

w-album 20

2017



**Turun Eläin- ja Kasvitieteellinen Seura ry
Hyönteiskerho**

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Ichneumonidae: Mesochorinae)**

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w-album

20 (2017)

ISSN 1795-665X

ISBN 978-952-5793-28-4 (nid.)

ISSN 1795-6668

ISBN 978-952-5793-29-1 (PDF)

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Julkaisija: Turun Eläin- ja Kasvitieteellinen Seura, Hyönteiskerho
Publisher: Entomological Club of the Zoological and Botanical Society of
Turku,
Finland

Toimitus/Editors: Veli-Matti Mukkala
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Lehden nimi, *w-album*, pohjautuu hyönteiskerhon logoon, joka on Ari Karhilahden tyyllitelemä jalavanopsasiipi (*Satyrium w-album*).

Taxonomy of some European species of *Mesochorus*, including three new species from Finland and Sweden (Hymenoptera: Ichneumonidae: Mesochorinae)

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Vikberg, V. & Vårdal, H. 2017: Taxonomy of some European species of *Mesochorus*, including three new species from Finland and Sweden (Hymenoptera: Ichneumonidae: Mesochorinae). – w-album (20) 2017, 3-42.

Received 24.1.2016, accepted 5.6.2017

Abstract. Redescriptions of the following seven species are made: *Mesochorus gemellus* Holmgren, 1860, *M. tachypus* Holmgren, 1860, *M. diversicolor* Viereck, 1912, *M. brevicollis* Thomson, 1886, *M. giberius* (Thunberg, 1822), *M. marginatus* Thomson, 1886, and *M. tetricus* Holmgren, 1860. Three new species are described: *M. marginatoides* Vikberg sp. n. from Finland and Sweden, *M. skanensis* Vikberg sp. n. from Sweden, and *M. ranini* Vikberg sp. n. from Finland. The female of *M. plumosus* Dasch, 1971 is described from Finland (this species is known earlier only from N. America). A key to females of the eleven studied European species of *Mesochorus* is included.

The following formal nomenclatural acts or changes are made: lectotypes are designated for *Mesochorus tachypus* Holmgren, 1860 and for *M. tetricus* Holmgren, 1860. *Mesochorus tachypus* Holmgren, 1860, stat. n. (= *M. macrurus* Thomson, 1886, syn. n.), *M. diversicolor* Viereck, 1912, stat. n., *M. brevicollis* Thomson, 1886, stat. n., *M. marginatus* Thomson, 1886, stat. n., and *M. tetricus* Holmgren, 1860 (= *M. curvicauda* Thomson, 1886, syn. n.).

Many females of *M. tachypus* and *M. tetricus* were found near the ground in the spruce forests in Janakkala, South Finland very late in the season (from October to December in 2011-2016). *M. cimbicis* (Ratzeburg, 1844) has been reared from cocoons of *Trichiosoma* sp. (*scalesii* Leach aggregate) and *T. nanae* Vikberg & Viitasaari in Finland. The correct primary host of *Mesochorus bipartitus* Schwenke, 1999 is *Lygus rugulipennis* Poppius (Hemiptera: Miridae).

Muutaman Eurooppalaisen *Mesochorus*-lajin taksonomiasta ja kolmen uuden lajin kuvaus Ruotsista ja Suomesta

Lyhennelmä. Seuraavat lajit kuvataan uudelleen: *Mesochorus gemellus* Holmgren, 1860, *M. tachypus* Holmgren, 1860, *M. diversicolor* Viereck, 1912, *M. brevicollis* Thomson, 1886, *M. giberius* (Thunberg, 1822), *M. marginatus* Thomson, 1886, ja *M. tetricus* Holmgren, 1860. Ruotsista kuvataan uusi laji *Mesochorus skanensis* Vikberg sp. n. ja Suomesta kuvataan kaksi uutta lajia: *M. marginatoides* Vikberg sp. n. ja *M. ranini* Vikberg sp. n., joista edellinen myös Ruotsista. Lajien tunnistamisen helpottamiseksi on laadittu tutkimuskaava tutkitun 11 eurooppalaisen lajin naarailla.

Seuraavat nimistöön vaikuttavat muutokset tehdään: Lajeille *Mesochorus tachypus* Holmgren ja *M. tetricus* Holmgren vahvistetaan lektotyypit. *Mesochorus tachypus* Holmgren, 1860, stat. n. (= *M. macrurus* Thomson, 1886, syn. n.), *M. diversicolor* Viereck, 1912, stat. n., *M. brevicollis* Thomson, 1886, stat. n., *M. marginatus* Thomson, 1886, stat. n. ja *M. tetricus* Holmgren, 1860 (= *M. curvicauda* Thomson, 1886, syn. n.).

Lajien *Mesochorus tachypus* ja *M. tetricus* naaraita löytyi runsaasti Janakkalan kuusimetsistä loka-joulukuussa vuosina 2011 - 2016. Ne ilmeisesti talvehtivat kuusien alla karikkeessa. Laji *M. cimbicis* (Ratzeburg, 1844) on kasvatettu Suomessa kahdesta karvanuijapistiäislajista, joista toinen esiintyy Käsivarren Lapissa ja toinen, rämenuijapistiäinen, elää toukkana vaivaiskoivuilla soilla. Lajin *Mesochorus bipartitus* Schwenke, 1999 oikea primaari-isäntä on Miridae-heimon lude *Lygus rugulipennis*. Pohjois-Amerikasta kuvatun lajin *M. plumosus* Dasch, 1971 löytöjä esitetään Janakkalasta ja lajin naaras kuvataan.

1. Introduction

The species of the ichneumonid subfamily Mesochorinae are koinobiont endophagous hyperparasitoids of Ichneumonidae or Braconidae (Hymenoptera), and, less frequently of Tachinidae (Diptera) (Gauld & Bolton 1988, Wahl & Sharkey 1993). The European species of the subfamily were revised by Schwenke (1999) and he recognized 300 species in 7 genera, of which 231 species were described as new. The largest genus by far is *Mesochorus* Gravenhorst, into which, according to a cladistic analysis (Wahl 1993) species of *Plectochorus* Uchida and *Stictopisthus* Thomson should also be included. The primary hosts of mesochorines are caterpillars of Lepidoptera, larvae of Symphyta, adults of Coleoptera and nymphs of Miridae in order of frequency. At present the identification of many European species is difficult and for reliable identification often the type specimens in the Schwenke collection, Munich and in other collections must be examined (Horstmann 2006).

In November and December 2011 females of one species of *Mesochorus* occurred numerously in four spruce forests in Janakkala in Southern Finland. The specimens could not be identified using existing keys to European species (Schmiedeknecht, 1910; Schwenke, 1999), therefore a study of museum specimens (including primary types) was initiated.

The purpose of this study is to clarify the taxonomy of some species of *Mesochorus* by studying their types and other available specimens, to describe three new species from Finland and Sweden, to correct the host of one European species, and to give additional information on some Finnish species of the genus.

This study started because it was difficult to identify a species of *Mesochorus* found in late autumn 2011 in Janakkala, Finland. The reason for that was that in the European revision of Mesochorinae by Schwenke (1999), two species: *Mesochorus gemellus* and *M. tachypus* described by Holmgren in 1860 were wrongly synonymized. However, they were separated by Homgren (1860)

by many characters. Using the revision of North American species (Dasch 1971) the species from Finland run clearly to *Mesochorus tachypus*.

2. Material and methods

The studied specimens of *Mesochorus* are deposited in following collections:

CNC = Canadian National Collection of insects, arachnids and nematodes, Ottawa, Canada (Andrew Bennett)

CVV = private collection of Veli Vikberg, Turenki, Finland
 MZH = Finnish Museum of Natural History, Zoological Museum, University of Helsinki, Finland (Pekka Malinen)

NHRS = Naturhistoriska Riksmuseet, Stockholm, Sweden (Hege Vårdal)

UUZM = Museum of Evolution, Uppsala University, Sweden (Hans Mejlom)

ZMLU = Museum of Zoology, University of Lund, Sweden (Christer Hansson)

In Finland earlier grid references of the uniform grid system were used in connection with the localities and they are mostly used in this article (their eastern component begins with number 3). From the beginning of the year 2009 grid references of ETRS-TM35FIN system are recommended and number 8 is added before to the eastern component of them, so that the two grid systems can be separated from each other.

The terminology of the body parts follows Goulet & Huber (1993). The measurements were made in a similar manner as in Dasch (1971), except that the height of the head was measured from the anterior margin of the clypeus to the vertex between the lateral ocelli. The width of the face was measured at lower margins of antennal sockets. The body length was measured excluding the ovipositor sheath or male genitalia. The length of fore wing was measured from the outer margin of the tegula to the apex of the wing. The hind femur was measured without trochantellus. When the claws are studied with a stereomicroscope on pinned specimens, as is the usual technique, often the teeth at the base of the claw cannot be seen properly. Therefore the drawings of the claws were made from slide preparations using a compound microscope with a drawing tube. It was noticed that the outer claw often has one small tooth more than the inner claw.

The following abbreviations are used:

POL: Postocellar line, measured as the distance between the inner margins of the lateral ocelli.

OOL: Ocello-ocular line, measured as the distance between the outer margin of one lateral ocellus and the inner margin of the compound eye of the same side.

OD: Ocellar diameter, measured as the maximum width of one lateral ocellus.

OCL: Ocellar-occipital carinal line, measured from the posterior edge of a lateral ocellus to the occipital carina.

DNA barcodes for two specimen of *M. tachypus* and one specimen of *M. tetricus* were analysed within the framework of the Finnish Barcode of Life project. The sequencing was carried out in the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph) following the protocols shown at: <http://www.dnabarcoding.ca/pa/ge/research/protocols>. Full COI sequence information, including GenBank accession numbers, collection data and voucher images, are publicly available in BOLD and can be accessed under [dx.doi.org/10.5883/DS-MESUCH](https://doi.org/10.5883/DS-MESUCH).

3. Results - Taxonomic treatments

3.1. *Mesochorus gemellus* Holmgren, 1860

Figs. 1, 4E, 7A-B

Mesochorus gemellus Holmgren 1860: 123. Lectotype (♀) designated by Aubert (1968) (NHRS: NHRS-HEVA000000965).

Lectotype is labelled Lp.m., Bhn, 28/7 and it bears the lectotype label of J.F. Aubert. According to the original description the specimen was captured in Lapponia meridionali ad Umenäs (d. 28 Julii). Condition of the lectotype: Clean pinned specimen, antennae broken (now left with 14 and right with 19 flagellomeres), right wing slightly injured.

Diagnosis. The female of *Mesochorus gemellus* has the following combination of characters: Thorax entirely black, large triangular yellow spot laterally on antennal torulus, hind tibia slightly infuscate apically and hind basitarsus mostly pale.

Table 1. Characters used in Holmgren's original descriptions (Holmgren, 1860) to separate the females of *Mesochorus gemellus* and *M. tachypus*.

Character in original description	<i>Mesochorus gemellus</i>	<i>Mesochorus tachypus</i>
Female internal orbit	yellow	reddish or straw-coloured
Thorax	entirely black	red dorsally and laterally or rarely almost entirely black
Tarsi	blackish with pale bases	hind tarsi entirely blackish
Tarsal claw	with long, but not dense teeth reaching the middle of claw	with short or obsolete teeth (rarely missing) at base of claw
Body size	2-2 1/4 lines	1 1/2- 2 lines
Wing	areolet moderately sized, recurrent vein received approximately in the middle	areolet relatively large, recurrent vein received a little bit anterior of middle
Posterior region of metasomal segment 2	reddish or straw yellow	subtestaceous
Ovipositor sheath	shorter than first segment	as long as first segment



Fig. 1A-D. Lectotype of *Mesochorus gemellus* Holmgren. A: Body in dorsal view. B: Head in anterior view. C: Body in lateral view. D: Labels of the specimen.

Kuva 1A-D. *Mesochorus gemellus* Holmgren –lajin lektotyypin Tukholman Luonnonhistoriallisessa museossa. A: Ruumin päältä. B: Pää edestä. C: Ruumin sivulta. D: Yksilön etiketointi.

It can be separated from the female of *M. tachypus* by the characters in table 1 and the following combination of characters: 1) hind tarsal claw with 5-6 sharp teeth, of which the basal 2 or 3 are small and the apical 3 are distinctly larger and reach the middle of the claw, 2) the hind tibia is

pale except for apical 0.1 part slightly infuscate, 3) hind tarsus apically infuscate with basal half or more of hind basitarsus pale, 4) recurrent vein of fore wing ordinarily received approximately near in the middle and 5) thorax entirely black.

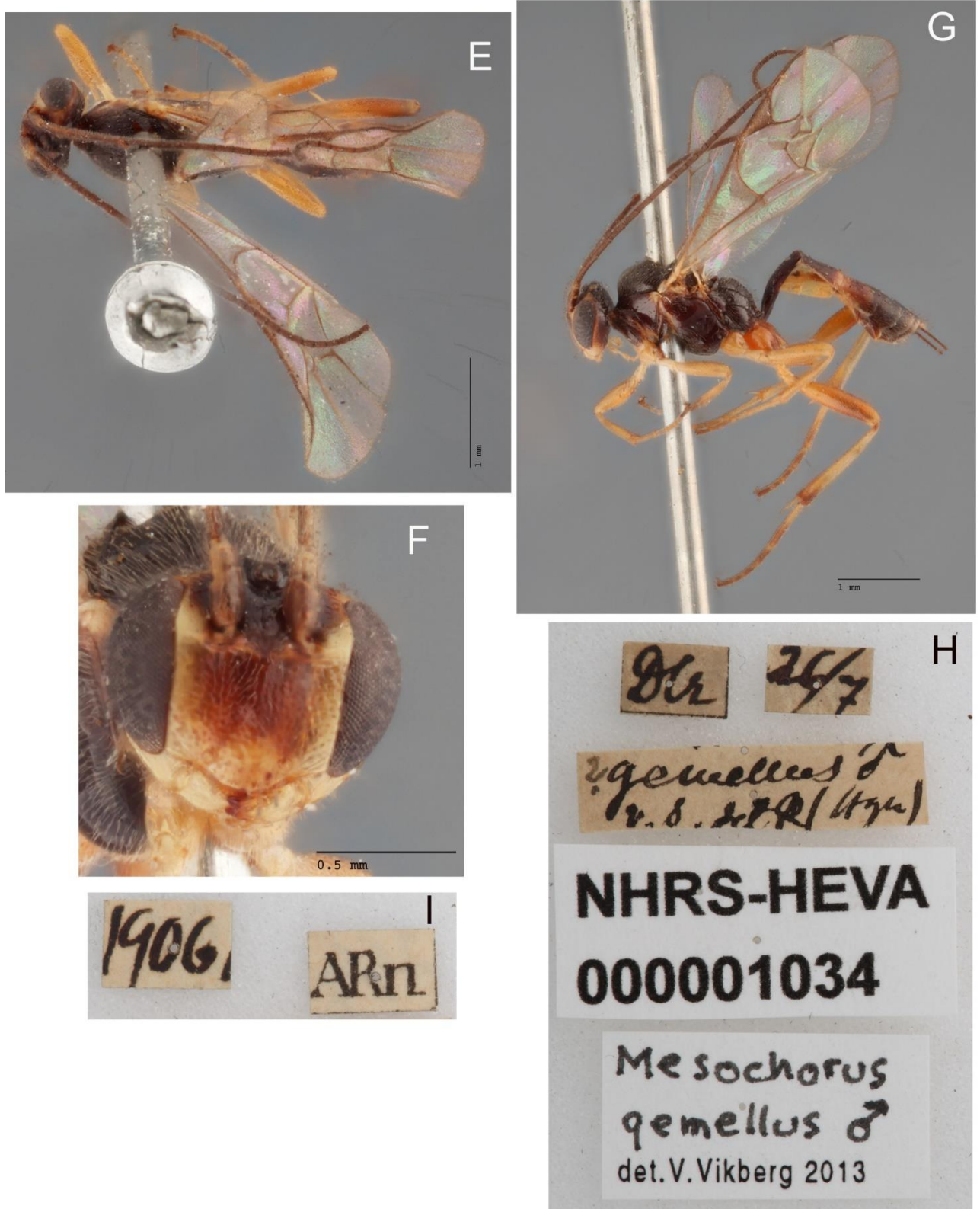


Fig. 1E-I. Male of *Mesochorus gemellus* Holmgren. E: Body in dorsal view. F: Head in anterior view. G: Body in lateral view. H: Labels of the specimen. I: Underside of two upper labels.

Kuva 1E-I. *Mesochorus gemellus* Holmgren –lajin koiras. E: Ruumis päältä. F: Pää edestä. G: Ruumis sivulta. H-I: Yksilön etiketointi.

Description (character state in lectotype in brackets).

Female (Fig. 1A-D). Body length 3.7-6.2 (6.2) mm. Fore wing length 3.6-4.9 (5.4) mm. Head width 0.92-1.20 (1.20) mm. Head width/head height 1.17-1.30 (1.25). Face and clypeus: width/height 1.13-1.31 (1.13). Face width/head width (0.60). Frons width/ face width (0.92). Malar space/basal width of mandible 0.57-0.84 (0.57). POL/OOL 0.57-0.88 (0.88). OOL/OD 1.3-1.7 (1.3). OCL/OD 1.4-2.0 (1.5). Occipital carina medially dipping and weakened (lectotype) or missing. Width of gena/width of eye 0.59-0.70 (0.59). Number of flagellomeres 27-33. Mesepisternum with sparse small punctures in upper anterior corner. Fore wing: pterostigma 3.2x as long as broad, leaving radius in apical third (0.67x); areolet rather small, trapezoidal, sessile, leaving recurrent vein slightly before middle. Nervulus interstitial. Nervellus opposite or reclivous (lectotype). Outer hind claw with 6 and inner hind claw with 4 sharp teeth in basal half, apical 3-4 teeth larger (lectotype; Fig. 7A-B)). Hind femur: length/height 4.4-4.7 (4.7). Hind basitarsus/hind tibia 0.44-0.49 (0.49). Propodeum with complete areolation (Fig. 4E). Area basalis connected broadly with areola. Areola longer than broad, leaving costula before (0.37) before middle. Area petiolaris reaching 0.43x length of propodeum (lectotype). Tergum 1: length/width 2.4-2.9 (2.7). Tergum 2: length/width 0.88-1.11 (0.91). Ovipositor sheath: length/height 6.3-7.3 (6.8). Ovipositor sheath/hind basitarsus 0.90-1.14 (0.91). Ovipositor sheath/tergum 1 0.66-0.82 (0.69). Ovipositor sheath in apical 0.3 part slightly curved upwards and slightly narrowed, especially on lower margin.

Colour. Head black, antenna dark or basally brownish. Inner orbits yellow, with broad yellow area lateral to antennal torulus. Mesosoma black, only mesoscutellum sometimes apically brownish or reddish. Wing stigma brown, basally and apically with small paler area. Hind tibia pale, in apical 0.13 part slightly infuscate, hind tarsus apically infuscate, hind basitarsus in basal half or more pale. Apical 0.2 part of tergum 2 reddish yellow both medially and laterally, tergum 3 reddish yellow to brown, apical terga basally

blackish brown, apically brown, with narrow pale hind margins. Sheath dark brown, apically paler.

Variation. Mesoscutellum and metanotum in some females reddish.

Male. (Fig. 1E-I) Body 4.0, fore wing 3.6 mm long. Head width 0.97 mm. Head width/head height 1.26. Face and clypeus: width/height 1.23. Malar space/basal width of mandible 0.63. POL/OOL 0.93. OOL/OD 1.5. OCL/OD 2.0. Occipital carina medially dipping and missing. Width of gena/width of eye 0.67. Number of flagellomeres 28. Fore wing: areolet rather small, trapezoidal, broadly sessile in one wing, shortly petiolate in another, leaving recurrent vein near middle. Nervulus interstitial. Nervellus opposite. Hind femur: length/height 4.4. Hind basitarsus/hind tibia 0.47. Hind claw with 3 small teeth, which are directed towards the apex of the claw. Propodeum with complete areolation. Area basalis connected broadly with areola. Tergum 1: length/width 2.8. Tergum 2: length/width 1.08. Stylet narrow, apically rounded. Stylet/hind basitarsus 0.63.

Colour. Clypeus, mandibles, gena and orbitae broadly yellow. Face medially below antennal toryli with a quadrate reddish brown area which reaches clypeus. Frontal orbit anteriorly broadly yellow, upwards the yellow area becomes narrower and almost reaches upper end of an eye. Frons and back of head blackish, a brownish yellow stripe from lateral ocellus to upper margin of eye, outer orbits narrowly reddish brown. Antenna dark brown. Mesosoma black. Upper hind angle of pronotum, tegula and humeral plate yellow. Posterior margin of scutellum and metanotum reddish. Metasoma blackish. Apical 0.27 part of tergum 2 with reddish brown and yellow colour, tergum 3 almost entirely brownish yellow to reddish brown, apical terga blackish. Stylet brownish black.

Variation. Only one male was studied.

Material examined. Lectotype (female): SWEDEN, Lapponia meridionali ad Umenäs, vii.28, Boheman (NHRS-HEVA000000965) (NHRS).

Non-type material: one female, SWEDEN, Skåne, "Rsiö"= Ringsjön, stood under *Mesochorus tachypus* in coll. Thomson; two females, locality labels unreadable, stood under *Mesochorus tachypus* in coll. Thomson (MZLU). One female, "Dir (= Dalarna), 26/7 1906 ARn (= A. Roman) *Mesochorus ?gemellus* ♀ leg. det. Roman" (NHRS-HEVA000001035). One male, same locality data as above (NHRS-HEVA000001034). FINLAND, Varsinais-Suomi: Pyhäjärvi, U. I. [now Karkkila 6713:3346], 18.6.1957 1 ♀, leg. V. Vikberg (CVV). Uusimaa: Siuntio, Barråsa, 24.6.-26.6.1999 1 ♀, R. Jussila leg. (MZH). South Häme: Somero (672:330), 29.5.-25.6.2000 1 ♀, leg. T. Mutanen (MZH). South Savo: Ristiina (6826:3502), 31.7.1980 1 ♀, leg. M. Koponen (MZH). North Savo: Varkaus, 7.5.-29.5.1963 1 ♀, 21.7.-29.7.1963 1 ♀, 5.8.-19.8.1963 1 ♀, E. Pulliainen leg. (MZH). Central Ostrobothnia: Lestijärvi (7048:3380), dwarf-shrub pine bog 12.7.1980 1 ♀, leg. M. Koponen (MZH). Reisjärvi, Susisaari (7057:3400), 11.7.1980 1 ♀, leg. M. Koponen (MZH).

Distribution. Europe (Yu et al. 2012, Zwakhals 2013). The records of *M. gemellus* from North America (Yu et al. 2012) were based on the wrong synonymization of *M. tachypus* with the species by Schwenke (1999). Based on our findings, *M. gemellus* is now restricted to Europe.

From Finland *Mesochorus gemellus* was reported from "Tavastland, Karelen and Kuusamo" by Woldstedt (1874). Later Krogerus (1938) recorded this species from Finland: Salla, Lantinkinsuo, one male on 26.6.1936, and Salla, Vuorijärvi district, one male on 1.7.1936 (det. A. Roman). These localities are now in Murmansk Region, Russia. We could not examine any of the mentioned specimens.

Comments. An addition to Holmgren's original description of the female the description of the male is based on two males as follows: "Hlm" (=Holmia=Stockholm) (NHRS-HEVA 000001026, NHRS-HEVA000001027). Based on the large size (body length 5.6-5.8 mm), red colour of the mesosoma including the mesoscutellum and hind tarsal claws that are pectinate nearly to the apex, it is our opinion that these males are not

conspecific with the lectotype. They have been identified as *Mesochorus marginatoides* Vikberg sp. n. in this article.

Thomson (1886) gave a description of *Mesochorus gemellus*, but none of the six specimens now in his collection (five males and one female) belongs to *M. gemellus*, and he misidentified and described the females of *M. gemellus* as *M. tachypus*.

3.2. *Mesochorus tachypus* Holmgren, 1860 stat. n.

Figs. 2, 3, 4A-B, 5A-E, 6A

Mesochorus tachypus Holmgren, 1860: 130. Lectotype (♀), designated here (NHRS: NHRS-HEVA000000964). 7 female and 2 male paralectotypes in NHRS (NHRS-HEVA 000001040-1047, NHRS-HEVA 000001052, NHRS-HEVA000001955).

The lectotype is labelled Hlm, Bhn. [printed labels = Sweden, Uppland, Stockholm "Holmia"], it was selected in 1962 by R. Hinz (his red lectotype label) but not published.

Condition of the lectotype: It is a pinned specimen in rather bad condition. Antennae broken (left with 6 and right with 2 flagellomeres), anterior part of mesosoma damaged by the pin, all wings broken away near their bases, and right foreleg missing beyond coxa.

Mesochorus (Mesochorus) macrurus Thomson, 1886: 342. Lectotype (♀), designated by Fitton (1982). **Syn. n.**

Lectotype (ZMLU), labelled: 1) Lpl (handwritten label) = Sweden, Lapland, 2) Lectotype, *Mesochorus macrurus* Th. Schwenke, 1968 red label).

Condition of the lectotype: dirty pinned specimen. Antennae missing, except right scape. Head glued on anterior end of mesosoma.

Diagnosis. *Mesochorus tachypus* has the following combination of characters: Thorax red laterally and dorsally. Lower frons without triangular yellow spot. Hind tibia apically with large infuscation, hind basitarsus totally infuscate. Hind claws near base with small teeth, which can



Fig. 2A-D. Lectotype of *Mesochorus tachypus* Holmgren. A: Body in dorsal view. B: Head in anterior view. C: Body in lateral view. D: Labels of the specimen.

Kuva 2A-D. *Mesochorus tachypus* Holmgren –lajin lektotyypin Tukholman Luonnonhistoriallisessa museossa. A: Ruumin päältä. B: Pää edestä. D: Ruumin sivulta. D: Yksilön etiketointi.

be seen only in some angles of light. It can be separated from *M. gemellus* by the following combination of characters: 1) hind tarsal claw with small teeth, 2) hind tibia strongly infuscate, 3) hind basitarsus entirely infuscate, 4) sheath is longer and 5) thorax often dorsally and laterally red, not entirely black.

Description (character state of the lectotype of *M. tachypus* in brackets).

Female. (Figs 2A-D, 3) Body length 3.2-6.3 (4.8) mm. Fore wing length 3.2-5.8 mm. Head width

0.67-1.14 mm (0.91). Head width/head height 1.08-1.22 (1.17). Face and clypeus: width/height 1.01-1.14 (1.12). Malar space/basal width of mandible 0.57-0.81 (0.58). POL/OOL 0.62-0.85 (0.63). OOL/OD 1.1-1.7 (1.2). OCL/OD 1.1-1.9 (1.3). Occipital carina varies medially: in some females transverse, in some with dipping and in some medially wanting (lectotype). Width of gena/width of eye 0.62-0.74 (0.69). Number of flagellomeres 29-37. Fore wing: areolet trapezoidal, sessile, leaving recurrent vein distinctly before middle. Nervulus interstitial.

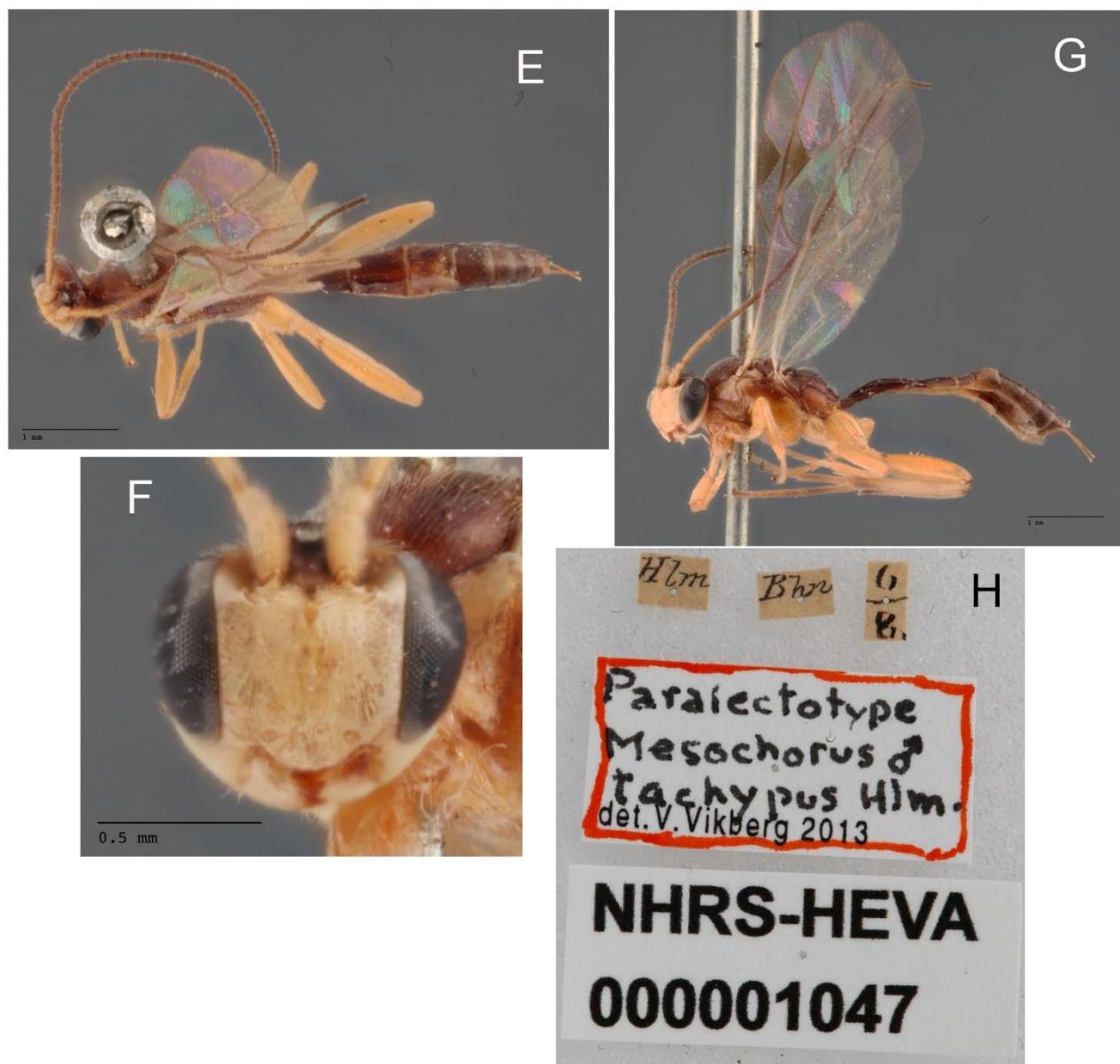


Fig. 2E-H. Male paralectotype of *Mesochorus tachypus* Holmgren. E: Body in dorsal view. F: Head in anterior view. G: Body in lateral view. H: Labels of the specimen.

Kuva 2E-H. *Mesochorus tachypus* Holmgren –lajin paralectotyypikoiras. E: Ruumis päältä. F: Pää edestä. G: Ruumis sivulta. H: Yksilön etiketointi.

Nervellus reclivous. Hind femur: length/height 4.3-5.6 (4.3). Hind basitarsus/hind tibia 0.42-0.46 (0.44). Hind claw with 3-4 small teeth basally (in preparations 7-8 sharp teeth in basal half (Fig. 6A). Propodeum with complete areolation (Fig. 4A-B). Area basalis small, with long petiole or with short petiole (lectotype) but its form can vary (Fig. 5A-E). Areola longer than wide, leaving costula before middle. Area petiolaris as long as wide,

reaching 0.4x length of propodeum. Tergum 1: length/width 2.4-3.0 (2.6). Postpetiolus: length/width 1.33-1.35 (1.33). Tergum 2: length/width 0.84-1.14(1.00). Ovipositor sheath: length/height 7.3-8.4 (7.7). Ovipositor sheath/hind basitarsus 1.27-1.49 (1.37). Ovipositor sheath/tergum 1 0.95-1.08 (1.01). Ovipositor sheath straight, covered with short setae, apically rounded.



Fig. 3. Female of *Mesochorus tachypus* Holmgren from Janakkala, Konttila, on 12.11.2012. Body length 6.0 mm. Photo taken by Pekka Malinen.

Kuva 3. Lajin *Mesochorus tachypus* Holmgren naaras Janakkalan Konttilasta 12.11.2012. Ruumiin pituus 6,0 mm. Valokuvan otti Pekka Malinen.

Colour. Head, including antenna, black. Mandibles (except teeth dark red), lower gena, malar space, lower lateral clypeus, and lower inner orbit white. Facial orbits brownish yellow, face and most of clypeus blackish or brownish black. Mesosoma black. Pronotum around spiracle, tegula and wing bases white. Pronotum laterally, mesoscutum, mesoscutellum and mesepisternum can be more or less red, especially in large females (lectotype). Wings subhyaline, venation brown, stigma dark brown, basally and apically slightly paler. Legs reddish brown, fore and mid-trochantelli whitish, tarsi apically infuscate, hind tarsus blackish. The hind coxa can be more or less infuscate and in small females blackish. Hind tibia brownish yellow, basal 0.1 part and apical 0.3 part blackish. Metasoma black. Apical margin of tergum 2 with narrow brownish yellow transverse band. Tergum 2 and/or tergum 3 may have brownish tint. Apical terga can have pale apical margins.

Variation. Anterior part of mesosoma with rich or scanty red colouration, but it can be totally black, especially in small specimens. Hind coxae totally reddish or partly blackish or totally black. The specimens collected in Janakkala are darker in colour than other specimens from Finland. The

metasoma can look more brownish in older specimens.

Male. (Fig. 2E-H) (n=2). Body 4.6-4.7, fore wing 3.9-4.2 mm long. Head width 0.89-0.90 mm. Head width/head height 1.22. Face and clypeus: width/height 1.08-1.22. Malar space/basal width of mandible 0.50. POL/OOL 0.79-0.83. OOL/OD 1.3-1.4. OCL/OD 1.5-1.7. Occipital carina medially with dipping and then wanting. Width of gena/width of eye 0.63. Number of flagellomeres 33-35. Fore wing: areolet rather large, trapezoidal, sessile or shortly petiolate, leaving recurrent vein distinctly before middle. Nervulus interstitial. Nervellus reclivous. Hind femur: length/height 5.0-5.1. Hind basitarsus/hind tibia 0.45. Hind claw with 3 minute erect teeth basally. Propodeum with complete areolation. Area basalis small, with long petiole. Tergum 1: length/width 3.3-3.4. Tergum 2: length/width 1.12. Stylet narrow, apically rounded. Stylet/hind basitarsus 0.69-0.71.

Colour. Face, clypeus, mandibles, and gena yellowish white. Frontal orbits anteriorly white, the white colour narrowing upwards and not reaching upper level of an eye. Frons medially and upper backside of head dark. Antenna apically dark brownish, scape, pedicel and flagellomere 1 brownish yellow. Prothorax mostly whitish. Mesoscutum reddish yellow, anterior corner and laterally dark, scutellum reddish. Tegula, and base of wings white. Stigma brown. Mesepisternum yellowish brown, near wing darkened. Metanotum and propodeum dark, metapleuron reddish brown. Fore and mid-coxae and trochanters whitish, legs brownish yellow, hind tibia paler, its base narrowly and apical 0.23 part infuscate, hind tarsus slightly infuscate. Metasoma dark, tergum 2 apically narrowly yellow, tergum 3 partly brownish, apically yellow, terga 4-6 slightly yellow apically. Stylet pale, brownish yellow.

Variation. Only two males examined

Material examined. Lectotype (female) ((NHRS-HEVA000000964): SWEDEN, Uplandia (= Upland) ad Holmiam (= Stockholm), leg. Boheman (NHRS). Paralectotypes: 2 female (NHRS-HEVA000001040-1041): Smoelandia (=Småland) at Anneberg near Grenna (NHRS), 3 female (NHRS-HEVA000001043-1045) and 2

male (NHRS-HEVA000001046-1047): Stockholm, leg. Boheman, 1 female (NHRS-HEVA000001052): Västerbotten, Tavelstö, 5.9. and 1 female (NHRS-HEVA000001955) with illegible label data, except date: 20.7 (according to original description one female in the type series was collected July 20 at Hvitsand, Värmland, leg. Axel Goës).

Non-type material: one female (NHRS-HEVA000001050), SWEDEN: Uppsala, 8.10.1933, leg. Hedgren, FINLAND. Åland: Eckerö, Käringsund, 3.8.1955 1 ♀, leg. W.Hellén (1312) ((MZH). Varsinais-Suomi: Pyhäjärvi, U. I. [now Karkkila (6713:3346)], 13.9.1959 1 ♀, 20.9.1959 1 ♀, leg. V. Vikberg (CVV). Uusimaa: Helsinki, Munkkiniemi, 18.9.1931 1 ♀, 27.9.1931 1 ♀, 4.10.1931 1 ♀. W. Hellén (3979, 3820, 3925) (MZH). Helsinki (6681:3393), 3.10.1972 1 ♀, leg. M. Viitasaari (MZH; *Mesochorus tetricus* Holmgren ♀ det. R. Jussila 2010). Helsingin pitäjä [now Helsinki, Mustavuori (668:339)], 18.5.1960 1 ♀, leg. V. Vikberg (CVV). South Karelia: Virolahti (6709:3524), 6.7.1974 1 ♀, leg. H. Luoma (MZH; *Mesochorus tetricus* Holmgren ♀ det. R. Jussila 2010). South Häme: Janakkala, Hangastenmäki (6755:3369) 12.11.2011 1 ♀; 16.11.2011 1 ♀; 23.11.2011 1 ♀, leg. V. Vikberg (CVV). Janakkala, Hangastenmäki (6755:3369), 24.5.2014 2 ♀♀, leg. V. Vikberg (CVV). Janakkala, Kalpalinna (6759:3370), 20.10.1993 1 ♀, leg. V. Vikberg (CVV). Janakkala, Kalpalinna (6759:3369) 25.11.2011 1 ♀, leg. V. Vikberg (CVV). Janakkala, Kalpalinna (6759:3370), 18.11.2011 12 ♀♀, 4.12.2011 16 ♀♀, 24.12.2011 11 ♀♀, 29.12.2011 5 ♀♀, 3.11.2012 2 ♀♀, 14.11.2012 1 ♀, 29.12.2013 2 ♀♀, 1.1.2014 1 ♀, leg. V. Vikberg (CVV). Janakkala, Kalpalinna (6760:3369), 29.10.2013 1 ♀, leg. V. Vikberg (CVV). Janakkala, Kalpalinna (6757:8370), 21.11.2016 3 ♀♀, leg. V. Vikberg (CVV). Janakkala, Kalpalinna (6757:8369), 31.12.2016 1 ♀, leg. V. Vikberg (CVV). Janakkala, Kesiäisjoki (6756:3367), 16.9.1993 2 ♀♀, 12.10.1993 1 ♀, leg. V. Vikberg (CVV). Janakkala, Kirinmylly (67639:33808), 31.12.2013 1 ♀, leg. V. Vikberg (CVV). Janakkala, Laurinkievari (6752:8369), 24.10.2016 1 ♀, leg. V. Vikberg (CVV). Janakkala, Laurinmäki (6755:3369), 26.12.2013 1 ♀, leg. V. Vikberg (CVV). Janakkala, Tarinmaa

(6756:3369), 26.11.2011 3 ♀♀, leg. V. Vikberg (CVV). Janakkala, Turenki, Konttila (6757:3373) 26.12.2011 10 ♀♀, 12.11.2012 10 ♀♀, 21.11.2012 2 ♀♀, 26.10.2014 1 ♀, 22.11.2016 3 ♀♀, leg. V. Vikberg (CVV). Janakkala, Turenki, Otila (6757:8375), 30.12.2013 2 ♀♀, leg. V. Vikberg (CVV). Janakkala, Turenki, Pyhämäki (6758:3371) 1.12.2011 18 ♀♀, 2.12.2011 24 ♀♀, 16.12.2011 7 ♀♀, 18.12.2011 6 ♀♀, 27.12.2011 8 ♀♀, 5.11.2012 2 ♀♀ and 11.11.2012 1 ♀, 28.11.2015 1 ♀, leg. V. Vikberg (CVV). Janakkala, Turenki, Rälssitie (6758:3373), 12.11.2011 1 ♀, leg. V. Vikberg (CVV). Lammi, Evo, 5.11.1932 1 ♀, leg. E. Kangas (MZH). Inari Lapland: Utsjoki kk [near NE. corner of Mantojärvi (7754:3501)], 4.6.1960 1 ♀, leg. V. Vikberg (CVV).

Distribution. Europe (Yu et al. 2012, Zwakhals 2013). The previously included Nearctic specimens are now included in *M. diversicolor* Viereck; see taxonomic treatment below.

Hosts. Bridgman (1893) reared *Mesochorus tachypus* from *Eupithecia lariciata* (Freyer, 1842) (Lepidoptera: Geometridae) and Delucchi (1982) states that *Zeiraphera griseana* (Hübner, 1799) (as *diniana* Guenée, 1845) (Lepidoptera, Tortricidae) are hosts of *Mesochorus tachypus* and that the *Mesochorus* species are hyperparasitoids.

Comments. The females of *Mesochorus tachypus* in Janakkala, South Finland were captured late in the autumn (October - December and in one year even in January) in spruce forests by sweeping the undervegetation near spruces (*Picea abies*). The undervegetation in the forests consists of *Vaccinium myrtillus*, *Vaccinium vitis-idaea*, and *Calamagrostis arundinacea* (most specimens of *Mesochorus* were swept on this). Different mosses cover most of the surface near the spruces. 125 females were captured in 2011, 18 females in 2012, 8 females in 2013, one female both in 2014 and 2015 and 8 females in 2016. Thus the year 2011 was exceptionally good for *M. tachypus* in Janakkala. Author VV tried to sweep for the same species during the summers 2012 and 2013 in the spruce forests in Janakkala. No males or females were captured during these summer seasons. So it

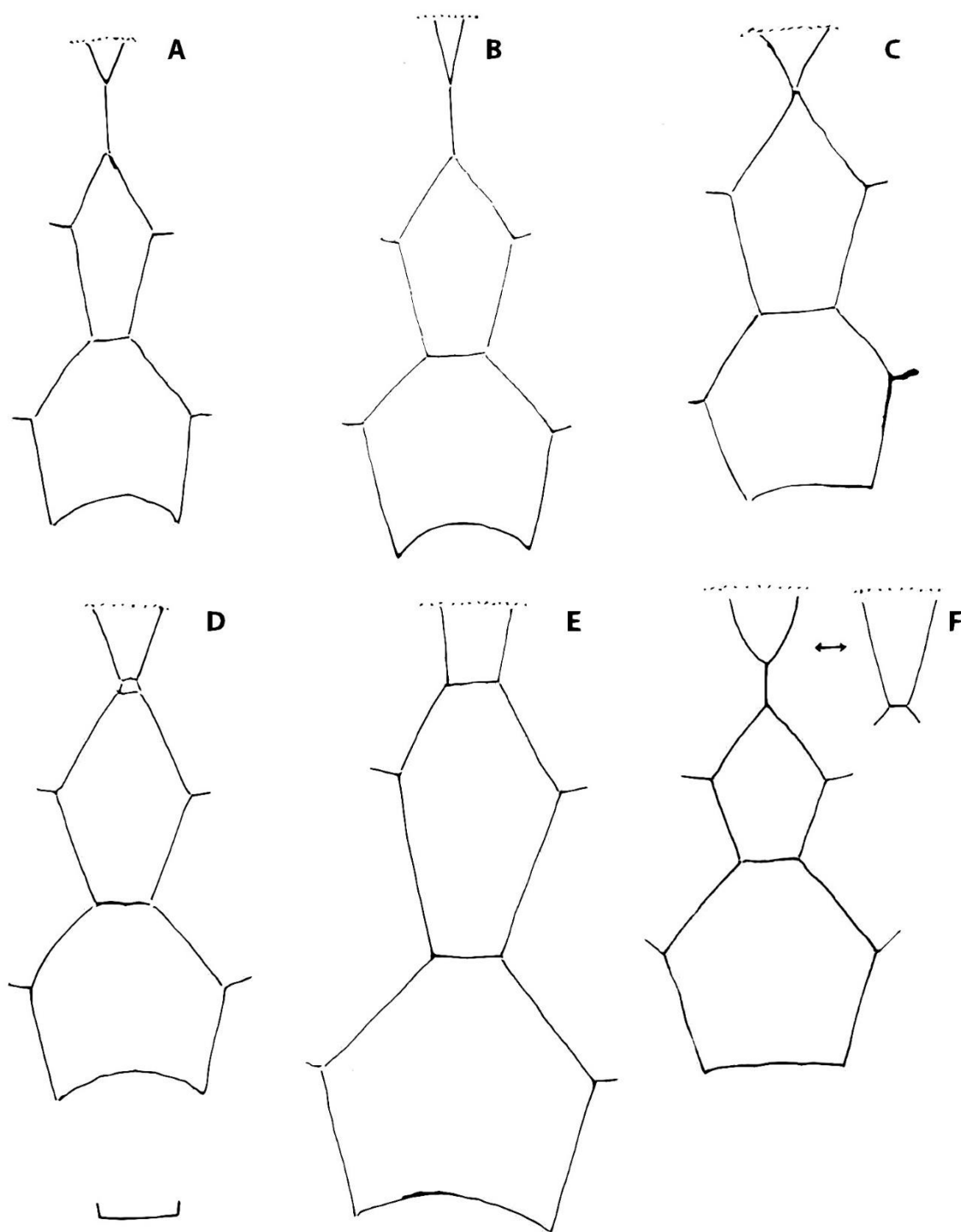


Fig. 4. Median areolation of propodeum of females of *Mesochorus*. A: *M. tachypus*, paralectotype from Stockholm. B: *M. tachypus* from Janakkala, Pyhäjärvi. C: *M. diversicolor* from Porcupine, ex *Choristoneura fumiferana*. D: *M. diversicolor* from Coyote Lake, ex *Choristoneura occidentalis*. E: *M. gemellus* from Siuntio. F: *M. tetricus* = *M. curvicauda* from Janakkala, Pyhäjärvi. Insert: different basal area. Scale line 0.1 mm.

Kuva 4. *Mesochorus*-lajien naaraiden tauksen keskiosan sarat. A: *M. tachypus*-lajin paralectotyypin Tukholmasta. B: *M. tachypus* Janakkalan Pyhäjärveltä. C: *M. diversicolor*, Porcupine, kasvatettu lajista *Choristoneura fumiferana*. D: *M. diversicolor*, Coyote Lake, kasvatettu lajista *Choristoneura occidentalis*. E: *M. gemellus* Siuntiossa. F: *M. tetricus* = *M. curvicauda* Janakkalan Pyhäjärvestä. Lisäkuva: erilainen tyvisarka. Mittajana 0,1 mm.

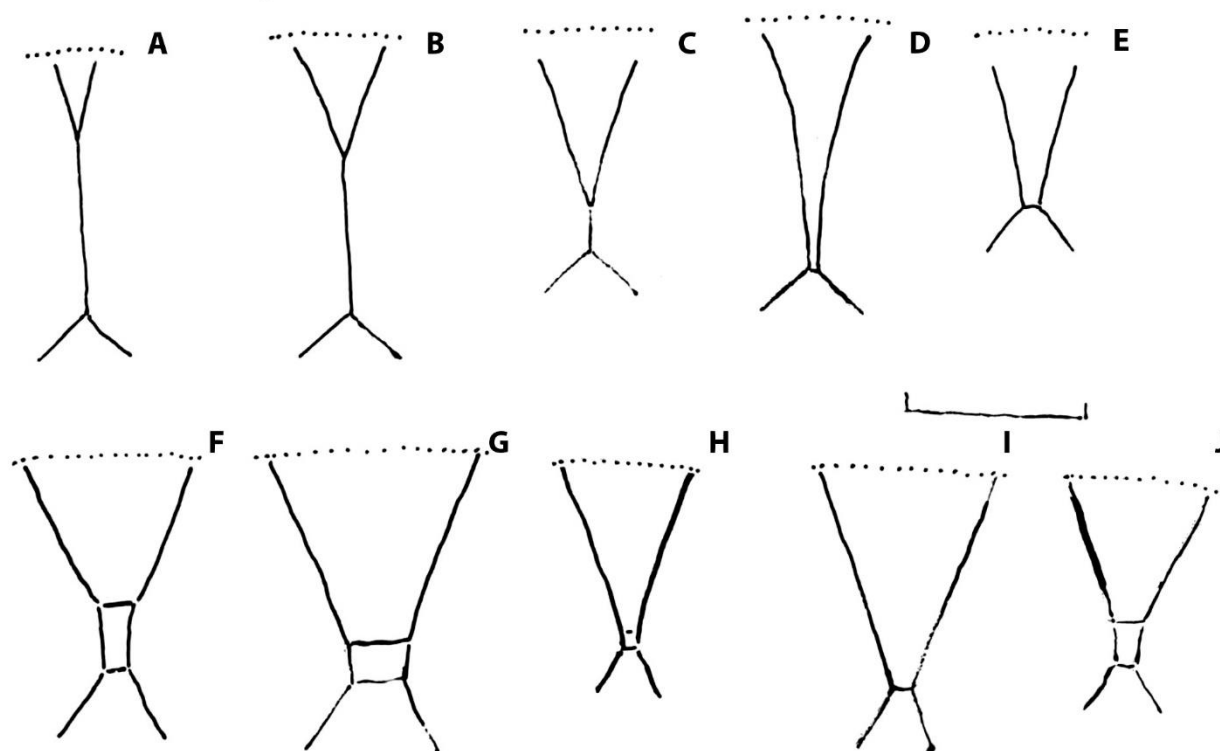


Fig. 5. Shape of area basalis of propodeum in females of *Mesochorus*. A: *M. tachypus* from Janakkala, Konttila. B: *M. tachypus* from Janakkala, Pyhämäki. C: *M. tachypus* from Janakkala, Konttila. D: *M. tachypus* from Janakkala, Pyhämäki. E: *M. tachypus* from Janakkala, Konttila. F: *M. diversicolor* from Porcupine, ex *Choristoneura fumiferana*. G: *M. diversicolor* from Mi 524 Alaska Hwy, ex *Acleris variana*. H: *M. diversicolor* from Keen Creak, ex *Acleris variana*. I: *M. diversicolor* from Mi 541 Alaska Hwy, ex *Zeiraphera* sp. J: *M. diversicolor* from Seebe, ex *Campsolechia niveopulvella*. Scale line 0.1 mm.

Kuva 5. *Mesochorus*-lajien naaraiden tauksen tyvisaran muoto. A: *M. tachypus* Janakkalan Konttilasta. B: *M. tachypus* Janakkalan Pyhämäeltä. C: *M. tachypus* Janakkalan Konttilasta. D: *M. tachypus* Janakkalan Pyhämäeltä. E: *M. tachypus* Janakkalan Konttilasta. F: *M. diversicolor*, Porcupine, kasvatettu lajista *Choristoneura fumiferana*. G: *M. diversicolor*, Alaskan valtatie, Maili 524, kasvatettu lajista *Acleris variana*. H: *M. diversicolor*, Keen Creak, kasvatettu lajista *Acleris variana*. I: *M. diversicolor*, Alaskan valtatie, Maili 541, kasvatettu lajista *Zeiraphera* sp. J: *M. diversicolor*, Seebe, kasvatettu lajista *Campsolechia niveopulvella*. Mittajana 0,1 mm.

is evident that in late autumn females only begin to hibernate there and during summer they live elsewhere. Most probably they occur higher among the twigs of the spruces where the supposed primary host caterpillars of Lepidoptera live.

It may be added that on the first excursion in 2012 one female of *Mesochorus tachypus* was swept on 15.4.2012 in Janakkala, Konttila (6757:3373) in a spruce forest. This means that the females of the

species hibernate and can be active in the spring of next year.

Mesochorus macrurus Thomson was erroneously synonymized with *M. tetricus* Holmgren by Schwenke (1999).

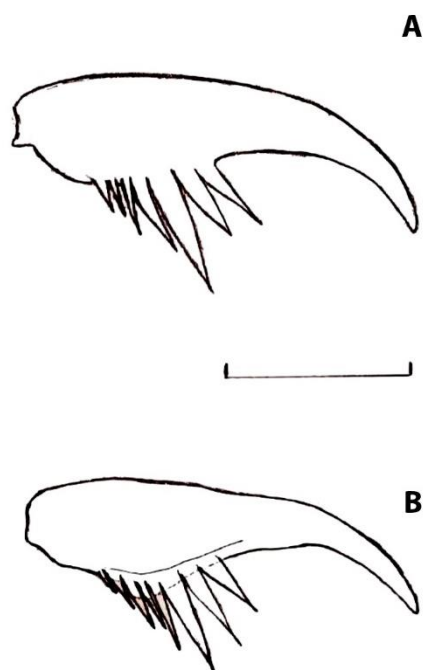


Fig. 6. Hind claws of the females of *Mesochorus*, to show teeth (setae not drawn). A: *Mesochorus tachypus* Holmgren from Janakkala, Konttila. B: *M. diversicolor* from Porcupine, ex *Choristoneura fumiferana*. Scale 0.05 mm. Kuva 6. *Mesochorus*-lajien naaraiden takakynsien hampaat sivulta (karvoja ei piirretty). A: *Mesochorus tachypus* Holmgren Janakkalan Konttilasta. B: *M. diversicolor*, Porcupine, kasvatettu lajista *Choristoneura fumiferana*. Mittajana 0,05 mm.

DNA-barcoding

Two females of *Mesochorus tachypus* from Janakkala were barcoded: The larger female (<http://id.luomus.fi/GL.2812>) with red colour was collected on 24.12.2011 in Kalpalinna and the smaller female (<http://id.luomus.fi/GL.2813>) without red colour was collected on 16.12.2011 in Pyhämäki. Their barcodes are accessible from the BOLD portal (<http://boldsystems.org>) with sequence IDs: ACUF11442-14 and ACUF11443-14. The two Janakkala *M. tachypus* barcodes are identical, and the intraspecific variation among all four European (Finland) specimens for which barcode sequences are available in BOLD is maximally 0,33 %.

3.3. *Mesochorus diversicolor* Viereck, 1912 stat. n.

Figs. 4C-D, 5F-J, 6B

Mesochorus diversicolor Viereck, 1912: 149. Holotype (♀) Duncan, British Columbia, Canada (USNM), not examined.

Diagnosis. *Mesochorus diversicolor* can be diagnosed from *M. tachypus* by the following combination of characters: 1) pale colouration of the female and 2) area basalis of propodeum not petiolate (Fig. 5F-J).

Description (holotype not examined).

Female. Body length 3.4-4.3 mm. Fore wing length 3.2-4.2 mm. Head width 0.76-0.96 mm. Head width/head height 1.13-1.23. Face and clypeus: width/height 1.11-1.19. Malar space/basal width of mandible 0.61-0.71. POL/OOL 0.69-0.96. OOL/OD 1.2-1.4. OCL/OD 1.3-1.7. Occipital carina varies medially: it may be complete with or without dipping or wanting. Width of gena/width of eye 0.60-0.71. Number of flagellomeres 31-33. Fore wing: areolet trapezoidal, sessile, leaving recurrent vein distinctly before middle. Nervulus interstitial. Nervellus reclivous. Hind femur: length/height 4.5-5.0. Hind basitarsus/hind tibia 0.42-0.48. Hind claw with 7-8 sharp teeth in basal half, 4 apical are larger and all teeth close to each other (Fig. 6B). Propodeum with complete areolation (Fig. 4C-D). Area basalis short triangular or joining more or less broadly with areola (Fig. 5F-J). Tergum 1: length/width 2.3-2.7. Tergum 2: length/width 0.86-1.12. Ovipositor sheath: length/height 6.3-7.5. Ovipositor sheath/hind basitarsus 1.08-1.30. Ovipositor sheath/tergum 1 0.88-1.04. Ovipositor sheath straight, covered with short setae, apically rounded.

Colour. Mesosoma is mostly brownish yellow, mesoscutum with brown lateral stripes and propodeum basally brownish infusate. Dasch (1971) gave detailed description of the colouration of the female.

Variation. Dasch (1971) described some regional colour variation (we examined only few specimens from rather limited area).

Male. Body 3.6-5.1, fore wing 3.3-4.4 mm long. Head width 0.80-1.01 mm. Head width/head height 1.19-1.25. Face and clypeus: width/height 1.09-1.15. Malar space/basal width of mandible 0.50-0.68. POL/OOL 0.75-1.04. OOL/OD 1.0-1.4. OCL/OD 1.2-1.8. Occipital carina medially with dipping and weakening. Width of gena/width of eye 0.54-0.62. Number of flagellomeres 29-35. Fore wing: areolet rather large, trapezoidal, sessile, leaving recurrent vein distinctly before middle. Nervulus interstitial. Nervellus reclivous. Hind femur: length/height 4.6-5.3. Hind basitarsus/hind tibia 0.43-0.45. Hind claw with minute erect teeth basally. Propodeum with complete areolation. Area basalis triangular or joining more broadly with area superomedia. Tergum 1: length/width 2.8-3.1. Tergum 2: length/width 0.98-1.33. Stylet narrow, apically rounded, often dark brown.

Colour. Coloured as in female but white on entire face and the fore and middle coxae.

Material examined. Paratype (female) 1 ♀, Duncan, B. C., reared in 1911 (paratype of *Mesochorus diversicolor* Viereck No. 301) (CNC); Non-type material: CANADA: 1 ♀, Porcupine, Ont., ex *Choristoneura fumiferana* in 1944 (CNC); 1 ♀, Mi 524 Alaska Hwy, B. C., ex *Acleris variana* in 1958 (CNC); 1 ♀, Mi 541 Alaska Hwy, B. C., ex *Zeiraphera* sp. in 1958 (CNC); 1 ♀, Seebe, Alta., ex *Campsiolechia niveopulvella* on aspen in 1957 (CNC); 1 ♀ 1 ♂, Keen Creak, B. C., ex *A. variana* in 1956 (CNC); 1 ♂, Hornepayne, Ont., ex *C. fumiferana* in 1948 (CNC); 1 ♂, Geraldton, Ont., ex *C. fumiferana* in 1962 (CNC); 1 ♂, The Pas, Manitoba, from host on W. Poplar in 1954 (CNC); 1 ♂, Maria-P., Quebec (CNC); USA: one female and one male, California, Coyote Lake (CNC).

Comparison of the specimens from Canada and USA with specimens from Sweden and Finland

The North American females are very pale; their pronotum (except sometimes lower lateral parts), mesoscutum (except often longitudinal lateral stripes), mesoscutellum, mesepisternum, metanotum, lower metapleuron and apical propodeum are yellowish red (almost the same

colour as the legs). Thus they are even paler than the palest Finnish females captured during the summer season.

The most notable difference, except the colour of the female body, between N. European and N. American specimens was found in the structure of area basalis. Most specimens in Europe have petiolated area basalis, often the petiole is much longer than the closed area. No such structure was found in any of the studied North American specimens. Otherwise both the females and males from Northern Europe and North America are very similar to each other. The claws of the females are quite similar. The study of DNA showed, that they are distinct species (see below).

Conclusion is that North American specimens belongs to *M. diversicolor* and specimens from Finland and Sweden belongs to *M. tachypus* and *M. gemellus*.

Distribution. North America. (Viereck, 1912, Dasch, 1971; as *Mesochorus tachypus*, Bennett, 2008; as *M. gemellus*).

Both sexes of North American species were described in great detail by Dasch (1971) as *Mesochorus tachypus*. Dasch studied 52 males and 74 females in the Arctic, Hudsonian, Canadian, and transition zones of North America and the adults of the species were captured from mid-May to mid-August. No specimens were found in October, November or December, as numerous females of *M. tachypus* were in Finland.

Hosts. Lepidoptera: Tortricidae and Gelechiidae. *Choristoneura occidentalis* Freeman (Viereck, 1912, Dasch, 1971, Bennett, 2008), *Acleris variana* (Fernald, 1886), *Zeiraphera* sp. and *Anacamptis niveopulvella* (Chambers, 1875) (Dasch, 1971).

The male from Munson has frontal orbits broadly white, stigma brownish yellow, posteriorly brownish infusate, hind tibia almost wholly pale and hind tarsus not infusate. Thus it has been misidentified and the host *Alsophila pometaria* mentioned by Dasch (1971) should be removed from the host list of the species.

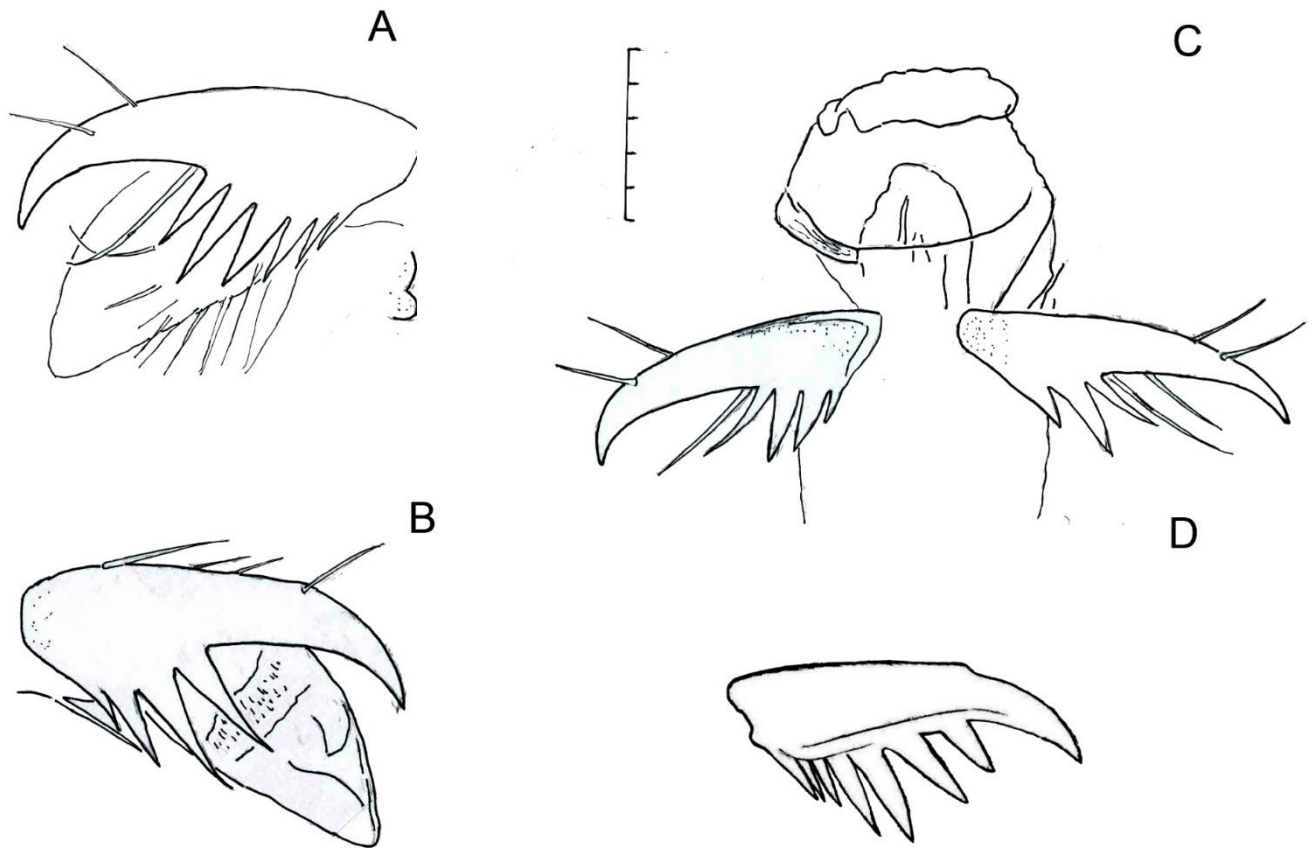


Fig. 7. Claws of the females of *Mesochorus*, to show teeth (all setae not drawn). A: Outer hind claw of *Mesochorus gemellus* Holmgren (lectotype). B: Inner hind claw of *Mesochorus gemellus* Holmgren (lectotype). C: Hind claws *Mesochorus brevicollis* Thomson (lectotype). D: Hind claw of *Mesochorus tetricus* Holmgren = *M. curvicauda* Thomson from Kalpalinna, Janakkala, Scale: 0.05 mm.

Kuva 7. *Mesochorus*-lajien naaraiden kynsien hampaat sivulta (kaikkia karvoja ei piirretty). A: *Mesochorus gemellus* Holmgren (lektotyypin), ulkotakakynsi. B: *Mesochorus gemellus* Holmgren (lektotyypin), sisätakakynsi. C: *Mesochorus brevicollis* Thomson (lektotyypin), takakynnet. D: *Mesochorus tetricus* Holmgren = *M. curvicauda* Thomson Janakkalan Kalpalinnasta, takakynsi. Mittajana 0,05 mm.

Comments. *Mesochorus diversicolor* Viereck was synonymized with European *M. tachypus* Holmgren by Dasch (1971) and *M. tachypus* further with *M. gemellus* Holmgren by Schwenke (1999). Both synonymizations were wrong and the North-American species should be called *M. diversicolor* again. Beside differences in the body colour of the female and the shape of area petiolar, the specimens from North America and Europe differ significantly in DNA (see below).

DNA-barcoding

The DNA barcode sequences of two females of *Mesochorus tachypus* from Janakkala were studied and they were identical.

All specimens from North America identified as *M. gemellus* had significantly different barcode

sequences from those Finnish specimens. In BOLD data accessible to us, the closest relative to *M. tachypus* is North American *M. "gemellus"*, with 7.19 % minimum K2P divergence between them. Considering this in addition to the morphological differences mentioned above it is justified to treat European and North American populations as different species. The intraspecific variation among the available barcodes of North American "*Mesochorus gemellus*" = *M. diversicolor* is maximally 0.32 %.

The species *Mesochorus diversicolor* Viereck which had previously been treated as a synonym of *Mesochorus tachypus*, is here treated as its separate sister species.

3.4. *Mesochorus brevicollis* Thomson, 1886 stat. n.

Figs. 7C, 8

Mesochorus (Mesochorus) brevicollis Thomson, 1886: 335. Lectotype (♀) designated by Fitton (1982).

The lectotype female of *M. brevicollis* Thomson is labeled 1) Hbg [handwritten label; =Helsinborg in Skåne, Sweden], and 2) Lectotypus ♀ *Mesochorus brevicollis* Th. Schwenke, 1968 [red label].

The condition of the lectotype: rather clean pinned specimen, head damaged on right side, antennae missing, except right scape. Left hind wing and right fore and mid-legs missing. Propodeum damaged on left side. Two apical tarsomeres of left hind leg are mounted in polyviol on slide.

Diagnosis. *Mesochorus brevicollis* is rather similar to *M. gemellus*, but it can be separated from that species by following characters: 1) smaller size (wing length 3.4 mm), 2) upper anterior corner of mesepisternum has rather dense small punctures, 3) areola leaving costula behind the middle, 4) hind claws have fewer teeth, 5) on apical part of tergum 2 the pale colour is broader laterally than medially.

Description of the lectotype

Female. Body length ca. 3.6 mm. Fore wing length 3.4 mm. Head width 1.00 mm. Head width/head height 1.28. Face and clypeus: width/height 1.38. Face width/head width 0.62. Frons width/face width 0.92. Malar space/basal width of mandible 0.74. Upper tooth of mandible slightly longer and wider than lower tooth. POL/OOL 0.93. OOL/OD 1.4. OCL/OD 1.5. Anterior frons smooth. Occipital carina medially transverse, very fine. Gena slightly flattened; width of gena/width of eye 0.67. Mesepisternum

smooth, near upper anterior corner with dense small punctures, in lower part with remote fine punctures. Fore wing: pterostigma 2.4x as long as wide, leaving radius at 0.63x length of stigma. Areolet small, length 0.20 mm, trapezoidal, sessile, leaving recurrent vein in the middle. Nervulus slightly postfurcal. Outer angle of discocubital cell acute. Hind wing: 1 hamulus on costellan fold. Nervellus slightly reclivous. Hind femur: length/height 5.0. Hind tarsus/hind tibia 1.09. Hind basitarsus/hind tibia 0.52. Hind claws (Fig. 7C) small (0.10 mm), shorter than pulvillus, outer claw with four and inner claw with three small teeth near base. Propodeum with complete areolation. Area basalis small, subrectangular. Areola longer than wide, leaving costula behind (0.62 x) the middle. Area petiolaris: length 0.24 mm, width 0.27 mm, extending 0.47x length of propodeum. Tergum 1: length/width 2.7. Postpetiolus: length/width 1.1. Tergum 2: length/width 0.69. Terga 2-6 in dorsal view 1.95x as long as maximally wide. Ovipositor sheath slightly upcurved: narrow, its length/height 8.0. Ovipositor sheath/hind basitarsus 1.05. Ovipositor sheath/tergum 1 0.76.

Head black. Clypeus and all orbitae yellowish red. Malar space and a triangular spot laterad of antennal hollows yellow. Mandibles brownish yellow, with teeth dark. Palpi brownish yellow. Vertex slightly rufous near eyes. Scape reddish yellow.

Mesosoma black. Apical corner of pronotum, tegula and base of fore wing yellow. Upper anterior corner of mesepisternum reddish. Wings clear, costa basally yellow, other veins brown. Stigma brown, basally and apically paler. Legs yellowish red, hind coxa basally slightly infuscate, hind tibia yellowish, with slight brownish infuscation on apical 0.15 part. Tarsi apically slightly brownish infuscated.



Fig. 8. Lectotype of *Mesochorus brevicollis* Thomson (ZMLU) from “Hbg” (Helsingborg), southern Sweden. A: Body in dorsal view. B: Head in anterior view. C: Body in right lateral view. D: Labels of the specimen.

Kuva 8. *Mesochorus brevicollis* Thomson –lajin lektotyypin Lundin Yliopiston Eläintieteen laitokselta. A: Ruumis päältä. B: Pää edestä. C: Ruumis sivulta. D: Yksilön etiketointi.

Metasoma black. Postpetiolus apically narrowly yellow. Tergum 2 medially with apical 0.3 part and laterally with apical 0.6 part brownish yellow. Tergum 3 basally brown and in apical 0.6 part mostly yellow. Tergum 4 from brown to yellow, apical terga telescoped inside it. Sheath pale brown.

Male. Unknown

Material examined. Lectotype (female): SWEDEN, Skåne, Helsingborg, Thomson (ZMLU)

Distribution. Europe. *M. brevicollis* is present in Bulgaria, Hungary, Moldova, Poland, Romania, Slovakia and Sweden (Zwakhals 2013).

Hosts. In Sweden, the species has been recorded as a hyperparasitoid on *Acleris comariana* (Lienig & Zeller 1846) (Lepidoptera: Tortricidae) in strawberry plantations (Kemner 1927).

3.5. *Mesochorus giberius* (Thunberg, 1822)

Fig. 9

Ichneumon giberius Thunberg, 1822: 263 and 1824: 315. Lectotype (♀) from England designated by Horstmann, 2004: 59, examined (UUZM).

Mesochorus thoracicus Gravenhorst, 1829. Lectotype (♂), from Sickerhausen near Kitzingen, Germany was designated by Townes et al. (1965). Synonymized by Roman (1912). Not examined.

Mesochorus sylvarum Curtis, 1833: plate 464. Lectotype (♂), from Great Britain or Ireland in coll. Curtis/Melbourne, designated by Fitton (1976: 323). Synonymized by Horstmann (2006). Not examined.

Diagnosis. *Mesochorus giberius* has the following combination of characters: Facial orbits slightly diverging anteriorly. Frontal orbits broadly yellowish white to lateral ocellus. Mesoscutum and mesepisternum entirely or almost entirely red. Metasoma black, with apical margins of terga narrowly whitish. Costellan fold with 4 or 5 hamuli. It can be separated from *M. marginatus*

and *M. marginatoides* by the following combination of characters: 1) larger size (head with 1.38-1.59 mm), 2) yellowish white frontal orbits reaching lateral ocelli, triangular spot on lateral antennal toruli missing, 3) mesoscutum and mesepisternum largely red 4) metasoma mostly black with apical margins whitish and 5) 4-5 hamuli on costellan fold of hind wing.

Description (character state in lectotype in brackets).

Female. Body length 5.9-6.8 mm. Fore wing length 5.4-6.4 (5.4) mm. Head width 1.38-1.59 (1.56) mm. Head width/head height 1.22-1.30. Face and clypeus: width/height 1.27-1.28. Malar space/basal width of mandible 0.30-0.35. POL/OOL 0.96-1.00. OOL/OD 1.5-1.6. OCL/OD 1.5-1.6. Occipital carina missing medially behind ocelli. Width of gena/width of eye 0.82-0.92. Number of flagellomeres 35-37. Fore wing: areolet trapezoidal, sessile, leaving recurrent vein before middle. Nervulus interstitial. Costellan fold with 4 hamuli (with 5 hamuli in both wings of one female). Nervellus slightly reclivous. Hind femur: length/height 4.6-4.9. Hind basitarsus/hind tibia 0.44-0.45. Claws strongly pectinate. Propodeum with complete areolation area (Fig. 9D) superomedia narrow. Area basalis narrow, triangular. Petiolar area short. Tergum 1: length/width 2.2-2.3. Tergum 2: length/width 0.78-0.78. Ovipositor sheath: length/height 6.0-6.7. Ovipositor sheath/hind basitarsus 1.0-1.1. Ovipositor sheath/tergum 1 0.70-0.71. Ovipositor sheath in apical 0.3 part slightly curved upwards and slightly narrowed, especially on lower margin.

Colour. Face, frons, ocellar area and posterior surface of head black. Malar space, mandible (except reddish brown teeth), palpi, clypeus and facial and frontal orbits to ocellus broadly whitish yellow. Outer orbit rufous. Antenna dark brown, basal flagellomeres slightly paler, with yellowish apical margins, flagellum apically infuscate. Mesosoma rufous, propodeum blackish, except apicolaterally rufous. Wings clear, veins brown, pterostigma brownish yellow, with anterior and posterior margins brownish. Metasoma black, apical margins of terga 2-5 narrowly whitish.

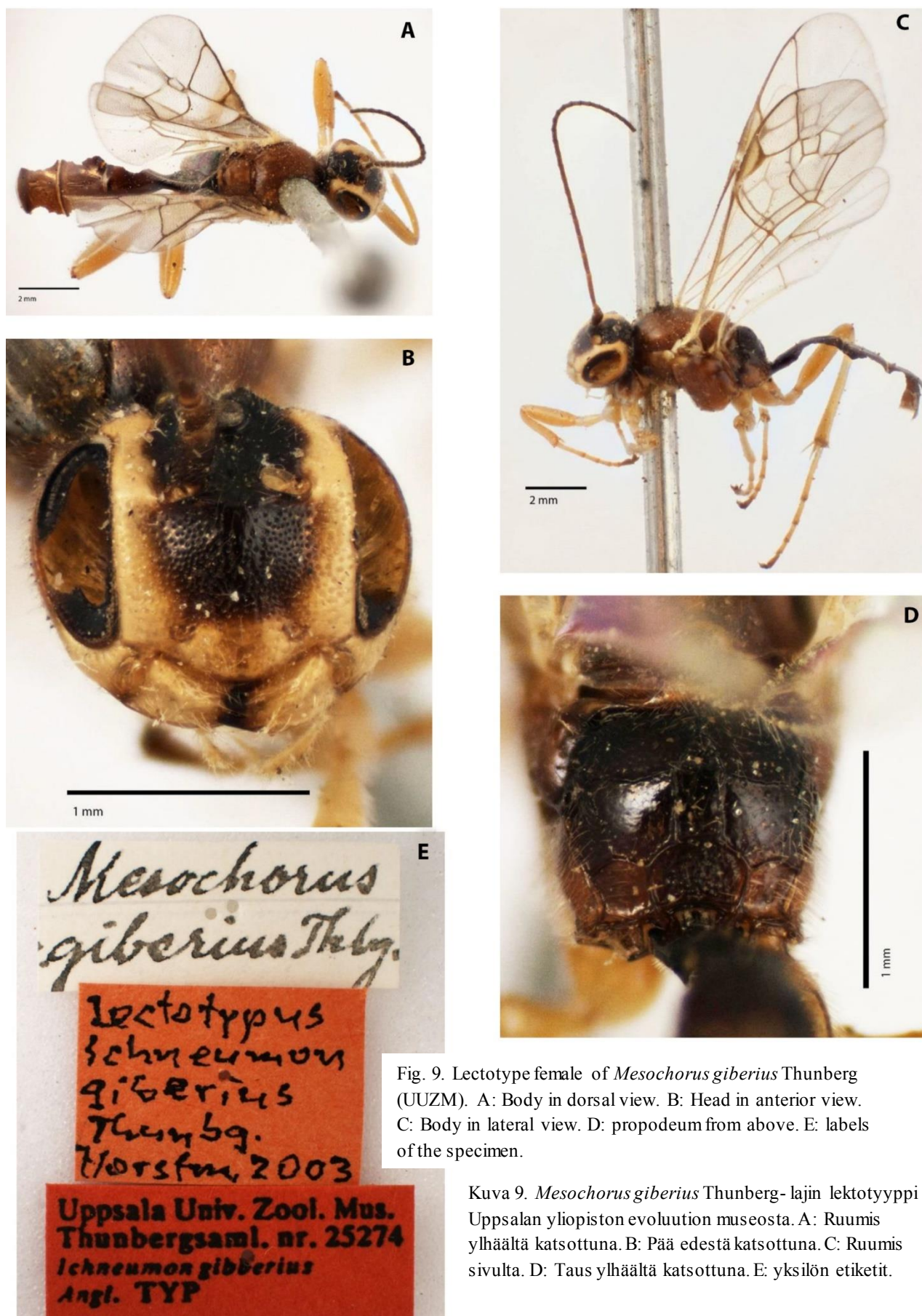


Fig. 9. Lectotype female of *Mesochorus giberius* Thunberg (UUZM). A: Body in dorsal view. B: Head in anterior view. C: Body in lateral view. D: propodeum from above. E: labels of the specimen.

Kuva 9. *Mesochorus giberius* Thunberg-lajin lektotyypin Uppsalan yliopiston evoluution museosta. A: Ruumis ylhäältä katsottuna. B: Pää edestä katsottuna. C: Ruumis sivulta. D: Taus ylhäältä katsottuna. E: yksilön etiketit.

Male. Body length 5.8-7.4 mm. Fore wing 5.0-5.8 mm long. Head width 1.43-1.56 mm. Head width/head height 1.23-1.32. Face and clypeus: width/height 1.32-1.32. Facial orbits slightly converging anteriorly. Malar space/basal width of mandible 0.37-0.42. POL/OOL 0.83-1.00. OOL/OD 1.3-1.4. OCL/OD 1.2-1.6. Vertex/face width 0.94-0.95. Occipital carina missing medially behind ocelli. Width of gena/width of eye 0.89-0.93. Number of flagellomeres 35 (n=1). Costellian fold with 3 hamuli. Hind femur: length/height 4.45-4.65. Hind basitarsus/hind tibia 0.43-0.44. Hind claw with 11-12 teeth which reach near apex of claw, 2-3 basal teeth are small, 9 apical teeth long, apically rounded, all teeth close to each other. Tergum 1: length/width 2.1-2.5. Tergum 2: length/width 0.84-1.03. Stylet brownish black, apically rounded, in one female slightly thickened apically, 0.65x as long as hind basitarsus.

Colour. The male is similarly coloured as the female, except that the face is whitish and medially pale brownish, and propleuron and prosternum are reddish (in female propleuron can be partly infuscate and prosternum is blackish).

Material examined. Lectotype (female), GREAT BRITAIN or IRELAND (UUZM), Non-type material: FINLAND. Varsinais-Suomi: Lohja ("Lojo"), 22.6.year? 1 ♂, 28.6.year? 1 ♂, leg. Håkan Lindberg (MZH). Uusimaa: Munksnäs (now Helsinki, Munkkiniemi), 1 ♀, leg. E. Lindqvist (4782, label bluish red; MZH). Tvärminne, Zoological Station (now belongs to Hanko), Krogen 6.6.-7.6.1910 1 ♀, leg. L. v. Essen (1315, label pale reddish; MZH). Ladoga Karelia: Parikkala, Likolampi, grove near church, 22.6.1945 1 ♂, leg. W. Hellén (1873; label whitish; MZH). Parikkala, Laurila, 21.6.1940 1 ♀ (8599), 28.6.-29.6.1940 1 ♀ (8737), leg. I. Hellén (8737, yellowish label; 8599, yellowish label; MZH). Parikkala, 16.6.-27.6.1940 1 ♀, leg. S. Hellén (9695, yellowish label; MZH). RUSSIA. Karelian Republic, Käkisalmi ("Kexholm"), 19.7.1886 1 ♀, leg. J. Sahlberg (515, "thoracicus Grav.", MZH). Leningrad area, Räisälä, 22.6.1920 1 ♀, leg. W. Hellén (83, brown label, black underline; MZH).

Distribution. Palearctic and Oriental regions (Yu et al. 2012). The records from Nearctic region were based on a nomenclatural error (see Comments).

Hosts. Coleoptera, Chrysomelidae: *Agelastica alni* (Linné) (Jolivet 1950), *Chrysolina didymata* Scriba (Jolivet & Théodoriès 1951), *C. hyperici* (Forster) (Jolivet & Théodoriès 1951), *Chrysomela varians* (Schaller) (Jolivet 1950), *Galerucella lineola* Fabricius (Jolivet 1950).

Comments. Horstmann (2006) stated that one further synonym of *Mesochorus giberius* is *M. sylvarum* Curtis, 1833, and that the valid name for *M. sylvarum* (Haliday, 1838) is *M. atriventris* (Cresson, 1872). Dasch (1971: 237) mis-named the North American specimens as *M. sylvarum* Curtis, when actually they were *M. sylvarum* Haliday (= *M. atriventris*). Based on this Yu et al. (2012) and Yu (2012) erroneously reported *M. giberius* from N. America.

Surprisingly, using the key in Dasch (1971) the Finnish females of *M. giberius* do not run to the *thoracicus* group, but to the couplet 78 and *M. oblitteratus* Dasch, 1971. This species is placed in *M. noctiphagus* group and it has been reared from a species of *Chrysomela?* sp. (Coleoptera: Chrysomelidae) via *Grisdalemyia* sp. (Diptera: Tachinidae). Thus the names of these two species groups in Dasch (1971) need re-naming.

Specimens of *Mesochorus giberius* are attracted to light, as published by Hellén (1953): Uusimaa: Helsinki, Kulosaari (as Brändö).

3.6. *Mesochorus marginatus* Thomson, 1886 stat. n.

Figs. 10A, 11

Mesochorus marginatus Thomson, 1886: 339. Lectotype (♀) from Sweden: Scan = Skåne designated by Aubert (1966: 133) (ZMLU). (See also Fitton (1982))

Diagnosis. *Mesochorus marginatus* has the following combination of characters: Facial orbits slightly diverging anteriorly. Frontal orbits with

yellowish white triangular spot laterally to antennal toryli, the white colour narrowing upwards and not reaching lateral ocellus. Mesoscutum and mesepisternum mostly black, with red markings. Metasomal terga 2 and 3 with reddish colouration. Costellan fold with 1 or 2 hamuli. It can be diagnosed from *M. marginatoides* by the following combination of characters: 1) Mesepisternum on lower half with strong and thick punctures., 2) Hind claw with 10-11 teeth which reach near apex of claw, 2-3 basal teeth are small and sharp, 9 apical teeth very large, apically rounded, all teeth close to each other (Fig. 10A), 3) Hind tibia apically shortly slightly infusate at extreme apex, hind tarsus pale, but apical tarsomere infusate, 4) basal flagellomeres pale and 5) medial keel on face sharper. It can be diagnosed from *M. giberius* (Thunberg) by the following combination of characters 1) it is a smaller species: head width 1.10-1.37 mm, 2) Facial orbits slightly diverging anteriorly and 3) Frontal orbits with yellowish white triangular spot laterally of antennal toryli, the white colour narrowing upwards and not reaching lateral ocellus.

Description (character state in lectotype in brackets).

Female. Body length 4.1-5.6 (5.5) mm. Fore wing length 4.5-5.6 (5.5) mm. Head width 1.07-1.30 (1.26) mm. Head width/head height 1.21-1.21. Face and clypeus: width/height 1.14-1.25 (1.14). Malar space/basal width of mandible 0.42-0.52. POL/OOL 0.74-1.10 (1.07). OOL/OD 1.07-1.27 (1.07). OCL/OD 1.4-1.6. Occipital carina straight medially. Width of gena/width of eye 0.67-0.88 (0.72). Number of flagellomeres 36-37 (37). Fore wing: areolet trapezoidal, shortly petiolate, leaving recurrent vein before middle. Nervulus interstitial. Costellan fold with 1-2 hamuli (2 in 25 % of wings). Nervellus slightly reclivous. Hind femur: length/height 4.6-5.1 (5.0). Hind basitarsus/hind tibia 0.40-0.46 (0.43). Hind claw with 10-11 teeth which reach near apex of claw, 2-

3 basal teeth are small and sharp, 9 apical teeth very large, apically rounded, all teeth close to each other (Fig. 10A). Propodeum with complete areolation. Area basalis connected broadly with areola. Petiolar area short, reaching 0.35x length of propodeum. Tergum 1: length/width 2.5-2.8. Tergum 2: length/width 0.83-0.95. Ovipositor sheath: length/height 5.7-7.0. Ovipositor sheath/hind basitarsus 0.99-1.10. Ovipositor sheath/tergum 1 0.65-0.74. Ovipositor sheath in apical 0.3 part slightly curved upwards and slightly narrowed, especially on lower margin.

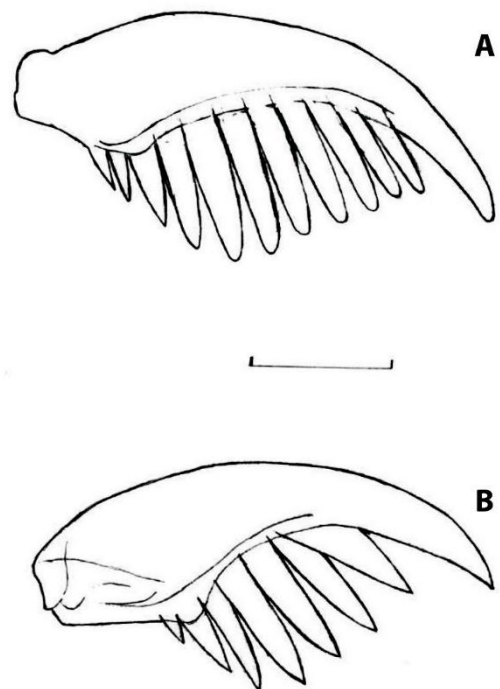


Fig. 10. Hind claws of the females of *Mesochorus*, to show teeth (setae not drawn). A: *Mesochorus marginatus* Thomson from Parikkala (leg. Hellén; 2749). B: *Mesochorus marginatoides* Vikberg sp. n. paratype from Parikkala (leg. Hellén; 680). Scale 0.1 mm.

Kuva 10. *Mesochorus*-lajien naaraiden takakynsien hampaat sivulta (karvoja ei piirretty). A: *Mesochorus marginatus* Thomson Parikkalasta (leg. Hellén; 2749). B: *Mesochorus marginatoides* Vikberg, sp. n. paratyypin Parikkalasta (leg. Hellén; 680). Mittajana 0,1 mm.

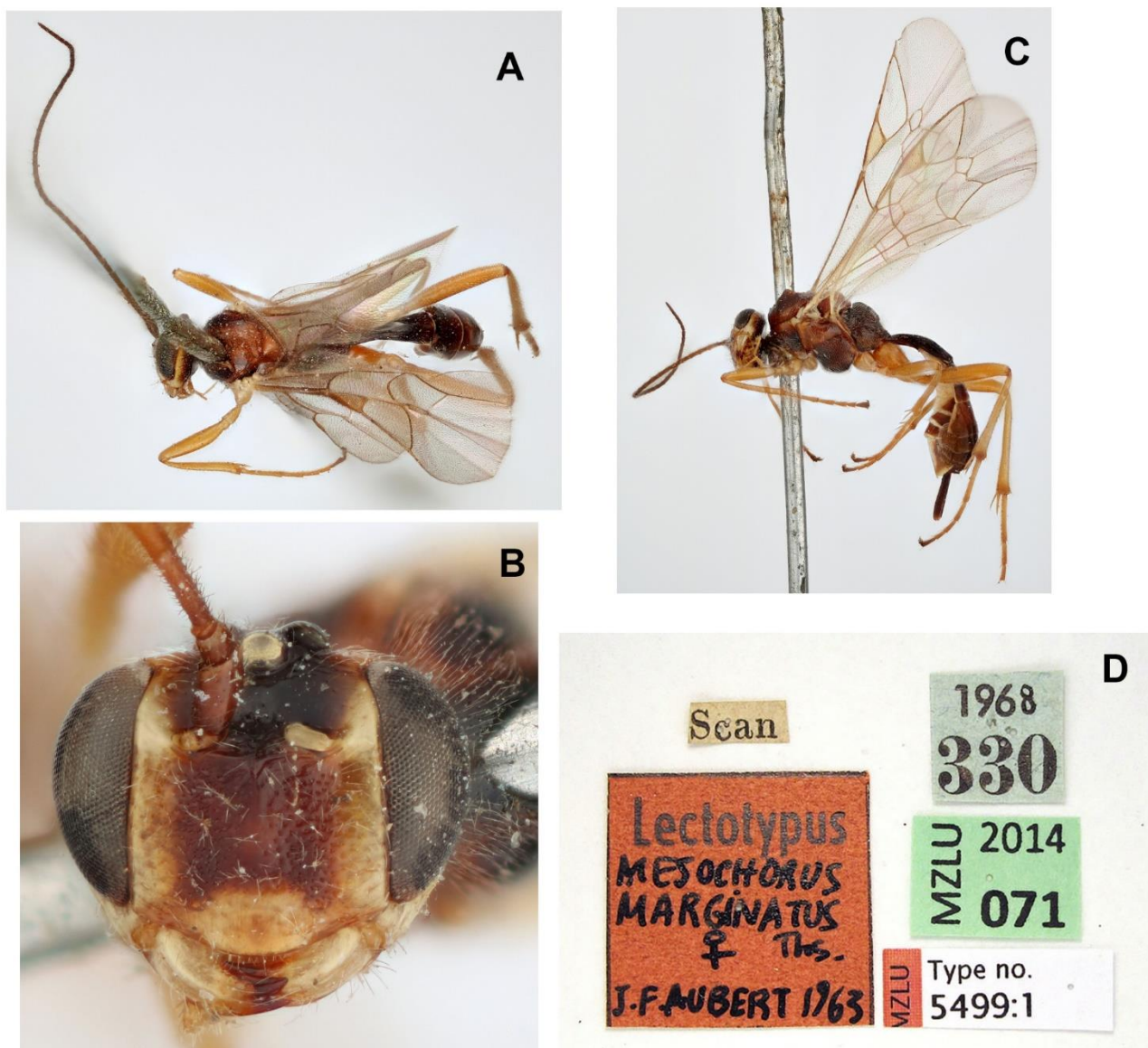


Fig.11. Lectotype of *Mesochorus marginatus* Thomson. A: Body in dorsal view. B: Head in anterior view. C: Body in lateral view. D: Labels of the specimen. Photo taken by Christer Hansson.

Kuva 11. *Mesochorus marginatus* Thomson-lajin lektotyypin Lundin Yliopiston Eläintieteen laitokselta. A: Ruumis päältä. B: Pää edestä. C: Ruumis sivulta. D: Yksilön etiketointi. Valokuvan otti Christer Hansson.

Colour. Facial orbit broadly yellow, large triangular yellow spot laterally of antennal torulus. Pronotum, mesoscutum, mesoscutellum, metanotum, mesepisternum with more or less extensive red colouration. Wing stigma brownish yellow, with hind margin brownish. Tergum 2 apically narrowly yellow and anteriorly of it red, tergum 3 in anterior 0.7 part red. Hind tibia apically shortly slightly infuscate, hind tarsus pale, but apical tarsomere infuscate.

Male. Body length 4.9-5.6 mm. Fore wing 4.2-6.0 mm long. Head width 1.10-1.23 mm. Head width/head height 1.27. Face and clypeus: width/height 1.20. Facial orbits slightly diverging anteriad. Malar space/basal width of mandible 0.35. POL/OOL 0.88. OOL/OD 1.2. OCL/OD 1.4. Vertex/face width 0.9. Number of flagellomeres 34-35. Occipital carina medially transverse, complete. Width of gena/width of eye 0.79. Costellan fold with 1 hamulus. Hind femur: length/height 4.7. Hind basitarsus/hind tibia 0.42. Hind claw with 9 teeth, 3 small teeth basally, then

3 slightly stronger erect teeth, apically 3 small teeth which are inclined towards apex, all teeth are much weaker than in female and reach near apex. Tergum 1: length/width 2.5. Tergum 2: length/width 1.04. Stylet brownish black, apically rounded, 0.7x as long as hind basitarsus.

Colour. Colours as in female, except face laterally whitish and medially pale brown.

Material examined. Lectotype (female): SWEDEN, Skåne, Thomson (ZMLU).

Non-type material: FINLAND. Åland: Eckerö, at light [yellow label], 25.6.1966 1 ♀, leg. J. Karvonen (MZH). South Savo: Mikkelin mlk. (6830:3501), light trap, 14.7.-15.7.1973 1 ♀, leg. M. Koponen (MZH). Valkeala (6772:3483), light trap, 28.7.1977 1 ♀, 29.7.1977 1 ♀, leg. M. Koponen (MZH). Ladoga Karelia: Parikkala, *ad lucem*, 10.7.1960 2 ♀♀ 1 ♂, 11.7.1960 2 ♀♀, 12.7.1960 3 ♀♀, 20.7.1960 1 ♀, 22.7.1960 1 ♀, 24.7.1960 1 ♀, 24.7.-30.7.1960 1 ♀, 26.7.1960 1 ♀, unknown date in 1960 1 ♀, leg. W. Hellén (MZH). SWEDEN. Lp. m., Bln. = Lapponia meridionalis, Boheman leg., 9/8, stood under *Mesochorus gemellus* in coll. Holmgren (NHRS-HEVA 000001036), 1 ♂. Småland, July 1941, Lbl. = Lundblad leg., "*Mesochorus gemellus* Hgn. ♀" (NHRS-HEVA 000001025) 1 ♀, Uppland. Upl., 2.9.1904, ARn = A. Roman leg. (NHRS-HEVA 000001030, stood under *M. gemellus* in coll. Holmgren), 1 ♂. Upl. 6.8.1905, ARn = A. Roman leg., "*Mesochorus gemellus* Hgn. ♂" (NHRS-HEVA 000001032); Upl., Skolp., 13.8.[19]05, A. Rn = A. Roman leg., *Mesoch. ?gemellus* Hgn. ♂" (NHRS-HEVA 000001031) 1 ♂. Upl., 13.8.1905, ARn = A. Roman leg., "*Mesochorus ad gemellus* (Hgn) ♂♀" (NHRS-HEVA 000001033) 1 ♂ 1 ♀.

Distribution. Europe (Yu et al. 2012). France (Aubert 1964); Bulgaria (Kolarov, 1981).

Hosts. Hymenoptera: Braconidae: *Meteorus versicolor* (Wesmael 1835); *Petalodes compressor* (Herrich-Schäffer, 1838) (Constantineanu, & Mustata, 1982). It has also been hatched from *Leucoma salicis* (Linnaeus, 1758) (Lepidoptera, Lymantriidae) (De Fluiter (1933), but it is probably a hyperparasitoid of one of the primary parasitoids of *Leucoma salicis*.

Comments. Thomson (1886) gave the body size as 6-8 mm in the original description.

3.7. *Mesochorus marginatoides* Vikberg sp. n.

Figs. 10B, 12, 13

Mesochorus marginatoides Vikberg sp. n. Holotype (female) from Finland, Satakunta: Karkku (MZH).

Holotype is a pinned specimen. Its left foreleg and left mid-leg are broken.

Diagnosis. *Mesochorus marginatoides* sp. n. has the following combination of characters: Subparallel facial orbits, conspicuous medial keel on face, basal flagellomeres dark, weak punctures on mesepisternum and hind tibia apically and hind tarsomeres infuscate. It can be diagnosed from *M. marginatus* by the following combination of characters: 1) subparallel facial orbits, 2) median vertical elevation of face more prominent than in *M. marginatus* and 3) Basal flagellomere dark and 4) Mesepisternum anteriorly with small and rather remote punctures.

Description (character state of holotype in brackets).

Female. Body length 5.5-6.4 (6.2) mm. Fore wing length 5.4-6.2 (6.2) mm. Head width 1.20-1.37 (1.37) mm. Head width/head height 1.21-1.28 (1.26). Face and clypeus: width/height 1.21-1.31 (1.25). Malar space/basal width of mandible 0.34-0.54 (0.34). POL/OOL 0.65-0.83 (0.83). OOL/OD 1.2-1.4 (1.2). OCL/OD 1.3-1.6 (1.3). Occipital carina dipping and missing medially. Width of gena/width of eye 0.68-0.76 (0.76). Number of flagellomeres 37-39 (39). Fore wing: areolet trapezoidal, sessile, leaving recurrent vein before middle. Nervulus interstitial. Costellan fold with 1 hamulus. Nervellus almost opposite. Hind femur: length/height 4.1-4.4 (4.1). Hind basitarsus/hind tibia 0.41-0.43 (0.43). Hind claw with 7-8 sharp teeth which reach near apex of claw, 6 apical teeth very large, all teeth close to each other (Fig. 10B). Propodeum with complete areolation. Area basalis connected broadly with areola. Area superomedia narrow, leaving costula



Fig. 12. Holotype female of *Mesochorus marginatoides* Vikberg sp. n. from Karkku. Photo taken by Pekka Malinen.
 Kuva 12. *Mesochorus marginatoides* Vikberg sp. n. lajin holotyypinaaras Karkusta. Valokuvan otti Pekka Malinen.



Fig. 13. Paratype male of *Mesochorus marginatoides* Vikberg sp. n. from Maxmo. Photo taken by Pekka Malinen.
 Kuva 13. *Mesochorus marginatoides* Vikberg sp. n. lajin paratyypikoiras Maksamaalta. Valokuvan otti Pekka Malinen.

much before middle. Area petiolaris short, extending 0.27x length of propodeum. Tergum 1: length/width 2.5-3.2 (3.2). Postpetiolus: length/width 1.2-1.7 (1.7). Tergum 2: length/width

0.84-0.97 (0.87). Ovipositor sheath: length/height 6.3-7.7 (6.4). Ovipositor sheath/hind basitarsus 0.90-1.01 (0.91). Ovipositor sheath/tergum 1 0.56-0.67 (0.57). Ovipositor sheath in apical 0.3 part slightly curved upwards and slightly narrowed, especially on lower margin.

Colour. Facial orbit yellow, yellow colour narrowing upwards, large triangular yellow spot laterally of antennal torulus. Mesosoma black, mesoscutum with reddish colour on notauli or posteriorly red, mesoscutellum and metanotum red. Wing stigma brownish yellow, with hind margin brownish. Metasoma black, tergum 2 apically narrowly yellow, tergum 3 with reddish tint or red. Hind tibia with basal 0.1 and apical 0.2 infusate, hind tarsus infusate.

Link to photos of the holotype

<http://id.luomus.fi/GL.1479>

Male. Body length 5.4-5.9 mm. Fore wing 5.1-5.6 mm long. Head width 1.20-1.35 mm. Head width/head height 1.23-1.30. Face and clypeus: width/height 1.22-1.28. Facial orbits parallel. Malar space/basal width of mandible 0.35-0.38. POL/OOL 0.80-0.90. OOL/OD 1.2-1.3. OCL/OD 1.3-1.4. Vertex/face width 0.9. Occipital carina medially dipping and then shortly missing. Width of gena/width of eye 0.67-0.82. Number of flagellomeres 36-38. Costellan fold with 1 hamulus. Hind femur: length/height 4.4-4.7. Hind basitarsus/hind tibia 0.40-0.43. Hind claw with 6-7 sharp and narrow teeth, remote from each other, much weaker than in female. Tergum 1: length/width 2.3-2.8. Postpetiolus: length/width 1.4. Tergum 2: length/width 0.91-1.07, densely hairy all over. Stylet brownish black, apically rounded, 0.6x as long as hind basitarsus.

Colour. Colour of male similar to that of female, except face is whitish and medially more or less brownish.

Material examined. Holotype (female). FINLAND, Satakunta: Karkku, 9.6.1960 1 ♀, leg. K. Lahtivirta (MZH: GL.1479). Paratypes: FINLAND. Uusimaa: Helsingin pitäjän [now Helsinki, Nordsjö], 11.6.1959 1 ♀ at light, leg. O. Ranin (CVV). Helsinki, 11.6.1959 1 ♂, leg. V. Vikberg (CVV). [Kirkkonummi], Siikajärvi, at light, 15.6.1961 1 ♀, leg. V. J. Karvonen (MZH).

South Häme: Ruovesi, Mustajärvi, 20.6.1931 1 ♂, leg. V. Saarinen (MZH). Satakunta: Karkku, 24.6.1960 1 ♀, 7.7.1960 1 ♀, leg. K. Lahtivirta (MZH). Ladoga Karelia: Parikkala, Laurila, 11.6.1940 1 ♀, leg. W. Hellén (680); Parikkala, ad lucem, 10.7.1960 1 ♀, leg. W. Hellén (2122) (MZH). North Karelia: Juuka, 28.6.1968 1 ♂, leg. J. Perkiömäki (CVV). South Ostrobothnia: Maxmo, 4.6.-14.6.1946 1 ♂, leg. W. Hellén (MZH: GL 1480). SWEDEN. Hlm = Holmia (Stockholm), Bhn. = Boheman leg., NHRS-HEVA 000001026 and 000001027 (stood under *M. gemellus* in coll. Holmgren), 2 ♂♂.

Distribution. Finland, Sweden.

Hosts. Unknown.

Etymology. The specific epithet is derived from *marginatus* and Greek suffix *-oides* meaning similar or resembling.

3.8. *Mesochorus tetricus* Holmgren, 1860

Figs. 4F, 7D, 14

Mesochorus tetricus Holmgren 1860: 122. Lectotype (♀) hereby designated (NHRS). It is labelled Sm., Bhn. [printed labels = Sweden, Småland, leg. Boheman], *tetricus* Holmgn. (cabinet label), Lectotypus *Mesochorus tetricus* Holm. Schwenke 1969 (red label), NHRS-HEVA 000006037.

Condition of the lectotype: pinned specimen. Antennae broken (left with 20 and right with 6 flagellomeres), forewings partly damaged, left hind leg missing.

Mesochorus (Mesochorus) curvicauda Thomson 1886: 335. Lectotype (♀) designated by Fitton (1982) (ZMLU), **syn. n.** It is labelled Ö. [printed label = Sweden, Öland], *curvicauda* [cabinet label], Lectotypus ♀ *Mesochorus curvicauda* Th. Schwenke, 1968 [red label], *Mesochorus tetricus* Holmgren ♀ det. Schwenke [red label].

Condition of the lectotype: pinned specimen. Left antenna broken, right entire, with 36 flagellomeres. Fore wings broken near base; a complete forewing glued on the locality label

cannot therefore belong to the lectotype specimen. Hind legs, except left coxa missing.

Link to photos of the lectotype of *M. curvicauda*
<https://www.flickr.com/search/?text=Mesochorus%20curvicauda>

Diagnosis. *Mesochorus tetricus* has the following combination of characters: Red colour on lateral pronotum, mesonotum and upper anterior mesepisternum, area petiolaris large and extending to half length of prodeum, and long ovipositor sheath strongly decurved. It can be distinguished from *M. recurvatus* Dasch by the following characters (character states of *M. recurvatus* in brackets): 1) Scape and pedicle black (rufous) 2) face brownish black (rufous), 3) base of hind tibia reddish (infusate) 4) terga 2-3 mostly brownish black (mostly rufous, tergum 2 with infusate lateral spot, tergum 3 lightly apically infusate) and 5) tergum 1 2.0-2.2x as long as wide (2.5x as long as wide).

Description. (character state in lectotype of *M. tetricus* in brackets).

Female. Body length 3.3-5.5 (5.0) mm. Fore wing length 3.0-4.8 (4.8) mm. Head width 0.79-1.12 (1.12) mm. Head width/head height 1.17-1.18. Face and clypeus: width/height 1.11-1.15. Malar space/basal width of mandible 0.50-0.72 (0.68). POL/OOL 0.81-0.94. OOL/OD 1.3-1.7. OCL/OD 1.6-2.0. Occipital carina medially transverse (lectotype) or shortly missing medially. Width of gena/width of eye 0.71-0.81. Number of flagellomeres 28-36. Fore wing: areolet small, trapezoidal, sessile, leaving recurrent vein before middle. Nervulus slightly antefurcal (lectotype) or interstitial. Nervellus slightly reclivous. 1 hamulus on costellan fold. Hind femur: length/height 4.0-4.7 (4.2). Hind basitarsus/hind tibia 0.46-0.49 (0.48). Hind claw with 6-7 sharp teeth, apical 4 strong teeth reaching rather near apex, two apicalmost teeth are separated from each other (Fig. 7D). Propodeum polished, with complete areolation (Fig. 4F). Area basalis triangular, with petiole or more broadly connected with areola (Fig. 4F, insert). Area petiolaris about as long as broad and extending to middle (0.48-0.51x) of propodeum. Tergum 1: length/width 2.0-2.2. Postpetiolus: length/width 1.0 (1.00). Tergum 2:

length/width 0.57-0.67. Ovipositor sheath: length/height 7.9-9.4 (7.9). Ovipositor sheath/hind basitarsus 1.32-1.43 (1.38). Ovipositor sheath/tergum 1 1.00-1.11 (1.00). Ovipositor sheath strongly decurved in profile, covered with rather long setae, apically rounded. Subgenital plate membranous medially.

Colour. Head black. Mandibles except teeth dark red and malar space whitish, palpi yellowish. Orbits reddish brown, face brownish black. Clypeus yellowish brown. Antenna blackish, with basal 2-3 flagellomeres brownish. Mesosoma black. Pronotum around spiracle, tegula and wing bases white. Upper part of pronotum laterally, mesoscutum, mesoscutellum and anterior upper part of mesepisternum reddish. Mesoscutum with anterior and lateral stripes blackish, and mesoscutellum anteromedially infuscate. Wings subhyaline, venation of fore wing brown, stigma dark brown, basally and apically with small, whitish area. Anterior four legs reddish brown, tarsi apically infuscate. Hind coxa reddish brown, in small females basally blackish or entirely black. Hind femur reddish brown, hind tibia yellowish white, basal 0.1 part reddish and apical 0.2 part blackish. Hind tarsus infuscate, basal 0.55 part of basitarsus pale. Metasoma brownish black, tergum 1 black. Tergum 2 with narrow brownish yellow apical margin. Ovipositor sheath black, its apex brownish.

Variation. Hind coxa can vary from reddish brown to entirely black.

Male. Body 3.0-5.7 mm, fore wing 3.7-4.7 mm long. Head width 0.94-1.16 mm. Head width/head height 1.18-1.23. Face and clypeus: width/height 1.05-1.06. Lateral margins of face very slightly converging ventrad. Face width/head width 0.55-0.56. Malar space/basal width of mandible 0.48-0.72. POL/OOL 0.80-0.87. OOL/OD 1.1-1.2. OCL/OD 1.2-1.5. Occipital carina medially transverse, shortly missing medially. Width of gena/width of eye 0.57-0.63. Number of flagellomeres 32-38. Fore wing: areolet small, trapezoidal, sessile, leaving recurrent vein before middle. Nervulus interstitial. 1 hamulus on costellan fold. Nervellus reclivous. Hind femur: length/height 4.7. Hind tibia lacking spines on lateral surface. Hind basitarsus/hind tibia 0.48.

Hind claw with 4 weak teeth near the base. Propodeum polished, with complete areolation. Area basalis triangular, with or without petiole. Area petiolaris about as long as broad and extending almost middle (0.49x) of propodeum. Tergum 1: length/width 2.6. Tergum 2: length/width 0.94. Stylet narrow, apically not pointed, 0.83-0.88x as long as hind basitarsus.

Colour. Facial orbits and clypeus white, face pale brown. Scape and pedicel yellow, 1-2 basal flagellomeres brownish yellow, flagellum yellowish brown to brown, apically infuscate. Pronotum and propleuron reddish yellow. Mesoscutum reddish, with three blackish longitudinal stripes, mesoscutellum red, mediobasally and apically blackish. Mesopleuron mostly reddish, partly infuscate. Legs pale, yellowish, anterior coxae and trochanters white. Apical 0.14 part of hind tibia infuscate, apices of hind tarsomeres infuscate, tarsomere 5 infuscate. Propodeum black, apically red. Tergum 1 black, tergum 2 blackish, with narrow yellow apical margin, terga 3-4 reddish brown, following terga blackish, their apical margins pale. Stylet brown.

Variation. Only two males studied and they are similarly coloured.

Material examined. Lectotype (female): SWEDEN: Småland, Boheman (NHRM). Lectotype female of *M. curvicauda*: Öland, Thomson (ZMLU).

Non-type material: FINLAND. Varsinais-Suomi: Vihti, Siikajärvi, VII-VIII.1969 1 ♀ (light trap), leg. A. Petramaa (MZH, coll. V. J. Karvonen). Uusikaupunki ("Nystad"), 23.7.-25.7.1921 1 ♀, leg. W. Hellén (941, white label, red upper line; MZH; coll. Hellén: *Mesochorus tetricus* Holmgren).

Uusimaa: Degerö (= Helsinki, Laajasalo?), 1 ♀, leg. Reuter (MZH; = *tetricus* (*curvicauda*) [by W. Hellén's hand]). Espoo, Siikajärvi, VIII.1968 1 ♀ (light trap), leg. O. Railo (MZH, coll. V. J. Karvonen). Helsingin pitäjä, 26.5.1969 1 ♀, leg. V. J. Karvonen (MZH, coll. V. J. Karvonen). Helsinki, 27.5.1962 1 ♀, leg. Karvonen (MZH, coll. V. J. Karvonen). Helsinki, 2.6.1977 1 ♀, leg. E. Karvonen (MZH, coll. V. J. Karvonen; *Mesochorus curvicauda* Thomson ♀ R. Jussila det. 2010). Helsinki, Lassila (6682:3382), 5.6.1980



Fig. 14. Female lectotype of *Mesochorus tetricus* Holmgren = *M. curvicauda* Thomson. A: Body in dorsal view. B: Head in anterior view. C: Body in lateral view. D: Labels of the specimen. E: Female specimen from Janakkala, Kalpalinna, on 9.11.2013. Body length 4.1 mm. Photo (E) taken by Pekka Malinen.

Kuva 14. *Mesochorus tetricus* = *M. curvicauda* Thomson lajin lektotyypinaaras. A: Ruumis päältä. B: Pää edestä. C: Ruumis sivulta. D: Yksilön etikointi. E- lajin naaras Janakkalan Kalpalinnasta 9.11.2013. Ruumiin pituus 4,1 mm. Valokuvan (E) otti Pekka Malinen.

1 ♀, leg. M. Koponen (MZH; *Mesochorus orbitalis* Holmgren ♀ R. Jussila det. 2010). Kirkkonummi, Luoma ("Bobäck"), 22.7.1952 1 ♀, leg. W. Hellén (210, pale brown label, MZH; coll. Hellén: *Mesochorus tetricus* Holmgren). Nurmijärvi, Rajamäki (6715:3375), 10.10.1987 1 ♀, leg. M. Koponen (MZH; *Mesochorus orbitalis* Holmgren ♀ R. Jussila det. 2010).

South Häme: Janakkala, Kalpalinna (6759:3370), 10.10.1999 1 ♀, 3.11.1999 1 ♀, 12.11.1999 1 ♂ 3 ♀♀, 22.12.2013 3 ♀♀, 29.12.2013 6 ♀♀, 1.1.2014 1 ♀, 9.1.2014 2 ♀♀, leg. V. Vikberg. Janakkala, Kalpalinna (6760:3370), 9.11.2013 2 ♀♀, leg. V. Vikberg. Janakkala, Kirinmylly (67639:33808), 31.12.2013 1 ♀, leg. V. Vikberg. Janakkala, Laurinmäki (6755:3369), 26.12.2013 1 ♀, leg. V. Vikberg. Janakkala, Turenki, Konttila (6757:3373), 26.10.2014 4 ♀♀, 3.11.2014 2 ♀♀, 22.11.2016 2 ♀♀, leg. V. Vikberg. Janakkala, Turenki, Otila (6757:8375), 30.12.2013 1 ♀, 12.11.2014 2 ♀♀, leg. V. Vikberg. Janakkala, Turenki, Pyhämäki (6758:3371), 5.11.2012 2 ♀♀, 24.11.2012 2 ♀♀, 23.10.2013 1 ♀, 2.11.2015 2 ♀♀, 28.11.2015 1 ♀, 7.12.2015 1 ♂, 22.12.2015 3 ♀♀, 23.12.2016 1 ♀, leg. V. Vikberg (CVV).

Outer Ostrobothnia: Aavasaksa (in Ylitornio), 1 ♀ e larva 1981, leg. J. Karvonen (MZH, coll. V. J. Karvonen; *Mesochorus curvicauda* Thomson ♀ R. Jussila det. 2010). Orajärvi (in Pello), 1 ♀ e larva 1981, leg. J. Karvonen (MZH, coll. V. J. Karvonen; *Mesochorus curvicauda* Thomson ♀ R. Jussila det. 2010).

Distribution. Europe (Yu et al. 2012). 15 countries are listed for *M. tetricus* and 6 countries for *M. curvicauda*, but we have examined specimens only from Finland and Sweden.

Hosts. 11 hosts (primary or secondary) are listed for *M. tetricus* and one primary host for *M. curvicauda* (Yu et al. 2012), but we have examined only two reared females and their hosts are not mentioned in the labels.

Comments. Hellén (1937) reported one female *M. tetricus* from Finland and he regarded *M. curvicauda* correctly as its synonym. Schwenke (1999) regarded both *M. tetricus* and *M.*

curvicauda [sic] as valid species, although he had identified the lectotype of *M. curvicauda* as *M. tetricus*.

Mesochorus macrurus Thomson was erroneously synonymized with *M. tetricus* Holmgren by Schwenke (1999).

M. tetricus (under the name *M. curvicauda*) has been found to overwinter as adult in Germany (Sebald et al. 2000).

Specimens in Janakkala, Finland (43 females 2 males) were swept near ground in spruce forests in late autumn (from October 10 to January 9). The host species lives apparently higher on spruce and in autumn the females come down for hibernation. No specimens were captured near ground in the same places during the summer season.

DNA barcode sequence

One female (<http://id.luomus.fi/GL.2814>) from Janakkala, Pyhämäki taken on 23.10.2013 was DNA barcoded. The barcode is accessible from the BOLD portal (<http://boldsystems.org>) with sequence IDs: ACUFI1444-14.

M. tetricus shows a unique DNA barcode with nearly 6 % or wider minimum K2P pairwise divergence to all other species of *Mesochorus*.

3.9. *Mesochorus skanensis* Vikberg sp. n.

Fig. 15

Mesochorus skanensis Vikberg sp. n. Holotype (♀) from Sweden, Skåne, Lund [printed label], tetricus [cabinet label] (coll. Thomson in ZMLU). The holotype is a complete pinned specimen.

Diagnosis. The female has a long area petiolaris which reaches a little more than half length of the propodeum. The species differs from *M. tetricus* which also have a long area petiolaris, by following characters (character states of *M. tetricus* in brackets): head width/head height is larger 1.25 (1.18), face and clypeus: width/height is 1.3 (1.0-1.2), tergum 1: length/width is 2.5-2.8 (2.0-2.2), apical metasomal terga are much paler in *M. skanensis* and ovipositor sheath is only slightly recurved.

Description. (character state in holotype in brackets).

Female. Body length 4.1-4.5 (4.5) mm. Fore wing length 4.0-4.4 (4.4) mm. Head width 1.10-1.20 (1.20) mm. Head width/head height 1.23-1.25 (1.25). Face and clypeus: width/height 1.31-1.35 (1.31). Malar space/basal width of mandible 0.52-0.60 (0.52). POL/OOL 0.71-0.75 (0.71). OOL/OD 1.7-1.8 (1.7). OCL/OD 1.7-1.8. Occipital carina medially transverse. Width of gena/width of eye 0.69-0.81 (0.69). Number of flagellomeres 34-36 (36). Fore wing: pterostigma 2.8x as long as broad, leaving radius in apical 0.3 part; areolet small, trapezoidal, sessile, leaving recurrent vein slightly before middle. Nervulus slightly postfurcal. Nervellus slightly reclivous. 2 hamuli on costellan fold. Hind femur: length/height 4.2-4.4 (4.2). Hind basitarsus/hind tibia 0.43-0.46 (0.46). Hind claw with 5-6 teeth in basal 0.6 part, apical 3 teeth larger. Propodeum polished, with complete areolation. Area basalis triangular, broadly connected with areola. Area petiolaris longer than broad and extending to middle of propodeum. Tergum 1: length/width 2.5-2.8 (2.5). Postpetiolus: length/width 1.2-1.3 (1.2). Tergum 2: length/width 0.76-0.98 (0.76). Ovipositor sheath: length/height 8.0-9.9 (8.0). Ovipositor sheath/hind basitarsus 1.36-1.49 (1.36). Ovipositor sheath/tergum 1 0.94-1.00 (0.94). Ovipositor sheath slightly decurved in profile, covered with rather long setae, apically rounded. Subgenital plate membranous medially.

Colour Head blackish. Mandibles, except teeth dark red and malar space yellow, palpi brownish yellow. Clypeus and orbits broadly reddish yellow, face brownish infuscate. Antenna pale brown, scape infuscate above. Mesosoma black. Pronotum around spiracle, tegula and wing bases yellow. Upper lateral pronotum, mesoscutum, scutellum, anterior upper part of mesepisternum and metanotum partly reddish. Wings subhyaline, venation of fore wing pale brown, stigma dark brown, basally with whitish area. Anterior four legs reddish brown, tarsi apically infuscate. Hind coxa reddish brown, basally infuscate. Hind femur reddish brown, hind tibia yellowish white, basal

0.1 part reddish and apical 0.2 part blackish. Hind tarsus apically infuscate. Metasomal terga 1-2 black. Tergum 1 apically slightly yellow and tergum 2 with short yellow apical margin. Tergum 3 mostly brown, terga 4-7 brown, basally darker and with pale apical margin. Ovipositor sheath dark, its apex brownish.

Male. Unknown.

Material examined. Holotype (♀), SWEDEN, Skåne, Lund (ZMLU). Paratypes, 1 ♀, Skåne, labelled "Pål" (handwritten label) = Pålsjö; 1 ♀, Skåne, Lund (in coll. Thomson, ZMLU).

Distribution. Sweden.

Hosts. Unknown.

Etymology. The specific name is derived from Skåne, where all specimens have been captured.

Comments. Holmgren (1860) did not mention that the ovipositor sheath of *Mesochorus tetricus* is downcurved. Therefore Thomson (1886) described *M. curvicauda* as a new species, and treated the present species as *M. tetricus*.

3.10. *Mesochorus plumosus* Dasch, 1971

Mesochorus plumosus Dasch, 1971: 246. Holotype (♀), Belding, Michigan, USA (USNM), not examined.

Diagnosis. The female of *M. plumosus* can be distinguished from all other species of *Mesochorus* by the very long setae on the dorsal surface of the ovipositor sheath and its small size (wing length: 2.2-2.7 mm).



Fig. 15. Holotype of *Mesochorus skanensis* sp. n. A: Body in dorsal view. B: Head in anterior view. C: Body in lateral view. D: Propodeum from above E: Labels of the specimen. Photos taken by Christoffer Fägerström.

Kuva 15. *Mesochorus skanensis* sp. n. -lajin holotyyppi Lundin Yliopiston Eläintieteen laitokselta. A: Ruumis päältä. B: Pää edestä. C: Ruumis sivulta. D: Taus ylhäältä katsottuna E: Yksilön etikointi. Valokuvat otti Christoffer Fägerström

Description.

Finnish female. Body length 2.0-2.4 mm. Fore wing length 2.2-2.6 mm. Head width 0.57 mm. Head width/head height 1.16. Face and clypeus: width/height 1.13. Malar space/basal width of mandible 0.75. POL/OOL 0.86. OOL/OD 2.0. OCL/OD 1.9. Occipital carina transverse. Width of gena/width of eye 0.52. Number of flagellomeres 23-24. Fore wing: areolet rather small, trapezoidal, sessile, leaving recurrent vein near middle. Nervulus interstitial. Nervellus opposite, reclivous. Hind femur: length/height 5.0. Hind basitarsus/hind tibia 0.38. Hind claw small, shorter than arolium, no teeth can be seen with stereomicroscope. Propodeum with complete areolation; area basalis triangular, areola narrow. Tergum 1: length/width 3.1. Tergum 2: length/width 0.82. Ovipositor sheath: length/height 10.0. Ovipositor sheath/hind basitarsus 1.73. Ovipositor sheath long and narrow, margins tapered to apex, basally on dorsal margin with very long setae.

Colour. Similar as in North America (Dasch 1971), except as noted below.

Male. Body length 1.7-1.8 mm. Fore wing length 2.0-2.1 mm

Material examined. Non-type material: FINLAND, South Häme: Janakkala, Kesiäisjoki (6756:3367), 7.10.1993, 1 ♀, leg. V. Vikberg, and 1 ♀ and 1 ♂ from the same locality and collector on 26.8.1993, and one ♂ on 17.9.1993. Later some more females were captured in Janakkala, Kalpalinna (6759:3370), Janakkala, Hangastenmäki (6755:3369), 22.10.2011, 1 ♀, leg. V. Vikberg, Turenki, Rälssitie (6738: 3373), 24.10.2011, 1 ♀, leg. V. Vikberg, Janakkala, Kalpalinna (6760:3369), 7.8.2012, 1 ♀, leg. V. Vikberg (all CVV).

Distribution. North America. Finland. The North American species *Mesochorus plumosus* was previously reported in Finland (Koponen et al. 2008).

Hosts. The secondary hosts are adult beetles of Chrysomelidae, mostly *Phyllotreta* spp. and the primary hosts are braconids of the genus *Microctonus* (Jourdeuil 1957; Loan 1967). The

species of *Microctonus* Wesmael, 1835 are now included in the genus *Perilitus* Nees, 1819 (Yu et al. 2012).

Comments. Most characters of Finnish females fit to the description of the species in Dasch (1971). The body length is smaller (in Dasch 2.5-2.8 mm), the fore wing is shorter (in Dasch 2.4-2.7 mm). Lateral margins of face are according to Dasch parallel, in Finnish female convergent (width of face below antennal sockets 0.35 mm, at clypeal level 0.31 mm). Hind tibia hardly infusate at base and slightly infusate apically (Dasch: infusate at base and apically).

The males are very similar to the males of *M. tipularius* Gravenhorst, 1829 and they are difficult or impossible to separate from each other (Horstmann 2006).

3.11 *Mesochorus ranini* Vikberg sp. n.

Figs. 16, 17

Mesochorus ranini Vikberg sp. n. Holotype (♀) from Finland, Inari Lapland: Utsjoki (MZH). The holotype is a complete carded specimen.

Diagnosis. The characters of the new species fit the descriptions of the genus *Stictopisthus* Thomson in Dasch (1971) and Schwenke (1999). Using Dasch (1971) the nearest species could be *S. argaleus* Dasch, but many characters are different. Using the keys in Schwenke (1999) the female runs to *S. nemoralis* Schwenke, described from Germany. This species is larger (body 3.7-4.4 mm), its stigma is blackish brown. The male runs to the same species, but the mesosoma of this species has extensive red colouration and the stylet is longer (as long as hind tarsomeres 2 and 3 together).



Fig. 16. Holotype female of *Mesochorus ranini* Vikberg sp. n. from Utsjoki. Photo taken by Pekka Malinen.

Kuva 16. *Mesochorus ranini* Vikberg sp. n. lajin holotyypinaaras Utsjoelta. Valokuvan otti Pekka Malinen.



Fig. 17. Paratype male of *Mesochorus ranini* Vikberg sp. n. from Utsjoki on 15.6.1960. Photo taken by Pekka Malinen.

Kuva 17. *Mesochorus ranini* Vikberg sp. n. lajin paratyypikoiras Utsjoelta 15.6.1960 Valokuvan otti Pekka Malinen.

Description (character state in holotype in brackets).

Female. Body length 2.4-2.6 (2.4) mm. Fore wing length 2.2-2.4 (2.2) mm. Head width 0.64-0.69 (0.64) mm. Head width/head height 1.25-1.28 (1.25). Face and clypeus: width/height 1.25-1.42 (1.25). Malar space/basal width of mandible 0.55-

0.65 (0.55). POL/OOL 0.80-0.89. OOL/OD 2.4-2.6 OCL/OD 2.4-2.5. Occipital carina transverse and complete medially. Width of gena/width of eye 0.77-0.80. Number of flagellomeres 20 (20). Fore wing: areolet trapezoidal, sessile, leaving recurrent vein at or after middle. Nervulus postfurcal. Costellan fold with 1 hamulus. Nervellus slightly antefurcal. Hind femur: length/height 3.3-3.4. Hind basitarsus/hind tibia 0.45-0.50 (0.45). Hind claw small (0.05 mm long), shorter than arolium, teeth cannot be seen without making a preparation. Propodeum with area basalis fused with areola. Area petiolaris broader than long, reaching 0.31-0.34x length of propodeum. Tergum 1: length/width 2.4 (2.4). Tergum 2: length/width 0.75-0.84. Ovipositor sheath: length/height 5.0-5.5 (5.0). Ovipositor sheath/hind basitarsus 0.79-0.90 (0.90). Ovipositor sheath/tergum 1 0.51-0.63 (0.63). Ovipositor sheath in apical view slightly curved upwards, covered with few setae.

Colour. Head with face and clypeus, malar space, mandible, except teeth reddish and orbits brownish yellow. On lower frontal orbit the yellow colour broadens and on lateral vertex it forms a spot towards lateral ocellus. Genal orbits narrowly yellow, in upper part reddish. Palpi brownish. Frons medially, ocellar area and posterior surface of head black. Scape brownish black, pedicel and flagellum pale brownish, apically flagellum slightly infuscate.

Mesosoma black. Tegula brownish yellow, base of wing pale yellow. Mesoscutum with faint longitudinal reddish stripes. Wings subhyaline, veins pale brown, pterostigma brownish, slightly paler basally and apically. Legs brownish, base of mid-coxa and entire hind coxa blackish, hind femur brownish infuscate, except apically. Hind tibia pale, basally and apically slightly infuscate, apical hind tarsomeres slightly infuscate.

Metasoma black. Apical 0.07 part of tergum 2 yellow, basal 0.4-0.6 part of tergum 2 reddish brown, apical terga with narrow pale apical margins. Ovipositor sheath blackish.

Link to photos of the holotype female

<http://id.luomus.fi/GL.1477>

Male. Body length 2.9 mm. Fore wing 2.5-2.6 mm long. Head width 0.72-0.73 mm. Head width/head height 1.22-1.29. Face and clypeus: width/height 1.31. Malar space/basal width of mandible 0.6-0.8. POL/OOL 0.89-0.92. OOL/OD 1.7-2.0. OCL/OD 2.1. Occipital carina rounded and complete medially. Width of gena/width of eye 0.67-0.84. Number of flagellomeres 21-22. Mesoscutum: width/length 0.92-1.02. Hind femur: length/height 3.6-3.8. Hind basitarsus/hind tibia 0.52-0.53. Propodeum with area basalis fused with areola. Area petiolaris broader than long, reaching 0.33-0.37x length of propodeum. Tergum 1: length/width 2.3-2.4. Tergum 2: length/width 0.74-0.80. Stylet dark brown, apically rounded, 0.5x as long as hind basitarsus and 0.62-0.64x as long as hind tarsomeres 2 and 3 together.

Colour. Colour of male similar to that of female, except entire antenna darker brown. Face and clypeus brownish black. Mid- and hind coxae and mid- and hind femora blackish. Tergum 2 with apical 0.10-0.13 part yellow.

Material examined. Holotype female, FINLAND, Inari Lapland: Utsjoki kk. [7754:3501], 18.6.1960 1 ♀, leg. V. Vikberg (MZH: GL.1477). Paratypes: same locality, 14.6.1960 1 ♂ (CVV), 15.6.1960 1 ♂ (MZH: GL.1478), 19.6.1960 1 ♀ (CVV), leg. V. Vikberg.

Distribution. Finland.

Hosts. Unknown

Etymology. The specific epithet *ranini* is given after Mr. Olli Ranin, the companion of author VV in his first excursion to Finnish Lapland. He is an amateur entomologist who collected and studied many groups of insects, including subfamily Ichneumoninae, of which he described new species of Phaeogenini. Although the specimens of the new species are labelled leg. V. Vikberg, the more correct labeling could be leg. O. Ranin & V. Vikberg.

Comments. *Mesochorus ranini* sp. n. belongs to a species group for which Thomson (1886) described the subgenus *Stictopisthus* of *Mesochorus*. Most later authors have regarded this as a distinct genus, but based on a cladistic study (Wahl 1993) its species should be included in *Mesochorus*. Yu & Horstmann (1997) treated *Stictopisthus* as a synonym of *Mesochorus*, but Yu et al. (2005) and Yu et al. (2012) as a valid genus. In the checklist of Broad (2016), *Stictopisthus* is not treated as a separate genus. Thus the new species is placed in *Mesochorus*.

4. Key to the females of the studied European species of *Mesochorus*

The latest key to European species of *Mesochorus* was published by Schwenke (1999). It does not include *Mesochorus plumosus* Dasch (*M. curvulus* group) which was first described from North America, *M. cimbicis* (Ratzeburg) (*M. fulgurans* group), which was re-described and solved by Horstmann (2006), and three new species which are described in this paper. *Mesochorus giberius* does not key correctly in his key, because it has broad white frontal orbits up to the level of lateral ocelli. In the key to North American species of *Mesochorus* (Dasch 1971) *M. thoracicus* (Gravenhorst) (= *M. giberius*) was misidentified, because correctly identified specimens of *M. giberius* run in the key to *M. noctivagus* group and not to *M. "thoracicus"* group. *Mesochorus marginatus* was incorrectly united with *M. giberius*, whereas *M. tachypus* and *M. brevicollis* were incorrectly united with *M. gemellus* by Schwenke (1999). Therefore it is hoped that the key below may help to identify and distinguish the females of the included 11 species from each other. Because obviously other resembling species can be mixed with some of these 11 species, for final identification of the species comparison with descriptions in this paper or other sources is needed.

Key to females of European *Mesochorus* species in the current study

- 1 Small species, length of fore wing 2.2-2.7 mm. ... 2.
 1* Larger species, length of fore wing 3.0-6.4 mm. ... 3.
- 2(1) Pubescence of ovipositor sheath elongate dorsally and basally, longer than 0.5x length of sheath (Dasch 1971, fig. 235). Ovipositor sheath 1.6-1.8x the length of the hind basitarsus. Length of fore wing 2.2-2.6 mm. Subantennal carina notched medially. Nervulus slightly antefurcal or interstitial. ... *plumosus* Dasch
 2* Pubescence of ovipositor shorter, distinctly less than 0.5x length of sheath. Ovipositor sheath 0.8-1.0x length of hind basitarsus. Length of fore wing 2.25-2.4 mm. Subantennal carina not notched medially. Nervulus postfurcal. ... *ranini* Vikberg sp. n.
- 3(1) Body mostly yellowish brown, with black or blackish colour on head, mesoscutum, anterior and upper part of mesepisternum, propodeum and terga 1-2. Hind claw in basal half with 4 erect teeth close to each other (Horstmann 2006, fig. 32). Ovipositor sheath 8.4-9.5x as long as high, 1.0-1.2x as long as hind basitarsus. Apical 0.44 part of ovipositor sheath with its lateral surface is polished and with few setae. ... *cimbicis* Ratzeburg
 3* Ground colour of body not yellowish brown, e.g. caudal terga from 3 onwards not yellowish brown. Hind claw: teeth different. Ovipositor sheath more evenly covered by setae. ... 4.
- 4(3) Propodeum with long area petiolaris which reaches half of length of propodeum. Ovipositor sheath narrow: length/height 7.9-9.9. Ovipositor sheath long: 1.3-1.5x as long as hind basitarsus. Ovipositor more or less decurved ... 5
 4* Propodeum with shorter area petiolaris which does not reach half length of propodeum. Ovipositor sheath can be broader or not so long. Ovipositor sheath straight or slightly upcurved6
- 5(4) Ovipositor sheath strongly decurved in profile. Terga 4-7 are dark. ... *tetricus* Holmgren (= *curvicauda* Thomson).
 5* Ovipositor sheath only slightly curved downwards. Terga 4-7 are mostly pale coloured. ... *skanensis* Vikberg sp. n.
- 6(4) Hind claw with 7-10 strong teeth reaching near apex (Figs 10A-B). Larger species: length of fore wing 4.5-6.4 mm, head width 1.10-1.59 mm. ... 7.
 6* Hind claw with at most 4 strong teeth, these do not reach near apex of claw (Figs 6A and 7A-C). Smaller species: length of fore wing 3.0-5.8, head width 0.67-1.17 mm. ... 9.
- 7(6) Larger species: head width 1.38-1.59 mm. Frontal orbits broadly yellowish white to lateral ocellus. Mesoscutum and mesepisternum entirely or almost entirely red. Metasoma black, with apical margins of terga narrowly whitish. Costellan fold with 4 or 5 hamuli. ... *giberius* (Thunberg)
 7* Smaller species: head width 1.10-1.37 mm. Frontal orbits with yellowish white triangular spot laterally of antennal toruli, the white colour narrowing upwards and not reaching lateral ocellus. Mesoscutum and mesepisternum mostly black, with red markings. Metasomal terga 2 and 3 with reddish colouration. Costellan fold with 1 or 2 hamuli. ... 8.
- 8(7) Mesepisternum on lower half with strong and thick punctures. Hind claw with 10-11 teeth which reach near apex of claw, 2-3 basal teeth are small and sharp, 9 apical teeth very large, apically rounded, all teeth close to each other (Fig. 10A). Hind tibia apically slightly infusate at extreme apex, hind tarsus pale, but apical tarsomere infusate. ... *marginatus* Thomson

- 8* Mesepisternum on lower half with faint and remote punctures. Hind claw with 7-8 sharp teeth which reach near apex of claw, 6 apical teeth very large, all teeth close to each other (Fig. 10B). Hind tibia with apical 0.2 part infuscate, hind tarsus infuscate. ... *marginatoides* Vikberg sp. n.
- 9(6) Apical 0.3 part of hind tibia infuscated, hind basitarsus totally infuscate. Sheath 1.3-1.5x as long as hind basitarsus. ... *tachypus* Holmgren
- 9* Apical 0.1 part of hind tibia infuscated, hind basitarsus mostly pale. Sheath 0.9-1.1x as long as hind basitarsus. ... 10.
- 10(9) Larger (fore wing 3.9-6.2 mm long). Upper anterior corner of mesepisternum has few small punctures. Areola leaving costula before the middle. Hind claws (Fig. 7A-B): outer claw with 6 and inner claw with 4 teeth. Apical 0.2 part of tergum 2 with pale colour throughout. ... *gemellus* Holmgren
- 10* Smaller (forewing 3.4 mm long). Upper anterior corner of mesepisternum with rather dense small punctures. Areola leaving costula behind the middle. Hind claws (Fig. 7C): outer claw with four and inner claw with three small teeth near base. Pale colour on apical part of tergum 2 broader laterally than medially. ... *brevicollis* Thomson

5. Biological and Distributional Observations and Conclusions

5.1. *Mesochorus cimbicis* Ratzeburg rearings in Finland

On 24.6.1973 one cocoon of a species of *Trichiosoma* (Hymenoptera: Cimbicidae) was found on the twig of *Betula pubescens* ssp. *czerepanovii* in Enontekiö Lapland: Leutsuvaara, regio subalpina by VV. The cocoon was taken for rearing, and later in the same summer 3 females and 5 males of *Mesochorus cimbicis* emerged. The size of the cocoon is 21 x 8 mm and the wasps made 3 exit holes.

The identification of the parasitoid was made using the description of the species in Horstmann (2006). The females are 5.2-6.1 mm long, the fore wing length is 4.4-5.2 mm. The males are 5.7-6.0 mm long, and fore wing length is 4.5-4.8 mm. The ovipositor sheath is 8.4-8.9 times as long as high, and 1.0-1.15 as long as hind basitarsus. In apical 0.44 lateral surface of sheath is polished and with few setae.

The primary host species in Kilpisjärvi area is apparently not *Trichiosoma lucorum* (Linné) which has not been recorded there. According to Viitasaari (1990) the host species could be a species of *T. scalesii* Leach aggregate, which feeds

on birches there and pupates in a cocoon attached to the twig of the host plant.

One earlier rearing of *M. cimbicis* is from eastern Finland, North Karelia: Kontiolahti, Romppala (698:364). In May 1969 a small cocoon of *Trichiosoma nanae* Vikberg & Viitasaari was found on *Betula nana* by VV. Three females and two males of *Olesicampe pubescens* (Ratzeburg) (= *Limneria hyalinata* Holmgren) (Ichneumonidae: Campopleginae) emerged from the cocoon after some time and also 10 males of a pale species of *M. cimbicis*. The size of the cocoon is 15 x 6-7 mm, and the parasitoid wasps made 5 exit holes.

The males of *Mesochorus* are much smaller than those which emerged in Leutsuvaara; their body is 3.0-4.2 mm and fore wing 2.8-3.9 mm long. The antennae have 32-35 flagellomeres. Their pale colour and other characters are rather similar to those of the larger males from Leutsuvaara. So the size of *Mesochorus cimbicis* can vary considerably. The species was reported as *Mesochorus* sp. by Vikberg & Viitasaari (1991). Summary: *Trichiosoma* sp. (*scalesii* Leach aggregate) and *T. nanae* are new primary hosts and *Olesicampe pubescens* is a new secondary host for *Mesochorus cimbicis*. *Trichiosoma nanae* is a new host for *Olesicampe pubescens*.

5.2. The host of *Mesochorus bipartitus* Schwenke (Hymenoptera: Ichneumonidae)

Jussila (2011) recorded *M. bipartitus* as reared from *Lygus rugilipennis* (Coleoptera: Cerambycidae) in Sweden, Västerbotten, Umeå and in Germany, Schleswig-Holstein, Sophienhof (T. Haye leg.). No such cerambycid exists.

Haye (2004) recorded *Mesochorus* species as hyperparasitoids of *Leiophron* (as *Peristenus*) spp. (Braconidae) in *Lygus* bugs (Hemiptera: Miridae). Therefore, it is most likely that the correct primary host of *M. bipartitus* cited by (Jussila 2001) is *Lygus rugulipennis* Poppius. No specimens of *M. bipartitus* were examined in this study.

6. Discussion

The large genus *Mesochorus* is one of the most difficult genera among the Ichneumonidae. The species are in full disorder even in most large collections today. The revision of Schwenke (1999) solved some problems, but also created many new. So examination of the types is needed, if one will seriously work on this genus. The reared series of specimens from known hosts would also be useful to understand the variation of individual species.

The treatments of North American species of *Mesochorus* by Dasch (1971) and European species of the same genus by Schwenke (1999) are very different. The former is richly illustrated (462 figures) and the species are keyed by using several morphological characters and measurements and using these characters the species are divided in 17 species groups in *Mesochorus* and species of *Stictopisthus*. The latter contains only 8 figures and the key is mostly based on artificial colour characters, 231 new species of Mesochorinae are described as new out of 300 species. Theirs descriptions are short and few characters are used. This work started with the findings of hibernating females of *Mesochorus tachypus* in the spruce forests in Janakkala, South Finland, very late in the season (December of 2011). The examination of the types revealed that the species had been wrongly united with *M. gemellus*, and also *M. brevicollis* had been united with *M. gemellus*

without any reason. Later hibernating females of *Mesochorus tetricus* = *M. curvicauda* were found to occur in the same spruce forests. Also their identification proved difficult and the study of the lectotypes was needed for the final identification. The specimens of *M. gemellus* in MZH, Helsinki contained many wrongly identified specimens of other species of *Mesochorus*. This led to the study of *Mesochorus giberius* and *M. marginatus*, which had been wrongly united by Schwenke (1999). A new species (*M. marginatoides* sp. n.) was found among the misidentified specimens of *M. gemellus* and in addition, another new species (*M. ranini* sp. n.) was found in Finnish Lapland and described.

7. Tiivistelmä

Marraskuussa ja joulukuussa 2011 Janakkalan kuusimetsistä löytyi runsaana yhtä *Mesochorus*-lajia. Sen naaraita saatiin haavimalla kuusien aluskasvillisuudesta 125 yksilöä. Lajilla oli ollut poikkeuksellisen hyvä vuosi ja myöhään syksyllä naaraat ilmeisesti menivät talvehtimaan kuusien alle karikkeeseen. Lajin tunnistus tuotti vaikeuksia. Pohjois-Amerikan määrittyskirjan (Dasch 1971) mukaan yksilöt sopivat parhaiten lajiin *Mesochorus tachypus* Holmgren. Euroopan lajien revision (Schwenke 1999) yhteydessä tämä laji vietiin yhteen toisen Holmgrenin kuvaaman lajin *Mesochorus gemellus* kanssa. Koska Holmgrenin kahden lajin alkuperäiskuvauksissa on selviä eroja, oli tarpeen tutkia lajien tyyppiyksilöt Tukholman Luonnonhistoriallisesta Museosta. Osoittautui että lajit eroavat selvästi toisistaan, joten ne oli väärin yhdistetty. Pohjois-Amerikan laji *Mesochorus diversicolor* Viereck on hyvin läheinen lajille *M. tachypus*, mutta sen väritys on vaaleampi ja pieniä rakenne-eroja löytyy mm. tauksen sarkojen muodossa. DNA:ssa oli eurooppalaisten ja Pohjois-Amerikan yksilöiden välillä selvät erot, joten niitä on pidettävä eri lajeina. Wolfgang Schwenke vei myös lajin *Mesochorus brevicollis* Thomson yhteen lajin *M. gemellus* kanssa. Lektotyypin tutkiminen osoitti kuitenkin että nämä kaksi lajia eroavat selvästi toisistaan ja tämäkin synonymisointi oli aiheeton.

Mesochorus-lajien tunnistus on vaikeaa, koska lajeja on suuri määrä ja niiden erot usein pieniä. Tästä syystä useimmissa kokoelmissa ne ovat vielä sekaisin. Suomen Luonnontieteellisen Keskusmuseon kokoelmassa nimellä *Mesochorus gemellus* oli monta lajia. Wolter Hellén määrittäi aikoinaan lajin *Mesochorus tachypus* oikein, mutta hänen yksilönsä olivat nyt *M. gemelluksen* joukossa. Oikein tunnistettuja *Mesochorus gemellus* -naaraita oli muutama. Yksilöiden joukossa oli monta suuremman lajin yksilöä jotka Schwenken revision mukaan sopivat parhaiten lajiin *Mesochorus giberius* Thunberg; niiden kynnet ovat vahvasti kampahampaisia. Paremmin ne sopivat kuitenkin lajiin *M. marginatus* Thomson, 1886, minkä Schwenke synonymisoi

Thunbergin lajin kanssa. Lisäksi löytyi jokunen tätä muistuttavan kuvaamattoman lajin yksilö. Se kuvataan kirjoituksessa nimellä *M. marginatoides*. Kaikilla näillä viidellä lajilla mm. kynsien kampahampaat ovat selvästi erilaisia. Näiden mainittujen lajien lisäksi *M. gemellus* – nimen alla oli vielä monen muun lajin yksilöitä. Niiden tunnistus on vaikeaa.

Janakkalan kuusimetsistä löytyi syksyllä 1999, 2012 - 2016 toisenkin *Mesochorus*-lajin naaraita. Tämä on läheinen Pohjois-Amerikan lajille *M. recurvatus* Dasch, 1971, josta tunnetaan vain holotyypinaaras Brittiläisestä Kolumbiasta. Lajin *Mesochorus curvicauda* Thomson, 1886 lektotyypinaaraan tutkiminen varmisti sen että Janakkalan kuusimetsän laji kuuluu tähän lajiin. Lajin *M. tetricus* Holmgren, 1860 lektotyypin tutkiminen varmisti, että se on Thomsonin lajin vanhempi toisintonimi ja nyt siis validi nimi. Lajin naaraiden on aiemmin todettu talvehtivan aikuisena. Molemmilla lajeilla (*M. curvicauda* ja *M. recurvatus*) on kapea, alaspäin kaartuva munanasettimen tuppi. C. G. Thomsonin kokoelmasta Lundista löytyi läheinen uusi laji *M. skanensis*, joka munanasettimen tuppi on vain heikosti alaskaartuva.

Kellanuskea laji *Mesochorus cimbicis* (Ratzeburg) on Suomessa kasvatettu rämeellä vaivaiskoivulla elävän lajin *Trichiosoma nanae* Vikberg & Viitasaari kotelokehdoista ja Kilpisjärvellä tunturikoivun oksilla talvehtivan toisen *Trichiosoma*-lajin kotelokehdoista.

Mesochorus bipartitus Schwenke –lajin primaari isäntä on oikeasti *Lygus rugulipennis* Poppius (Hemiptera, Miridae). Lähes kaikki *Mesochorus*-suvun lajit ovat loisenloisia.

Pohjois-Amerikasta kuvatun lajin *Mesochorus plumosus* Dasch uusia löytöjä esitetään Janakkalasta. Laji on läheinen lajille *M. tipularius* Gravenhorst, mutta niiden naaraat eroavat munanasettimen tupen erilaisen karvoituksen perusteella; ensin mainitulla lajilla on tupen tyviosan selkäpuolella hyvin pitkiä karvoja, kun taas jälkimmäisen tupen karvoitus on kauttaaltaan lyhyttä.

Utsjoelta Mantojärven rannalta kuvataan tieteelle uusi laji nimellä *Mesochorus ranini*, joka kuuluu lajiryhmään, mikä usein on viety sukuun *Stictopisthus* Thomson. Yhden kladistisen tutkimuksen mukaan nämäkin lajit on vietävä suureen sukuun *Mesochorus*.

Tutkittujen 11 eurooppalaisen lajin tunnistamisen helpottamiseksi esitetään niiden naaraiden tutkimuskaava.

8. Acknowledgements

Andrew Bennett, Ottawa, Christer Hansson, Lund, Hans Mejlon, Uppsala and Pekka Malinen, Helsinki loaned specimens of *Mesochorus* which made this study possible. Martti Koponen, Mikkeli provided us with further data beyond the number codes of L. v. Essen, Wolter Hellén and J. Sahlberg. Christer Hansson and Christoffer Fägerström photographed the lectotypes of *Mesochorus curvicauda*, *M. marginatus* and the

holotype of *M. skanensis*, in C. G. Thomson's collection (ZMLU). Pekka Malinen took the photographs of the holotypes and paratypes of *Mesochorus marginatoides* and *M. ranini* and the females of *M. tachypus* and *M. tetricus* = *M. curvicauda* from Janakkala. Andrew Bennett made detailed comments and suggestions which improved the manuscript greatly. Canadian National Collection of insects, arachnids and nematodes is thanked for allowing us to barcode specimens of *M. diversicolor* and BOLD for help with barcoding of *M. tachypus* and *M. diversicolor*. Johan Nylander (Swedish Museum of Natural History/EMBIS), Juho Paukkunen (MZH) and Marko Mutanen (Oulu University) are thanked for help with analysing barcode sequences.

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