.9:0.9. F1 3.5 × as long as wide (width taken at

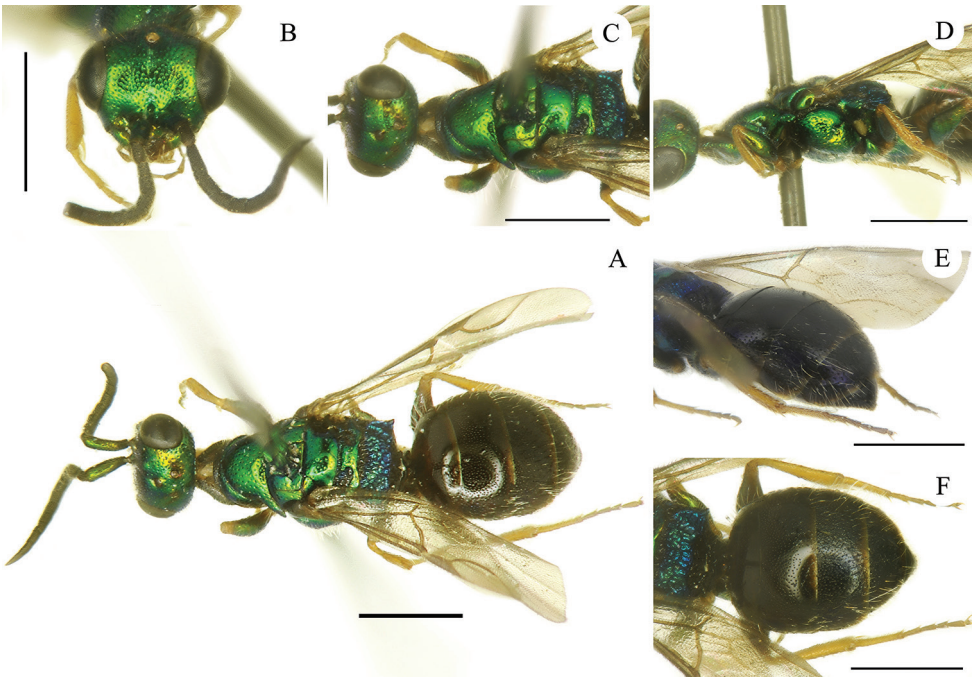

Figure 3. *Cleptes mongolicus* sp. nov., male, paratype **A** habitus, dorsal view **B** head, frontal view **C** head and mesosoma, dorsal view **D** mesosoma, lateral view **E** metasoma, postero-lateral view **F** metasoma, dorsal view. Scale bars: 1.0 mm.

distal apex), F2 1.5×. ***Head.*** Head in frontal view 1.3 × as broad as long between lower edge of clypeus and vertex. Face and vertex with small, even, and denser punctures (1–2 PD) compared to female (Fig. 3B). Frontal sulcus narrow and visible in the first part, from anterior ocellus to brow, faint in the second half, from mid-face to the clypeal margin (Fig. 3B). Lower face medially with punctures more spaced 4–5 PD. Ocellar triangle, post-ocellar sulcus, and posterolateral pits similar to female. F1 1.5 × as long as P. ***Mesosoma.*** Punctation overall similar to that of female; metascutellum larger, with narrow anteromedian mesoscutellar-metascutal suture; metapleuron polished. Other characters as in female. ***Metasoma.*** T1 with denser (2–5 PD), tiny punctures; T2 with even, denser (1–3 PD), small punctures (3–5 PD), posteromedially sparser to polished; T3 with dense, irregular and double punctation; scattered to polished toward the apical margin; T4 with similar punctures; T5 almost polished, with scattered punctures. ***Colouration.*** Species sexually dimorphic with head and mesosoma bright green, including ventral side; propodeum blue. Mandible metallic green from base to half length. Scapus green, pedicel and flagellum black. Metasoma entirely black, with terga apically brownish and laterally with feeble blue reflections on T3 and T4 (Fig. 3E). Tegulae brown. Coxae and femora medially green; trochanters brown, femora distally and tarsi yellowish.

Etymology. The specific epithet is named after the country of origin.

Distribution. Mongolia (Dornod).

Subfamily Chrysidinae
Tribe Chrysidini
Genus *Chrysis* Linnaeus, 1761

Chrysis Linnaeus, 1761: 414. Type species: *Sphex ignita* Linnaeus, 1758 [= *Chrysis ignita* (Linnaeus, 1758)], by subsequent designation of Latreille 1810: 437.
Tetrachrysis Lichtenstein, 1876: 27. Type species: *Chrysis aeruginosa* Dahlbom, 1854, by subsequent designation of Ashmead 1902: 226. Synonymized by Linsenmaier 1959: 91.

Chrysis aestiva Dahlbom, 1854

Chrysis aestiva Dahlbom, 1854: 286. Holotype ♀; Greece: Rhodes (Berlin ?) (*aestiva* group).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai); Asiatic-European, from Caucasus, Turkey, Greece, Iran, Palestine, European part of Russia to Mongolia (Rosa et al. 2019, present record).

Remarks. This is the most eastern record for *Chrysis aestiva*.

Chrysis angustula Schenck, 1856

Chrysis angustula Schenck, 1856: 28. Lectotype ♀ (designated by Morgan 1984: 9); Germany: former Duchy of Nassau (Frankfurt) (*ignita* group).

Material examined. Mongolia: *Arkhangai*, 5 ♀♀, 1 ♂, Chuluut Gol River, 47°48'N, 100°19'E, 23.VII.2005, leg. JH (MHC); 4 ♀♀, 1 ♂, 70 km NE of Tsetserleg, 25.VII.2005, leg. JH (MHC); *Tuv*, 1 ♀, 2 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Tuv); Asiatic-European, from western Europe to China and Russia (Rosa et al. 2019).

Chrysis asahinai Tsuneki, 1950

Chrysis (*Tetrachrysis*) *asahinai* Tsuneki, 1950: 80. Holotype ♀; China, Manchuria, 22.VIII.1938, leg. S. Asahina (OMNH) (*pulchella* group).
Chrysis asahinai: Móczár 1967: 189 (cat., Mongolia: 1 ♀, Estgobi aimag: Cagan Elis, 800 m, 30 km ESE von Zuun-Bajan, Exp. Dr. Z. Kasab, 1963, nr. 22, 23.VI.1963).

Material examined. Mongolia: *Bayankhongor*, 12 ♂♂, 130 km S of Bayankhongor, 45°03'N, 100°59'E, 1240 m, 6.VII.2004, leg. JH, MK (MHC, PRC); 1 ♀, ibid, Orog Nuur, 6–7.VII.2004, on *Saxaul*, leg. JS (PRC); *Bulgan*, 13 ♀♀, 4 ♂♂, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Sukhbaatar*, 1 ♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 2 ♀♀, 2 ♂♂, 75 km W of Ulaanbaatar, dunes, 2.VIII.2005, leg. JH (MHC); 39 ♀♀, 37 ♂♂, 70 km W of Ulaanbaatar, 1070 m, dunes, 16.VIII.2007, leg. JH, MH (MHC); *Umnugovi*, 1 ♂, Gobi, 100 km SW of Dalanzadgad, Bayanzag, on *Saxaul*, 1–2.VII.2003, leg. JH (MHC).

Distribution. Mongolia (*Bayankhongor, *Bulgan, Dornogovi, *Sukhbaatar, *Tuv, *Umnugovi); China (Liaoning) (Rosa et al. 2014).

Chrysis belokobylskiji Rosa, 2019

Chrysis belokobylskiji Rosa, 2019: 2. Holotype ♀; Kyrgyzstan: Naryn River near Karakolka (ZIN) (examined); paratypes: 2 ♀♀, 1 ♂ [Mongolia: Nogon-kub, N. Gobi; 50 km E of Ulaanbaatar, Tuul River; 40 km SW of Uliastay]) (*pulchella* group).

Material examined. Mongolia: *Umnugovi*, 1 ♀, Nogon-kub, N. Gobi, 1.VIII.1926, P. Kozlov (ZIN); *Tuv*, 1 ♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); *Zavkhan*, 1 ♀, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. Mongolia (Tuv, Umnugovi, Zavkhan); China (Qinghai), Kyrgyzstan, Tajikistan (Rosa 2019).

Chrysis brevitarsis Thomson, 1870

Chrysis brevitarsis Thomson, 1870: 107. Holotype ♀; Sweden: Nerike [= Närke] (Lund) (examined) (*ignita* group).

Material examined. Mongolia: *Bulgan*, 1 ♀, 137 km NE of Aravaykheer, 47°20'N, 103°40.5'E, 1250 m, 26.VII.2004, leg. JH (MHC).

Distribution. *Mongolia (Bulgan); Asiatic-European, from western Europe to Russia (Rosa et al. 2019).

Chrysis castigata Linsenmaier, 1959

Chrysis (*Chrysis*) *exsulans* var. *asiatica* Linsenmaier, 1951: 82. Holotype ♀; Uzbekistan: Ferghana (Budapest) (examined) (*ignita* group), nom. praeocc., nec Radoszkwoski 1889.

Chrysis (*Chrysis*) *exsulans* var. *castigata* Linsenmaier, 1959: 155. Replacement name for *C. asiatica* Linsenmaier, 1951.

Material examined. Mongolia: *Selenge*, 2 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 1 ♂, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Selenge, Tuv); Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan, Russia (Eastern Siberia) (Rosa et al. 2019).

Chrysis chinensis Mocsáry, 1912

Chrysis (*Tetrachrysis*) *ignita* var. *chinensis* Mocsáry, 1912: 589. Holotype ♀; China: Shanghai (HNHM) (examined) (*ignita* group).

Chrysis chinensis: Rosa et al. 2019: 109 (cat., Mongolia, without locality, see Material examined).

Material examined. Mongolia: *Arkhangai*, 24 ♂♂, Chuluut Gol River, 47°48'N, 100°19'E, 23.VII.2005, leg. JH (MHC); 2 ♀♀, 4 ♂♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); 2 ♀♀, ibid, 27.VII.2005, leg. JH (MHC); *Tuv*, 1 ♀, 1 ♂, Ulaanbaatar Bog Duul, 11.VII.1983, leg. Karl Bleyl (NMLS); 7 ♀♀, 28 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); 6 ♂♂, Khangayn Mts, 5 km N of Khunt, 20.VII.2005, leg. JH (MHC); *Selenge*, 11 ♀♀, 19 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC).

Distribution. Mongolia (*Arkhangai, *Selenge, *Tuv); Asiatic-European, from western Europe (Switzerland) to China (Helongjiang, Shanghai) (Linsenmaier 1959).

Remarks. This species was previously reported from Mongolia (Rosa et al. 2019) without exact locality.

Chrysis consanguinea Mocsáry, 1889

Chrysis (*Gonochrysis*) *consanguinea* Mocsáry, 1889: 299. Syntypes ♀♀; Italy: Sicily; Algeria (MHNG) (examined) (*viridula* group).

Material examined. Mongolia: *Arkhangai*, 1 ♂, Chuluut Gol River, 47°48'N, 100°19'E, 23.VII.2005, leg. JH (MHC); 3 ♀♀, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.VII.2005, leg. JH (MHC); *Bulgan*, 1 ♀, 137 km NE of Aravaykheer, 47°20'N, 103°40.5'E, 1250 m, 2.VII.2004, leg. JH (MHC); *Dornod*, 1 ♀, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. JH (MHC); *Khentii*, 4 ♂♂, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 1 ♀, 2 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Sukhbaatar*, 2 ♂♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 7 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC);

1 ♂, Khangaun Mts, 5 km N of Khunt, 20.VII.2005, leg. JH (MHC); 1 ♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. JH (MHC); *Ulaanbaatar*, 1 ♀, 7 km E of Ulaanbaatar, Gachuurt, 47°55'N, 107°06'E, 31.VII.2002, leg. JS (MHC); *Zavkhan*, 1 ♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Bulgan, Dornod, Khentii, Selenge, Sukhbaatar, Tuv, Ulaanbaatar, Zavkhan); Palaearctic, from southern Europe and northern Africa to Eastern Siberia ang Mongolia (Rosa et al. 2019, present records).

Chrysis dauriana Linsenmaier, 1959

Chrysis (*Chrysis*) *cavaleriei* ssp. *dauriana* Linsenmaier, 1959: 112. Holotype ♀; Russia: Dauria (NMLS) (examined) (*succincta* group). Elevated to species rank by Rosa et al. 2017a: 40.

Chrysis (*Tetrachrysis*) *mongolica* Semenov-Tian-Shanskij, 1967: 178, nec Mocsáry, 1914. Holotype ♀; Russia [not Mongolia]; Transbaikalia: Ingoda River (St. Petersburg) (examined). Rosa et al. 2017a: 39 (cat., type series), 155 (Plate 91). Synonymised by Rosa et al. 2017a: 40.

Chrysis mongoliana Bohart in Kimsey and Bohart 1991: 440. Replacement name for *Chrysis mongolica* Semenov-Tian-Shanskij, 1967: 178, nec Mocsáry 1914.

Material examined. Mongolia: *Arkhangai*, 1 ♀, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.VII.2005, leg. JH (MHC); *Bayankhongor*, 2 ♂♂, 163 km S of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JH (MHC); *Bulgan*, 1 ♂, 170 km W of Ulaanbaatar, dunes, 1070 m, 16.VIII.2007, leg. MH (MHC); *Khentii*, 1 ♀, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 4 ♀♀, 2 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 2 ♀♀, 4 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); 2 ♂♂, ibid, 12.VII.2003, leg. JH (MHC); 10 ♀♀, 6 ♂♂, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC, PRC); *Zavkhan*, 2 ♂♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. Mongolia (*Arkhangai, *Bayankhongor, *Bulgan, *Khentii, *Selenge, *Zavkhan); Russia (Eastern Siberia) (Rosa et al. 2017a).

Remarks. This species was previously reported from Mongolia (Rosa et al. 2019) without exact locality.

Chrysis equestris Dahlbom, 1854

Chrysis equestris Dahlbom, 1854: 307. Holotype ♀; locality unknown [most likely Sweden] (Stockholm) (examined) (*smaragdula* group).

Material examined. Mongolia: *Arkhangai*, 1 ♀, 2 ♂♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); 1 ♀, 1 ♂, ibid, leg. MK (MHC);

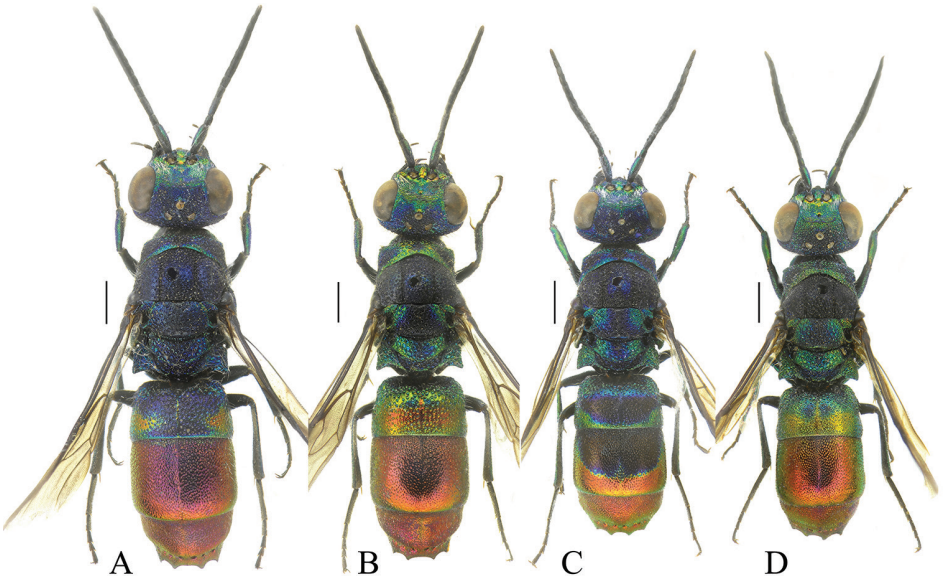

Figure 4. *Chrysis fulgida* Linnaeus, habitus dorsal view **A** form A, ♀ **B** form B, ♀ **C** form A, ♂ **D** form B, ♂. Scale bars: 1.0 mm.

1 ♀, 1 ♂, 70 km NE Tsetserleg, 25.VII.2005, leg. JH (MHC); *Selenge*, 1 ♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Selenge); Asiatic-European, from western Europe to Russia (Rosa et al. 2019).

Chrysis fulgida Linnaeus, 1761

Chrysis fulgida Linnaeus, 1761: 415. Lectotype ♀ (designated by Morgan 1984: 9); Sweden: Uppsala (LSL) (*ignita* group).

Material examined. Mongolia: (*Form A*): *Arkhangai*, 2 ♀♀, 1 ♂, 70 km NE of Tsetserleg, 25.VII.2005, leg. JH (MHC); *Selenge*, 1 ♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 5 ♀♀, 3 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); (*Form B*): *Arkhangai*, 2 ♀♀, 1 ♂, 70 km NE of Tsetserleg, 25.VII.2005, leg. JH (MHC); 1 ♀, 1 ♂, Chuluut Gol River, 47°48'N, 100°19'E, 23.VII.2005, leg. JH (MHC); *Tuv*, 1 ♀, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Selenge, Tuv); Asiatic-European, from Europe to eastern Siberia, Russian Far East and North-East China (Manchuria) (Rosa et al. 2014, 2019).

Remarks. Two distinct colour forms (Fig. 4) are recorded from Mongolia, Siberia and Primorsky Territory (Russia), and Heilongjiang (China). Form A is matching with the typical European *Chrysis fulgida* (Fig. 4A, C). Form B is chromatic different

without the typical blue colouration on male and female metasoma and with non-metallic black areas on head vertex and mesosoma (Fig. 4B, D). Male T1 golden-greenish, with or without a narrow transversal green or bluish stripe or patch; T2 red, with or without a basal, narrow black stripe; female T1 golden-greenish, with green to bluish colour on T1 frontal declivity to petiolar insertion. This colour variation has also been observed in specimens from Russia (Siberia and Primorsky Territory) and China (Heilongjiang). The Chinese form was mentioned by Linsenmaier (1968) as *Chrysis aequicolor* Linsenmaier, 1968, which is anyway an unnecessary replacement name for *Chrysis fulgida* var. *concolor* Mocsáry, 1912 nec Mocsáry, 1892 (actually male and female of the same taxon). Other evident different morphological characteristics are not recognizable. However, these two forms may represent two sister species, genetically separate, but difficult to identify on the basis of morphological characteristics, as in other known cases of *Chrysis* of the *ignita* group (Paukkunen et al. 2015; Orlovskytė et al. 2016).

Chrysis ignita (Linnaeus, 1758)

Sphex ignita Linnaeus, 1758: 571. Lectotype ♀ (designated by Richards 1935); Europe (LSL) (*ignita* group).

Chrysis ignita: Buyanjargal and Abasheev 2015: 31 (biol. host of *Euodynerus dantici*, central Mongolia: Khugnu-Khaan Mts, Khugnu-Tarna N.P.).

Material examined. None examined.

Remarks. The identification of *Chrysis ignita* by Buyanjargal and Abasheev (2015) is doubtful and very likely represent another species of the *C. ignita* group or even a member of another species group (e.g., *succincta* group). In fact, the host association with *Euodynerus dantici*, as observed by the two authors, is unusual. *Euodynerus dantici* is known as a possible host for members of the *C. succincta* group (*C. germari* and *C. tristicula* (sub *C. succincta succinctula*) Pauli et al. 2019, supplementary file 4). For example, *C. dauriana* Linsenmaier was erroneously identified as *C. ignita* by several authors, including Trautmann (identification label pinned with the type of *C. dauriana*).

Distribution. Mongolia (Bulgan) [doubtful]; West-Palaearctic: from West Europe to central Asia (Linsenmaier 1997b).

Chrysis illecebrosa Semenov, 1967

Chrysis (*Tetrachrysis*) *illecebrosa* Semenov-Tian-Shanskij, 1967: 166. Holotype ♂; Bugas near Khami, SE from Tian Shan [China, Xinjiang] (ZIN) (examined) (*maculicornis* group).

Material examined. Mongolia: *Umnugovi*, 1 ♂, Deemgin-gobi, 25 km SSO of Khajlastyn-Khuduka, 20.VI.1971, leg. M. Kozlov (ZIN).

Distribution. *Mongolia (Umnugovi); China (Xinjiang) (Rosa et al. 2014).

Chrysis illigeri Wesmael, 1839

Chrysis illigeri Wesmael, 1839: 176. Syntypes ♂♀; Belgium (Bruxelles, MSNG) (examined) (*succincta* group).

Material examined. Mongolia: *Selenge*, 1 ♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 1 ♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Selenge, Tuv); Asiatic-European, from western Europe to Mongolia (present record).

Chrysis ismaeli Semenov, 1967

Chrysis (*Allochrysis*) *ismaeli* Semenov-Tian-Shanskij, 1967: 124. Holotype ♀; Kazakhstan: Balamurun, Karatau Mountain ridge foothills, leg. V. Kozhantschikov (ZIN) (*ear* group).

Material examined. Mongolia: *Dornod*, 1 ♂, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MK (MHC); *Dornogovi*, 5 ♂♂, 65 km SE of Chatan-Bulag, 1020 m, 2.VIII.2007, leg. MH (PRC/MHC); *Umnugovi*, 1 ♀, Gobi, Dalanzadgad, 24–26. VI.2003, leg. JH (MHC); 12 ♀♀, 70 km S of Saynshand, 1100 m, 6.VIII.2007, leg. MH (PRC/MHC).

Distribution. *Mongolia (Dornod, Dornogovi, Umnugovi); Kazakhstan (Rosa 2018).

Notes. As supposed by Rosa (2018), living specimens are red and change to greenish after preparation.

Chrysis jaxartis Semenov, 1910

Chrysis sybarita var. *jaxartis* Semenov-Tian-Shansky, 1910: 222. Lectotype ♂ (designated by Rosa et al. 2017a: 54). Kazakhstan: Djulek (Budapest) (examined) (*graelsii* group).

Material examined. Mongolia: *Dornod*, 6 ♀♀, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MH (MHC); 9 ♀♀, 2 ♂♂, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E 24.VII.2007, leg. MH (MHC); *Khentii*, 11 ♀♀, 4 ♂♂, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 3 ♀♀, 1 ♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 5 ♀♀, 1 ♂, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13. VIII.2007, leg. MH (MHC); 1 ♀, same date and locality, and collector (P. Tyrner priv. coll.); *Umnugovi*, 1 ♂, Gobi, Dalanzadgad, 25.VI.2003, leg. JH (MHC).

Distribution. *Mongolia (Dornod, Khentii, Selenge, Tuv, Umnugovi); Asiatic-European, from Greece, Iran, and Turkey to Central Asia (Rosa et al. 2019).

Chrysis leptomandibularis Niehuis, 2000

Chrysis leptomandibularis Niehuis, 2000: 192. Holotype ♀; Germany: Rheinland-Pfalz, Monsheim (Frankfurt) (*ignita* group).

Material examined. Mongolia: *Tuv*, 3 ♀♀, 2 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH, det. J. van der Smissen and MH (MHC).

Distribution. *Mongolia (Tuv); Asiatic-European from Europe to Russia (Rosa et al. 2019).

Chrysis mane Semenov, 1912

Chrysis mane Semenov-Tian-Shanskij, 1912: 192. Lectotype ♂ (designated by Bohart in Kimsey and Bohart 1991: 436); China: Alashan (192 (descr.), depository: ZIN).
Chrysis mane: Kimsey and Bohart 1991: 436 (China [not Mongolia]: Gansu, Quingai, cat., *ignita* group).

Material examined. Mongolia: *Tuv*, 1 ♂, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MK (PRC).

Distribution. *Mongolia (Tuv); China (Gansu, Qinghai, Inner Mongolia) (Rosa et al. 2014).

Chrysis matutina Semenov, 1967

Chrysis (*Tetrachrysis*) *matutina* Semenov-Tian-Shanskij, 1967: 179. Holotype ♀; China: Gansu (ZIN) (*ignita* group).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai); China (Gansu) (Rosa et al. 2014).

Chrysis mediata Linsenmaier, 1951

Chrysis ignita var. *mediata* Linsenmaier, 1951: 76. Lectotype ♀ (designated by Linsenmaier 1959: 154); Switzerland: Wallis (NMLS) (examined) (*ignita* group).

Material examined. Mongolia: *Tuv*, 2 ♀♀, Ulaanbaatar Bog Duul, 11.VII.1983, leg. Karl Bleyl, det. Linsenmaier 1992 (NMLS).

Distribution. *Mongolia (Tuv); Palaearctic region excluding Japan (Linsenmaier 1997b).

Chrysis mocsaryi Radoszkowski, 1889

Chrysis (*Tetrachrysis*) *Mocsaryi* Radoszkowski, 1889: 29. Holotype ♀; Mongolia: Kobden (Khovd) (ISEA-PAS) (examined) (*comparata* group). Mocsáry 1889: 426 (cat., descr., Mongolia).

Chrysis mocsaryi: Dalla Torre 1892: 78 (cat., Mongolia); Kimsey and Bohart 1991: 440 (cat., Mongolia: Kobden, *comparata-scutellaris* group). Rosa et al. 2015: 41 (cat., type series), 42 (Fig. 4).

Material examined. Mongolia: Holotype ♀, golden rounded label, Kansu Kobden-Owatu 12/VIII [handwritten] *Mocsáry* [handwritten by Radoszkowski] // *Chrysis Mocsaryi* Rad. (tres interep.) [?] [handwritten by Mocsáry], label with right flagellum and metasoma, Mus. Pan Krakow [hadwritten by Dylewska].

Distribution. Mongolia (Khovd) (Radoszkowski 1889).

Chrysis mysticalis Linsenmaier, 1959

Chrysis mysticalis Linsenmaier, 1959: 165. Holotype ♀; Spain: Zamora (Luzern) (examined) (*inaequalis* group).

Material examined. Mongolia: *Arkhangai*, 1 ♀, 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. MK (MHC); *Bulgan*, 2 ♂♂, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Dornogovi*, 1 ♀, 28 km of SE Chatan-Bulag, 3.VIII.2007, leg. MH MHC); *Tuv*, 1 ♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); 2 ♀♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC); *Zavkhan*, 1 ♀, 1 ♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Bulgan, Dornogovi, Tuv, Zavkhan); from southern Europe to eastern Siberia (Rosa et al. 2017b).

Chrysis nox Semenov, 1954

Chrysis (*Tetrachrysis*) *nox* Semenov in Semenov-Tian-Shanskij and Nikol'skaya 1954: 128. Lectotype ♀ (designated by Bohart in Kimsey and Bohart 1991: 444); Tajikistan [not Mongolia]: Peter the Great Range, Yashil'-Kul' Lake, 7.VIII.1911, leg. Golbek (ZIN) (examined) (*facialis* group). Rosa et al. 2017a: 42 (cat., type series), 158 (plate 97).

Chrysis nox: Kimsey and Bohart 1991: 444 (cat., Mongolia: Yihe Bogdo, Peter the Great Range, *facialis* group).

Material examined. Mongolia: *Govi-Altai*, 4 ♀♀, 1 ♂, Ikhe-Bogdo, Gobi Altai, 30.VI–12.VII.1926, leg. P. Kozlov // Paratypes (ZIN); 4 ♀♀, idem, 15–17.VII.1926,

Paratypes (ZIN); 1 ♀, North slope of Ikhe-Bogdo, 30.VI–12.VII.1926, leg. P. Kozlov, Paratypes (ZIN); 1 ♀, Ihe-Bogdo, Gob. Altai, 15–17.VII.1926, leg. P. Kozlov [in Cyrillic], det. M. Nikol'skaya (NMLS); *Tuv*, 1 ♀, Ulaanbaatar Bog Duul, 11.VII.1983, leg. Karl Bleyl, det. Linsenmaier 1990 (NMLS).

Distribution. Mongolia (Govi-Altai, Tuv); Tajikistan (Rosa et al. 2017a).

Chrysis pavesii Rosa, 2017

Chrysis pavesii Rosa in Rosa et al. 2017c: 27. Holotype ♀; Russia: Western Siberia, Altai Rep., 5 km SE of Chagan-Uzun, Tudtuyaryk River, 1780 m, 11.VII.2016, leg. M. Proshchalykin & V. Loktionov (ZIN) (examined) (*bihamata* group).

Material examined. Mongolia: *Govi-Altai*, 1 ♂, 10 km SSE of Ich-Oba-Ula, 18.VII.1970, leg. E. Narchuk (ZIN).

Distribution. *Mongolia (Govi-Altai, Tuv); Russia (western Siberia) (Rosa et al. 2017c).

Chrysis priapus Rosa, 2018

Chrysis priapus Rosa, 2018: 281. Holotype ♂; Mongolia: Govi-Altai Prov., 8 km SE of Argalant-Ula (ZIN) (examined) (*slava* group).

Material examined. Mongolia: *Govi-Altai*, 1 ♂, 8 km SE of Argalant-Ula, 20.VI.1980, leg. G. Medvedev (ZIN).

Distribution. Mongolia (Govi-Altai) (Rosa 2018).

Chrysis pseudobrevitarsis Linsenmaier, 1951

Chrysis ignita var. *pseudobrevitarsis* Linsenmaier, 1951: 79. Lectotype ♀ (designated by Linsenmaier 1959: 158); Switzerland: Wallis (NMLS) (examined) (*ignita* group).

Chrysis (*Chrysis*) *pseudobrevitarsis*: Linsenmaier 1997b: 114 (descr., Mongolia, without locality, see in Material examined).

Chrysis pseudobrevitarsis: Rosa et al. 2019: 153 (cat., Mongolia).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 70 km NE of Tsetserleg, 25.VII.2005, leg. JH (MHC); *Tuv*, 1 ♀, Tereltz, 8.VII.1983, leg. Karl Bleyl, det. Linsenmaier 1992 (NMLS); 2 ♀♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC).

Distribution. Mongolia (Arkhangai, Tuv); Asiatic-European, from western Europe to Mongolia (Linsenmaier 1997a).

Chrysis pupilla Semenov, 1967

Chrysis (*Tetrachrysis*) *pupilla* Semenov-Tian-Shanskij, 1967: 174. Holotype ♀; Uzbekistan: Termez (ZIN) (examined) (*varidens* group).

Material examined. Mongolia: *Umnugovi*, 1 ♀, "Yuzhno-Gobiyskiy Ajmag, sajr Undyn-Gol, 25 km S of Khan-Bogdo, 7.VII.1971", leg. M. Kozlov (ZIN).

Distribution. *Mongolia (Umnugovi); Uzbekistan (Semenov-Tian-Shanskij 1967).

Chrysis rutilans Olivier, 1791

Chrysis rutilans Olivier, 1791: 676. Type unknown; France: Angoumois (depository unknown) (*splendidula* group).

Material examined. Mongolia: *Tuv*, 1 ♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Tuv); Palaearctic, from western Europe and North Africa to China and Japan (Linsenmaier 1997b).

Chrysis schencki Linsenmaier, 1968

Chrysis (*Chrysis*) *ignita* ssp. *schenckiana* Linsenmaier, 1959: 156, nom. praeocc., nec Mocsáry, 1912. Holotype ♀; Switzerland: Graubünden (Luzern) (examined) (*ignita* group).

Chrysis (*Chrysis*) *ignita schencki* Linsenmaier, 1968: 99. Replacement name for *C. ignita schenckiana* Linsenmaier, 1959.

Material examined. Mongolia: *Arkhangai*, 2 ♀♀, Chuluut Gol River, 47°48'N, 100°19'E, 23.VII.2005, leg. JH, det. J. Van der Smissen (MHC); *Bulgan*, 2 ♀♀, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH, det. J. Van der Smissen (MHC).

Distribution. *Mongolia (Arkhangai, Bulgan); Asiatic-European, from western Europe to Central Asia, Siberia and Japan (Rosa et al. 2019).

Chrysis sibirica Rosa, 2017

Chrysis sibirica Rosa in Rosa et al., 2017c: 24. Holotype ♀; Russia: Tuva Rep., 31 km NEE of Erzin, Erzin River, 18.vii.2014, leg. A. Lelej, M. Proshchalykin & V. Loktionov (St. Petersburg) (*bihamata* group).

Material examined. Mongolia: *Arkhangai*, 1 ♀, Chuluut Gol River, 47°48'N, 100°19'E, 23.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai); Russia (Eastern Siberia) (Rosa et al. 2017c).

Chrysis solida Haupt, 1957

Chrysis ignita solida Haupt, 1957: 115. Lectotype ♀ (designated by Niehuis 2000: 199); Poland: Bellinchen [= Bielinek] (MLU) (*ignita* group).
Chrysis mediata fenniensis Linsenmaier, 1959: Móczár 1967: 189 (cat., Mongolia: 1 ♀, Čojbalsan [= Dornod] aimag: Menengijn valley, 160 km W of Bujr nur Lake, 600 m, Exp. Dr. Z. Kaszab, 1965, nr. 416, 15.VIII.1965).

Material examined. None examined.

Distribution. Mongolia (Dornod); Asiatic-European, from western Europe to Japan (Linsenmaier 1997b).

Chrysis splendidula unica Radoszkowski, 1891

Chrysis splendidula var. *unica* Radoszkowski, 1891: 189. Syntypes ♂, ♀; Turkmenistan: Ashgabad (ISEA-PAS) (examined) (*splendidula* group).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai); Turkmenistan (Radoszkowski 1891).

Chrysis subcoriacea Linsenmaier, 1959

Chrysis (*Chrysis*) *longula* ssp. *subcoriacea* Linsenmaier, 1959: 160. Holotype ♀; Finland: Kyrkslätt [= Kirkkonummi] (Luzern) (examined) (*ignita* group).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 70 km NE of Tsetserleg, 25.VII.2005, leg. JH, det. J. Van der Smissen (MHC).

Distribution. *Mongolia (Arkhangai); Asiatic-European, from western Europe to Central Asia, Russia and Japan (Rosa et al. 2019).

Chrysis viridula Linnaeus, 1761

Chrysis viridula Linnaeus, 1761: 415. Type unknown; Sweden (unknown) (*viridula* group).

Material examined. Mongolia: *Tuv*, 1 ♀, 100 km E of Ulaanbaatar, 20 km NE of Tereltz, Tuul River, 15–21.VII.2003, leg. JH (PRC).

Distribution. *Mongolia (Tuv); Asiatic-European, from western Europe to Central Asia, Russia, and Japan (Rosa et al. 2019).

Genus *Chrysura* Dahlbom, 1845

Chrysura Dahlbom, 1845: 6. Type species: *Chrysis austriaca* Fabricius, 1804, by subsequent designation of Bodenstein 1939: 125.

Chrysura dichroa (Dahlbom, 1854)

Chrysis dichroa Dahlbom, 1854: 146. Lectotype ♀ (designated by Rosa and Xu 2015: 17); Hungary: Budapest (MSNT) (*dichroa* group).

Material examined. Mongolia: *Zavkhan*, 1 ♀, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Zavkhan); Asiatic-European, from western Europe to Central Asia and western Siberia (Rosa et al. 2019).

Chrysura ignifrons Brullé, 1833

Chrysis ignifrons Brullé, 1833: 375. Holotype ♂ [not ♀]; Greece: Peloponnese (Paris) (examined) (*austriaca* group).

Material examined. Mongolia: *Zavkhan*, 1 ♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Zavkhan); Palaeartcic, from southern Europe and northern Africa to Middle East and Central Asia (Rosa et al. 2019).

Genus Euchroeus Latreille, 1809

Euchroeus Latreille, 1809: 49. Type species: *Chrysis purpurata* Fabricius, 1787 [= *Euchroeus purpuratus* (Fabricius, 1787)], by monotypy.

Euchroeus mongolicus Tsuneki, 1947

Euchroeus purpuratus f. *mongolicus* Tsuneki, 1947: 54. Holotype ♀; China: Inner Mongolia: Apaka (NIAS).

Euchroeus (*Euchroeus*) *mongolicus*: Linsenmaier 1959: 73 (tax., descr., Mongolia [= Inner Mongolia]), 200 (fig. 213).

Spinolia (*Euchroeus*) *par* Semenov, 1967: 189 (cat., Mongolia: 1 ♀, Uburchangaj aimag: Changaj Mt., 8 km W of Somon Chajrchandulaan, 2000 m, Exp. Dr. Z. Kaszab, 1964, nr. 217, 28.VI.1964; 1 ♀, Southgobi aimag: 60 km E of Somon Bulgan, 1120 m, Exp. Dr. Z. Kaszab 1964, nr. 262, 4.VII.1964).

Brugmoia quadrata f. *mongolica*: Kimsey and Bohart 1991: 296 (cat., China [not Mongolia]: Apaka).
Euchroeus mongolicus: Rosa et al. 2014: 68 (cat.), 111 (Plate 59); Rosa et al. 2019: 326 (Mongolia, figs 83, 84).

Material examined. Mongolia: *Govi-Altai*, 25 ♀♀, 1 ♂, 70 km E of Altay city, Guulin, 14.VII.2005, leg. JH (MHC, PRC).

Distribution. Mongolia (*Govi-Altai, Umnugovi, Uvurkhangai); China (Inner Mongolia, Shanxi) (Rosa et al. 2014).

Euchroeus orientis Semenov, 1910

Pseudochrysis (*Euchroeus*) *purpurata* subsp. *orientis* Semenov-Tian-Shansky, 1910: 214. Lectotype ♂, designated by Kimsey in Kimsey & Bohart 1991: 296; China: Bugas near Khami, SE of Tian-Shan [China, Xinjiang], 3–5.IX.1895, leg. V. Roborovskij & P. Kozlov (ZIN) (examined).
Spinolia (*Euchroeus*) *orientis*: Móczár 1967: 189 (cat., Mongolia: 1 ♂, Suchebaator [= Sukhbaatar] aimag: Ongon elis, 10 km S of Somon Chongor, 900 m, Exp. Dr. Z. Kaszab, 1965, nr. 356, 3.–4.VIII.1965; 1 ♂, 44 km SSW of Baruun urt, 1050 m, Exp. Dr. Z. Kaszab, 1965, nr. 349, 2.–3.VIII.1965).
Euchroeus (*Euchroeus*) *purpuratus orientis*: Linsenmaier 1968: 46 (descr., Mongolia, observed in the collections of HNHM and MHNH, without precise localities).

Material examined. None examined.

Distribution. Mongolia (Sukhbaatar); China (Xinjiang) (Rosa et al. 2014).

Genus *Pentachrysis* Lichtenstein, 1876

Pentachrysis Lichtenstein, 1876: 227. Type species: *Chrysis amoena* Eversmann 1858 [= *Pentachrysis amoena* (Eversmann, 1858)], by subsequent designation of Ashmead 1902: 226

Pentachrysis amoena (Eversmann, 1858)

Chrysis amoena Eversmann, 1858: 562. Holotype ♀; Russian SFSR: 'campis transuralensibus' (ISEA-PAS) (examined).
Pentachrysis amoena: Kimsey and Bohart 1991: 521 (Mongolia, without specific locality); Rosa et al. 2019: 197 (cat., Mongolia).

Material examined. None examined.

Distribution. Mongolia (without locality); Asiatic-European, from eastern Europe to Mongolia (Kimsey and Bohart 1991).

Genus *Pseudochrysis* Semenov, 1891

Pseudochrysis Semenov, 1891: 444. Type species: *Chrysura humboldti* Dahlbom, 1845: 6 [= *Pseudochrysis humboldti* (Dahlbom, 1845)], by subsequent designation of Semenov 1892: 485.

Pseudospinolia Linsenmaier, 1951: 65 (as subgenus of *Euchroeus* Latreille, 1809). Type species: *Chrysis uniformis* Dahlbom, 1854: 149, by original designation. Synonymized by Rosa et al. 2017b

Pseudochrysis gengiskhan Rosa, 2017

Pseudochrysis gengiskhan Rosa in Rosa et al. 2017c: 9. Holotype ♀; Mongolia: Övörkhangay [Bulgan], 137 km NE of Aravaykheer, 47°20'N, 103°40.5'E, 1250 m, 26.vii.2004, leg. J. Halada (ZIN) (examined). Rosa et al. 2019: 198 (cat., Mongolia), 328 (fig. 91).

Material examined. Mongolia: *Bayankhongor*, 1 ♀, 1 ♂, 129 km NW of Bayankhongor, 47°13'N, 99°55'E, 2590 m, 16.VII.2004, leg. JH (MHC); *Bulgan*, 4 ♀♀, Mongolia, 137 km NE of Aravaykheer, 47°20'N, 103°40.5'E, 1250 m, 26.VII.2004, leg. JH (PRC/ZIN); 1 ♂, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Dornod*, 2 ♂♂, 100 km W of Choibalsan, 820 m, 23.VII.2007, leg. MH (MHC); 3 ♂♂, 20 km W of Choibalsan, 48°01'N, 114°14'E, 800 m, 24.VII.2007, leg. MH (MHC); 2 ♂♂, 50 km SW of Choibalsan, 960 m, 25.VII.2007, leg. JH (MHC); *Selenge*, 2 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII. 2003, leg. JH (MHC); *Sukhbaatar*, 1 ♂, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, Allotype, leg. MK (ZIN); 3 ♂♂, ibid, 27.VII.2007, leg. MH (MHC); 2 ♀♀, 7 ♂♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 4 ♂♂, Khangayn Mts, 5 km N of Khunt, 20.VII.2005, leg. JH (MHC); 4 ♂♂, 75 km W of Ulaanbaatar, dunes, 2.VIII.2005, leg. JH (MHC); 13 ♀♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. JH (MHC); 8 ♀♀, ibid, leg. MH (MHC).

Distribution. Mongolia (*Bayankhongor, *Dornod, *Selenge, Sukhbaatar, *Tuv, Bulgan); Russia (Siberia) (Rosa et al. 2017c).

Pseudochrysis neglecta (Shuckard, 1837)

Chrysis neglecta Shuckard, 1837: 169. Lectotype ♀ (designated by Morgan 1984: 9); England (LSL).

Material examined. Mongolia: *Tuv*, 1 ♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC).

Distribution. *Mongolia (Tuv); Holarctic: from west Europe to Turkey, Siberia, Manchuria and Russian Far East (Rosa et al. 2019); North America (Bohart and Kimsey 1982).

Genus *Spinolia* Dahlbom, 1854

Spinolia Dahlbom, 1854: 363. Type species: *Spinolia magnifica* Dahlbom, 1854 [= *Spinolia lamprosoma* (Förster, 1853)], by monotypy.

Spinolia spinosa Rosa & Halada, sp. nov.

http://zoobank.org/A105F4B1-87F4-4005-B1A0-09844A7247B0
Figures 5A, D, 6A, D

Type material. ***Holotype*:** ♀, Mongolia: *Bayankhongor*, Edringiyn-Nuru Ridge, 100 km SSW of Bayan-Under, 5.IX.1970, leg. V. Zaitzev (ZIN).

Diagnosis. *Spinolia spinosa* sp. nov. is closely related to Central Asian species of the *unicolor* group, which includes *S. chalcites* (Mocsáry, 1890), *S. rusalka* (Semenov, 1901), *S. hedychroides* (Bingham, 1903) and other small species so far considered synonyms of *S. chalcites* (Kimsey and Bohart 1991). *S. spinosa* sp. nov. female can be easily separated from all these species by: lateral pronotal area and propleuron ventrally V-shaped carinate, displaying two teeth in lateral view (Fig. 5D) (vs. unmodified in other species); mesopleuron with large and deep scrobal sulcus subtended by large projecting subrectangular carina (Fig. 5D) (vs. U-shaped carina); sparse, deep and large punctures on mesosoma (Fig. 6D), and sparse and deep punctures on metasoma (vs. punctation with dense, shallow and tiny punctures on mesosoma, denser and shallower on metasoma); antennae yellowish, distinctly elongate (Fig. 5A) (vs. black to dark brown, with short to very short flagellomeres); head, in frontal view, transversely subrectangular (Fig. 6A) and not triangular (Fig. 6B); with bulging eyes, similarly to *S. unicolor*. It is additionally separated from *S. unicolor* by punctation, elongate and yellowish antennae and bronze body colour (entirely blue body in *S. unicolor*, with shortened, blackish flagellomeres).

Description. Female. Body length 6.0 mm. Fore wing length 3.8 mm. OOL = 2.3 MOD; POL = 1.9 MOD; MS = 0.7 MOD; relative length of P:F1:F2:F3 = 1.0:1.4:1.0:0.8; subantennal space: 1.4 MOD. ***Head.*** Vertex with deep and contiguous punctures, as large as 0.25 MOD; vertex moderately depressed and impunctate in front of anterior ocellus and impunctate laterad of posterior ocelli; median anterior depression developed to upper scapal basin; TFC faint; frons continuous, without two flattened or concave, striate areas; scapal basin almost flat, laterally densely micro-punctate, medially with contiguous punctures forming transverse winkles (Fig. 6A); lower part of scapal basin medially impunctate and sulcate; apex of clypeus discoloured, W-shaped and bent under, medially the folded part measures 0.6 MOD. Malar space very

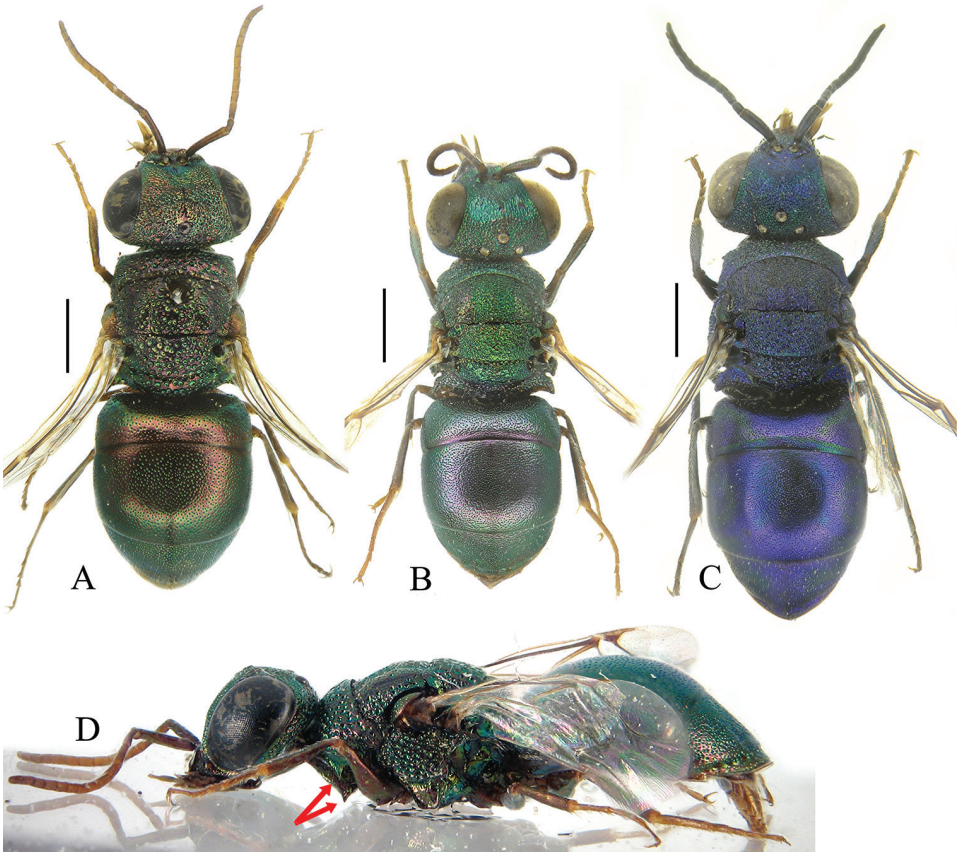

Figure 5. *Spinolia* species, females **A** *S. spinosa* sp. nov., dorsal view **B** *S. chalcites*, dorsal view **C** *S. unicolor*, dorsal view **D** *Spinolia spinosa* sp. nov., lateral view: arrows pointing at pronotal and propleural spines. Scale bars: 1.0 mm.

short, distinctly less than 1 MOD. Antennae elongate, with flagellomeres as long as 1.5 × their width. Mouth parts elongate (as long as 0.8 × head length) and evidently protruding from oral fossa. ***Mesosoma.*** Pronotal groove barely visible; anterolateral corner of the pronotum projected to form an acute humeral angle (Fig. 5A); lateral pronotal area ventrally V-shaped carinate forming an acute tooth (Fig. 5D); propleuron ventrally carinate in a large V-shaped tooth (Fig. 5D). Mesosoma punctation dorsally with large, spaced punctures; interspaces medially polished, laterally micro-punctate; notauli incomplete, visible and deep only basally towards the transscutal fissure; parapsidal furrows fully visible; mesopleuron with a large subrectangular area subtended the mesepimeron + mesepisternum; posterior propodeal projections narrow, acute and downward directed. Wing venation unmodified, with long Rs bending slightly away from costal margin, leaving marginal cell broadly open. ***Metasoma.*** Punctation on T1 with tiny, sparse punctures (separated by 1–4 PD) (Fig. 6D), laterally micro-punctate on interspaces; T2 with larger and deeper punctures, anterodorsally denser (0.1–2 PD), laterally micro-punctate on interspaces; T3 with coarse to contiguous small punctures;

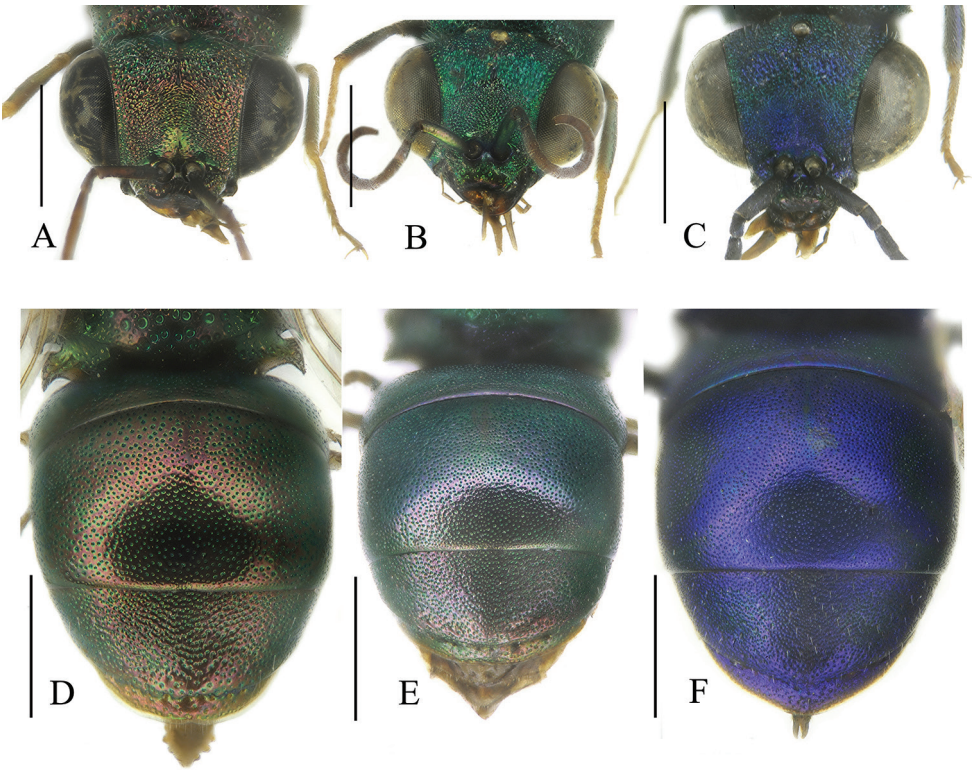

Figure 6. *Spinolia* species, females, head in frontal view (**A–C**), and metasoma in dorsal view (**D–F**). **A** *S. spinosa* sp. nov. **B** *S. chalcites* **C** *S. unicolor.* **D** *S. spinosa* sp. nov. **E** *S. chalcites* **F** *S. unicolor*. Scale bars: 1.0 mm.

T3 pit row barely sunken, with small, round pits, equally spaced; posterior pit row area almost polished, with a few, sparse, tiny punctures; T3 with two lateral angles and fully bordered by hyaline margin. Metasomal invaginated T5, T6, and S5 with several dorsal and lateral lobes. S2 black spots oval, transversally placed and separated 0.5 MOD each other. ***Colouration.*** Body coppery-bronze, darker to black on median area of mesoscutum; ventrally golden to copper; tegulae golden to non-metallic yellowish on outer margin; tarsi dark brown. Mandible brown, lighter medially. Scape and pedicel coppery, antennomeres yellowish-orange, darker on distal segments. Legs pale coloured, with slight metallic reflections, with non-metallic proximal and distal joints; tarsi yellowish. Forewings hyaline, slightly amber, with light brown veins. ***Vestiture***. Whitish, short and sparse setae on head and mesosoma (up to 1.5 MOD long); face with short whitish setae (less than 1.0 MOD); metasoma with short (less than 1. MOD) whitish, sparse setae on T3 and ventrally on S2 and S3 and femora.

Male. Unknown.

Etymology. The specific epithet *spinosa* (feminine) is derived from the Latin adjective *spinosus* (thorny) for the long and acute teeth ventrally displayed on pronotum and propleuron and clearly visible in lateral view (Fig. 5D).

Distribution. Mongolia (Bayankhongor).

Spinolia unicolor (Dahlbom, 1831)

Chrysis unicolor Dahlbom, 1831: 32. Syntypes ♂♂; Sweden: Scania: Lomma and Käflinge [= Kävlinge] (ZMUL) (examined).
Spinolia unicolor: Kimsey and Bohart 1991: 552 (cat., Mongolia, without locality).

Material examined. Mongolia: *Govi-Altai*, 1 ♂, 70 km E of Altay city, Guulin, 14.VII.2005, leg. JH (MHC).

Distribution. Mongolia (*Govi-Altai); Asiatic-European: from eastern Europe to Mongolia (Linsenmaier 1959, Kimsey and Bohart 1991).

Genus *Stilbum* Spinola, 1806

Stilbum Spinola, 1806: 9. Type species: *Chrysis calens* Fabricius, 1781, by subsequent desigation of Latreille 1810: 437.

Stilbum calens (Fabricius, 1781)

Chrysis calens Fabricius, 1781: 455. Holotype ♀; Russia: Siberia (NHMUK).
Stilbum calens zimmermanni Linsenmaier, 1959: Linsenmaier 1997b: 132 (China, Inner Mongolia [not Mongolia]).

Material examined. Mongolia: *Arkhangai*, 9 ♀♀, 25 km NE of Tsetserleg, 47°38'N, 101°45'E, 23.VII.2004, leg. JH (MHC); *Bulgan*, 1 ♀, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Dornogovi*, 1 ♂, 28 km SE of Chatan-Bulag, steppe, 3.VIII.2007, leg. MK (PRC); *Tuv*, 2 ♀♀, 1 ♂, Khangayn Mts, 5 km N of Khunt, 20.VII.2005, leg. JH (MHC); 1 ♂, 75 km W of Ulaanbaatar, dunes, 2.VIII.2005, leg. JH (MHC); *Uvurkhangai*, 3 ♀♀, 12 km E of Aravaykheer, 46°22'N, 102°49'E, 1800 m, 3.VII.2004, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Bulgan, Dornogovi, Tuv, Uvurkhangai); widely distributed in the Palaearctic Region (Tsuneki 1948, Linsenmaier 1959), Russia (Siberia), China (Liaoning, Beijing, Inner Mongolia, Shanxi) (Rosa et al. 2019). Linsenmaier (1997b) mentioned Mongolia in the distribution range of *Stilbum calens*, yet the specimen examined by the Swiss author was collected in China, Inner Mongolia: 1 ♂, Hutjertu Gol [currently Khujirt Gol River, near Bailingmiaozhen monastery, N of Baotou, Inner Mongolia, China] 1927, Sven Hedins Exp. Ctr. Asien Dr. Hummel, det. Linsenmaier 1963 (NMLS).

Genus *Trichrysis* Lichtenstein, 1876

Trichrysis Lichtenstein, 1876: 27. Type species: *Sphex cyanea* Linnaeus, 1758 [= *Trichrysis cyanea* (Linnaeus, 1758)], by monotypy.

Trichrysis cyanea (Linnaeus, 1758)

Sphex cyanea Linnaeus, 1758: 572. Lectotype ♂ (designated by Morgan 1984: 10); Europe (LSL).

Material examined. Mongolia: *Bayankhongor*, 1 ♀, 16 km SW of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JH (MHC); *Selenge*, 1 ♀, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 1 ♀, 100 km E of Ulaanbaatar, 20 km NE Tereltz, Tuul River, 15–21.VII.2003, leg. JH (MHC); 2 ♀♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Bayankhongor, Selenge, Tuv); Palaearctic, from western Europe and northern Africa to Central Asia, China and Japan (Rosa et al. 2019).

Trichrysis pellucida (du Buysson, 1887)

Chrysis pellucida du Buysson, 1887: 183. Lectotype ♀ (designated by Rosa et al. 2016: 123); China (MNHN) (examined).

Chrysis (*Trichrysis*) *buyssoni* Mocsáry, 1889: 323. Unnecessary replacement name for *Chrysis pellucida* du Buysson, 1887.

Chrysis (*Trichrysis*) *mongolica* Mocsáry, 1914: 24. Lectotype ♀ (designated by Bohart in Kimsey and Bohart 1991: 571); Mongolia (HMNH).

Material examined. Mongolia: 1 ♀, *mongolica* Mocs. typ. det. Mocsáry, red label, *Chrysis* L. *pellucida* Buyss. Linsenmaier det. 59, Lectotype *Chrysis mongolica* Mocs. ♀ RM Bohart, id nr. 135554 HNHM Hym. coll. Paralectotypes: 4 ♀♀, Mongolia, *mongolica* Mocs. typ. det. Mocsáry, red label, *Chrysis* L. *pellucida* Buyss. Linsenmaier det. 59, Paralectotype *Chrysis mongolica* Mocs. ♀ RM Bohart, id nr. 135555–135558 HNHM Hym. coll.

Distribution. Mongolia (without locality); East-Palaearctic: Russia (Far East), China (Liaoning, Inner Mongolia, Hebei, Beijing, Hunan) (Rosa et al. 2016, 2019).

Trichrysis secernenda (Mocsáry, 1912)

Chrysis (*Trichrysis*) *secernenda* Mocsáry, 1912: 376. Lectotype ♂ (designated by Bohart in Bohart and French 1986: 342); Uzbekistan: Gouldsha (HNHM) (examined).

Material examined. Mongolia: *Selenge*, 1 ♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC).

Distribution. *Mongolia (Selenge); Afghanistan, Uzbekistan, China (Xinjiang, Ningxia) (Rosa et al. 2016).

Tribe Elampini

Genus *Colpopyga* Semenov, 1954

Colpopyga Semenov, 1954: 137. Type species: *Hedychrum flavipes* Eversmann, 1858 [= *Colpopyga flavipes* (Eversmann, 1858)], by original designation.

***Colpopyga nesterovi* Rosa, 2017**

Colpopyga nesterovi Rosa, 2017b: 301. Holotype ♀; Kazakhstan: Aktobe Prov., Mugodzhary Mt., Emba River valley, 17.vi.1985, leg. M. Nesterov (ZIN) (examined).

Material examined. Mongolia: *Dornod*, 2 ♀♀, 1 ♂, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E, 24.VII.2007, leg. MH (MHC).

Distribution. *Mongolia (Dornod); Kazakhstan (Rosa 2017b).

Genus *Elampus* Spinola, 1806

Elampus Spinola, 1806: 10. Type species: *Chrysis panzeri* Fabricius, 1804 [= *Elampus panzeri* (Fabricius, 1804)], by subsequent designation of Latreille 1810: 437.
Ellampus Agassiz, 1846: 136. Unjustified emendation of *Elampus* Spinola, 1806 (part.).
Notozus Förster, 1853: 351. Type species: *Notozus frivaldszkii* Förster, 1853 [= *Elampus spina* (Lepeletier, 1806)], by subsequent designation of Ashmead 1902: 228.

***Elampus albipennis* (Mocsáry, 1889)**

Ellampus (*Notozus*) *albipennis* Mocsáry, 1889: 80. Lectotype ♂ (designated by Móczár 1964: 447); Russia: Astrakhan (HMNH) (examined).

Material examined. Mongolia: *Arkhangai*, 93 ♀♀, 30 ♂♂, Chuluut Gol River, 47°48'N, 100°19'E, 23.VII.2005, leg. JH (MHC); *Dornogovi*, 1 ♂, Orgon, 11.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Dornogovi); Asiatic-European, from eastern Europe, Saudi Arabia, UAE to Central Asia and eastern Siberia (Rosa et al. 2019).

***Elampus coloratus* Rosa, 2017**

Elampus coloratus Rosa in Rosa et al. 2017d: 2. Holotype ♂; Russia: Tyva Rep., 20 km SSW of Erzin, Tore-Khol' Lake (ZIN) (examined).

Material examined. Mongolia: *Sukhbaatar*, 1 ♂, Lun-Ula, 30 km WSW of Dariganga, 1.VII.1971, leg. I. Kerzhner (ZIN).

Distribution. Mongolia (Sukhbaatar); Russia (Tyva Rep.) (Rosa et al. 2017d).

Elampus montanus (Mocsáry, 1890)

Ellampus (*Notozus*) *montanus* Mocsáry, 1890: 49. Holotype ♂; Turkey: Buyuk Agri Dagi (Mount Ararat) (ISEA-PAS) (examined).

Material examined. Mongolia: *Dornogovi*, 6 ♂♂, Orgon, 11.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Dornogovi); Turkey (Mocsáry 1890) and Central Asia (unpubl. data).

Elampus panzeri (Fabricius, 1804)

Chrysis scutellaris Panzer, 1798: fig. 51, pl. 11. Type unknown; Germany: Nürnberg (depository unknown), nom. praeocc., nec Fabricius, 1794.
Chrysis panzeri Fabricius, 1804: 172. Replacement name for *Chrysis scutellaris* Panzer, 1798.

Material examined. Mongolia: *Arkhangai*, 1 ♂, 25 km NE of Tsetserleg, 47°38'N, 101°45'E, 23.VII.2004, leg MK (MHC); *Zavkhan*, 1 ♀, 2 ♂♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Zavkhan); Asiatic-European, from western Europe to eastern Siberia, Russian Far East, and China (Heilongjiang) (Rosa et al. 2019).

Elampus sanzii Gogorza, 1887

Elampus sanzii Gogorza, 1887: 33. Holotype ♂; Spain: Madrid (MCNM).
Notozus sanzii: Móczár 1967: 183 (cat., Mongolia: Central aimag, Zuun-Chara, 850 m, Exp. Dr. Z. Kaszab, 1964, Nr. 281; 8.VII.1964).

Material examined. None examined.

Distribution. Mongolia (Tuv); Asiatic-European, from Iberian Peninsula to Mongolia and eastern Siberia (Rosa et al. 2019).

Elampus spinifemoris (Móczár, 1967)

Notozus spinifemoris Móczár, 1967: 185. Holotype ♀; Mongolia: Uvurkhangai aimag: Arc Bogd ul, ca. 20 km S of von Somon Chovd, 1760 m, Exp. Dr. Z. Kaszab,

1964, 22.VI.1964 (HNHM) (examined). Rosa et al. 2017e: 113 (cat., typ., Mongolia: Arc Bogd ul, fig. 87).

Material examined. Mongolia: *Uvurkhangai*, 1 ♀, Uburchangaj aimag, Arc Bogd ul, cca 20 km S of von somon Chovd, 1760 m Exp. Dr. Z. Kaszab, 1964, Nr. 170, 22.VI.1964, *Notozus* sp. nov. ♀ det. Móczár 965, ♀ *Omalus* Pz. *Notozus panzeri* F. Linsenmaier det. 1964, Holotype ♀ *Notozus spinifemoris* L. Móczár 1966, Hym. Typ. No. 87 Mus. Budapest, id nr. 134892 HNHM Hym. coll. (HNHM).

Distribution. Mongolia (Uvurkhangai) (Móczár 1967).

Genus *Hedychridium* Latreille, 1802

Hedychridium Abeille de Perrin, 1878: 3. Type species: *Hedychrum minutum* Lepeletier, 1806 [= *Hedychridium ardens* (Coquebert, 1801)], by subsequent designation of Ashmead 1902: 227.

Hedychridium ardens (Coquebert, 1801)

Chrysis ardens Coquebert, 1801: 59. Holotype ♀; France: Bordeaux (MNHN?).
Hedychridium ardens: Móczár 1967: 189 (cat., Mongolia: Uvurkhangai aimag: Baga Bogd ul, between Somon Bogd and Somon Baruun Hajan-ulaan, 1900 m, Exp. Dr. Z. Kaszab, 1964, nr. 176, 23.VI.1964).

Material examined. Mongolia: *Arkhangai*, 1 ♀, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); *Bayankhongor*, 9 ♀♀, 8 ♂♂, 16 km SW of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JH (MHC); *Dornod*, 2 ♀♀, 3 ♂♂, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MH (MHC); 5 ♀♀, 2 ♂♂, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E, 24.VII.2007, leg. MH (MHC); *Khentii*, 1 ♀, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 2 ♀♀, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Sukhbaatar*, 1 ♀, 1 ♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Ulaanbaatar*, 7 ♀♀, Ulaanbaatar, Tuul River valley, 12.VII.2003, leg. JH (MHC); *Zavkhan*, 2 ♂♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. Mongolia (*Arkhangai, *Bayankhongor, *Dornod, *Khentii, *Selenge, *Sukhbaatar, *Ulaanbaatar, Uvurkhangai, *Zavkhan); Asiatic-European, from Europe and Middle East to Russia (Far East) (Kimsey and Bohart 1991; Kurzenko and Lelej 2007).

Hedychridium asianum Linsenmaier, 1997

Hedychridium integrum ssp. *asianum* Linsenmaier, 1997a: 254. Holotype ♂, Mongolia: Ulan Bator, 1900 m (UKC).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); *Bayankhongor*, 1 ♂, 16 km SW of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JH (MHC); *Bulgan*, 3 ♂♂, 137 km NE of Aravaykheer, 47°20'N, 103°45.5'E, 1250 m, 2.VII.2004, leg. JS (MHC); 2 ♀♀, 2 ♂♂, 143 km NE of Aravaykheer, 47°24'N, 103°39'E, 1300 m, 26.VII.2004, leg. MH (MHC); *Ulaanbaatar*, 1 ♂, Ulaanbaatar, 16.VII.1989, 1900 m, leg. Peter Salk, det. Linsenmaier, 1997 (NMLS).

Distribution. Mongolia (*Arkhangai, *Bayankhongor, *Bulgan, Ulaanbaatar); China (Gansu) (Rosa et al. 2014).

Remarks. *Hedychridium asianum* was described as a subspecies of *H. integrum*. As recently pointed out by Paukkunen et al. (2014), *H. integrum* is a synonym of *H. ardens* and *H. integrum* sensu Linsenmaier (1959) is *H. cupreum*.

Hedychridium belokobylskiji Rosa, 2017

Hedychridium belokobylskiji Rosa in Rosa et al. 2017d: 11. Holotype ♀; Russia: Eastern Siberia, Tuva Rep., 12 km SW of Samagaltai, Dyttyg-Khem River, 19.VII.2014, leg. A. Lelej, M. Proshchalykin, V. Loktionov (ZIN) (examined).

Material examined. Mongolia: *Tuv*, 1 ♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MK (PRC).

Distribution. *Mongolia (Tuv); Russia (Eastern Siberia) (Rosa et al. 2019).

Hedychridium cupreum (Dahlbom, 1845)

Hedychrum cupreum Dahlbom, 1845: 3. Lectotype ♀ (designated by Paukkunen et al. 2014: 23); Sweden: Lund (NHMW) (examined).

Material examined. Mongolia: *Bayankhongor*, 2 ♀♀, 16 km SW of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JH (MHC); *Dornogovi*, 1 ♂, 65 km SE of Chatan-Bulag, 1020 m, 2.VIII.2007, leg. MH (MHC); *Govi-Altai*, 4 ♀♀, 70 km E of Altay City, Guulin, 14.VII.2005, leg. JH (MHC); *Tuv*, 2 ♀♀, 1 ♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); 1 ♀, Khangaun Mts, 5 km N of Khunt, 20.VII.2005, leg. JH (MHC); *Umnugovi*, 3 ♀♀, Gobi, 100 km SW of Dalanzadgad, Bayanzag, 1–2.VII.2003, leg. JH (MHC); *Uvurkhangai*, 1 ♂,

12 km E of Aravaykheer, 46°22'N, 102°49'E, 1800 m, 3.VII.2004, leg. JH (MHC); *Zavkhan*, 2 ♀♀, 1 ♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Bayankhongor, Dornogovi, Govi-Altai, Tuv, Umnugovi, Uvurkhangai, Zavkhan); Asiatic-European, from north-western Europe to Mongolia and China (Rosa et al. 2014).

Remarks. Specimens from Mongolia display an unusual red colouration.

Hedychridium gabriellae Rosa, 2017

Hedychridium gabriellae Rosa in Rosa et al. 2017d: 19. Holotype ♀; Russia: Eastern Siberia, Tuva Rep., 20 km of SSW Erzin, Tore-Khol' Lake, 30.VI–3.VII.2013, leg. V. Loktionov & M. Proshchalykin (ZIN) (examined).

Material examined. Mongolia: *Bayankhongor*, 18 ♂♂, 22 ♀♀, 75 km S of Bayankhongor, 45°20'N, 100°48.5'E, 1330 m, 8.VII.2004, leg. JH, JS (MHC); *Dornogovi*, 5 ♀♀, 5 ♂♂, 65 km SE of Chatan-Bulag, 1020 m, 2.VIII.2007, leg. MH (MHC); *Tuv*, 1 ♂, 70 km W of Ulaanbaatar, 1070 m, dunes, 16.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Bayankhongor, Dornogovi, Tuv); Russia (Eastern Siberia) (Rosa et al. 2019).

Hedychridium longigena Rosa, 2017

Hedychridium longigena Rosa in Rosa et al. 2017d: 21. Holotype ♀; Russia: Irkutsk Prov., 8 km N of Irkutsk, Angara River, sandy slopes, 10.VII.2001, collector unknown (ZIN) (examined).

Material examined. Mongolia: *Bayankhongor*, 1 ♀, 1 ♂, 56 km NW of Bayankhongor, 46°33'N, 100°12'E, 2200 m, 12.VII.2004, leg. JS (MHC); *Bulgan*, 2 ♀♀, 137 km NE of Aravaykheer, 47°20'N, 103°45.5'E, 1250 m, 2.VII.2004, leg. MK (MHC); 3 ♀♀, ibid, 26.VII.2004, JH (MHC); *Dornod*, 1 ♂, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MH (MHC); *Dornogovi*, 1 ♂, 65 km SE of Chatan-Bulag, 1020 m, 2.VIII.2007, leg. MH (MHC); *Khentii*, 2 ♀♀, 2 ♂♂, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 1 ♀, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 10 ♀♀, 9 ♂♂, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MK (PRC); 4 ♂♂, 70 km W of Ulaanbaatar, 1070 m, dunes, 16.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Bayankhongor, Bulgan, Dornod, Dornogovi, Khentii, Selenge, Tuv); Russia (Eastern Siberia) (Rosa et al. 2019).

Hedychridium propodeale Rosa, 2017

Hedychridium propodeale Rosa in Rosa et al. 2017d: 16. Holotype ♀; Russia: Eastern Siberia, Tuva Rep., 20 km SSW of Erzin, Tore-Khol' Lake, 3.VII.2013, leg. V. Loktionov & M. Proshchalykin (ZIN) (examined).

Material examined. Mongolia: *Govi-Altai*, 1 ♀, Mongolia W, 70 km E of Altay city, Guulin, 14.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Govi-Altai); Russia (Eastern Siberia) (Rosa et al. 2019).

Hedychridium roseum (Rossi, 1790)

Chrysis carnea var. *rosea* Rossi, 1790: 75. Syntypes; Italy (Berlin?).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.7.2004, leg. JH (MHC); *Dornod*, 21 ♀♀, 4 ♂♂, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MH (MHC); 19 ♀♀, 1 ♂, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E, 24.7.2007, leg. MH (MHC); *Dornogovi*, 4 ♂♂, 2 km SE of Khuvsgol, 5.VIII.2007, leg. MH (MHC); *Sukhbaatar*, 1 ♀, 1 ♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); 4 ♂♂.

Distribution. *Mongolia (Arkhangai, Dornod, Dornogovi, Sukhbaatar); Asiatic-European, from western Europe to Russia (Far East) (Rosa et al. 2019).

Remarks. The record from Korea (Tsuneki 1953b and Korean checklists) must be referred to *Hedychridium tsunekii* Linsenmaier, 1959. In fact, Linsenmaier (1959) described as *Hedychridium tsunekii* the Korean specimens collected and identified by Tsuneki (1953) as *H. roseum*.

Genus *Hedychrum* Latreille, 1802

Hedychrum Latreille, 1802: 317. Type species: *Chrysis lucidula* Fabricius, 1775 [= *Hedychrum nobile* (Scopoli, 1763)], by monotypy.

Hedychrum chalybaeum Dahlbom, 1854

Hedychrum chalybaeum Dahlbom, 1854: 64. Syntypes ♂♂; Europe: 'Europa media et meridionali', Russia, Prussia, Silesia (MfN, ZMUL) (examined). Móczár 1967: 188 (cat., Mongolia: 1 ♀, Sukhbaatar aimag: 44 km SSW of Baruun urt, 1050 m, Exp. Dr. Z. Kaszab, 1965, nr. 349, 2.–3.VIII.1965; 1 ♀, Chadatin-bulan, 60 km N of Somon Bajanterem, 950 m, Exp. Dr. Z. Kaszab, 1965, nr. 340, 31.VII.1965).

Material examined. Mongolia: *Bayankhongor*, 1 ♂, 2 km S of Bayankhongor, 46°12'N, 100°43'E, 1800 m, 10.VII.2004, leg. JH (PRC); 20 ♀♀, 2 ♂♂, 56 km NW of Bayankhongor, 46°33'N, 100°12'E, 2200 m, 12.VII.2004, leg. JH (PRC); *Dornod*, 16 ♀♀, 9 ♂♂, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MH (MHC); 16 ♀♀, 6 ♂♂, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E 24.VII.2007, leg. MH (MHC); 1 ♂, 15 km W of Choibalsan, Kerulen River, 770 m, 24.VII.2007, leg. MK (PRC); 1 ♂, 50 km SW of Choibalsan, 960 m, 25.VII.2007, leg. JH (MHC); 1 ♀, 50 km SW of Choibalsan, 960 m, 25.VII.2007, leg. MH (MHC); *Govi-Altai*, 2 ♂♂, 70 km E of Altay city, Guulin, 14.VII.2005, leg. JH (MHC); *Selenge*, 1 ♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (PRC); *Sukhbaatar*, 6 ♀♀, 2 ♂♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 1 ♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); *Ulaanbaatar*, 1 ♂, Ulaanbaatar, Tuul River valley, 12.VII.2003, leg. JH (PRC); 1 ♀, 7 km E of Ulaanbaatar, Gachuurt, 47°55'N, 107°06'E, 31.VII.2002, 1310 m, leg. JS (PRC).

Distribution. Mongolia (Bayankhongor, *Dornod, *Govi-Altai, *Selenge, Sukhbaatar, Tuv, *Ulaanbaatar); widely distributed in the Palaearctic Region (Linsenmaier 1959; Kurzenko and Lelej 2007), China (Heilongjiang, Inner Mongolia, Gansu) (Rosa et al. 2014).

Hedychrum gerstaeckeri Chevrier, 1869

Hedychrum gerstaeckeri Chevrier, 1869: 47. Syntypes ♀♀, ♂♂, [not holotype]; Switzerland (Geneva) (examined).

Material examined. Mongolia: *Khentii*, 3 ♀♀, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 1 ♀, 5 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 4 ♀♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Khentii, Selenge, Tuv); Palaearctic and Oriental region, from western Europe to Russian Far East, Japan, China and Taiwan (Rosa et al. 2014, 2019).

Hedychrum lama du Buysson, 1891

Hedychrum lama du Buysson, 1891: 31. Lectotype ♂ (designated by Kimsey in Kimsey and Bohart 1991: 215); Mongolia: Kansu-Kobden Owatu (MNHN).

Material examined. Mongolia: *Khovd*, 1 ♂, Mongolie O. Radoszkowsky, Kansu-Kobden Owatu, 12.8, Mongolie Coll. R. du Buysson 1900, Type, Museum Paris.

Distribution. Mongolia (Khovd) (du Buysson 1891).

Hedychrum longicolle Abeille de Perrin, 1877

Hedychrum longicolle Abeille de Perrin, 1877: 65. Lectotype ♀ (designated by Kimsey 1986: 108); France: Marseille, Toulon (Geneva, Paris) (examined).

Material examined. Mongolia: *Bulgan*, 1 ♂, 170 km W of Ulaanbaatar, dunes, 1070 m, 16.VIII.2007, leg. MH (MHC); *Dornod*, 1 ♂, 50 km SW of Choibalsan, 960 m, 25.VII.2007, leg. JH (MHC); *Sukhbaatar*, 1 ♂, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, leg. MH (MHC); 2 ♂♂, 6 ♀♀, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 1 ♀, 75 km W Ulaanbaatar, dunes, 2.VIII.2005, leg. JH (MHC); *Umnugovi*, 1 ♀, Gobi Gurvansaikhan National Park, 44°00'N, 101°50'E, 10.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Bulgan, Dornod, Sukhbaatar, Tuv, Umnugovi); Palaearctic, from southern Europe and northern Africa, to western Asia, Siberia, and China (Rosa et al. 2019).

Hedychrum nobile (Scopoli, 1763)

Sphex nobile Scopoli, 1763: 297. Holotype ♀; Italy [not Austria] (lost).

Material examined. Mongolia: *Arkhangai*, 1 ♀, 25 km NE of Tsetserleg, 47°38'N, 101°45'E, 23.VII.2004, leg. JH (MHC); 4 ♂♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); 4 ♀♀, 9 ♂♂, ibid, 27.VII.2005, leg. JH (MHC); *Selenge*, 2 ♀♀, 12 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 2 ♀♀, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC); *Zavkhan*, 3 ♂♂, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Selenge, Tuv, Zavkhan); Asiatic-European, from western Europe to Siberia (Rosa et al. 2019).

Hedychrum rutilans ermak Semenov, 1967

Hedychrum intermedium ermak Semenov-Tian-Shanskij, 1967: 142. Holotype ♂; Russia: Siberia, Shira Lake [Khakass Rep.], 24.VII.1897, Yu. Wagner (ZIN) (examined). Móczár 1967: 188 (cat., Mongolia: Sukhbaatar aimag: Ongon elis, 10 km S of Somon Chongor, 900 m, Exp. Dr. Z. Kaszab, 1965, nr. 357, 3.–4.VIII.1965).

Material examined. Mongolia: *Arkhangai*, 1 ♀, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); 1 ♀, 2 ♂♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.VII.2005, leg. JH (MHC); *Dornod*, 2 ♂♂, 20 km W of Choibalsan, 48°01'N, 114°14'E, 800 m, 24.VII.2007, leg. MH (MHC); *Selenge*, 1 ♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 1 ♀, 50 km

N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MK (PRC); 7 ♀♀, 3 ♂♂, ibid, 8–13.VIII.2007, leg. MH (MHC).

Distribution. Mongolia (*Arkhangai, *Dornod, *Selenge, Sukhbaatar, *Tuv); Russia (Siberia, Far East) (Rosa et al. 2019).

Genus *Holopyga* Dahlbom, 1845

Holopyga Dahlbom, 1845: 4. Type species: *Holopyga amoenula* Dahlbom, 1845, by subsequent designation of Ashmead 1902: 227.

Holopyga generosa asiatica Trautmann, 1926

Holopyga gloriosa var. *asiatica* Trautmann, 1926: 5. Holotype ♀; Turkey: İzmir prov.: Smyrna (MFN) (examined).

Material examined. Mongolia: *Selenge*, 3 ♀♀, 5 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC).

Distribution. *Mongolia (Selenge); Asiatic-European, from southern Europe to China (Rosa et al. 2019).

Holopyga kaszabi Móczár, 1967

Holopyga kaszabi Móczár, 1967: 187. Holotype ♂; Mongolia: Ostgobi aimag 40 km NW of Chara-Eireg 1150 m Exp. Dr. Z. Kaszab, 1963 (HNHM) (examined). Rosa et al. 2017e: 108 (cat., type series, Mongolia).

Material examined. Mongolia: *Dornogovi*, 1 ♂, Ostgobi aimag 40 km NW of Chara-Eireg, 1150 m Exp. Dr. Z. Kaszab, 1963, Nr. 62, 30.VI.1963, Holotype ♂ *Holopyga kaszabi* n. sp. det. Móczár 1966, Hym. Typ. No. 89, id nr. 134927 HNHM Hym. coll. (HNHM); 1 ♀, Ostgobi aimag 40 km NW of Chara-Eireg 1150 m Exp. Dr. Z. Kaszab, 1963, Nr. 62, 30.VI.1963, Allotype ♀ *Holopyga kaszabi* n. sp. det. Móczár 1966, Hym. Typ. No. 96, id nr. 134933 HNHM Hym. Coll. (HNHM). 1 ♂: Ostgobi aimag 40 km NW of Chara-Eireg 1150 m Exp. Dr. Z. Kaszab, 1963, Nr. 62, 30.VI.1963, *Holopyga* sp. n. ? <handwritten by Móczár>, ♂ Allotype *Holopyga* Dhlb. *diversicolor* Lins. Linsenmaier 1966, Paratype ♂ *Holopyga kaszabi* n. sp. det. Móczár 1966, Hym. Typ. No. 90 (HNHM); 1 ♂, Mongolia, Ostgobi aimag 40 km NW of Chara-Eireg 1150 m Exp. Dr. Z. Kaszab, 1963, Nr. 62, 30.VI.1963, Paratype ♂ *Holopyga kaszabi* n. sp. det. Móczár 1966, Hym. Typ. No. 91, id nr. 134929 HNHM Hym. coll. (HNHM); 1 ♂: Mongolia, Ostgobi aimag 40 km NW of Chara-Eireg 1150 m Exp. Dr. Z. Kaszab, 1963, Nr. 62, 30.VI.1963, Paratype ♂ *Holopyga kaszabi* n. sp. det. Móczár 1966, Hym. Typ. No. 93, id nr. 134930 HNHM Hym. coll. (HNHM); 1

♂, Mongolia, Ostgobi aimag 40 km NW of Chara-Eireg 1150 m Exp. Dr. Z. Kaszab, 1963, Nr. 62, 30.VI.1963, Paratype ♂ *Holopyga kaszabi* n. sp. det. Móczár 1966, Hym. Typ. No. 94, id nr. 134931 HNHM Hym. coll. (HNHM); 1 ♀: Mongolia, Ostgobi aimag 40 km NW of Chara-Eireg 1150 m Exp. Dr. Z. Kaszab, 1963, Nr. 62, 30.VI.63, *Holopyga gloriosa* ? *intermedia* ? det. L. Móczár, Type *Holopyga* Dhlb. *diversicolor* Lins. Linsenmaier 1966, Paratype ♀ *Holopyga kaszabi* n. sp. det. Móczár 1966, Hym. Typ. No. 95 / id nr. 134932 HNHM Hym. coll. (HNHM); 1 ♂, Mongolia, Catgobi aimag 40 Km NW of Chara-Eireg 1150 m, Exp.Dr. Z. Kaszab, 1963, Nr.62, 30.VI.1963, Paratype (NMLS); 1 ♀, Mongolia, Catgobi aimag 40 Km NW of Chara-Eireg, 1150 m, Exp. Dr. Z. Kaszab, 1963 / Nr.62, 30.VI.1963, Paratype (NMLS); *Umnugovi*, 1 ♂, Gobi, Dalanzadgad, 25.6.2003, leg. JH (MHC); *Uvurkhangai*, 1 ♂, 139 km SW of Aravaykheer, 45°17'N, 101°41'E, 1430 m, 4.VII.2004, leg. JS (MHC).

Distribution. Mongolia (Dornogovi, *Umnugovi, *Uvurkhangai) (Móczár 1967).

Holopyga minuma Linsenmaier, 1959

Holopyga minuma Linsenmaier, 1959a: 31. Holotype ♀; Turkey: Niğde prov.: Niğde (NMLS) (examined).

Material examined. Mongolia: *Dornod*, 22 ♀♀, 14 ♂♂, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MH (MHC); 25 ♀♀, 6 ♂♂, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E 24.VII.2007, leg. MH (MHC); *Sukhbaatar*, 1 ♂, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, leg. MH (MHC).

Distribution. *Mongolia (Dornod, Sukhbaatar); Asiatic-European, from central Europe to eastern Siberia (Rosa et al. 2019).

Genus *Omalus* Panzer, 1801

Omalus Panzer, 1801: 13. Type species: *Chrysis aenea* Fabricius, 1787, by monotypy.

Omalus aeneus (Fabricius, 1787)

Chrysis aenea Fabricius, 1787: 284. Holotype ♀; Germany: Hala Saxonum [= Halle] (Copenhagen) (examined).

Material examined. Mongolia: *Tuv*, 1 ♀, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); *Ulaanbaatar*, 1 ♀, Ulaanbaatar, Tuul River valley, 12.VII.2003, leg. JH (MHC).

Distribution. *Mongolia (Tuv, Ulaanbaatar); Holarctic and Oriental: from Europe and North Africa to Japan and Taiwan (Wei et al. 2014). Probably accidentally introduced to North America (Kimsey and Bohart 1991).

Omalus berezovskii (Semenov, 1932)

Ellampus (*Dictenulus*) *berezovskii* Semenov-Tian-Shanskij, 1932: 12. Holotype ♀; China: Sichuan (ZIN) (examined).

Material examined. Mongolia: *Ulaanbaatar*, 1 ♂, Ulaanbaatar, Tuul River valley, 12.VII.2003, leg. JH (MHC).

Distribution. *Mongolia (Ulaanbaatar); East-Palaearctic: Russia (Eastern Siberia, Far East), China (Ningxia, Sichuan) (Rosa et al. 2019).

Omalus margianus (Semenov, 1932)

Ellampus (*Dictenulus*) *margianus* Semenov-Tian-Shanskij, 1932: 15. Lectotype ♀ (designated by Kimsey 1986: 107); Turkmenistan: Imam-baba (ZIN) (examined).

Material examined. Mongolia: *Arkhangai*, 1 ♀, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.VII.2005, leg. JH (MHC); *Bayankhongor*, 1 ♀, 75 km S of Bayankhongor, 45°20'N, 100°48.5'E, 1330 m, 8.VII.2004, leg. JS (MHC); *Bulgan*, 2 ♂♂, 137 km NE of Aravaykheer, 47°20'N, 103°45.5'E, 1250 m, 2.VII.2004, leg. JH (MHC); 1 ♀, 1 ♂, 143 km NE of Aravaykheer, 47°24'N, 103°39'E, 1300 m, 26.VII.2004, leg. MH (MHC); 2 ♂♂, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Sukhbaatar*, 2 ♀♀, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 1 ♂, 80 km W of Ulaanbaatar, 1230 m, dunes, 17.VIII.2007, leg. MH (MHC).

Distribution. *Mongolia (Arkhangai, Bayankhongor, Bulgan, Sukhbaatar, Tuv); Central Asia (Kimsey and Bohart 1991).

Omalus miramae (Semenov, 1932)

Ellampus (*Dictenulus*) *miramae* Semenov-Tian-Shanskij, 1932: 13. Lectotype ♀ (designated by Rosa et al. 2017a: 76); Turkmenistan: Pereval (ZIN) (examined).

Material examined. Mongolia: *Bayankhongor*, 1 ♂, 75 km S of Bayankhongor, 45°20'N, 100°48.5'E, 1330 m, 8.VII.2004, leg. JH (MHC); *Dornogovi*, 2 ♀♀, Orgon, 11.VII.2005, leg. JH (MHC); *Sukhbaatar*, 2 ♀♀, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, leg. MH (MHC).

Distribution. *Mongolia (Bayankhongor, Dornogovi, Sukhbaatar); Central Asia (Kimsey and Bohart 1991).

Omalus stella (Semenov, 1932)

Ellampus (*Ellampus*) *stella* Semenov-Tian-Shanskij and Nikol'skaya, 1954: 93. Lectotype ♀ (designated by Kimsey 1986: 107); Tajikistan: Stalinabad (currently Dushambe) (ZIN) (examined).

Material examined. Mongolia: *Arkhangai*, 1 ♀, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); *Tuv*, 3 ♂♂, 75 km W of Ulaanbaatar, dunes, 2.VIII.2005, leg. JH (MHC); *Uvurkhangai*, 1 ♀, 159 km of SW Aravaykheer, 45°11'N, 101°26'E, 1250 m, 5.VII.2004, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai, Tuv, Uvurkhangai); Central Asia (Kimsey and Bohart 1991).

Genus *Philoctetes* Abeille de Perrin, 1879

Philoctetes Abeille de Perrin, 1879: 27. Type species: *Holopyga cicatrix* Abeille de Perrin, 1879 [= *Philoctetes micans* (Klug, 1835)], by subsequent designation of Ashmead 1902: 228.

Ellampus Agassiz, 1846: 136. Unjustified emendation of *Elampus* Spinola, 1806 (part.).

Philoctetes bogdanovii (Radoszkowski, 1877)

Holopyga bogdanovii Radoszkowski, 1877: 5. Holotype ♂; Uzbekistan: Zarafshan (ZMMU) (examined).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 27.7.2005, leg. JH (MHC).

Distribution. *Mongolia (Arkhangai); Asiatic-European, from southern Europe, western Asia, Iran, and Turkey to Mongolia (Rosa et al. 2013; present record).

Philoctetes cynthiae Rosa, 2017

Philoctetes cynthiae Rosa in Rosa et al. 2017c: 35. Holotype ♀; Russia: Tyva Rep., 13 km SW of Samagaltai, Dyttyg-Khem River, 9.VII.2013, leg. V. Loktionov & M. Proshchalykin (ZIN) (examined).

Material examined. Mongolia: *Bayankhongor*, 1 ♀, 1 ♂, 75 km S of Bayankhongor, 45°20'N, 100°48.5'E, 1330 m, 8.VII.2004, leg. JH (MHC); 1 ♀, 56 km NW of Bayankhongor, 46°33'N, 100°12'E, 2200 m, 12.VII.2004, leg. JS (MHC); 3 ♀♀,

7 ♂♂, 86 km NW of Bayankhongor, 46°50'N, 100°04'E, 2070 m, 14.VII.2004, leg. JH, MK (MHC); *Sukhbaatar*, 1 ♀, SE Mongolia, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, leg. MK, paratype (PRC); 1 ♂, ibid, leg. MH (MHC); *Ulaanbaatar*, 2 ♂♂, Ulaanbaatar, Tuul River valley, 12.VII.2003, leg. JH (MHC); *Uvurkhangai*, 4 ♂♂, 12 km E of Aravaykheer, 46°22'N, 102°49'E, 1800 m, 3.VII.2004, leg. JH (MHC);

Distribution. Mongolia (*Bayankhongor, Sukhbaatar, *Ulaanbaatar, *Uvurkhangai); Russia (Tyva Rep.) (Rosa et al. 2017c).

Philoctetes diakonovi (Semenov, 1932)

Ellampus (*Ellampus*) *diakonovi* Semenov-Tian-Shanskij, 1932: 34. Holotype ♀; Kazakhstan: "Turkestan septentr.: Bajgakum (ZIN) (examined).

Material examined. Mongolia: *Dornogovi*, 1 ♀, 1 ♂, Orgon, 11.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Dornogovi); Central Asia (Kimsey and Bohart 1991).

Philoctetes lyubae Rosa, 2017

Philoctetes lyubae Rosa in Rosa et al. 2017c: 39. Holotype ♀; Russia: Tuva Rep., 20 km SSW of Erzin, Tore-Khol' Lake, 3.VII.2013, leg. V. Loktionov & M. Proshchalykin (ZIN) (examined).

Material examined. Mongolia: *Dornogovi*, 1 ♂, Atayn Mts, Gichigniv Nuruu, 10 km SW of Sain-Shand, 12.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Dornogovi); Russia (East Siberia) (Rosa et al. 2017c).

Philoctetes mongolicus (du Buysson, 1901)

Ellampus horvathi var. *mongolicus* du Buysson, 1901: 98. Lectotype ♂ (designated by Móczár 1967: 186); N Mongolia (NHMW) (examined). Rosa et al. 2020: 87 (cat., type series), 88 (fig. 55).

Ellampus horwathi (!) var. *mongolicus*: Bischoff 1913: 8 (cat., North Mongolia).

Omalus (*Notozus*) *mongolicus*: Linsenmaier 1959: 23 (descr. Mongolia).

Omalus mongolicus: Móczár 1967: 186 (cat., Mongolia: 1 ♂, Uvurkhangai aimag: Arc Bogd ul, ca. 20 km S of Somon Chovd, 1760 m, Exp. Dr. Z. Kaszab, 1964, nr. 170, 22.VI.1964; 1 ♂, Ulan-Baator, Bogdo ul, 1500 m, Exp. Dr. Z. Kaszab, 1963, nr. 4, 16.VI.1963).

Philoctetes horvathi var. *mongolicus*: Kimsey and Bohart 1991: 256 (cat., North Mongolia).

Philoctetes mongolicus: Rosa et al. 2014: 33 (cat., distr.); 2015: 436 (cat., descr., tax., Mongolia: Ulaanbataar, Baruun-Urt Moltsoy Els).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 25 km NE of Tsetserleg, 47°38'N, 101°45'E, 23.VII.2004, leg. JH (MHC); *Bayankhongor*, 2 ♂♂, 16 km SW of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JH (MHC); 1 ♂, 56 km NW of Bayankhongor, 46°33'N, 100°12'E, 2200 m, 12.VII.2004, leg. JH (MHC); 1 ♂, 86 km NW of Bayankhongor, 46°50'N, 100°04'E, 2070 m, 14.VII.2004, leg. JH (MHC); *Khentii*, 2 ♀♀, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 1 ♀, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Sukhbaatar*, 1 ♀, SE Mongolia, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, MK (PRC); *Tuv*, 1 ♀, 50 km N of Ulaanbataar, E of Mandal, 1180 m, 8–13.VII.2007, leg. MK (PRC); 1 ♀, 1 ♂, ibid, leg. MH (MHC); *Uvurkhangai*, 1 ♂, N. Mongolei Leder 92, *Ellampus Horvathi* Mocs. var. *mongolicus* Buyss. var. nov. R. du Buysson det. 1901 ♂, Lectotype v. *mongolicus* Buysson det. L. Móczár <red label> (NHMW). Paralectotypes: 1 ♂ N. Mongolei Leder 92, *Ellampus Horvathi* Mocs. var. *mongolicus* Buyss. var. nov. R. du Buysson det. 1901 ♂, *Paralectotype* v. *mongolicus* Buysson det. L. Móczár <red label> (NHMW); 1 ♀, N. Mongolei Leder 92, *Ellampus Horwathi* Mocs. var. *mongolicus* Buyss. var. nov. R. du Buysson det. 1901 ♀, *Omalus horvathi* Mocs. det. L. Móczár (NHMW).

Distribution. Mongolia (*Arkhangai, *Bayankhongor, *Khentii, *Sukhbaatar, *Tuv, Ulaanbaatar, Uvurkhangai); widely distributed from Mongolia to Central Asia and southern Russia to Volga (Trautmann 1927), China (Shanxi) (Rosa et al. 2014).

Philoctetes shokalskii (Semenov, 1932)

Ellampus (*Dictenulus*) *shokalskii* Semenov-Tian-Shanskij, 1932: 24. Lectotype ♀ (designated by Kimsey 1986: 107); Mongolia: "Mongolia borealis: prope oppid. [um] Urga [Ulaanbaatar], 1–4.VI.1909, leg. P. Kozlov (ZIN) (examined). Rosa et al. 2017a: 78 (cat., type series), 218 (Plate 218). Rosa et al. 2017e: 119 (Mongolia: Chentej aimak 10 km W von Somon Delgerchaan, 1250 m Exp. Dr. Z. Kaszab, 1965 // Nr. 476. 24.VIII.1965).

Omalus shokalskii: Móczár, 1967: 186 (cat., Mongolia: 1 ♂, Ostgobi aimag; 40 km NW of Chara-Eireg, 1150 m, Exp. Dr. Z. Kaszab, 1963, nr. 62, 30.VI.1963; 1 ♂, Ostgobi aimag: 20 km SO of Čojren, 1200 m, Exp. Dr. Z. Kaszab, 1963, nr. 70, 1.VII.1963; 1 ♂, Sukhbaatar aimag: 44 km SSW of Baruun urt, 1050 m, Exp. Dr. Z. Kaszab, 1965, nr. 353, 3.VIII.1965; 1 ♀, Chentej aimag: 10 km W of Somon Delgerchaan, 1250 m, Exp. Dr. Z. Kaszab, 1965, nr. 476, 24.VIII.1965, allotype).

Philoctetes shokalskii: Kimsey and Bohart 1991: 257 (cat., Mongolia: Urga).

Material examined. Mongolia: *Bayankhongor*, 5 ♀♀, 11 ♂♂, 86 km NW of Bayankhongor, 46°50'N, 100°04'E, 2070 m, 14.VII. 2004, leg. JS, MK, JH (MHC); *Dornod*, 1 ♀, 50 km SW of Choilbalsan, 960 m, 25.VII.2007, leg. JH (MHC); *Govi-Altai*, 1 ♀, 1 ♂, 70 km of Altay city, Guulin, 14.VII.2005, leg. JH (MHC); *Govi-Sümber*, 2 ♂♂, 20 km SE of Choyr, 1480 m, 7.VIII.2007, leg. MK (PRC); 1 ♀, 1 ♂, ibid, leg. MH (MHC);

Sukhbaatar, 4 ♂♂, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, leg. MK (PRC); 1 ♂, 210 km SSE of Baruun-Urt, 29.VII.2007, steppe, leg. MK (PRC); 12 ♂♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 1 ♀, Teregtin, 1350 m, Exp. Dr. Z. Kaszab, 1963, Nr.73, 2.VII.1963, det. Linsenmaier 1966 (NMLS); *Ulaanbaatar*, ♀ [not ♂], env. Urga [Ulaanbaatar], 1–4.VI.1909, leg. P. Kozlov, *Ellamp. shokalskii m*. [mihi] Typ. ♂. A. Semenov-Tian-Shansky det. V.19, Lectotype *Ellampus shokalskii* Sem. design. LS Kimsey <red label> (ZIN); 1 ♀, same data, paralectotype (ZIN); *Umnugovi*, 1 ♀, Gobi Gurvansaikhan National Park, 40 km W of Dalanzadgad, 2000 m, 28–30.VI. 2003, leg. JH (MHC); *Uvurkhangai*, 9 ♂♂, 12 km E of Aravaykheer, 46°22'N, 102°49'E, 1800 m, 3.VII.2004, leg. JH (MHC).

Distribution. Mongolia (*Bayankhongor, *Dornod, Dornogovi, *Govi-Sümber, Khentii, Sukhbaatar,*Tuv, Ulaanbaatar, *Umnugovi, Uvurkhangai) (Kimsey 1986).

Genus *Pseudomalus* Ashmead, 1902

Pseudomalus Ashmead, 1902: 229. Type species: *Omalus semicircularis* Aaron, 1885 [= *Pseudomalus janus* (Haldeman, 1844)], by original designation.

Pseudomalus auratus nigridorsus (Tsuneki, 1953)

Ellampus auratus f. *nigridorsus* Tsuneki, 1953a: 54. Syntypes ♂, ♀; Japan, Korea, Manchuria (NIAS).

Material examined. Mongolia: *Bulgan*, 1 ♀, 137 km NE of Aravaykheer, 47°20'N, 103°45.5'E, 1250 m, 2.VII.2004, leg. JS (MHC); 1 ♀, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Khentii*, 1 ♀, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Tuv*, 2 ♀♀, 18 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); *Zavkhan*, 2 ♀♀, 40 km SW of Uliastay, dunes, 18.VII.2005, leg. JH (MHC).

Distribution. *Mongolia (Bulgan, Khentii, Tuv, Zavkhan); Russia (Eastern Siberia, Far East), China, Korea, Japan (Rosa et al. 2019).

Pseudomalus corensis (Uchida, 1927)

Philoctetes punctatus var. *corensis* Uchida, 1927: 153. Holotype ♂; Korea: Seiryori (descr.) (NIAS).

Omalus joannisi du Buysson, 1908: Móczár 1967: 185. (cat., Mongolia: Central aimag: Zuun-Chara, 850 m, Exp. Dr. Z. Kaszab, 1964, nr. 281; 8.VII.1964) (mis.).

Material examined. Mongolia: *Bulgan*, 1 ♀, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Dornod*, 1 ♀, 100 km W of Choilbalsan,

820 m, 23.VII.2007, leg. MH (MHC); 2 ♂♂, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E, 24.VII.2007, leg. MH (MHC/PRC); *Khentii*, 1 ♀, 1 ♂, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 7 ♀♀, 5 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC/PRC); *Tuv*, 7 ♀♀, 3 ♂♂, 50 km N of Ulaanbaatar, E of Mandal, 1180 m, 8–13.VIII.2007, leg. MH (MHC, PRC); *Ulaanbaatar*, 3 ♀♀, Ulaanbaatar, Tuul River valley, 12.VII.2003, leg. JH (MHC).

Distribution. Mongolia (*Bulgan, *Dornod, *Khentii, *Selenge, Tuv, *Ulaanbaatar); Russia (Eastern Siberia, Far East); Japan (Hokkaido) (Rosa et al. 2019).

Remarks. The specimen illustrated in the volume of Russian cuckoo wasps (Rosa et al. 2019: fig. 18) is apparently misidentified and currently belonging to an unidentified species. Examination of type material by Uchida is needed for further studies.

Pseudomalus punctatus (Uchida, 1927)

Philoctetes punctatus Uchida, 1927: 152. Syntypes ♂, ♀; Japan: Hokkaido and Honshu (NIAS?).

Omalus punctatus: Móczár, 1967: 185 (cat., Mongolia: 1 ♀, 1 ♂, Čojbalsan [= Dornod] aimag: Chamardavaa ul, 80 km SO of Somon Chalchingol, 600 m, Exp. Dr. Z. Kaszab, 1965, nr. 401, 13.VIII.1963).

Material examined. Mongolia: *Bulgan*, 1 ♀, Mongol Els Nat. Res., dunes, 47°24'N, 103°39'E, 31.VII.2005, leg. JH (MHC); *Khentii*, 14 ♀♀, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. JH, MH (MHC); *Tuv*, 18 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC).

Distribution. Mongolia (*Bulgan, Dornod, *Khentii, *Tuv); Russia (Eastern Siberia, Far East); Korea, Japan (Rosa et al. 2019).

Pseudomalus pusillus (Fabricius, 1804)

Chrysis pusilla Fabricius, 1804: 176. Lectotype ♀ (designated by Rosa et al. 2020: 66); Austria (NHMW) (examined).

Omalus pusillus: Móczár, 1967: 195 (cat., Mongolia: 1 ♀, Čojbalsan [= Dornod] aimag: 50 km SO of Čojbalsan [= Choibalsan], 700 m, Exp. Dr. Z. Kaszab, 1965, nr. 421, 16.VIII.1965; 1 ♂, Čojbalsan [= Dornod] aimag: 44 km NW of Čojbalsan [= Choibalsan], 750 m, Exp. Dr. Z. Kaszab, 1965, nr. 425, 17.VIII.1965).

Material examined. Mongolia: *Bayankhongor*, 2 ♀♀, 16 km SW of Bayankhongor, 46°13'N, 100°30'E, 2165 m, 10.VII.2004, leg. JS (MHC); *Bulgan*, 2 ♀♀, 137 km NE of Aravaykheer, 47°20'N, 103°45.5'E, 1250 m, 2.VII.2004, leg. JS (MHC); *Dornod*, 4 ♀♀, 5 ♂♂, 100 km W of Choilbalsan, 820 m, 23.VII.2007, leg. MH (MHC); 4 ♀♀, 20 km W of Choilbalsan, 800 m, 48°01'N, 114°14'E 24.VII.2007,

leg. MH (MHC); 2 ♂♂, 50 km SW of Choilbalsan, 960 m, 25.VII.2007, leg. JH (MHC); *Khentii*, 3 ♀♀, 5 ♂♂, 100 km NE of Ondorkhaan, Kerulen River, 970 m, 22.VII.2007, leg. MH (MHC); *Selenge*, 2 ♂♂, 90 km N of Ulaanbaatar, Segnez River, 1450 m, 6–8.VII.2003, leg. JH (MHC); *Tuv*, 2 ♂♂, 50 km E of Ulaanbaatar, Tuul River, 22.VI.2003, leg. JH (MHC); *Umnugovi*, 3 ♀♀, 12 ♂♂, Gobi Gurvansaikhan National Park, 40 km W of Dalanzadgad, 2000 m, 28–30.VI.2003, leg. JH (MHC); *Uvurkhangai*, 4 ♀♀, 13 ♂♂, 12 km E of Aravaykheer, 46°22'N, 102°49'E, 1800 m, 3.VII.2004, leg. JH (MHC).

Distribution. Mongolia (*Bayankhongor, *Bulgan, Dornod, *Khentii, *Selenge, *Tuv, *Umnugovi, *Uvurkhangai); Palaearctic, from western Europe and northern Africa to Russian Far East (Kurzenko and Lelej 2007).

Tribe Parnopini

Genus *Parnopes* Latreille, 1797

Parnopes Latreille, 1797: 126. Type species: *Chrysis carnea* Fabricius, 1775 [= *Parnopes grandior* (Pallas, 1771)], by monotypy.

Parnopes glasunowi Semenov, 1901

Parnopes glasunowi Semenow, 1901: 25. Holotype ♂; Tajikistan: "Turkestan occid. [entalis]: Jagnob: Rovat, 12.VII.1892, leg. D. Glasunow" (ZIN) (examined).

Material examined. Mongolia: *Khovd*, 1 ♂, ur. Elkhon, 20 km SE of Altai, Bodoncha, 27.V.1970, leg. E. Narchuk (ZIN).

Distribution. *Mongolia (Khovd); Central Asia, Russia (south of European part) (Rosa et al. 2019).

Parnopes popovii Eversmann, 1858

Parnopes popovii Eversmann, 1858: 567. Holotype ♀; Russia: Siberia "campis orientalibus" (ISEA-PAS) (examined). Kimsey and Bohart 1991: 586 (cat., Mongolia, without locality).

Material examined. Mongolia: *Arkhangai*, 1 ♂, 25 km NE of Tsetserleg, 47°38'N, 101°45'E, 23.VII.2004, leg. JH (MHC); 1 ♂, 90 km NE of Tsetserleg, 48°03'N, 102°25'E, 24.VII.2004, leg. JH (MHC); 1 ♀, ibid, 27.VII.2005, leg. JH (MHC); *Bulgan*, 1 ♂, 143 km NE of Arvaykheer, 47°24'N, 103°39'E, 26.VII.2004, 1300 m, sandy dunes, JS (PRC); 4 ♀♀, 3 ♂♂, Mongol Els Nat. Res., 47°24'N, 103°39'E,

dunes, 1320 m, 31.VII.2005, leg. JH (PRC); *Dornod*, 2 ♂♂, 50 km SW of Choibalsan, 960 m, 25.VII.2007, leg. JH (MHC); *Dornogovi*, 1 ♀, 2 ♂♂, 28 km SE of Chatan-Bulag, 3.VIII.2007, leg. MH (MHC); *Sukhbaatar*, 4 ♀♀, 4 ♂♂, 200 km SSE of Baruun-Urt, Moltsoy Els, 1250 m, 27.VII.2007, leg. MH (MHC); 1 ♂, 3 ♀♀, ibid, 27.VII.2007, leg. JH (MHC); 2 ♂♂, 100 km SSW of Baruun-Urt, 1100 m, 30.VII.2007, leg. MH (MHC); *Tuv*, 1 ♀, 75 km W of Ulaanbaatar, dunes, 2.VIII.2005, leg. JH (MHC); *Umnugovi*, 1 ♀, Gobi, Dalanzadgad, 25.VI.2003, leg. JH (MHC).

Distribution. Mongolia (*Arkhangai, *Bulgan, *Dornod, *Dornogovi, *Sukhbaatar, *Tuv, *Umnugovi); China (Heilongjiang, Shanghai, Shandong), Korea, Russia (Rosa et al. 2014).

Species to be excluded from Mongolian fauna

The following 19 taxa were described or listed for Mongolia by Radoszkowski (1887, 1891), Mocsáry (1890), Dalla Torre (1892), du Buysson (1893), Bischoff (1913), Linsenmaier (1959), and Kimsey and Bohart (1991), yet the type localities are situated in Inner Mongolia (China) or Central Asian countries. These species are expected in Mongolia due to the close vicinity of the collecting localities, with the only exception of *Chrysis fouqueti* (du Buysson, 1909), which belongs to the Oriental fauna.

***Elampus mocsaryi* Radoszkowski, 1887**

Elampus mocsari (!) Radoszkowski, 1887: 45. Holotype ♀; Mongolia [= China]: Qinghai: Zaïdam (ISEA-PAS) (examined).
Ellampus (*Notozus*) *mocsaryi*: Mocsáry 1889: 80. Justified emendation of *Elampus mocsari* Radoszkowski, 1887. Dalla Torre 1892: 14 (cat., Mongolia [= China]).
Ellampus mocsaryi: Dalla Torre 1892: 14 (cat., Mongolia [= China]); Kimsey and Bohart 1991: 168 (cat., Mongolia [= China]: Zaidam).
Notozus mocsaryi: Bischoff 1913: 6 (cat., Mongolia [= China]).
Omalus (*Notozus*) *mocsaryi*: Linsenmaier 1959: 16 (key), 24 (tax., descr., Mongolia [= China]).

***Elampus spinipes* (Mocsáry, 1890)**

Ellampus (*Notozus*) *spinipes* Mocsáry, 1890: 49. Holotype ♀; Mongolia [= China, Inner Mongolia]: Mongolia meridionalis (Ta-Wan) (ISEA-PAS) (examined).
Ellampus spinipes: Dalla Torre 1892: 18 (cat., Mongolia [= Inner Mongolia]).
Elampus spinipes: Kimsey and Bohart 1991: 171 (cat., Mongolia [= Inner Mongolia]: Ta-Wan).
Notozus spinipes: Bischoff 1913: 7 (cat., Mongolia [= Inner Mongolia]).
Omalus (*Notozus*) *spinipes*: Linsenmaier 1959: 16 (key), 24 (descr., Mongolia [= Inner Mongolia]).

***Hedychridium ardens mongolicum* Tsuneki, 1947**

Hedychridium ardens f. *mongolicum* Tsuneki, 1947: 47. Holotype ♀; China: Inner Mongolia: Apaka (NIAS).
Hedychridium ardens f. *mongolicum*: Kimsey and Bohart 1991: 188 (cat., Mongolia [= China, Inner Mongolia]: Apaka).

***Hedychrum simile* Mocsáry, 1889**

Hedychrum cyaneum Mocsáry in Radoszkowski 1889: 10, nec Brullé, 1846. Lectotype ♀ (designated by French, in Bohart and French 1986: 341); China "Ta-schian-sy" (HNHM) (examined).
Hedychrum simile Mocsáry, 1889: 157. Replacement name for *Hedychrum cyaneum* Radoszkowski, 1889, nec Brullé, 1846.
Hedychrum simile f. *mongolicus* Tsuneki, 1947: 54. Syntypes ♀♀, ♂♂; China: Inner Mongolia: Apaka (NIAS).
Hedychrum simile: Linsenmaier 1959: 39 (descr., key, Mongolia [= China, Inner Mongolia]); Kimsey and Bohart 1991: 220. Mongolia (cat., without locality, related to the record of *H. simile mongolicus* from Inner Mongolia by Tsuneki 1947).

***Philoctetes hypocrita* (du Buysson, 1893)**

Ellampus hypocrita du Buysson, 1893: 246. Syntypes ♀♀; Mongolia [= China, Inner Mongolia], Kansu-Jelisyn-Kuse (ISEA-PAS); Persia (MNHN) (examined). Bischoff 1913: 8 (cat., Mongolia [= China, Inner Mongolia])
Omalus hypocritus: Kimsey and Bohart 1991: 248. Incorrect subsequent spelling.
Pseudomalus hypocrita: Rosa et al. 2015: 77.
Philoctetes hypocrita: Farhad et al. 2018: 199. Lectotype designation: ♂; China: Kansu Jelisyn Kuse (ISEA-PAS).

***Pseudomalus tshingiz* (Semenov, 1954)**

Ellampus tshingiz Semenov in Semenov-Tian-Shanskji and Nikol'skaya, 1954: 93. Holotype ♂; China: Sandzhu [Xinjiang], Gushan Gobi (depository: ZIN) (examined). Rosa et al. 2017a: 80 (cat., type series), 221 (plate 223).
Pseudomalus tshingiz: Kimsey and Bohart 1991: 270 (cat., Mongolia [= China]: Sachow Gobi [= Oasis Sachzhou, Gashunskoe Gobi [= Dunhuang, Gansu]).

***Chrysis aegle* Semenov, 1967**

Chrysis (*Gonodontochrysis*) *aegle* Semenov-Tian-Shanskij, 1967: 160. Holotype ♀; China: Alashan, Maladzhin (ZIN) (examined).

Chrysis aegle: Kimsey and Bohart 1991: 379 (cat., Mongolia [= China, Inner Mongolia]: Alashan, Maladzhin).

***Chrysis analis altaica* Mocsáry, 1912**

Chrysis (*Tetrachrysis*) *analis* var. *altaica* Mocsáry, 1912: 586. Holotype ♀; Kazakhstan: Altai: Semipalatinsk (HNHM) (examined).
Chrysis altaica: Kimsey and Bohart 1991: 381 (cat., Mongolia [= Kazakhstan]: Altai Mts).

***Chrysis fouqueti* (du Buysson, 1909)**

Tetrachrysis fouqueti du Buysson, 1909: 210. Holotype ♀; Viet Nam: Tonkin (MNHN).
Chrysis fouqueti: Kimsey and Bohart 1991: 412 (cat., Mongolia for the erroneous synonymy of *Chrysis csikiana* Mocsáry, 1912).

***Chrysis csikiana* Mocsáry, 1912**

Chrysis (*Tetrachrysis*) *Csikiana* Mocsáry, 1912: 406. Lectotype ♂ (designated by Bohart in Bohart and French 1986: 341); Kazakhstan: Semipalatinsk (HMNH) (examined).
Chrysis csikiana: Kimsey and Bohart 1991: 412 (cat., Mongolia [= Kazakhstan]: Altai Mts).

***Chrysis jelisyni* Radoszkowski, 1891**

Chrysis jelisyni Radoszkowski, 1891: 186. Syntypes ♀♀; Mongolia [= China]: Kansu, Jelissyn-Kuce (ISEA-PAS, MfN) (examined).
Chrysis (*Tetrachrysis*) *jelisyni*: Bischoff 1913: 54 (cat., Mongolia [= China]: Totau (locality not found)).
Chrysis jelisyni: Kimsey and Bohart 1991: 34 (cat., Mongolia [= China]: Kansu).

***Chrysis keriensis* Radoszkowski, 1887**

Chrysis (*Tetrachrysis*) *keriensis* Radoszkowski, 1887: 47. Holotype ♂ [not ♀]; China: Xinjiang, Keria-Daria (ISEA-PAS) (examined).
Chrysis (*Tetrachrysis*) *keriensis*: Mocsáry 1889: 516 (tax., descr., Mongolia [= China]); Bischoff 1913: 54 (cat., Mongolia [= China]).
Chrysis keriensis: Dalla Torre 1892: 73 (cat., Mongolia [= China]); Kimsey and Bohart 1991: 427 (cat., Mongolia [= China]: Keria Daria).

***Chrysis kozlovi* Semenov, 1967**

Chrysis (*Gonodontochrysis*) *kozlovi* Semenov-Tian-Shanskij, 1967: 160. Holotype ♂; China: Alashan, Uzosto canyon, 14.5.1908, leg. P. Kozlov (ZIN) (examined).

Chrysis kozlovi: Kimsey and Bohart 1991: 429 (cat., Mongolia [= China, Inner Mongolia]: Alashan, Uzosto Canyon).

Chrysis mongoliana Bohart, 1991

Chrysis (*Tetrachrysis*) *mongolica* Semenov-Tian-Shanskij, 1967: 178, nec Mocsáry, 1914. Holotype ♀; Russia: Transbaikalia: Ingoda River (ZIN) (examined).
Chrysis mongoliana Bohart in Kimsey and Bohart 1991: 440. Replacement name for *Chrysis* (*Tetrachrysis*) *mongolica* Semenov-Tian-Shanskij, 1967, nec Mocsáry, 1914 (cat., Mongolia: Transbaikalia: Ingoda river).

Chrysis potanini Radoszkowski, 1891

Chrysis potanini Radoszkowski, 1891: 186. Holotype ♂; Mongolia [= China]: Tufyn (ISEA-PAS) (examined).
Chrysis (*Tetrachrysis*) *potanini*: Bischoff 1913: 57 (cat., Mongolia [= China]).
Chrysis potanini: Kimsey and Bohart 1991: 450 (cat., Mongolia [= China]: Tufyn).

Chrysis przewalskii Radoszkowski, 1887

Chrysis Przewalskii Radoszkowski, 1887: 46. Holotype ♂; Mongolia [= China]: Zaïdam (ISEA-PAS) (examined).
Chrysis (*Tetrachrysis*) *przewalskii*: Mocsáry 1889: 504 (tax., descr., Mongolia [= China]); Bischoff 1913: 57 (cat., Mongolia [= China]).
Chrysis przewalskii: Dalla Torre 1892: 86 (cat., Mongolia [= China]); Kimsey and Bohart 1991: 452 (cat., Mongolia [= China]: Zaidam, Keria Mts).

Chrysis spinidens Mocsáry, 1887

Chrysis (*Tetrachrysis*) *spinidens* Mocsáry in Radoszkowski, 1887: 48. Holotype ♂; Mongolia [= China]: Zaïdam (ISEA-PAS) (examined). Mocsáry 1889: 516 (cat., descr., Mongolia [= China]); Bischoff 1913: 59 (cat., Mongolia [= China]).
Chrysis spinidens: Dalla Torre 1892: 97 (cat., Mongolia [= China]); Kimsey and Bohart 1991: 464 (cat., Mongolia: Zaidam).

Chrysura alticola (Semenov-Tian-Shanskij, 1912)

Chrysis petri alticola Semenov-Tian-Shanskij, 1912: 190. Lectotype ♀ (designated by Rosa et al. 2017a: 45); Kyrgyzstan: Peter the Great Range, Gardan-Kaftar Pass (ZIN) (examined).
Chrysura alticola: Kimsey and Bohart 1991: 486 (cat., Mongolia [= Kyrgyzstan]).

Conclusions

Approximately 1500 chrysidid specimens were examined for the compilation of this first checklist of the Mongolian Chrysididae. Fifty-seven resulted newly recorded, but still a large number of specimens are laying unidentified in museum and private collections. Nineteen species were excluded from the fauna of Mongolia, because collecting localities are currently included in China territories; however, these species are expected for Mongolia. Based on the available data, distributional records for 90 Mongolian species are listed, representing 18 genera grouped in two subfamilies. In terms of species richness, Cleptinae are represented only by two species so far, and the subfamily Chrysidinae is the most speciose (88 species, 98%). Among Chrysidinae, Chrysidini is the most speciose tribe (47 species, 53.4%), followed by Elampini (39 species, 44.3%), and finally Parnopini (2 species, 2.2%).

Currently eight species (9% of known taxa) are provisionally considered endemic: *Cleptes mongolicus* Rosa, Halada & Agnoli, sp. nov., *Chrysis mocsaryi* Radoszkowski, 1889, *Ch. priapus* Rosa, 2018, *Spinolia spinosa* Rosa & Halada, sp. nov., *Elampus spinifemoris* (Móczár, 1967), *Hedychrum lama* du Buysson, 1891, *Holopyga kaszabi* Móczár, 1967, and *Philoctetes shokalskii* (Semenov, 1932).

From a chorological point of view, one species has a Holarctic distribution (*Pseudochrysis neglecta*), ten have Palaearctic distributions, one has a Holarctic and Oriental distribution (*Omalus aeneus*), one a Palaearctic and Oriental distribution (*Hedychridium gerstaeckeri*), 28 species have an Asiatic-European distribution, 21 have an East Palaearctic distribution, and 19 have a Central Asian distribution.

Another result of the present study is a better knowledge of the distributional limits of some species, and Mongolia represents the easternmost record for seven species: *Chrysis aestiva*, *Ch. illigeri*, *Ch. jaxartis*, *Ch. leptomandibularis*, *Chrysura ignifrons*, *Elampus albipennis* and *Philoctetes bogdanovii*.

The most widespread Mongolian species is the endemic *Philoctetes shokalskii* recorded in ten aimags. *Chrysis consanguinea* and *Hedychridium ardens* were recorded in nine aimags. This is not surprising because *C. consanguinea* resulted in being one of the most common species from Western to Eastern Siberia also (Rosa et al. 2017c, d), whereas *H. ardens* is one of the most common Euro-Siberian species ranging from Central Europe to China (Rosa et al. 2014). *Pseudomalus pusillus* was recorded in eight aimags, whereas *H. cupreum*, *H. chalybaeum* and *Philoctetes mongolicus* were recorded in seven7 aimags; they are Asiatic-European species, sometimes locally abundant. *Hedychridium longigena* and *Parnopes popovii* were recorded in seven aimags, yet they are East-Palaearctic species.

Although most of the Mongolian aimags are under-represented in the existing data due to inadequacy of surveys, based on the currently available data we can state that the highest number of recorded species was collected in Tuv (42 species), Arkhangai (27 species), and Selenge and Dornod (20 species) aimags (Table 2). The family Chrysididae has not yet been documented from Bayan-Ulgii, Darkhan-Uul,

Table 2. Species diversity of aimags in terms of area size, number of specimens and number of collecting sites.

Aimags	Area, km²	No. of species	No. of coll. sites	No. of specimens
Arkhangai	55 314	27	4	237
Bayankhongor	115 978	18	10	142
Bulgan	48 733	18	4	61
Dornod	123 597	19	4	228
Dornogovi	109 472	16	4	42
Govi-Altai	141 448	8	5	49
Govi-Sümber	5 542	1	1	4
Khentii	80 325	12	1	55
Khovd	76 061	4	4	4
Selenge	41 153	20	1	100
Sukhbaatar	82 286	17	4	79
Tuv	74 042	42	10	350
Ulaanbaatar	4 704	10	4	20
Umnugovi	165 381	13	7	34
Uvurkhangai	62 895	12	5	42
Zavkhan	82 457	11	1	21

Comment. Chrysididae are not known in Bayan-Ulgii, Darkhan-Uul, Dundgovi, Khuvsgul, Orkhon, and Uvs.

Dundgovi, Khuvsgul, Orkhon, and Uvs although it is probable that this cosmopolitan family is present in these aimags and it is only a matter of time before the fauna is sampled and recorded.

Overall, the Mongolian fauna is still too poorly known for a complete analysis of species richness and composition. The faunal richness of Mongolia is doubtless much higher than we currently know, in comparison with the chrysidid fauna of the adjacent countries and considering the geographic position of Mongolian aimags and their different biotopes. For example, at least another 75 species recorded for Siberia (Rosa et al. 2017d) are expected for Mongolia, as well as other five genera known from bordering and central Asian countries (Chrysidini: *Chrysidea* Bischoff, 1913, *Spintharina* Semenov, 1892; Elampini: *Chrysellampus* Semenov, 1932, *Haba* Semenov, 1954; Parnopini: *Cephaloparnops* Bischoff, 1910). Copious undescribed members of the genus *Prochridium* Linsenmaier, 1968 were collected in Mongolia. The descriptions of Mongolian *Prochridium*, and a revision of this genus, are in preparation. Only a single record of an undescribed *Prochridium* was previously known in literature for Central Asia (Turkmenistan) (Linsenmaier 1994).

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RESEARCH ARTICLE

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Revision of the *Megasoma* (*Megasoma*) *gyas* (Jablonsky in Herbst, 1785) species group (Coleoptera, Scarabaeidae, Dynastinae)

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Abstract

The taxa of the genus *Megasoma* Kirby, 1825 (Coleoptera, Scarabaeidae, Dynastinae) related to *M. gyas* (Jablonsky in Herbst, 1785) are revised. *Megasoma* (*M.*) *gyas* is recognized as a monotypic species restricted to the Caatinga biome of northeastern Brazil. *Megasoma gyas rumbucheri* Fischer, 1968, is considered as a new synonym of *M. gyas*. The "long-horned *M. gyas*" is recognized as a separate polytypic species *M.* (*M.*) *typhon* (Olivier, 1789) with the nominative subspecies occurring through the Mata Atlântica biome of Brazil, from Bahia to São Paulo states and *M.* (*M.*) *typhon prandii* Milani, 2008 restricted to a small area in the state of Santa Catarina, South Brazil. *Megasoma gyas porioni* Nagai is considered as a new synonym of *M. typhon typhon*. The "short-horned *M. gyas*" occurring in Minas Gerais, São Paulo, and southwestern Bahia, is recognized as a separate new species and described as *M.* (*M.*) *hyperion* **sp. nov.** The paper includes an historical research and the redescriptions of the other nominal species of the genus. Distribution maps and a key to species in the *M.* (*M.*) *gyas* species group (males and females) are also provided.

Keywords

Cerrado, Neotropical region, new species, Scarabaeoidea, South America

Introduction

Megasoma (*Megasoma*) *gyas* (Coleoptera, Scarabaeidae, Dynastinae), locally known as "besouro de chifre" or "besouro com chifre" or "grande besouro", is perhaps the most interesting species among all the large-sized South American *Megasoma*. Unlike its glabrous related species, i.e., the species of the *M. actaeon* (Linnaeus, 1758) group, it displays a thick cover of short shiny setae on the whole dorsum, a feature shared with *M. anubis* (Chevrolat in Guérin, 1836) and *M. joergenseni* Bruch, 1910. Through the examination of the type material as well as a large series of specimens from several localities, it became possible to re-define the species and to isolate three taxa that deserve a separate species or subspecies status. In this paper a new species distributed in open Cerrado areas, as in some transitional areas of Cerrado and Caatinga, ranging from São Paulo to Bahia states of Brazil, is described. Furthermore, we propose the new synonymy of *M.* (*M.*) *gyas* over *M. rumbucheri*, the use of *M.* (*M.*) *typhon* over *M. gyas* for the current "long-horned *M. gyas*", and the new synonymy with *M. typhon* for the previous synonyms of *M. gyas*, *Scarabaeus entellus* Olivier, 1792, and *S. monoceros* Weber, 1801.

Materials and methods

In total, 328 specimens were studied (all wild-collected). The specimens were examined through naked eye observation, or/and with a stereomicroscope. Pictures were taken with a digital camera Canon Powershot S50 and a Leica M5 stereomicroscope and focus stacked with the Combine ZP software. Dissection of male genitalia was made by extraction with forceps through an aperture between tergite VI and the propygidium. The parameres were then glued on a card and pinned below the specimens. The distribution maps were made using a base map suitable for the purpose and available on the Internet. Each specimen of the type series of the new species bears a red label: "*Megasoma hyperion* sp. nov. / [Holotypus] Paratypus / M. Prandi, P.C. Grossi & F.Z. Vaz-de-Mello det. 2020 [numbered from 1 to 154]".

List of abbreviations

CL cephalic horn length measured along the external curve
EL elytral maximum length
EW elytral maximum width
FL fore tibia length
HL head length
L body length from the clypeal apex to the elytral apex
PH lateral pronotal horn length from base
PL pronotum maximum length
PW pronotum maximum width
TF fore tarsus length
TH lateral thoracic horn length from base
TL length from the tip of cephalic horn to the elytral apex

Depositories of examined material

BMNH The Natural History Museum, London, UK (Maxwell Barclay);
CEMT Universidade Federal do Mato Grosso, Instituto de Biociências, Cuiabá, Brazil (Fernando Z. Vaz-de-Mello);
CERPE Universidade Federal Rural de Pernambuco, Recife, Brazil (Paschoal C. Grossi);
DZUP Universidade Federal de Paraná, Centro Politécnico, Curitiba, Brazil (Lucia Massutti de Almeida);
EPGC Everardo and Paschoal C. Grossi collection, Nova Friburgo, Rio de Janeiro, Brazil;
EUMJ Ehime University, Entomological Department, Matsuyama, Japan (Hiroyuki Yoshitomi);
INPA Instituto Nacional de Pesquisa da Amazônia, Manaus, Brazil (Márcio L. de Oliveira);
KKC Kazuho Kobayashi private collection, Tokyo, Japan;
LMC Leonello Milani private collection, Calvignasco, Milano, Italy;
MPC Massimo Prandi private collection, Salò, Brescia, Italy;
MPEG Museu Paraense Emilio Goeldi, Belém, Brazil (Orlando Tobias);
MSNM Museo Civico di Storia Naturale, Milano, Italia (Fabrizio Rigato);
MZC Michele Zilioli private collection, Buguggiate, Varese, Italy;
UBC Ugo Bosia private collection, Asti, Italy;
UNLP Facultad de Ciencias Naturales y Museo de la Universidad Nacional de La Plata, La Plata, Argentina (Analia Lanteri).

Nomenclatural and taxonomic history of the taxon *Megasoma gyas*

Pre-Linnaean accounts

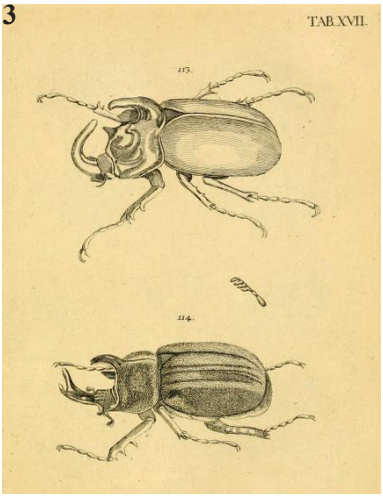
In the year 1637, the Count Johan Maurits van Nassau-Siegen became the General Governor of the Dutch North and Northeast Brazil under the Geoctoyeerde Westindische Compagnie, (the Dutch West-Indies Company). He invited, among other scientists and artists, George Marcgraf (or Marcgrave) to Brazil for the first scientific expedition of the area, which took place between 1637 and 1644. During the expedition beautiful oil and watercolor plates, showing maps and scientific subjects, such as people, plants, animals, and insects, were executed by Albert Eckout, Frans Post, Zacharias Wagner, and by George Marcgraf himself (Boeseman et al. 1990; Sick 1997; Dantas Silva 2005; Correa do lago 2010; Teixeira Leite 2014; Ossenbach 2017; Anderson 2019). A big part of those plates was rejoined into the "Libri picturati" now housed in Krakow, Poland. Among the subjects of the "Handbook" ("Libri principis") of "Libri picturati" there is a beautiful plate showing a *Megasoma gyas* (Fig. 1). It was the first time that this species was brought to the attention of the Western world.

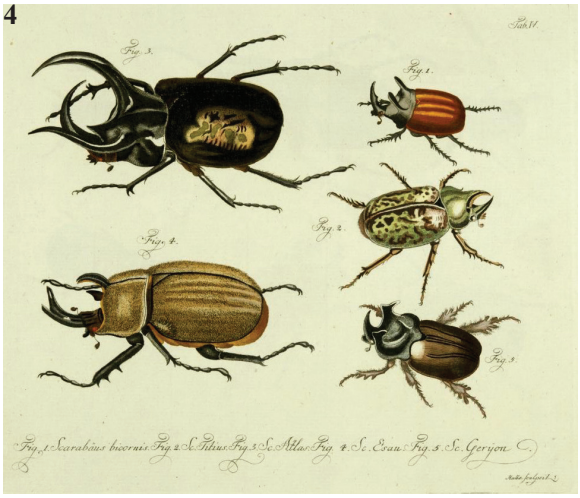
Figures 1, 2. 1 George Marcgraf, "Libri Principis" of Libri Picturati, before 1648, page 477, "*Enéma*" (indigenous name) **2** W. Piso & G. Marcgraf, "Historia Naturalis Brasiliae" 1648, page 246. *Enéma*, *Enena*, *Escaravelha Lusitanis*, *Taurus Volans.*

Subsequently, another illustration, a poorly executed drawing of the same beetle, was published in the "Historia Naturalis Brasiliae" of 1648 by Piso and Marcgraf (Fig. 2). This plate was the one seen by Linnaeus (1758) and listed by him among the references he provided with a description of *Scarabaeus actaeon* (see Prandi 2018a, 2018b; 2019). Despite the poor quality of the drawing, there is little doubt that it represents a *Megasoma gyas* specimen, an interpretation supported by the accompanying text: "the body is covered by yellowish pilosity…the first section of the body is three-horned…". The chapter of the book dealing with *Megasoma gyas* is entitled "Enema rare conformationis" and the *Megasoma* beetle was called "Taurus volans" (flying bull) together with the other three beetles. Marcgraf's first xylography at page 246 (Fig. 2), and the related gouache color image in "Libri picturati" (Fig. 1) show clearly a short-horned *Megasoma*: this is the most relevant character referring to *Megasoma gyas* s. str.

George Marcgraf (1610–1644) was a German naturalist and astronomer who, at the beginning of the Dutch expedition, was an attendant of the famous physician Wilhem Piso. Day after day, thanks to his enthusiastic work, he gained the favor of the Dutch Governor. Eventually, there were four books written by Piso on the traditional Brazilian medicine, and eight books on the natural sciences written by Marcgraf, all gathered in the "Historia Naturalis Brasiliae" (1648), funded by J. Maurits van Nassau after his return to Holland and four years after Marcgraf's death.

"Historia Naturalis Brasiliae", until the beginning of XIX century, represented a source of important information on Brazilian natural history for European scientists, including Linnaeus, who referred to it in the 10th and 12th editions of his "Systema Naturae", often using Marcgraf's or Piso's descriptions, all validated for scientific purposes with binomial Latin names, as the only basis for establishing his species (Boeseman 1994). Marcgraf's drawings and descriptions of course referred to the places that Marcgraf visited himself, i.e., the old Dutch "Captaincy" of the northeast, which included the current states of Paraíba, Pernambuco, Alagoas, Ceará, Piauí, and Rio Grande do Norte. In fact, during his seven-year stay, Marcgraf undertook various expeditions to visit the interior of northeastern Sertão to develop his detailed work on the





Figures 3, 4. 3 Johann Euseb Voets, 1782 edition of "Kaferwerk", fig. 114. *Scarabaeus Goliath*. **4** Carl Gustav Jablonsky 1785. "Natursystem aller bekannten…" Vol. I. Kafer, fig. 4. *Scarabaeus gyas*.

natural history of Brazil (Alcantara-Rodriguez et al. 2019). At least three expeditions of forty, twenty, and eleven days' duration between 1638 and 1640 were undertaken, most likely within the Pernambuco, Paraíba and the Rio Grande do Norte regions. These field expeditions allowed him and Piso to collect and catalog animals and plants from different environments, from the lagoons of the coast to the interior of the Caatinga (Teixeira 1995). Hence it is very likely that the information given by Marcgraf on *Megasoma gyas* refers to the specimens observed or collected in those regions and then given to Count J. Maurits. Indeed, Marcgraf confided to Nassau also dried plant specimens and the manuscripts about Brazilian natural history before leaving for Angola between 1643 and 1644 (Whitehead 1979).

Post-Linnaean scientific reports

Jablonsky (1785) described *Scarabaeus gyas* following the binominal nomenclature and wrote: "...in the lower part of the head there is a horn, considerably wide but hidden, in the shape of a shovel, which the more it lengthens and the more it becomes wider, towards the end it ends in two long teeth…the armor is completely covered by yellow hair…in addition to this sickle-shaped horn the armor stretches downwards and both sides form a point…so it can also be called tricorn thorax…the elytra are thick and covered with yellow hair, which give to the insect an unusual sumptuous appearance…". The description is enriched by a precious color plate by Jablonsky himself.

Carl Gustav Jablonsky (1756–1787) was a German scientist and illustrator, private secretary of the Queen of Prussia. Although "Natursystem alles bekannt...." is attributed to JFW Herbst (1743–1807), it must be noticed that Jablonsky was the author of the first volumes of that work (Bousquet 2016), i.e., the first volume on butterflies and the first volume on beetles. Herbst took over the job after the untimely death of Jablonsky

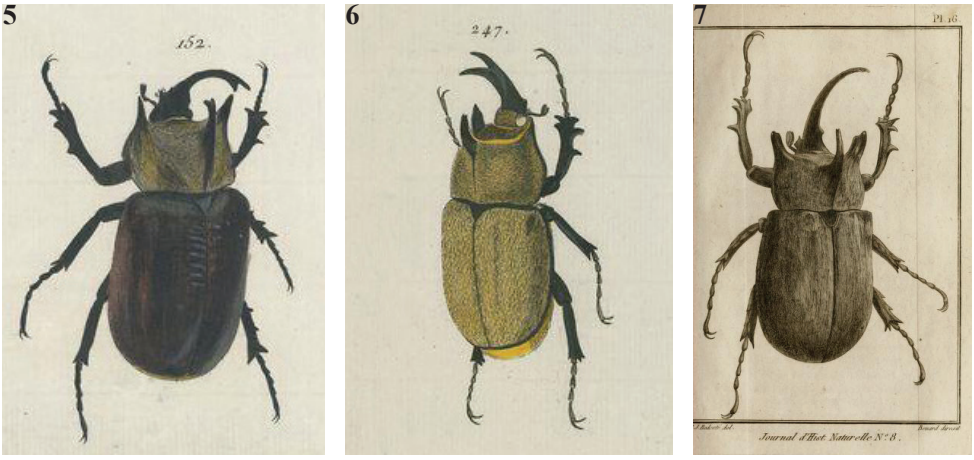
in 1787, at the age of 31. It is important to note that also in Jablonsky's plate the specimen of *Megasoma gyas* displays a short and wide cephalic horn. This particular shape of the cephalic horn matches exactly both the painted picture and the xylography in Marcgraf's publication. This is a key point because in 1789 the French scientist Guillaume-Antoine Olivier (1756–1814) in his "Entomologie ou histoire naturelle des insectes" described *Scarabaeus typhon* and *Scarabaeus laniger*. The specimens of Olivier show two different features of the cephalic horn: long, thick, with a bifurcated apex the former, as shown in his plate XVI fig. 252 (reproduced in Fig. 5) and shorter, flatter and wider, with a very-well bifurcated apex the latter, as in his plate XXVIII fig. 247 (reproduced in Fig. 6). Olivier's *Scarabaeus typhon* actually represents the species that up to now has been treated as *Megasoma gyas* s.l. by the majority of authors. Burmeister (1847) established the synonymy between *Megalosoma typhon* Olivier (*Megalosoma* Burmeister is a junior synonym of *Megasoma* Kirby) and *Scarabaeus gygas* Jablonsky, giving priority to the former. Later, Harold (1868) maintained the synonymy by Burmeister, but in the addendum (Harold 1871: 121–122) he suggested the priority of *M. gyas* over *M. typhon*. *Scarabaeus laniger* Olivier, 1789 was correctly synonymized by Burmeister (1846: 106–108) with *M. gyas*, with priority given to the latter. Burmeister (1847: 277–278) incorrectly treated *S. laniger* as a synonym of *M. typhon*, considered as "variation B", a variation with a short horn similar to that of *S. gyas* and *S. esau*. Before him, Kirby and Spence (1826) cited *S. typhon* and *S. lanigerum* as separate species. But, taking into account Harold's subsequent actions, now *S. laniger* is correctly considered a synonym of *Megasoma gyas*, with which it shares the same specific characters. As for the types of *S. typhon* and *S. laniger*, they were illustrated in the above-mentioned plates by Olivier (1789). To prepare his book, Olivier traveled through England and Holland to visit the private cabinets of collectors and to draw the species which were not available in Paris. Likely, the specimens of *S. typhon* and *S. laniger* illustrated by Olivier were kept in the collections he visited during the aforementioned trips. Olivier's reference under the description of *S. laniger*, "du cabinet de Mr. Juliaans" (from the collection of Mr. Juliaans), clearly indicates a Dutch family name. As for *S. typhon*, Olivier reported no localities, apart from the indication "du Musée Britannique" (from the British Museum). A recent search by Kazuho Kobayashi at the Natural History Museum in London revealed some old specimens (from the Fry collection, dated approximately 1900) of classical "long-horned *M. gyas*" coming from Rio de Janeiro and Bahia, but not the specimens seen by Olivier.

Jablonsky (1785) cited three references. The first reference is "Fuessly Mag. I. p. 37": Johan Caspar Fuessly (1778) referred to Voets (1766) and copied in his work (Hagen 1857). The Latin description of the beetle is the same as reported by Jablonsky; there is also a reference to illustration, "Tab. XVII fig. 114". The second reference is "*Scarabaeus Goliath*. Voet. Scar, tab. 17. fig. 114". The third reference is "Goeze Ent, Beytr. I. p. 56. n.11": Johan August Ephraim Goeze (1777) also referred to Voets (1766), giving a short Latin description and the title "Goliath, der amerikanische gelbe Bar". It is clearly the same insect.

Johann Euseb Voets (1706–1778) died before the publication of Jablonsky, hence it is obvious that his description of *Scarabaeus Goliath* must be precedent, also because

Fuessly (1778) and Goeze (1777) referred to him. Voets' main work, the "Catalogue raisonné ou systématique du genre des insectes, qu'on appelle Coleoptrées", was apparently published in parts starting from 1766. The first part was mentioned, without details, in April 1767 by the "Gazette littéraire de l'Europe". Other parts were issued in 1776 and 1781. Finally, the work was completed and published by Bakhuysen in 1806, under the name "Catalogus systematicus Coleopterorum" (Bousquet 2016). In the work "Beschreibungen and Abbildungen…" (1785), published after his death and illustrated by GWF Panzer, the above-cited fig. 114 in plate XVII (reproduced in Fig. 3) perfectly matches Jablonsky's image. In fact, Jablonsky wrote that he tried to find a good description of the insect drawn by Voets from the collection of Dr. Luchmann, but without result. Hence, he decided to copy the drawing, giving a better description and changing the name "*Goliath*", already used by Linnaeus for another beetle without horns, with the name of a Titan, *Gyas*.

Therefore, Voets' name *Scarabaeus Goliath* should have priority over *M. gyas*. However, Voets' "Catalogus systematicus Coleopterorum" fails to fulfill the requirements of Article 11.4 of the ICZN, namely that for scientific names to be available the entire work in which they appear must be consistently binomial. Voets' names varied from two to five names in series, thus violating this rule, so none of Voets' names, even those which happened to be binomial, are available in the sense of the ICZN. The original Luchmann's specimen is apparently lost. The iconography by Marcgraf and Voets/Jablonsky allows us to state that the first "*gyas*" described following the binominal nomenclature had a short, flat, and wide cephalic horn (Figs 3, 4). In this case, since Jablonsky's type does not match Olivier's *S. typhon*, necessary changes in nomenclature need to be made. In Fig. 4 (a reproduction of one of Jablonsky's plates), the insect is named *Scarabaeus esau*. For this reason, *S. esau* is considered as a synonym of *M. gyas*. Some plates appeared with the name *S. gyas*, some other with the name *S. esau*. But no description of *S. esau* was provided.



Figures 5–7. 5 G-A Olivier 1789. "Entomologie ou Histoire Naturelle des Insectes", Tav. XVI fig. 252. *Scarabaeus typhon* **6** G-A Olivier 1789. "Entomologie ou Histoire Naturelle des Insectes", Tav. XXVIII fig 247. *Scarabaeus laniger* **7** G-A Olivier 1792. "Journal d'Histoire Naturelle", no. 8. *Scarabaeus entellus*

Fischer (1968) described *M. rumbucheri* (afterwards considered a subspecies of *M. gyas*: see Endrödi 1977) from Rio Pajeú, Planalto da Borborema, Pernambuco, Brazil. But this taxon actually displays the same characters of Marcgraf and Voets/Jablonsky original descriptions and is therefore a junior synonym of *M. gyas* (Fig. 8). Curiously, in 1991 Kurt Rumbucher, to whom the Fischer's subspecies had been dedicated, suggested that *M. rumbucheri* fell within the variability of *M. gyas* s.l. This opinion was supported by some photos of *M. gyas* s.l. specimens of different sizes and tables with measurements. He did not examine the aedeagus nor assessed the geographical variability of the specimens he had studied.

Nagai (2003) described *M. gyas porioni* from Jaguaquara, Bahia state, Brazil, dedicated to the French entomologist Thierry Porion. The main character currently in use to distinguishing this subspecies is a long, normally straight, cephalic horn (although in the original description it is indicated as short and thicker in the middle area), showing in the majority of cases a medial depressed zone, and a normally bifurcate apex (Fig. 15). This character is found in the type of *S. typhon* Olivier. It can be concluded that no reasonable external differences between the "long-horned *M. gyas*", *M. gyas porioni*, and Olivier's *S. typhon* can be found (Figs 5, 7). Milani (2008: 120) reported the inconsistency of characters between the original description and the specimens from the type locality. The synonymy between *M. gyas porioni* and the "long-horned" *M. gyas* was also suggested by Grossi et al. (2008).

Grossi et al. (2008: 364–365) hypothesized the presence of *M. gyas* in the state of Santa Catarina and the same year Milani described *M. gyas prandii*, from Santa Catarina state, Brazil. This is the southernmost distribution record of *M. gyas*. Unlike the aforementioned subspecies, in this case, both the geographical isolation and the peculiar morphology of the taxon leave little doubt about its validity as a subspecies, although, due to the present new arrangement, it must be considered as a subspecies of *Megasoma typhon*. None of the specimens of *M. typhon prandii* we have examined thus far show a depressed area in the middle of the cephalic horn. All examined specimens show a thick long horn, often curved backwards, without any flattened area, with a distinctly bifurcate apex bent upwards. Besides the type locality, it was recently possible to find (authors' unpublished data) other specimens of *M. typhon prandii* in old collections, from even more southern localities, labeled "Porto Alegre" (Rio Grande do Sul, Brazil) or "surroundings of Porto Alegre" (ca. 1930-40, collection of Ugo Bosia, Asti, Italy). Interestingly, one of those old specimens bears the label "*M. typhon*".

Taxonomic treatment

Megasoma (*Megasoma*) *gyas* species group

The *Megasoma gyas* species-group consists of three species, including one polytypic, with an overall distribution range occupying most of eastern Brazil, extending northwards up to Ceará (estimated latitude 3°42'02"N) and southwards to Rio Grande Do Sul (estimated latitude 30°00'44"S) states.

***Megasoma* (*Megasoma*) *gyas* (Jablonsky in Herbst, 1785)**
Figures 8A–E, 13A–C

Scarabaeus gyas Jablonsky, 1785: 263–267
Scarabaeus Goliath Voets, 1766 (unavailable name).
Scarabaeus esau Jablonsky, 1785; synonym by Burmeister 1847: 277–278.
Scarabaeus laniger Olivier, 1789; synonym by Burmeister 1846: 106–108.
Megasoma gyas rumbucheri Fischer, 1968, syn. nov.

Type material. The holotype is the specimen seen and illustrated by Voets, whose illustration was later copied by Jablonsky (1785: Plate 4 fig. 4) and is probably lost.

Distribution. *Megasoma gyas* occurs in the Caatinga biome of the Brazilian states of Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, and Sergipe (Fig. 9). The distribution range of this species overlaps a portion of the "subregioes nordestinas" (Vasconcellos et al. 2010; Beserra Nobre et al. 2014) of "Meio-norte" and "Sertao" regions (Fig. 10). The Caatinga biome (xeric shrubland and thorn forest) occupies an area of 497,000 sq. miles, i.e., 10% of Brazilian territory (Fig. 9); it is a recent biome located on an ancient seabed. This biome experiences long periods of drought, which can last up to eight months. It is mainly composed of dry Savannah (Coutinho 2016).

Material examined. 13 major ♂, 4 minor ♂, and 7 ♀ from the following Brazilian states: **Alagoas**, Canapi, X 2018, J. Dantas Leg. (1 ♂, CERPE, 1 ♀, MPC); **Pernambuco**, Timbaúba, with indication of 1 hour and half by car inland of Recife, XII 1979 (1 ♂ and 1 ♀, MPC); Areia, VI 1945 (1 ♂, MPC); Araripina, 1953 (2 ♂, LMC); Brazil, Estaçao …(not visible), G.L.Sladen Leg., 1925 (2 ♂, 1 ♀, BMNH); Custódia, X 2012, leg. C.E.B Nobre (1 ♂, MPC); São José do Egito (sitio Humaitá), IV 2010 Leg. R.M. Correia (1 ♂, CEMT); Igarassu, Três Ladeiras, Usina São José XII 2017, (1 ♀, CERPE); **Sergipe**, didactic collection of the University, no further data (1 ♂, CERPE, 1 ♂, MPC); Capela, Ref. Vida Silv. – Mata do Jumco Station (RUSMJ), III 2014 Leg. O.G. Moura (1 ♂, CERPE); **Ceará**, no data (1 ♂, CERPE); Ceará, no data (1 ♂, 1 ♀, EPGC); **Piauí**, didactic collection of the University, Teresina, São Francisco, IV 2001 (1 ♂, CERPE); **Rio Grande do Norte**, Tenente Laurentino Cruz, I 2015, leg. R. Andreazze (1 ♂, CERPE, 1 ♀, MPC); **Paraiba,** Patos, no further data, (1 ♂, CERPE, 1 ♀, MPC).

Male (Fig. 8). *Size*. L: 77 mm; TL: 88 mm; PL: 21 mm; PW: 35 mm; EL: 49 mm; EW: 42 mm; CL: 23 mm; PH: 8.5 mm. ***General appearance*.** Uniformly dark brown, covered by yellowish short, fine, dense pubescence; head, including horn, consistently black with yellowish sparse bristles at base. ***Head*.** Cephalic horn**:** short, projecting forwards and curved upwards. In lateral view flat, distally bent upwards. In dorsal view, narrower at base gradually broadened towards distinctly forked apex. Apex U-shaped, with slightly divergent, long, tips (Fig. 8C). Distance between tips 11.5 mm. Sides bordered with a weak, hardly detectable rim, from base to mid-length. Dorsal side at base with relief of an almost imperceptible tooth. ***Pronotum*.** Whole surface covered by fine, dense yellowish pubescence. Anterior angles projecting as small but elongate, sharp,

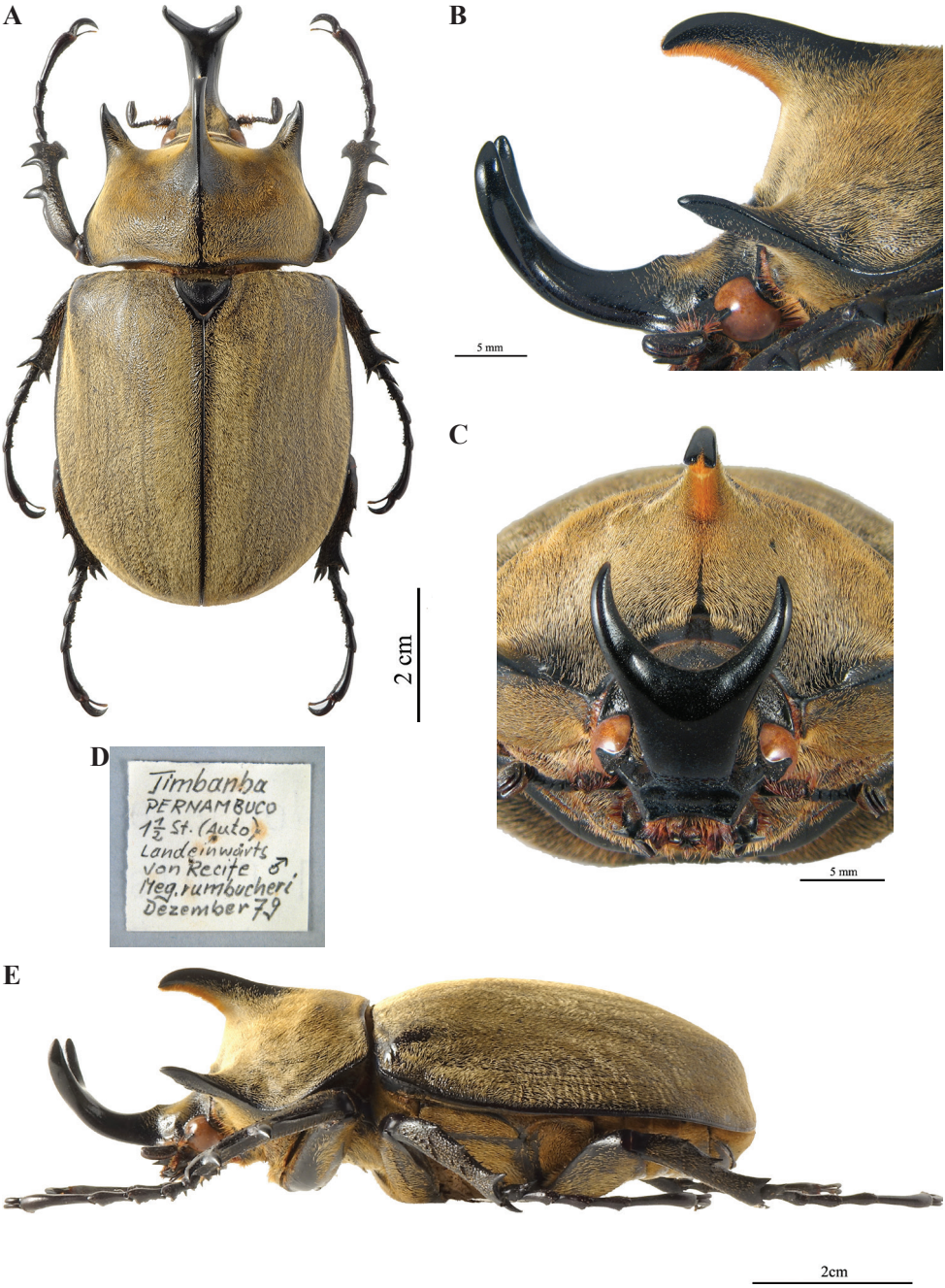
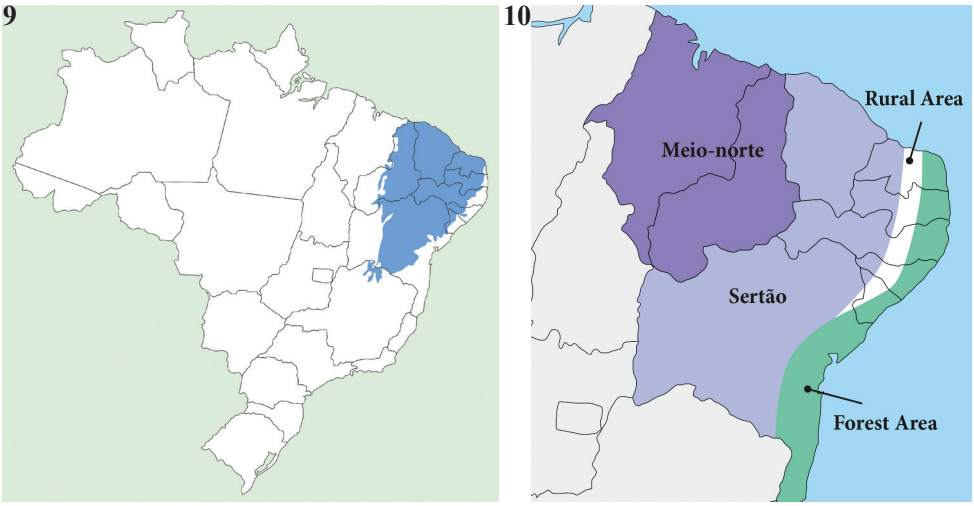


Figure 8. *Megasoma gyas* ♂ from Brazil, Pernambuco **A** dorsal habitus **B** cephalic horn lateral view **C** cephalic horn frontal view **D** original label **E** lateral habitus.

parallel horns, slightly bent outwards; width of horn at base 4.5 mm; length from base to tip 8.5 mm; distance between apices of anterior horns 23 mm. Median thoracic horn longer than lateral ones, length 15 mm, with characteristic sickle-shaped form,



Figures 9, 10. 9 Surface of bioma Caatinga in Brazil **10** The subregions in NE Brazil.

dorsal side with glossy black line, ventral side of median horn with recumbent fine pubescence. PL/TH ratio 2.470. L/PL ratio 3.666, showing a fairly elongated feature of the body. ***Elytra.*** Surface covered by fine, dense, recumbent, yellowish pubescence apart from elytral suture and epipleura, glabrous; EL/EW ratio 1.166. Elytral surface covered by (two or three on each elytron) visible longitudinal ridges: sutural edge black, glabrous, punctate; other pubescent ridges spaced out. Elytra in lateral view more convex proximally and then gradually flattened towards apex. L/EL ratio 1.571, elongate.

Abdomen. Sides covered with short, very fine, yellowish brown pubescence, medially almost glabrous. ***Legs.*** Fore tibia almost straight, inner apical edge strongly dilated inwards, 23 mm in length. Anterior edge of protibia V-shaped. Lateral edge with three strong teeth, decreasing in size proximally, from base to apex; basal tooth more distant from subapical tooth than the latter from the apical tooth. Basal and subapical teeth large, triangular, thick, sharp, pointing rearwards; apical tooth short, pointing forwards. Inner apical spur strongly curved downwards, as long as apical tooth. Fore tarsi length 25 mm. ***Aedeagus.*** Parameres of tegmen elongate and narrow, as in Fig. 31A, B. Thickness of section from anterior phallobase to median lobe also narrow.

Variation, males. Major and medium males always with apex of cephalic horn U-shaped, with long tips. Minor males with cephalic horn length not more than twice head length, from vertex to clypeus, bear the apex of cephalic horn V-shaped with shorter tips and wider body. Dorsal tooth of cephalic horn absent in medium and minor males.

Measurements. L: 53–77 mm; TL: 59–88 mm; PL: 14–21 mm; PW: 24–35 mm; EL: 38–49 mm; EW: 30–43 mm; CL: 10–23 mm; FL: 15–23 mm; TF: 17–25 mm.

Female (Fig. 13). ***Size.*** L: 54 mm; PL: 16 mm; PW: 23 mm; EL: 34 mm; EW: 30 mm. ***General appearance.*** Uniformly black; elytra with 6/7 of its surface covered by grey-brownish dense pilosity. ***Head.*** Fronto-clypeal suture with a double conical tubercle. ***Pronotum.*** Surface dull, coarsely punctate-rugose, strongly convex; posterior median carina 8 mm long, ½ of total PL. Anterior angles obtusely projecting, yet with

Figure 11. View of Caatinga biome near Sairé, Pernambuco (photograph P. Grossi).

Figure 12. View of Serra Talhada, vale do Rio Pajeú, Pernambuco. (photograph P. Grossi).

sharp tips. Lateral edges with the presence of sparse bristles. ***Elytra.*** Surface with puncture mixed to wrinkles anteriorly, glossy black; punctate black surface extending for 8 mm. Elytral pubescence thick, uniform, with clearly visible longitudinal ridges, three or four for each elytron, almost equidistantly spaced out. Dorsal suture and lateral margins glossy black, with very fine punctation. ***Abdomen.*** Sternites finely punctate, covered by short, yellowish brown pilosity, except for a small central portion in the middle of sternites III–V. ***Legs.*** Fore tibiae shorter than in males, TL 15 mm, and shorter than

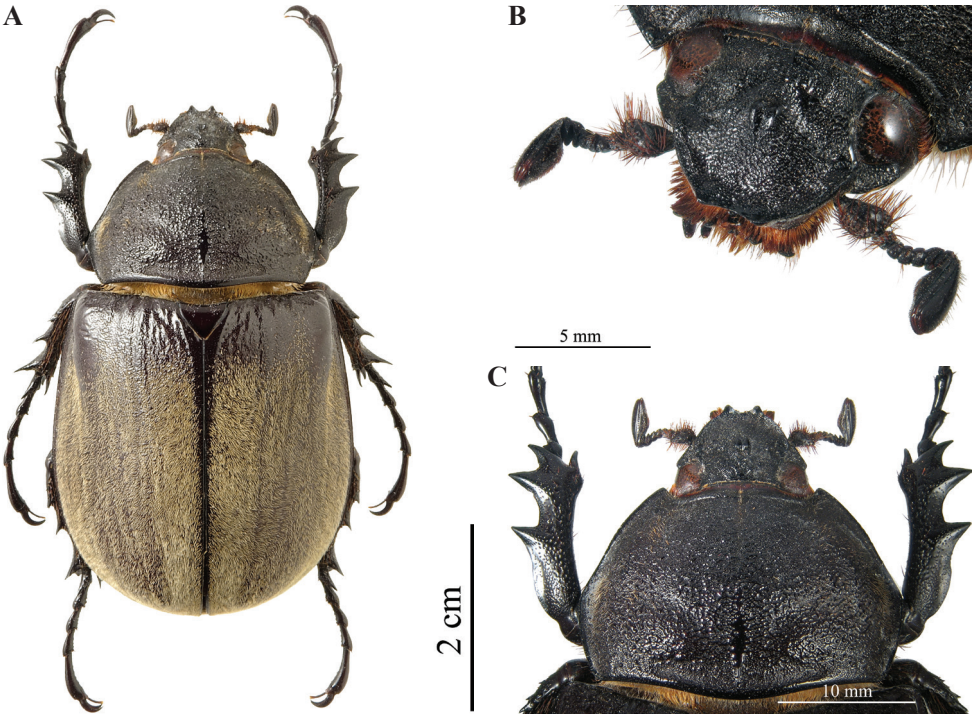


Figure13. *Megasoma gyas* ♀ from Brazil, Rio Grande do Norte, Tenente Laurentino **A** dorsal habitus **B** double head's tubercle **C** pronotum with carina.

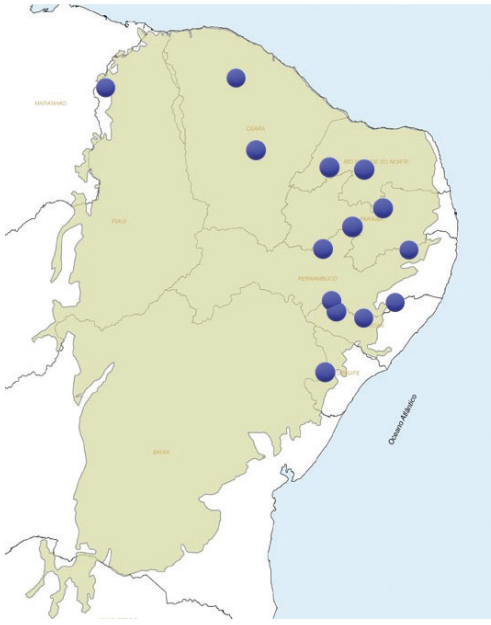


Figure 14. Map of Caatinga's biome with collecting localities (grouped) of *Megasoma gyas* in northeastern Brazil.

tarsi, TF 17 mm; external sides with three strong teeth almost equal in length, with the subapical tooth a little longer. Lateral teeth and inner apical spur smaller than in males.

Measurements. L: 52–60 mm; PL: 15–16 mm; PW: 23–27 mm; EL: 34–39 mm; EW: 30–34 mm; FL: 15–16 mm; TF: 17–18 mm; HL: 6–8 mm.

Megasoma (*Megasoma*) *typhon* ssp. *typhon* (Olivier, 1789)

Figures 15A–D, 17A–C

Scarabaeus typhon Olivier, 1789: 12.
Scarabaeus entellus Olivier, 1792, syn. nov.
Scarabaeus monoceros Weber, 1801, syn. nov.
Megasoma gyas porioni Nagai, 2003, syn. nov.

Type material. The holotype, i.e., the specimen illustrated by Olivier (1789: Tav. XVI fig. 252; reproduced in Fig. 5) is probably lost (Kobayashi, pers. comm., 2019). The designation of a neotype does not seem necessary since the species is well characterized and a search for the type in historical collections is still ongoing.

Distribution. As explained above, the classical "long-horned" beetle up to now called *M. gyas gyas*, is actually a distinct species, *M. typhon* (Olivier, 1789). It occurs through the Mata Atlântica biome along the coastal areas of the Brazilian states of Bahia, Espirito Santo, Rio de Janeiro, São Paulo, and Minas Gerais. The biome Mata Atlântica (Atlantic Rain Forest) occupies an area equivalent to 622,000 sq. miles, i.e., 13% of Brazilian territory, and consists mainly of forests that run along the coastline from the State of Rio Grande do Norte to the State of Rio Grande do Sul. Due to its high human population density, it is one of the most deforested areas of Brazil. Only 7% of its original vegetation remains, scattered over hundreds of mostly small fragments. The Mata Atlântica presents a diversified group of forest ecosystems and a variety of floristic structures connected to specific different climatic conditions, all of them enjoying the humid winds that blow from the ocean (Coutinho 2016). We have no records of *M. typhon* from Paraná state, being São Paulo state (Antunes et al. 2007; Luzzi et al. 2016) the southernmost record. This species shows an interesting variability in the shape of cephalic and thoracic horns, mainly in the flat or thin section of the former and in the tips of the latter. This variability however is found all over the distribution range of the species and therefore is an individual variability without a geographical meaning. Based on this new interpretation, *M. gyas porioni* Nagai is a synonym of *M. typhon typhon*.

Material examined. More than 100 specimens (major ♂ 80%, minor ♂ 10%, ♀ 10%) from the following Brazilian states: **Bahia**, Jaguaquara, IV 1992 from coll. T. Porion (3 ♂ 3 ♀, MPC), same locality, IV 1997 (1 ♂, KKC); IV 1997 (1 ♂, LMC); IV 1993 "Holotype Megasoma gyas porioni Shinji Nagai, 2003. Collection of S. Hisamatsu. (Brazil) Bahia, near Jaguaquara, ca. 800 m in alt., from T. Porion" (1 ♂, EUMJ); Paratypes, same data (1 ♂, 1 ♀, EUMJ); Amargosa, 20 XI 1988 (3 ♂, MPC),

V 1989 (1 ♀, MPC), 20 XI 1988 (1 ♀, MPC); Salobrinho, 2000 (1 ♂, MPC), Ilhéus, Salobrinho, light, Atlantic forest, 14 VII 2016 (1 ♂, 2 ♀, MPC); Arataca, III 2013 (4 ♂, MPC); Ilhéus, Faz. Aliança 28 I 2017, leg. Souza (2 ♀, MPC) II 2013, same locality, II2019 (6 ♂, MPC), Bahia, XII 2002 Ceplac (1 ♂, EPCG); Porto Seguro, VIII 1970 (2 ♂, EPCG); Olivença, VI 2003 leg. R. Koike (2 ♂, EPGC); Una, VIII 2003 (1 ♂, EPCG); Itamajú, 100 m. II 2006 (3 ♀, MPC); Itabuna, II 2013 (3 ♂, MPC), Bahia, Fazenda de Cacau 10 XII 2010 (1 ♂, MPC); Itacaré, III 2012 (1 ♂, MPC); Jequié, no data (1 ♂, EPCG): **São Paulo**, Ubatuba VI 2013 (1 ♂, MPC); "Province" of SP, no further data (2 ♂, MPC); **Rio de Janeiro**, Teresópolis, I 2002 leg. Izabel (1 ♂, 1 ♀, EPCG); Rio das Ostras, VI 2011 leg. Igor (2 ♂, EPCG); Guapimirim, II 1980 leg. H.R. Pearson (1 ♂, EPCG); Xerém, VI 1999, 18.VII.1992 (2 ♂, MPC), same locality, VI 2001 (1 ♀, MPC); Nova Iguaçu, Res. Bio Tinguá VI 2009 leg. J.R. Mermudes (2 ♂, CEMT); **Espirito Santo,** Linhares II 1966 (1 ♂, MPC); **Minas Gerais**, Ipatinga, V 1987 leg. E.& P. Grossi (3 ♂, EPCG), same locality, V 2010, III 2016 (2 ♂, MPC), IV 1985 (3 ♂, LMC), V 1987 (1 ♂, LMC); V 2001, III 2016 (2 ♀, MPC), V 1995 leg. E.J. Grossi (1 ♂, 1 ♀, CEMT); Vale do Rio Doce, IV 1990 (1 ♀, MPC); Cataguases, VI 1995 leg. F.Z. Vaz-de-Mello (1 ♂, CEMT).

Male (Fig. 15). The description below is based on a specimen from Bahia state, Jaguaquara locality, that closely resembles the specimen illustrated by Olivier. Other specimens from different localities are shown to illustrate the morphological variability constantly found all over the distributional range of the species (Fig. 16A–F). ***Size.*** L: 79 mm; TL: 108 mm; PL: 23 mm; PW: 37 mm; EL: 54 mm; EW: 49 mm; CL: 38 mm; PH: 10.5 mm. ***General appearance.*** Uniformly ebony brown covered by a yellowish short, fine, uniform, pilosity; head, including horn, consistently black except for the basal part near pronotum with sparse bristles. Tips of thoracic horns glossy black. ***Head.*** Cephalic horn long, projecting forwards and slightly curved upwards. In dorsal view, wider base, decreasing for a length of 6 mm and then gradually widening to a median flattener zone with a maximal width of 5.5 mm, then decreasing again for 13 mm, and finally gradually broadened towards forked apex. Apex always V-shaped, with divergent tips (Fig. 15A). This feature occurs always in minor, medium, and major males, with median or longer horns. Sometimes the tips of the cephalic horn, in dorsal view, are slightly bent backwards, mostly in medium or small specimens. The distance between the tips is 8.5 mm. The sides are bordered with a weak rim easily detectable, from base to mid-length. The dorsal side at the base bears the relief of a distinct tooth, with a maximal height of 3.5 mm.

Pronotum. Whole surface is covered by uniform, fine, dense, yellowish pubescence. Anterior angles projecting as elongate, sharp, divergent horns, distinctly bent outwards, basal width ca. 9.5 mm, length from base 10.5 mm, distance between apices of anterior horns 37 mm. Median thoracic horn longer than laterals, length 17 mm, straight, dorsal side with a glossy black line, ventral side of median horn with abundant fine pubescence. PL/TH ratio 2.190. ***Elytra.*** Covered by very fine, uniformly dense, yellowish pubescence except along sutural edge and lateral margins; EL/EW ratio 1.102. Sutural edge with glossy black stripe; three or four ridges

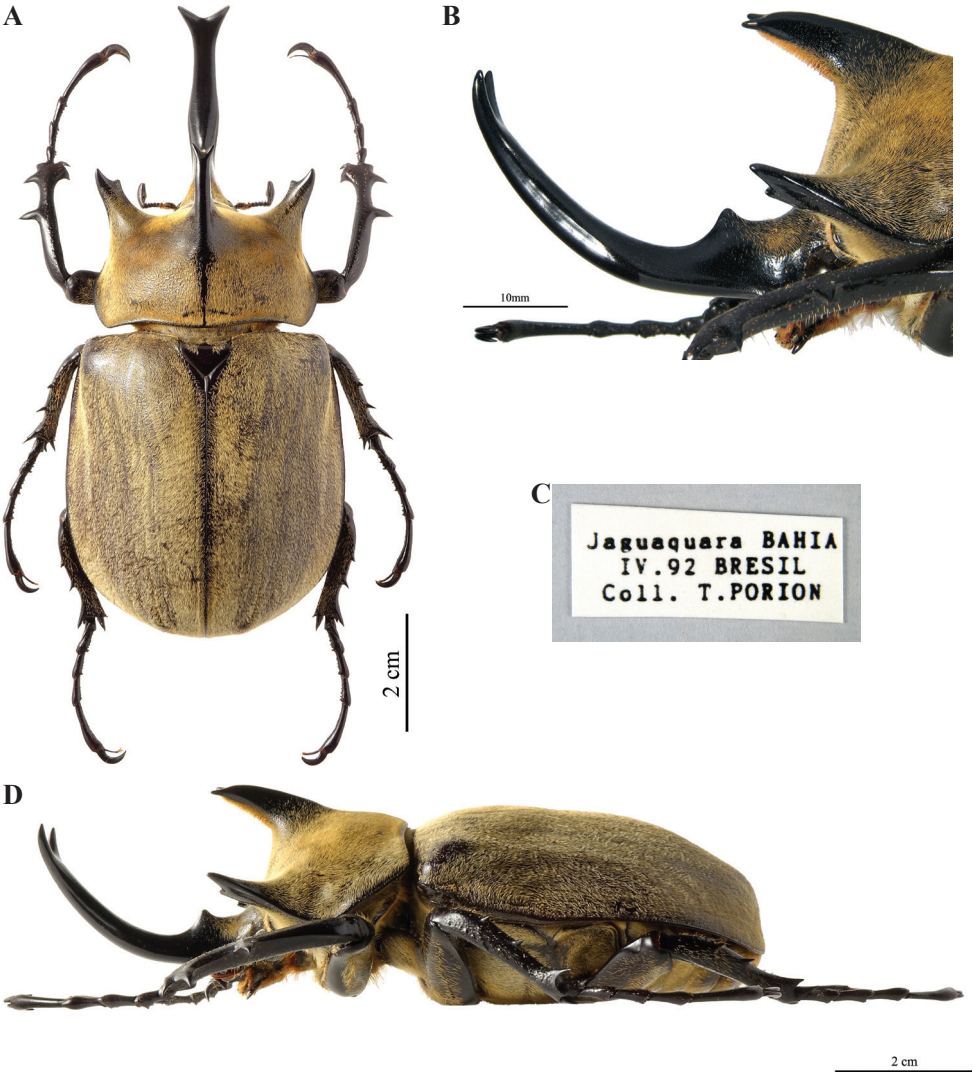


Figure 15. *Megasoma typhon typhon* ♂ from Brazil, Bahia, Jaguaquara **A** dorsal habitus **B** cephalic horn lateral view **C** original label **D** lateral habitus.

almost equally spaced on each elytron, covered by pubescence. Elytra in lateral view bulging but gradually flattened towards the apex. L/EL ratio 1.462, showing an elongate feature of the body. ***Abdomen.*** Laterally covered with very fine, short, reddish brown pilosity, medially glabrous only in a small area of each sternite. ***Legs.*** Fore tibia slightly rounded inwards, inner edge strongly dilated at apex, FL 26 mm. Anterior edge of protibia V-shaped. Lateral edge with three strong teeth, decreasing in length from basal to apical teeth, but basal tooth longer than subapical; basal tooth more distant from subapical tooth than the latter from apical. Basal and subapical teeth large, thick, sharp, triangular, pointing rearwards; apical tooth very reduced, point-

ing forwards. Inner apical spur strongly curved ventrally, distinctly longer than the apical tooth. TF 29 mm. ***Aedeagus.*** Overall appearance of the parameres more massive than in *M. gyas*, subrectangular, not narrow, as showed in Fig. 31C, D. Anterior phallobase also bigger.

Variation, males. As usual, the development of cephalic and thoracic horns is allometric, but in medium and small specimens of *M. typhon typhon* with shorter ce-

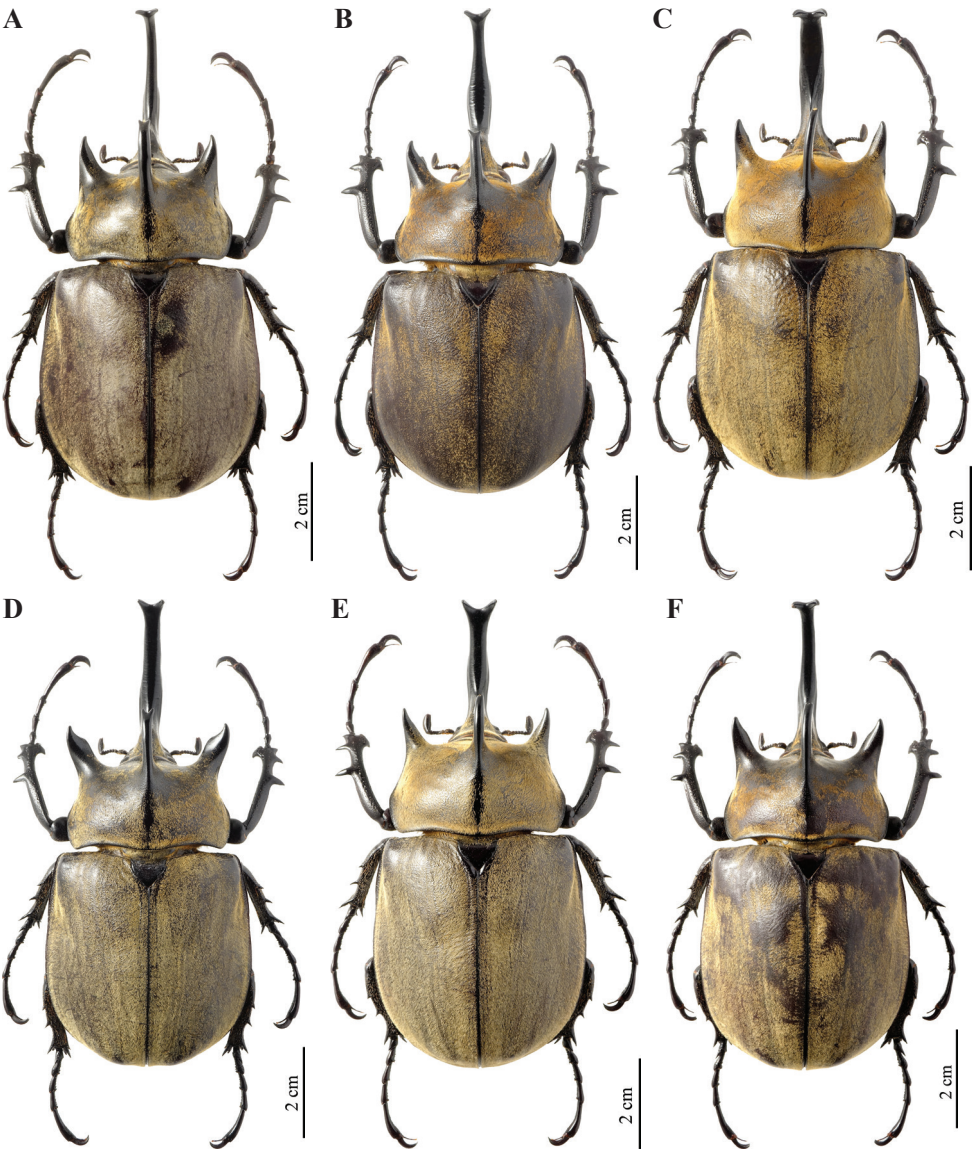


Figure 16. *Megasoma typhon typhon* gallery from different localities **A** Brazil, Bahia, Salobrinho **B** Brazil, São Paulo Province **C** Brazil, Bahia, Arataca **D** Brazil, Minas Gerais, Ipatinga **E** Brazil, Bahia, Jaguaquara **F** Brazil, Rio de Janeiro, Teresópolis.

phalic horn, thoracic horns remain well developed. The tooth on the dorsal side of the cephalic horn is always present, in major, medium, and small specimens. Minor males in lateral view, often show a rounder feature of the body.

Measurements. L: 57–85 mm; TL: 65–119 mm; PL: 17–24 mm; PW: 29–40 mm; EL: 41–57 mm; EW: 35–50 mm; CL: 13–38 mm; FL: 19–26 mm; TF: 22–30 mm.

Female (Fig. 17). ***Size.*** L: 73 mm; PL: 20 mm; PW: 32 mm; EL: 49 mm; EW: 41 mm.

General appearance. Uniformly black; elytra covered with yellow-brownish dense pilosity for 4/5 of the total surface. ***Head.*** Middle of fronto-clypeal suture with single tubercle. ***Pronotum.*** Dull, coarsely punctate-rugose, strongly convex; posterior median carina 12 mm long, more than ½ total length. Anterior angles projecting, obtuse, with blunt tip. ***Elytra.*** Punctate-rugose glossy black on dorsal, anterior area, extending for 10 mm, almost 1/5 of the EL; sculpture finer towards pubescent surface. Pubescent surface consistently covered, with clearly visible longitudinal ridges, three or four ridges for each elytron, not equally spaced. Sutural line and epipleura glabrous, glossy black, with very fine punctation. ***Abdomen.*** Finely punctate, covered by short, brown-yellowish pilosity except for median central portion on sternites III-V. ***Legs.*** Fore tibiae shorter than in males, shorter than tarsi, 17 mm long, fairly arcuate, with three lateral strong teeth. Basal and subapical teeth

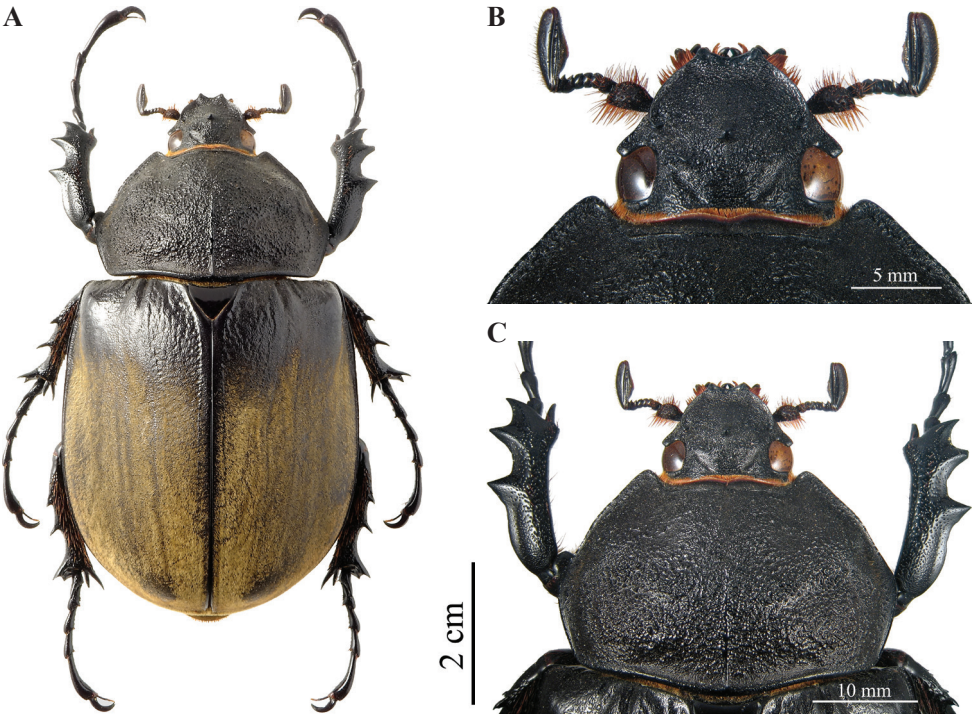
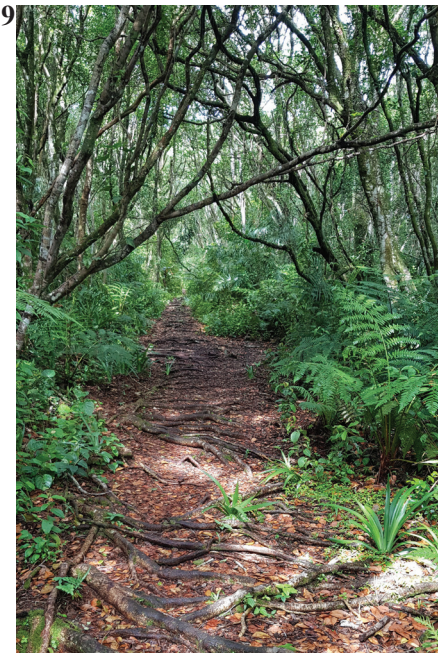


Figure 17. *M. typhon typhon* ♀ from Brazil, Minas Gerais, Ipatinga **A** dorsal habitus **B** single head's tubercle **C** pronotum with carina.



Figures 18, 19. 18 View of Mata Atlântica biome, native trail, Itacaré, Bahia. (photograph L. Migliorati). **19** Trail into Mata Atlântica, Serra do Mar, Santa Catarina (photograph M. Prandi).

equal in length; apical tooth smaller. Inner side with slight dilatation at apex. Inner spur curved ventrally almost equal in length as apical tooth. Lateral and inner apical teeth smaller than in males. TF length 22 mm.

Measurements. L: 47–78 mm; PL: 12–21 mm; PW; 20–34 mm; EL; 29–50 mm; EW: 26–44 mm; FL: 11–19 mm; TF: 16–24 mm; HL: 5–11 mm.

Megasoma (*Megasoma*) *typhon* ssp. *prandii* Milani, 2008

Figures 20A–D, 21A–D

Megasoma (*Megasoma*) *gyas* ssp. *prandii* Milani, 2008: 119–133.

Distribution. This is the southernmost subspecies, nowadays restricted to the Serra do Mar region in the northern part of the Santa Catarina state. It displays a constant distinct morphology with respect to *M. typhon typhon*, which in addition to its geographic isolation, allows us to consider this population as a distinct subspecies.

Material examined. ***Holotype*** (male): "Brasile, Santa Caterina, Vale do Rio Itajaí, Timbó, 27 III 1989 local collector lgt., L. Milani det. 2008" (MPC). Paratypes: same data (4 ♂, MPC, 1 ♂, LMC, 1 ♂, MZC); same locality, 26 III 1989 (1 ♂, MPC); 28 III 1989 (1 ♂, MPC); 29.III.1989 (1 ♂, MPC); 6 IV 1989 (1 ♂, MSNM); 7 IV 1989 (1 ♂, MPC); 22 IV 1989 (1 ♂, 1 ♀, MPC). **Additional material examined:** Brazil, **Santa**

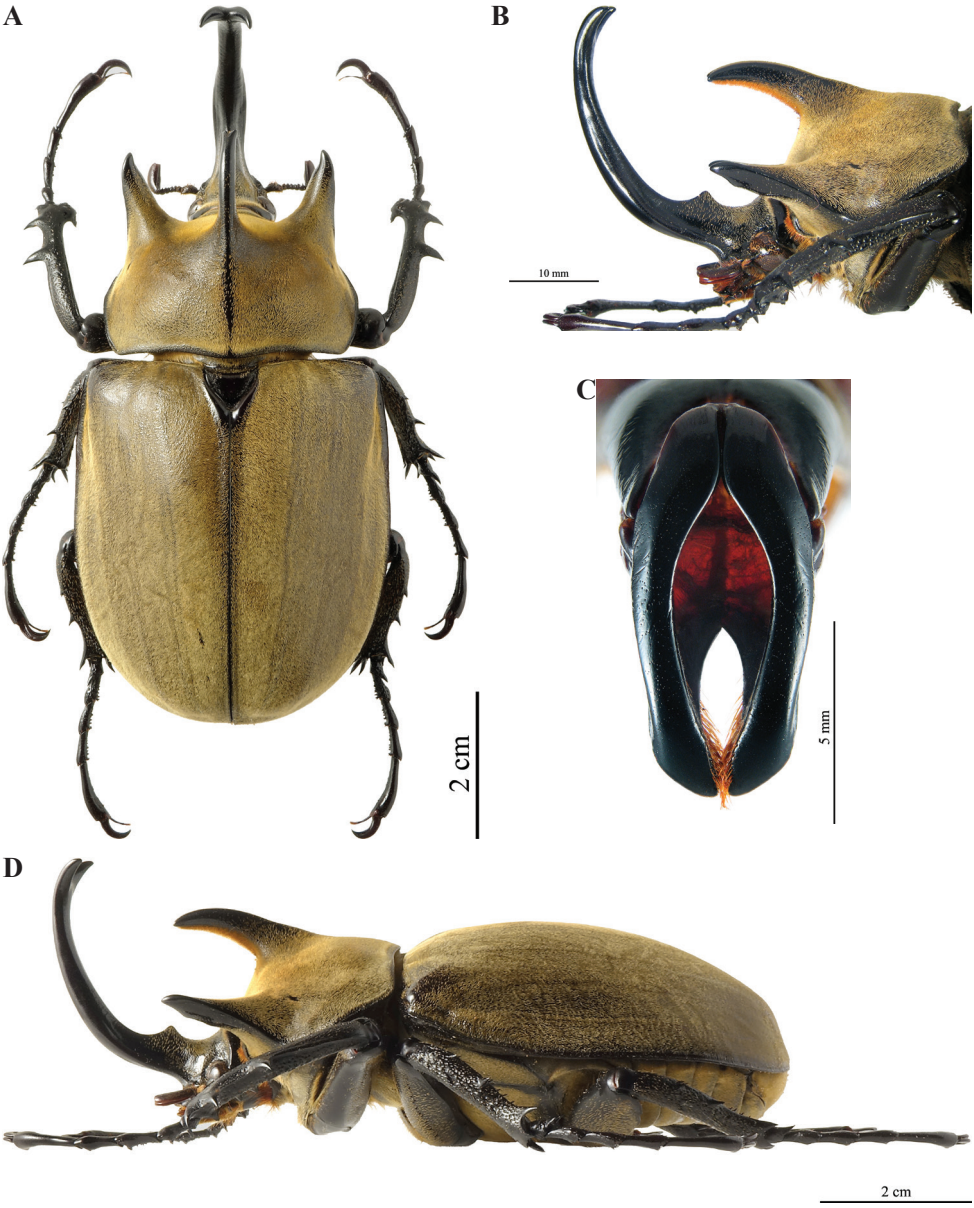


Figure 20. *M. typhon prandii* ♂ from Brazil, Santa Catarina, Serra do Mar **A** dorsal habitus **B** cephalic horn lateral view **C** aedeagus **D** lateral habitus.

Catarina, Rio dos Cedros, 2010 (1 ♂, UNLP); Hansa Humboldt, from the Collection Reitter (1 ♀, UBC); Joacaba, 1981 leg. Hartmann (1 ♀, UBC). **Rio Grande do Sul**, Porto Alegre, X 1946 (1 ♂, UBC); Porto Alegre, 1938, with label "*Typhon*" (1 ♂, UBC).

Remarks. The diagnosis below is based on a specimen from Serra do Mar, near Rio dos Cedros, above 180 m a.s.l., caught in 2010. After this date very few specimens

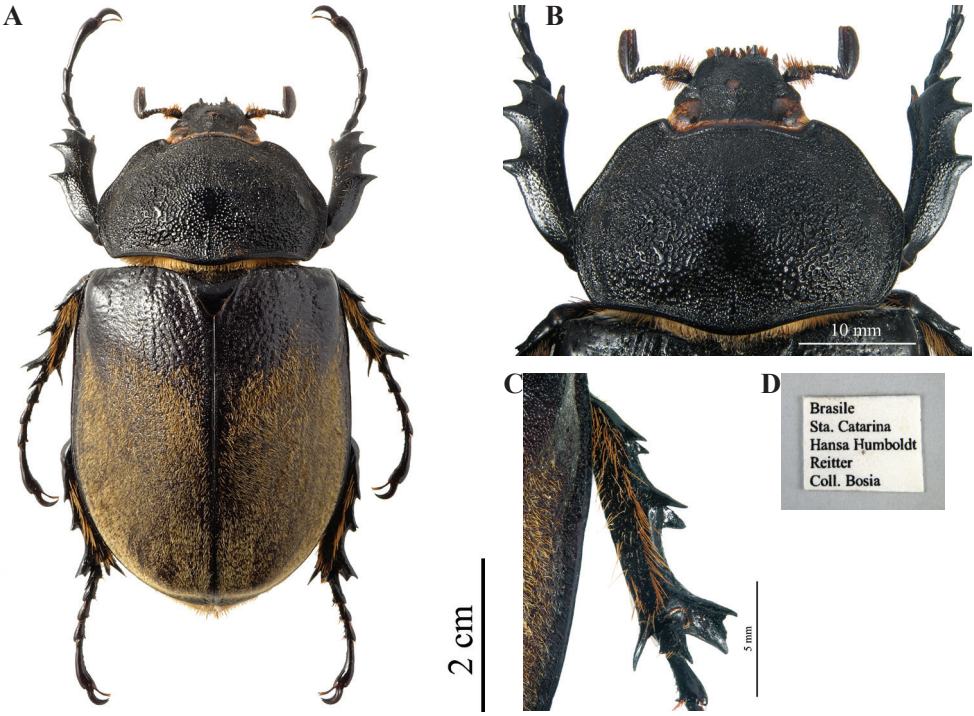


Figure 21. *M. typhon prandii* ♀ from Brazil, S. Catarina, Hansa Humboldt (now Joinville) **A** dorsal habitus **B** single head's tubercle and pronotum **C** mesotibia with carina **D** label.

have been found, suggesting that the subspecies could be threatened by the reduction of its habitat.

Male diagnosis (Fig. 20). A large *Megasoma*, uniformly dark brown, covered by a yellowish short, fine, uniform, pubescence; head, including horn, consistently black. Elongate body. ***Size.*** L: 75 mm; TL: 100 mm; PL: 21 mm; PW: 34 mm, EL: 52 mm; EW: 44 mm; CL: 39 mm; FL: 24 mm; TF: 25 mm. ***Head.*** Cephalic horn long, projecting forwards and noticeably curved upwards. In dorsal view, slightly wider at the base and apex, but remaining almost subrectangular laterally, without median flattened zone. Apex always V-shaped, with divergent tips (Fig. 20A). ***Pronotum.*** Whole surface covered by uniform, fine, dense, yellowish pubescence. Anterior angles projecting as elongate, sharp, weakly divergent horns. Median thoracic horn longer than laterals, straight, dorsal side with a glossy black line. ***Elytra.*** Covered by very fine, dense, uniform, yellowish pubescence except for sutural edge and epipleura; in lateral view not bulging, uniformly flattened towards apex. ***Legs.*** Fore tibia slightly rounded inwards, the inner edge strongly dilated apically. Anterior hedge of protibia V-shaped. ***Aedeagus.*** It differs from the nominative subspecies for the parameres of tegmen smoother and rounder laterally, as in Fig. 20C.

Variation, males. A feature of the apex of the cephalic horn is that it is always V-shaped. A distinct tooth present on the dorsal side of the cephalic horn is always visible,

also in medium and minor ♂. A feature of the body, in lateral view in medium specimens is that it is almost flat, and only very small specimens sometimes show a rounded body.

Measurements. L: 53–78 mm; TL: 62–102 mm; PL: 15–23 mm; PW: 26–36 mm; EL: 33–53 mm; EW: 35–46 mm; CL: 11–40 mm; FL: 17–26 mm; TF: 19–27 mm),

Female diagnosis (Fig. 21). A medium-large female of *Megasoma*, uniformly black, elytra covered for 5/6 of total surface by dense yellow-brownish pilosity. ***Size.*** L: 62 mm; PL: 17 mm; PW: 29 mm; EL: 42 mm; EW: 34 mm; FL: 17 mm; TF: 19 mm; HL: 8 mm. ***Head.*** Middle of fronto-clypeal suture with a single tubercle. ***Clypeus.*** Anterior lateral angles projecting into a very small tooth directed forwards and upwards; in this ssp. the two small teeth are distinctly more acuminate and curved upwards than in other species. ***Pronotum.*** Dull, except for the sides, with sparse bristles. Strongly convex, coarsely punctate-rugose; with posterior median carina flat, enlarged, smooth. Pronotum more expanded longitudinally and rounded laterally than in other species (Fig. 21A). ***Elytra.*** Punctate-rugose on dorsal, anterior area, glossy black; sculpture steadily finer towards pubescent surface. Pubescent surface rather sparse, roughly covered, with no visible longitudinal ridges. ***Legs.*** Fore tibiae shorter than tarsi, fairly arcuate, with three strong lateral teeth. On mesotibiae and metatibiae lateral teeth evolving into evident lateral carinae (Fig. 21C); lateral spiny processes extending up to 3 mm laterally, immediately before tarsi junction.

Measurements. L: 49–65 mm; PL: 13–18 mm; PW: 21–29 mm; EL: 32–43 mm; EW: 29–36 mm; FL: 13–19 mm; TF: 15–20 mm; HL: 7–9 mm).

***Megasoma* (*Megasoma*) *hyperion* sp. nov.**
http://zoobank.org/F291D96E-BE88-4ECC-A64F-BEFCE2C0245B
Figures 22A–D, 25A–C

Type material. ***Holotype*** ♂ (deposited in CERPE): Brazil, **Minas Gerais**, Águas Vermelhas, IV 2006. Paratypes (154 in total, 86 major ♂ [> 65mm]), 30 minor ♂ and 38 ♀), as follows: 1 paratype (allotype) ♀ same locality of holotype, III 2002 (CERPE); **Minas Gerais**, Salinas, V 2002 (1 ♂, CEMT); same locality, 2007 (1 ♂, CEMT); same locality, IV 2005 (1 ♂, 1 ♀, EPCG); Águas Vermelhas, V 2006 (1 ♂, MSNM); same locality, VI 1992 (1 ♂, EPCG); same locality III 2001 (1 ♂, EPCG); same locality, IV 2001 (8 ♂, 1 ♀, EPCG); same locality, III 2002 (5 ♂, EPCG); same locality, IV 2005 (1 ♂, MPC); same locality, V 2005 (1 ♂, 1 ♀, MPC); same locality, IV 2006 (35 ♂, EPCG, 11 ♂, 2 ♀, MPC); same locality, V 2006 (27 ♀, EPCG, 5 ♂, MPC); same locality, V 2008 (1 ♀, MPC); same locality, IV 2013 (18 ♂, EPCG); same locality, XII 1994 (2 ♂, KKC); same locality, III 2013 (1 ♂, MPC); same locality, IV 2013 (3 ♂, MPC); same locality , IV 2014 (1 ♂, KKC); same locality , VI 2014 (2 ♂, MPC); same locality , III 2016 (2 ♂, MPC); same locality , III 2018 (7 ♂, MPC); same locality , IV 2019 (4 ♂, MPC); Paracatú, VI 1981 (1 ♂, EPCG); Jaíba, V 1997 (1 ♂, EPCG); Montes Claros, II 2000 (1 ♂, EPCG); same locality, IV 2000 (1 ♀, EPCG); Capitólio, IV 2004 (1 ♂, EPCG); **São Paulo**, Boituva, VII 1991 (2 ♂, EPCG, 1 ♂ MPC).

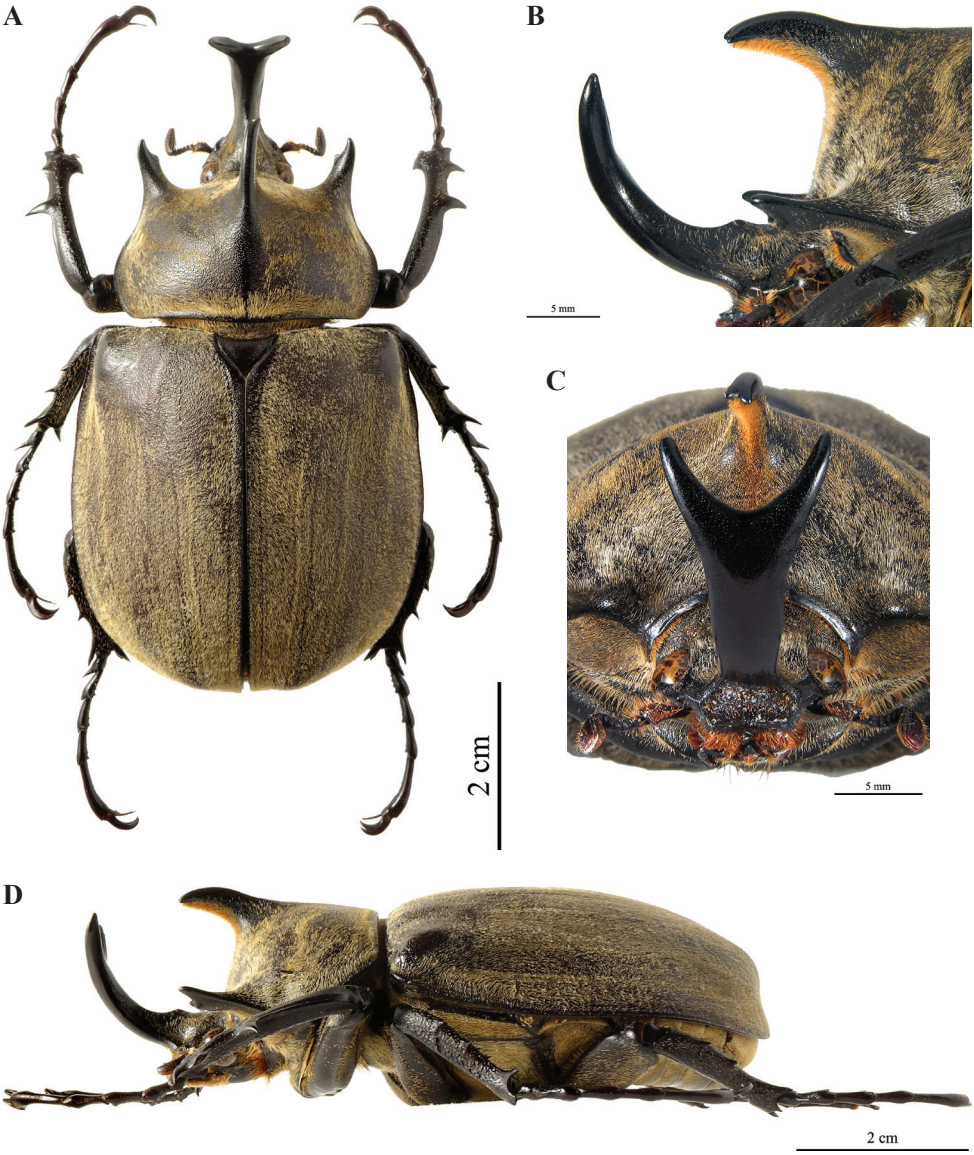


Figure 22. *Megasoma hyperion* sp. nov., holotype from Brazil, Minas Gerais, Águas Vermelhas ♂ **A** dorsal habitus **B** cephalic horn lateral view **C** cephalic horn frontal view **D** lateral habitus.

Description of the holotype (Fig. 22). ***Size.*** L: 70 mm; TL: 79 mm; PL: 18 mm; PW: 32 mm, EL: 43 mm; EW: 42 mm, CL: 22 mm; TH: 8 mm; FL: 21 mm; TF: 24 mm. ***General appearance.*** Uniformly dark ebony brown covered by sometimes dense, sometimes sparse rough pilosity; pubescence that turns from grey to yellowish brown color. Head, including horn, consistently black; base of horn towards pronotum with sparse bristles. Tip of pronotal horns, sutural and lateral edges of elytra and

Figure 23. Panorama in Ponto dos Volantes, north of Minas Gerais (photograph P. Grossi).

thorax shiny black as in legs. ***Head.*** Cephalic horn short, projecting forwards and curved upwards in lateral view. In dorsal view, narrower at base, 3 mm, and gradually broadens to a maximum of 7 mm towards the apex. Apex distinctly forked, V-shaped, distance between tips 10 mm (Fig. 22C). Sides bordered with weak rim from base to apex, rim detectable on total length. Dorsal side at base with small but evident triangular tooth. In lateral view, apex of tooth blunt, projecting upwards; height of tooth from base 1 mm. ***Clypeus.*** Anterior edge slightly concave, less concave than in *M. gyas*, broader than width of cephalic horn at base, lateral angles with small tooth, projecting forward, surface punctate with sparse bristles. ***Mandibles.*** Each with two small lateral teeth. In ventral view, interocular minimum width (IW) 4 mm, transverse eye diameter (TE) 4.5 mm, IW/TE ratio 1.154. Antennal club, in dorsal view, 3.8 mm of length. ***Pronotum.*** Completely covered by rough pubescence, with distal part quite abraded. Anterior angles projecting as sharp, elongate, parallel horns, slightly bent outwards; width at base ca. 4.9 mm, length 8 mm, distance between apices of anterior horns 21 mm. Median thoracic horn longer than laterals, sickle-shaped, 11 mm long. PL/TH ratio 2.250. L/PL ratio 3.888, higher than in *M. gyas*. ***Scutellum.*** Subtriangular, 5 mm long, 7 mm wide, largely coarsely punctate, lateral edges and lower apex smooth. ***Elytra.*** Covered by rough pubescence, except for black glossy punctation around scutellum, along epipleura and elytral suture; EL/EW ratio 1.023. Pubescence quite abraded on the anterior part of elytra, close to pronotum. Sutural punctate black stripe limited by very fine, visible ridges, covered by pubescence; three or four ridges, almost equally spaced, on each elytron. Elytra in lateral view not bulging, with flat feature declining towards apex. L/EL ratio 1.628, significantly higher than in *M. gyas*,

with bulker body and shorter, broader elytra. This provides *M. hyperion* sp. nov. with an obviously more "squared" feature. ***Pygidium.*** Convex, covered by yellowish pubescence. ***Abdomen.*** Laterally covered with very fine, short, yellowish brown pilosity, medially on sternites III-V almost glabrous. ***Legs.*** Fore tibia almost straight, inner edge rather dilated inwards at apex, 21 mm of length. Anterior edge V-shaped, just over first tarsomere. External sides of tibiae with three teeth, decreasing in length from basal to apical tooth; basal tooth more distant from subapical than the latter from apical. Basal and subapical teeth large, sharp, triangular, pointing rearwards; apical tooth sharp, pointing forwards. Inner apical spur strongly curved ventrally, as long as the basal tooth. Fore tarsus 24 mm of length. Mesotibia and metatibia with three very pointed teeth increasing in length from basal to apical teeth; first tarsomere in middle and hind tarsi very acute. ***Aedeagus.*** Intermediate between *M. gyas* and *M. typhon*, more massive than the former, shorter in frontal view and less massive with parameres laterally more rounded than the latter, as shown in Fig. 31E, F. **Labels.** 1 (white): "Brazil, Minas Gerais, Aguas Vermelhas IV 2006"; 2 (red): "*Megasoma hyperion* sp. nov. / Holotypus ♂ / M. Prandi, P.C. Grossi & F.Z. Vaz-de-Mello det. 2020".

Paratype variations, males. The overall morphology is quite homogenous. Proportional to the body, the measured differences in CL are slight. The shape of the cephalic horn shows the most interesting variability, e.g., more elongate vs.

Figure 24. Panorama of north of Minas Gerais, near Aguas Vermelhas, with enclaves of Cerrado and Caatinga biomes (photograph P. Grossi).

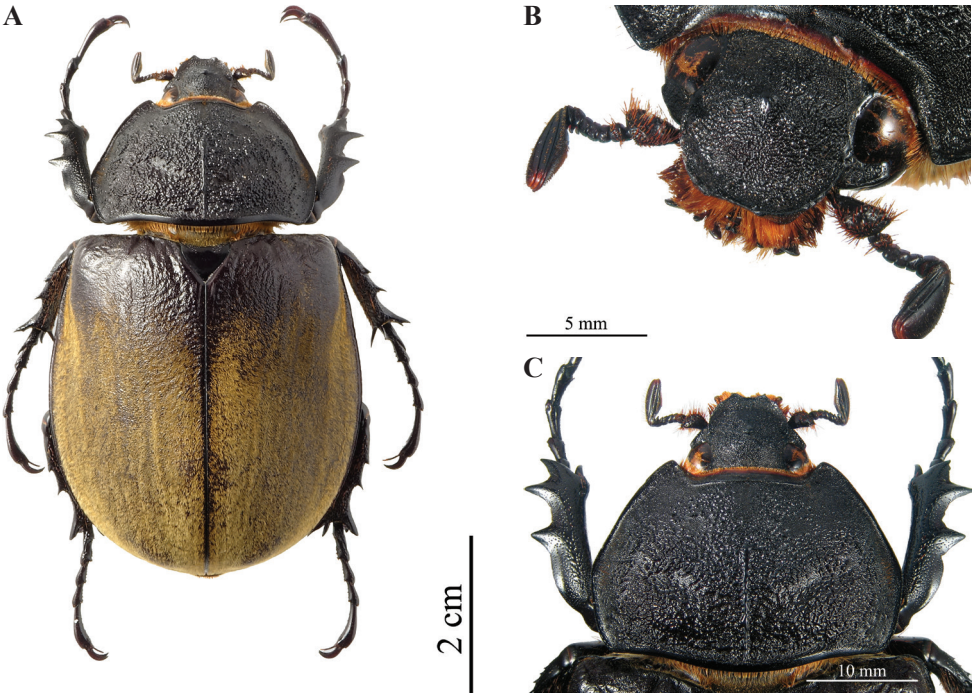


Figure 25. *Megasoma hyperion* sp. nov. from Brazil, MG, Águas Vermelhas, allotype ♀ **A** dorsal habitus **B** single head's tubercle **C** pronotum with carina.

more squared; triangular shape vs. subrectangular, even if all the paratypes always maintain the same V-shaped apex with regular/short tips, in both small and large specimens. The median thoracic horn is always longer than the laterals, often sickle-shaped as in holotype, but sometimes elongate as in other paratypes. The color of the pubescence changes from grey to yellowish to reddish brown. The elytra appear flat in lateral view in major and medium specimens, but small paratypes show an accentuated rounder body.

Measurements. L: 45–71 mm; TL: 52–94 mm; PL: 14–24 mm; PW: 22–37 mm; EL: 34–52 mm; EW: 14–47 mm; CL: 5–25 mm; TH: 4–9 mm; FL: 14–25 mm; TF: 18–26 mm.

Description of the female (allotype) from Brazil, Minas Gerais (Fig. 25). ***Size.*** L: 64 mm; PL: 18 mm; PW: 27 mm; EL: 42 mm; EW: 38 mm; HL: 8 mm. ***General appearance.*** Uniformly black; elytra with 3/4 of its surface covered by yellowish brown dense recumbent pilosity. ***Head.*** The middle of fronto-clypeal suture with a single tubercle. In ventral view, inter-ocular distance length 3.4 mm; transverse eye diameter width 3.5 mm. ***Clypeus.*** Finely punctate; anterior lateral angles projecting into a tooth directed forwards and upwards; distance between tips 2.5 mm; apical edge between the angles concave. ***Pronotum.*** Dull, coarsely punctate-rugose, strongly convex; posterior median carina 11 mm long, more than ½ of total length. Anterior

angles projecting, obtuse, with blunt tips. ***Scutellum.*** Triangular, smooth, shiny, impunctate. ***Elytra.*** Surface glossy black, punctate-rugose anteriorly, near base coarser; punctate surface extending for 12 mm in length, almost 1/5 of EL. Elytral pilosity very uniform, yellowish brown, with easy detectable longitudinal ridges, three or more for each elytron, almost equidistantly spaced out. Dorsal sutural line and lateral edges glossy black, with very fine punctation. As in males, the distinct shape of a stocky body is a visible differential character (Fig. 25A). ***Pygidium.*** In lateral view, concave, with very fine punctation. Surface in basal half-covered with short, fine, grey pubescence; in apical half with scattered, erected, brown-yellowish setae. ***Abdomen.*** Sternites very finely punctate, covered by short, yellowish brown pilosity, except for a small central portion in the middle of sternites III-V. ***Legs.*** Protibiae shorter than tarsi, shorter than in the males, tarsi shorter too; FL 17 mm, TF 20 mm. External sides with three strong teeth almost equidistant. Basal and subapical teeth almost equal in length; the apical tooth smaller. Inner side without a strong dilated apex. Inner spur curved ventrally and shorter than apical tooth. On mesotibiae and metatibiae three lateral sharp teeth, with the subapical and the apical weakly evolving in lateral carinae, with presence of basal embryonic spiny processes.

Measurements of female paratypes. L: 48–71 mm; PL: 14–20 mm; PW: 21–33 mm; EL: 32–48 mm; EW: 27–38 mm; FL: 11–17 mm; TF: 16–20 mm; HL: 6–8 mm.

Bionomics. Very little information is available on this beetle's behavior. The beetle flies usually from 9–10 p.m. till 2 a.m. and it is attracted by white mercury lights. Males are encountered more frequently (EJ Grossi, pers. comm., 2019).

Etymology. Noun in apposition. Following the example of Jablonsky who chose the name of a Titan, Gyas, we also follow Greek mythology and choose the name of another Titan, Hyperion, son of Uranus (the sky) and Gaia (the earth).

Remarks. Grossi et al. (2008) were the first to remark on the disjunct distribution range of (alleged) *M. rumbucheri* (see also Prandi 2016; Santos et al. 2013). The type locality of the new species falls within the "mata seca ou de cipó" (dry forest) habitat, a crossroad of the three biomes: Caatinga, Cerrado, and Mata Altlântica. An interesting historical record (1908) from Be-Kuwa (Kobayashi 2019) in the locality of Paranaíba (western Minas Gerais state, Brazil). The beetle's external morphology is rather homogeneous, with the cephalic horn showing a certain degree of variability, but the species-specific characters here identified are constant and indicate this taxon as a separate species.

Related South American taxa

***Megasoma* (*Lycophontes*) *joergenseni joergenseni* (Bruch, 1910)**
Figure 26

Lycophontes jörgenseni Bruch, 1910: 74.

Remarks. The subgenus *Lycophontes*, of the genus *Megasoma*, is a group comprised of small-sized taxa. *Megasoma jorgenseni jorgenseni* is a completely-pubescent taxon, oc-

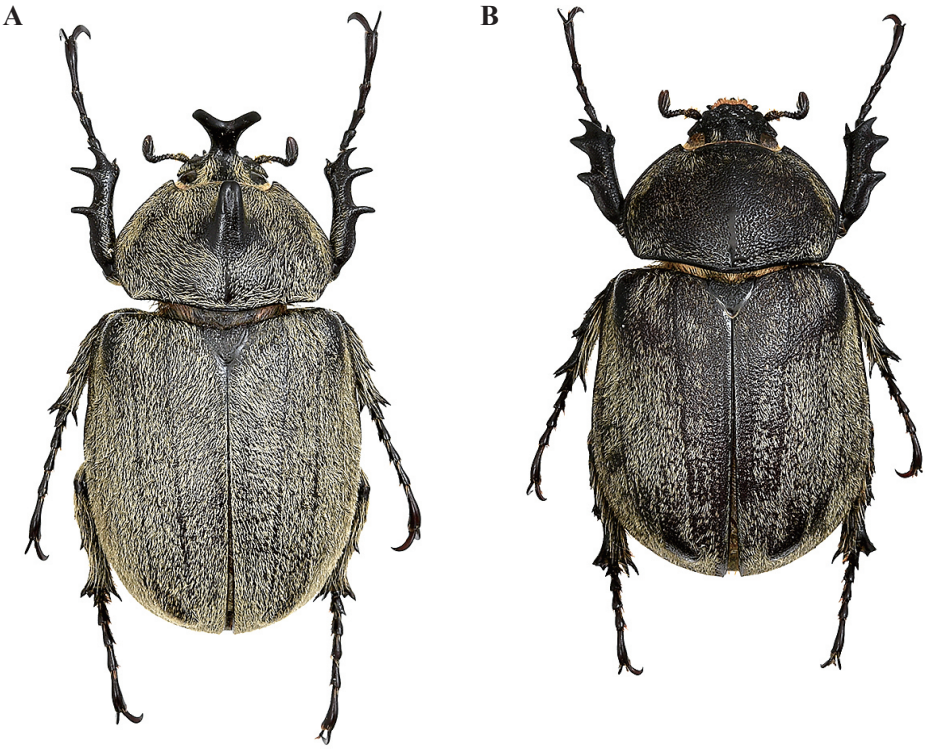


Figure 26. A *M. joergenseni joergenseni* ♂ **B** *M. joergenseni joergenseni* ♀.

curring in central-northern Argentina and southeastern Bolivia. The total body length varies from 30 to 40 mm (Fig. 26, courtesy of Mushi-sha). The original type of Bruch (San Luis, Mendoza) considered lost, was recently found by the Argentinean entomologist FC Penco in a private collection, and is now deposited in the UNLP collection.

Megasoma (*Lycophontes*) *joergenseni penyai* Nagai, 2003

Figure 27

Megasoma joergenseni ssp. *penyai* Nagai, 2003: 38–39.

Remarks. The subspecies *penyai* is restricted to an area in central-western Paraguay (holotype from Loma Plata, Chaco). The main characters differentiating it from the subspecies *joergenseni* are found in the smaller median thoracic horn and in the denser pubescence, giving a more brownish color. It is also usually smaller than ssp. *joergenseni*. (Fig. 27, courtesy of Mushi-sha).

Figure 27. A *M. joergenseni peynai* ♂ **B** *M. joergenseni peynai* ♀.

***Megasoma* (*Megasoma*) *anubis* (Chevrolat in Guérin, 1836)**
Figure 28

Scarabaeus anubis Chevrolat, 1836: t.139–140.
Scarabaeus hector Gory, 1836, synonymy by Burmeister 1847: 278–279.
Megalosoma theseus Laporte, 1840, synonymy by Burmeister 1847: 278–279.

Remarks. This is another completely-pubescent South American taxon belonging to the genus *Megasoma*. It occurs in northeastern Argentina (Misiones region), southeastern Paraguay, and in eastern and southern Brazil (Espírito Santo, Rio de Janeiro, Paraná, Santa Catarina, and Rio Grande do Sul states). It is interesting to note that in the first two Brazilian states, in the region of Teresópolis, RJ, it is sympatric with *Megasoma typhon typhon*. The distinctive characters are the cephalic horn and the sickle-shaped thoracic horn, both short with a very wide bifurcated apex. Total body length varies from 50 to 90 mm (Fig. 28, courtesy of Mushi-sha).

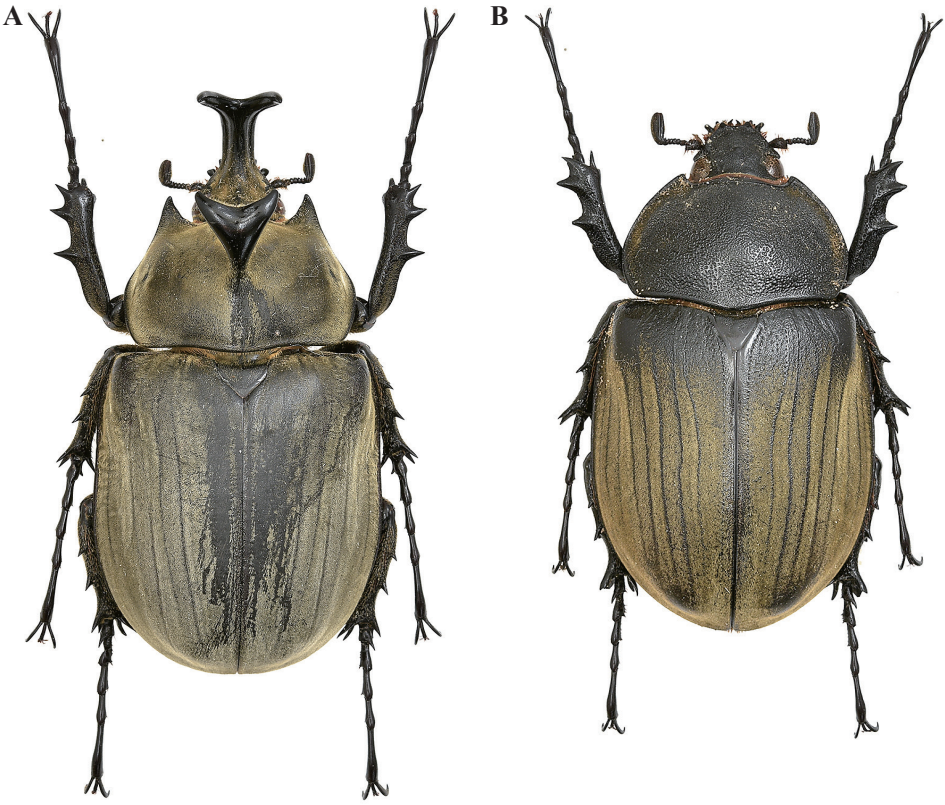


Figure 28. A *M. anubis* ♂ **B** *M. anubis* ♀.

***Megasoma* (*Megasoma*) *hermes* Prandi, 2016**
Figure 29

Megasoma hermes Prandi, 2016: 525–584.

Remarks. The distribution range of this species (northern Brazil, on the border with Venezuela and Guyanas) represents the northernmost distribution compared to the aforementioned species and subspecies. It is likely that Endrödi's (1977) and Morón's (2005) claims of the alleged presence of *M. gyas* in Suriname and Guyana refer to this species. The validity of this taxon has been recently confirmed by further findings from Venezuela, at the border with Brazil (see Kobayashi, 2019). Only ten specimens have been collected thus far and a large specimen is deposited in MSNM. It is a completely glabrous *Megasoma* on its dorsal side. Ventrally it bears a very poor pubescence, mainly on female specimens. The variability of total body length varies from 68 to 105 mm (Fig. 29, courtesy Mushi-sha).

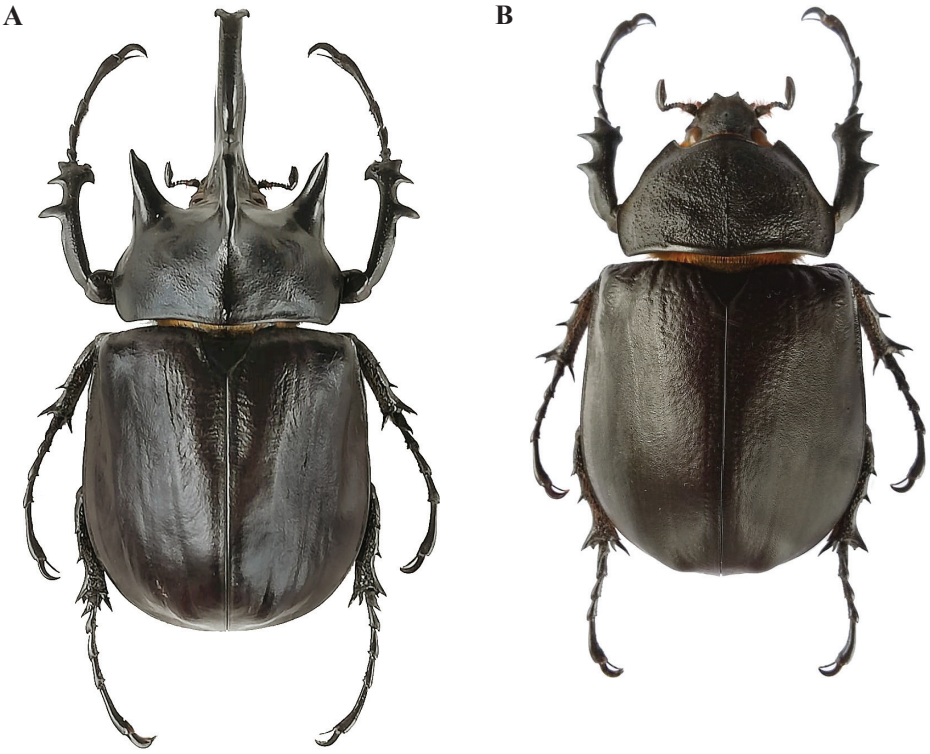


Figure 29. A *M. hermes* ♂ **B** *M. hermes* ♀.

Identification keys for major males and females of the *Megasoma* (*Megasoma*) *gyas* species group. The identification of minor males requires the examination of the aedeagus.

Males:

1	Dorsum covered by pubescence, pronotum three-horned	***M. gyas* species group 2**
–	Different combination of characters	**other *Megasoma* species**
2	Cephalic horn wide and short (< 30 mm)	**3**
–	Cephalic horn elongate, medium to long (> 30 mm)	**4**
3	Cephalic horn with apex U-shaped with long tips	***Megasoma gyas***
–	Cephalic horn with apex V-shaped with short tips	***Megasoma hyperion* sp. nov.**
4	Cephalic horn medium to long, straight	***Megasoma typhon typhon***
–	Cephalic horn long, curved upwards and backwards	***Megasoma typhon prandii***

Females:

1	Female with a single cephalic tubercle	**2**
–	Female with two cephalic tubercles	***Megasoma gyas***
2	Sides of pronotum rounded	***Megasoma typhon prandii***
–	Sides of pronotum subtrapezoidal	**3**
3	Elongated body shape	***M. typhon typhon***
–	Stocky body shape	***M. hyperion* sp. nov.**

Conclusions

Retracing the history of the taxon *Megasoma gyas* was more than a revision, it was a dip in the past. The historical part, with the various Fathers of Entomology who have studied this insect, was exciting. In an age without knowledge, and without modern scientific means, scientists like George Marcgraf, Carl Gustav Jablonsky, and Guillaume-Antoine Olivier were able to write and paint with an accuracy that seems miraculous. We want to dedicate this paper to those pioneers, hoping that it will be useful for the reader to clarify the taxonomic evolution and the correct classification of one of the most beautiful taxa of the Dynastini tribe.

Figure 30. Collecting localities of the *Megasoma gyas* species-group.

Figure 31. Frontal view of aedeagi **A** aedeagus of *M. gyas* from Brazil, Pernambuco, Custódia **B** aedeagus *M. gyas* from Brazil, Sergipe **C** aedeagus of *M. typhon typhon* from Brazil, Bahia, Jaguaquara **D** aedeagus of *M. typhon typhon* from Brazil, Minas Gerais, Ipatinga **E, F** aedeagi of *M. hyperion* sp. nov. from Brazil, Minas Gerais, Aguas Vermelhas.

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Supplementary material 1

The taxa of the genus *Megasoma* Kirby, 1825 (Coleoptera, Scarabaeidae, Dynastinae) related to *M. gyas* (Jablonsky in Herbst, 1785) are revised.

Authors: Massimo Prandi, Paschoal C. Grossi, Fernando Z. Vaz-De-Mello

Data type: COL

Explanation note: *Megasoma* (*Megasoma*) *gyas* is recognized as a monotypic species (confirming the invalid subspecies status of *M. gyas rumbucheri*, new synonymy) restricted to the Caatinga biome of Northeastern Brazil. The "long-horned *gyas*" is recognized as a separate polytypic species with the name *Megasoma* (*Megasoma*) *typhon typhon* (Olivier, 1789) (stat. nov.) for the populations occurring through the Mata Atlântica biome of Brazil, from Bahia to São Paulo states (*M. gyas porioni* Nagai is synonymized with *M. typhon typhon* new synonymy), and *Megasoma* (*Megasoma*) *typhon prandii* Milani, 2008 (new combination) for the population restricted to a small area in the state of Santa Catarina, South Brazil. The "short-horned *gyas*" occurring in Minas Gerais, São Paulo and southwestern Bahia is recognized as a separate new species and described as *Megasoma* (*Megasoma*) *hyperion* sp. nov. The work includes a substantial historical research and the redescriptions of the historical species. Additionally, distribution maps and a male and female key to the species in the species group are provided.

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Synopsis of the genus *Ulomorpha* Osten Sacken, 1869 (Diptera, Limoniidae) in Japan

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Abstract

Japanese species of the genus *Ulomorpha* Osten Sacken, 1869 are revised and *U. amamiana* Kato & Kolcsár, **sp. nov.** and *U. longipenis* Kato & Kolcsár, **sp. nov.** are described. A key to the four Japanese species of the genus is provided, with images of habitus and wings, and drawings of their male terminalia. *Ulomorpha amamiana* Kato & Kolcsár, **sp. nov.** is the first representative of the genus discovered from the Oriental region.

Keywords

Crane flies, male terminalia, new species, taxonomy, Tipuloidea

Introduction

Ulomorpha Osten Sacken, 1869 is a small genus of the subfamily Limnophilinae and so far includes two Palaearctic and eight Nearctic species (Oosterbroek 2020). The adults are characterized by having conspicuous macrotrichiae on wing cells and cell R_3 sessile to subsessile. A similar condition is present in the limnophiline genera *Adelpho-*

myia Bergroth, 1891, *Paradelphomyia* Alexander, 1936, and *Limnophila* (*Lasiomastix*) Osten Sacken, 1860 but only in *Ulomorpha* are macrotrichiae proximal to the cord present. Morphological analyses of the characters of immature stages demonstrate that *Ulomorpha* is closely related to *Pilaria* Sintenis, 1889 (Oosterbroek and Theowald 1991). Cladistic analysis of the adult morphological characters recovered a close relationship of *Ulomorpha* with *Pseudolimnophila* Alexander, 1919, *Pilaria*, and *Hexatoma* Latreille, 1809 owing to the bifid interbase in males (Ribeiro 2008).

Immature stages of *U. pilosella* (Osten Sacken, 1860) were described by Alexander (1920a) and were reported from soil rich in organic matter in shaded woods (Alexander and McAtee 1920), but the biology of the genus is otherwise poorly known.

Two species of the genus have been recorded from Japan, *U. nigricolor* Alexander, 1924 (Honshu, Shikoku, and Kyushu islands) and *U. polytricha* Alexander, 1930 (Yakushima Island) (Nakamura 2014; Oosterbroek 2020). In this study, the Japanese species of the genus are revised, and two new species are described, with additional faunistic records including the first representative of the genus from the Oriental region. Images of wings and habitus, drawings of male terminalia, and a key to the Japanese species are provided.

Materials and methods

The specimens were collected by insect nets by D. Kato and L.-P. Kolcsár and either preserved in 90% ethanol or pinned. Overall descriptions of the species were based on the observations made through a Leica MZ7.5 stereomicroscope. Male terminalia of pinned specimens were heated in a solution of 10% KOH for several minutes, then rinsed in a solution of 70% ethanol with 3% acetic acid for neutralization and transferred to glycerol for examination and drawing. The treated genitalia were preserved in genitalia tubes filled with glycerol and the tubes were pinned below the body remains. Drawings were made using the stereomicroscope equipped with a grid eyepiece micrometer. Habitus and wings were photographed with an Olympus OM-D E-M5 Mark II using a M. Zuiko Digital ED 60 mm F2.8 macro lens. Wing venation terminology follows the traditional system, based on McAlpine (1981) and Merz and Haenni (2000), with a modifications from Starý (2008); CuA is referred to here as Cu (Fig. 1C). General distributions of species are from the Catalogue of the Craneflies of the World (Oosterbroek 2020).

Depositories

BLKU Biosystematic Laboratory, Kyushu University, Japan;
CKLP Private Collection of L.-P. Kolcsár;
USNM National Museum of Natural History, Smithsonian Institution, Washington, DC, USA.

Taxonomic treatment

***Ulomorpha* Osten Sacken, 1869**
Figs 1, 2, 3, 4, 5

Type species. *Limnophila pilosella* Osten Sacken, 1860 by original designation (Osten Sacken 1869: 232).

General description of Japanese species of *Ulomorpha* Osten Sacken, 1869. General coloration shiny black, mainly yellow on legs, body clothed with relatively long setae.

Head with eye dichoptic, separated by about twice width of scape on dorsal part and about 1.5 times on ventral part; rostrum 2/3–3/4 length of scape; antenna 16–segmented, 3–4 times as long as head; scape cylindrical, about twice length of pedicel and as wide as pedicel; pedicel globular; flagellum with verticils, longer on middle segments, at most 2.5 times as long as each segment, shortest on apical segment, shorter than apical segment; basal flagellomeres (Figs 1B, 4B) long-oval with pubescences ventrally, as long as 1/2–1 width of each segment; distal flagellomeres long and cylindrical; palpus 5-segmented, shortest on basal segment and longest on apical segment.

Thorax with prescutal pit roundish; tuberculate pit situated near anterior margin on prescutum; meron small, largely membranous on posterior part, separating mid and hind coxae by about 1/2 width of coxa; wing (Figs 1C, 2B, 3B, C, 4C) covered with macrotrichiae except basal part; Sc end at level of distal 1/3 to tip of Rs; crossvein sc-r near tip of Sc; MA present; Rs origin near middle between MA and distal end of Rs; crossvein R_2 indistinct, situated at basal 1/2–1/4 of R_3; R_{3+4} very short, often absent; M_{1+2} not forked (forked in some Nearctic species); cell d closed; crossvein m-cu situated near middle of cell d; Cu curved posteriorly near wing margin; halter about half length of hind coxa; legs with tibial spurs 1 + 2 + 2; tarsomeres 1 to 3 each with 1 tarsal spur; claw about half as long as tarsomere 5, covered with small, hair-like setae on basal half, ventral margin smooth, without teeth; arolium present.

Male terminalia (Figs 1D–H, 2C–G, 3D–H, 4D–H) with segment 9 ring-shaped; tergite 9 and sternite 9 fused laterally; tergite 9 with pair of small roundish lobes at posterior margin; sternite 9 widely concaved at middle of posterior margin; gonocoxite about 1.5 times as long as tergite 9, slightly wide on basal part; gonostyli 1/2–2/3 length of gonocoxite; outer gonostylus black, wide on basal part, tip narrowed into small curved spine; inner gonostylus slightly longer than outer gonostylus, gradually narrowed to tip; interbase bilobed distally, outer lobe narrow and directed posterodorsally, acute at tip; medial lobe larger and directed medially, narrowed to tip; each base of interbase extending medially and fused into bridge.

Ovipositor (Fig. 3I) long, more than 1/3 as long as abdomen; cercus more than 1.5 times as long as tergite 10, weakly upcurved on distal part; hypogynial valve more than 1.5 times as long as sternite 8, almost straight, tip ending at near level of middle of cercus.

Key to Japanese species of *Ulomorpha* Osten Sacken, 1869

1 Wing with distinct dark spot at origin of Rs and with distinct dark seam on fork of Rs to crossvein m-cu (Fig. 3B, C); prescutum shiny with narrow longitudinal line of pruinosity at center ..... ***U. nigricolor*** **Alexander, 1924**

– Wing without dark spot at origin of Rs and conspicuous dark seam on crossvein m-cu (Figs 1C, 2B, 4C); prescutum sparsely covered with pruinosity or entirely shiny **2**

2 Wing with stigma distinctly dark and fork of Rs to crossvein r-m weakly dark (Fig. 2B); aedeagus with rod-shaped part more than three times as long as wide (Fig. 2F) ..... ***U. longipenis*** **Kato & Kolcsár, sp. nov.**

– Wing with stigma and dark seam on fork of Rs to crossvein m-cu indistinct (Figs 1C, 4C); aedeagus with rod-shaped part twice as long as wide (Figs 1G, 4G) **3**

3 Male flagellum oval on basal 4 segments, with pubescence on basal 6–7 segments ventrally (Fig. 1B); medial lobe of interbase medial to base of outer lobe about 1.5 times as long as wide (Fig. 1H) ..... ***U. amamiana*** **Kato & Kolcsár, sp. nov.**

– Male flagellum oval on basal 2–3 segments, with pubescence on basal 2–3 segments ventrally (Fig. 4B); medial lobe of interbase medial to base of outer lobe more than twice as long as wide (Fig. 4H) ..... ***U. polytricha*** **Alexander, 1930**

Ulomorpha amamiana **Kato & Kolcsár, sp. nov.**

http://zoobank.org/7CB700D7-FBCE-43C9-817D-D91229A29886

Figs 1, 5A

Material examined. ***Holotype*** ♂, pinned. Original label: "JAPAN, Nansei Islands, Amami I., Yamato-son, Yuwangama; alt. 250 m; 28°21.07'N, 129°25.31'E; 31 Mar. 2019; D. Kato leg." "HOLOTYPE *Ulomorpha amamiana* Kato & Kolcsár, sp. nov. [red label]" (BLKU).

Paratypes. Japan: [Nansei Islands] Amami I.: • 2♂, 1♀; same data as holotype • 1♀; Setouchi-chô, Shinokawa, Yakugachi-gawa River; alt. 130 m; 28°13.25'N, 129°18.88'E; 3 Apr. 2019; D. Kato leg. (BLKU). Tokunoshima I.: • 2♂, 1♀; Amagi-chô, Tôbe, Mt Minada-yama; alt. 300 m; 27°47.72'N, 128°56.22'E; 2 Apr. 2019; D. Kato leg. (BLKU) • 2♂; Tokunoshima-chô, Mt Inokawa-dake to Mt Hage-dake; 27°45.89'N, 128°59.5'E; 30 Sep. 2013; D. Kato leg. (BLKU) • 2♂, 2♀; Tokunoshima-chô, Todoroki, near Mt Sasontsuji-dake; alt. 200 m; 27°50.36'N, 128°56.45'E; 2 Apr. 2019; D. Kato leg. (BLKU).

Diagnosis. Body blackish. Vertex and scutum sparsely pruinose. Flagellomeres oval to bacilliform on basal 4 segments; ventral sides with pubescences on basal 6–7 segments. Wing brownish tinged, unpatterned; stigma sometimes indistinctly darker. Halter yellow. Interbase with outer lobe shorter than medial lobe in dorsal view;

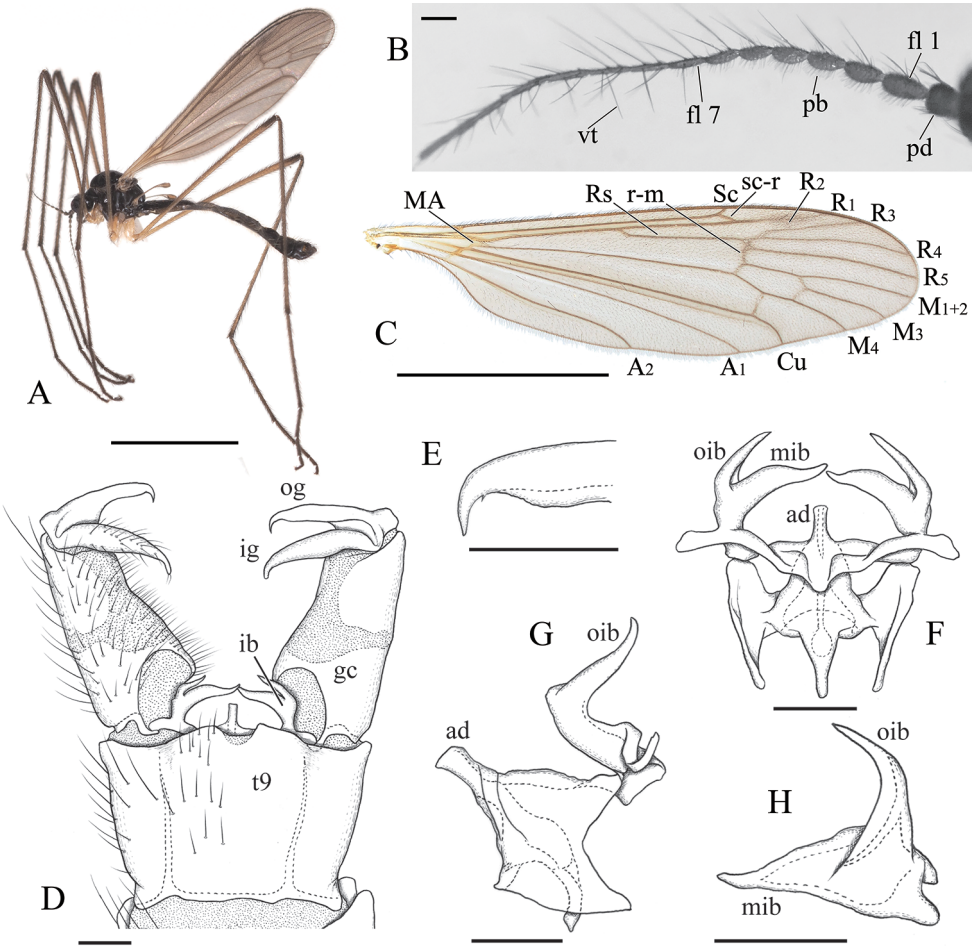

Figure 1. *Ulomorpha amamiana* Kato & Kolcsár, sp. nov. **A** habitus, male **B** basal part of antenna, lateral view **C** wing **D** male terminalia, dorsal view **E** tip of outer gonostylus, dorsal view **F** aedeagal complex, dorsal view **G** aedeagal complex, lateral view **H** interbase, posterodorsal view. Abbreviations: ad – aedeagus; fl – flagellomere; ib – interbase; ig – inner gonostylus; gc – gonocoxite; mib – medial lobe of interbase; og – outer gonostylus; oib – outer lobe of interbase; pb – pubescence; pd – pedicel; t9 – tergite 9; vt – verticil. Scale bars: 3 mm (**A, C**); 0.1 mm (**B, D, E–H**).

medial lobe medial to base of outer lobe about 1.5 times as long as wide. Aedeagus with rod-shaped distal part, twice as long as wide and almost straight.

Description. Male. Body length 5.6–8.0 mm, wing length 5.8–7.9 mm.

Head: subnitidous black, sparsely dusted with gray pruinosity; vertex with brighter gray pruinosity at anterior end. Rostrum and mouthparts brown to dark brown. Antenna brown to dark brown; scape and pedicel sometimes slightly darker; basal 4 flagellomeres oval to bacilliform; basal 6–7 segments covered with pubescences ventrally (Fig. 1B).

Thorax: subnitidous dark brown to black, sparsely dusted with brownish pruinosity; postpronotum yellowish or brownish. Wing (Fig. 1C) tinged with brown; basal region yellowish; stigma absent or indistinctly darker; veins dark brown, yellowish on basal part of wing; barely dark seam sometimes present on fork of Rs to crossvein r-m. Halter yellow. Legs mainly yellow to dusky yellow; fore coxa sometimes weakly dark on basal part; femora narrowly dark at tips; dark area on fore femur sometimes weak and occupying distal half; tibiae narrowly dark at tips; tarsi weakly dark from tip of tarsomere 1 to apical segment.

Abdomen: subnitidous dark brown to black, sparsely covered with brownish pruinosity.

Male terminalia (Fig. 1D–H): caudal margin of tergite 9 roundly produced at middle, with small U-shaped notch at center. Outer gonostylus in dorsal view (Fig. 1E) with tip narrowed and curved anteriorly; concaved margin with indistinct teeth. Interbase with outer lobe shorter than medial lobe in dorsal view (Fig. 1F); outer lobe wide at base, inner basal end situated near middle of medial lobe (Fig. 1H); medial lobe strongly narrowed distally, distal part medial to base of outer lobe about 1.5 times as long as wide (Fig. 1H); aedeagus with rod-shaped distal part, twice as long as wide andalmost straight (Fig. 1F, G).

Female. Body length 7.0–9.2 mm, wing length 5.8–8.0 mm.

Generally resembling male. Antenna with flagellum oval only on segment 1, only basal 2 flagellomeres less distinctly covered with pubescences.

Ovipositor: dark brown; yellow on cercus hypogynial valve, and distal 1/3 of tergite 10; cercus 2.0–2.5 times as long as tergite 10.

Etymology. The name of this species is derived from that of the type locality, Amami Island. The name is deemed to be a latinized adjective in nominative singular.

Distribution. Japan (Nansei Islands: Amami Islands (Amami and Tokunoshima Island)) (Fig. 5A).

Biogeographic notes. The crane fly fauna of the Nansei Islands or Ryukyu Arc is poorly known, and the new species and new distribution records are recently reported (Kato 2020; Kolcsár et al. 2020, in press). The Amami Islands are in the northeastern part of the Oriental faunal realm. The hypothetical boundary between the Palearctic and Oriental (Indomalaya) realms, the Watase line or Tokara gap, is delimited between Yakushima/Tanegashima and Amami islands (Komaki and Igawa 2017). The Ryukyu Islands arc once formed a continental margin arc which connected to the eastern margin of the Asian continent and served as an important land bridge (Osozawa et al. 2012). The presence of *Ulomorpha* in the Amami Islands is not surprising, as the group occurs in Yakushima Island. However, *U. amamiana* Kato & Kolcsár, sp. nov. is the first representative of the genus in the Oriental faunal realm. Future phylogenetic analyses may help understanding of the biogeography of the group in the area.

Remarks. This species is similar to *U. polytricha* Alexander, 1930. See the key to the Japanese species above for differentiation and diagnostic characters.

***Ulomorpha longipenis* Kato & Kolcsár, sp. nov.**
http://zoobank.org/E2EA56ED-B89A-43B8-B668-03E0E4E9FDAC
Figs 2, 5B

Material examined. ***Holotype*** ♂, pinned. Original label: "JAPAN, Hokkaido, Sapporo-shi, Minami-ku, Moiwashita, Mt Moiwa-yama; alt. 200 m; 43°0.84'N, 141°20.01'E; 23 Jun. 2014; D. Kato leg." "HOLOTYPE *Ulomorpha longipenis* Kato & Kolcsár, sp. nov. [red label]" (BLKU).

Paratypes. Japan, [Hokkaido] • 3♂; same data as holotype • 1♀; Hidaka-chô, Chisaka, tributary of Saru-gawa River; alt. 739 m; 42°58.39'N, 142°40.79'E; 28 Jul. 2019; L.-P. Kolcsár leg. (CKLP). [Honshu] • 1♀; Aomori, Nishimeya-mura, Kawaratai, Ôkawa Path; alt. 300 m; 40°30.04'N, 140°12.24'E; 30 Jun. 2013; D. Kato leg. (BLKU) • 3♂; Aomori, Towada-shi, Okuse, Tsutanuma Path; alt. 460 m; 40°35.45'N, 140°57.42'E; 1 Jun. 2014; D. Kato leg. (BLKU) • 1♂; same data as previous except 21 Jun. 2014 • 1♂; Niigata, Tôkamachi-shi, Matsunoyama-Amamizukoshi, Mt Amamizu-yama; alt. 920 m; 37°1.46'N, 138°33.77'E; 2 Aug. 2019; D. Kato leg. (BLKU) • 2♂; Aichi, Seto-shi, Iwaya-chô, near Iwayadô Park; alt. 300 m; 35°14.37'N, 137°9.05'E; 4 May 2016; D. Kato leg. (BLKU) • 1♀; Kyoto, Kibune; 35°7.29'N, 135°45.45'E (rough coordinate, altitude unknown); ?.IV.1935; M. Tokunaga leg. (USNM). [Shikoku] • 1♂, 1♀; Ehime, Kumakôgen-chô, Chichinokawa; alt. 580 m; 33°36.29'N, 132°51.35'E; 19 May 2019; L.-P. Kolcsár leg. (CKLP) • 1♂; Ehime, Kumakôgen-chô, Hinoura; alt. 722 m; 33°35.13'N, 132°57.71'E; 19 May 2019; L.-P. Kolcsár leg. (CKLP) • 2♂; Ehime, Kumakôgen-chô, Nishidani, near Prefectural road 328; alt. 1430 m; 33°34'N, 132°56.2'E; 17 Jun. 2019; D. Kato leg. (BLKU) • 1♂; same data as previous except alt. 1387 m; 33°33.89'N, 132°56.1'E; L.-P. Kolcsár leg. (CKLP) • 1♀; same data as previous except alt. 890 m; 33°32.92'N, 132°56.88'E; L.-P. Kolcsár leg. (CKLP) • 2♂; Ehime, Kumakôgen-chô, Wakayama; alt. 930 m; 33°42.95'N, 132°6.5'E; 18 May 2019; L.-P. Kolcsár leg. (CKLP) • 1♂; Ehime, Matsuyama-shi, Jikibamachi; alt. 180 m; 33°51.69'N, 132°49.55'E; 16 May 2019; L.-P. Kolcsár leg. (CKLP) • 1♀; Ehime, Matsuyama-shi, Shukunomachi; alt. 240 m; 33°52.08'N, 132°50.09'E; 3 May 2019; L.-P. Kolcsár leg. (CKLP) • 1♀; Ehime, Matsuyama-shi, Yuyamayanagi; alt. 250 m; 33°53.41'N, 132°50.52'E; 3 May 2019; L.-P. Kolcsár leg. (CKLP) • 1♂, 1♀; Ehime, Saijô-shi, Nishinokawa-Tei, Mt Ishizuchi-san; alt. 1530 m; 33°45.29'N, 133°9.19'E; 16 Jun. 2019; D. Kato leg. (BLKU) • 1♂, 2♀; same data as previous except alt. 1480 m; 33°45.3'N, 133°9.23'E; 16 May 2019; L.-P. Kolcsár leg. (CKLP). [Kyushu] • 2♂, 2♀; Fukuoka, Fukuoka-shi, Jônan-ku, Katae, Mt Abura-yama; alt. 230 m; 33°31.83'N, 130°21.96'E; 19 Apr. 2014; D. Kato leg. (BLKU) • 1♂, 2♀; Fukuoka, Fukuoka-shi, Sawara-ku, Itaya, Mt Sefuri-san; alt. 970 m; 33°26.29'N, 130°22'E; 4 Jun. 2015; D. Kato leg. (BLKU) • 2♀; same data as previous except 10 Jun. 2015 • 2♀; same data as previous except 17 Jun. 2015 • 1♂; Fukuoka, Miyako-machi, Saigawa-Hobashira, Notôge Pass; alt. 740 m; 33°29.74'N, 130°57.69'E; 12 May 2019; D. Kato leg. (BLKU) • 2♀; Fukuoka, Miyawaka-shi, Inunaki, Mt Inunaki-san; alt.

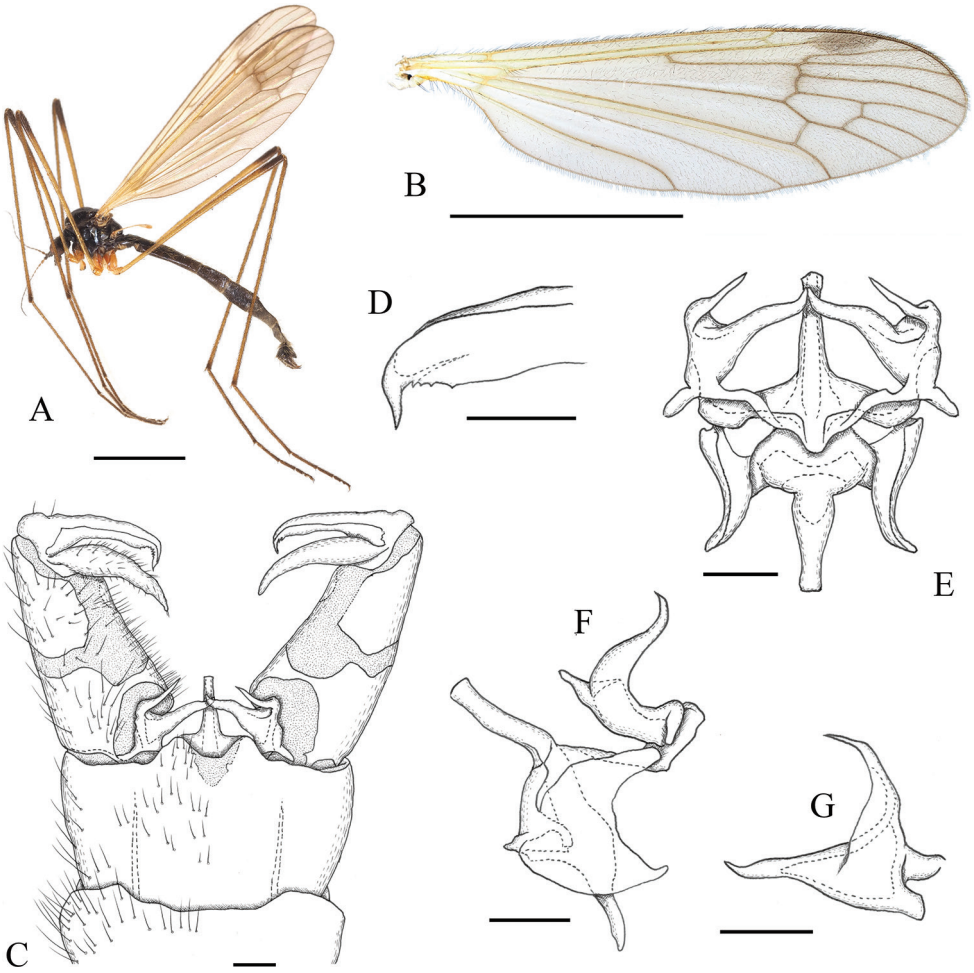

Figure 2. *Ulomorpha longipenis* Kato & Kolcsár, sp. nov. **A** habitus, male **B** wing **C** male terminalia, dorsal view **D** tip of outer gonostylus, dorsal view **E** aedeagal complex, dorsal view **F** aedeagal complex, lateral view **G** interbase, posterodorsal view. Scale bars: 3 mm (**A, B**); 0.1 mm (**C–G**).

300 m; 33°40.87'N, 130°33.19'E; 5 May 2015; D. Kato leg. (BLKU) • 1♀; Saga, Kanzaki-shi, Sefuri-machi-Fukumaki; alt. 980 m; 33°26.04'N, 130°22.12'E; 23 May 2019; L.-P. Kolcsár leg. (CKLP) • 1♂; Saga, Saga-shi, Fuji-machi-Sekiya, Kase-gawa River near Hokuzan Dam; alt. 320 m; 33°25.99'N, 130°13.93'E; 23 May 2015; D. Kato leg. (BLKU) • 2♂; Miyazaki, Takachiho-chô, Gokasho, Mt Sobo-san, near Kitadani trailhead; alt. 1150 m; 32°49.36'N, 131°19.64'E; 22 May 2019; D. Kato leg. (BLKU).

Diagnosis. Body blackish. Vertex sparsely pruinose, sometimes partly polished. Flagellomeres with basal 2–3 segments oval ventral sides with pubescences. Scutum sparsely pruinose or polished. Wing brownish tinged, with oval, dark-brown stigma and weakly dark seam on anterior part of cord. Halter yellowish. Interbase with outer

lobe shorter than medial lobe in dorsal view; medial lobe medial to base of outer lobe about 2.3 times as long as wide. Aedeagus with rod-shaped distal part, 3.3–4.4 times as long as wide and almost straight.

Description. Male. Body length 7.2–11.0 mm, wing length 7.1–11.9 mm.

Head: subnitidous black, sparsely dusted with gray pruinosity; vertex with brighter gray pruinosity at anterior end; anterior part of vertex sometimes largely shiny except anterior end or with shiny and small, longitudinally long bacilliform area at middle posterior to anterior brighter area. Rostrum and mouthparts dark brown. Antenna with scape and pedicel dark brown; flagellum dusky yellow to brown; basal 2–3 flagellomeres oval, covered with pubescences ventrally.

Thorax: subnitidous black, sparsely dusted with brownish pruinosity, sometimes polished and pruinosity absent on prescutum and most of scutal lobe; postpronotum yellowish or brownish. Wing (Fig. 2B) tinged with brown; basal and costal regions proximal to cord yellowish; stigma oval, dark brown, with faint outline; veins dark brown, yellowish on Sc and basal part of wing; weakly dark seam on fork of Rs to crossvein r-m. Halter yellow to dusky yellow. Legs mainly yellow to dusky yellow; fore coxa dark on basal half, sometimes entirely so, mid and hind coxae sometimes narrowly dark at bases; femora narrowly dark at tips; dark area on fore femur often extending to near middle; tibiae narrowly dark at tips; tarsi weakly dark from tip of tarsomere 1 to apical segment.

Abdomen: subnitidous dark brown to black, sparsely covered with brownish pruinosity.

Male terminalia (Fig. 2C–G): caudal margin of tergite 9 roundly produced at middle, with shallow U-shaped notch at center. Outer gonostylus in dorsal view (Fig. 2D) with tip narrowed and curved anteriorly, concaved margin with distinct teeth. Interbase with outer lobe shorter than medial lobe in dorsal view (Fig. 2E); outer lobe wide at base, inner basal end situated near middle of medial lobe (Fig. 2G); medial lobe strongly narrowed distally, weakly sinuous, distal part medial to base of outer lobe about 2.3 times as long as wide (Fig. 2G). Aedeagus with rod-shaped distal part, 3.3–4.4 times as long as wide and almost straight (Fig. 2E, F), usually shorter in specimens from southern part of Japan.

Female. Body length 7.0–11.7 mm, wing length 6.2–10.2 mm. Generally resembling male.

Ovipositor: dark brown; yellow on cercus, hypogynial valve, and distal 1/4–1/3 of tergite 10; cercus 1.5 times as long as tergite 10.

Etymology. The specific epithet is from the Latin *longus/longi* (long) + *penis* (penis) and refers to the long aedeagus of this species compared to the other Japanese species of the genus. The name is an adjective in nominative singular.

Distribution. Japan (Hokkaido, Honshu, Shikoku, and Kyushu islands) (Fig. 5B).

Remarks. This species is similar to *U. polytricha* Alexander, 1930 but is differentiated from it by the following characters: wing with stigma distinctly dark, fork of Rs to crossvein r-m weakly darkened (Fig. 2B) (stigma indistinct in *U. polytricha*; Fig. 4C); aedeagus with rod-shaped part more than three times as long as wide (Fig. 2F) (twice as long as wide in in *U. polytricha*; Fig. 4G). This species also resembles a Nearctic species, *U. nigronitida* Alexander, 1920, according to the original description (Alexander

1920b), but is distinguished from it by the following characters: antenna pale on flagellum, yellow to brown (black throughout in *U. nigronitida*); coxae with distal parts yellowish (coxae brownish black, hind pair paler in *U. nigronitida*); halter entirely yellowish (knob dark brownish black in *U. nigronitida*).

Ulomorpha nigricolor Alexander, 1924

Figs 3, 5A

Ulomorpha nigricolor Alexander 1924: 75 (type locality: Japan, Honshu I., Gunma or Fukushima, Lake Oze-numa); Alexander 1953a: 82; Alexander 1953b: 68; Nakamura 2014: 20; Oosterbroek 2020.

Material examined. ***Holotype*** ♂. Japan, Honshu, Lake Ozenuma, on boundary between Iwashiro-no-kuni and Kotsuke-no-kuni (between Fukuoka and Gunma); altitude 5460 feet; 36°55.62'N, 139°18.23'E (rough coordinate); 26 Jul. 1923; T. Esaki leg. (USNM).

Non-types. Japan: [Honshu] • 1♀; Aomori, Nishimeya-mura; alt. 275 m; 40°31.39'N, 140°13.93'E; 23. Jun. 2012; D. Kato leg. (BLKU) • 1♂; same data as previous except 24. Jun. 2012 • 2♂, 1♀; Aomori, Nishimeya-mura, Kawaratai, Shirakami Nature Observation Garden; alt. 225 m; 40°31.13'N, 140°12.89'E; 21 Jun. 2013; D. Kato leg. (BLKU) • 1♂; Aomori, Nakadomari-machi, Ôsawanai, Ôsawanai Pond; alt. 35 m; 40°56.78'N, 140°27.74'E; 15 May 2014; D. Kato leg. (BLKU) • 1♂; same data as previous except 24 May 2014 • 1♂; Aomori, Towada-shi, Okuse, Tsutanuma Path; alt. 470 m; 40°35.45'N, 140°57.42'E; 23 May 2014; D. Kato leg. (BLKU) • 1♀; Iwate, Hachimantai-shi, near Tôshichi Spa; alt. 1340 m; 39°56.55'N, 140°52.08'E; 28 Aug. 2014; D. Kato leg. (BLKU) • 1♂; Niigata, Echigo, Iwafune, Mt Zao; 38°4.64'N, 139°28.57'E (rough coordinate, altitude unknown); 3 May 1955; K. Baba leg. (USNM) • 1♀; Gifu, Mino, Sakauchi; 35°36.41'N, 136°22.96'E (rough coordinate, altitude unknown); 9 Jun. 1957; Mishima leg. (USNM) • 5♂, 4♀; Okayama, Maniwa-shi, Hiruzen-Shimotokuyama; alt. 780 m; 35°19.76'N, 133°35.84'E; 17 May 2015; D. Kato leg. (BLKU) • 2♂, 2♀; Okayama, Maniwa-shi, Hiruzen-Kamifukuda, Nawashirodani-gawa River; alt. 600 m; 35°19.19'N, 133°36.49'E; 29 Apr. 2016; D. Kato leg. (BLKU) • 1♂; Hiroshima, Akiôta-chô, Yokogô; alt. 890 m; 34°35.65'N, 132°8.7'E; 18 May 2015; D. Kato leg. (BLKU). [Shikoku] • 1♂; Ehime, Kumakôgen-chô, Nishidani, near Prefectural road 328; alt. 1430 m; 33°34'N, 132°56.2'E; 17 Jun. 2019; D. Kato leg. (BLKU) • 2♂, 2♀; same data as previous except alt. 1387 m; 33°33.89'N, 132°56.1'E; L.-P. Kolcsár leg. (CKLP) • 4♂; Ehime, Saijô-shi, Nishinokawa-Tei, Mt Ishizuchi-san; alt. 1530 m; 33°45.29'N, 133°9.19'E; 16 Jun. 2019; D. Kato leg. (BLKU) • 2♂; same data as previous except alt. 1480 m; 33°45.3'N, 133°9.23'E; 16 May 2019; L.-P. Kolcsár leg. (CKLP) • 1♂, same data as previous except 16 Jun. 2019. [Kyushu] • 3♂; Miyazaki, Takachiho-chô, Gokasho, Mt Sobo-san,

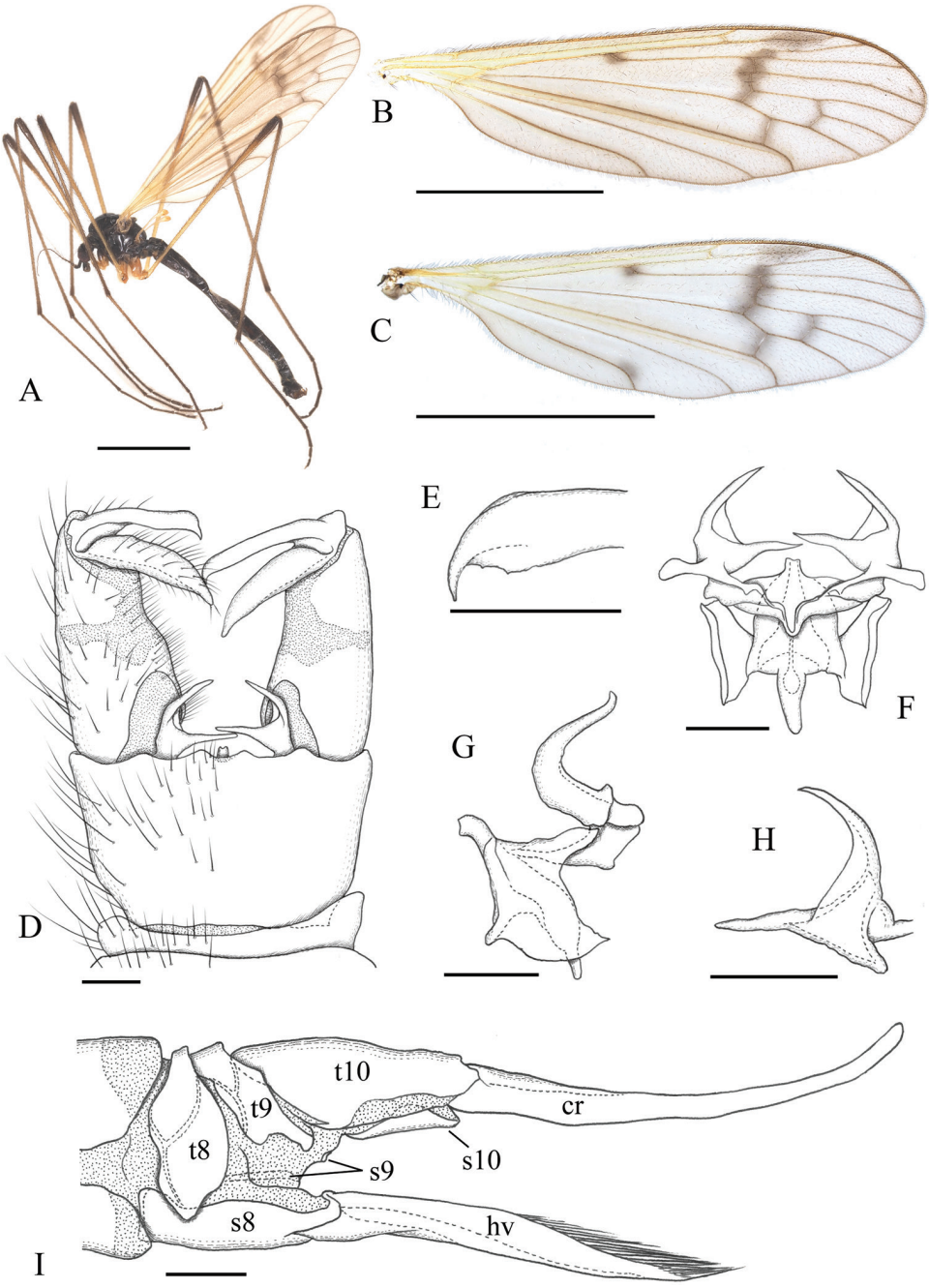

Figure 3. *Ulomorpha nigricolor* Alexander, 1924. **A** habitus, male **B, C** wing **D** male genitalia, dorsal view **E** tip of outer gonostylus, dorsal surface **F** aedeagal complex, dorsal view **G** aedeagal complex, lateral view **H** interbase, posterodorsal view **I** female ovipositor, lateral view. Abbreviations: cr – cercus; hv – hypogynial valve; s – sternite; t – tergite. Scale bars: 3 mm (**A–C**); 0.1 mm (**D–H**); 0.3 mm (**I**).

near Kitadani trailhead; alt. 1150 m; 32°49.36'N, 131°19.64'E; 22 May 2019; D. Kato leg. (BLKU) • 5♂, 1♀; same data as previous except alt. 1182 m; 32°49.36'N, 131°19.64'E; L.-P. Kolcsár leg. (CKLP).

Diagnosis. Body blackish. Vertex sparsely pruinose, anterior part largely polished. Flagellomeres oval on basal 2–4 segments; ventral sides with pubescences on basal 2–6 segments. Prescutum polished, with narrow longitudinal line of pruinosity at middle. Wing brownish tinged, with oval, dark-brown stigma and dark spot or seam each on Rs origin, anterior part of cord, crossvein m-cu, and outer end of cell d; dark spot at tip of A_2 sometimes present. Halter yellowish. Interbase with outer lobe as long as medial lobe in dorsal view; medial lobe medial to base of outer lobe about 3.5 times as long as wide. Aedeagus with rod-shaped distal part, twice as long as wide and weakly curved ventrally.

Description. Male. Body length 5.5–10.1 mm, wing length 5.3–10.0 mm.

Head: subnitidous black, sparsely dusted with gray pruinosity; vertex with brighter gray pruinosity at anterior end; anterior part of vertex largely shiny except anterior end. Rostrum and mouthparts dark brown. Antenna with scape and pedicel dark brown; flagellum dusky yellow to dark brown; basal 2–4 flagellomeres oval; basal 2–6 segments covered with pubescences ventrally.

Thorax: subnitidous black, sparsely dusted with brownish pruinosity; polished and pruinosity absent on prescutum and most of scutal lobe; postpronotum sometimes yellowish; prescutum with narrow longitudinal line of pruinosity at middle in whole length, sometimes anterior part of this line indistinct. Wing (Fig. 3B, C) tinged with brown; basal and costal regions proximal to cord yellowish; stigma oval, dark brown, faint in outline; veins dark brown, yellowish on Sc and basal part of wing; dark, wide seam on fork of Rs to crossvein r-m; narrow, dark seam on each of crossvein m-cu and outer end of cell d, but one on latter sometimes indistinct; dark small spot at Rs origin and sometimes with additional one at tip of A_2 (Fig. 3C), this anal spot usually present in specimens from southern part of Japan. Halter yellow to pale yellow. Legs mainly yellow to dusky yellow; fore coxa dark on basal 1/2, sometimes entirely so; mid and hind coxae yellow to dark brown, sometimes dark at bases in case of yellowish coxae; femora narrowly dark at tips, dark area on fore femur sometimes occupying distal 1/3; tibiae narrowly dark at tips; tarsi weakly dark from tip of tarsomere 1 to apical segment.

Abdomen: subnitidous dark brown to black, sparsely covered with brownish pruinosity.

Male terminalia (Fig. 3D–H): caudal margin of tergite 9 almost straight or weakly convex at middle, with shallow U-shaped notch at center. Outer gonostylus in dorsal view (Fig. 3E) relatively wide on distal part, tip narrowed and curved anteriorly, concaved margin with indistinct teeth. Interbase with outer lobe as long as medial lobe in dorsal view (Fig. 3F); outer lobe wide at base, inner basal end situated near middle of medial lobe (Fig. 3H); medial lobe strongly narrowed and rod-shaped on distal half, distal part medial to base of outer lobe about 3.5 times as long as wide (Fig. 3H); Aedeagus with rod-shaped distal part, twice as long as wide and tip weakly curved ventrally (Fig. 3G).

Female. Body length 6.3–9.6 mm, wing length 5.4–8.2 mm. Generally resembling male.

Ovipositor (Fig. 3I): dark brown; yellow on cercus, hypogynial valve, and distal 1/4–1/3 of tergite 10; cercus 2–2.5 times as long as tergite 10.

Distribution. Japan (Hokkaido, Honshu, Shikoku, and Kyushu islands) (Fig. 5A) and North Korea.

Remarks. This species is easily distinguished from the other species of the genus by the following combination of characters: thorax and abdomen excluding legs dark brown to black; wing with distinct dark areas each at origin of Rs, on fork of Rs to crossvein r-m, and outer end of cell d (Fig. 3B, C).

Ulomorpha polytricha Alexander, 1930

Figs 4, 5A

Ulomorpha polytricha Alexander 1930a: 72 (type locality: Japan, Nansei Islands, Yaku-shima I., Kosugidani); Alexander 1930b: 508; Nakamura 2014: 20; Oosterbroek 2020.

Material examined. ***Holotype***. ♂, Japan, Nansei Islands, Yaku-shima I., Kosugidani; altitude 2,500 feet; 30°20.84'N, 130°35.25'E (rough coordinate); 29 Apr. 1929; S. Issiki leg. (USNM).

Non-types. Japan: [Nansei Islands] Yakushima I.: • 17♂, 1♀; near Shirataniunsuikyô Valley; alt. 600 m; 30°23.04'N, 130°34.37'E; 25 Apr. 2019; D. Kato leg. (BLKU) • 1♂; same data as previous except 27 Apr. 2019 • 1♂; unnamed stream near Kigensugi; alt. 1270 m; 30°18.1'N, 130°32.56'E; 25 Apr. 2019; D. Kato leg. (BLKU) • 2♂, 1♀; unnamed stream near Mt Mae-dake; alt. 625 m; 30°18.91'N, 130°36.61'E; 25 Apr. 2019; D. Kato leg. (BLKU).

Diagnosis. Body blackish. Vertex sparsely pruinose. Basal 2–3 flagellomeres oval, with pubescence ventrally. Prescutum sparsely pruinose. Wing brownish tinged, unpatterned except indistinctly darker stigma. Halter yellow. Interbase with outer lobe shorter than medial lobe in dorsal view, medial lobe medial to base of outer lobe more than twice as long as wide. Aedeagus with rod-shaped distal part, about 2.2 times as long as wide and almost straight.

Description. Male. Body length 5.7–8.0 mm, wing length 6.0–8.1 mm.

Head: subnitidous black, sparsely dusted with gray pruinosity; vertex with brighter gray pruinosity at anterior end. Rostrum and mouthparts dark brown. Antenna brown; scape and pedicel sometimes slightly darker; basal 2–3 flagellomeres oval, ventrally with pubescence (Fig. 4B).

Thorax: subnitidous dark brown to black, sparsely dusted with brownish pruinosity; postpronotum yellowish or brownish. Wing (Fig. 4C) tinged with brown;, basal region yellowish; stigma indistinctly darker; veins dark brown, yellowish on basal part of wing; barely dark seam sometimes present on fork of Rs to crossvein r-m. Halter yellow. Legs mainly yellow to dusky yellow; fore coxa dark on basal half; femora narrowly dark at tips of mid and hind pairs; fore femur dark on distal 2/3; tibiae narrowly dark at tips; tarsi weakly dark from tip of tarsomere 1 to apical segment.

Abdomen: subnitidous dark brown to black, sparsely covered with brownish pruinosity.

Male terminalia (Fig. 4D–H): caudal margin of tergite 9 roundly produced at middle, with shallow U-shaped notch at center. Outer gonostylus in dorsal view

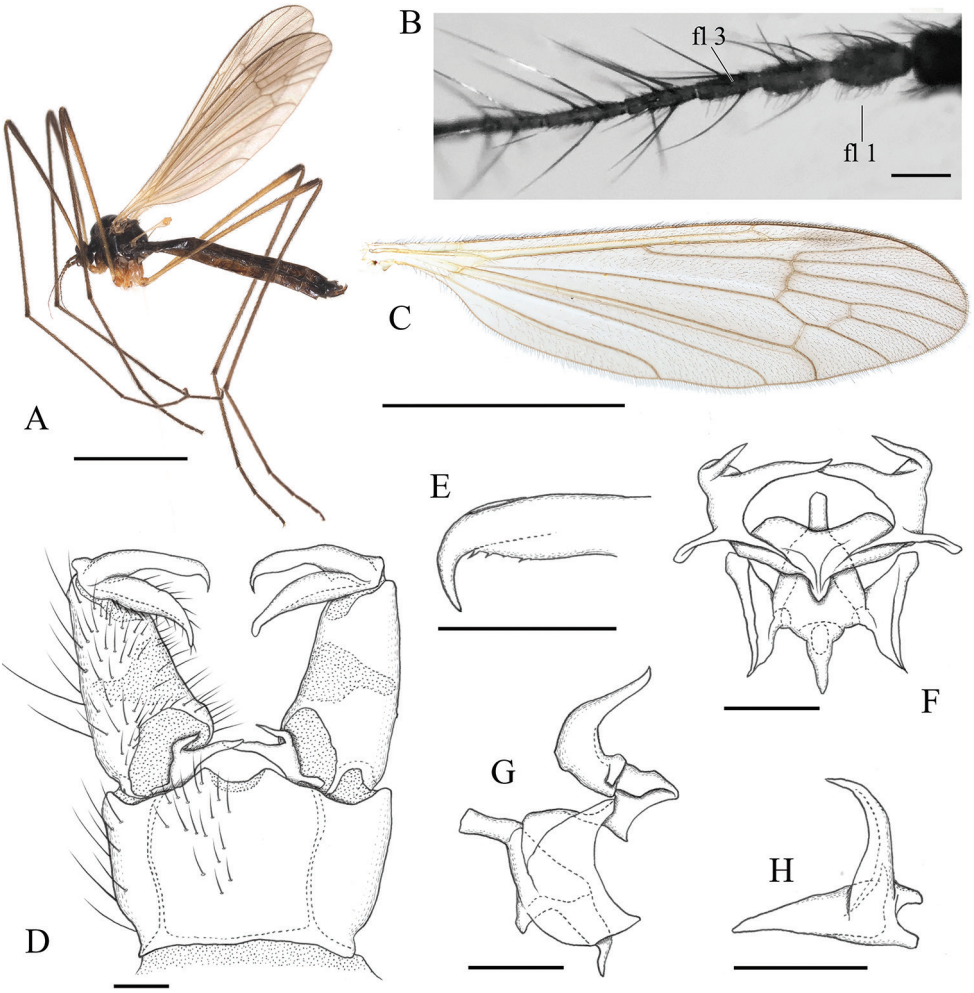

Figure 4. *Ulomorpha polytricha* Alexander, 1930. **A** habitus, male **B** basal part of antenna, lateral view **C** wing **D** male genitalia, dorsal view **E** tip of outer gonostylus, dorsal surface **F** aedeagal complex, dorsal view **G** aedeagal complex, lateral view **H** interbase, posterodorsal view. Scale bars: 3 mm (**A, C**); 0.1 mm (**B, D–H**).

with tip narrowed and strongly curved anteriorly, concaved margin with small teeth (Fig. 4E). Interbase with outer lobe shorter than medial lobe in dorsal view (Fig. 4F); outer lobe weakly wide at base, inner basal end at basal 1/3 of medial lobe (Fig. 4H); medial lobe gradually narrowed distally, distal part medial to base of outer lobe more than twice as long as wide (Fig. 4H). Aedeagus with rod-shaped distal part, about 2.2 times as long as wide and almost straight (Fig. 4G).

Female. Body length 7.2–7.6 mm, wing length 6.7–7.1 mm. Generally resembling male.

Ovipositor: dark brown; yellow on cercus, hypogynial valve, and distal 1/4 of tergite 10; cercus twice as long as tergite 10.

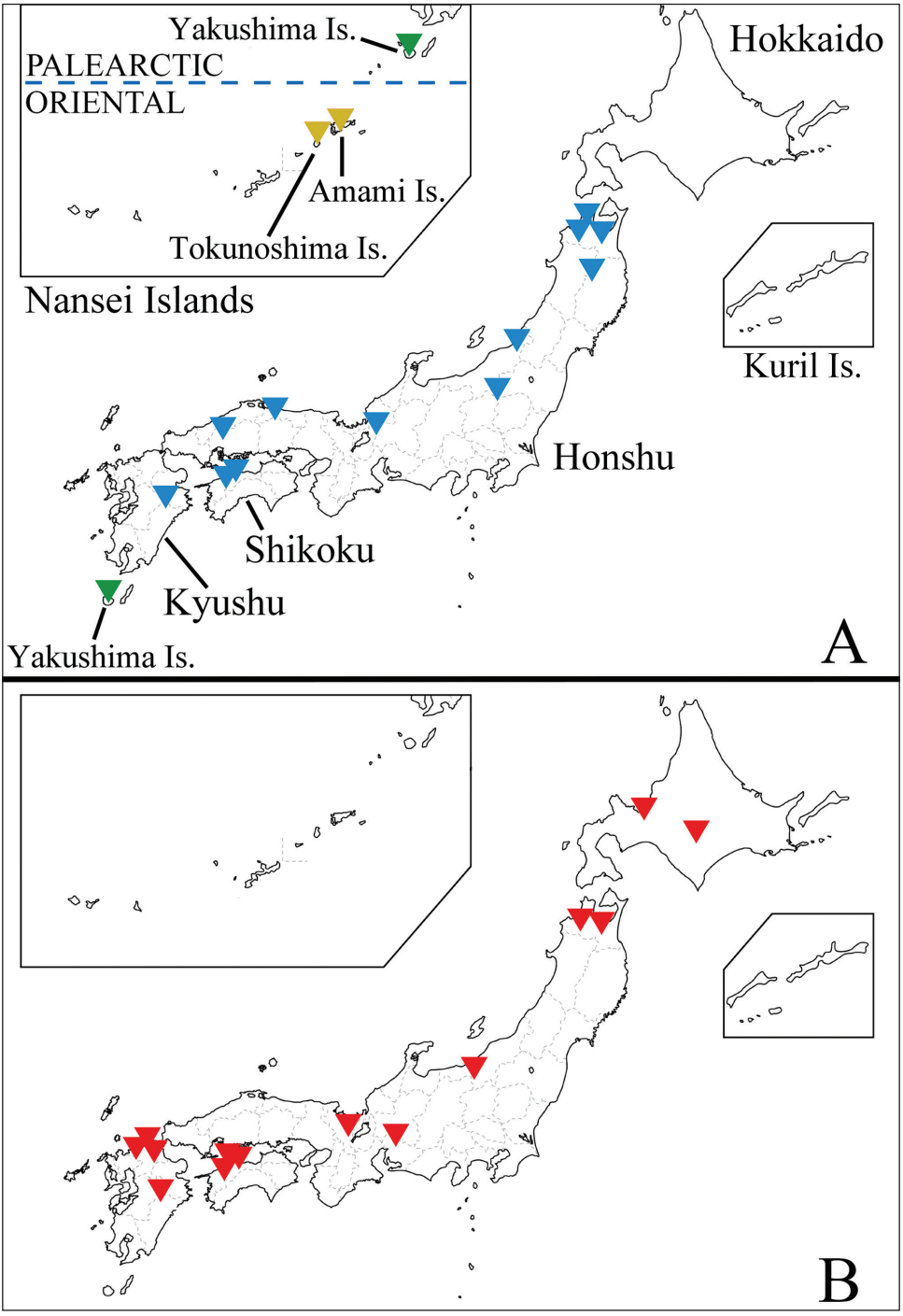

Figure 5. Distribution map of Japanese species of *Ulomorpha*. **A** *U. amamiana* Kato & Kolcsár, sp. nov. (orange), *U. nigricolor* Alexander, 1924 (blue), *U. polytricha* Alexander, 1930 (green) **B** *U. longipenis* Kato & Kolcsár, sp. nov. (red).

Distribution. Japan (Nansei Islands: Yakushima Island) (Fig. 5A).

Remarks. This species is similar to *U. amamiana* sp. nov. See the key to the Japanese species above for differentiation and diagnostic characters.

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RESEARCH ARTICLE

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Neotype designation for *Thymallus aeliani* Valenciennes, 1848 from a museum topotype specimen and its affiliation with Adriatic grayling on the basis of mitochondrial DNA

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Abstract

In 1848, the grayling *Thymallus aeliani* (Valenciennes) was described from Lake Maggiore, Italy, in the north Adriatic basin. Genetic analyses of the mitochondrial control region showed a unique evolutionary history of grayling inhabiting the rivers of northern Adriatic basin, from the upper reaches of the Po River and its left tributaries in the west to the Soča River in the east, which resulted in the designation of this phylogenetic lineage as Adriatic grayling. Consequently, the name *T. aeliani* was connected to the Adriatic lineage, re-establishing the validity of this taxon. However, the mitochondrial haplotypes belonging to Adriatic grayling were never compared with the type specimens of *T. aeliani*, as their whereabouts were unknown. In this study, a neotype for *T. aeliani* was designated using topotypical specimens stored at the Natural History Museum in Vienna. The neotype (NMW 68027:2 labelled as "Lago Maggiore, Bellotti, 1880") was designated pursuant to the conditions stipulated in Article 75.3 of the International Code of Zoological Nomenclature. Furthermore, the mitochondrial control region of the neotype was compared

to haplotypes of the Adriatic lineage and showed high genetic similarity, which therefore connects the species name *T. aeliani* to the Adriatic grayling. This crucial step in fixing nomenclatural status of this species is very important for its protection and management.

Keywords
Adriatic basin, control region, morphology, museum DNA, neotypification, taxonomy

Introduction

The distribution of variation and disruption of the gene flow are multidimensional and continuous in nature; thus, specialists agree that delineating species can only be arbitrary (Galtier 2018). However, several research fields, such as ecology and macroevolution, and the general public need species as a simplified representation of natural variation. Ideally, biodiversity protection legislation would principally aim to protect management units (MU) or evolutionary significant units (ESU). Nevertheless, the European legislation focuses on endangered species, thereby making the species the basic unit of biodiversity protection. Specimens used to formally describe a species, called type specimens, are indispensable for determining the species affiliation of all subsequently analysed individuals. The absence of a type specimen can potentially be a significant source of nomenclatural instability. Accurate taxonomy is important for the identification of species and the evaluation of their conservation status, and without accurate identification, it is impossible to list those taxa whose existence is at risk and to set appropriate measures for their protection and management (Kottelat 1997).

An example of an endangered entity without a name-bearing type is Adriatic grayling, which represents endemic populations in the Adriatic basin, from the upper reaches of the Po River and its left tributaries in the west to the Soča (Isonzo) River in the east (Sušnik et al. 2001). Its clear distinctiveness from European grayling, *Thymallus thymallus* (Linnaeus, 1758), was recognised based on the mitochondrial (mt) control region (CR), revealing the Adriatic (AD) lineage that supposedly split from remaining European lineages about four million years ago (Sušnik et al. 2001; Meraner and Gandolfi 2012; Marić et al. 2012). Morphological studies of Adriatic populations from the mid-20th century indicated differences between grayling from the Soča River (Adriatic Basin in Slovenia) and Sava River (Black Sea Basin) (Janković 1960, 1964), and distinguished Adriatic grayling from European grayling in the Danube, Ural, and Volga drainages (Bajić et al. 2018). However, especially in the study by Bajić et al. (2018), Adriatic grayling examined were introgressed with European grayling genome of domestic origin, and as such these comparisons should be considered with caution. Over the last 50 years, grayling from various European lineages has been and, in some parts, is still stocked into the natural range of the Adriatic grayling, resulting in introgressive hybridisation with native individuals (Sušnik et al. 1999, 2001; Meraner and Gandolfi 2012; Meraner et al. 2014). Introductions were also detected in the Ticino and Maggia rivers, the main inlets to Lake Maggiore, where Danubian mt haplotypes were detected (Sušnik et al. 2001).

In 1848, *Thymallus aeliani* (Valenciennes) was described on the basis of external morphology of grayling from Lake Maggiore (Po River drainage, Adriatic Basin) (Cuvier and Valenciennes 1848: 447–448). Later, this name appeared in the Catalogue of Fishes in the British Museum (Günther 1866: 201), though it was not included in Freshwater Fishes of the Austrian Monarchy (Heckel and Kner 1858), Siebold's Freshwater Fishes of Middle Europe (Siebold 1863), and other important contemporary publications (e.g., Fatio 1882; Berg 1911). The name *T. aeliani* is also absent from subsequent reviews of the Italian fish fauna (e.g., Griffini 1903; Gridelli 1936; Tortonese 1970). The name reappeared in 1997 as a synonym of *T. thymallus* (Kottelat 1997) but was absent from the Handbook of European Freshwater Fishes (Kottelat and Freyhof 2007). The species *T. aeliani* was re-established by Bianco (2014), who considered the genetic distinctness, described by Sušnik et al. (2001), Meraner and Gandolfi (2012), and Marić et al. (2012) as sufficient to support species validity and connect the Adriatic lineage with the name *T. aeliani*. The species name was used as such, again without novel data, in two subsequent publications (Dyldin et al. 2017; Persat et al. 2019) and in the most recent checklist of Italian fish fauna (Lorenzoni et al. 2019). In their study to barcode (mt COI) circum-Mediterranean species, Geiger et al. (2014) deemed *T. aeliani* as a potential candidate species or a recovered synonym (appendix S1 in Geiger et al. 2014). In secondary sources, such as FishBase (Froese and Pauly 2010), *T. aeliani* is still listed as a synonym of *T. thymallus*. In the IUCN regional listing for Italy, Lista Rossa IUCN dei Vertebrati Italiani (Rondinini et al. 2013), Adriatic grayling is listed in the category of Endangered as *T. thymallus* pop. aut. The name *T. aeliani* has only recently been included on the IUCN Red List (Duchi et al. 2020), with deficient information indicating lack of knowledge of this species (e.g., species range).

At present, the whereabouts of the type specimens of *T. aeliani* are unknown, though they should presumably be deposited at National History Museum in Paris (see Discussion for more details). As such, it is not possible to objectively associate the species name referring to the type specimens from Lake Maggiore with the Adriatic grayling in its modern concept. Thus, neotypification of the Adriatic mt lineage provides the only solution if the name *T. aeliani* is to be tied indisputably to the Adriatic grayling. Owing to genetic mixing between native and introduced graylings mentioned above, extant populations are not proper candidates for the *T. aeliani* neotype selection, while no grayling translocations were recorded or discerned in the 19th century (Povž 1995; Bianco and Ketmaier 2001; Povž and Šumer 2005). Therefore, museum collections from this period can offer suitable material to designate grayling neotype using specimens originating from the type locality (e.g. Splendiani et al. 2017). The ichthyology collection of the Natural History Museum in Vienna (NMW) houses grayling specimens from Lake Maggiore deposited in the museum in 1880 and 1881. We consider these specimens, originating prior to the translocations, as appropriate candidates for the neotype for *T. aeliani*.

The aim of this study was to designate a neotype for *T. aeliani* on the basis of 1) morphological comparison of the museum topotype specimens with the original description by Valenciennes (Cuvier and Valenciennes 1848: 447–448), and 2) sequenced CR of topotype specimens in comparison with the Adriatic mt lineage.

Material and methods

Material

To clarify the identity of *T. aeliani*, four white-eyed, museum topotype specimens registered under catalogue numbers NMW 68027:1–2, NMW 68090:1–2 were analysed and compared to the first description of the species, and then to the results of subsequent studies of the Adriatic grayling within the proposed species range. All four museum specimens are from the same time (1880–1881) and space (Lake Maggiore, type locality); the different naming is due to the inconsistent use of the name *T. aeliani*.

Morphology

Measurements and counts (44 and 9, respectively) were taken of the topotype specimens of grayling deposited in the NMW ichthyology collection. Preserved specimens were examined under a stereomicroscope and photographs taken using a digital camera. Measurements were taken point-to-point using IP54 digital callipers with 0.1 mm precision. Relative measurements are presented as percentage of fork length (Lsm) or head length (HL). Morphological characters were compared to those listed in the original description of *T. aeliani* (Cuvier and Valenciennes 1848) and those applied in a morphological study of the Adriatic population from the Soča River (Adriatic Basin in Slovenia) (Janković 1960). According to the known history of stocking in Slovenia (Povž 1995; Povž and Šumer 2005), it can be speculated that the latter study was done on non-introgressed grayling.

Molecular genetics

To link the species name *T. aeliani* to the Adriatic mt lineage of grayling (Adriatic grayling), we extracted DNA from the museum topotype specimens. Extra care was considered to avoid cross-contamination between specimens. Tissue for DNA extraction was taken from the right lateral fin, using sterilised and UV-irradiated utensils. Laboratory work was performed in a DNA clean room. For DNA extraction, QIAamp DNA Blood Mini Kit (Qiagen) was used, following the manufacturer's protocol. All extractions included extraction controls to ensure there was no contamination of the buffers. DNA concentrations were quantified using a Qubit4 fluorometer (ThermoFisher Scientific, USA) and integrity checked on 1% agarose gel electrophoresis.

The complete mt CR was amplified using seven primer pairs (Table 2), designed based on the alignment of sequences found in European grayling to amplify overlapping fragments with lengths between 231–340 bp. The primers were designed using Primer3 (Untergasser et al. 2012).

All reactions were amplified using AmpliTaq Gold DNA polymerase (Applied Biosystems, USA) in 25 µl reactions according to manufacturer protocol with the use of an enhancer 360 GC, supplied by the manufacturer. Amplification was performed on a Veriti Thermal Cycler (Applied Biosystems, USA) using a simple two-step protocol with 10 min initial denaturation at 95 °C, 5 cycles of 30 sec denaturation at 95 °C,

Table 1. Museum specimens used in this study.

Catalogue number	Designated name	Year of collection	Locality	Preservative
NMW 68027:1	*T. vexillifer*	1880	Lake Maggiore	Ethanol
NMW 68027:2	*T. vexillifer*	1880	Lake Maggiore	Ethanol
NMW 68090:1	*T. aeliani*	1881	Lake Maggiore	Ethanol
NMW 68090:2	*T. aeliani*	1881	Lake Maggiore	Ethanol

Table 2. Primers designed and used to sequence the complete mt CR of museum specimens. F: forward strand, R: reverse strand.

Fragment	Publication name	5–3′	F/R	Length (bp)
A	LRBT-25	AGAGCGCCGGTGTTGTAATC	F	267
	Thy_mus_A_rev	TGTGCTGATGTATGAGGGGT	R	
B	Thy_mus_B_for	CCTCTGACGCGCCTATGTTA	F	335
	Thy_mus_B_rev	TCGTTGGTCGGTTCTTACTACA	R	
C	Thy_mus_C_for	ACCCCTCATACATCAGCACA	F	338
	Thy_mus_C_rev	AGGTTAACCGCATCAACCAGA	R	
D	Thy_mus_D_for	AAGAACCGACCAACGATTTA	F	301
	Thy_mus_D_rev	TTCAAAGTTTAGTTCGACCTTATTAGT	R	
E	Thy_mus_E_for	CATGCATCTGGTTGATGCGG	F	340
	Thy_mus_E_rev	CGCGTAGAAGCCGGGGGA	R	
F	Thy_mus_F_for	AGAACTAATAAGGTCGAACTAAACT	F	231
	Thy_mus_F_rev	AGCGCTAATCGAGACTTCCTG	R	
G	Thy_mus_G_for	GAnTCCCCCGGCTTCTAC	F	306
	LRBT-1195	GCTAGCGGGACTTTCTAGGGTC	R	

30 sec annealing stage at 55 °C, and 30 sec elongation stage at 72 °C, followed by 40 cycles at 52 °C annealing temperature and final elongation stage of 7 min. Amplicons were checked for size on 1% agarose gel electrophoresis, purified with a Qiagen PCR purification kit and sequenced in both directions by LGC genomics (Berlin, Germany) using PCR primers. Sequences were checked visually and merged into a single sequence using BIOEDIT software (Hall et al. 2011) to construct the composed haplotypes of complete CR, which were subsequently compared to the NCBI database using BLAST.

Phylogenetic analysis

The phylogenetic tree was constructed using Bayesian inference (BI) in BEAST 2.5.2 (Drummond et al. 2012). The obtained sequences were aligned with those from previous studies (GenBank accession numbers AF522395–AF522415, AF522418–AF522419, AF522425–AF522452; JX099337–JX099344, JX099346; JN796420–JN796435, JX144730–JX144732, KF280207–KF280208; Koskinen et al. 2002; Marić et al. 2012, 2014; Meraner and Gandolfi 2012) defining all known mt grayling lineages in Europe. Sequences of accession numbers AF522453 (*Thymallus arcticus*), AF522454 (*T. grubii*), and AF522455 (*T. brevirostris*) were used as an outgroup. The nucleotide substitution model was selected using hierarchical likelihood ratio tests implemented in MODELTEST 2.1.7 (Darriba et al. 2012). Three independent runs (50,000,000 steps) were performed and combined with LOGCOMBINER after 10% of each run was discharged as a burn-in phase.

Figure 1. Photo (**a**) and radiograph (**b**) of the neotype *Thymallus aeliani* (NMW 68027:2) with fork length of 267.7 mm.

Results

Morphology

Measurements and counts are presented in Table 3. Low standard deviation (SD) values were observed in measurements when all museum specimens were treated as a single population, except for depth of the posterior part of the dorsal fin and head depth at the nape. Counts had the highest SD for the number of pyloric caeca and number of lateral line scales. The specimen NMW 68027:2 (Fig. 1), which matched with the original description of *T. aeliani* by Valenciennes and offered the best preservation of available specimens, was selected as the neotype. A comparative description of the neotype is provided in Tables 3, 4.

Molecular genetics and phylogeny

DNA concentrations of isolates ranged from 25.8–29.4 ng/µl. Amplification and sequencing were successful in all four samples for each of the seven fragments. Length of overlapping fragments resulted in 1088 bp combined alignment of complete mt CR for each sample. No discrepancy in sequence between overlapping parts of fragments in any of the sample was observed, thus excluding possible contamination. A single haplotype was identified in all four specimens, and this sequence was deposited in the NCBI GenBank as *Thymallus aeliani* under accession number MT762347.

Alignment included CR sequences of grayling and the outgroup from GenBank and resulted in a total length of 1093 bp. Comparison of the sequence of topotype specimens to those in the NCBI database revealed that all four specimens carry the haplotype previously observed in grayling from the Adige and Adda Rivers and designated

Table 3. Measurements and counts of four historical NMW samples of *Thymallus* from Lake Maggiore, including the neotype of *Thymallus aeliani* – NMW 68027:2 in bold.

NMW number	68027:1	**68027:2**	68090:1	68090:2	Mean; SD
MEASURMENTS					
Lsm, mm (fork length)	282.6	267.7	289.9	282.3	280.6; 9.3
% Lsm					
body length to base of caudal fin	93.6	93.3	94.9	94.7	94.1; 0.8
trunk length	75.9	75.9	78.7	77.6	77; 1.4
preanal distance	68.6	69.5	70.5	70.6	69.8; 0.9
predorsal distance	33.1	36	33.1	34.2	34.1; 1.4
prepelvic distance	45.5	43.7	46.6	46.5	45.6; 1.4
distance between pectoral and pelvic fins	27.4	26.5	30	30.1	28.5; 1.8
distance between pelvic and anal fins	23.8	26.5	25.8	25.3	25.4; 1.1
length of pectoral fin	14	14.7	13.4	14.3	14.1; 0.6
length of pelvic fin	16	16	14	14.6	15.2; 1
length of base of dorsal fin	23	19.3	19.9	19.3	20.4; 1.8
depth of anterior part of dorsal fin	13	13.2	12.5	12.1	12.7; 0.5
depth of posterior part of dorsal fin	13.7	10.3	9.6	10.4	11; 1.8
length of base of anal fin	10.1	8.6	9.3	8.9	9.2; 0.7
depth of anal fin	12.2	12.3	11.8	12	12.1; 0.2
distance between anal fin and base of caudal fin	16.8	17.3	17	17.4	17.1; 0.3
distance between adipose fin and base of caudal fin	16.1	17.1	17.9	17.3	17.1; 0.8
length of caudal peduncle (as projection)	16.2	17.6	16.8	17.5	17; 0.7
body depth	20.6	22.2	24.3	21.2	22.1; 1.6
depth of caudal peduncle (minimum body depth)	7.1	7.6	7.3	7.8	7.5; 0.3
length of upper lobe of caudal fin	15.6	n/a	16	13	14.9; 1.6
length of lower lobe of caudal fin	n/a	18.1	n/a	15.7	16.9; 1.7
length of middle rays of caudal fin	5.7	6.8	5.7	6.4	6.2; 0.5
HL (head length)	18.8	18.9	18.7	19.3	18.9; 0.3
% HL					
snout length	5.8	5.4	5.8	5.9	5.7; 0.2
postorbital distance	5.8	5.4	5.8	5.9	5.7; 0.2
long diameter of eye	9.3	9.2	9.5	10.3	9.6; 0.5
length of maxillary	4.7	4.8	4.3	4.4	4.6; 0.2
depth of maxillary	6.7	6.2	6.2	6.8	6.5; 0.3
length of lower jaw	6.7	6.2	6.2	6.8	6.5; 0.3
interorbital width	1.9	2	2	2.3	2.1; 0.2
head depth at nape	8.1	8	8.2	8.9	8.3; 0.4
head depth through eye	5.3	5.3	5.6	5.8	5.5; 0.2
% HL					
snout length	30.9	28.7	30.8	30.4	30.2; 1
postorbital distance	49.3	48.9	50.6	53.3	50.5; 2
long diameter of eye	25	25.5	22.8	22.9	24.1; 1.4
length of maxillary	35.4	33.1	33.3	35.2	34.3; 1.2
depth of maxillary	10.2	10.5	10.9	11.9	10.9; 0.7
length of lower jaw	43.1	42.2	43.8	45.8	43.7; 1.5
interorbital width	28.4	28.3	29.7	29.9	29.1; 0.8
head depth at nape	69.5	68.7	73.1	74.2	71.4; 2.7
head depth through eye	51	50.3	49.5	50.4	50.3; 0.6
depth of posterior part of dorsal fin (% dorsal-fin base length)	59.8	53.4	48.2	53.9	53.8; 4.7
depth of maxillary (% length of maxillary)	28.7	31.7	32.6	33.9	31.7; 2.2
COUNTS					
total lateral-line scales	83	83	78	79	80.7; 2.6
total dorsal-fin rays	23.5	22.5	21.5	22.5	22.5; 0.8
branched pectoral-fin rays	13	14	13	13	13.3; 0.5
branched pelvic-fin rays	10	10	10	10	10; 0
total anal-fin rays	14.5	15.5	14.5	14.5	14.8; 0.5
gill rakers	22	23	n/a	21	22; 1
branchiostegal rays	8	8	8	8	8; 0
total vertebrae	59	58	59	57	58.3; 1
pyloric caeca	18	23	n/a	n/a	20.5; 3.5

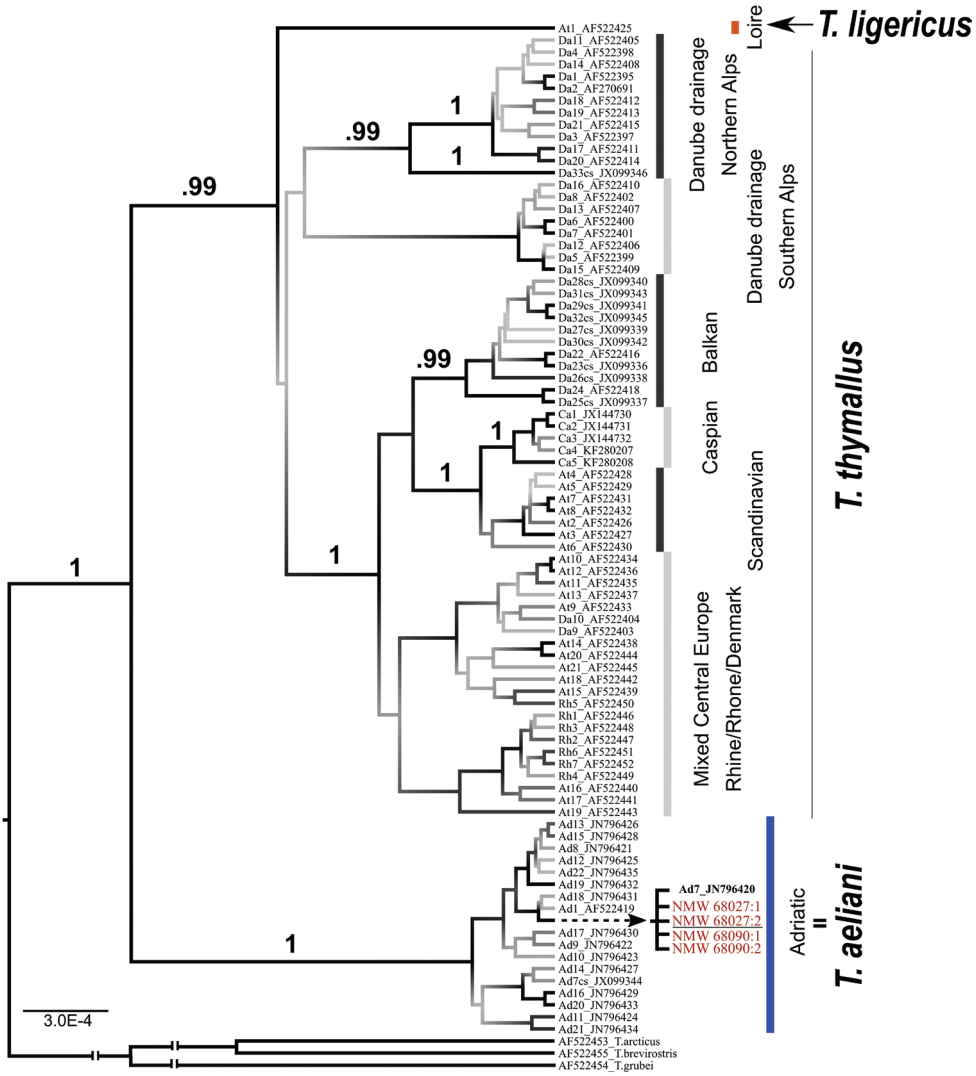

Figure 2. Phylogenetic tree with different evolutionary lineages of grayling found in Europe. Museum specimen haplotypes are shown in red, and the proposed neotype specimen is underlined. Posterior probabilities are shown above branches.

as Ad7 (GenBank acc. no. JN796420; Meraner and Gandolfi 2012). Furthermore, at least 98.5% identity to the haplotypes of the other Adriatic lineage was confirmed.

A phylogenetic Bayesian inference tree (Fig. 2), based on the complete CR sequences and constructed using the HKY+I +G nucleotide substitution model (Hasegawa et al. 1985), revealed that topotype specimens clustered together with other haplotypes endemic to the Adriatic basin with high support (posterior probability (pp) = 1). The Adriatic clade formed a sister clade to the monophyletic group of haplotypes found throughout Europe (*T. thymallus* + *T. ligericus*) comprising multiple previously described phylogenetic lineages.

Table 4. Characters distinguishing *Thymallus aeliani* and *Thymallus thymallus* (historic literature data compared to the neotype characteristics).

Character	Cuvier and Valenciennes (1848)		Janković (1960)		Sabbadini (2000)		Neotype of *T. aeliani* NMW 68027:2
Name in publication	*T. aeliani*	*T. vexillifer* (= *T. thymallus*)	*T. thymallus*, Soča River	*T. thymallus*, Danube tributaries	*T. thymallus*, Italy	*T. thymallus*, Danube	
Dorsal fin size	Short and shallow	Long and deep					
Depth of posterior part of dorsal fin (% dorsal-fin base length)			mean 43.0	means 50.7–56.3			53.4
Depth of posterior part of dorsal fin (% fork length)			5–14 [mean 9.4]	5–18 [means 11.0–12.2]			10.3
Head depth at nape (% head length)			62–82 [mean 71.7]	60–94 [means 73.1–76.4]			68.7
Number of branchiostegal rays	8	10					8
Number of gill rakers			20–25 [mode 21; mean 21.4]	(20, 21)22–29 [modes 24 and 25; means 24.7–25.3]			23
Number of simple rays in dorsal fin			7–10 [mean 8.1]	6–9 [means 7.0–7.3]			8
Total number of dorsal-fin rays			21–25 [mean 22.8]	20–24 [means 21.1–22.4]			22 [if two last rays counted as one ray]
Total number of vertebrae			57–61 [mode 59; mean 59.0]	55–62 [mode 59; means 59.0–59.4]			58
Number of pyloric caeca			18–38 [mean 26.6]	12–33 [means 18.0–20.3			23
Total number of lateral-line scales	84	87	78–92, most commonly 87–89 [mode 88; mean 86.8]	81–99, most commonly 88–92 [modes 88, 90 and 92; means 88.3–89.5]			83
Colour of caudal fin					Dark blue-grey	Reddish yellow to hot orange or red	
Black spot on each side of throat (under-part of mouth)					Absent	Present	Absent
Large magenta or claret blotch of irregular shape above and behind pelvic fin on both sides of body					Absent	Present	

Discussion

Our findings regarding the fate of the syntypes for *T. aeliani* leading up to the neotypification for the Adriatic grayling are summarised below. The designation of the neotype, its morphological description and genetic identity of the neotype and the Adriatic mt lineage of grayling are discussed.

Neotype designation

The main obstacle for the clear and indisputable clarification of the taxonomic position of *T. aeliani* was the inability to compare the Adriatic grayling with type specimens of the species. The syntypes of *T. aeliani* (in Cuvier and Valenciennes 1848) included three specimens of about equal length (ca 30 cm) collected by M. Savigny (Marie Jules César Lelorgne de Savigny) in Lake Maggiore (Cuvier and Valenciennes 1848: 447) likely prior to 1824 (Savigny ceased his professional activities by this year due to health issues; http://www.archives.seine-et-marne.fr/marie-jules-cesar-lelorgne-de-savigny-1777-1851). His specimens were deposited at the National Museum of Natural History (NMNH) in Paris, but to the extent of our knowledge, no other information was ever published about their existence, and according to the NMNH curators, these syntypes cannot be found in the museum and are considered lost (Dr Patrice Pruvost pers. comm, e-mail to AP of 04.09.2019). Since no type name-bearing specimens for *T. aeliani* are extant and the clarification of the taxonomic status of the Adriatic grayling is crucial for its conservation, we used museum topotype material from NMW in Vienna to designate the neotype.

Accordingly, a female specimen NMW 68027:2 (Lsm 267.7 mm, SL 252.5 mm) labelled "*T. vexillifer*, Lago Maggiore, Bellotti, 1880" is herein designated as the neotype under the conditions stipulated in Article 75.3 of the International Code of Zoological Nomenclature (ICZN) (International Commission on Zoological Nomenclature 1999). We failed to find an NMW accession book for this period, though the label text likely refers to an act of donation (or exchange) from Cristoforo Bellotti, honorary curator (*conservatore onorario*) at the Museo Civico di Storia Naturale in Milan at that time. Therefore, the actual date of collection is likely prior to 1880.

The morphology of the neotype fits the original description by Valenciennes (Cuvier and Valenciennes 1848: 447–448) (Tables 1, 2, Fig. 1). The diagnosis from the original description (Cuvier and Valenciennes 1848: 447–448) was based on the limited number of specimens and most of the listed characters are similar between *T. aeliani* and *T. thymallus*. However, the original description still provides a guideline for distinguishing *T. aeliani* from *T. thymallus* [as *T. vexillifer* in Cuvier and Valenciennes (1848: 438), unknown number of specimens originating from Lake Geneva and "northern Europe"]: short and shallow dorsal fin (vs long and deep), eight branchiostegal rays (vs 10), 84 total lateral-line scales (vs 87). The neotype corresponds to the original description both in number of branchiostegal rays and total lateral-line scales (Table 4). The distinguishing value of these characters was later supported by a detailed morphological study of an allegedly non-introgressed Adriatic grayling population from the Soča River (Janković 1960), although overlap is observed between the Adriatic and Danube populations in almost all characters (Table 4). All measured museum specimens in this study had eight branchiostegal rays, while the number of total lateral-line scales was variable: the specimens bearing catalogue number NMW 68027 had 83 total lateral-line scales, while specimens with catalogue number NMW 68090

had fewer scales (78 and 79). Three characters were considered of primary importance for diagnosing grayling populations in the Adriatic basin (Sabbadini 2000; Bianco 2014): (1) caudal fin colour in adults, which is reddish yellow to orange or red in non-Adriatic and blue in Adriatic populations, (2) a claret or pinkish stain above the pelvic fin, which is absent in the Adriatic populations, and (3) absence of the black spot on the throat in Adriatic grayling. However, the first two characters can only be evaluated in live, adult, spawning individuals, while the degree of colour expression is highly variable depending on habitat, season, sex, and size (Sabbadini 2000). Accordingly, these characters cannot be used to unambiguously identify live, young individuals or preserved collection specimens of any size. Nevertheless, the absence of the black spot on the throat was observed in all four museum specimens.

Genetic characteristics of the neotype

The neotype and three other specimens from the NMW historical fish collection listed in Table 1 were also molecularly defined by sequencing the mt CR. All museum specimens were found to share the same sequence, i.e. the Ad7 haplotype, which was previously confirmed in Adriatic grayling from the Adige and Adda Rivers (Italy), and this differed only up to 1.5% from other Adriatic sequences (Meraner and Gandolfi 2012). There are no data available on the recent frequency of native haplotypes in the Lake Maggiore drainage.

As seen in the phylogenetic tree (Fig. 2), the neotype sequence belongs to the monophyletic cluster that joins all CR sequences of grayling populations endemic to the northern Adriatic basin, and shows clear evolutionary distinctiveness from *T. thymallus* and *T. ligericus* (Persat et al. 2019). The clustering of CR sequences of the neotype and paratypes within the Adriatic mt lineage of grayling, connects the species name *T. aeliani* with Adriatic grayling in its modern concept. Therefore, based on the above, there can be no objection in applying this species name to the native grayling throughout the Adriatic basin.

The neotype designation for *T. aeliani* satisfies the provisions of Article 75.3 of the Code (ICZN) by: 1) clarifying the taxonomic identity of the Adriatic Grayling in its widely accepted modern concept (Article 75.3.1); 2) nominating its control region haplotype (GenBank acc. no. MT762347) as a diagnostic character (Article 75.3.2); 3) providing data and description sufficient to ensure recognition of the specimen designated (Article 75.3.3); 4) giving reasons and references for believing that original type material is lost (Article 75.3.4); 5) selection of the neotype is consistent with the original description of the species and collected not long after the original description and, as such, represent the native grayling that occurred in Lake Maggiore in the 19th century (Article 75.3.5); 6) choosing a neotype from the originally cited type locality, Lake Maggiore (Po catchment, Italy) (Article 75.3.6); and 7) recording that the neotype is the property of a recognized scientific institution, NHM in Vienna (Article 75.3.7).

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