

## On the identity of three little-known *Microterys* Thomson species (Hymenoptera: Encyrtidae)

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### ABSTRACT

Illustrated redescrptions are given for three species of encyrtid wasps first described in the early 1800s: *Microterys cedrenus* (Walker), *M. cyanocephalus* (Dalman) and *M. interpunctus* (Dalman), and four new synonyms are proposed: *M. aldreysi* Japoshvili (of *M. cedrenus*), *M. dichrous* (Mercet) (of *M. cedrenus*), *M. steinbergi* Sugonjaev (of *M. cyanocephalus*), and *M. duplicatus* (Nees) (of *M. interpunctus*).

Keywords: Taxonomy, *Microterys*, redescrptions, soft scale parasitoids, Europe

### INTRODUCTION

*Microterys* Thomson, 1876, is a relatively large genus of small hymenopterans known as parasitoids of soft scale insects and mealybugs, in particular of Coccidae, Kermesidae and Pseudococcidae, with about 230 species described worldwide (Noyes 2019). Many new species of *Microterys* have been described such as the 19 Costa Rican species described by Noyes (2010), which are also preceded by a modern diagnosis of *Microterys*. In the same monumental work Noyes noted that Jensen (1989) did not provide a convincing argument regarding the valid separation of the two genera *Aschitus* Mercet, 1921 and *Microterys*. In 2011 Japoshvili shared the same point of view. Eventually Japoshvili, Higashiura & Kamitani (2016), suggested *Aschitus* as a synonym of *Microterys*. Nevertheless species of the *Microterys* (*Aschitus*) group can still be separated from other *Microterys* species by their unique and characteristic scutellum sculpture.

Several of the European species of *Microterys* established in the first half of the nineteenth century were given only short, insufficient descriptions. Though the two keys to the European/Palaearctic species of *Microterys* by Trjapitzin (1978, 1989) include two of the three species redescrbed here, these species are hard to recognize from the combinations of diagnostic characters used in these keys.

Johan Wilhelm Dalman (1787–1828) collected and published on several insect orders during the first decades of the nineteenth century, and much of this material is still stored in the collections of NHRS (see below), including his collection of encyrtids, which contains 170 specimens of about 50 species-level taxa (Fig. 1). In 1820 Dalman published the first comprehensive paper on encyrtids, as Pteromalini, giving short descriptions of 55 nominal species all placed in *Encyrtus* Latreille. The majority of the 200-year old specimens are still in good condition. Typically his



Fig. 1. — Drawer of Dalman collection with Encyrtidae.

specimens are pinned through the mesosoma with very fine pins, and the pin labels may give information about collector, *e.g.*, tiny rectangular or triangular red labels indicate Boheman. The collection contains type material for ten *Microterys* species, including the type species for the genus *Microterys*: *E. sylvius* Dalman, 1820.

Francis Walker (1809–1874) published extensively on Chalcidoidea; on Encyrtidae particularly in 1837 and 1838. Walker described almost 160 species of Encyrtidae, eight of which are currently placed in *Microterys* (*aeneiventris* Walker, 1837, *cedrenus* Walker, 1838, *colligatus* Walker, 1872, *jalyus* Walker, 1837, *madyes* Walker, 1837, *polylaus* Walker, 1846, *tanais* Walker, 1837, *zarina* Walker, 1837). Most of Walker's original material, including the lectotype of *E. cedrenus*, is deposited in NHMUK (see below). Walker's specimens (generally card-mounted, though some have been remounted on points) typically have a label with the (handwritten) taxon name on one side and 'Stood under this name in old B.M. Coll. C. Waterhouse' printed on the other. C. Waterhouse was in charge of the NHMUK – then British Museum – Hymenoptera collection in the early 20th century. In addition, some specimens have a round acquisition number label and a few also have a determination label in Walker's handwriting. Information on collector and locality is generally absent, but can often be obtained from the published descriptions.

The present paper aims to investigate the identities of three *Microterys* species, namely *E. cedrenus* Walker, *E. cyanocephalus* Dalman and *E. interpunctus* Dalman using photography to produce modern illustrated descriptions, including images of lectotypes, and diagnostic notes are provided.

## MATERIAL AND METHODS

Type material was studied in the collections of Naturhistoriska Riksmuseet, Stockholm, Sweden (NHRS); Natural History Museum, London, UK (NHMUK); Museo Nacional de Ciencias Naturales, Madrid, Spain (MNCN); and Zoological Institute Academy of Sciences, St. Petersburg, Russia (ZIN).

The images and details of gastral sclerites and ovipositor were taken of slides from specimens regarded as conspecific with the lectotypes in question. In some hypopygium images the margins are indicated with black dots. As far as possible specimen catalogue numbers are given in association with measurements and images.

At NHRS images of the lectotypes were taken with a Canon EOS 5D Mark II DSLR camera equipped with Canon MP-E 65mm 1-5× super-macro lens and mounted on a Stackshot motorised rail from Cognisys, and Canon EOS Utility software and Zerene Stacker from Zerene Systems. The image of the *Encyrtus interpunctus* (NHRS-HEVA00003136) lectotype wing in slide 4201 was taken with a Nikon DS-Ri2 camera on a Nikon SMZ25 stereo microscope with 1:1 lens, using Nis-Elements D software version 5.10.01.

At NHMUK images of the lectotype were taken with a Canon 5DsR camera + Mitutoyo 10× lens, Canon MT-24ex flash and Cognisys Stackshot, and Helicon remote software (images stacked using Helicon Focus).

Images of some of the additional specimens were taken with a Canon EOS M6 mark II, connected to a Leica M205C with a LMscope adapter and stacked using Zerene Stacker. In addition a few old 35mm negatives were digitalized and also used in this paper.

## TERMS AND MEASUREMENTS

Unless otherwise stated, terms used in this paper follow Gibson (1997: 16–44).

All measurements are in mm, unless otherwise stated; measurements of distance between points were made when both points were in focus, though measurements made on slides (as indicated) may be a little inaccurate. Measurements were repeated at least twice. After their first mention specimen catalogue numbers are abbreviated, thus specimen NHMUK013457242 is later referred to as NHM7242. In figure captions LT stand for lectotype.

Length of mesosoma was measured from the most anterior position of pronotum to the most posterior medial part of propodeum. Length of gaster was measured from the most anterior medial part of the first gastral tergite to the most posterior part of the syntergum, *i.e.*, the fused seventh and eighth gastral tergites.

*Format used for measurements:* value for the specimen used for the measurements is given first, followed by the value for the lectotype when available and the range in the examined material (*e.g.*, HW 0.72 (0.70; 0.65–0.73)).

*Abbreviations:* AC=angle of ocelli, measured as the angle between the lines connecting the centre of the anterior ocellus with the centres of each of the posterior ocelli; AOD=maximum diameter of anterior ocellus; AOL=minimum distance between anterior ocellus and one of the posterior ocelli; AxL=length of axillae; CAOL=distance between centres of anterior ocellus and one of the posterior ocelli; CL=club length; CPOL=distance between centres of posterior ocelli; CW=club width; EL=maximum length of eye; EML=minimum distance from eye to mouth

margin; EW=minimum length of eye; F1,F2–F6=funicle segments 1,2–6; F123L=combined length of F1–F3; F1L=length of F1; F1W=width of F1; F456L=combined length of F4–F6; F56L=combined length of F5–F6; FL=length of funicle; FVW=minimum width of frontovertex – often in front of anterior ocellus (Fig. 10); FWL=length of fore wing – not including marginal fringe (Fig. 7); FWW=width of fore wing (Fig. 22); GaL=length of gaster; GaW=width of gaster; GoL=length of gonostylus; HW=width of head – frontal view (Fig. 10); HWL=length of hind wing; HWW=width of hind wing; MBL=length of mid basitarsus; MesL=length of mesosoma; MscL=maximum length of mesoscutum; MscW=maximum width of mesoscutum; MSL=length of mid tibial spur; MTL=length of mid tibia; MVL=length of marginal vein; OCL=minimum distance from posterior ocellus to occipital margin; OOL=minimum distance from posterior ocellus to adjacent eye; OPL=maximum length of outer plates; OPW=maximum width of outer plates; OvL=length of ovipositor; PeL=length of pedicel; PeW=width of pedicel; PFCL=combined length of pedicel+funicle+club; POD=maximum diameter of a posterior ocellus; POL=minimum distance between posterior ocelli; PVL=length of postmarginal vein; r.m.=relative measurements; ScL=length of scutellum; ScW=width of scutellum; SL=length of scape; StL=length of stigmal vein; SVL=length of submarginal vein (Fig. 31); SW=width of scape; SyL=length of syntergum – the fused gastral tergites T7 and T8 – measured from an imaginary line connecting the anterior margins of the cercal plates to its apex; SyW=width of syntergum – measured as the distance between the outer margins of the cercal plates; TE=minimum distance between antennal torulus and adjacent eye; TL=length of torulus – measured as maximum distance between lower and upper outer margins; TMM=minimum distance between antennal torulus and mouth margin.

### *Microterys cedrenus* (Walker, 1838)

(Figs 2–14)

= *Encyrtus cedrenus* Walker, 1838: 112. Lectotype ♀ (designated by Graham 1969: 259).

= *Encyrtus dichrous* Mercet, 1921: 405–407. Lectotype ♀ (designated by Noyes 1981: 173), paralectotype ♂, syn. n.

= *Microterys dichrous* (Mercet) (Trjapitzin, 1967: 197).

= *Microterys cedrenus* (Walker) (Graham, 1969).

= *Microterys aldreysi* Japoshvili, 2011: 196–197. syn. n.

The following description of the *Microterys cedrenus* (Walker) female is based on the lectotype of *Encyrtus cedrenus* Walker, 1838, B.M.TYPE HYM 5.2929, NHMUK013457199 (NHM7199) (Figs 2–5), on the lectotype of *Encyrtus dichrous* Mercet, 1921, on slide NHMUK010148423 (NHM8423) (Figs 7–14), but essentially the description and measurements are based on the specimen NHMUK013457242 (NHM7242) (Fig. 6), which is very similar in appearance to the type material.

#### Description

♀, length of lectotype of *E. cedrenus*: 1.61mm; length of lectotype of *E. dichrous*: 1.73mm; length of NHM7242: 1.65mm; variation in studied material 1.57mm–2.04mm.

Head including occiput yellow to orange-yellow with a faded brown area on each side of clypeus above mouth margin. Ocelli dark reddish-brown (Fig. 4). Mandibles light brown with margins of teeth and truncation distinctly brown-black. Palpi light brown with light setae. Radicle yellow-light brown. Scape and pedicel yellow-light brown, scape with lower margin semi-transparent making it appear darker. F1–F3 yellow-light brown, F4 gradually changing from yellow-light brown to yellow-white, F5–F6 yellow-white, club brown-black (Figs 3–4, 6, 9). Setae

light grey between and in front of ocelli, setae black behind ocelli, along inner orbits, between eyes and mouth margin and on genae. Two black setae, one behind each of the posterior ocelli, about as long as POD, pointing backward and outward. Outer aspects of scape with grey-white setae, upper margin and inner aspects of scape and the pedicel with dark brown setae, setae of funicle segments gradually changing from dark brown to grey-white, club with brown-black setae.

Frontovertex with distinct reticulate sculpture, mesh size smaller than an eye facet. Sculpture of antennal scrobe more superficial reticulate, area below eye on each side of malar sulcus with finely elongate to irregular sculpture. Head about 4× as wide as frontovertex (Fig. 10), and head a little less wide than combined length of pedicel+flagellum, AC about 55°, antennal toruli situated closer to mouth margin than to inner eye orbit, scape about 3.1× as long as wide, F1 distinctly shorter than pedicel; club slightly longer than combined length of F4–F5–F6. Malar sulcus present, but not very distinct. Occiput relatively distinctly margined.



Figs 2–5. — *Microterys cedrenus* (Walker), ♀, LT (NHM7199): 2, dorsal view; 3, head & thorax; 4, head dorsal view; 5, left fore wing.

*Measurements.* HW 0.57 (0.57–0.64); FVW 0.13 (0.13–0.17); EL 0.34 (0.33–0.38); EW 0.31 (0.28–0.33); EML 0.21; AOD 0.04 (0.04); AOL 0.07 (0.07–0.08); OCL 0.04 (0.04); OOL 0.01 (0.01–0.02); POL 0.06 (0.06–0.09); POD 0.04 (0.03–0.04); CAOL 0.11 (0.10–0.11); CPOL 0.10 (0.095–0.12); TL 0.09; TE 0.10; TMM 0.07; SL 0.28 (0.26–0.31); SW 0.09 (0.08–0.10); PeL 0.08 (0.08–0.10); PeW 0.04 (0.04–0.05); FL 0.35 (0.32–0.37); FIL 0.05 (0.05–0.06); FIW 0.03 (0.03); F456L 0.17 (0.16–0.18); CL 0.18 (0.16–0.18); CW 0.07 (0.07–0.09); PFCL 0.61 (0.59–0.67).

Pronotum, mesoscutum, axillae, basal part of tegulae and scutellum, prepectus, mesopleuron and sides of propodeum generally light rusty yellow-orange, neck of pronotum with large dark brown spot, apical part of tegulae semitransparent making it appear darker, axillulae and lateroposterior margin of scutellum brown to dark brown, mesonotum lateral to scutellum dark brown, metanotum and propodeum medially light brown-brown. Mesoscutum with violet-golden metallic reflections, scutellum with weaker bluish-golden sheen. Fore wing infusate with most of basal area hyaline and with one hyaline band beyond venation; this hyaline band narrowed medially due to a characteristic infuscated indentation along the distal margin of the hyaline band (Figs 5, 7). All coxae, trochanters, femora and tibiae, and tarsi yellow-orange, except darker apical tarsi segments. Setae of pronotal collar, mesoscutum, tegulae, axillae and scutellum black, 10–15 setae along outer aspect of spiracle of propodeum grey-white.

Longest setae on pronotal collar about as long as AOL, setae in anterior part of mesoscutum about  $0.5\times$  AOL, longest setae along the posterior rim of mesoscutum  $0.7\times$  AOL, setae of scutellum almost as long as AOL and the bristles at the tip of scutellum slightly longer than AOL. Longest setae near spiracle of propodeum about as long as AOL. Tegulae each with five setae a little shorter than AOL. Legs generally with grey-white setae, anterior aspects of all femora with short dark brown setae. Mid tibia with setae uniform throughout, without a patch of conspicuously more dense setae externally. Sculpture of mesoscutum anteriorly with superficial imbricate-reticulate, posteriorly with superficial irregular reticulate sculpture, sculpture of scutellum a little deeper and more coarse than on mesoscutum (Fig. 3), anteriorly almost imbricate-reticulate and posteriorly irregular reticulate, scutellum moderately convex in profile (Fig. 6). Propodeum very superficially irregularly sculptured.

Visible part of mesoscutum about  $1.8\times$  as wide as long, and with short deep traces of notaular lines in antero-lateral part of mesoscutum; scutellum slightly longer than wide. Mesopleuron not quite touching base of gaster. Fore wings about  $2.4\times$  as long as wide, submarginal vein a little shorter than width of fore wing (Fig. 7), marginal vein about as long as postmarginal vein, and both a little shorter than stigmal vein (Fig. 8). Basal area of fore wing with a moderate sized basal cell, black setae in anterior part of basal area and with grey-white setae in posterior part of basal area, filum spinosum present with 3 thickened setae (Fig. 11). Mid tibial spur about as long as mid basitarsus. Apex of mid tibia anteriorly margined with uniform pegs, ventral surface of basitarsus with several pegs, and ventral surface of mid tibial spur with relatively coarse setae.

*Measurements.* MesL 0.77; MscL 0.30 (0.25–0.35); MscW 0.55 (0.55–0.65); ScL 0.32 (0.32–0.41); ScW 0.30 (0.28–0.36); FWL 1.43 (1.43–1.69); FWW 0.60 (0.60–0.72); HWL 1.07 (1.07–1.33); HWW 0.31 (0.31–0.39); SVL 0.56 (0.56–0.69); MVL 0.09 (0.09–0.10); StL 0.10 (0.09–0.11); PVL 0.09 (0.09–0.10); MTL 0.56 (0.56); MSL 0.19 (0.18–0.19); MBL 0.19 (0.18–0.19).

Gaster brown, anterior part of the first tergite light brown like the edges of the gaster. Gaster with very superficial reticulate sculpture almost appearing smooth. Each side of dorsal part of the gastral tergites with a single transverse line of 4–6 setae, about  $0.5\times$  as long as AOL, which are parallel to the posterior margin of the tergites and situated about midway between the visible anterior and posterior margins of the tergites. Gastral sternites with several lighter setae about as long as AOL, visible part of outer plates of ovipositor with several black stronger setae as long as AOL, and posterior rim of each outer plate with two long black setae one on each side of the plates about  $1.5\times$  as long as AOL.

Gaster a little shorter than mesosoma, but a little longer than length of mid tibia, which is longer than length of syntergum. From slide NHM8423: syntergum about  $1.5\times$  wider than long (Fig. 12). Hypopygium incurved (Fig. 13). Mid tibia distinctly shorter than ovipositor (Fig. 14), but slightly longer than length of outer plates, mid tibial spur slightly longer than length of gonostyli.

*Measurements.* GaL 0.66; SyL 0.40. From slide NHM8423: MTL 0.56; MSL 0.19; SyL 0.37; SyW 0.55; OvL 0.71; OPL 0.54; OPW 0.13; GoL 0.17.

*Variation.* In some specimens the areas on each side of clypeus above mouth margin appear slightly brownish darkened. The mandible colour varies from light brown to brown. Areas near posterior ocelli and between anterior and posterior may appear darker, brown to dark brown. The infuscation of fore wing along the distal margin of the hyaline band sometimes appears like five darker spots. AC may vary from 50° to 65°. Scape may vary from 3× to 3.5× longer than wide. Funicle varies from segments F1–F3 slightly darker than segments F4–F6 to funicle segments progressively becoming slightly lighter distally. Club about as long as or slightly longer than combined length of F4–F5–F6.

#### *Description of male*

♂, length: 1.5mm (according to Mercet 1921). Head generally black-brown, with blue sheen, vertex also with golden-green sheen. Lower face and gena with white setae. Scape lemon yellow, pedicel brown, funicle and club yellow-brown. Thorax generally black brown, except for yellow dorsolateral corners of pronotum; pronotum with dark blue and posteriorly also bronzy metallic reflections, mesoscutum with dark bluish-green, axillae with bronzy and scutellum with bronzy-copper reflections, tegulae yellow basally and brownish apically; mesopleuron, metanotum and propodeum with bluish reflections. Legs yellow, except darker hind coxae with green metallic reflections. Wings hyaline. Gaster generally black brown, anteriorly with bluish-green posteriorly with bronzy reflections. AC 60°, posterior ocelli separated from inner orbits by distance equal to POD. Antennae inserted towards the centre of the face, at the level of lower eye margin. Scape short, flattened, somewhat widened towards the centre, as long as first funicle segment, pedicel as long as wide, much shorter than the following segments, all funicle segments longer than wide, progressively becoming shorter distally, club lanceolate, a little shorter than the two preceding funicle segments together. Mesoscutum dotted-chagrinate, with transverse rows of small white setae, scutellum somewhat convex, punctate-chagrinate, with greyish setae, which are longer and thicker than those of mesoscutum. Gaster subtriangular, convex, slightly truncated at apex, shorter and narrower than the thorax.

#### *Material examined*

Type material: Lectotype of *M. cedrenus*, ♀, FRANCE (southern): no further data, B.M.TYPE HYM 5.2929 (NHM7199). Lectotype of *M. dichrous* ♀, SPAIN: Madrid, Chamartin, 20.vi.1916, leg. R.G. Mercet.

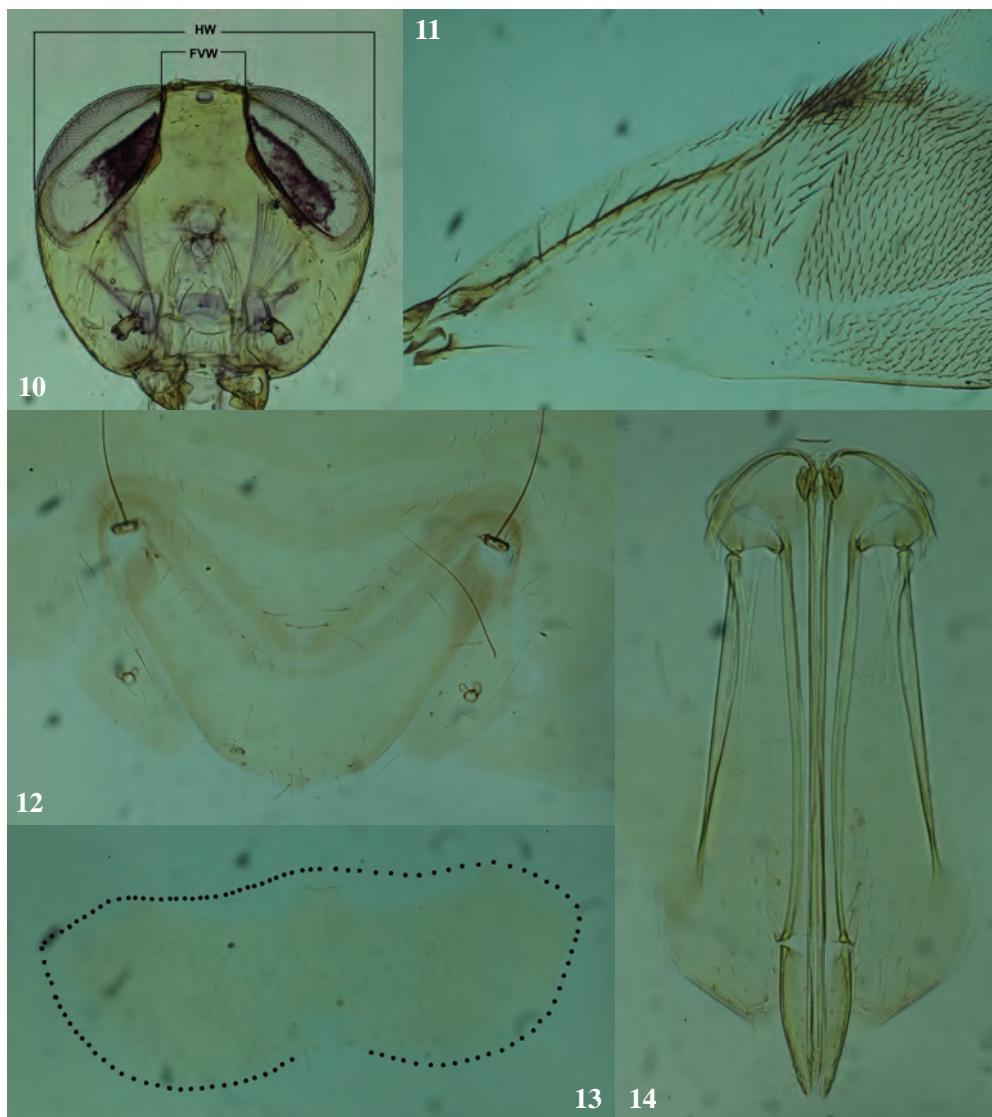
Other material: SPAIN: Madrid, El Pardo, 1♀, 28.vi.1973, leg. Z. Boucek (slide NHM8423). 1♀, 29.vi.1973, leg. Z. Boucek (NHM7242). PORTUGAL: Algarve, Portimão, 2♀♀, 19.ix.1983, leg. J.S. Noyes (NHMUK). 1♀ no location given, labelled ex *Nidularia pulvinata* – *Encyrtus dichrous* Mercet (NHMUK013456784) (NHM6784).

*Biology:* Parasitoid of *Nidularia pulvinata* (Planchon) (Hemiptera, Kermesidae; formerly placed in Eriococcidae). The *M. cedrenus* specimen (NHM6784) apparently was reared from *N. pulvinata*. Japoshvili reported *N. pulvinata* as host of his species *Microterys aldreyi*. From Italy Roberto *et al.* (2016) reported severe damage of *N. pulvinata* on *Quercus ilex* L., which is noteworthy because Mercet stated that his species *E. dichrous* was collected below *Q. ilex*.

*Distribution:* France, Spain, Portugal. Due to a misidentification of *M. (Aschitus) problematicus* Hoffer, *M. cedrenus* (Walker) was erroneously recorded from Denmark by Jensen (1984: 100). *M. dichrous* (Mercet) has been reported from the Czech Republic and the Slovak Republic by Hoffer (1977: 188) and from Hungary by Erdős (1957: 49), but these records need confirmation. PBJ has studied a species close to *Microterys (Aschitus) problematicus* Hoffer (from central Europe) that closely resembles *M. cedrenus* except for the sculpture of scutellum, which is characteristic of the species formerly placed in *Aschitus* Mercet (see Jensen 1989).



Figs 6–9. — *Microterys cedrenus* (Walker), ♀: 6, NHM7242, lateral view; 7–9, slide NHM8423: 7, wings; 8, venation; 9, antenna.



Figs 10–14. — *Microterys cedrenus* (Walker), ♀, slide NHM8423: 10, head frontal view; 11, base of fore wing; 12, syntergum; 13, hypopygium (outlined by dotted line); 14, ovipositor.

*Comments:* Examination of the lectotypes of *Encyrtus cedrenus* Walker and *E. dichrous* Mercet shows they are conspecific. The fine description by Japoshvili of his new species *M. aldreyi* leaves no doubt that the recorded specimens are representatives of *M. cedrenus*. It is noteworthy that Japoshvili states that the holotype of *M. aldreyi* was reared from *N. pulvinata* and collected by Mercet, but he adds no dates for the holotype (♀) and the two paratypes (♀♀) of *M. aldreyi*. Japoshvili similarly adds no named location but only coordinates for his holotype and paratypes – coordinates that match those given for the types of *M. dichrous*. This is surprising because when Noyes (1981) designated the lectotype (♀) of

*E. dichrous*, he stated that this and the male paralectotype were collected in Madrid, Chamartin, 20.vi.1916. Unfortunately, probably due to a typing error or a mix of labels, Japoshvili writes that the lectotype of *E. dichrous* is a ♂ and that the paralectotype is a ♀.

In the key to females of the European *Microterys* species by Trjapitzin (1978), *M. cedrenus* runs to the group of species that share the following combination of characters: *fore wing with one hyaline band, scape between 3× and 4× longer than wide, sides of mesothorax orangish-yellow or chocolate-brown sometimes partly darkened*. In the group of species with the above-mentioned combination of characters *Microterys axius* Trjapitzin, 1978, *M. masii* Silvestri, 1919, and *M. trjapitzini* Jasnosh, 1968, can be separated from *M. cedrenus* by having mesoscutum and scutellum partly or completely dark with blue metallic reflections and funicle with clearly contrasting dark and light segments. The remaining two species: *Microterys lunatus* (Dalman, 1820) and *M. bellae* Trjapitzin, 1968, can be separated from *M. cedrenus* by having contrasting dark and light funicle segments and a relatively small basal cell of fore wing and the basal area only with dark setae. In the key to Palaearctic *Microterys* species females by Trjapitzin 1989, *M. cedrenus* eventually must be separated from practically the same species as in the 1978 key. In the key to *Microterys* species of Iberian Peninsula by Japoshvili (2011), *M. cedrenus* females run to *M. aldreyi*, while *M. dichrous* essentially is separated from *M. aldreyi* by having mesoscutum and scutellum dark, almost black with metallic reflections, which matches the description of the male thorax of *M. dichrous* by Mercet (1921).

### *Microterys cyanocephalus* (Dalman, 1820)

(Figs 15–27)

= *Encyrtus cyanocephalus* Dalman, 1820b: 344. Lectotype ♀ (designated by Graham 1969: 261)

= *Microterys cyanocephalus* (Dalman, 1820) (Thomson, 1876: 159)

= *Microterys steinbergi* Sugonjaev, 1971: 776–778. syn. n.

The following description of the *Microterys cyanocephalus* (Dalman) female is based on the lectotype of *Encyrtus cyanocephalus* Dalman, 1820, NHRS-HEVA000003147 (NHR3147) (Figs 15–18), on the specimen NHMUK013457274 (NHM7274) (Figs 19–21) and on images of a slide of *Microterys steinbergi* Sugonjaev loaned from ZIN, where it was compared with the holotype of *M. steinbergi* Sugonjaev (Figs 23–27). The measurements are essentially based on the specimen NHM7274, which is similar in appearance to the lectotype of *M. cyanocephalus*.

#### Description

♀, length of lectotype (NHR3147): 2.64mm; length of NHM7274: 2.73mm; length of MZLU00173084: 2.36mm and of MZLU00173087: 2.05mm; length of *M. steinbergi*: 1.50–2.10mm (Sugonjaev 1971); variation in studied material 2.05–2.73mm.

Head generally dark brown-black, with temples and areas along the upper and outer margins of toruli yellow-orange. Lower face and frontovertex with bronze-green and upper face with strong violet-blue reflections (Fig. 17). Setae on lower face and interantennal prominence relatively coarse and light grey. Mandibles light brown. Radicula proximal part light brown, distal part dark brown, antenna with scape dark brown-black, pedicel and F1–F4 dark brown, F5 brownish gradually more light brown towards apex, F6 yellow-white, club dark brown-black (Figs 15, 17).

Antennal scrobes shallowly meeting dorsally, broadly ∩-shaped, not sharply separated from frontovertex. Malar sulcus present, slightly curved. Mandibles broad, with two teeth and a

truncation. Lower face between toruli and interantennal prominence with superficial irregular sculpture. Lower face between toruli and malar sulcus with elongate irregular sculpture.

Upper face and frontovertex with irregular reticulate sculpture, mesh size about size of nearby eye facets. Narrowest point of frontovertex just in front of anterior ocellus, frontovertex with two rows of about ten very shallow depressions each with a light seta (Fig. 17), starting on each side of the anterior ocellus and running to upper margin of scrobal depression.

Head about  $3.6\times$  as wide as frontovertex (Fig. 18), and head about  $1.1\times$  as wide as combined length of pedicel + flagellum. AC  $64^\circ$ . Posterior ocelli much closer to eye orbit than to occipital margin. Antennal toruli much closer to mouth margin than to inner eye orbits. Scape about  $3.3\times$  as long as wide (Fig. 27). Club slightly longer than combined length of F4–F5–F6.

*Measurements.* HW 0.83; FvW 0.23; EL 0.45; EW 0.38; EML 0.34 AOD 0.05; AOL 0.11; OCL 0.06; OOL 0.02; POL 0.12; CAOL 0.16; CPOL 0.17; TL 0.12; TE 0.18; TMM 0.10; SL 0.37; SW 0.11; PeL 0.10; PeW 0.05; FL 0.44; F1L 0.08; F1W 0.05; F456L 0.21; CL 0.23; CW 0.11; PFCL 0.77.

Thorax both dorsally, laterally and ventrally, generally dark brown-black with bronzy or bronzy-green reflections, and with black setae. Propodeum dark brown-black. Fore wing moderately infuscate with one indistinct transverse hyaline band beyond venation, most distinct in anterior part of wing, hardly visible in posterior part of wing (Figs 19, 22). Legs brown to dark brown with apices of femora and tibiae light brown, mid-tibial spur dark brown, tarsi light brown to brown.

Mesoscutum with imbricate-reticulate sculpture which gradually changes to superficial reticulate sculpture in posterior half. Scutellum with more coarse imbricate-reticulate to irregular reticulate sculpture (Fig. 21). Costal cell of fore wing with two complete rows of setae along anterior margin. Basal area of fore wing with black setae only, and with two rows of setae below submarginal vein and with a relatively small basal cell enclosed by setae (Fig. 23). Mesoscutum about  $1.55\times$  as wide as long, scutellum a little longer than wide. Fore wing about  $2.30\text{--}2.35\times$  as long as wide (Fig. 22); submarginal vein about  $0.9\times$  as long as width of fore wing (Fig. 22); marginal vein distinctly shorter than postmarginal vein, which is a little shorter than stigmal vein.

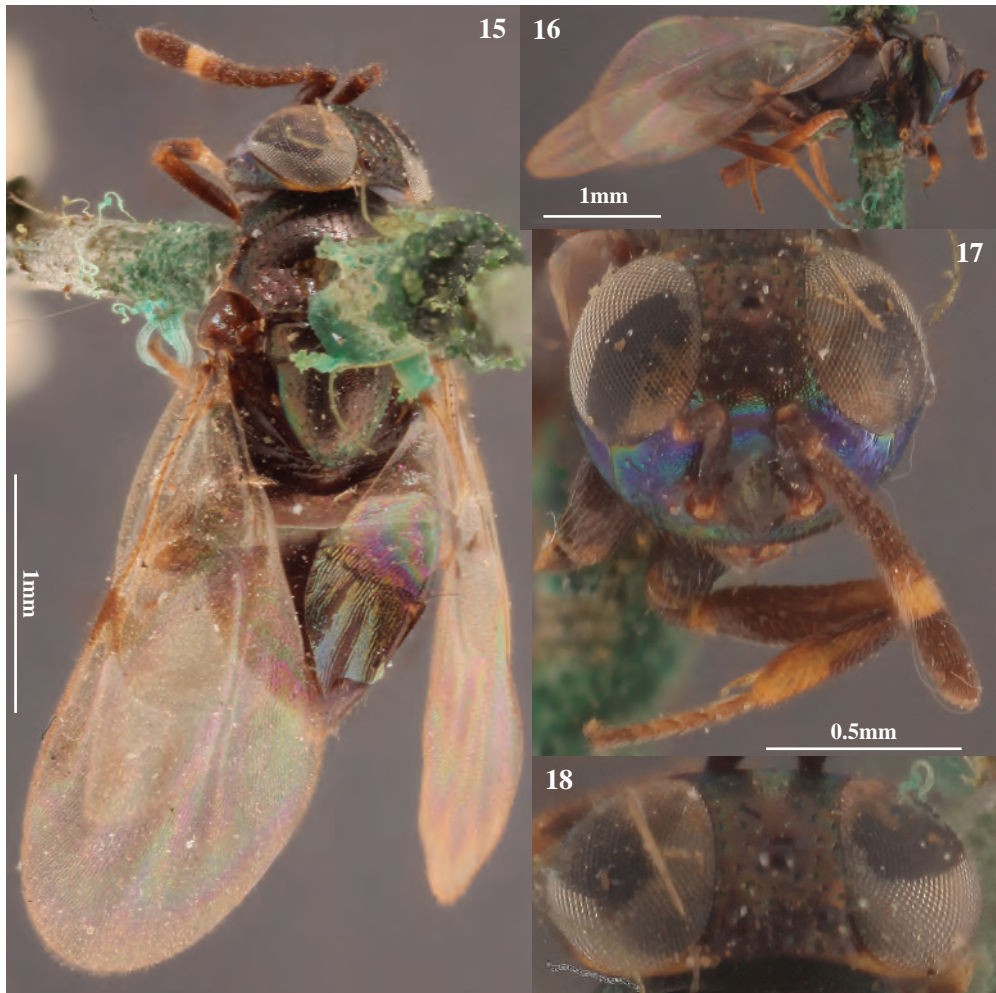
*Measurements.* MscL 0.54; MscW 0.84; ScL 0.54; ScW 0.51; FWL 2.51; FWW 1.06; HWL 1.74; HWW 0.62; SVL 0.96; MVL 0.10; StL 13.5; PVL 12.5; MTL 0.88; MSL 0.27; MBL 0.29.

Gaster dark brown-black, with blue or blue-green reflections, visible tip of ovipositor light brown. Gastral tergites and sclerites with superficial reticulate sculpture, visible parts of sclerites with many coarse light grey setae. The gaster of the lectotype (NHR3147) a little longer than wide, and shorter than the length of mesosoma. From the slide of *M. steinbergi*: syntergum about  $1.7\times$  wider than long (Fig. 25). Hypopygium strongly incurved (Fig. 26). Outer plates of ovipositor about  $3.75\times$  as long as wide. Ovipositor about  $3.9\times$  as long as gonostyli (Fig. 24). Gonostyli about  $1.3\times$  as long as width of outer plates.

*Variation.* The studied specimens exhibit very little variation in the colour of head, thorax and gaster. The infuscation of the fore wings varies slightly with regard to the posterior part of the hyaline band beyond venation. This varies from having indistinct borders to being hardly discernible. In the studied material the length of the gaster varied from at least slightly to distinctly shorter than the length of mesosoma. This is in accordance with Sugonjaev (1971), who stated that the relative length of gaster varies from being distinctly shorter than the length of mesosoma in dry specimens to slightly shorter than mesosoma in specimens in alcohol. Stacked images of two *M. cyanocephalus* females in the Thomson collection (cabinet 397, drawer 100, specimens MZ3084 and MZ3087) indicate very little colour variation in this species.

#### *Description of male – based on the description of the male of M. steinbergi*

♂, length 1.9mm. Head green with strong copper-red reflections. Scape and pedicel brown with weak bronzy reflections, funicle and club darkened. Thorax dark, with golden-blue-green reflections. Tegulae brown. Sides of thorax black. Legs brown-dark brown, with knees of fore- and mid legs, fore tibia, major part of mid tibia and apical part of hind tibia yellow-brown. AC about  $90^\circ$ , OCL about  $0.75\times$  POD, and OOL about  $0.5\times$  POD. Scape about  $3\times$  longer than wide, F1 about  $2\times$  longer than wide. Phallobase of genitalia almost  $14\times$  longer than wide.



Figs 15–18. — *Microterys cyanocephalus* (Dalman), LT (NHR3147), ♀: 15, dorsal view; 16, lateral view; 17, head dorsofrontal view; 18, head dorsal view. (scale bars: Figs 15–16 = 1.0mm; Fig. 17 = 0.5mm).

#### Material examined

Type material: Lectotype of *M. cyanocephalus*, ♀, SWEDEN: Scania (Skåne), leg. J.W. Zetterstedt (NHR3147). Skåne, Ringsjön (55.890716, 13.52005); 1♀ (MZ3084). Skåne, Kullen (56.297756, 12.469116); 1♀, 23.vii.1833 (MZ3087), both at the Zoological Museum, Lund, Sweden (MZLU). Holotype and paratype (slide) of *M. steinbergi* 2♀♀, RUSSIA: Stavropol reg., Teberda (now in Karachay-Cherkessia), 24–25.vi.1960, leg. E.S. Sugonjaev, ZIN.

Other material: KOSOVO (former Yugoslavia): Decani, 1♀, 3.x.1979, leg. L. Mihajlovic (NHM7274).

**Biology:** *M. steinbergi* was reared from *Eulecanium tiliae* L. on *Corylus avellana* L. (Sugonjaev 1971). Dalman (1820) noted that *E. cyanocephalus* was associated with *Carpinus* L.

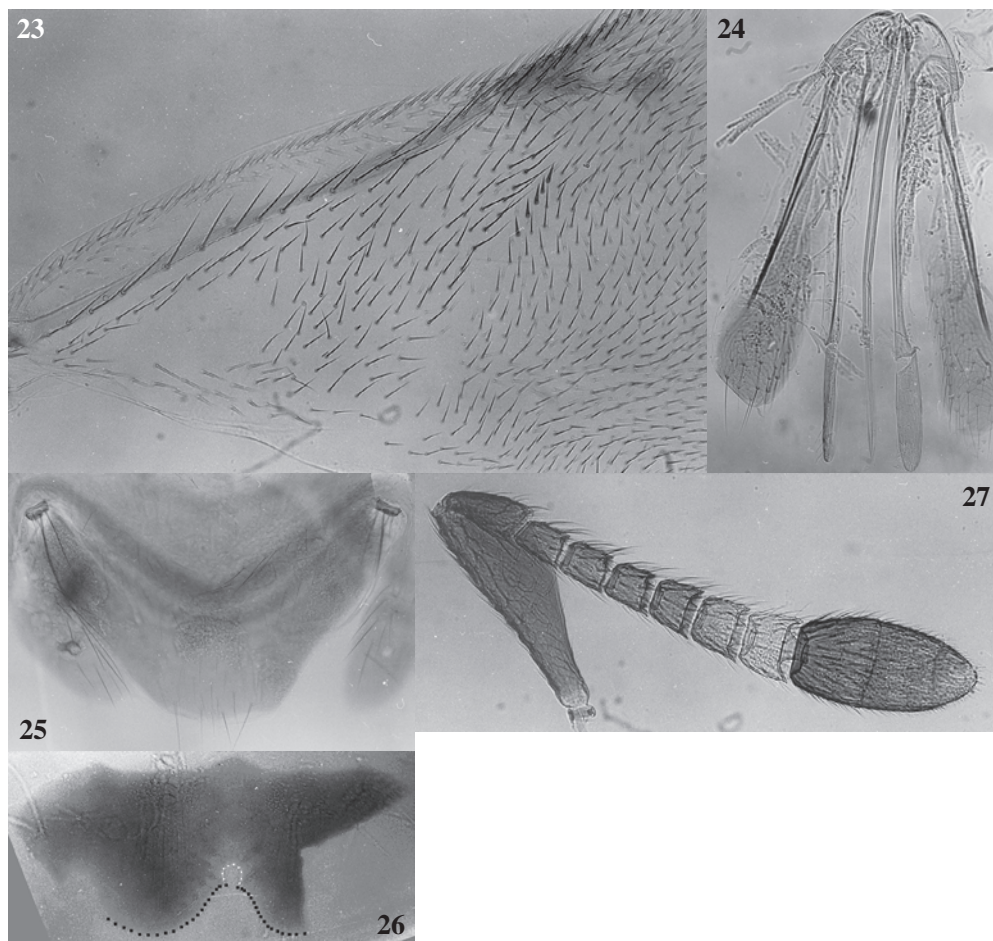
**Distribution:** Apparently limited to colder/subalpine climates; according to Thomson (1876) the species occurs in the middle and southern parts of Sweden,



Figs 19–22. — *Microterys cyanocephalus* (Dalman), ♀, 19–21, NHM7274: 19, lateral view; 20, head dorsolateral view; 21, thorax dorsal view; 22, MZ3087, lateral view & fore wing. (scale bar: Fig. 22=1.0mm).

while the specimens collected in Karachay-Cherkessia were captured 1300–1400m above sea level, and the Kosovo specimen was collected in the Decan area known for its mountainous terrain.

*Comments:* The lectotype of *Encyrtus cyanocephalus* Dalman, 1820, designated by Graham (1969) was examined at NHRS. Graham claimed that the spur of mid tibia was shorter than first tarsal segment (r.m. 25 : 30). However measuring the precise length of mid tibial spur and first tarsal segment on the lectotype is actually challenging, since the mid legs are bent so that the spurs and tarsi are situated just below the thorax, and measurement of spur and tarsal segment is further made difficult due to the proximity of the pin. Measurements made on a specimen (NHM7274) of *M. cyanocephalus* (Dalman), studied at NHMUK, indicated that the



Figs 23–27. — *Microterys cyanocephalus* (Dalman), ♀, slide ZIN-PT: 23, base of fore wing; 24, ovipositor; 25, syntergum; 26, hypopygium (for explanation of dotted line, see above); 27, antenna.

mid tibial spur is almost as long as first tarsal segment (r.m. 27:29). Later the holotype of *M. steinbergi* Sugonjaev was examined at ZIN, and a suspicion was confirmed: *M. steinbergi* was conspecific with *M. cyanocephalus*. This study also confirmed the statement by Sugonjaev that the mid tibial spur is almost as long as first tarsal segment in *M. steinbergi*.

In the key to the Palearctic *Microterys* species females by Trjapitzin (1989), *M. cyanocephalus* runs to the group of species that share the following combination of characters: *fore wing with one hyaline band beyond venation – though sometimes barely discernible, scape between 3× and 4× longer than wide, sides of mesothorax more or less black, head black-brown at most with small yellowish areas on face and frons*. In the group of species with the above-mentioned combination of characters *Microterys cneus* Trjapitzin & Sugonjaev, 1976, may be separated from *M. cyanocephalus* by its having width of head distinctly shorter than combined length of pedicel and flagellum (r.m. 68:76), upper face and frons at least partly yellow to

orange-brown, F1–F4 dark brown contrasting with white F5–F6, and AOL slightly longer than POL. Likewise *Microterys subcupratus* (Dalman, 1820) may be separated from *M. cyanocephalus* by its having width of head distinctly shorter than combined length of pedicel and flagellum (r.m. 56:68), scape about 4× as long as wide, posterior half of basal cell of fore wing with both black and white setae, and AOL about as long as POL. Finally *Microterys tshumakovae* Pilipjuk & Sugonjaev, 1971, may be separated from *M. cyanocephalus* by its having the funicle uniformly dark brown, scape about 4× as long as wide, head as wide as combined length of pedicel and flagellum, and AOL distinctly shorter than POL (r.m. 6:9).

*Microterys interpunctus* (Dalman, 1820)  
(Figs 28–41)

= *Encyrtus interpunctus* Dalman, 1820a: 157. Lectotype herewith designated.

= *Microterys interpunctus* (Dalman, 1820) Thomson, 1876

= *Microterys duplicatus* (Nees, 1834) sensu Sugonjaev 1965: 168. syn. n.

The following description of the *Microterys interpunctus* (Dalman) female is based on the lectotype (here designated) of *Encyrtus interpunctus* Dalman, 1820, (NHRS-HEVA000003136+slide 4201) (NHR3136) (Figs 28–29), on the specimens in Boheman's collection: NHRS-HEVA00016643, (NHR6643) (Figs 30–31) and NHRS-HEVA000018493 (NHR8493); on the specimen NHMUK013457239; on the specimen SF\_Nurmijarvi\_21051983 (SF1983) (Figs 33–37); and on images of slides of *M. duplicatus*: ZIN-Pu and ZIN-Rh (Figs 32, 38–41). The measurements are essentially based on the specimen NHM7239.

*Description*

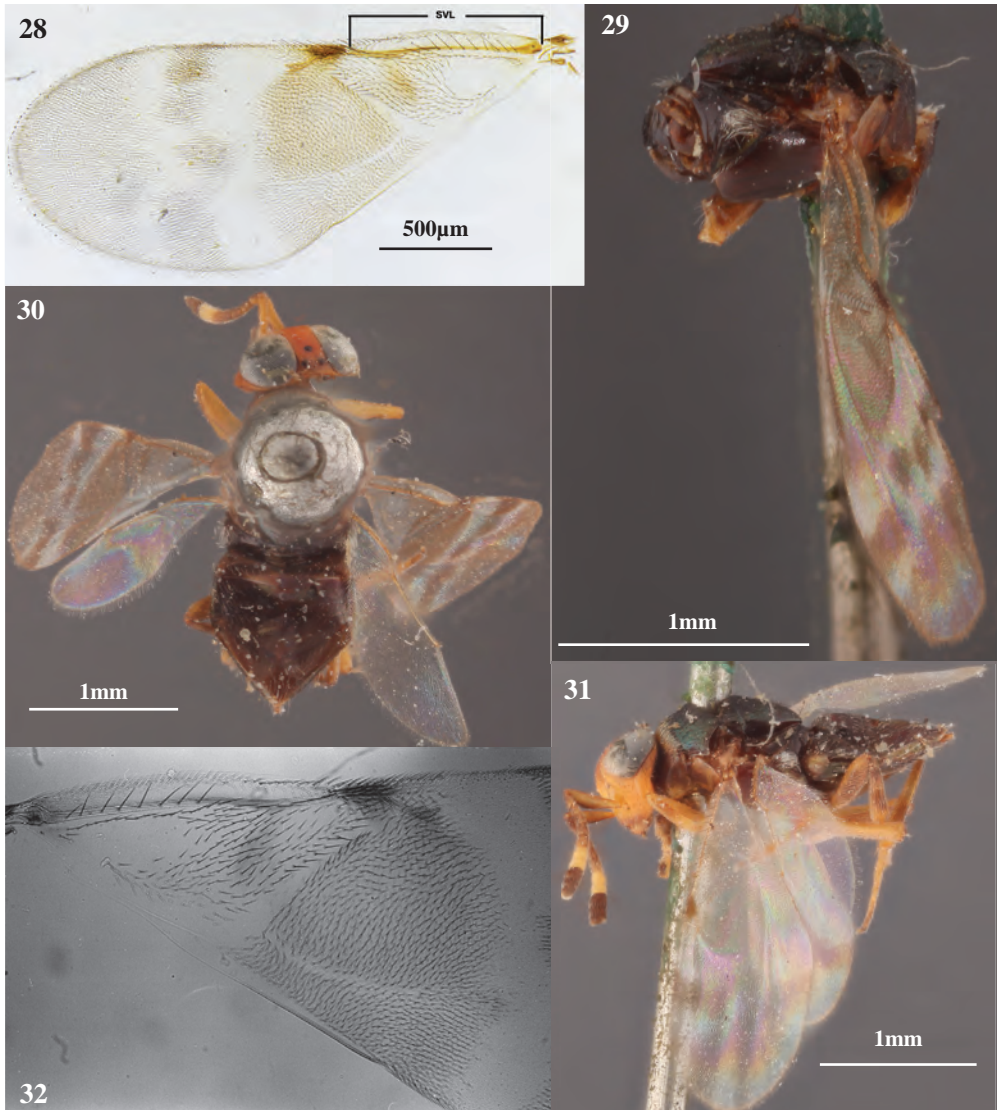
♀, length of NHR6643: 2.30mm; length of NHM7239: 2.15mm; length of SF1983: 1.84mm (variation in studied material 1.84mm–2.30mm).

Head including occiput yellow to orange-yellow (Figs 30, 34) with lateral parts of upper mouth margin somewhat brownish darkened (Figs 31; 37) and frontovertex somewhat brown to black-brown near ocelli (Fig. 34). Setae black posterior of ocelli and along inner orbits near ocelli, on genae, lower face and interantennal prominence. Setae white anterior of ocelli and above antennal scrobe. Mandibles yellowish-light brown, with darker teeth; visible parts of palpi light brown, except outermost segment of maxillary palpi brown. Radicula yellowish to light brown, slightly darker than head, scape and pedicel yellowish-light brown, setae dark brown to black on scape – particularly inner aspect of scape – and on pedicel, dorsal aspect of pedicel slightly darker brown than ventral aspect, F1–F3 brown with grey to brown setae, F4 brown dorsally yellow-light brown ventrally and with light brown setae, F5–F6 light yellow to white as are setae, club dark brown to black as are setae (Figs 37–38).

Antennal scrobes shallowly meeting dorsally, broadly ∩-shaped, not sharply separated from frontovertex. Malar sulcus present, slightly curved. Mandibles broad, with two teeth and a truncation. Lower face, antennal scrobes and interantennal prominence with superficial irregular sculpture. Area bordered by antennal scrobes, inner orbits and malar sulcus with finely elongate to irregular sculpture. Frontovertex above scrobal depression with fine reticulate to irregular sculpture, mesh size smaller than nearby eye facets. Occipital margin distinct but not sharp, eyes reaching occipital margin. Narrowest point of frontovertex about level with anterior ocellus, frontovertex in front of anterior ocellus with two rows of 4–5 very shallow depressions each with white setae other than those along inner orbits. Setae between eye facets light grey to white, inconspicuous about as long as or a little longer than diameter of a facet.

Head about 4.5× as wide as frontovertex, and a little less wide than combined length of pedicel+flagellum. Antennal toruli slightly closer to mouth margin than to inner eye orbits. AC 60°. Scape about 3.2× as long as wide, F1 shorter than pedicel, and at least 2× as long as broad, and club slightly shorter than F4–F5–F6. Longitudinal sensillae are present on all club and funicle segments (observed from slide).

**Measurements.** HW 0.72 (0.70; 0.65–0.73); FVW 0.16 (0.17; 0.14–0.17); EL 0.40 (0.38–0.40); EW 0.38 (0.32–0.38); EML 0.32 (0.27–0.32); AOD 0.05 (0.05; 0.04–0.05); AOL 0.08 (0.08; 0.06–0.08); OCL 0.05 (0.06; 0.04–0.06); OOL 0.02 (0.02; 0.02–0.03); POL 0.07 (0.07; 0.06–0.07); POD 0.04 (0.04); CAOL 0.12 (0.10–0.12); CPOL 0.12 (0.09–0.12); TL 0.15; TE 0.15 (0.13–0.15); TMM 0.10 (0.09–0.10); SL 0.36 (0.35; 0.29–0.36); SW 0.11 (0.10; 0.08–0.11); PEDL 0.11 (0.11; 0.10–0.12); PEDW 0.05 (0.04–0.05); FL 0.47 (0.38–0.47); FIL 0.08 (0.07–0.08); FIW 0.04 (0.04); F123L 0.24 (0.20; 0.19–0.24); F456L 0.22 (0.22; 0.21–0.22); F56L 0.19 (0.18–0.20); CL 0.2 (0.22; 0.20–0.22); CW 0.08 (0.10; 0.07–0.10); PFCL 0.77 (0.77).



Figs 28–32. — *Microterys interpunctus* (Dalman), ♀, 28–29 LT, NHR3136: 28, slide 4201, left fore wing; 29, lateral view & right fore wing; 30–31. NHR6643: 30, dorsal view; 31, lateral view; 32, slide ZIN-Pu, base of fore wing. (scale bars: Fig. 28=0.5mm, Figs 29–31=1.0mm).

Pronotum behind head dark brown, dorsoposterior and lateral parts of pronotum and prepectus yellow to light brown. Mesoscutum dark brown to black with lateral parts of mesoscutum next to tegulae light brown, tegulae yellow to light brown, axillae dark brown to black except lateral parts of axillae near tegulae orange to light brown, scutellum dark brown to black with lateroposterior



Figs 33–38. — *Microterys interpunctus* (Dalman), ♀, 33–37, SF1983: 33, lateral view; 34, head dorsal view; 35, head frontal view; 36, thorax dorsal view; 37, antennae; 38, slide ZIN-Rh: antenna.

margin orange-light brown (Figs 29–31, 36). Posterior margin of pronotum, mesoscutum, axillae and scutellum with grey to brown setae slightly shorter than length of axillae, corners of propodeum with about 18–20 greyish-white setae slightly shorter than length of axillae. Metanotum, and propodeum between spiracles, dark brown to black, mesopleuron and sides of propodeum yellow to light brown, mesosternum brown. Mesoscutum and scutellum with weak bluish to weak bronzy reflections. Fore wing infuscate with two transverse partly connected hyaline bands beyond venation (Fig. 28). Fore coxae yellow-light brown, fore femora and tibiae yellow with black setae, tibial spur and tarsi yellow with apical tarsal segment darker. Basal half of mid coxae brownish, distal half light brown, mid femora yellow, mid tibiae yellow with basal half more brownish, tibial spur and tarsi yellow. Hind coxae brownish, hind femora light brown somewhat brownish darkened medially, hind tibiae yellow-light brown without distinct dark bands (see Variation), tarsi yellow with apical tarsal segment darker.

Fore wing about  $2.5\times$  as long as wide (Fig. 28). Submarginal vein distinctly shorter than width of fore wing, marginal vein about as long as stigmal vein and slightly longer than postmarginal vein. Basal area of fore wing with relatively large basal cell and with light setae near posterior margin of the wing and near posterior part of linea calva, these light setae appear less strong than the more anterior setae near submarginal vein and venation (Fig. 32). Mesoscutum with imbricate-reticulate sculpture which gradually changes to superficial reticulate sculpture in posterior half. Scutellum with slightly more coarse imbricate-reticulate to irregular reticulate sculpture (Fig. 36). Mesopleuron superficially and irregularly sculptured. Mesoscutum  $1.75\times$  as wide as long. Scutellum weakly convex, and about as wide as long. Mesopleuron practically separating metapleuron/propodeum and hind coxae. Anterior apical margin of mid tibiae with row of rather uniform pegs. Mid tibial spur slightly shorter than adjacent basitarsus.

*Measurements.* MscL 0.41 (0.34–0.43); MscW 0.71 (0.69–0.71); ScL 0.44 (0.44); ScW 0.43 (0.38–0.43); FWL 2.10 (2.27; 1.95–2.27); FWW 0.84 (0.97; 0.80–0.97); HWL 1.43 (1.43); HWW 0.41 (0.40–0.41); SVL 0.77 (0.88; 0.73–0.88); MVL 0.14 (0.12–0.14); StL 0.14 (0.13–0.15); PVL 0.11 (0.11–0.13); MTL 0.77 (0.70–0.77); MSL 0.27 (0.20–0.27); MBL 0.28 (0.24–0.28).

Gaster uniformly dark brown-black with superficial reticulate sculpture, visible part of gonostyli light brown. Length of gaster about  $6/7\times$  length of mesosoma, and about as wide as long. – From slide ZIN-Pu: Syntergum about  $1.5\times$  wider than long (Fig. 39). Posterior margin of hypopygium distinctly incurved (Fig. 40). Length of ovipositor about  $0.8\text{--}0.85\times$  length of mid tibia. Outer plates of ovipositor about  $3.3\times$  as long as wide, gonostyli about as long as width of outer plates (Fig. 41).

*Measurements.* GaL 0.83, GaW 0.84. Measured from slide ZIN-Pu: r.m. SyL 0.51, r.m. SyW 0.79.

*Variation.* General colour of head varies from yellow to orange-light brown, upper mouth margin laterally slightly to distinctly brownish darkened, sometimes also middle part of mouth margin slightly darkened, frontovertex around ocelli often brownish to black-brown darkened. Mesoscutum varies from partly yellow-orange (laterally) and partly dark brown (medially) in the light form to a totally black-brown mesoscutum in the dark form. Axillae and scutellum vary from generally yellow-orange to generally black-brown. Prepectus generally from yellow to light brown, mesopleuron varies from yellow-light brown in light forms to generally black-brown with only anterior margin lighter brownish in dark forms. Basal area of fore wing varies very little, the basal cell of fore wing relatively large, and setae light grey near posterior part of linea calva. Legs vary from yellow at most with hind femora slightly darkened medially and hind tibiae yellow-light brown without darker bands (as in NHM7239) to light brown legs with darker brown hind femora and hind tibiae with two darker bands though with indistinct margins. Gaster varies from lighter brownish or partly yellow-light brown and partly brown in light forms to gaster dark brown to blackish in dark forms.

Apparently Nees regarded the light and dark forms of *M. interpunctus* as different species. The light form that Nees named *M. duplicatus* (1834: 204–205) was recognized here by Mercet (as *Encyrtus*, 1921), Nikolskaya (as *Encyrtus*, 1952) and Sugonjaev (1965). In 1976, Sugonjaev had realized that there existed both light forms and dark forms of *M. duplicatus*. Our investigation supports Sugonjaev in that there are no obvious morphological differences between the light and the dark forms of *interpunctus*, not even between the forms of *M. interpunctus* reared from *Pulvinaria* sp. and *Rhodococcus* sp. respectively.

*Description of male*

♂, length (NHMUK010835312): 1.9mm. Head yellow to yellow-white, somewhat darkened between posterior ocelli, face with white setae. Scape yellow, pedicel brownish with yellow to light-brown apical half, flagellum yellow to light-brown, with grey-brown setae. Pronotum with dark brown anterior half and yellow-white posterior half, mesoscutum, scutellum and gaster dorsally generally black-brown, mesoscutum and scutellum with grey-white setae, mesoscutum with strong blue-green metallic reflections, scutellum with less strong blue metallic reflections. Prepectus, tegulae, mesopleuron and coxae yellow-white, legs yellow. Fore wing hyaline.

Frontovertex with obvious setigerous depressions between ocelli and inner orbits. Head about  $2.5\times$  as wide as frontovertex, AC  $75^\circ$ . OCL about  $0.75\times$  POD, and OOL about  $1\times$  POD. Scape broadened and flattened slightly less than  $2\times$  longer than wide, funicle segments becoming progressively shorter distally. SVL a little shorter than FWW; MSL a little longer than MBL.

*Measurements*: HW 0.56; FVW 0.22; AOD=POD 0.04; AOL 0.05; OCL 0.03; OOL 0.04; POL 0.07; SL 0.16; F1 0.15; F6 0.09; CL 0.14; FWL 1.57; FWW 0.63; SVL 0.56; MSL 0.16; MBL 0.14.

*Material examined*

Type material: Lectotype of *Encyrtus interpunctus*, ♀ (here designated). SWEDEN: according to Dalman collected by Boheman in Småland, Dalman's collection, labels 101 (1958) 228 (1966) 324 (1985) (NHRS-HEVA000003136) (R.M. prep. 4201, left fore wing).

Other material: ENGLAND: Surrey, Kew, 1♀, 12.vi.1977, leg. V.F. Eastop (15.525), on *Populus italica*, NHMUK010835310. London, Kensington, Palace Gardens, 1♀, 1♂, 12.vi.1988, ex *Pulvinaria vitis* on *Ribes sanguineum*, leg. C. Malumphy, NHMUK010835311, NHMUK010835312. FINLAND: Nurmijärvi, 6715:376; 1♀, 21.v.1983, leg M. Koponen, Museum of Zoology, Helsinki, Finland (MZH) (SF1983). FRANCE: Dordogne, 3.5km E. Issigeac,  $44^\circ43'N$ ,  $0^\circ38'E$ , 154m, 1♀, 6–12.viii.2011, leg. J.S. Noyes, NHM(Ent) 2011-201, NHMUK013457239. KOSOVO: (FRYK Orgydag), 1♀, 13.v.1970, Brit. Mus. 1989-128, as *M. duplicatus* (Nees) det. Trjapitzin, NHMUK013457275. SWEDEN, 1♀, Boheman's collection, labels V.G. (Västergötland), Bhn, Thoms, and NHRS-HEVA000016643; 1♀, Boheman's collection, labels V.G.; Bhn; '*interpunctus*'; Thoms, red label 53(59) and NHRS-HEVA000018493.

*Biology*: Parasitoid of *Pulvinaria vitis* (L.), *Eulecanium tiliae* (L.), *Paleolecanium bituberculatum* (Targ.), *Rhodococcus spiraeae* Borchs. and *Rh. turanicus* (Arch.) (Coccidae) (Sugonjaev 1984).

*Distribution*: Widely distributed but not common in Europe (Hoffer 1977: 188, on *M. duplicatus*), which is in accordance with Trjapitzin (1989) who mentions countries from Portugal to western parts of Russia, and from Sweden to Italy. Pilipjuk & Sugonjaev (1971) mention that *M. duplicatus* was reared from *P. vitis* collected on willow in a park in the Sakhalin Province of Far-East Russia. This record was not mentioned by Trjapitzin (1989), which might indicate that *M. interpunctus* does not occur naturally in Far-East Russia.

Lundbeck (1896) recorded an *E. interpunctus* female from Greenland, Kagsiarsuk, Igaliko-Fjord. This specimen, which is in good condition, represents the species *Microterys curio* Trjapitzin, 1966, and is kept in the entomological collections of the Natural History Museum of Denmark (ZMUC).

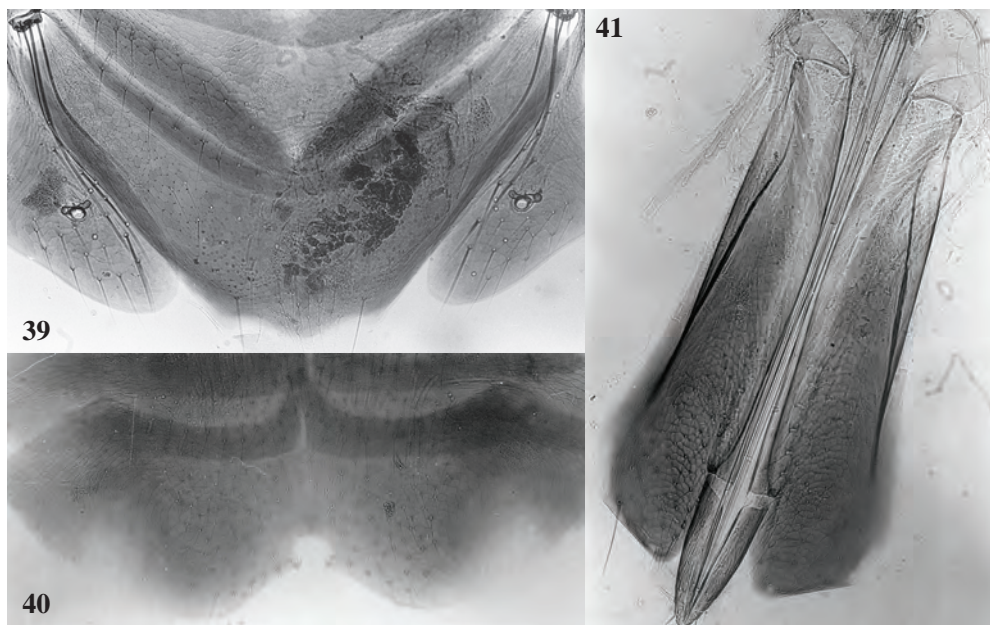
*Comments*: A pin with the remnants of an encyrtid specimen, here designated as lectotype, is placed under the name '*interpunctus* 8' in the collection of Dalman – the integer 8 indicates that *interpunctus* was listed as species no. 8 in his original paper (Dalman 1820a). The pin goes through the thorax of this specimen and on the pin three small more or less red loan labels with the numbers: 101/58, 228/66 and

324/85 are present, as well as the label NHRS-HEVA000003136. Only the mesosoma and the right fore wing are left of this specimen (Fig. 29); the left fore wing has been transferred to a slide, number 4201 (Fig. 28).

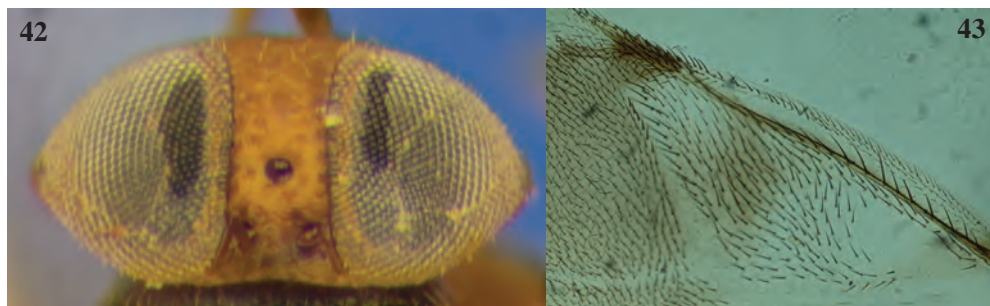
In Boheman's collection two specimens stand under the name *E. interpunctus* Dalman. The specimen NHR6643 is in very good condition, and NHR8493 is also in good condition, though the infuscation of the fore wing has faded. It is possible that they are syntypes, though this cannot be proven. In the 1980s these specimens were compared with the specimen in Dalman's collection, which was missing the head but otherwise was less fragmentary than now, and it was concluded that the two specimens in Boheman's collection were conspecific with the specimen in Dalman's collection.

Nees ab Esenbeck (1834) based his species *Encyrtus duplicatus* Nees, 1834, on the *Encyrtus lunatus variation*  $\beta$  Dalman, 1820. Unfortunately the collection of Nees ab Esenbeck is assumed to have been mostly destroyed, and no type material of *E. duplicatus* have been found in remaining parts of Nees ab Esenbeck's collection, including that reported by Graham (1988). Actually in 1957 Graham borrowed six specimens from Dalman's collection (four specimens under the name *E. lunatus*, and two specimens under *lunatus variation*  $\beta$ ). One of these specimens is labelled lectotype of *Encyrtus lunatus* Dalman ♀ M. de V. Graham det. 1958; this female lacks its head. Apparently Graham never published his choice of lectotype of *Encyrtus lunatus* Dalman. The six specimens in Dalman's collection under the names *E. lunatus* and *lunatus variation*  $\beta$ , including the specimen of *lunatus* Dalman selected by Graham as lectotype, all have infusate fore wings with one hyaline band beyond the venation. Therefore none of these fits Nees ab Esenbeck's (1834) interpretation of *Encyrtus lunatus variation*  $\beta$  Dalman. Thus the understanding of *duplicatus* Nees has been based on interpretations of text, rather than on physical material. The best known interpretations of *E. duplicatus* Nees have been published by Sugonjaev (1965, 1976) and Trjapitzin (1978, 1989). The specimens identified as *E. duplicatus* Nees by E.S. Sugonjaev and subsequently V.A. Trjapitzin are conspecific with the now designated lectotype of *E. interpunctus* Dalman. Consequently *E. duplicatus* Nees *sensu* Sugonjaev is hereby synonymised under *E. interpunctus* Dalman. *M. colligatus* (Walker) is very close to *E. interpunctus*, but we hesitate to suggest *M. colligatus* as a synonym of *E. interpunctus* due to the state of the lectotype of *M. colligatus*.

In the key to Palaearctic *Microterys* species females by Trjapitzin (1989), *Microterys interpunctus* runs to the group of species that share the following combination of characters: *fore wing infusate with two interrupted and partly connected hyaline bands beyond venation, submarginal vein distinctly shorter than width of fore wing, HW about 4.5× as wide as frontovertex, scape yellow-light brown and 3× to 4× as long as wide, at least F1 clearly longer than wide and funicle with contrasting dark and light segments, AC about 60°, mid tibia with setae uniform throughout, without a patch of conspicuously more dense setae externally, ovipositor practically not exerted*. In the group of species with the above-mentioned combination of characters *Microterys herbaceus* Sugonjaev, 1962, may be separated from *interpunctus* (Dalman) by having the posterior margin of hypopygium straight (not emarginate), head yellow to orange with lower part of face blackish brown with copper-red reflections, but otherwise may seem similar to the dark form of *interpunctus*. Likewise *Microterys temporarius* Sugonjaev, 1976, may be separated from *interpunctus* by the relatively narrow frontovertex, HW about



Figs 39–41. — *Microterys interpunctus* (Dalman), ♀, 39–41, slide ZIN-Pu: 39, syntergum; 40, hypopygium; 41, ovipositor.



Figs 42–43. — *Microterys turanicus* Sugonjaev, ♀, 42, NHM7241: head dorsal view; 43, slide ZMUC3435: base of fore wing.

4.9 $\times$  as wide as FVW, AC clearly less than 60°, and mid tibial spur clearly shorter than mid basitarsus, but otherwise the colour pattern of *M. temporarius* may appear similar to the dark form of *M. interpunctus*. *Microterys tessellatus* (Dalman, 1820) may be separated from *M. interpunctus* by having F6 dark-brown, often almost as dark as club, HW about 3.5 $\times$  as wide as FVW, head mainly with bronze-green or violet-green reflections and upper face with a band of strong violet-blue reflections. Finally, *Microterys turanicus* Sugonjaev, 1965 may be separated from *M. interpunctus* by the relatively small basal cell and the setae of basal area of fore wing, which are relatively strong and black (Fig. 43), and by distance from posterior ocelli to occipital margin being more than 1.5 $\times$  the diameter of a posterior ocellus

(Fig. 42). The interpretation of *M. turanicus* is based on an examination of the holotype of *M. turanicus* at ZIN, and four females at NHMUK with data 'Kazakhstan, near Almaty, Dzungar Alutau area, S. Koktuma, Alakole, 25.vi.1962, leg. Tobias, *Microterys turanicus* Sug. det. Sugonjaev', in particular the specimen NHMUK013457241 (Fig. 42), and a fifth female with the same data, slide number 34–35 (Fig. 43), housed in ZMUC.

## DISCUSSION

This paper provides fully illustrated descriptions of three old (at least in relation to date of initial description) and little-known *Microterys* species that hopefully establish adequately and unambiguously the identities of these species, and thereby ease the identification of these soft scale insect parasitoids. Four new synonymies are proposed, *M. aldreysi* (under *M. cedrenus*), *M. dichrous* (under *M. cedrenus*), *M. duplicatus* (under *M. interpunctus*), *M. steinbergi* (under *M. cyanocephalus*). *M. cedrenus* is possibly limited to the southern part of Europe, while *M. cyanocephalus* is very likely a rare species limited to subalpine localities. *M. interpunctus* has been reported from most parts of Europe, in particular the western parts, while *M. interpunctus* has not yet been found in the Nearctic; records of *M. interpunctus* from Japan need confirmation (Japoshvili, Higashiura & Kamitani 2016). Hopefully, a future project may be able to use molecular analysis to further characterise these three species.

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