

Keys for the identification of British and Irish nocturnal Ichneumonidae

Gavin R. Broad

Dept. of Life Sciences, Natural History Museum, Cromwell Road, London SW7 5BD; email:
g.broad@nhm.ac.uk

Introduction

These notes and draft keys support the Nocturnal Ichneumonoidea Recording Scheme (<http://nocturnalichs.myspecies.info/>), concentrating on Ichneumonidae. The main emphasis here is on the species of Ophioninae, a subfamily of predominantly nocturnal species, and on the species of *Netelia*. The keys and notes presented here are mostly rather rough and ready, although keys to *Cidaphus* and *Enicospilus* are taken from published papers. Some illustrations have been copied from published sources: *Ophion* from Brock (1982), *Cidaphus* from Fitton (1985), *Enicospilus* from Broad & Shaw (2016) and *Netelia* (*Netelia*) from Konishi (2005). Kazuhiko Konishi has also kindly sent me a draft plate with his drawings of *Netelia* (*Bessobates*) male genitalia, based on British specimens. A few of my own images are included. Figures are numbered independently for each key. Dichotomous characters are listed first, confirmatory characters that are not reflected in the other half of the couplet are placed in square brackets. It is important to bear in mind that many species of *Ophion* and *Netelia* are not identifiable by single characters, instead several characters need to be evaluated in combination. The more specimens that you've amassed, the better, as it will then be easier to compare character states across species.

These keys are not intended for formal publication in their current state but please do send this to anybody who may be interested in learning more about nocturnal ichneumonoids. A paper on the identification, biology and distribution of British and Irish *Netelia* species is almost complete and when this is published, the distribution data will also be made available. The key to Braconidae genera is barely illustrated at the moment and keys to species need to be added. Huddleston & Gauld's (1988) paper contains some useful illustrations and a key which will often be of use, although their taxon coverage does not entirely correspond to mine.

Definition of 'nocturnal Ichneumonoidea'

The Ichneumonoidea comprises two species-rich families, Braconidae (c.1,270 British and Irish species) and Ichneumonidae (2,500 species). Light-trapping can be a surprisingly effective means of sampling ichneumonoids, including many species not usually considered to be nocturnal (e.g. many Pimplinae seem to come to light in small numbers). However, a small subset of the superfamily are more strictly nocturnal and are largely or entirely testaceous or pale reddish in colour (sometimes with dark markings), with long antennae, large wings and large eyes and ocelli. A similar appearance has evolved independently in several subfamilies in groups which search for nocturnal hosts (usually Lepidoptera larvae but a few genera attack sawfly larvae and two genera attacks adult weevils and adult bees). These wasps are easily caught using light traps and some species are very seldom found otherwise; Malaise traps typically catch very few Ophioninae or *Netelia*.

Separation of Braconidae and Ichneumonidae

These two superfamilies are easily separated using Shaw & Huddleston (1991) or Broad *et al.* (in press). For the nocturnal genera, separation is straightforward as all of the nocturnal Ichneumonidae have fore wing vein *2m-cu* present, which is lacking in all European Braconidae.

Following the key to genera of nocturnal Ichneumonoidea, subfamily accounts detail literature sources and include some keys to species. The morphological terminology follows Broad *et al.* (in press) for Ichneumonidae and mostly van Achterberg (1993) for Braconidae. If you do not have access to these then email me and I can send you a PDF of the terminology pages.

Key to nocturnal genera of Ichneumonidae

This key only works for largely testaceous ichneumonoids. Potentially any ichneumonoid may be found at light so non-testaceous species will need to be run through other, more comprehensive keys.

1. Fore wing vein *2m-cu* present, vein *RS+M* absent(**Ichneumonidae**) 2
- Fore wing vein *2m-cu* absent, vein *RS+M* usually present (absent in one genus considered here)
.....(**Braconidae**) 16
2. Fore wing with one *rs-m* cross-vein, and this distal to *2m-cu*, thus discosubmarginal cell produced beyond *2m-cu* (Figs 1, 2a,b); first metasomal tergite lacking glymma, spiracle far behind middle (Fig.6a) .
..... (**Ophioninae**) 3
- Fore wing with one or two *rs-m* cross-veins, if one then this proximal to *2m-cu*, thus discosubmarginal cell not extending beyond *2m-cu* (Fig.2c-e); first metasomal tergite often with glymma, spiracle at or before middle (Fig.6b)6
3. Mandible strongly twisted (Fig.3a); pterostigma narrow, gradually tapering into margin of wing (Fig.1b); occipital carina absent**Stauropogon**
- Mandible not or slightly twisted (Fig.3b,c); pterostigma broader, more abruptly narrowing into margin of wing (Fig.1a,c;2a,b); occipital carina usually present4
4. Mandibles distinctly tapered, basally twice as broad as at apex and upper tooth distinctly longer than lower (Fig.3b); discosubmarginal cell with large glabrous area extending under vein *2r&Rs*, often with sclerites (Fig.1a); vein *2r&Rs* slightly sinuous, sometimes thickened medially (Fig.1a)**Enicospilus**
- Mandibles not or only slightly tapered, hardly narrower apically than basally and teeth about equal in length (Fig.3c); discosubmarginal cell with only small glabrous area below pterostigma, never with sclerites; vein *2r&Rs* evenly curved or abruptly bent but not sinuous (Fig.1c;2a,b)5
5. Fore wing vein *2r&Rs* abruptly bent near origin on pterostigma (Fig.1c); lower edge of mesopleuron with weak, blunt, projection (Fig.5a, arrowed) **Eremotylus**
- Fore wing vein *2r&Rs* evenly curved or straight (Fig.2a,b); lower edge of mesopleuron lacking projection**Ophion**
6. Mandibles strongly narrowed and twisted (Fig.3d); fore wing veins *2rs-m* and *3rs-m* delimiting narrow, triangular areolet (very occasionally *3rs-m* absent) (Fig.2c) [tarsal claw pectination long and dense; Fig.7]**Netelia (Tryphoninae)**
- Mandibles only weakly and evenly narrowed and not twisted (Fig.3e,f;4a); fore wing veins *2rs-m* and *3rs-m* delimiting broader, rhombic areolet (e.g.Fig.2d,e) (but one species with *3rs-m* absent)7
7. Face and clypeus in same plane, no division (Fig.3e); female with ovipositor sheaths straight, unsculptured and inflexible, ovipositor lacking notch (Fig.8a); male with parameres spine-like, long (Fig.8b)(**Mesochorinae**) 8
- Face and clypeus separated by distinct suture or transverse impression (e.g. Fig.3f); female with ovipositor sheaths flexible, with microsculpture, ovipositor with dorsal, sub-apical notch (Fig.9a); male with parameres not spine-like (e.g. Fig.9b)(**Ctenopelmatinae**) 9
8. Fore wing with areolet regularly rhombic, diamond-shaped, veins *2rs-m* and *3rs-m* sub-equal (Fig.2d); hind wing with distal abscissa of *CU* absent (nervellus not intercepted); smaller, wing length <7 mm
.....**Mesochorus**
- Fore wing with areolet irregularly rhombic, *2rs-m* much shorter than *3rs-m* (Fig.2e); hind wing with abscissa of *Cu* present (nervellus intercepted); larger, wing length >7 mm (usually >10 mm)**Cidaphus**
9. Fore wing vein *AA* with ventral deflection on lower edge of 1st sub-discal cell (Fig.10a,b)10
- Fore wing vein *AA* straight, lacking ventral deflection (Fig.10c)11
10. Fore wing with glabrous area in discosubmarginal cell, below pterostigma, with small sclerite below this area, and ramulus on vein *1m-cu&M* (Fig.11a); female with hypopygium large, roughly triangular; ovipositor sheaths no longer than wide, largely membranous (Fig.12a)**Lophyroleptus**
- Fore wing with discosubmarginal cell uniformly setose, lacking sclerite and ramulus (Fig.11b); female with hypopygium small, inconspicuous; ovipositor sheaths slender, not membranous (Fig.12b) . **Absyrtus**
11. Hind wing with nervellus intercepted above the middle (1st abscissa of vein *CU* obviously shorter than vein *cu-a*)12

- Hind wing with nervellus intercepted at or below the middle (1st abscissa of vein *CU* longer than or sub-equal to vein *cu-a*)13
- 12. Mesopleuron with transverse groove at mid-height (Fig.5b); large insects, wing length c. 15 mm *Opheltes*
- Mesopleuron lacking groove; smaller insects, wing length <8 mm *Perilissus* (in part)
- 13. First metasomal tergite lacking glymmae; fore wing lacking areolet (vein *3rs-m* missing) *Phobetres*
- First metasomal tergite with glymmae; fore wing with areolet (vein *3rs-m* present)14
- 14. First metasomal tergite with deep glymmae, separated medially by translucent partition; mandible with lower tooth much longer than upper (Fig.4a); mesoscutum with notauli faint15
- First metasomal tergite with glymmae superficial, widely separated medially; mandible with teeth about equal in length; mesoscutum with notauli strong anteriorly *Alexeter*
- 15. Head with occipital carina meeting hypostomal carina at mandible base; *Priopoda*
- Head with occipital carina meeting hypostomal carina before latter reaches mandible base *Perilissus* (in part)
- 16. Fore wing lacking vein *RS+M*, thus with large discosubmarginal cell¹; tarsal claws cleft *Syntretus*
- Fore wing with vein *RS+M*, thus with discal and 1st submarginal cells; tarsal claws undivided but may have wide lobe or pectination17
- 17. Head with rounded hypoclypeal depression above mandibles, surface of depression formed by labrum, curved and shiny (Fig.4b) (Rogadinae) 18
- Head lacking hypoclypeal depression, labrum concealed (e.g. Fig.4c)21
- 18. Second tergite of metasoma with complete, median longitudinal carina, distinct from surrounding sculpture; female with ovipositor short, not extending beyond metasomal apex19
- Second tergite of metasoma lacking median carina, although sometimes entire surface of tergite longitudinally striate; female with ovipositor longer, extending conspicuously beyond metasomal apex ... *Clinocentrus*
- 19. Fore wing 2nd submarginal cell about as high as long; hind trochantellus longer than trochanter; female antenna with white band *Heterogamus*
- Fore wing 2nd submarginal cell longer than high, or if only very slightly longer than high, other characters not as above; hind trochantellus shorter than trochanter; female antenna lacking white band 20
- 20. Tarsal claws with distinct basal lobe; inner surface of hind tibia at apex with comb of closely spaced setae; body entirely orange *Rogas*
- Tarsal claws lacking lobe; inner surface of hind tibia at apex lacking comb of setae, if with comb of setae then body not entirely orange *Aleiodes*
- 21. Fore wing with one submarginal cell22
- Fore wing with two submarginal cells23
- 22. Clypeus simply convex; female mesosternum with dense pile of felt-like setae; female with ovipositor shorter than metasoma, down-curved or very robust *Pygostolus* (Euphorinae)
- Clypeus with apical edge regularly indented, like a pie-crust (just about observable in Fig.4c); mesosternum without dense setae; female with ovipositor as long as or longer than metasoma, straight and slender *Charmon* (Charmontinae)
- 23. Hind trochantellus with row of apical teeth; first metasomal tergite with sides straight or slightly diverging posteriorly (Macrocentrinae) 24
- Hind trochantellus lacking apical teeth; first metasomal tergite either much narrower anteriorly than posteriorly or slightly narrowed behind spiracles25
- 24. Longest hind tibial spur more than half length of hind basitarsus; female with ovipositor no longer than apical depth of metasoma *Austrozele*
- Longest hind tibial spur less than half length of hind basitarsus; female with ovipositor about as long as length of metasoma, or longer *Macrocentrus*
- 25. First metasomal tergite much wider posteriorly than anteriorly (Meteorinae) 26
- First metasomal tergite not or barely wider posteriorly than anteriorly; slightly narrowed behind

¹ Note that a variety of Braconidae (including some Aphidiinae, Alysiinae, Cheloninae and other Euphorinae) could key out here but should not be entirely testaceous. If in doubt, check the tarsal claws, but bear in mind that this character requires high magnification and a clean specimen.

- spiracles ***Homolobus* (Homolobinae)**
26. Hind wing marginal cell narrowed apically (furthest from body); metasomal tergites with setae restricted to posterior bands ***Meteorus***
- Hind wing marginal cell widened apically; metasomal tergites with setae uniformly distributed ***Zeletus***

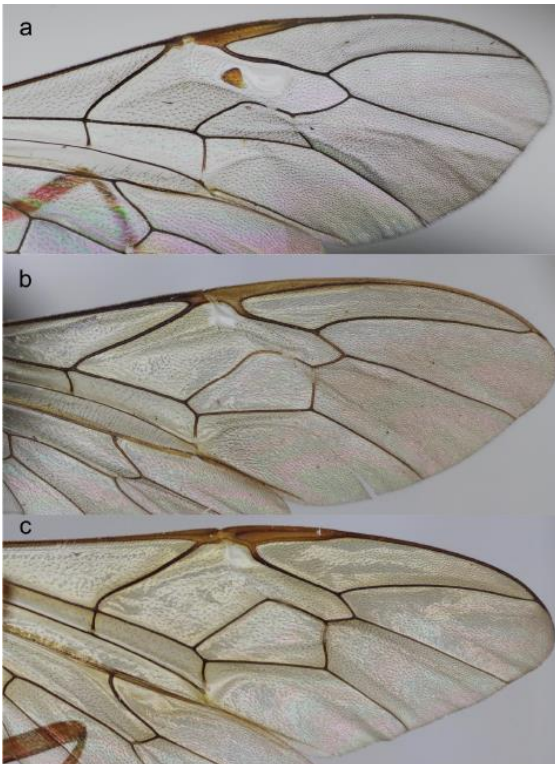


Fig.1. Fore wings, (a) *Enicospilus repentinus*, (b) *Stauropactonus bombycivorus*, (c) *Eremotylus marginatus*.

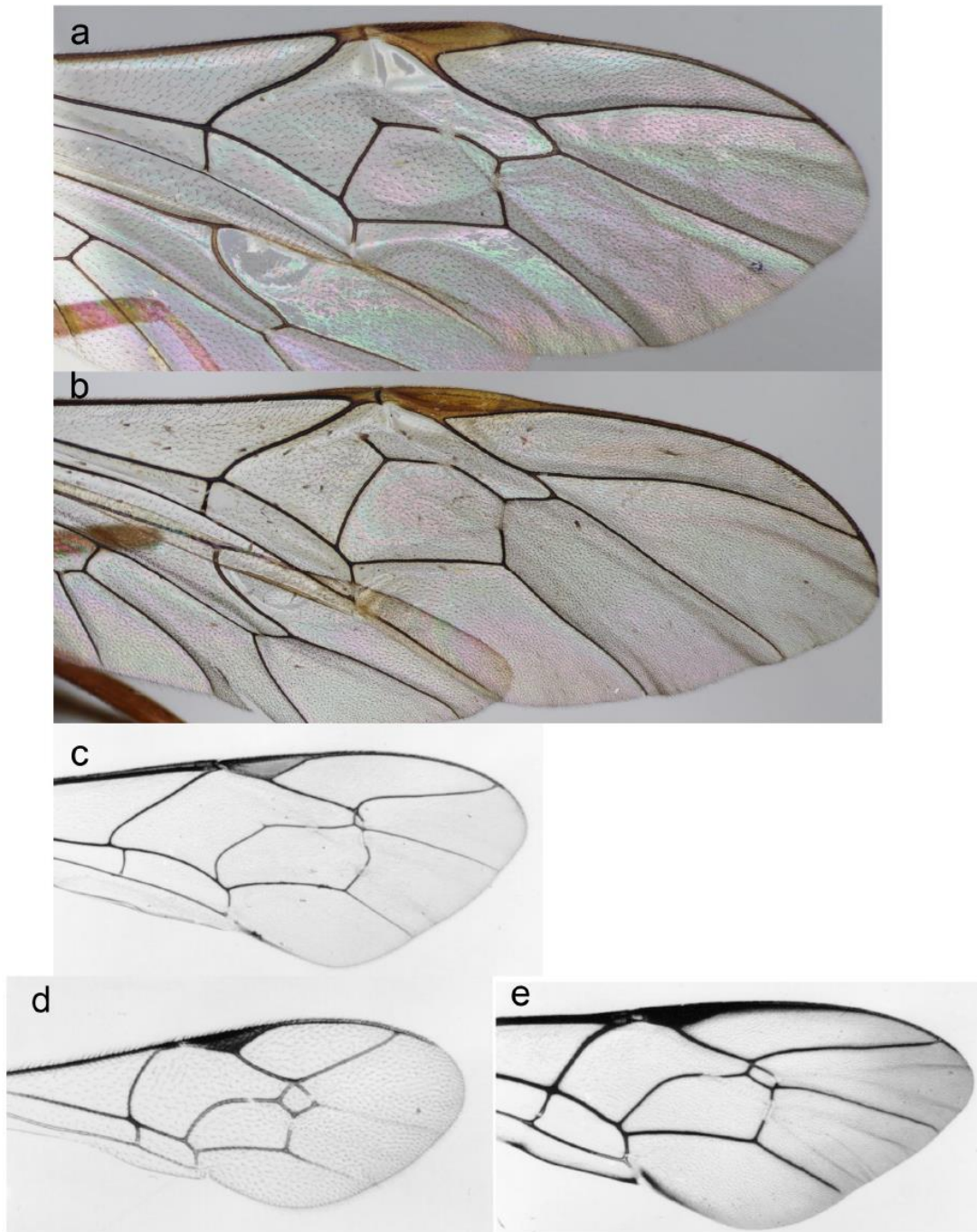


Fig.2. Fore wings, (a) *Ophion minutus*, (b) *Ophion mocsaryi*, (c) *Netelia* sp., (d) *Mesochorus* sp., (e) *Cidaphus* sp.

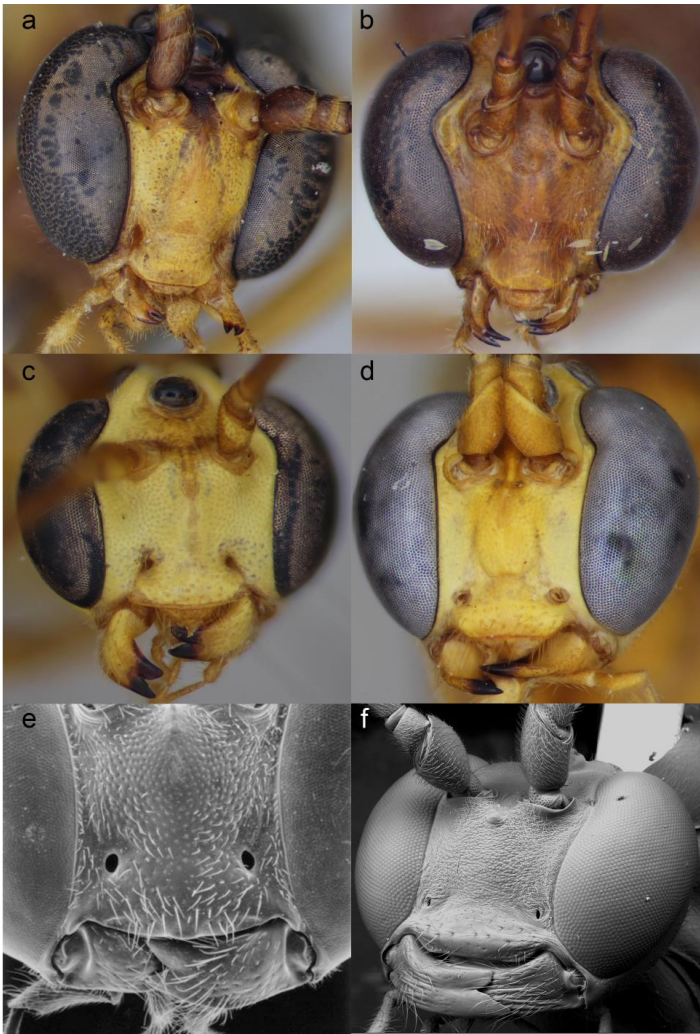


Fig.3. Face and mandibles, (a) *Stauropoctonus bombycivorus*, (b) *Enicospilus repentinus* (c) *Ophion minutus*, (d) *Netelia cristata*, (e) *Cidaphus* sp., (f) *Absyrtus vicinator*.



Fig.4. Face, mandibles, (a) *Priopoda stictica*, (b) *Aleiodes praetor*, (c) *Charmon extensor*.

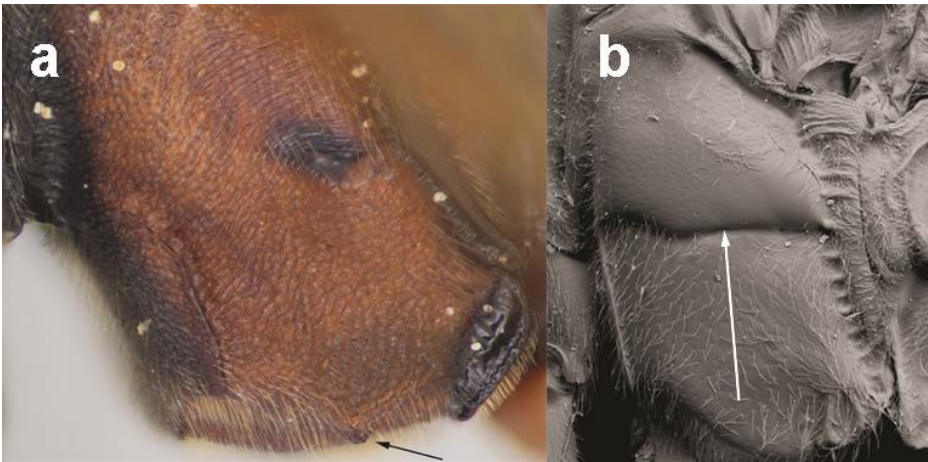


Fig.5. Mesopleuron, (a) *Eremotylus marginatus*, (b) *Opheltes glaucopterus*.

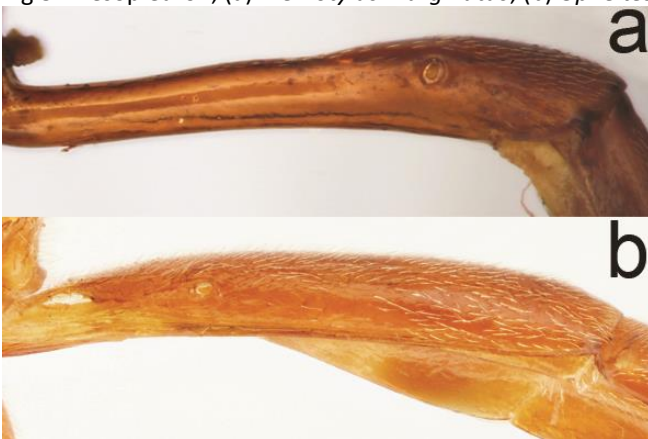


Fig.6. First metasomal segment, (a) *Enicospilus combustus*, (b) *Netelia infractor*.



Fig.7. Tarsal claw, *Netelia infractor*.



Fig.8. *Cidaphus atricillus*, female ovipositor and sheaths (a), male parameres (b).

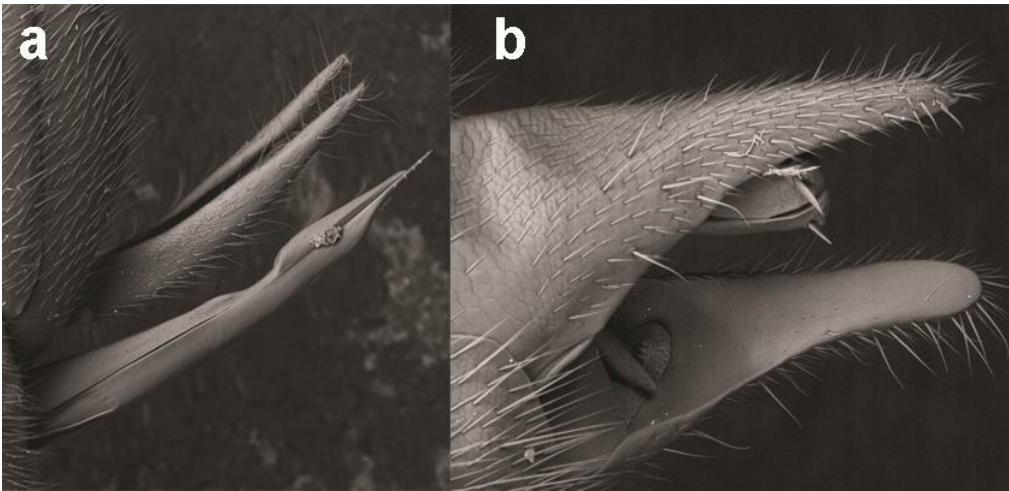


Fig.9. *Absyrtus vicinator*, female ovipositor and sheaths (a), male parameres (b).

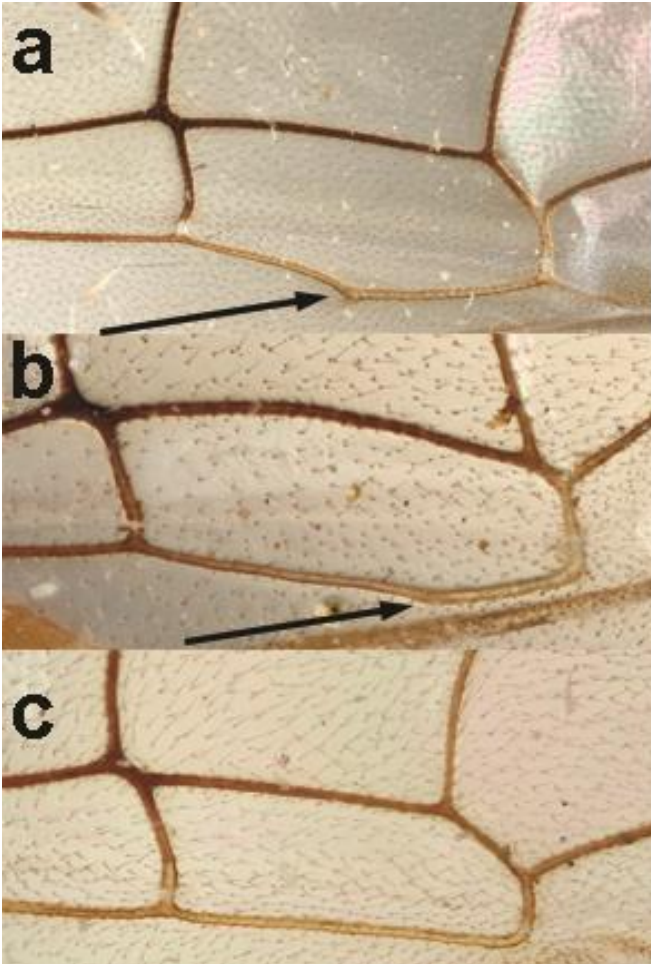


Fig.10. Fore wing vein AA, (a) *Absyrtus vicinator*, (b) *Lophyroleptus oblongopunctatus*, (c) *Perilissus pallidus*.

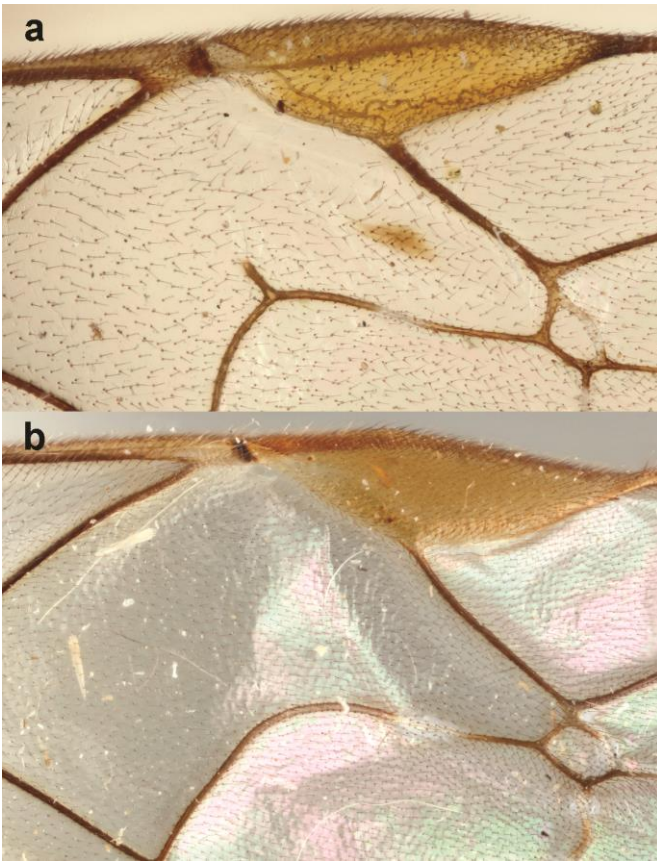


Fig.11. Fore wing, (a) *Lophyroplectus oblongopunctatus*, (b) *Absyrtus vicinator*.

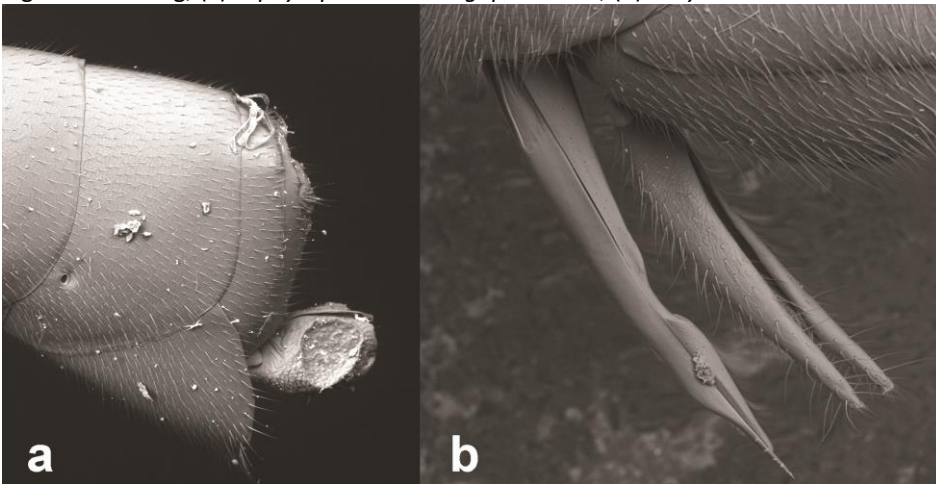


Fig.12. Apex of female metasoma, (a) *Lophyroplectus oblongopunctatus*, (b) *Absyrtus vicinator*.

Ichneumonidae

Mesochorinae

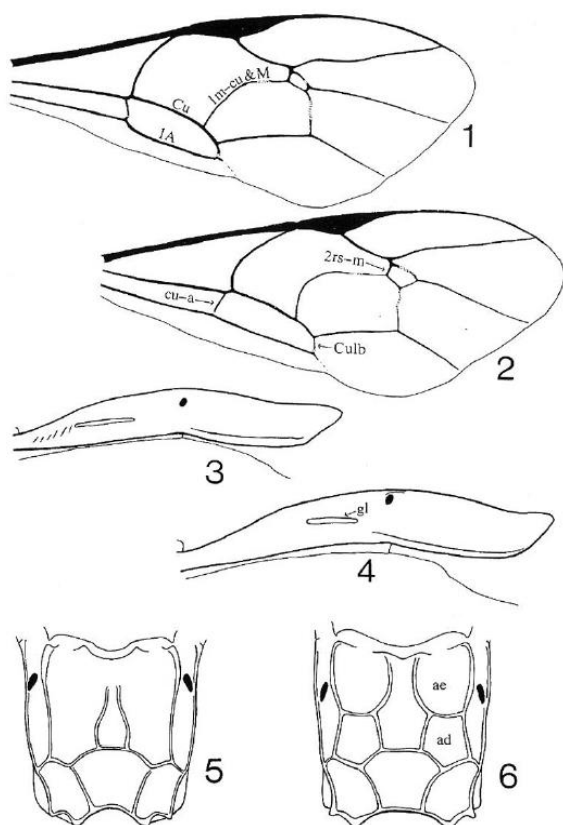
Cidaphus – Mike Fitton's (1985) key to the three British species works very well (reproduced below).

Mesochorus – there are a number of uniformly, or almost uniformly testaceous species. At present, it is not possible to present a key to species.

There are two further genera of Mesochorinae in Britain, *Astiphromma* and *Dolichochoerus* (often considered a synonym of *Astiphromma*). They may be found at light but none are 'ophionoid' in appearance, at least in Europe.

Key to *Cidaphus* species in Britain and Ireland (from Fitton, 1985)

1. Fore wing (Fig. 1) with the bend in vein $1m-cu \& M$ relatively weaker and closer to $2rs-m$ than CU ; abscissa of AA (labelled 1A) between $1cu-a$ and $2cu-a$ curved proximally. Propodeum (Fig. 6) with the keel separating the area externa and area dentipara strong. [Metasomal tergite 1 with the lateral area in front of the glymma smooth. Head mainly orange in colour except around the ocelli and the occiput. The median longitudinal ridge crossing the pronotal trough obsolete. Fore wing length 7.0-12.0 mm]..... ***alarius* (Gravenhorst)**
- Fore wing (Fig. 2) with the bend in vein $1m-cu \& M$ relatively stronger and closer to CU than $2rs-m$; abscissa of AA (labelled 1A) between $1cu-a$ and $2cu-a$ almost straight. Propodeum (Fig. 5) with the keel separating the area externa and area dentipara weak or absent.....**2**
2. Metasomal tergite 1 (Fig. 4) with the lateral area in front of the glymma smooth. Head mainly orange in colour. The median ridge crossing the pronotal trough relatively weak. [Fore wing length 12.5-13.5 mm]..... ***areolatus* (Boie)**
- Metasomal tergite 1 (Fig. 3) with the lateral area in front of the glymma with about 5 small, subparallel, diagonal ridges. Head mainly black in colour. The median ridge crossing the pronotal trough very strong. [Fore wing length 10.0-13.0 mm].....***atricillus* (Haliday)**



Figs 1-6. 1,2, right fore wing of (1) *C. alarius*; (2) *C. atricillus*. 3,4, metasomal segment 1, left lateral view, of (3) *C. atricillus*; (4) *C. areolatus*, gl = glymma. 5,6, propodeum, dorsal view, of (5) *C. atricillus*; (6) *C. alarius*, ae = area externa, ad = area dentipara.

Ctenopelmatinae

Absyrtus – Two species in Britain and Ireland, easily separated (but some more illustrations are needed):

- Propodeum shinier, less sculptured; petiolar area narrow, almost straight-sided anteriorly; median longitudinal carinae absent or (rarely) short sections present posteriorly, anterior transverse carina absent (Fig.1); first tergite narrower; fore wing vein *1cu-a* usually narrowly separated from *M&RS* but sometimes more widely separated; hind femur slenderer; aedeagus with apical spines (one on each side) pointing down (generic key: Fig.7b) ***vicinator* (Thunberg)**
- Propodeum matt; petiolar area longer, rounded anteriorly; median longitudinal carinae present and usually complete, sometimes only median sections present, anterior transverse carina often indicated (Fig.2); first tergite stouter; fore wing vein *1cu-a* widely separated from *M&RS*; hind femur stouter (at least in spring generation); aedeagus lacking apical spines ***vernalis* Bauer**



Fig.1. Propodeum (anterior uppermost), *Absyrtus vicinator*



Fig.2. Propodeum (anterior uppermost), *Absyrtus vernalis*

Alexeter – two nocturnal species in Britain, *A. clavator* (Müller) and *A. nebulator* (Thunberg), which were separated by Gauld & Mitchell (1977). However, there is some doubt as to how many species are involved.

Lophyoplectus – one species, *L. oblongopunctatus* (Hartig), rarely found except by rearing from its hosts, diprionid sawflies (it is a well-known parasitoid of the forestry pest species, *Neodiprion sertifer*).

Opheltetes – one species, *O. glaucopterus* (Linnaeus), a large and distinctive parasitoid of Cimbicidae sawfly larvae. Males are seldom found.

Perilissus – four testaceous, nocturnal species in Britain; a provisional key is included below.

Phobetres – eight British species, of which one, *P. nigriceps* (Gravenhorst), is predominantly testaceous.

Priopoda – two British species, one of which, *P. apicaria* (Geoffroy) (= *stictica* Fabricius misident.), is predominantly testaceous and comes to light.

Key to nocturnal (predominantly testaceous) *Perilissus* in Britain and Ireland

1. Pterostigma dark brown (Fig.1a)2
- Pterostigma testaceous (Fig.1b)3
2. Metasoma and mesosoma entirely testaceous; metasoma posteriorly conspicuously laterally compressed and elongate (Fig.2a); first metasomal tergite rather arched in profile (Fig.4a); propodeum with only petiolar area delimited by carinae (Fig.5a); aedeagus lacking spines ***compressus* Thomson**
- Metasoma posteriorly black (Fig.2b), mesoscutum varying from testaceous to mostly black with testaceous markings anteriorly (Fig.3), usually with restricted dark marks on each lobe; metasoma a

little laterally compressed posteriorly, not so elongate; first metasomal tergite flat in profile (Fig.4b); propodeum with area superomedia delimited by carinae (Fig.5b); aedeagus with apical spines (Fig.6)

- ***holmgreni* Habermehl**
- 3. Malar space long (Fig.7a); ocelli small (Fig.8a); mesopleuron sculpture coarser (Fig.9a); propodeum with carinae complete, strongly raised (Fig.10a); *1cu-a* only slightly postfurcal (Fig.11a) ***pallidus* (Gravenhorst)**
- Malar space short (Fig.7b); ocelli large (Fig.8b); mesopleuron sculpture weaker (Fig.9b); propodeum with carinae weak, area superomedia usually absent or weakly defined anteriorly, occasionally fully defined (Fig.10b); *1cu-a* usually strongly postfurcal (Fig.11b), occasionally only slightly postfurcal ***albitarsis* Thomson**

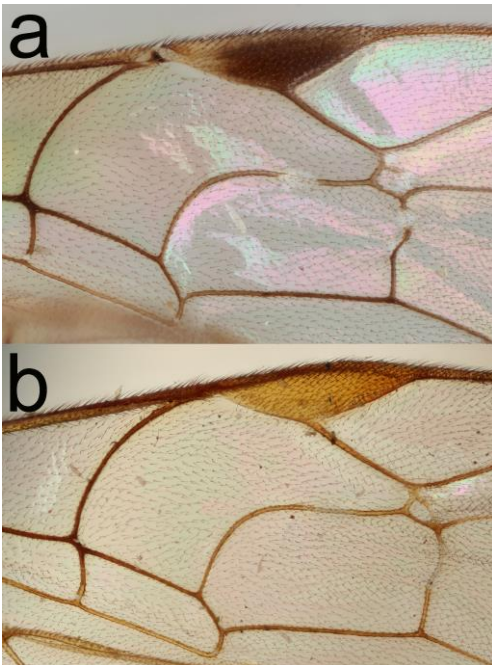


Fig.1. Pterostigma, *Perilissus holmgreni* (a), *P. pallidus* (b).



Fig.2. Metasoma, lateral, *P. compressus* (a), *P. holmgreni* (b).



Fig.3. Mesoscutum, *P. holmgreni*.



Fig.4. First metasomal tergite, *P. compressus* (a), *P. holmgreni* (b).

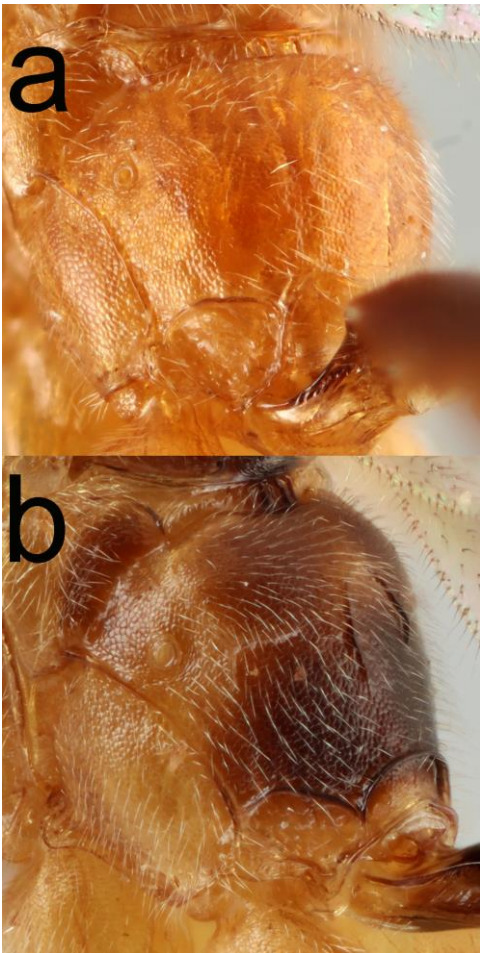


Fig. 5. Propodeum, *P. compressus* (a), *P. holmgreni* (b).



Fig. 6. Aedeagus (spine arrowed), *P. holmgreni*.



Fig. 7. Head, lateral, malar space arrowed, *P. pallidus* (a), *P. albitarsis* (b).

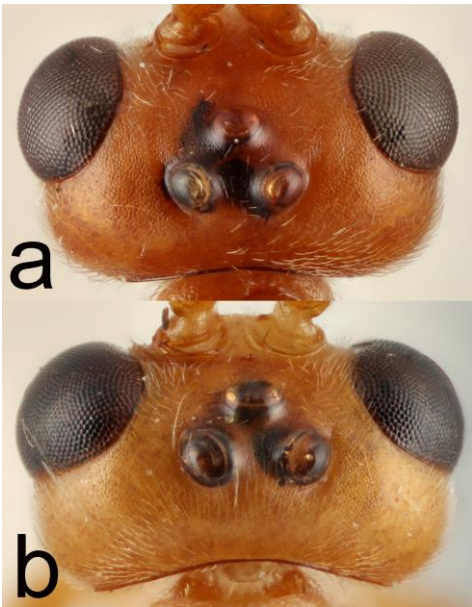


Fig.8. Head, dorsal, *P. pallidus* (a), *P. albitarsis* (b).



Fig.9. Mesopleuron, *P. pallidus* (a), *P. albitarsis* (b).

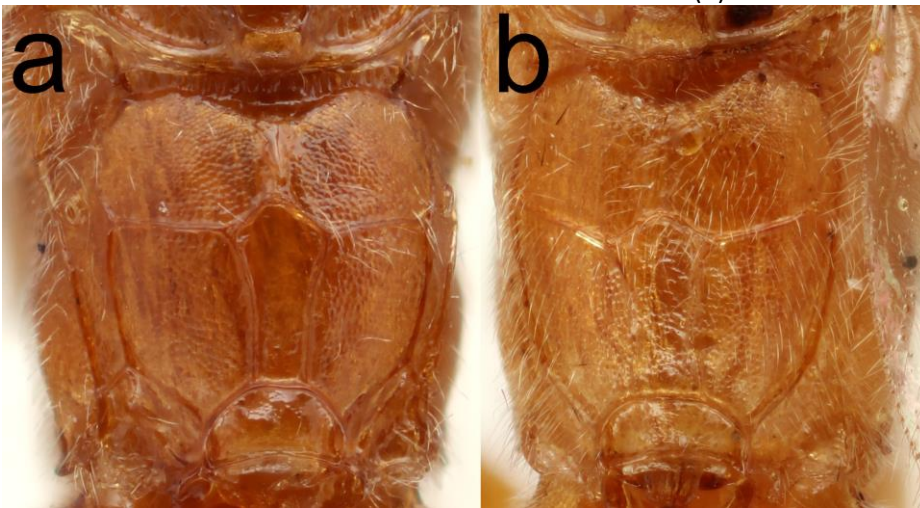


Fig.10. Propodeum, dorsal, *P. pallidus* (a), *P. albitarsis* (b).

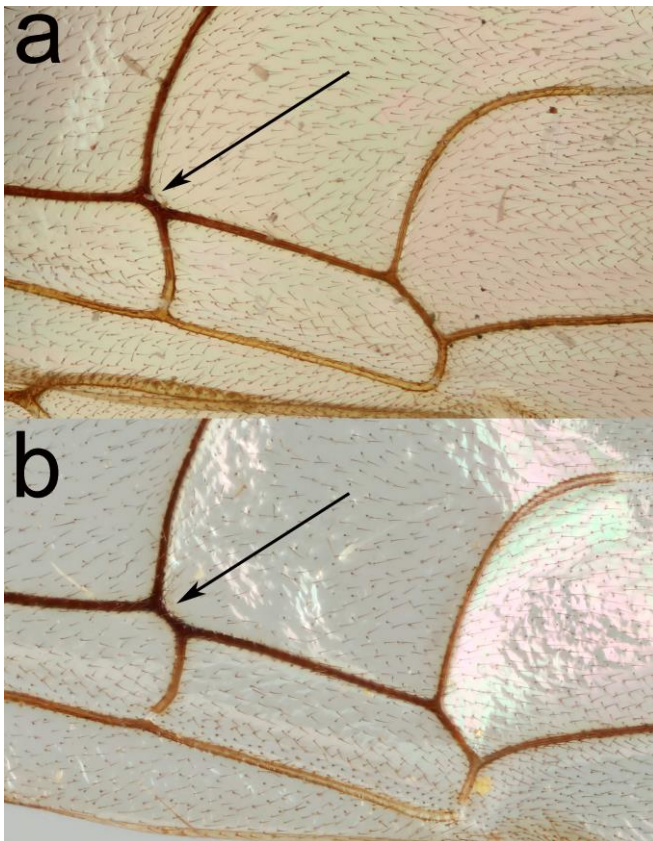


Fig.11. Fore wing vein 1cu-a, arrowed, *P. pallidus* (a), *P. albitarsis* (b).

Tryphoninae - *Netelia*

Readily identified by the combination of strongly twisted mandibles, fully pectinate claws and fore wing vein 2m-cu distal to 2rs-m (and areolet usually present).

Most of the British and Irish species of *Netelia* have been consistently confused and misidentified. Together with Mark Shaw (manuscript in prep.), I have revised the fauna and Mark has been able to provide many reliable rearing records, giving a fair idea of the host preferences of many of the species. There are now 25 species known from Britain and Ireland, five of which we are describing as new. These undescribed species are included in the keys in the format, 'sp. R'. *Netelia* species are subdivided into subgenera, five of which are known from Britain. A sixth European subgenus is included in the key as at least one species of *N.* (*Toxochiloides*) might be found in Britain. After the keys, I have included an introductory section from the manuscript.

An introduction to *Netelia*

Worldwide, *Netelia* is an extensive genus of mostly rather large parasitoids of Lepidoptera that includes some very common British species. In Britain, the adults are predominantly testaceous, have relatively long antennae and legs, large wings, and an elongate metasoma – in all these features resembling the distantly related Ophioninae (Ichneumonidae) and some other groups of orange Ichneumonidae and Braconidae which are, like *Netelia*, largely nocturnal (cf. Huddleston & Gauld, 1988).

All *Netelia* are koinobiont ectoparasitoids of Lepidoptera larvae and mostly (though not always) they attack the final instar larvae of exposed macrolepidoptera, delaying much larval development until the host has prepared a pupation retreat, in which the parasitoid rapidly consumes it and spins its own black cocoon. Most species are solitary as far as is known, but there are a few normally gregarious species, and others in which gregarious development is facultative.

In some studied species (e.g. Shaw, 2001) the host is subdued by a temporarily paralysing venom, enabling the eggs to be placed by the female with little host resistance. In others no venom is deployed but

the host is grasped very firmly by the ovipositing female parasitoid using all six of her legs. Shaw (2001) found that, when used, the temporarily paralysing venom had no direct effect on subsequent host development, but there was some indication (that requires further investigation) that after only a short period of parasitoid feeding the hosts were unable to develop further, even if the parasitoid larvae were removed. The black egg is anchored onto the host, almost always not far behind the head (where the caterpillar cannot reach it with its mandibles), and the egg later splits to reveal the first instar larva which, initially, remains partially within the egg shell. Because the anchor extends into the epidermis the egg can stay put through the host's moult, simply tearing through the old integument as it is sloughed. Thus hosts can also be attacked successfully in penultimate larval instars, with the parasitoid still enjoying the benefit of eventual development in the relative safety of the host's pupation site. Kasparyan (1973, translation 1981) gives a detailed review of the biology of the subfamily Tryphoninae, most of which, however, pertains to parasitoids of sawflies classified in tribes other than the Phytodietini, to which *Netelia* belongs.

Identification of British *Netelia* has not hitherto been easy. Most species are of rather uniform appearance and species have been much confused in collections and in the literature. Delrio's (1975) revision of the western Palaearctic species is very useful but the results of keying specimens are not always reliable, especially as the quality of reproduction of the male genitalia plates was too poor to enable the important characters to be seen. Since Townes's (1939) revision of the Nearctic species much emphasis has been placed on the utility of the male genitalia in *Netelia* taxonomy, unusually for ichneumonids. Preparation of the male genitalia is straightforward. Dried specimens can be relaxed (chopped laurel (*Prunus laurocerasus*) leaves are ideal for this purpose) for two days and the genital capsule removed with forceps. The basal ring needs to be separated from the parameres and the membranes torn, then the parameres can be splayed. In some species (especially of the subgenus *Netelia*) the pad curls up when dry. For convenience, the genitalia can be laid flat on a card rectangle which is mounted on the same pin as the specimen but this is not suitable for long-term storage as genitalia may eventually fall off if the glue is too thin or brittle. Genitalia can be kept dry in a gelatin capsule on the same pin as the specimen or in a more specialised container filled with glycerol. A more permanent (and recommended) technique is to slide-mount the genitalia in a cavity slide cross-referenced to the specimen. There is no need for the genitalia to be cleared or macerated; indeed we have seen several macerated preparations that are almost useless as the weakly sclerotized pad, with its diagnostic characters, has been dissolved almost entirely away.

Key to species of *Netelia* in Britain and Ireland

[Confirmatory characters are included in square brackets.]

An asterisk (*) denotes a species not yet recorded from Britain.

- 1 Female: ovipositor short, not projecting beyond metasomal apex [occipital carina entirely absent; fore wing vein 1cu-a approximately opposite M&RS].....(subgenus **Bessobates**) **6**
Male, or female with ovipositor longer, obviously projecting beyond metasomal apex**2**
- 2 Occipital carina absent; fore wing vein 1cu-a opposite or slightly antefurcal or postfurcal to M&RS.....**3**
Occipital carina present; fore wing vein 1cu-a usually postfurcal to M&RS, sometimes opposite**14**
- 3 Scutellum with lateral carinae strong to apex; fore wing vein 1cu-a slightly antefurcal to M&RS or rarely opposite; male parameres long, parallel-sided and internally lacking pad or other structures
.....(subgenus **Prosthodocis**) **13**
Scutellum with lateral carinae absent or weak, not extending much beyond mid-length; fore wing vein 1cu-a usually opposite M&RS; male parameres different, shorter, more rounded, or angulate ventrally, with internal structures, often including pad**4**
- 4 Fore wing with areolet open, i.e. vein 3rs-m missing; pterostigma dark greyish brown [female with ovipositor projecting beyond metasomal apex by xx x length of hind tibia].....
.....**N. (Parabates) nigricarpa** Thomson
Arolet usually closed by vein 3rs-m (occasionally absent in small specimens); pterostigma pale**5**
- 5 Female, or male with parameres short, rounded, with curved 'brace' across internal surface.....
.....(subgenus **Paropheltes**) **15**
Male, with parameres longer, more angulate, lacking curved 'brace' across internal surface.....
.....(subgenus **Bessobates**) **6**

- 6 Mesosternum dark brown and mesoscutum with three broad, dark brown markings laterally and medially (fig....) [flagellum uniformly testaceous; male paramere with comma-shaped pad at apex internally and curved strip of darker, minutely papillate cuticle].....**virgata (Geoffroy)**
Mesoscutum and mesosternum testaceous but sometimes with paler markings7
- 7 Female8
Male.....10
- 8 Terminal flagellomeres darkened; thorax usually lacking yellow markings, occasionally with some yellow marks; if with yellow marks, scutellar carinae conspicuous anteriorly; temples usually more rounded (fig....), very occasionally narrow, as in *pallescens*9
Flagellum uniformly testaceous; thorax with inconspicuous, pale yellow markings often on some of the following: lower edge of mesoscutum, along notauli, on subalar prominence, on anterior edge of pronotum and on propleuron; scutellar carinae absent beyond scuto-scutellar groove; temples narrower (fig....) [1st subdiscal cell with much of lower third glabrous or very sparsely setose, with only a single line of setae below glabrous patch (fig....)]**pallescens (Schmiedeknecht)**²
- 9 Propodeum without a trace of transverse carina and slightly flattened posteriorly (fig....), medially with at most very faint striations; 1st subdiscal cell with distal glabrous patch; smaller, wing length around ... mm**latungula (Thomson)**
Propodeum with lateral sections of transverse carina (fig....), if these are lacking then with at least a slightly elevated ridge here and propodeum more rounded than in *latungula*, propodeum medially with faint transverse striations; 1st subdiscal cell usually with only very narrow glabrous strip along wing fold but sometimes with distal glabrous patch or extensively glabrous on lower part; usually larger but very variable in size, wing length aroundmm **cristata (Thomson)**
- 10 Claws of mid leg with dense pectination, spaces between teeth barely visible (fig....); with extensive yellow markings (as above, for female); parameres in lateral view with elongate terminal lobe (fig....) and internally with dark, curved strip of minutely papillate cuticle (fig....) [genitalia internally with pointed pad, not extending towards apical, heavily sclerotized area]**pallescens (Schmiedeknecht)**
Claws of mid leg with sparser pectination, spaces between teeth obvious (fig....); lacking yellow markings, except occasional specimens; parameres in lateral view not with such an elongate, apical lobe (figs....), lacking or with very faint curved strip of minutely papillate cuticle11
- 11 Parameres internally with apical, heavily sclerotized area; lobe small and lateral; hind wing with 5 distal hamuli**sp. R**
Parameres internally lacking apical fold of heavily sclerotized area; lobe larger and more central; hind wing with 6 to 9 distal hamuli12
- 12 Parameres in lateral view with distinct ventral angulation (fig....), internally with large, rounded lobe adpressed to apical area (fig....); other characters as for female (above)..... **cristata (Thomson)**
Parameres in lateral view narrowed towards tip, lacking angulation (fig....), internally with smaller lobe, more angulate and protruding laterally (fig....); other characters as for female (above).....
.....**latungula (Thomson)**
- 13 Areolet present, petiolate anteriorly; hind tibia with dorsal spines more evenly spaced along length of tibia; male parameres more rounded apically, internally with dark streak..... **sp. S**
Arolet absent; hind tibia with dorsal spines mostly lacking in apical quarter of tibia; male parameres more angulate apically, internally lacking dark streak..... **sp. U**
- 14 Lateral carinae of scutellum weak, at most not extending much beyond middle; stemmaticum testaceous or yellowish [males with short, usually square-ended or rounded parameres]15
Lateral carinae of scutellum strong, extending nearly to apex of scutellum; often with black or dark brown stemmaticum but sometimes pale; some males with lateral carinae of scutellum weak but stemmaticum contrasting dark brown or black.....21
- 15 Transverse carina of propodeum strongly and evenly curved throughout; distinctive creamy pattern on thorax, including spot on metapleuron [male parameres internally with large, faintly sclerotized pad apically, no sclerotized structure visible in apical third]

²The female of sp. R is unknown but would probably key to *pallescens*; by analogy with the male, sp. R may differ in more rounded temples, uniformly testaceous thorax and smaller number of distal hamuli.

-(subgenus ***Paropheltes***) ***ornata*** (Vollenhoven)
 Transverse carina of propodeum straight across mid-line or largely absent; thorax with or without
 creamy pattern, if patterned then without spot on metapleuron16
- 16 Mesoscutum matt, dull; thorax entirely testaceous, lacking yellow marks [propodeum with transverse
 carina weak or absent; male parameres with tooth on inner edge]
 (subgenus ***Paropheltes***) ***terebrator*** (Ulbricht)*
 Mesoscutum more polished, or with yellow stripes; thorax often with yellow marks (may be faint) or
 mesoscutum with mid-lobe brown17
- 17 Fore wing vein *1cu-a* opposite *M&RS* or slightly postfurcal; transverse carina of propodeum
 incomplete or absent (subgenus ***Paropheltes***) 18
 Fore wing vein *1cu-a* postfurcal to *M&RS* by at least 0.2 times length of *1cu-a*; transverse carina of
 propodeum usually complete19
- 18 Mesosoma testaceous with (usually) brown median lobe of mesoscutum, female otherwise
 testaceous [male often with extensive yellow markings]; areolet pointed anteriorly, *2rs-m* and *3rs-m*
 meeting on *Rs* or forming a short stalk; malar space ~0.4 times basal width of mandible; male
 parameres blunt-ended, internally with heavily sclerotized brace curving across entire width
 ***tarsata*** (Brischke)
 Median lobe of mesoscutum testaceous, pronotum, lower edges and paired median stripes of
 mesoscutum, and sides of scutellum yellow in both sexes; areolet petiolate, with *2rs-m* and *3rs-m*
 joined for 0.5-1.0 times height of areolet; malar space ≤ 0.25 times basal width of mandible; male
 parameres narrowed apically, internally with weaker brace, extending diagonally towards inner side
 ***millieratae*** (Kriechbaumer)
- 19 Transverse carina of propodeum complete, strong, with strong transverse striations anterior to
 carina; no pale yellow/creamy markings; females only (subgenus ***Netelia***) ***testacea*** (Gravenhorst)
 Transverse carina of propodeum incomplete or weak, with much weaker striations anterior to carina;
 usually with some yellow/creamy markings on mesosoma; males or females
 (subgenus ***Paropheltes***) 20
- 20 [Female unknown] Antennal flagellum entirely infusate, ~46-48-segmented [small sample]; creamy
 marks (on notauli, lower edge of mesoscutum, sides of scutellum) contrasting against dark orange
 background colour; transverse carina of propodeum faint; fore wing vein *1cu-a* postfurcal to *M&RS* by
 0.4-0.5 times length of *1cu-a*; male parameres with faint triangularly widening area of sclerotization,
 with denticle on dorsal, inner edge and pad lacking striation **sp. C**
- Antennal flagellum occasionally basally infusate but mostly dull orange, 40-43-segmented; creamy
 marks inconspicuous against the pale orange background; transverse carina of propodeum usually
 strong, sometimes faint in males; fore wing vein *1cu-a* distal to *M&RS* by at most 0.3 times length of
1cu-a; male parameres with conspicuous triangularly widening area of sclerotization towards inner
 edge, dorsal margin rounded, lacking denticle, and pad with conspicuous striation ... ***inedita*** (Kokujev)
- 21 Propodeum with conspicuous punctation, no obvious transverse striae; males with short, rounded
 parameres, lacking internal pad.....subgenus ***Toxochiloides***³
 Mesopleuron and propodeum with inconspicuous punctation, with obvious striae on propodeum;
 males with longer, more angulate parameres with internal pad (subgenus ***Netelia***) 22
- 22 Fore wing vein *1cu-a* postfurcal of *M&RS* by about 0.4-0.6 the length of *1cu-a*; frequently with distinct
 ocular-ocellar space 23
 Fore wing vein *1cu-a* distal of *M&RS* by 0.3 the length of *1cu-a* or less; usually without distinct ocular-
 ocellar space.....24
- 23 Head in dorsal view with temples bulging, nearly in line with outer edge of eyes; legs stouter, fore
 femur **XX** as long as wide; spines on fore tarsus more conspicuous; antennae shorter, 41-45
 flagellomeres, 1st flagellomere ~2.3 times as long as broad; male antennal flagellum entirely infusate

³Three species of *Netelia* (*Toxochiloides*) are known in Europe but none has yet been found in Britain. Perhaps the most likely species to occur is *N. punctator* Delrio, which is a rather dark, reddish testaceous with black metasomal apex, pterostigma and antenna.

- except for base of 1st flagellomere; males frequently with dark markings on mesosternum, lower edge of metapleuron and anterior of first tergite; male genitalia with pad more elongated dorsally, with smaller lateral lobe.....**dilatata (Thomson)**
- Head in dorsal view with temples less rounded; legs slenderer, fore femur **XX** as long as wide; spines on fore tarsus less conspicuous; antennae longer, 44-51 flagellomeres, 1st flagellomere ~**XX** times as long as broad; male antenna testaceous on basal few flagellomeres; males with at most vague brown markings on mesosternum and metapleuron; male genitalia with pad with only short dorsal process, with larger lateral lobe**fuscicornis (Holmgren)**
- 24 Temples long and bulging, nearly as wide as or wider than outer edge of eyes; stemmaticum black or dark brown **vinulae (Scopoli)**
- Temples shorter, more abruptly narrowed, not as wide as outer edge of eyes; stemmaticum from testaceous to black.....**25**
- 25 Metasoma broadly black apically, **5th tergite onwards** entirely black; mid-lobe of mesoscutum matt, usually brown [stemmaticum black]**26**
- Metasoma usually testaceous apically, sometimes darker or with dark markings but never abruptly black over entire apical tergites; if mid-lobe of mesoscutum matt then other character not agreeing [stemmaticum testaceous to black]**27**
- 26 Male or female: temples strongly narrowed dorsally; male genitalia with large, ovoid pad **melanura (Thomson)**
- Male: temples more rounded; genitalia with pad strongly bilobed **opacula (Thomson) ♂**
- 27 Female: mesoscutum strongly matt [stemmaticum brown; metapleuron with indistinct, almost horizontal striae intermixed with punctures; temples rounded] **opacula (Thomson) ♀**
- Male or female: mesoscutum shiny**28**
- 28 Stemmaticum testaceous (females) or dark orange to brown (males)**29**
- Stemmaticum black.....**32**
- 29 Head in dorsal view with temples rounded; lateral sections of posterior transverse carina of propodeum low; male genitalia with pad roughly square in shape, large; lateral carinae of scutellum usually weak, not traceable much beyond scuto-scutellar groove.....**testacea (Gravenhorst)**
- Head in dorsal view with temples strongly narrowed; lateral sections of posterior transverse carina of propodeum high; male genitalia with pad roughly ovoid in shape, smaller; lateral carinae of scutellum strong, traceable to near apex of scutellum**30**
- 30 Antennal flagellum darkened from around the middle, with 43-46[check] flagellomeres; propodeal crests weaker; metapleural striae weaker; male genitalia with pad relatively small and ovoid **valvator Aubert**
- Antennal flagellum darkened only in the apical third or mostly dark, usually with more than 50 flagellomeres (occasionally with fewer); propodeal crests higher; metapleural striae stronger; male genitalia with pad relatively larger and ovoid or distinctly bilobed.....**31**
- 31 Fore wing vein 1cu-a slightly to distinctly angled; propodeal and metapleural striae intermixed with some obvious punctures, propodeal striae medially posteriorly angled; antennal flagellum rather more infuscate, in male almost entirely dark (many males will key to couplet 32 with a black stemmaticum); male stemmaticum usually dark brown**fuscicarpus (Kokujev)**
- Fore wing vein 1cu-a straight; propodeal and metapleural striae with very inconspicuous punctures, propodeal striae medially not angled; antennal flagellum paler, infuscate on about apical third or quarter in both sexes; male stemmaticum pale brown **sp. W**
- 32 Hind wing nervellus intercepted lower, upper abscissa of CU inclivous at more obtuse angle; hind tarsus paler than tibia (but sometimes altered by preservation); male face pale yellow; male genitalia with pad large, extending beyond level of tip of aedeagus, conspicuously incurved **infractor Delrio**
- Hind wing nervellus intercepted higher, upper abscissa of CU inclivous at more acute angle; hind tarsus the same colour as hind tibia; male face often testaceous; male genitalia with pad large and ovoid or bilobed but smaller, not reaching level of tip of aedeagus, less incurved**33**
- 33 Temples rather rounded in dorsal view; propodeal carina rather weak; male genitalia with pad large, ovoid.....**testacea (Gravenhorst)**

Temples strongly narrowed in dorsal view; propodeal carina stronger; male genitalia with pad bilobed

.....34

- 34 Antennal flagellum infusate (except very basally); mesoscutum with more conspicuous punctation, with punctures close together; lateral ocelli contiguous with eye; hind wing with vein *CU* between *M+CU* and *cu-a* about 0.39 – 0.45 times as long as vein *cu-a*, vein *CU* moderately inclivous and hind wing veins dark brown; male genitalia with apical lobe of pad broader, pad more weakly incurved

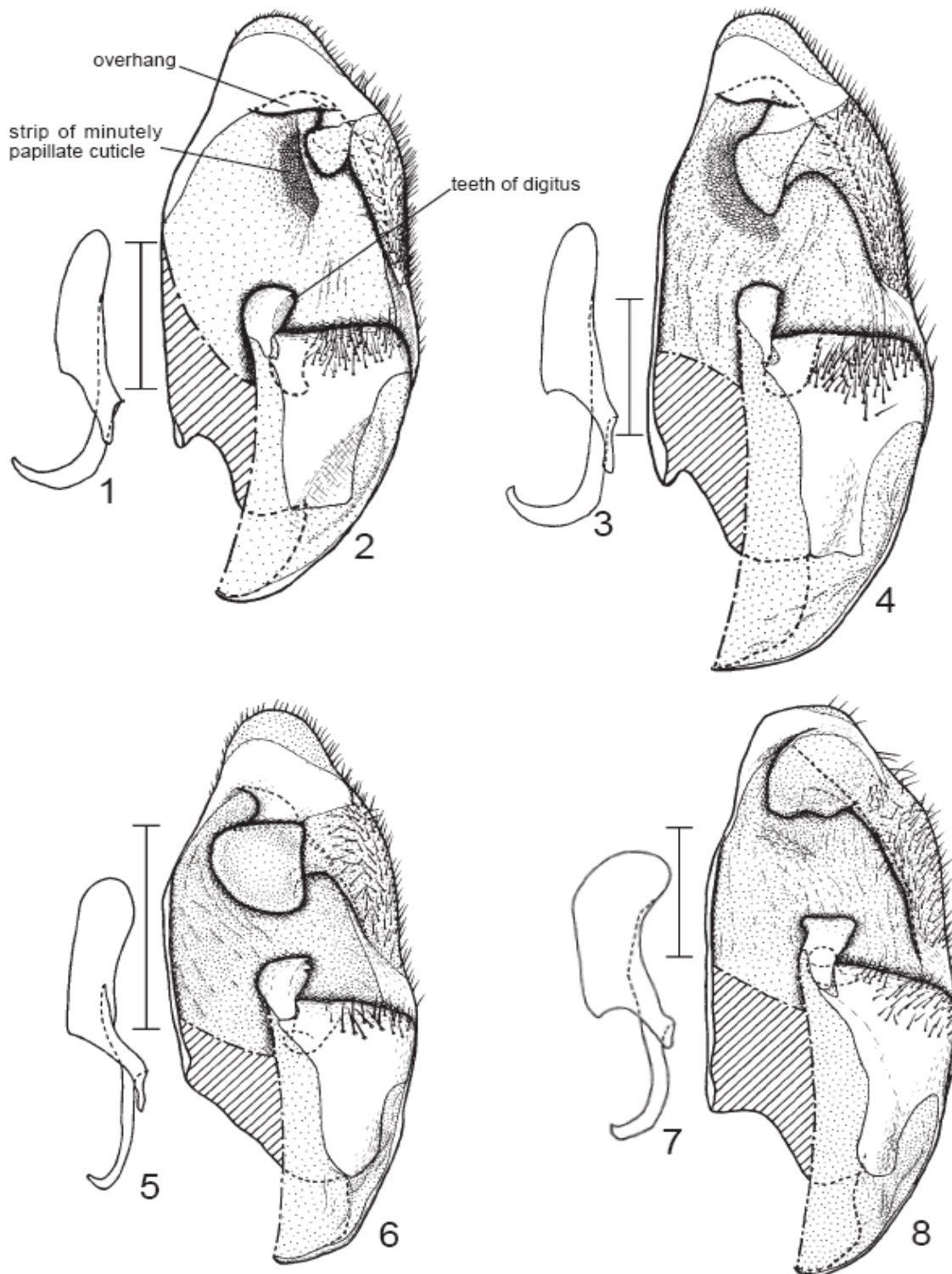
.....***fuscicarpus* (Kokujev)**

Antennal flagellum testaceous, darkened apically; mesoscutum with less conspicuous punctation, punctures further apart; lateral ocelli separated from eye by very narrow strip of cuticle [female only?]; hind wing with vein *CU* between *M+CU* and *cu-a* about 0.30 – 0.35 times as long as vein *cu-a*, vein *CU* strongly inclivous and hind wing veins light brown/testaceous; male genitalia with apical lobe of pad narrower, pad more strongly incurved

.....***ocellaris* (Thomson)**

Subgenus *Bessobates* Townes, Townes & Gupta, 1961

Other than *virgata*, which has a distinctive pattern of dark markings, females of the subgenus *Bessobates* can be difficult to separate. Males are easily identified by their genitalia.



Figs 1-8. Male genitalia, aedeagus (odd numbers) and internal surface of paramere (even numbers) of (1,2) *N. virgata*, (3,4) *N. pallescens*, (5,6) *N. latungula*, (7,8) *N. cristata*.



Fig.9. Mid claw, male *N. pallescens*.



Fig. 10. Mid claw, male *N. cristata*.

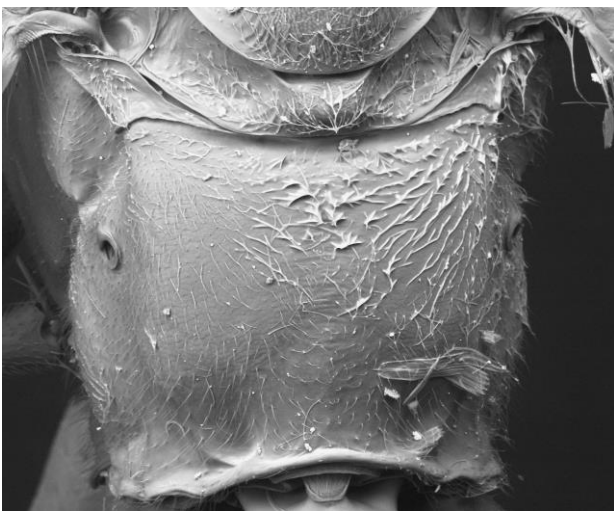


Fig.11. Propodeum, dorsal, *N. latungula*.

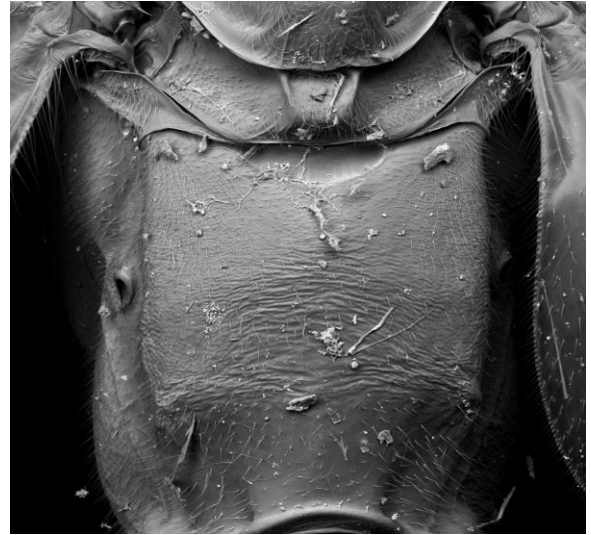


Fig.12. Propodeum, dorsal, *N. cristata*.

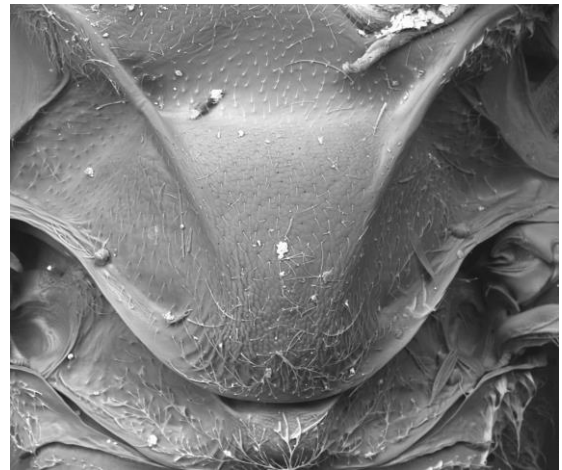


Fig.13. Scutellum, *N. latungula*.

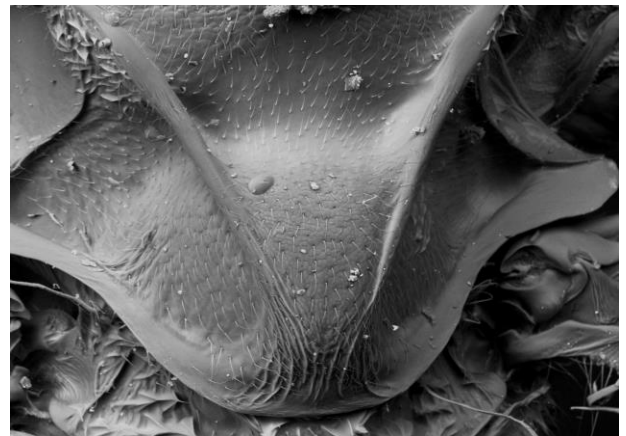


Fig.14. Scutellum, *N. cristata*.

Subgenus *Netelia* Gray, 1860

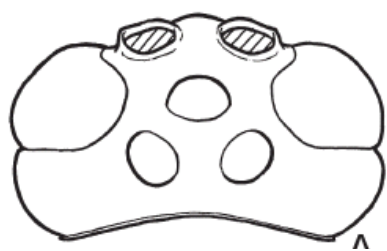


Fig.1. Head, dorsal, *N. dilatata*.



Fig.2. Head, dorsal, *N. fuscicornis*.

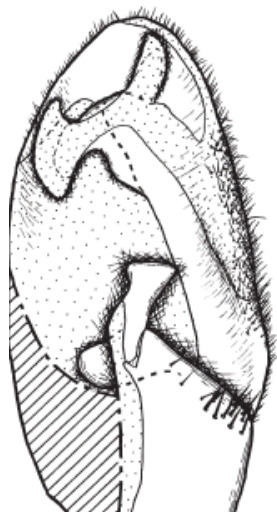


Fig.3. Male paramere, internal, *N. dilatata*.

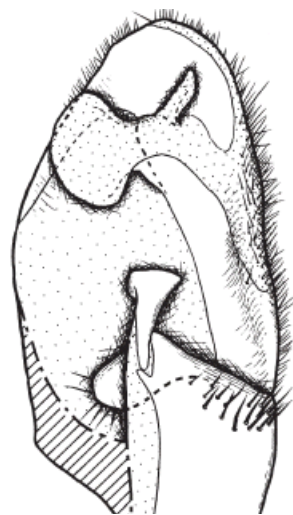


Fig.4. Male paramere, internal, *N. fuscicornis*.

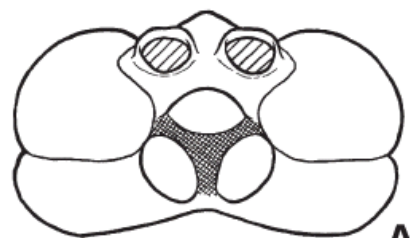


Fig.5. Head, dorsal, *N. vinulae*.

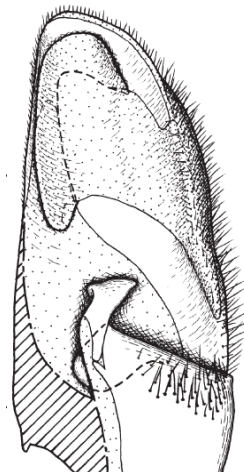


Fig.6. Male paramere, internal, *N. vinulae*.

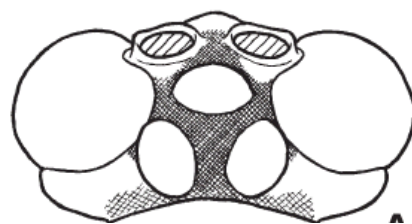


Fig.7. Head, dorsal, *N. melanura*.

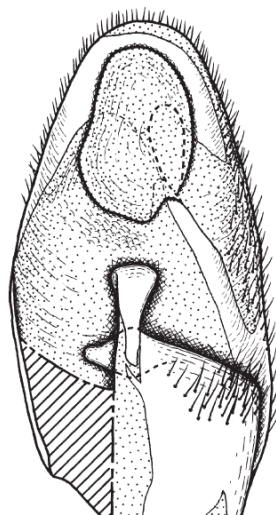


Fig.8. Male paramere, internal, *N. melanura*.

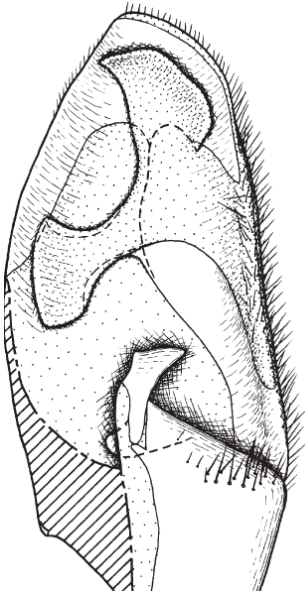


Fig.9. Male paramere, internal, *N. opacula*.

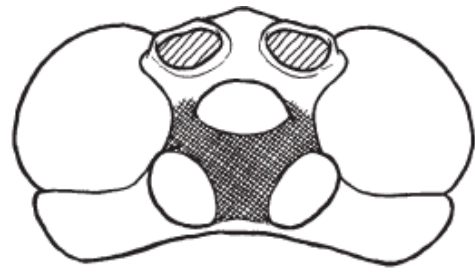


Fig.12. Head, dorsal, *N. fulvator* male.

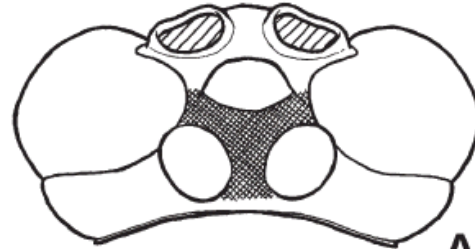


Fig.13. Head, dorsal, male *N. testacea*.

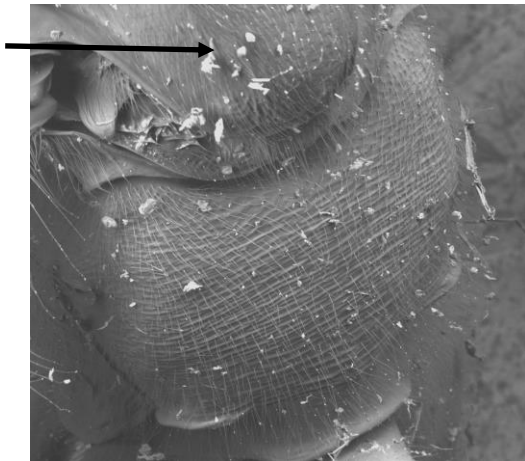


Fig.10. Propodeum, dorsal, *N. testacea*; posterior end of scutellum arrowed.

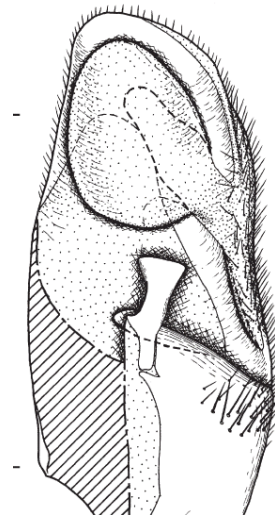


Fig.14. Male paramere, internal, *N. testacea*.

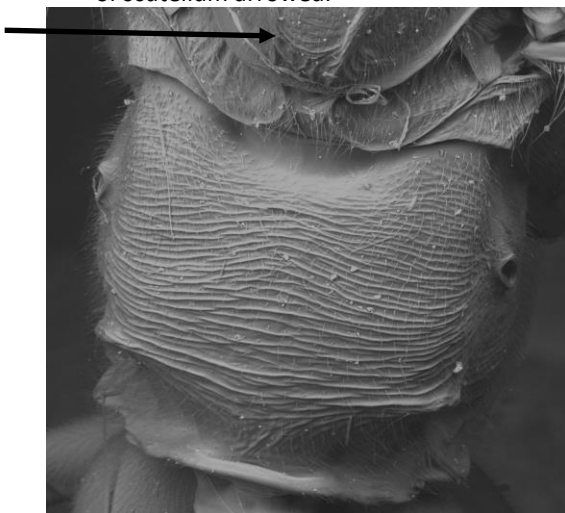


Fig.11. Propodeum, dorsal, *N. sp. W.*; posterior end of scutellum arrowed .

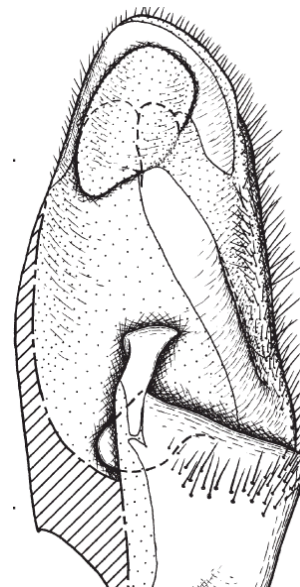


Fig.15. Male paramere, internal, *N. sp. W.*

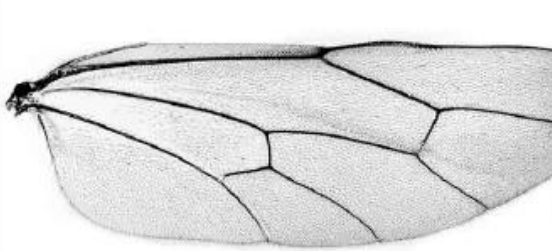


Fig.16. Hind wing, cf. *N. infractor*.

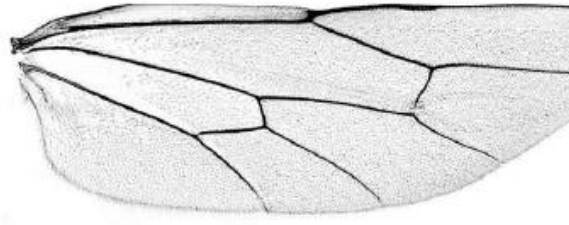


Fig.17. Hind wing, *N. ocellaris*.

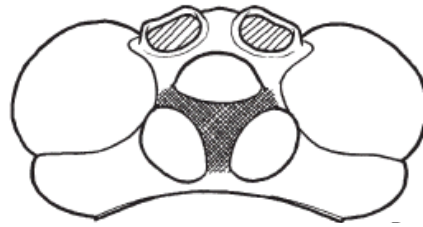


Fig.18. Head, dorsal, *N. infractor*.

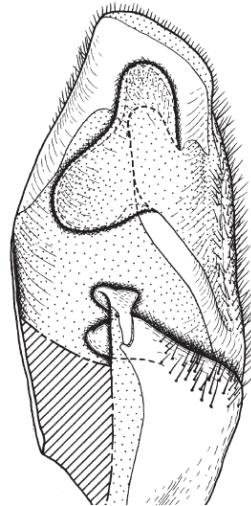


Fig.19. Male paramere, internal, *N. infractor*.

Subgenus *Parabates* Förster, 1869

Only one species in Britain (and Europe): *Netelia (Parabates) nigricarpa* (Thomson)

Subgenus *Paropheltes* Cameron, 1907

Males of some *Paropheltes* species have the convenient habit of fairly frequently dying with their parameres splayed out and thus easily examined without preparation. Our species are not difficult to distinguish.

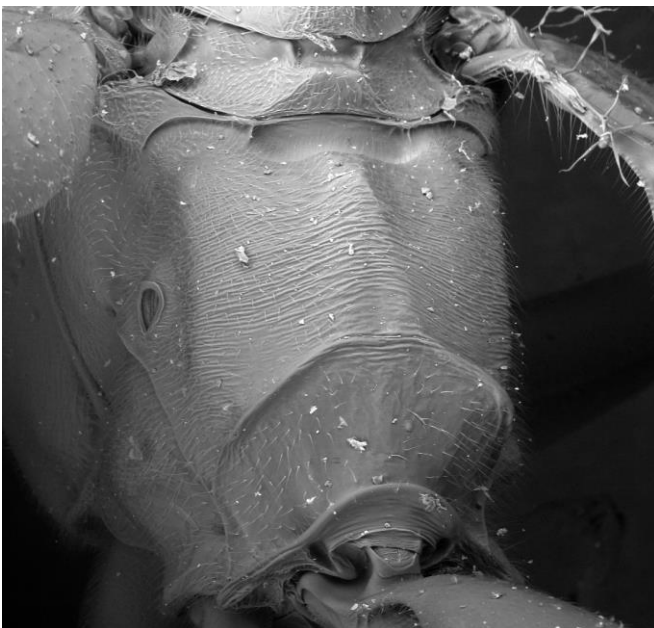


Fig.1. Propodeum, dorsal, *N. ornata*.

Subgenus *Prosthodocis* Enderlein, 1912

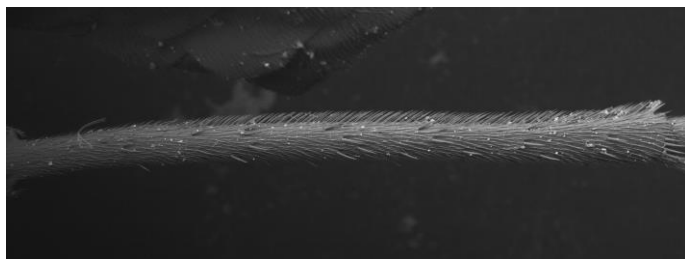


Fig.1. Hind tibia, *N. sp. S.*

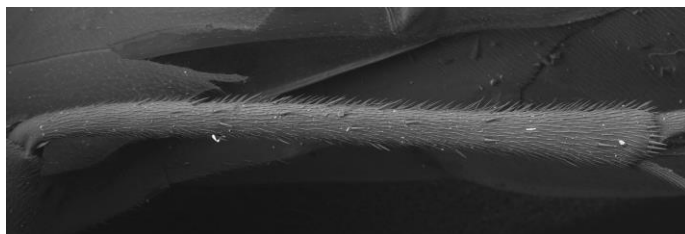


Fig.2. Hind tibia, *N. sp. U.*

Subgenus *Toxochiloides* Tolkanitz, 1974



Fig.1. Mesosoma, lateral (anterior to right), *N. punctator*.



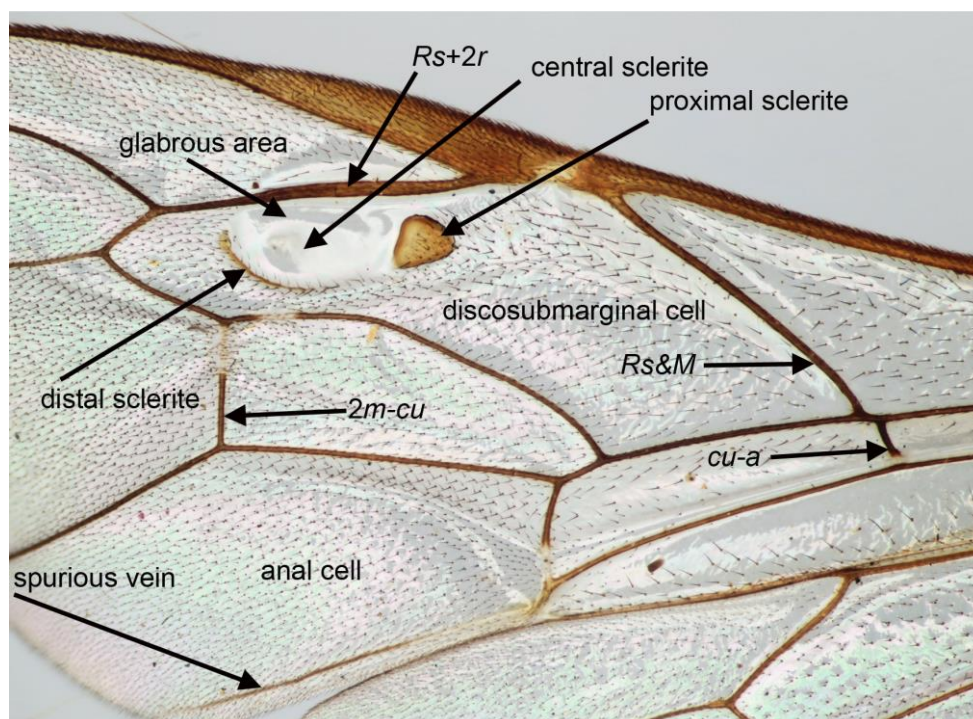
Fig.2. Male paramere, internal surface, *N. punctator*.

Ophioninae

The subfamily as a whole is one of the more distinctive, with fore wing vein *2m-cu* ending proximal to the single *rs-m* cross vein and the lower, apical section of the fore wing (second subdiscal cell) with a dark pigmented spurious vein paralleling the wing margin. The genera are straightforward to identify but most species of *Ophion* are very similar.

Key to species of *Enicospilus*

Enicospilus is a hugely species-rich genus, particularly in the tropics. The European fauna is depauperate. The few British species of *Enicospilus* have a messy taxonomic history; please see Broad & Shaw (2016) for a review of the species.



1. Fore wing lacking sclerites in glabrous area of discosubmarginal cell (Fig. 2A); large species, wing length c. 20 mm2
 - Fore wing with at least one discrete sclerite in discosubmarginal cell (Fig. 2B–D); smaller species, wing length < 15 mm3
2. Head posteriorly, in dorsal view, not expanded laterally beyond the eyes; ocelli touching or almost touching eye; antennal socket separated from inner margin of eye by not more than a third socket diameter (Fig. 3A) *Enicospilus inflexus* (Ratzeburg, 1844)
 - Head posteriorly, in dorsal view, expanded so that head is wider than its width at the eyes; ocelli distinctly separated from eye by about 0.2 × diameter of ocellus; antennal socket separated from inner margin of eye by about half socket diameter (Fig. 3B) *Enicospilus undulatus* (Gravenhorst, 1829)
3. Fore wing with distinct, pigmented proximal and central sclerites (Fig. 2B)4
 - Fore wing with distinct, pigmented proximal sclerite: central sclerite may be present but translucent (Fig. 2C–D)8
4. Pronotum, mesopleuron, mesoscutum and propodeum with dark patches (Fig. 14A) *Enicospilus combustus* (Gravenhorst, 1829)
 - Mesosoma lacking dark patches, uniformly testaceous5
5. Metasoma abruptly tipped with black posteriorly, from 5th or 6th tergite (Fig. 14B) *Enicospilus ramidulus* (Linnaeus, 1758)
 - Metasoma not abruptly black-tipped (but may be diffusely infusate ventrally and apically)6

6. Head with temples rounded, more buccate, and with distinct ocular-ocular space (Fig. 4C); first metasomal tergite in lateral view with better-defined dorsal dip (Fig. 6C); male aedeagus apically paler, apex more rounded, protruding more dorsally and not reflexed ventrally (Fig. 9B).....*Enicospilus myricae* Broad & Shaw
- Head with temples narrowed, straighter, with ocelli adjacent to or only narrowly separated from eyes (Fig. 4A–B); first metasomal tergite with shallow dorsal dip (Fig. 6A–B); male aedeagus same colour throughout, apex more smoothly curved, not so protruding dorsally, reflexed ventrally (Fig. 9A)7
7. Temples very strongly narrowed behind eyes (Fig. 4A); scutellum with sides more nearly parallel, heavily punctate and with slight posterior ridge (Fig. 5A); antenna with 51–56 flagellar segments, preapical flagellar segments stouter (Fig. 7B).....*Enicospilus cerebrator* Aubert, 1966
- Temples less strongly narrowed posteriorly (Fig. 4B); scutellum with sides distinctly converging posteriorly, more sparsely punctate and smoothly curved posteriorly (Fig. 5B); antenna with 58–69 flagellar segments, preapical flagellar segments slenderer (Fig. 7A).....*Enicospilus adustus* (Haller, 1885)
8. Fore wing with small translucent central sclerite and narrow pigmented distal sclerite (Fig. 2C); fore wing vein *1cu-a* distinctly proximal to *M&RS* (Fig. 11A) *Enicospilus merdarius* (Gravenhorst, 1829)
- Fore wing lacking central sclerite and with very faint distal sclerite (Fig. 2D); fore wing vein *1cu-a* opposite vein *M&RS* (Fig. 11B)*Enicospilus repentinus* (Holmgren, 1860)

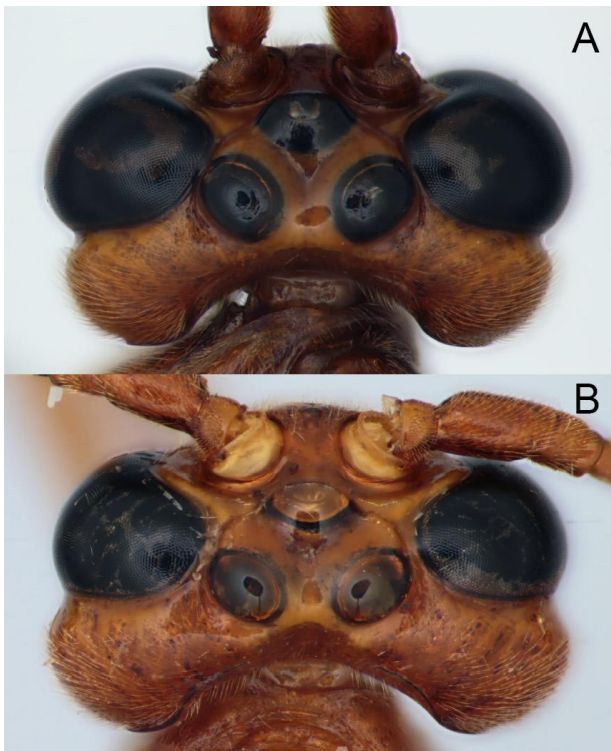


Fig. 3. Head, dorsal view. A. *Enicospilus inflexus*. B. *E. undulatus*.

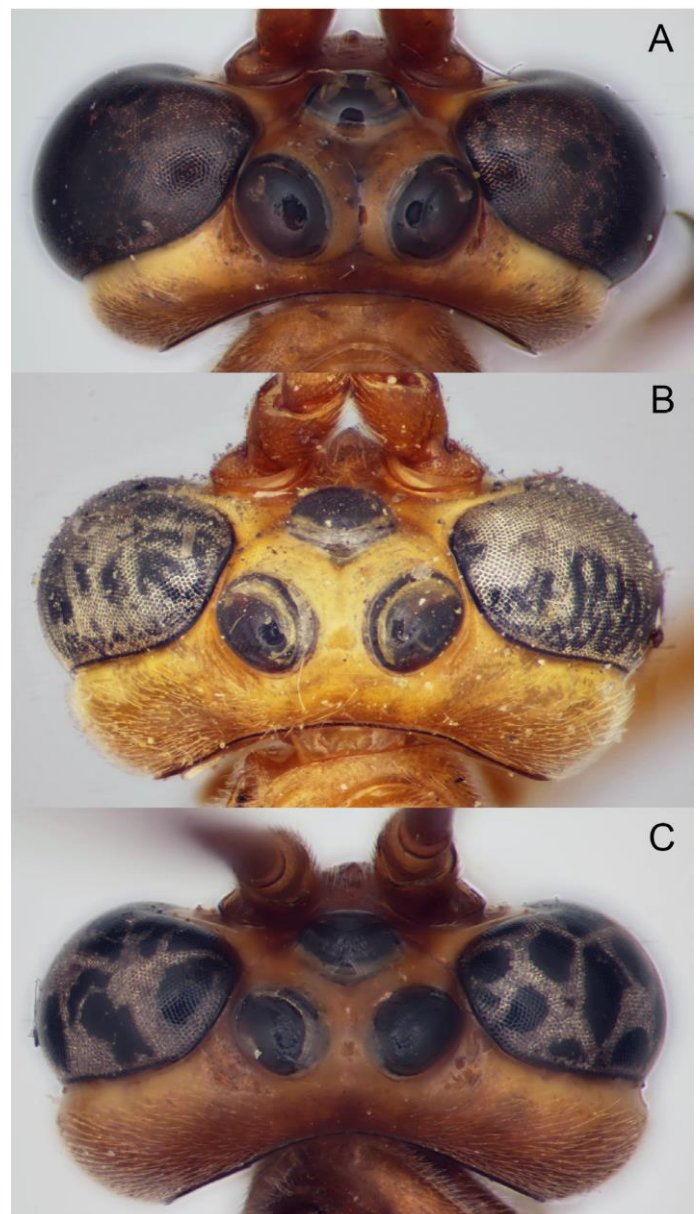


Fig. 4. Head, dorsal view. A. *Enicospilus cerebrator*. B. *E. adustus*. C. *E. myricae*.

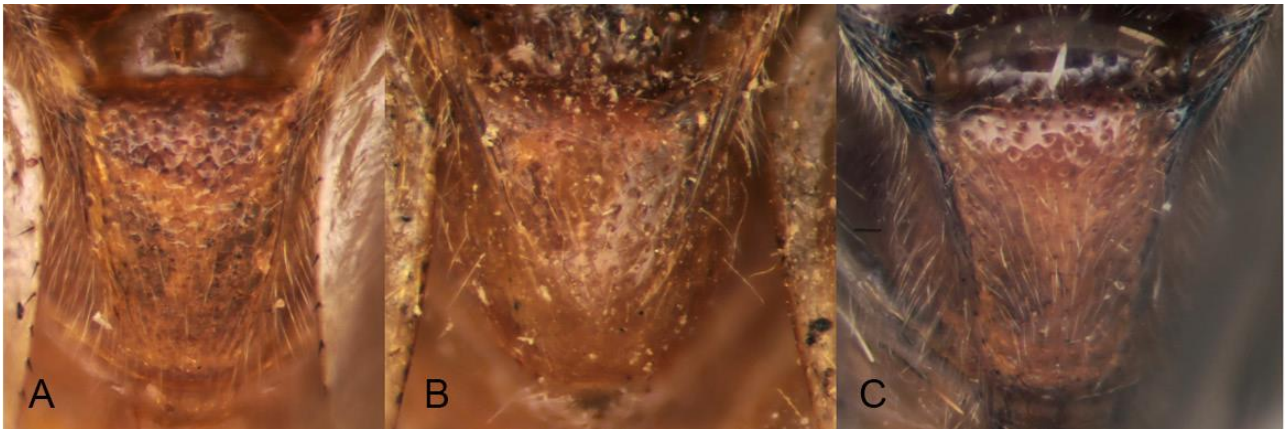


Fig. 5. Scutellum. A. *Enicospilus cerebrator*. B. *E. adustus*. C. *E. myricae*.

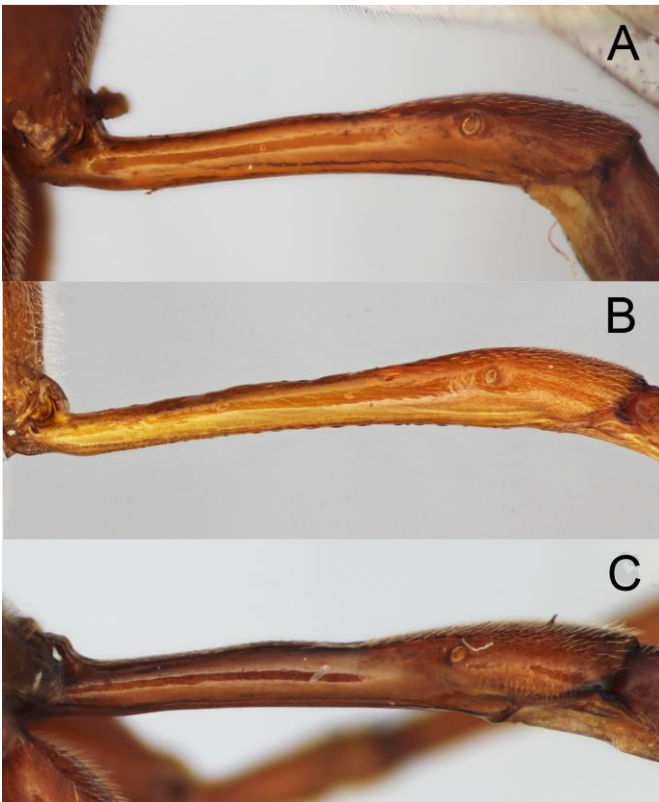


Fig. 6. First metasomal segment (anterior to left). A. *Enicospilus cerebrator*. B. *E. adustus*. C. *E. myricae*.



Fig. 7. Distal flagellar segments. A. *Enicospilus adustus*. B. *E. cerebrator*.



Fig. 8. Male parameres (claspers). A. *Enicospilus adustus*. B. *E. cerebrator*. C. *E. myricae*.



Fig. 9. Male aedeagus. A. *Enicospilus adustus*. B. *E. myricae*.

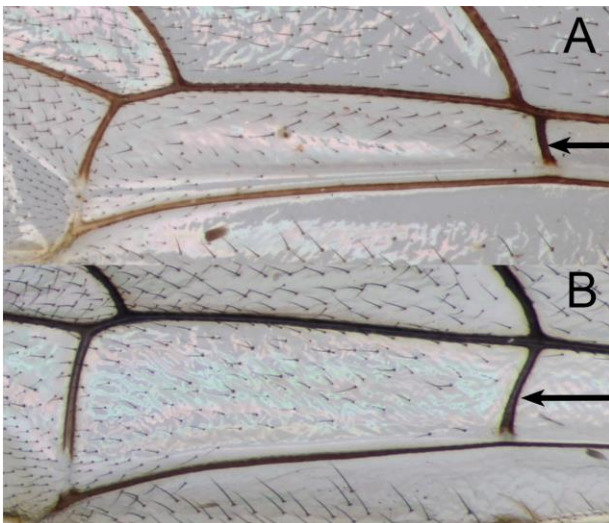


Fig. 11. Fore wing (distal to left), vein *cu-a* arrowed. A. *Enicospilus merdarius*. B. *E. repentinus*.

Eremotylus

Two British species, which are abundantly distinct. *Eremotylus curvinervis* may easily be passed over as an *Ophion*.

- Conspicuously patterned black and testaceous; wing membrane yellow; large, fore wing length c.15 mm
..... ***marginatus* (Jurine)**
- Uniformly testaceous; wing membrane hyaline; smaller, fore wing length c. 11 mm
..... ***curvinervis* (Kriechbaumer)**

E. curvinervis: very few British specimens, from southern England. A parasitoid of *Dryobotodes eremita* (Noctuidae).

E. marginatus: very localised, in southern/eastern England, but seems to be abundant at some sites (e.g. Monks Wood, Hunts.), where males fly by day and females are more strictly nocturnal. Host unknown.

Key to species of *Ophion*

Whilst there are a few distinctive species of *Ophion*, most of the British species are very similar and difficult to separate on 'simple' characters. Gauld produced several papers on the British Ophioninae but, unfortunately, these cannot be recommended. Gauld's characters were over-simplified and he misinterpreted some species. Brock's (1982) revision was a great improvement and should be used by all with an interest in British *Ophion*. However, Brock's key is very difficult to use. Note that ongoing taxonomic work in Sweden is revealing several previously unrecognised species and some misidentifications. Note that the plurivoltine 'species' (*O. obscuratus* and *O. parvulus*) will almost certainly prove to be complexes of univoltine species, as other European *Ophion* seem to routinely only have one generation per year. I hope that the key presented here will be found to be relatively simple to use; however, for all but the most distinctive species, it is worth checking your identifications, at least initially, against the descriptions and key provided by Brock. A good starting point in identifying *Ophion* is to collect specimens from one or more sites over the course of a year and try to recognise the common species, and which species are present at different times of the year. Whilst there will be only two or possibly three species on the wing in September, in June a good site might hold seven similar species.

1. Occipital carina absent dorsally, usually entirely; stemmaticum black; wing membrane yellowish; scutellum almost square in dorsal view.....**2**
- Occipital carina complete; stemmaticum testaceous or black if body with extensive black markings; wing membrane not yellowish (unless body with extensive black markings); scutellum narrowed**3**
2. Occipital carina entirely absent; propodeum with area superomedia complete but anterior transverse carina otherwise mostly lacking; first flagellomere less than 3.5 x as long as wide
.....***ocellaris* Ulbricht**
- Occipital carina with lateral section faintly present; propodeum with anterior transverse carina complete; first flagellomere more than 3.5 x as long as wide***areolaris* Brauns**
3. Body with conspicuous black marks on frons, median lobe of mesoscutum and anterior half of propodeum (Fig.1); wing membrane strongly yellowish***ventricosus* (Thunberg)**
- Body lacking black markings, any dark marks vaguely defined; wing membrane transparent or slightly infusate/yellowish**4**
4. Small, wing length at most 11 mm; fore wing vein 2r&RS distinctly thickened near junction with pterostigma (generic key: Fig.2a); frequently yellow-marked ***minutus* Kriechbaumer**
- Larger, wing length >11 mm; fore wing vein 2r&RS not thickened near junction with pterostigma (generic key: Fig.2b); often uniformly testaceous**5**
5. With conspicuous pale yellow markings on the ocellar area of the head, forming stripes on the mesoscutum (Fig.2), and at the apex of the pterostigma, at least, usually on the mesopleurum too.....**6**
- Lacking yellow markings, although sometimes with ill-defined paler areas**7**
6. Antenna with > 51 flagellomeres; distance between posterior ocellus and occipital carina much less than 2.0 x maximum width of first flagellomere; third metasomal segment, in lateral view, up to 3.0 x as

- broad apically as at base (Fig.3b)..... **obscuratus Fabricius**
 - Antenna with < 50 flagellomeres; distance between posterior ocellus and occipital carina c. 2.0 or more x maximum width of first flagellomere; third metasomal segment, in lateral view, not more than twice as broad apically as at base (Fig.3a)..... **forticornis Morley**
- 7. Hind coxa and femur slender (Fig.4a), coxa not larger than pleural area of propodeum; antenna usually with more than 64 flagellomeres (very occasionally < 60); mesoscutum usually darker than rest of body [head usually with distinct ocellar-ocular interspace; early spring species]..... **scutellaris Thomson**
- Hind coxa and femur less slender (Fig.4b-d), coxa larger than pleural area of propodeum; antenna usually with less than 64 flagellomeres (some *costatus* and *crassicornis* with up to 64 flagellomeres); mesoscutum not darker than rest of the body, although occasionally darker in combination with other dark markings on thorax8
- 8. Mandibular gape with acutely angled gap between teeth, lacking internal angles (Fig.5), teeth frequently dull, *and* hind trochantellus as long as wide in dorsal view (measurements arrowed in Fig.7a); following characters in combination: fore wing vein *RS* strongly sinuous; fore wing veins testaceous; fore wing ramulus very short; temples rounded **luteus (Linnaeus)**
- Mandibular gape right-angled, with internal angles (Fig.6) and glossy teeth; hind trochantellus usually shorter than wide in dorsal view (Fig.7b), but sometimes as long as wide, in which case other characters not as above, ramulus often long (Fig.8)9
- 9. Epicnemial carina, in antero-ventral view, with pleurosternal angles nearly in line with sternal angles; pleurosternal angles more nearly right-angled (Figs9,23); antenna with first flagellomere c.3.0 or less x as long as wide10
- Epicnemial carina with pleurosternal angles obviously anterior to sternal angles; pleurosternal angle usually obtuse (Figs 10,22); *if* angles nearly aligned *then* first flagellomere slender, more than 3.5 x as long as wide13
- 10. Head with lateral ocelli touching eyes (Fig.11); temples strongly narrowed in dorsal view.....11
- Head with gap between ocelli and eyes (*cf.* Fig.12); temples more rounded in dorsal view.....12
- 11. Head with deep, sharply defined groove bordering posterior side of hind ocellus (Fig.11); antennae longer, with 57 or more flagellomeres, usually 60 or more; pleurosternal angles of epicnemial carina more rounded (Fig.15); wing membrane with slight smoky or yellow suffusion; propodeal spiracle narrow, linear (Fig.16)..... **costatus Ratzeburg**
- Head with shallower, less defined groove bordering posterior side of hind ocellus (Fig.13); antennae shorter, with 58 or, usually, fewer flagellomeres; pleurosternal angles of epicnemial carina more sharply angled, rather acute (Fig.14); wing membrane lacking any yellow suffusion; propodeal spiracle more ovoid (Fig.16) **mocsaryi Brauns**
- 12. Hind trochantellus almost as long dorsally as wide (*cf.* Fig.7a); fore wing with ramulus short, c.0.2-0.3 x width of submarginal cell at ramulus; antenna longer, usually with >60 flagellomeres but occasionally fewer **crassicornis Brock**
- Hind trochantellus obviously shorter than wide dorsally (Fig.7b); fore wing with ramulus longer, c.0.4-0.5 x width of submarginal cell at ramulus; antenna shorter, with 60 or fewer flagellomeres **?crassicornis Brock** northern 'morph'
- 13. Scutellum with lateral carinae distinct over at least basal 0.5; first tergite in lateral view with slight or distinct median undulation (Fig.17); first sternite ending obviously posterior to spiracle; fore wing vein *RS* strongly sinuous14
- Scutellum with lateral carinae absent; first tergite in lateral view lacking undulation (Fig.18); first sternite ending level with or slightly behind spiracle; fore wing vein *RS* evenly curved or weakly sinuous..15
- 14. Head with distinct gap between lateral ocellus and eye; temples rounded; antenna short, with 50 or fewer flagellomeres **perkinsi Brock**
- Head usually with no gap between lateral ocellus and eye; temples usually strongly narrowed; antenna longer, >50 flagellomeres, usually 54-57 **pteridis Kriechbaumer**
- 15. Head with distinct gap (at least 0.4 x diameter of ocellus) between eye and lateral ocellus (Figs 12,19); temples rounded and broad, in dorsal view from slightly less than maximum length of eye to distinctly greater.....16
- Head with no or slight (no more than 0.3 x diameter of ocellus) gap between eye and lateral ocellus (*cf.*

- Fig.20); temples often rounded but obviously shorter than length of eye in dorsal view17
16. Propodeum with transverse carinae strong but longitudinal carinae weak (except in petiolar area); antenna longer (54 or more flagellomeres), central flagellomeres longer than wide; genal inflection short, not more than 0.3 x mandible base, much shorter than postgena (Fig.21); male with temples very long, about 1.3 x length of eye in dorsal view (Fig.19); female with apex of metasoma usually black.....
.....**longigena Thomson**
- Propodeum with transverse and longitudinal carinae strong; antenna shorter (usually <50 flagellomeres), central flagellomeres as wide as long; genal inflection longer, about 0.4-0.5 x width of mandible base, not much shorter than postgena (Fig.22); temples shorter, no more than about 1.0 x length of eye in dorsal view (Fig.12); apex of metasoma not black**brevicornis Morley**
17. Propodeum with anterior transverse carina strong, posterior transverse carina with at least lateral sections strong; longitudinal carinae very weak or absent; head with no separation between stemmaticum and frons; hind trochantellus much shorter than wide in dorsal view; fore wing vein *RS* evenly curved **parvulus Kriechbaumer**
- Propodeum with different pattern of carinae, either with anterior transverse carina strong, but posterior absent or interrupted medially and faint laterally, or with anterior transverse carina mostly absent but with area superomedia defined; usually with sections of longitudinal carinae present; head with distinct line separating stemmaticum from frons; hind trochantellus often as long as wide in dorsal view; fore wing vein *RS* often slightly sinuous18
18. Face with inner orbits (area alongside inner margin of eye) yellow, sharply differentiated from testaceous; proximal corner of pterostigma usually yellow; fore wing with ramulus short, about 0.2-0.3 x width of submarginal cell; propodeum with median longitudinal and posterior transverse carina mostly absent.....**obscuratus Fabricius** 'dwarf' forms
- Face with inner orbits paler than middle of face but not so clearly defined as yellow lines; proximal corner of pterostigma not differentiated; fore wing ramulus long, c.0.5 x width of submarginal cell; propodeum with median longitudinal and posterior transverse carinae present (although latter missing centrally) **?crassicornis Brock** northern 'morph'

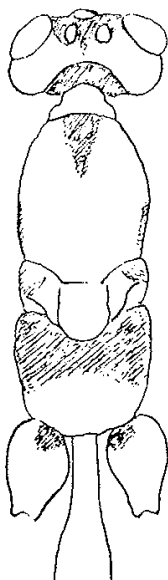


Fig.1. Dark markings on *Ophion ventricosus*.

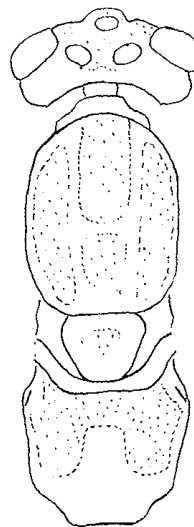


Fig.2. Pale markings on *O. obscuratus*.

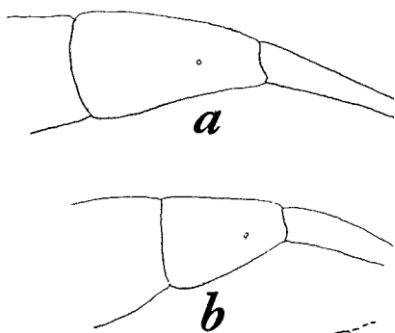


Fig.3. 2nd and 3rd metasomal tergites (anterior to right) of (a) *O. forticornis*, (b) *O. obscuratus*.

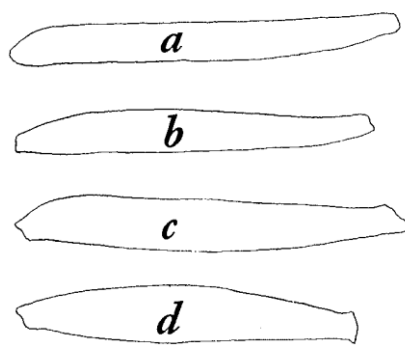


Fig.4. Range of hind femur shapes in *Ophion*.

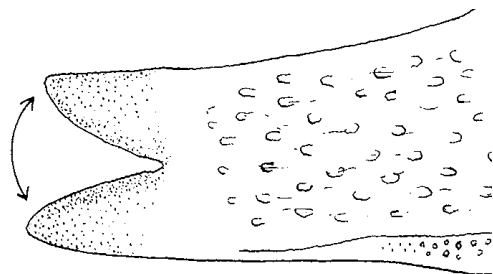


Fig.5. Mandible of *O. luteus*.

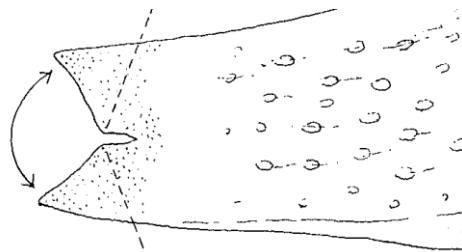


Fig.6. Mandible, *Ophion* species other than *O. luteus*.

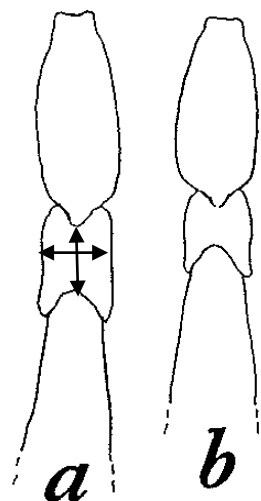


Fig.7. Hind trochantellus, dorsal view, (a) *O. luteus*, (b) generalised *Ophion*.

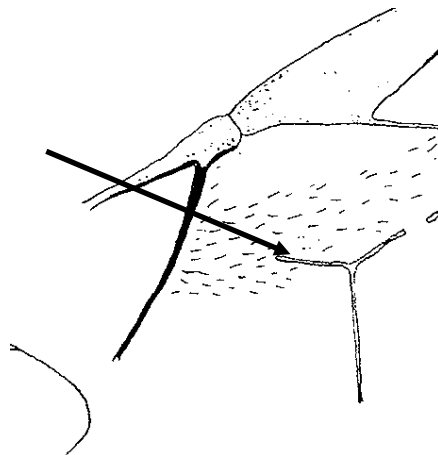


Fig.8. Fore wing discosubmarginal cell with ramellus arrowed.

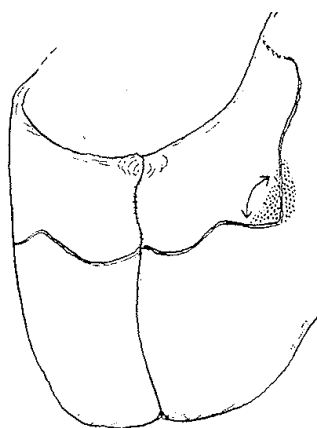


Fig.9. Epicnemial carina, *O. crassicornis*, ventral view, anterior uppermost.

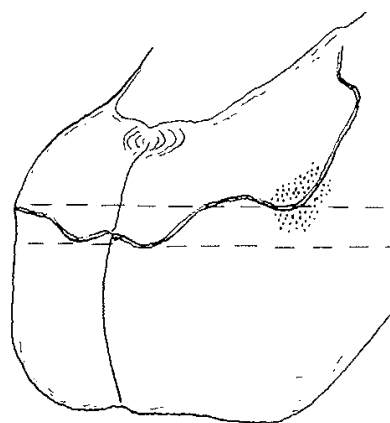


Fig.10. Epicnemial carina, *O. pteridis*, ventral view, anterior uppermost.

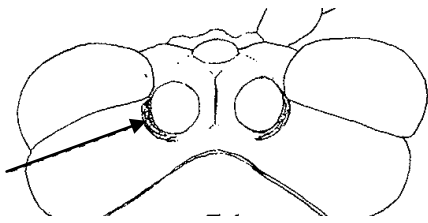


Fig. 11. Head, dorsal view, *O. costatus*, groove of posterior sulcus of stemmaticum arrowed.

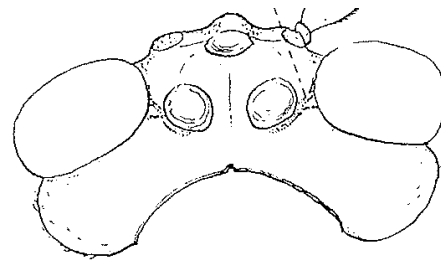


Fig. 12. Head, dorsal view, *O. brevicornis*.

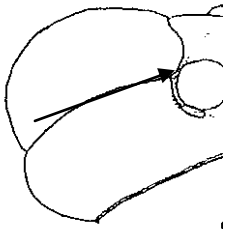


Fig. 13. Head, dorsal view, *O. mocsaryi*, groove of posterior sulcus of stemmaticum arrowed.

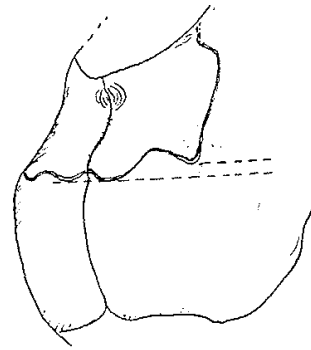


Fig. 14. Epicnemial carina, *O. mocsaryi*, ventral view, anterior uppermost.

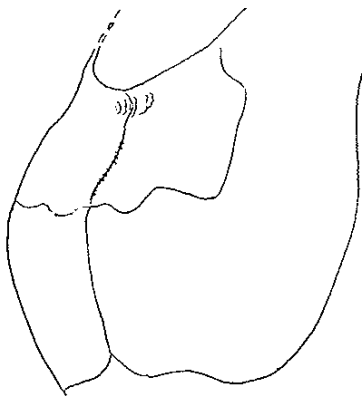


Fig. 15. Epicnemial carina, *O. costatus*, ventral view, anterior uppermost.

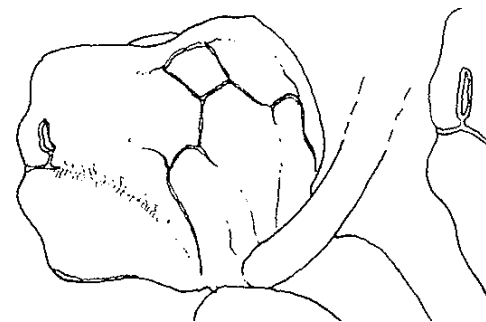


Fig. 16. Propodeum of *O. mocsaryi*, with propodeal spiracle of *O. costatus* inset.

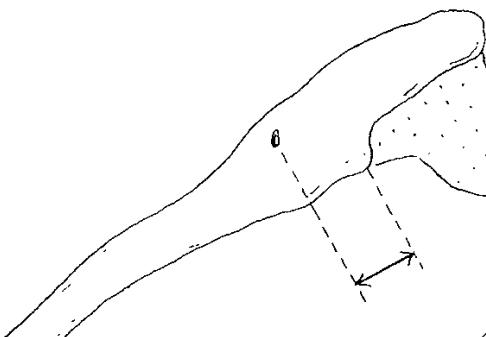


Fig. 17. First tergite, *O. pteridis*, anterior to left.

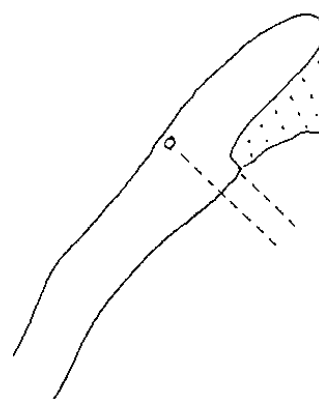


Fig. 18. First tergite, *O. parvulus*, anterior to left.

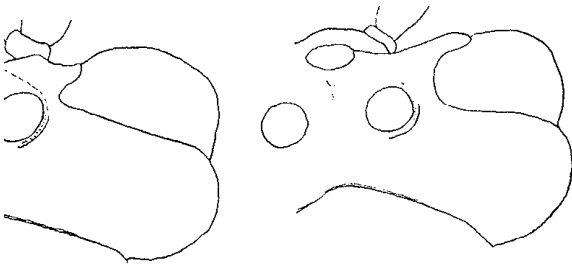


Fig.19. Head, *O. longigena*, dorsal view, female (left) and male (right).

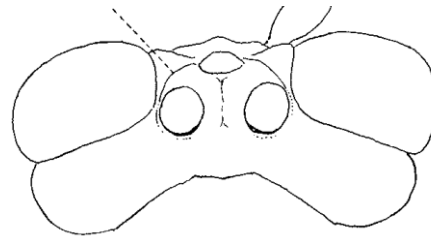


Fig.20. Head, *O. pteridis*, dorsal view.

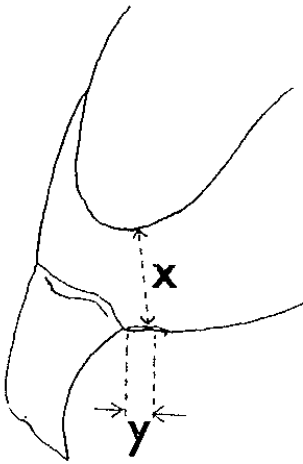


Fig.21. Head, *O. longigena*, side view, y: genal inflection, x: postgena.

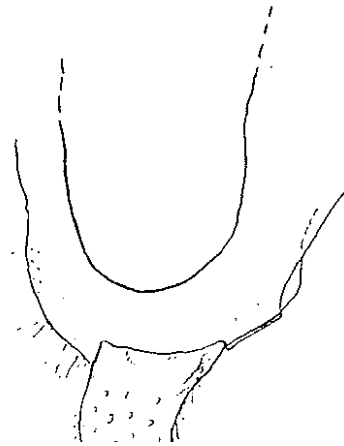


Fig.22. Head, *O. brevicornis*, side view.



Fig.22. Mesopleuron, *Ophion parvulus*, head facing left.



Fig.23. Mesopleuron, *Ophion mocsaryi*, head facing left.

- O. areolaris*: only known in Britain from one Scottish specimen; is apparently common in Scandinavia.
- O. brevicornis*: localised, seems to prefer southern deciduous woodlands where it attacks *Cosmia trapezina*. Shares with *O. crassicornis* a short and stout first flagellomere and thick hind femur.
- O. costatus*: another predominantly southern woodland species, has been reared from *Cucullia*. Very similar to *O. mocsaryi*.
- O. crassicornis*: rather similar in some characters to both *O. brevicornis* (head shape, hind femur) and *O. costatus* (shape of epicnemial carina, large size). Scottish populations differ from those in southern England in several characters and probably represent an undescribed species. In this Scottish form, the pleurosternal angles of the epicnemial carina are more rounded and not quite as aligned with the sternal angles, so it is taken out in two places in the key.
- O. forticornis*: rarely collected, known from southern sand dunes where it flies in early summer and has been reared from *Ochropleura praecox*. Very similar to *O. obscuratus*.
- O. longigena*: rather thinly distributed, most frequent in southern England. Has been reared from *Cucullia*. A rather distinctive species, with males being the most 'buccate-headed' of our *Ophion*.
- O. luteus*: very widespread and frequently abundant in August and September; later on the wing than most species. Many *Ophion* have been misidentified as *O. luteus*. There has been much confusion over the identity of *O. luteus*, which has frequently been called *O. slaviceki*. Linnaeus's type specimen is unusually small and buccate-headed, like the very rare summer 'morph' of *O. luteus*. Fairly recently established to be a parasitoid of *Agrotis* species, probably usually attacking *Agrotis exclamationis*. Generally fairly readily identified if several characters are checked.
- O. minutus*: can be abundant in deciduous woodlands in mid- to late spring, where it is a parasitoid of *Agriopsis* spp. (Geometridae). Distinctive, easily identified.
- O. mocsaryi*: rather widespread and sometimes quite common. A parasitoid of various noctuid larvae. Very similar to *O. costatus*.
- O. obscuratus*: almost ubiquitous and often very common; the only *Ophion* that can be found on the wing in winter, though usually trapped in autumn and spring. Different generations differ slightly morphologically, except for a summer-flying 'dwarf' form, which often lacks most yellow markings and can be difficult to recognise as *O. obscuratus*; see Brock (1982) for an analysis of variation. The very common autumn generation has, suprisingly, never been reared. The generation that flies through the winter attacks *Mythimna* larvae and the heathland summer 'dwarf' form has been reared from *Lycophotia porphyria*. The rare 'autumnal dwarf' form has not(?) been reared.
- O. ocellaris*: rare but fairly widespread. A parasitoid of Thyatiridae larvae. With *O. areolaris*, has been placed at times in a separate genus, *Platophion*, as they are rather divergent from most *Ophion* species.
- O. parvulus*: common and widespread, attacking Noctuidae which over-winter as pupae. Unlike other *Ophion*, pupates within the larval skin of its host. Although a fairly distinctive 'species' (there is no clear division between the stematicum and frons and the first metasomal segment is particularly stout), there is much intra-specific variation, ranging from small and pale to large and marked with infusate patches and probably comprises a complex of similar species. A few individuals with very narrow temples and rather short first flagellomere can be hard to differentiate from *O. mocsaryi* but the shape of the epicnemial carina and the pattern of propodeal carinae should distinguish the two.
- O. perkinsi*: rare but widespread, flying in early summer. The head shape is similar to *O. brevicornis* but in other respects it resembles *O. pteridis*. Has been reared from *Anarta myrtillae* and *Hadena conspersa*.
- O. pteridis*: common and widespread but particularly abundant in mid- to late summer in coastal localities where it is a frequent parasitoid of Hadeninae (Noctuidae) larvae. Fairly easy to recognise on the shape of the first tergite and the fore wing venation but can be confused with *O. parvulus* (a useful character is that the wing venation of *O. pteridis* is testaceous, that of *O. parvulus* infusate). Some small males, with rather buccate heads, can be very similar to *O. perkinsi*.
- O. scutellaris*: common and widespread in early spring (March to May), usually on the wing before any species other than *O. obscuratus*, which is easily identified by its yellow markings. Specimens without a date of capture may be misidentified as *O. perkinsi* as *O. scutellaris* has a long and slender first metasomal segment and a distinct gap between ocellus and eye. The very slender legs and very long (even for an *Ophion*) antennae should readily identify *O. scutellaris*. A parasitoid of over-wintering noctuid larvae, particularly *Xestia*.

O. ventricosus: very distinctive, with a colour pattern that is more similar to *Eremotylus marginatus* than to any other *Ophion*. On wing venational features, is most similar to *O. minutus*, which is also a parasitoid of geometrid larvae. Rather localised but can be abundant in ancient, deciduous woodland. Has been reared from *Apocheima pilosaria* (Geometridae).

Stauropoctonus

One European species, *S. bombycivorus* (Gravenhorst). Distinctive, large and with conspicuous black markings on the thorax; the antennae are basally black, apically bright yellow and the metasoma largely black but with the first and fourth tergites yellow. Rarely collected, seems to be restricted to the New Forest and some nearby mature woodlands (e.g. Berks. and Isle of Wight). Has been reared from *Stauropus fagi*.



Stauropctonus bombycivorus, Denny Wood, Hampshire (P. Brock).

Braconidae

Charmontinae

Charmon – two species on the British and Irish list, which are very similar and are keyed by van Achterberg (1979). Parasitoids of Lepidoptera larvae and frequent at light, although the metasoma is usually predominantly black.



Charmon cruentatus, courtesy of Bryan Formstone

Euphorinae

Pygostolus – four British and Irish species, three of which are commonly found in light traps and all are probably nocturnal. Reared from adult weevils but there are some authentic-seeming records from Lepidoptera larvae. Keyed by van Achterberg (1992).

Syntretus – 14 British and Irish species, mostly diurnal but some are mostly testaceous and possibly nocturnal. Rearing records are from adult Hymenoptera (bees and ichneumonids). Revised by van Achterberg & Haeselbarth (2003).

Meteorinae

Meteorus – 29 species on the British and Irish list, several of which are predominantly testaceous or occur in testaceous colour forms. Some non-testaceous species are also frequent at light. Parasitoids of Lepidoptera larvae. Stigenberg & Ronquist (2011) key the species of *Meteorus* and *Zelee*. Huddleston (1980) is still useful.

Zelee – four British and Irish species, three of which are frequently taken at light. Parasitoids of Lepidoptera larvae. Keys can be found in van Achterberg (1979, 1984) and Stigenberg & Ronquist (2011).



Zele albiditarsus, courtesy of Edwin Brosens.

Homolobinae

Homolobus – five British and Irish species, all of which are readily attracted to light and four of which are predominantly testaceous. Parasitoids of Lepidoptera larvae. Shaw (2010) has revised the British fauna.

Macrocentrinae

Austrozele – one very seldom collected species, *A. longipalpis* van Achterberg, known from England. It is a parasitoid of *Hypena crassalis* (Lepidoptera: Noctuidae) (van Achterberg, 1993).

Macrocentrus – 14 British and Irish species, some of which are frequently collected at light and predominantly nocturnal (although usually with a black metasoma). All are parasitoids of Lepidoptera larvae in weak concealment. Van Achterberg (1993) provides keys for identification.

Rogadinae

Aleiodes – many British and Irish species, with quite a few undescribed. Currently the species are mostly not safely identifiable, but Mark Shaw and Kees van Achterberg have works in preparation revising the European fauna. Their introductory paper (van Achterberg & Shaw, 2016) includes a key to species groups. Several species are predominantly testaceous and many species can be found at light. All species, like other rogadines, are parasitoids of Lepidoptera larvae, mummifying the host.

Clinocentrus – seven British and Irish species, mostly not nocturnal but some (particularly *C. cunctator* (Haliday)) may be predominantly testaceous and frequent in light traps. Belokobylskij (1995) provides keys.

Heterogamus – until recently, usually regarded as a synonym or subgenus of *Aleiodes*. Two British and Irish species, one very rare but one (*H. dispar* (Haliday)) reasonably widespread. Hosts unknown.

Rogas – one British species, *R. luteus* Nees, which is a very rarely collected (no recent British specimens) parasitoid of *Apoda limacodes* (Limacodidae).



Heterogamus dispar female

References

- Achterberg, C. van (1979) A revision of the subfamily Zelinae *auct.* (Hymenoptera, Braconidae). *Tijdschrift voor Entomologie* **122**, 241-479.
- Achterberg, C. van (1984) Addition to the revision of the genus *Zele* Curtis (Hymenoptera: Braconidae). *Entomologische Berichten* **44**, 110-112.
- Achterberg, C. van (1992) Revision of the European species of the genus *Pygostolus* Haliday (Hymenoptera: Braconidae: Euphorinae), with a key to the Holarctic species. *Zoologische Mededelingen, Leiden* **66**, 349-358.
- Achterberg, C. van (1993) Revision of the subfamily Macrocentrinae Foerster (Hymenoptera: Braconidae) from the Palaearctic region. *Zoologische Verhandelingen* **286**, 1-110.
- Achterberg, C. van & Haeselbarth, E. (2003) Revision of the genus *Syntretus* Foerster (Hymenoptera: Braconidae: Euphorinae) from Europe. *Zoologische Mededelingen* **77**, 9-78.
- Achterberg, C. van & Shaw, M.R. (2016) Revision of the western Palaearctic species of *Aleiodes* Wesmael (Hymenoptera, Braconidae, Rogadinae). Part 1: Introduction, key to species groups, outlying distinctive species, and revisionary notes on some further species. *ZooKeys* **639**, 1-164. DOI: 10.3897/zookeys.639.10893
- Belokobyl'skij, S.A. (1995) Revision of the European species of the genus *Clinocentrus* (Hymenoptera, Braconidae). *Journal of Natural History* **29**, 803-836.
- Broad, G.R., Shaw, M.R. & Fitton, M.G. (in press) The ichneumonid wasps of Britain and Ireland (Hymenoptera: Ichneumonidae). *Handbooks for the Identification of British Insects*.
- Brock, J.P. (1982) A systematic study of the genus *Ophion* in Britain (Hymenoptera, Ichneumonidae). *Tijdschrift voor Entomologie* **125**, 57-97.
- Delrio, G. (1975) Révision des espèces ouest-paléarctiques du genre *Netelia* Gray (Hym., Ichneumonidae). *Studi Ssassaresi sez. III.- Annali della Facolta di Agraria dell'Università di Sassari* **23**, 1-126.
- Fitton, M.G. (1985) The British species of *Cidaphus* (Hymenoptera: Ichneumonidae). *Entomologist's Gazette* **36**, 293-297.
- Huddleston, T. & Gauld, I.D. (1988) Parasitic wasps (Ichneumonoidea) in British light-traps. *The Entomologist* **107**, 134-154.
- Gauld, I.D. (1973) Notes on the British Ophionini (Hym., Ichneumonidae) including a provisional key to species. *Entomologist's Gazette* **24**, 55-65.
- Gauld, I.D. (1974) Further notes on the British Ophionini (Hym., Ichneumonidae). *Entomologist's Gazette* **25**, 147-148.
- Gauld, I.D. & Mitchell, P.A. (1977) Nocturnal Ichneumonidae of the British Isles: the genus *Alexeter* Foerster. *Entomologist's Gazette* **28**, 51-55.
- Huddleston, T. (1980) A revision of the western Palaearctic species of the genus *Meteorus* (Hymenoptera: Braconidae). *Bulletin of the British Museum (Natural History)(Entomology)* **41**, 1-58.
- Kasparyan, D.R. (1973) *Fauna of the USSR Hymenoptera Vol.III Number 1. Ichneumonidae (Subfamily Tryphoninae) Tribe Tryphonini Nauka Publishers* [translated from Russian. Amerind Publishing Co. Ltd., New Delhi, 1981. 414pp.], Leningrad.
- Konishi, K. (2005) A preliminary revision of the subgenus *Netelia* of the genus *Netelia* from Japan (Hymenoptera, Ichneumonidae, Tryphoninae). *Insecta Matsumurana* **62**, 45-121.
- Shaw, M.R. (2001) Interactions between adults of some species of *Netelia* Gray (Hymenoptera: Ichneumonidae: Tryphoninae) and their caterpillar hosts (Lepidoptera). *Journal of Hymenoptera Research* **10**, 101-111.
- Shaw, M.R. (2010) Palaearctic Homolobinae (Hymenoptera: Braconidae) in the National Museums of Scotland, with host and distribution records and a key to British species. *Entomologist's Gazette*, **61**, 43-51.
- Shaw, M.R. & Huddleston, T. (1991) Classification and biology of braconid wasps (Hymenoptera: Braconidae). *Handbooks for the Identification of British Insects* **7**, 1-126.
- Stigenberg, J. & Ronquist, F. (2011) Revision of the Western Palearctic Meteorini (Hymenoptera, Braconidae), with a molecular characterization of hidden Fennoscandian species diversity. *Zootaxa* **3084**, 1-95.
- Townes, H.K. (1939) The Nearctic species of *Netelia* (*Paniscus*) of authors and a revision of genera of Neteliini (Hymenoptera, Ichneumonidae). *Lloydia* **1(1938)**, 168-231.