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Additions to the Swedish fauna of Diplazontinae (Hymenoptera: Ichneumonidae) with the descriptions of five new species

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Abstract. Although Sweden is a country with a comparatively well-known fauna, there are still many species that await discovery, especially in the boreal regions. In this study five new species of Diplazontinae, *Homotropus klopfsteinae* sp. nov., *Homotropus hellqvisti* sp. nov., *Homotropus mugerwai* sp. nov., *Homotropus riedeli* sp. nov. and *Woldstedtius aureotibialis* sp. nov., are described. *Sussaba roberti* Klopfstein, 2014 and *Homotropus megaspis* (Thomson, 1890) are reported for the first time from Sweden. Four of the new species are described from boreal areas, which highlights the need to further investigate the river- and seaside areas of the western taiga.

Keywords. Parasitoid, Syrphidae, *Homotropus*, *Sussaba*, *Woldstedtius.*

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Introduction

The subfamily Diplazontinae Viereck, 1918 contains about 355 described species in the world (Yu *et al.* 2016; Broad *et al.* 2018) divided between 22 recent genera. The Holarctic region with its boreal and high alpine areas seems to be especially rich in species (Mankyuan 1995; Klopfstein 2007, 2014b) and Sweden specifically houses more than 80 of the 100 species of Diplazontinae known to occur in the Western Palaearctic (Klopfstein 2014b). All diplazontines, of which the hosts are known, are solitary, koinobiont endoparasitoids of Syrphidae Latreille, 1802 and all but one genus (*Bioblapsis* Förster, 1869) seem to be specialized on hosts feeding on aphids.

Dasch (1964) revised the Nearctic fauna of Diplazontinae whereas the eastern Palaearctic Diplazontinae have been treated by Uchida (1957), Manukyan (1995, 2007) and Klopfstein (2011, 2014a). Klopfstein (2014b) presented a thorough revision of the Western Palaearctic species of Diplazontinae. A large proportion of the material treated in that monograph was collected in Sweden, partly as a consequence of the author being stationed at the National History Museum in Stockholm. Also included in the revision was a vast material of diplazontines collected in various projects, primarily the Swedish Malaise Trap Project (SMTP), which aimed to increase the knowledge of poorly know insect groups. Klopfstein suggested that several taxa most likely still remained undescribed within the study area and expressed hope that the

revision would inspire future research of this intriguing group of parasitoid wasps. Since then, only one new species, *Woldstedtius merkli* Vas, 2016, has been described from the Western Palaearctic (Hungary) (Vas 2016). This study, which relies on the taxonomic foundation provided by the revision of Klopfstein (2014b), presents the descriptions of five new species of *Diplazontinae* from Sweden.

Material and methods

Specimen records presented in this study come from several different sources, including specimens collected by sweep netting, mercury vapour (MV) light traps and Malaise traps. All types of the new species listed in this paper are kept in the NHRS. The new species have been compared to the descriptions of the known species in the Palaearctic and Nearctic and in some cases to the type material of closely related species.

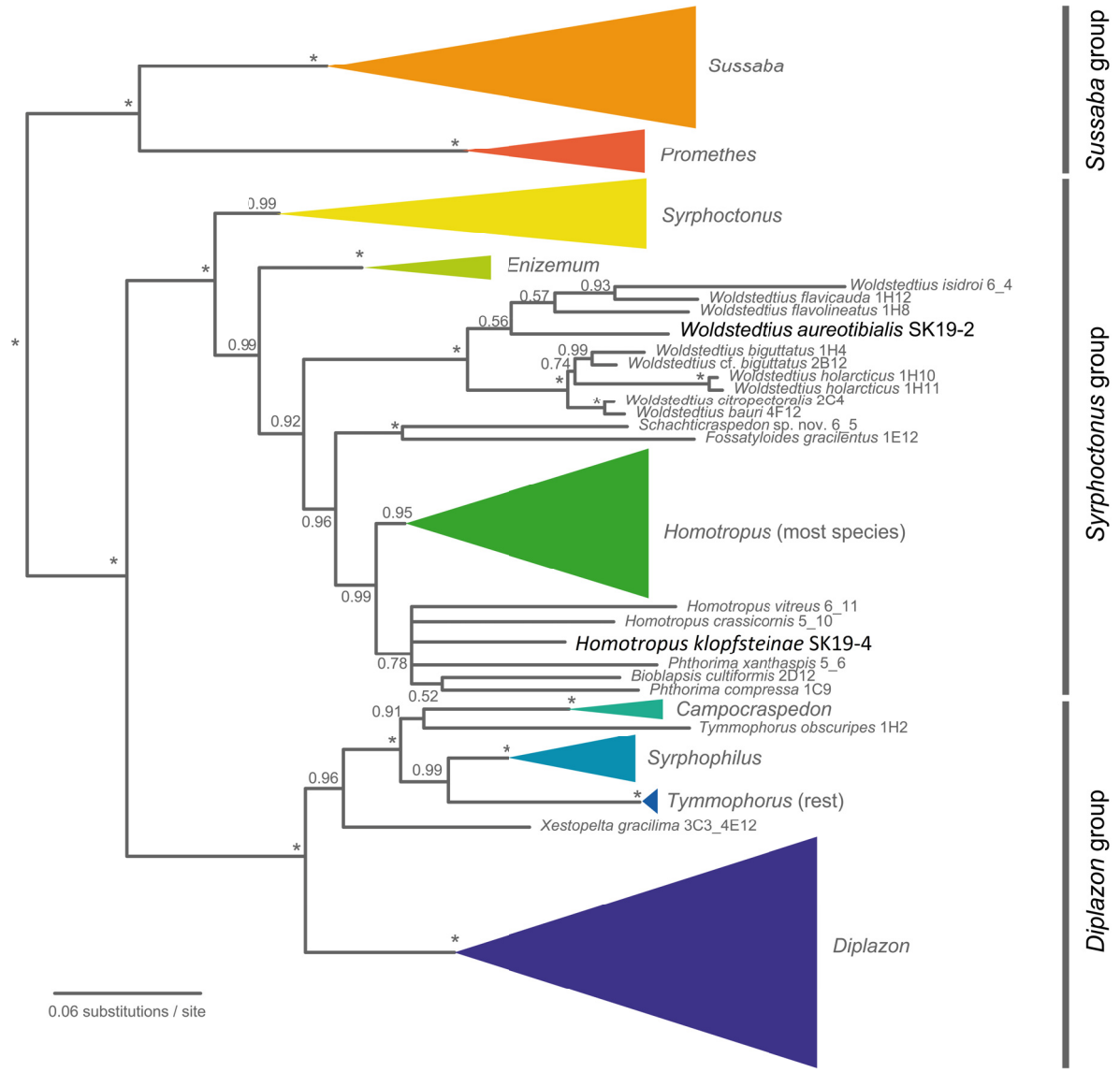

Fig. 1. Bayesian phylogenetic reconstruction based on a four-gene dataset from Klopfstein *et al*. (2011). The two new taxa *Homotropus klopfsteinae* sp. nov. and *Woldstedtius aureotibialis* sp. nov. were included in the dataset by their barcoding region (CO1). Values next to nodes are posterior probabilities, with asterisks representing maximum clade support.

In order to place the new taxa into a phylogenetic context (Fig. 1), sequences from the mitochondrial gene cytochrome oxydase I (COI) were obtained from *Homotropus klopfsteinae* sp. nov. and *Woldstedtius aureotibialis* sp. nov. as follows.

DNA was extracted from a mid or hind leg using the Qiagen DNeasy Blood & Tissue kits according to the manufacturer's instructions, but allowing 16–18 hours for the digestion step. About 700 bp of the the 5′ half of CO1 (barcoding region) were amplified, using primers from Folmer *et al.* (1994) (forward: LCO 5′-GGTCAACAAATCATAAAGATATTGG-3′; reverse: HCO 5′-TAAACTTCAGGGTGACCAAAAAATCA-3′).

The PCR assays were performed in a total volume of 25 µL using FIREPol mastermix (Solis Biodyne) according to the manufacturer's instructions. The relative volumes of the PCR components were 17 µL water, 1 µL of each 10 mM primer, 4.5 µL of the master mix, and 1.5 µL of genomic extract. The PCR protocols used 3 min initial denaturation, followed by 36 cycles of 30 s denaturation, 30 s annealing, at 50°C and 45 s extension, plus 3 min of final extension. PCR success was assessed on a 1.5% Agarose gel using GelRed DNA staining and UV light to detect bands. PCR products were sent to Macrogen Europe for Sanger sequencing, and resulting AB1 files were analysed and assembled in MEGA X ver. 10.0 (Kumar *et al.* 2018). A Bayesian phylogenetic analysis was conducted in MrBayes ver. 3.2 (Ronquist *et al.* 2012), using the four-gene dataset from Klopfstein *et al.* (2011) in order to place the new taxa in the only published phylogenetic framework of the subfamily. Settings were as in the original analysis, with topology convergence (ASDSF < 0.008) reached after 7 Mio generations.

Morphological terminology follows Klopfstein (2014b). Unless stated otherwise, pictures were taken by Krister Hall, Halmstad, using a Canon eos 5dr with a Mitutoyo 5 × Plan Apo Infinity corrected/Mitutoyo 10 × Plan Apo Infinity corrected lens (microscopic pictures) and a Canon mp-e 65 mm f/2.8 1–5 × and stacked using Zerene Stacker.

Abbreviations of depositories

NHRS = Naturhistoriska Riksmuseet, Stockholm, Sweden
NJ = Private collection of Niklas Johansson, Habo, Sweden
USUC = The collection of the Utah State University, Utah, USA
SMTP = The Swedish Malaise Trap Project, Skogsby, Sweden

Results

Descriptions

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Ichneumonoidea Latreille, 1802
Family Ichneumonidae Latreille, 1802
Subfamily Diplazontinae Viereck, 1918

Homotropus hellqvisti sp. nov.
urn:lsid:zoobank.org:act:F3840017-E3FA-4A8A-99EC-15EB8C79310D
Figs 2, 5C

Diagnosis

Homotropus hellqvisti sp. nov. (Fig. 2A–B) is similar to *Homotropus collinus* (Stelfox, 1941) (Fig. 5D, F), but is primarily distinguished based on the irregular microsculpture on the 3–7th tergites (Fig. 2B) and

the shorter and more weakly excised clypeus (Fig. 5C). The new species is also similar to *Homotropus melanogaster* (Holmgren, 1872) (Fig. 5E) from which it differs by the only weakly laterally compressed metasoma (in *H. melanogaster* the metasoma is strongly compressed, knife-like from the 5th tergite onwards), the irregular microsculpture on the 3–7th tergites (Fig. 2B), the absence of a subbasal dark spot on the hind tibia and the usually more numerous flagellomeres. Note that while the females of *H. melanogaster* usually have the mid and hind coxae infuscate, the species sometimes occurs in a colour variety with red hind coxae in Sweden (Klopfstein 2014b: 68–69) (see Remarks). The number of flagellomeres ranges from 17–19 in *H. melanogaster* (n = 20) and 19–20 in *H. hellqvisti* sp. nov. Two of the three known females all have distinct, quite large shoulder marks, while only one of the studied females of *H. melanogaster* (n = 17) has small and diffuse shoulder marks.

Etymology

The specific epithet *hellqvisti* (masculine name in genitive case) is derived from the name of one of the collectors of the specimens who revealed the presence of this new species, Sven Hellqvist (Umeå, Sweden).

Type material

Holotype

SWEDEN • ♀; Västerbotten, Åselet, Hästholmen; 65.233° N, 20.414° E; 25 May–19 Aug. 2019; R. Mugerwa Pettersson and S. Hellqvist leg.; Malaise trap in riverside, herb rich, mixed forest; NHRS-HEVA000011635.

Paratypes

SWEDEN • 2 ♀♀; same collection data as for holotype; NHRS-HEVA000011636, NHRS-HEVA000011637.

Description

Female

Fore wing length 4.2–4.3 mm. Body length 5.5 mm. Head transverse in anterior view. Inner orbits parallel. Face entirely coriaceous and matt. Clypeus with apical margin bilobed and thin, weakly excised

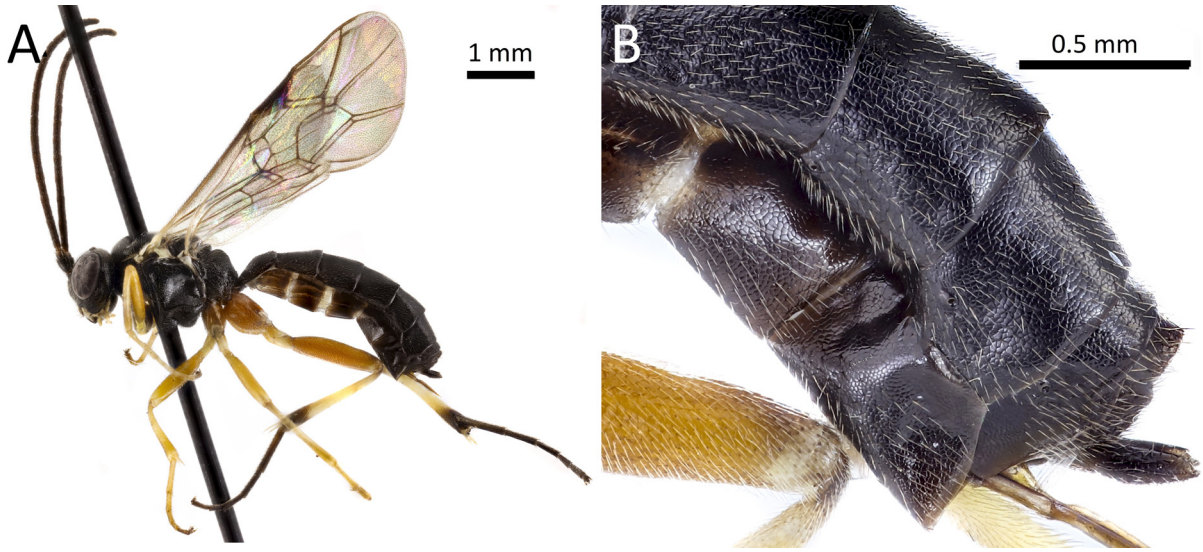

Fig. 2. *Homotropus hellqvisti* sp. nov., paratype, ♀ (NHRS-HEVA000011637). **A**. Habitus, lateral view. **B**. Posterior segments of metasoma.

centrally (Fig. 5C). Antennae with 19–20 flagellomeres. First flagellomere about four times as long as wide. Apical flagellomeres with multiporous plate sensillae also present ventrally. Head behind eyes slightly narrowed. Temple in lateral view about 0.6 times as wide as compound eye. Mesoscutum matt with fine rugulose microsculpture and very weak punctures dissolving against background. Mesopleuron in lower half irregularly rugulose, in upper half polished, below subtegular ridge with irregular punctures. Metapleuron coriaceous. Propodeum evenly coriaceous without carinae. Coxae coriaceous, matt. Fore wing with areolet closed and vein 3rs-m unpigmented (Fig. 2A). Metasoma laterally weakly compressed from the 4th tergite onwards (Fig. 2A), with dense hairs. First tergite stout, slightly longer than wide, evenly coriaceous with a faint indication of longitudinal striae in apical corners. Second tergite evenly coriaceous. Third tergite onwards with fine irregular microsculpture (Fig. 2B). Spiracle of second and third tergite above lateral fold. Ovipositor sheath apically rounded.

Colouration. Body and head black. Mandibles, palpi, occasionally subtegular ridge, hind corner of pronotum and tegulae whitish. Clypeus yellowish. Pale central face patch absent or diffuse. Yellowish shoulder mark small or absent. Scutellum black. Pterostigma transparent brownish. Legs orange, fore coxae white, basally more or less black. Mid and hind coxae orange. Trochanter and trochantelli yellow except for hind trochanter, which is orange. Tibiae whitish. Fore and mid tibia with yellow apices. Hind tibia with apical 0.25 black and base very narrowly infuscate. Hind tarsi black. Mid and fore tarsi whitish, except for brownish apical segment. Metasoma black.

Male

Unknown.

Remarks

Klopfstein (2014b) noted that some females of *Homotropus melanogaster* collected in Sweden had orange hind and mid coxae, thereby differing in colour from the nominate form with black coxae. Since both forms also often occurred together at the same localities, they were treated as varieties of the same species. The actual specimens with the red coxae studied by Klopfstein bear a handwritten label "sp. X". I have studied 5 ♀♀ and 2 ♂♂ of this form of *H. melanogaster* (NHRS, SMTP) and it is not conspecific with the species here described and apart from the paler coxae there are no reliable distinguishing characters between the two forms. In the key to the species of *Homotropus* Förster, 1869 provided by Klopfstein (2014b), *Homotropus hellqvisti* sp. nov. will run to either couplet 6 together with *Homotropus melanogaster* or to couplet 8 with *H. collinus*. For distinguishing characters, see Diagnosis.

Ecology

The three known females were collected by a Malaise trap situated in a herb rich riverside boreal forest dominated by birch *Betula* spp. along the forest river Byskeälven The area (Fig. 12A–B) rests on sandy ground and is periodically flooded. The trap also collected several rarely recorded diplazontines such as *Syrphoctonus idari* Diller, 1985, *Homotropus melanogaster*, *Diplazon neoalpinus* Zwakhals, 1979 and *Syrphophilus asperatus* Dasch, 1964.

Homotropus klopfsteinae sp. nov.

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Figs 3–4

Diagnosis

Homotropus klopfsteinae sp. nov. (Figs 3, 4A–E) is easily distinguished from other diplazontines by the combination of the strongly sculptured first and second tergites, the strongly convex clypeus which is protruding in lateral view, the unique constitution of the propodeal carinae, with four strongly raised

longitudinal carinae and a central arcuate formation, and the unique colour combination with the entire scutellum, part of inner orbits and the basal half of the hind tibia pale yellowish. The known female is also strikingly larger than most species of Diplazontinae known from the Western Palaearctic.

Etymology

The species epithet *klopfsteinae* (feminine name in genitive case) is in honour of Seraina Klopfstein (Bern, Switzerland), for her contribution to the systematics of Diplazontinae wasps.

Type material

Holotype

SWEDEN • ♀; Norrbotten, Haparanda, Seskarö, Santasaari; 65.777° N, 23.846° E; 5 Aug.–6 Sep. 2017; N. Ryrholm and C. Källander leg.; MV-light trap in herb rich coastal meadow on sandy ground; Barcode deposited under GenBank accession number MT268209; NHRS-HEVA000011629.

Fig. 3. *Homotropus klopfsteinae* sp. nov., holotype, ♀ (NHRS-HEVA000011629). Habitus, lateral view.

Description

Female

Fore wing length 7.8 mm. Body length: 9.0 mm. Head transverse in anterior view (Fig. 4A). Inner orbits parallel. Face entirely coriaceous with weak, scarce punctures (Fig. 4A). Central area below antennal sockets distinctly elevated. Clypeus with apical margin weakly bilobed, strongly convex in lateral view. Antenna with 23 flagellomeres. First flagellomere about 4 times as long as wide. Mesopleuron weakly punctate in lower half, punctures ventrally dissolving against strongly coriaceous background. Speculum and area around mesopleural furrow shining, impunctate (Fig. 4E). Epicnemial carina widely interrupted centrally behind fore coxae. Metapleuron in lower part strongly coriaceous, along upper margin more weakly sculptured. Mesoscutum laterally strongly polished with large distinct punctures, interstices between punctures almost equal to their diameter. Mesoscutum centrally with more or less distinct microsculpture between punctures. Scutellum with weak punctures. Propodeum weakly rugose with rather irregular, but distinct arcuate carinae emanating from the metasomal incision (Fig. 4D),

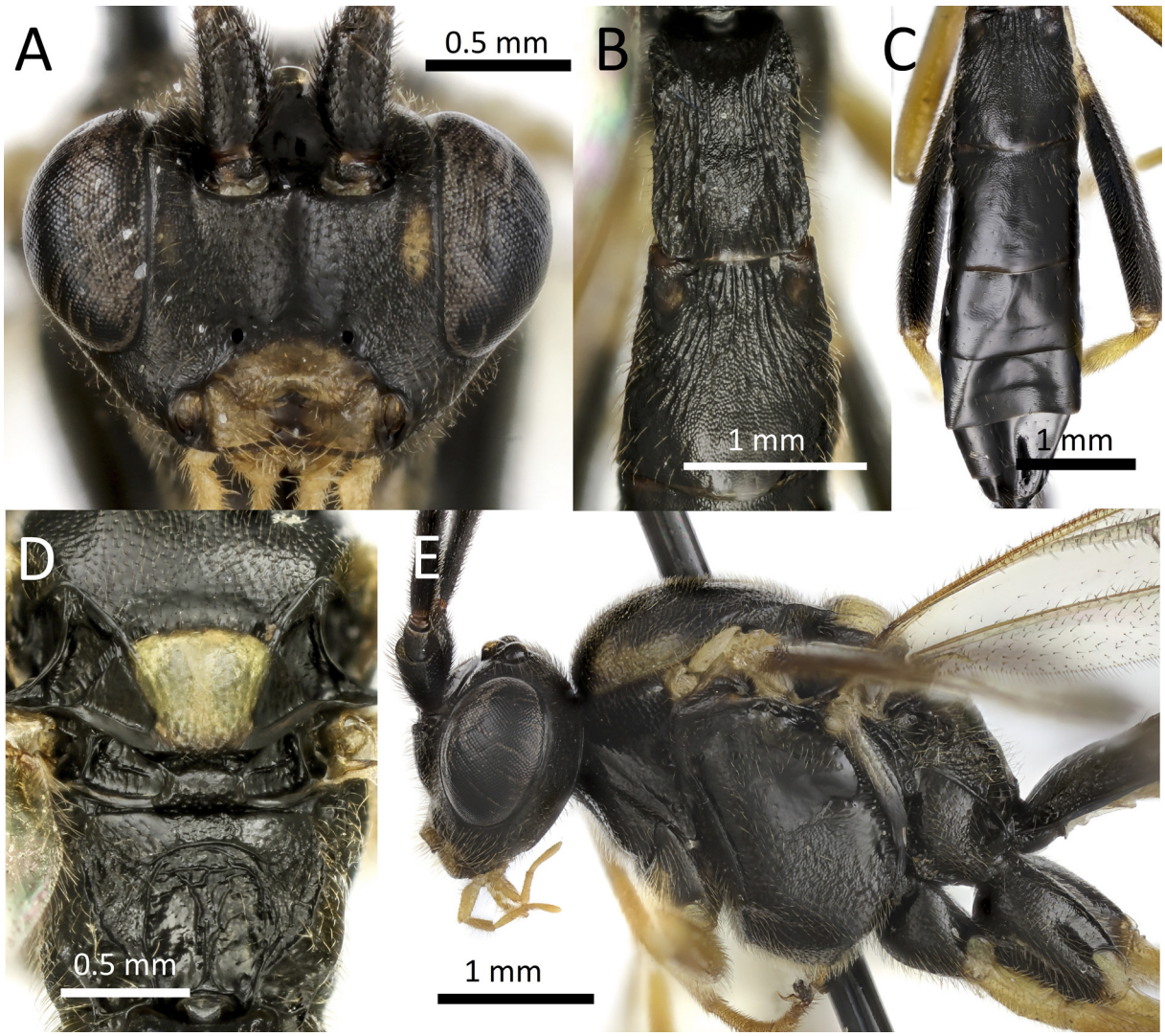

Fig. 4. *Homotropus klopfsteinae* sp. nov., holotype, ♀ (NHRS-HEVA000011629). **A**. Head anterior view. **B**. First and second tergites, dorsal view. **C**. Tergites 2–7, dorsal view. **D**. Scutellum and propodeum, dorsal view. **E**. Head and mesosoma, lateral view.

with two strongly raised, almost flange-like longitudinal carinae laterally on each side. Fore wing with areolet closed and vein 3rs-m pigmented. Metasoma elongate, dorsoventrally depressed. Hind margins of tergites almost straight. First tergite about two times as long as wide in dorsal view, with strong coriaceous sculpture and partly longitudinally striate laterally and basally. Second tergite about 1.3 times as long as wide in dorsal view. Dorsally with strong striation over most of its surface (Fig. 4B). Third tergite polished with weak microsculpture, in basal half coriaceous and matt. Tergites 4–7 polished with weak reticulate-coriaceous microsculpture (Fig. 4C). Spiracle on second and third tergites above lateral fold. Ovipositor sheath apically rounded.

Colouration. Body and head black. Clypeus in ventral 0.8, mandibles and palpi yellow. Face black with two elongate pale spots along inner orbits. Antennae black. Large shoulder mark, tegulae, small mark on subtegular ridge and scutellum yellow. Legs yellow. Fore coxae black basally, yellow in apical half. Mid and hind coxae entirely black. Hind femur black, basally and apically narrowly yellow. Hind tibia yellow with apical 0.4–0.5 black. Hind tarsus black. Metasoma black with posterior margins of tergites 2–4 paler. Ovipositor sheath pale brownish.

Male

Unknown.

Ecology

The only known female was collected by a MV-light trap placed on a herb rich coastal meadow on sand (Fig. 13) between the 5th of August and the 6th of September.

Remarks

According to the phylogenetic analysis (Fig. 1), *Homotropus klopfsteinae* sp. nov. belongs to the *Syphoctonus* genus group, where it is situated between some rather atypical species of *Homotropus* (*H. crassicornis* Thomson, 1890 and *H. vitreus* Dasch, 1964) and the genera *Phthorima* Förster, 1869 and *Bioblapsis* Förster, 1869. This, in combination with the unique combination of characters, suggests that the species possibly should be assigned to a new genus. However, considering the present, unresolved situation in the genus group, a generic revision, preferably including molecular methods, would be needed to establish more strongly supported generic delimitations. The new species is here placed in the genus *Homotropus*, mainly based on the phylogenetic analysis in combination with the general appearance of the species, i.e., the absence of a strongly elongated and laterally compressed metasoma with distinctly concave hind margins of the 3–5th tergites, typical of females belonging to *Bioblapsis* or *Phthorima*. Given the quite distinct characteristics of the species it runs to couplet 13 in the key to genera in Klopfstein (2014b), where it is distinguished from *Fossatyloides gracilentus* (Holmgren, 1858) by the colouration, larger size, the more convex clypeus and the more distinct carination of the propodeum.

Homotropus mugerwai sp. nov.

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Figs 5B, 6

Diagnosis

Homotropus mugerwai sp. nov. (Fig. 6) is similar to and easily confused with *Homotropus pallipes* (Gravenhorst, 1829), but has the mesoscutum polished with quite distinct punctures (Fig. 5B), while it is shagreened with indistinct punctures in *H. pallipes* (Fig. 5A). The area covered by microsculpture on the mesopleuron is ending lower than in *Homotropus pallipes*. The two known females lack pale shoulder marks anteriorly on the lateral part of mesoscutum, a feature which is present in all but one female specimen of *H. pallipes* studied by the author (n = 89), even if the mark is smaller and less distinct in

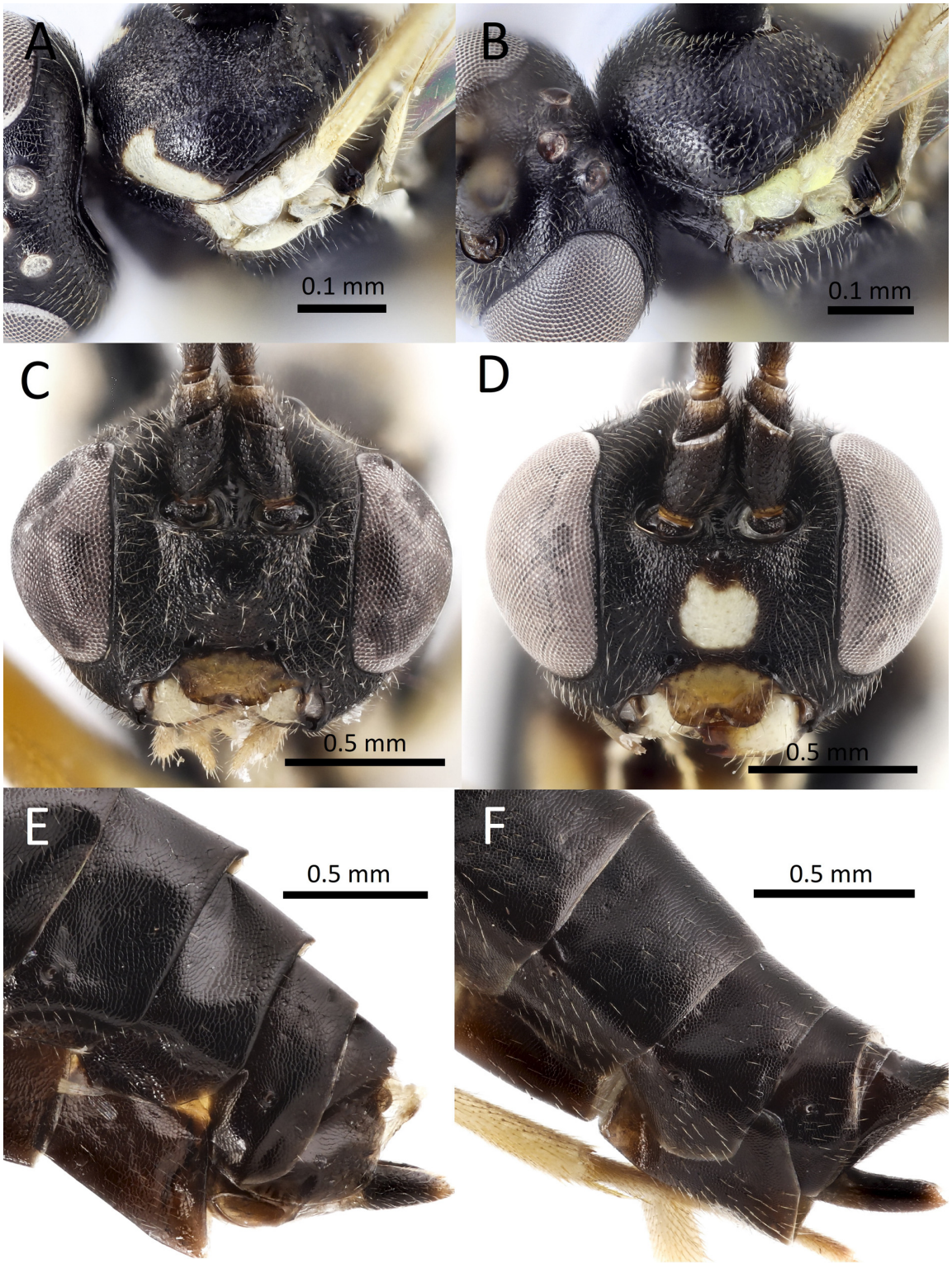

Fig. 5. A–B. Mesoscutum of female, anterodorsal view. **A**. *Homotropus pallipes* (Gravenhorst, 1829). **B**. *Homotropus mugerwai* sp. nov., paratype (NHRS-HEVA000011633). **C–D**. Head, anterior view of female. **C**. *Homotropus hellqvisti* sp. nov., paratype (NHRS-HEVA000011637). **D**. *Homotropus collinus* (Stelfox, 1941). **E–F**. Posterior segments of metasoma of female. lateral view. **E**. *Homotropus melanogaster* (Holmgren, 1872). **F**. *Homotropus collinus*.

northern specimens. The pterostigma is brownish with the basal part paler, but entirely yellowish in *H. pallipes*. The mid-coxae in the two known females are almost entirely yellow, while they are orange at least basally in *H. pallipes*. The species is also similar to *Homotropus signatus* (Gravenhorst, 1829), but has more numerous flagellomeres, 20 in *Homotropus mugerwai* sp. nov. and 19 in *H. signatus*. The metasoma is also less strongly compressed apically than in *H. signatus*. The scutellum is entirely yellow in *Homotropus mugerwai* sp. nov. and the hind trochanter has a dark spot while the scutellum in *H. signatus* is black or only with a small yellow spot apically and the hind trochanter lacks any dark markings.

Type material

Holotype

SWEDEN • ♀; Västerbotten, Åselet, Hästholmen; 65.233° N, 20.414° E; 25 May–19 Aug. 2019; R. Mugerwa Pettersson and S. Hellqvist leg.; Malaise trap in riverside, herb rich, mixed forest; NHRS-HEVA000011634.

Paratype

SWEDEN • 1 ♀; Västerbotten, Fällfors, Marranäset; 65.109° N, 20.790° E; 25 May–19 Aug. 2019; R. Mugerwa Pettersson and S. Hellqvist leg.; Malaise trap in riverside, decidous forest. NHRS-HEVA000011633.

Fig. 6. *Homotropus mugerwai* sp. nov., paratype, ♀ (NHRS-HEVA000011633). Habitus, lateral view.

Etymology

The specific epithet *mugerwai* (masculine name in genitive case) is derived from the name of one of the the collectors, Roger Mugerwa Pettersson (Robertsfors, Sweden).

Description

Female

Fore wing length 4 mm. Body length 4.5 mm. Head transverse in anterior view. Inner orbits almost parallel. Face entirely coriaceous and matt. Clypeus with apical margin bilobed and thin, weakly excised centrally. Antennae with 20 flagellomeres. First flagellomere about 5.5–6.0 times as long as wide. Apical flagellomeres with multiporous plate sensilla also present ventrally. Head behind eyes slightly narrowed. Temple in lateral view about 0.5 times as wide as compound eye. Mesopleuron in lower half with weak rugulose microsculpture, in upper half polished. Metapleuron strongly coriaceous. Mesoscutum shining with small punctures, centrally with very weak microsculpture (Fig. 5B). Propodeum evenly coriaceous with only pleural carinae present. Fore wing with areolet closed and vein 3rs-m weakly pigmented. Coxae coriaceous, matt. Pterostigma light brownish, basally pale (Fig. 6). Metasoma laterally weakly compressed from the 4th tergite (Fig. 6). First tergite about 1.5 times as long as wide, coriaceous with weak longitudinal striae. Second tergite coriaceous with weak striation basally, striae reaching about 0.5 times length of tergite. Third tergite coriaceous, apically becoming more or less reticulate-coriaceous. Fourth tergite onwards reticulate-coriaceus. Spiracle of second and third tergite above lateral fold. Ovipositor sheath apically rounded.

Colouration. Body and head black. Mandibles, lower part of clypeus, palpi, subtegular ridge, hind corner of pronotum, tegulae and weak central spot on face whitish. Scutellum entirely yellow. Legs orange. Fore and mid coxae, trochanter and trochantelli yellow, fore and mid coxae at most with very small dark spot basally. Hind coxae orange. Hind trochantellus with small black spot. Tibae whitish, with apical 0.3 and base narrowly black. Hind tibia with subbasal black spot dorsally. Metasoma black. Apical third of tergite 2 and the entire tergites 3 and 4 orange.

Male

Unknown.

Remarks

In the key to the species of *Homotropus* provided by Klopfstein (2014b), *Homotropus mugerwai* sp. nov. will run to couplet 30 as *H. pallipes*, from which it is distinguished by the characters given in the diagnosis.

Ecology

The two known females were collected by Malaise traps situated in herb rich riverside boreal forests dominated by *Betula* spp. (Fig. 12A–B). Both areas are periodically flooded. The trap at Hästholmen also collected several other rarely recorded diplazonines such as *Syrphoctonus idari*, *Homotropus melanogaster*, *Diplazon neoalpinus*, *Syrphophilus asperatus* and the here described *Homotropus hellqvisti* sp. nov.

Homotropus riedeli sp. nov.

urn:lsid:zoobank.org:act:015B88D4-B3AA-4A41-B694-425A00662113

Figs 7–8

Diagnosis

Separated from all other species of *Homotropus* primarily by the unique colour pattern with the legs, metasoma and antennae almost entirely red and the mesosoma with extensive red markings (Fig. 7).

Also distinguished by the strong sculpture and carination of the propodeum (Fig. 8B–C). Perhaps superficially most similar to *Homotropus haemorrhoidalis* Szépligeti, 1898, but that species has a slightly different colouration with for example the antennae and most of metasoma black and all coxae orange. Furthermore, the apical flagellomeres have short thick bristles in *H. haemorrhoidalis* and the propodeum has less prominent carinae.

Fig. 7. *Homotropus riedeli* sp. nov., holotype, ♀ (NHRS-HEVA000011630). Habitus, lateral view.

Etymology

The specific epithet *riedeli* (masculine name in genitive case) is in honour of Matthias Riedel (Bad Fallingbostel, Germany), for his contributions to the systematics of ichneumonid wasps.

Type material

Holotype

SWEDEN • ♀; Skåne, Ystad, Kåseberga; 55.385° N, 14.066° E; 17 Jul.–14 Sep. 2013; N. Ryrholm and C. Källander leg.; MV-light trap in warm coastal sandslopes; NHRS-HEVA000011630.

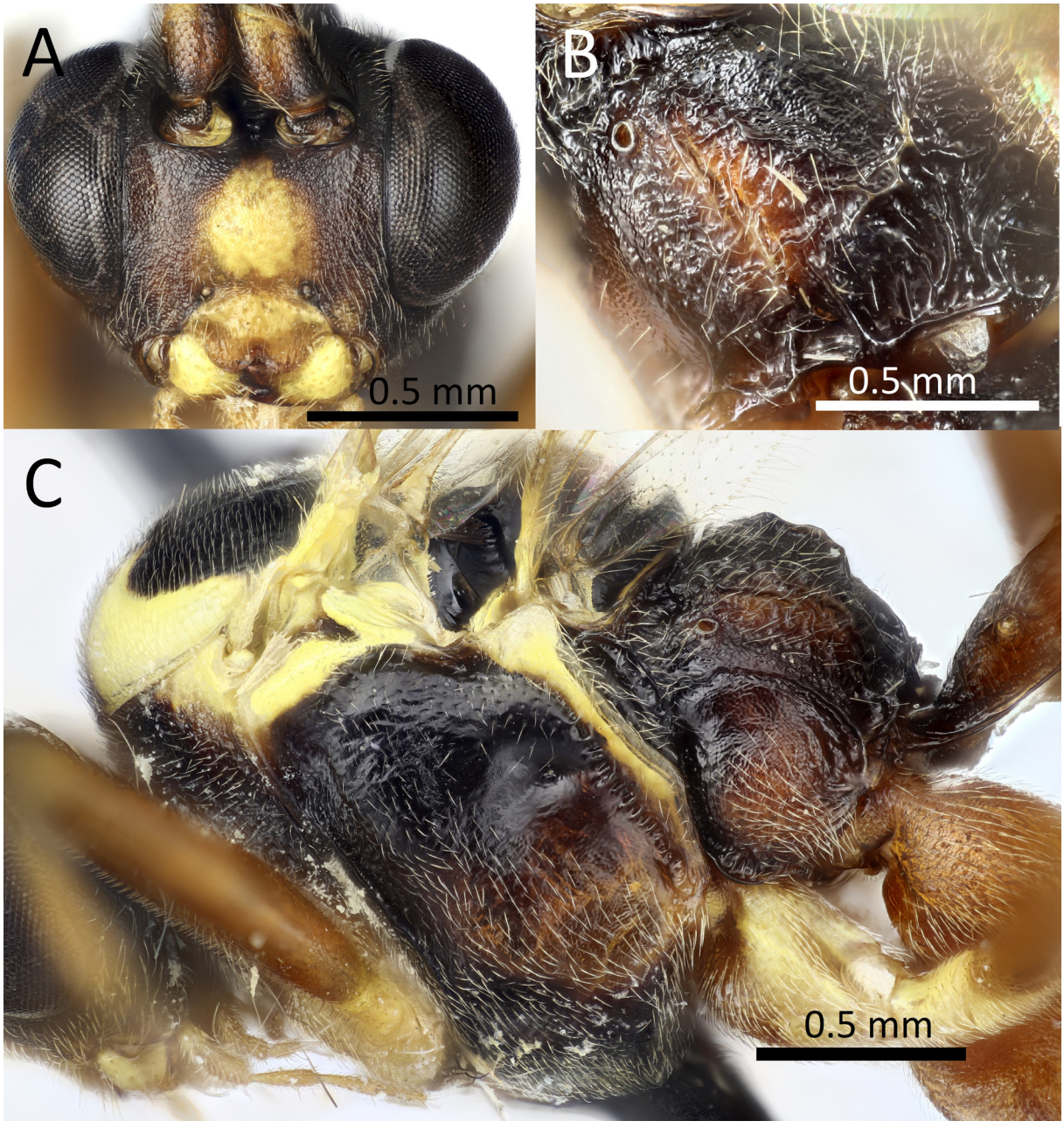

Fig. 8. *Homotropus riedeli* sp. nov., holotype, ♀ (NHRS-HEVA000011630). **A**. Head, anterior view. **B**. Propodeum, posterodorsal view. **C**. Mesosoma, lateral view.

Description

Female

Fore wing length 5.0 mm. Body length 6.9 mm. Head transverse in anterior view. Inner orbits almost parallel. Face entirely coriaceous and matt (Fig. 8A). Clypeus with apical margin bilobed and thin. Clypeus in basal 0.66 weakly convex. Antennae with 20 flagellomeres. Head behind eyes strongly narrowed. Temple in lateral view about 0.3 times as wide as compound eye. Mesopleuron centrally anteriorly with shallow punctures. The interstices about equal to diameter of punctures. In lower part, punctures become indistinct against coriaceous background. In upper part, punctures partly fading to irregular, almost rugose sculpture (Fig. 8C). Area around mesopleural furrow polished without punctures. Metapleuron coriaceous, shining. Mesoscutum shining with weak microsculpture between punctures, centrally becoming more strongly coriaceous. Scutellum weakly coriaceous with distinct punctures, interstices between punctures slightly larger than diameter of punctures. Propodeum strongly irregularly rugose, with area petiolaris and indicated area superomedia delimited by strong, irregular carinae (Fig. 8B). Indicated area superomedia with surface covered with irregular transverse carinae. Coxae coriaceous, matt. Fore wing with areolet closed and vein 3rs-m pigmented (Fig. 7). Metasoma laterally compressed from 4th tergite. First tergite strongly longitudinally striate. Second tergite strongly coriaceous with weak striation basally. Third tergite polished with weak microsculpture, in basal half coriaceous and matt. Tergites 4–7 polished with weak microsculpture. Spiracle of second tergite above lateral fold and on third tergite on lateral fold.

Colouration. Body and head black. Antennae reddish brown. Scapus brown, fading to brownish yellow ventrally. Clypeus, mandibles except mandibular teeth, palpi and large central face patch yellow. Face below antennal sockets dark reddish brown. Lower part of mesopleuron, metapleuron and a large spot on propodeum laterally orange. Scutellum orange. Large shoulder mark, subtegular ridge, tegulae, hind margin of mesopleuron and large spot at the hind corner of pronotum yellow. Legs orange. Fore and mid coxae yellow, orange basally. Trochanters and trochantelli on fore and mid leg yellow. Hind trochanter and trochantelli with large yellow spot. Hind legs apart from trochanter and trochantelli, entirely orange. Metasoma orange. First tergite centrally black with lateral and apical margins widely orange. Tergites 7 and 8 black.

Male

Unknown.

Ecology

The only known specimen was collected by a MV-light trap placed in an area characterized by warm steppe-like sandy heaths and herb-rich coastal slopes at the southern tip of Sweden. The female was collected between the 7th of July and the 14th of September.

Woldstedtius aureotibialis sp. nov.

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Figs 9–10

Woldstedtius patei – Klopfstein 2014b: 113.

Type material

Holotype

SWEDEN • ♂; Härjedalen, Hede, Synderkölen; 62.294° N, 13.406° E; 5–7 Aug. 2016; N. Johansson leg.; Sweepnet along alpine stream/bog; Barcode deposited under GenBank accession number MT268212; NHRS-HEVA000011631.

Paratypes

SWEDEN • 1 ♀; Lappland; 10 Aug. (year unknown); C.H. Boheman (1796–1868) leg.; NHRS-HEVA000010749 • 1 ♀; Härjedalen, Hede, Synderkölen; 62.292° N, 13.405° E; 28 Jul. 2019; N. Johansson leg.; sweepnet along alpine stream/bog; NHRS-HEVA000011632.

NORWAY • 1 ♀; Oppland, Dovre; C.H. Boheman (1796–1868) leg.; NHRS-HEVA000010750.

Diagnosis

Woldstedtius aureotibialis sp. nov. (Figs 9A–C, 10A–C) is distinguished from *Woldstedtius patei* (Dasch, 1964) (Fig. 11) by the orange legs, the less extensive pale colouration of the mesosoma and the less distinct carination of the propodeum (Fig. 10C). *Woldstedtius patei*, known from two specimens collected in the southern part of the Rocky Mountains in North America, has the fore and mid coxae orange, basally infuscate with the apices largely yellow (Fig. 11A–C). The hind femur is orange with the inner side infuscate and the hind tibiae are whitish, apically infuscate and with a small subbasal black spot. Furthermore, the yellow shoulder mark, the yellow apices of the scutellum and postscutellum are more extensive in *W. patei* (Fig. 11A–C) while the orange spot on the metapleuron is considerably smaller.

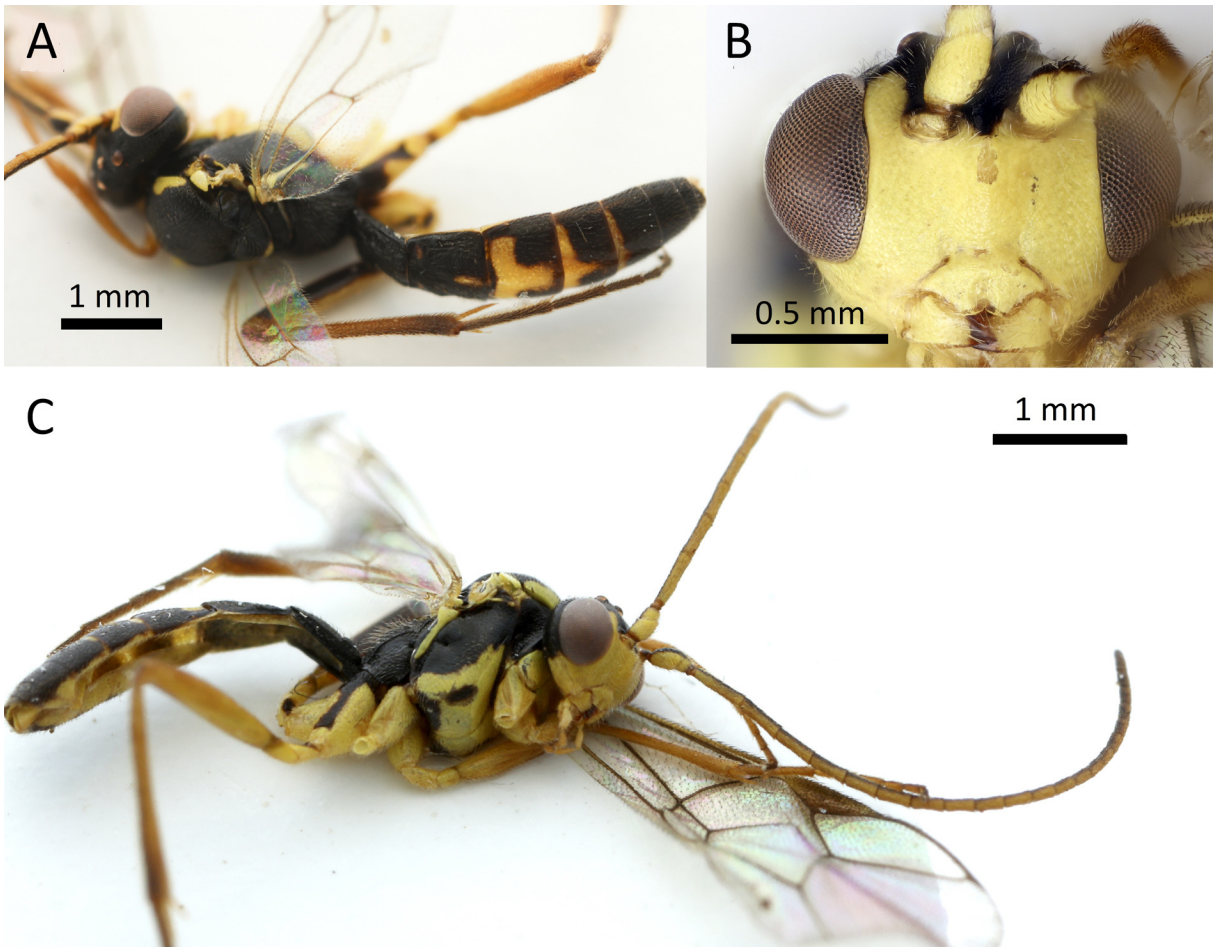

Fig. 9. *Woldstedtius aureotibialis* sp. nov., holotype, ♂ (NHRS-HEVA000011631). **A**. Habitus, laterodorsal view. **B**. Head, anterior view. **C**. Habitus, lateroventral view.

Etymology

The specific epithet *aureotibialis* (adjective) is derived from the colour of the hind tibia, *aureo* = golden.

Description

Fore wing length 3.1–4.2 mm. Body length 4.5–5.5 mm. Head in anterior view strongly transverse, central area strongly elevated. Inner orbits almost parallel (Figs 9B, 10B). Antennae with 22 flagellomeres. First flagellomere about 5 times as long as wide. Second flagellomere about 3.5–4 times as long as wide. Clypeus in basal third with a transverse swelling, separated from face by a shallow groove. Face evenly and finely coriaceous, matt (Figs 9B, 10B). Clypeus with apical margin bilobed, in basal 0.3 distinctly convex. Temple in dorsal view strongly narrowed behind eye. Mesopleuron almost entirely coriaceous, only a small area around mesopleural furrow shining. Sternauli weakly impressed. Epicnemial carina complete, metapleuron strongly coriaceous, matt. Mesoscutum and scutellum evenly and entirely coriaceous. Propodeum strongly coriaceous with only lateral longitudinal carinae present basally, centrally in anterior part with small depression covered by irregular transverse carinae (Fig. 10C). Hind coxae coriaceous. Fore wing areolet open, hind wing with three basal hamuli. Metasoma dorsoventrally

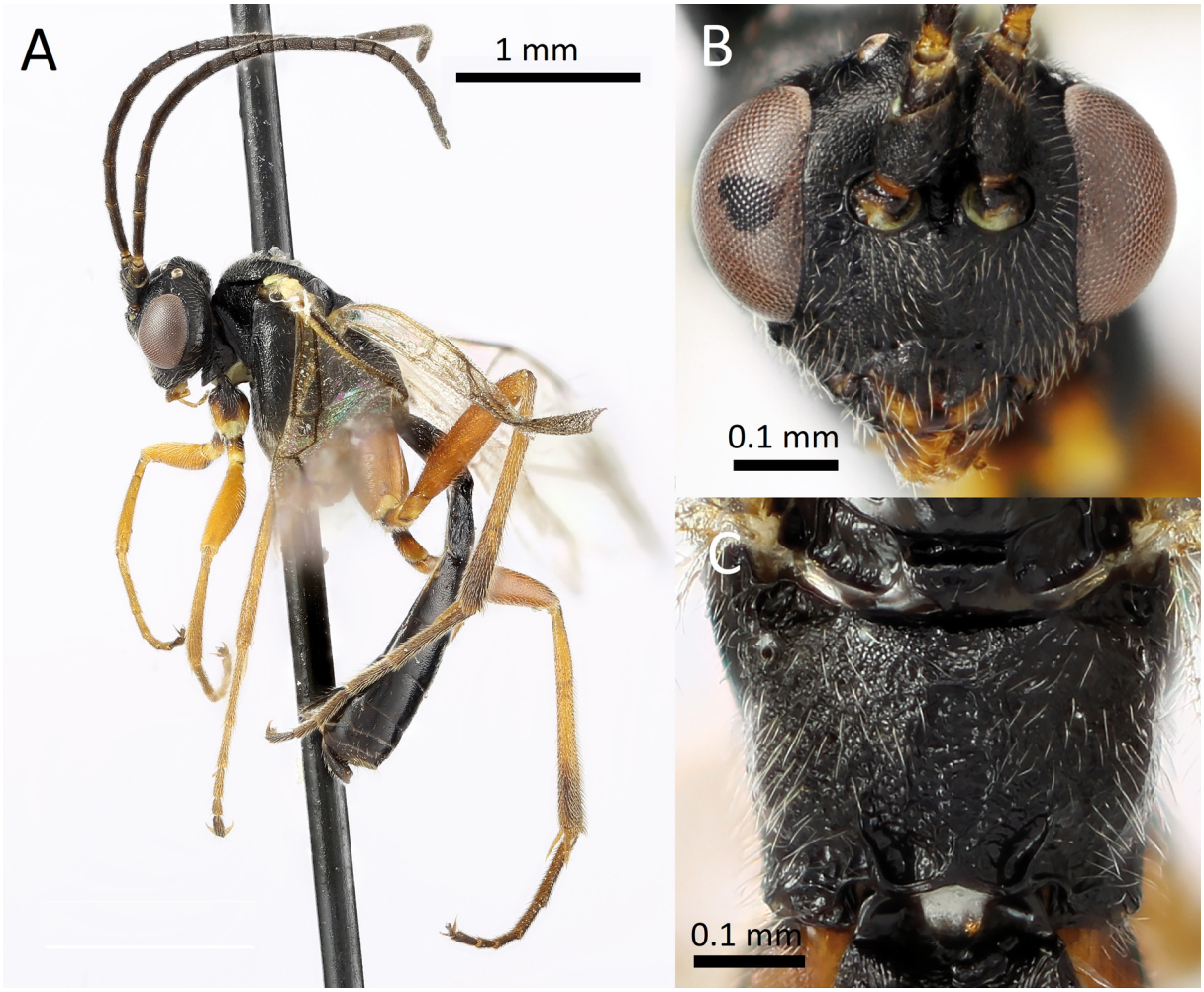

Fig. 10. *Woldstedtius aureotibialis* sp. nov., paratype, ♀ (NHRS-HEVA000011632). **A**. Habitus, lateral view. **B**. Head, anterior view. **C**. Propodeum, dorsal view. Photos: Alexander Berg.

depressed. Tergites coriaceous, weakly shining. Second tergite basally with longitudinal striae. Third tergite with spiracle slightly above lateral fold. Ovipositor apically truncate.

Colouration of male

Body and head black. Antennae ventrally orange. Scapus yellow ventrally. Face, clypeus, palpi and temple in ventral part entirely yellow. Lower part of propleuron and mesopleuron yellow. Suture between meta- and mesopleuron yellow (Fig. 9C). Large shoulder mark, tegulae, subtegular ridge and hind corner of pronotum yellow. Scutellum with small yellow apical spot. Legs orange. Coxae yellow. Hind coxae at base dorsally black and with an irregular black stripe on outer side. Trochanters and trochantelli yellow. Hind trochantelli basally with small black spot. Hind femur on inner side with a large black stripe, which covers almost the entire inner surface. Hind tibia orange, infuscate apically. Hind tarsi infuscate. Metasoma black. Second tergite with a small central yellow spot posteriorly. Third and fourth tergites with large t-shaped yellow spot. Fifth tergite basally yellow (Fig. 9A). Laterotergites and parameres yellow.

Colouration of female

The three known females are quite consistent regarding colouration (Fig. 10A–C). Body and head black. Tegulae and very small spot on hind corner of pronotum whitish. Palpi yellow. Mandibles yellow with

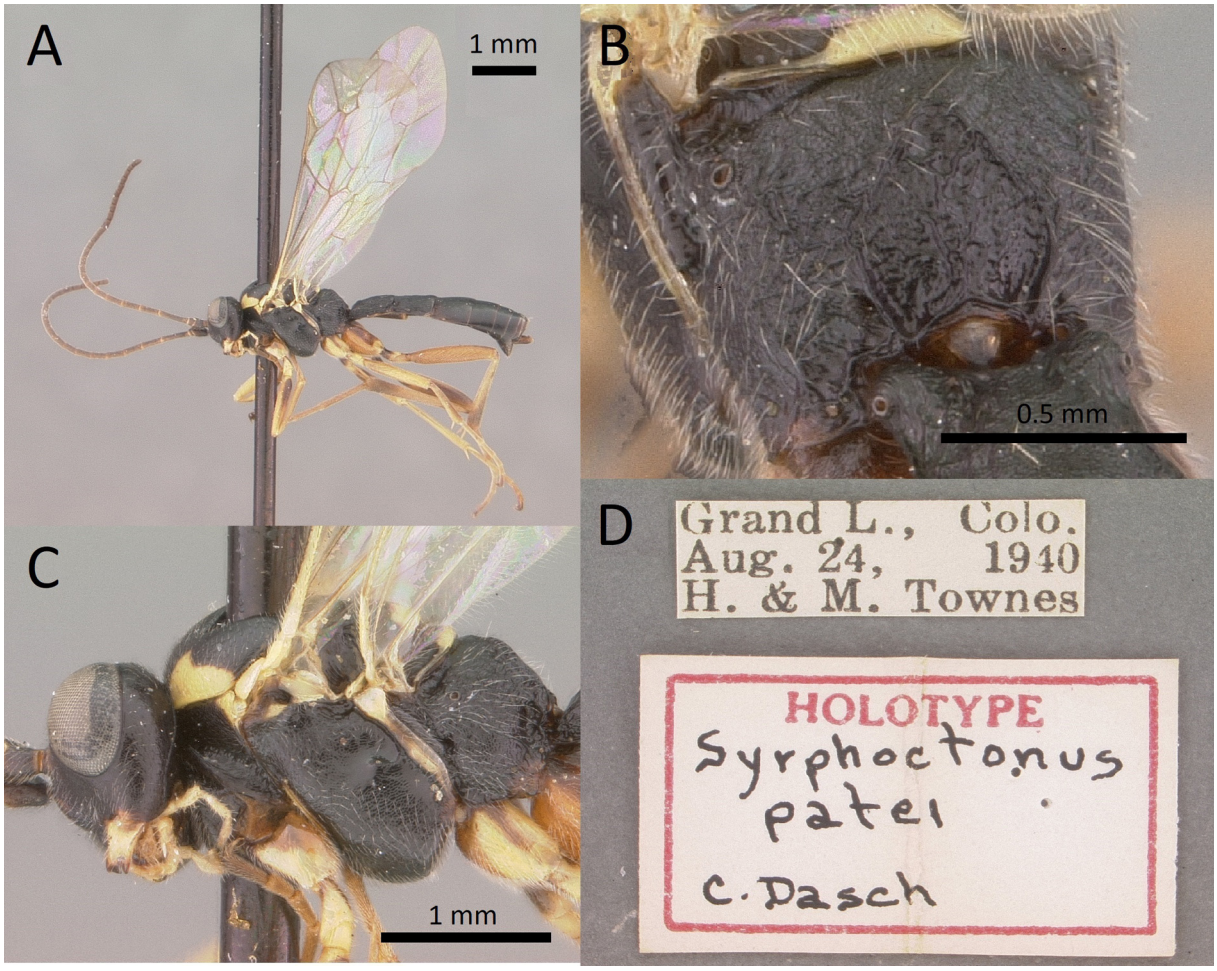

Fig. 11. *Woldstedtius patei* (Dasch, 1964), holotype, ♀, Colorado, Grand L., 24 Aug. 1940, H. and M. Townes leg. (USUC). **A**. Habitus, lateral view. **B**. Propodeum, laterodorsal view. **C**. Head and mesosoma, lateral view. **D**. Labels. Photos: David Wahl (USUC).

more or less extensive black mark. Metapleuron basally with large red mark and posterior basal corner on mesopleuron with smaller red mark, the latter may be absent.

Remarks

The taxonomic status of the paratype of *Woldstedtius patei* from Alaska (1 ♀; Independence Mine; 6 Aug. 1956; W.C. Frohne leg.; USUC) is somewhat uncertain. The orange legs and the slightly weaker carination of the propodeum would suggest that the specimen also belongs to the species here described, but the more abundant pale markings of the coxae and mesosoma are features shared by *Woldstedtius patei*. It is therefore not included in the type series. Klopfstein (2014b) based the decision to assign the then two known Scandinavian females to *W. patei* on the study of the Alaskan paratype and was, according to the notes (p. 113), unaware of a second, non-type female from Colorado (1 ♀; Colorado, Mount Evans; 26 Jul. 1964; C. Dasch leg.; 9800' trap; USUC), thereby overlooking the identity of the species. The morphological differences between *W. patei* and *W. aureotibialis* are subtle. The shape and structure of the propodeum is consistent in the three Scandinavian females, which all have the carination of propodeum less distinct (Fig. 10C) than in the two Nearctic females, including the holotype, which both have a diamond-shaped area surrounded by weak carinae centrally (Fig. 11B). Furthermore, the colouration of the legs, in which the two species differ considerably, is regarded as a stable character in diplazontines, commonly used in species diagnosis and delimitation (Dasch 1964; Klopfstein 2014b). The phylogenetic analysis places *Woldstedtius aureotibialis* sp. nov. at a rather basal position within the genus, as sister to a clade including *W. flavolineatus* and two Neotropical species (Fig. 1).

Ecology

The male holotype and one of the female paratypes were sweep netted between the 5th and 10th of August by an open bog with scattered *Salix* bushes (primarily *Salix lapponum* L.) surrounding a small stream in an alpine area.

New records for Sweden

Sussaba roberti Klopfstein, 2014

Sussaba roberti Klopfstein, 2014b: 92–93.

Material examined

SWEDEN • 1 ♀; Halland, Kungsbacka, Förlanda, Äskhult; 57.430° N, 12.282° E; 2 Jun.–15 Jul. 2016; K. Larsson leg.; Malaise trap in rocky grazed, small scale farmland; NJ.

Remarks

Previously known from Switzerland, Austria, Russia, Ukraine, Germany, Italy, Macedonia and Turkey (Klopfstein 2014b). The trap where the single female was collected was situated in a graze meadow in the culture and nature reserve Äskhult, where an ancient agricultural landscape has been restored.

Homotropus megaspis Thomson, 1890

Homotropus megaspis Thomson, 1890: 1516–1517.

Homotropus megalaspis – Schulz 1906: 98, 341.

Fig. 12. A. Malaise trap at Hästholmen by the forest river Byskeälven. Type locality for *Homotropus hellqvisti* sp. nov. and *Homotropus mugerwai* sp. nov. Photo: Roger Mugerwa Pettersson. **B**. The Natura 2000 area Byskeälven from Marranäsvältan. Photo: Sören Uppsäll, Länsstyrelsen.

Material examined

SWEDEN • 1 ♀; Åsele lappmark, Åsele, Björnlandets nationalpark, Häggsjöbäcken; 63.949° N, 17.999° E; 29 Jul.–26 Aug. 2014; A. Garpebring leg.; Malaise trap in boreal forest; NJ • 1 ♀; Östergötland, Boxholm, Rinna, Björneberg; 58.195° N, 14.911° E; 15–27 May 2018; N. Johansson leg.; NJ.

Remarks

Described by the Swedish Entomologist C.G. Thomson from material collected by J. Kriechbaumer from Bavaria, Germany (Thomson 1890). The distribution covers the Palaearctic, but the species seems to be rarely recorded (Klopfstein 2014b). The Swedish records are both from mature, semi-open taiga forests.

Discussion

This study is an extension of the solid systematic work conducted by previous authors, in particular the extensive revision of the Western Palaearctic fauna made by Klopfstein (2014b). The time consuming and complicated work of sorting out the basic taxonomy is a prerequisite that enables new taxa to be discovered and defined in a relatively 'simple' way.

The study here presented also emphasizes the fact that our knowledge of Darwin wasps (Klopfstein *et al*. 2019) depends heavily on practical fieldwork and the collection of material from new areas and locations. One might easily be misled to believe that three centuries of collecting and systematic work would have left little to discover, but the fact is almost the opposite. Even in countries as Sweden, that one would presume have a relatively well-known fauna, many insect groups, primarily within Diptera

Fig. 13. Seashore along the Baltic sea at Haparanda Santasaari, type locality for *Homotropus klopfsteinae* sp. nov. Photo: Nils Ryrholm.

and Hymenoptera, are still poorly known (Ronqvist *et al.* 2020). It is also notable that the material of all new species treated in this study comes from surveys initiated by lepidopterists, dipterists and coleopterists, which indirectly highlights the benefit of establishing a network of contacts for acquiring material that otherwise would be disposed of.

The results here presented also indicate that primeval boreal river- and seaside forests may be unexplored hotspots for diplazontines. It is well-known that many Syrphidae feeding on aphids have a pronounced boreal distribution (Bartsch *et al.* 2009), and the periodically flooded and herb-rich forests probably offer ideal conditions for many Diptera and their parasitoids. Byskeälven (Fig. 12B), the river by which two of the new species were discovered, is the second largest untamed forest river in Sweden and one of a few rivers to be unaffected by hydroelectric dams. The river and its pristine surrounding was only recently protected as a part of Natura 2000, EU's network of protected areas, which means that any kind of exploitation is prohibited according to Swedish law. Several studies have shown that the unnatural periodicity of surface levels caused by water control has damaged many of the terrestrial riverside habitats in Northern Sweden (Jonsson *et al.* 2013; Strasevicius *et al.* 2013). This means that untamed rivers like Byskeälven and the even larger forest river Råneälven, potentially hold a pristine ecosystem with many undiscovered species. As the ecosystems along these great taiga rivers are virtually unknown, a more thorough insect surveillance project using Malaise traps in riverside habitats would most likely result in the discovery of new species.

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