

# Reared specimens of western Palaearctic *Ophion* Fabricius (Hymenoptera: Ichneumonidae: Ophioninae) in the National Museums of Scotland

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## ABSTRACT

Following recent changes to the taxonomy of north-western European *Ophion* Fabricius, 1798, species, host records are updated and new records presented for these nocturnal, koinobiont endoparasitoids of Lepidoptera larvae. Rearing data are presented for 22 species with two species re-described. Five species are recorded as new to Britain and Ireland.

Keywords: Ichneumonoidea, Lepidoptera, parasitoid, new species, Britain, Ireland, Europe

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## INTRODUCTION

The National Museums of Scotland (NMS) houses a large collection of European, but especially British, Ichneumonoidea, its importance depending to a large extent on the inclusion of a much larger proportion of reared material than is found elsewhere. In this paper we give the data for the reared specimens of *Ophion* Fabricius, 1798, in the collection.

A revision of British *Ophion* by Brock (1982), based on morphology, broke much new ground, but acknowledged that more than just morphological study would be needed to engage with many of the difficulties and probable species aggregates that he identified. The resolution of much of this has been achieved in a review of the genus in (especially) Sweden by Johansson & Cederberg (2019) with the benefit of CO1 (barcode) sequences to supplement morphology and ecology, in which several aggregates were resolved, some names were raised from synonymy, and 18 new species were described. One consequence is that several of the reared specimens from the M.R. Shaw collection (now NMS) cited by Brock (1982) required reassignment to species in line with the current concept. Here we present the results of this exercise, paying attention to the previous citations of individual specimens to correct misidentifications and to prevent double citation. Some larval remains were figured by Short (1978) from cocoons in NMS and these identifications are also corrected when necessary. The considerable reared material added to the NMS collection since Brock's (1982) paper is also covered.

## MATERIALS AND METHODS

Most rearings (all of those by MRS, and many from cocoons donated by others) have been done under semi-natural conditions of daylength and temperature in a

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well-shaded, detached and partly open outdoor shed, which ensures that adult emergence occurs more-or-less as in nature; and with the strict accounting protocols of hosts that effectively eliminate the risk of overlooked contaminants (Shaw 1997). In other cases, some emergences might have been abnormally early (indoors). Host determinations are those of the collector (named in parentheses in the following lists) unless indicated otherwise. Determination, especially of low-feeding noctuid larvae, can be fraught and identification of the noctuid hosts collected by MRS by



Fig. 1. — Dorsal habitus of *Ophion ?cephalotes*, ♀.



Fig. 2. — Metasoma, lateral, of: a, *Ophion ?cephalotes*, ♀; b, *Ophion longigena*, ♀, NHMUK010574709.

sweeping *Salix repens* L. at night on 5.vi.1975 (relevant to records for *O. mocsaryi* and *O. variegatus*) was, unfortunately, particularly unclear and even sorting into categories might not have been accurate. *Ophion* determinations have been made or controlled by GRB (2023), including a few that were first made by Johansson and determination of some by MRS. Larval hosts were generally (possibly always) in their final instar when collected.

In the lists, 'coll.' is date of collection of the host larva; 'coc.' or 'cocs' refers to the date at which cocoon formation by the parasitoid occurred (often this date is imprecise or lacking as the event usually takes place in concealment); and 'em.' is the date of adult emergence. A single asterisk \* after an entry indicates that the cocoon is present for a specimen, and a double asterisk \*\* indicates that in addition host remains are present for at least some. Host names of British specimens have been updated from the data labels to conform with Agassiz, Beavan & Heckford (2013); plant names have also been updated, using internet sources. Host names are of Noctuidae unless otherwise indicated. All the parasitoids were solitary with respect to the host.

Morphological terminology follows Broad, Shaw & Fitton (2018) and the format of the species (re-)descriptions follows Johansson & Cederberg (2019). Institutional abbreviations are NMS for National Museums of Scotland (Edinburgh) and NHMUK for the Natural History Museum (London).

#### REARED MATERIAL IN NMS

##### *Ophion arenarius* Johansson, 2019

1♂ ENGLAND: Somerset, Taunton (VC 5) ex *Ceramica pisi* (Linnaeus, 1758) on *Carduus/Cirsium* coll. 15.viii.1974, em. 26.vi.1975 (K. Noble)\*\*. 1♂ WALES: Powys, Black Mountains (VC 42) ex *C. pisi* on *Pteridium* coll. 3.viii.1975, coc. viii.1975, em. 23.vii.1976 (S. Hopton)\*. 1♀ [probably SCOTLAND] ex *C. pisi*, no other data (R.F. Logan)\*.

New to Britain. Brock (1982) cited the Taunton and Black Mountains specimens as *O. pteridis* Kriechbaumer, 1879. Johansson & Cederberg (2019), who did not examine the material, mentioned the specimens seen by Brock (1982) from *C. pisi* under *O. inclinans*, with the proviso that they might belong to another close species, which indeed they do.

##### *Ophion ?cephalotes* Meyer, 1929 (Figs 1–4)

3♀♀ CZECH REPUBLIC: Plzeň, Sušice ex *Cucullia verbasci* (Linnaeus, 1758) on *Verbascum nigrum* L., coll. 8.vi.2015, em. 24–25.vi.2016 (M.R. Shaw)\*\*.

We are uncertain of the identity of these specimens, which closely resemble *O. longigena*. Despite *Cucullia verbasci* being reasonably common and widespread in Britain, *O. longigena* has never been reared from this species, whereas it has been reared quite regularly from other *Cucullia* species (see below). The presence of an *Ophion* parasitoid of *C. verbasci* elsewhere in Europe, with potentially some morphological differences, suggests these specimens represent a species which does not occur in northern Europe. It seems possible that these specimens are *Ophion cephalotes* Meyer, 1929, described from Uzbekistan (Meyer 1929). The holotype male is lost (Townes, Momoi & Townes 1965), but N. Johansson (pers. comm.) has tentatively identified European specimen as *O. cephalotes* which, however, have even wider heads than *O. longigena*. Compared to most *O. longigena*, and certainly specimens from northern Europe, the metasoma is differently patterned, extensively black or dark brown from the fifth tergite in *O. longigena*, testaceous in the specimens reared from *C. verbasci*, only a little infusate ventrally (Fig. 2); and the median longitudinal carinae of the propodeum are virtually absent in these specimens, but the posterior transverse carina is strong, whereas in many *O. longigena* the median longitudinal

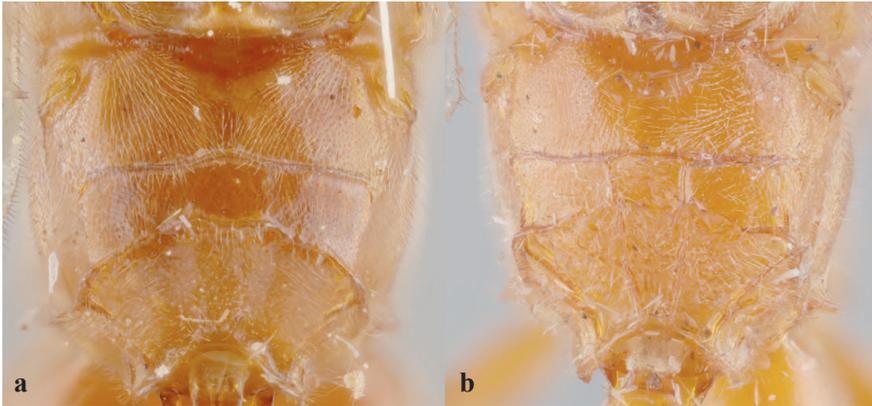


Fig. 3. — Propodeum (dorsal) of: a, *Ophion* ?*cephalotes*, ♀; b, *Ophion longigena*, ♀, NHMUK010574709.



Fig. 4. — Head of *Ophion* ?*cephalotes*, ♀: a, dorsal; b, lateral, showing junction of occipital and hypostomal carinae.

carinae are strong and the posterior transverse carina weaker medially (Fig. 3). Note, however, that these are trends and could all lie within geographic variation in *O. longigena* (N. Johansson, pers. comm.). The difference in hosts is indicative of a different species being involved. The Czech specimens reared from *C. verbasici* are described fully here, to facilitate any future taxonomy of this species group.

#### Description

♀: Fore wing length 17mm. Body length *ca.* 21–22mm. Antenna with 55–56 flagellar segments; temple wide, rounded behind eyes, about as long as eye width in dorsal view (Fig. 4a), in lateral view about 1.1× width of eye; malar space 1.5× as long as mandible width; lateral ocellus separated from compound eye by 0.25× length of ocellus; face 2.0× as wide as high, not convergent ventrally; occipital carina medially straight, ventrally meeting hypostomal carina distant from mandible base by 0.4× mandible width (Fig. 4b); face below antennal sockets densely punctate with faint microsculpture, punctures separated by about a puncture width; mandibular gape right-angled, with internal angles; first flagellomere 4.4× as long as wide, central

flagellomeres 1.6×, apical flagellomeres 2.3× as long as wide. Mesoscutum shining, punctures separated by about puncture diameter; mesopleuron mostly shining, some weak crenulations around episternal scrobe, punctures ventrally separated by about 1.5–2.0× puncture diameter; epicnemial carina, in antero-ventral view with pleurosternal angles right-angled, a little anterior of sternal angles; scutellum with lateral carinae extending along about 0.7× scutellum length; propodeum shining, punctate, posteriorly weakly punctate-rugulose, anterior transverse carina strong, complete, slightly angled medially, posterior transverse carina strong, complete, closer to anterior carina medially than laterally, weak traces of median longitudinal carinae between transverse carinae. First metasomal segment with sclerotized section of first sternite ending slightly posterior to spiracle, tergite rather straight, not undulating in lateral profile; hind trochantellus shorter than wide; hind femur not very slender, 6.4× as long as medially high; inner spur of hind tibia 0.4× as long as hind basitarsus. Wing membrane clear; ramulus short; radius (vein RS) sinuous; vein 2r&RS straight, not thickened near junction with pterostigma; hind wing nervellus intercepted at middle, CU a little inclivous, cu-a strongly reclivous.

Colour: uniformly pale reddish, metasoma a little darkened ventrally, posteriorly, ovipositor sheath pale reddish. Pterostigma pale reddish, a little paler proximally. Wing membrane a little yellowish over proximal 0.5 or so. Antenna darkened apically, with apical flagellar segment paler.

### *Ophion confusus* Johansson, 2019

1♀ ENGLAND: Norfolk, Hockham (VC 28) ex *Dryobotodes eremita* (Fabricius, 1775) coll. vi.1991, em. 16.v.1992 (G.M. Haggett)\*\*. 1♂ ENGLAND: Huntingdonshire, Monks Wood ex *D. eremita* coll. 14.v.2009, em. 8.v.2010 (M.R. Shaw)\*\*.

Johansson & Cederberg (2019) cite the Monks Wood male from *D. eremita*, which they had examined, as *O. mocsaryi*. The specimens reared from arboreal *D. eremita* differ from those reared from *Agrochola lota*, or similar low-feeding noctuids (see *O. mocsaryi*, below), in the less complete area superomedia, more densely punctate face and, at least in the male, by the rounded occipital carina dorsally. It seems clear, based on morphology and on hosts, that there are two species represented here, but in assigning them to species using Johansson & Cederberg's (2019) criteria we have reached opposite conclusions: Johansson & Cederberg (2019) name a Swedish specimen reared from *A. lota* as *O. confusus* and refer to one specimen above as *O. mocsaryi*. Of course, it may be the case that one or more additional species are present in the UK and not in Sweden or vice versa.

### *Ophion cortesi* Ceballos, 1940 (Figs 5–7)

2♀♀ SPAIN: Madrid, Ciempozuelos, 600m, ex *Calamodes occitanaria* (Duponchel, 1829) (Geometridae) on *Thymus* (in a treeless landscape) coll. 27.iii.2005, coc. 13.iv.2005, em. 12–13.ii.2006 (G.E. King)\*\*; 1♀, SPAIN: Zaragoza, Montes de Torrero, ex geometrid on *Gypsophila struthium*, coll. 5.iii.1998, coc. 29.iii.1998, em. i.1999 (G.E. King) [1♀, not reared, SPAIN: Madrid, Terminal de Barajas, in *Cytissus*, 28.iii.2002 (G.E. King)]. The host belongs to the same subfamily (Ennominae) as those of *O. minutus*, but in low scrub rather than the woodland habitat of *O. minutus*.

Clearly closely related and similar to *O. minutus*. We are fully redescribing *O. cortesi* based on these specimens as this species has not been adequately characterised since its original description (Ceballos 1940), and Izquierdo (1984) concentrated on distinguishing it from the rather dissimilar *O. obscuratus*. It is similar in most respects to *O. minutus* but differs most conspicuously in the ivory colour of the anterior part of the first metasomal segment (Fig. 5b) and the different pattern of propodeal carinae, with a more or less well-defined area superomedia, missing in *O. minutus* (Fig. 6). *Ophion cortesi* also has the radius (2r&RS) rather less curved and less thickened as it leaves the pterostigma, the ramulus absent or tiny, longer antennae (46–50 flagellar segments vs 40–48 in *O. minutus*), slightly more convergent eyes, a redder face, and a narrower, more rounded clypeus with less conspicuous punctures (Fig. 7). Another similar species in the *Ophion minutus* species-group (which should probably be upgraded to a separate genus;

Johansson & Cederberg 2019; Shimizu & Maeto 2023) is the western Asiatic *O. pusillus* Johansson, 2021, but this clearly differs in the nearly absent pleurosternal angles of the epicnemial carina and the sternite of the first metasomal segment ending further behind the spiracle.

*Re-description*

♀ (♂♂ not seen): Fore wing length 8.2–10.0mm. Body length 10–13mm. Antenna with 46–50 flagellar segments; temple a little narrowed behind eyes, in lateral view about 0.8× width of eye; malar space 0.3× as long as mandible width; lateral ocellus separated from compound eye by 0.35× length of ocellus; face 1.8× as wide immediately below antennal sockets as high, slightly convergent ventrally; occipital carina medially angled; face below antennal sockets with



Fig. 5. — Habitus of *Ophion cortesi*: a, ♀, dorsal; b, ♀, lateral.

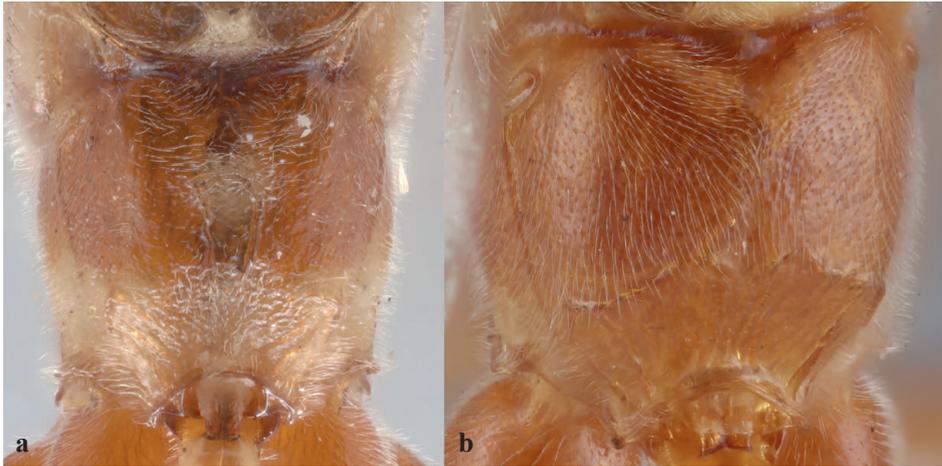


Fig. 6. — Propodeum (dorsal) of: a, *Ophion cortesi*, ♀; b, *Ophion minutus*, ♀.



Fig. 7. — Faces of: a, *Ophion cortesi*, ♀; b, *Ophion minutus*, ♀.

punctures separated by 1–2× puncture width; frons transversely rugulose; wide, rather deep groove alongside and posterior to hind ocellus; mandibular gape right-angled, with internal angles; first flagellomere 4.4× as long as wide, central flagellomeres 1.9×, apical flagellomeres 1.9× as long as wide. Mesoscutum shining, punctures separated by about 2× puncture diameter; mesopleuron mostly shining, with very weak sculpture, some weak transverse striation below speculum, punctures ventrally separated by about 2–3× puncture diameter; epicnemial carina in antero-ventral view with pleurosternal angles well-defined, obtuse, far anterior of sternal angles; scutellum without lateral carinae; propodeum shining, very weakly sculptured on anterior 0.3, weakly rugulose medially, more strongly rugulose posteriorly, anterior transverse carina weakly present medially, or virtually absent, median longitudinal carinae present medially, or very weak, area superomedia 2× as long as wide, if defined, lateral sections of posterior transverse carina present. First metasomal segment with sclerotized section of first sternite ending posterior to spiracle by 1.8× height from spiracle to ventral edge of segment; hind trochantellus much shorter than wide; hind femur slender, 8× as long as medially high; inner spur of hind tibia 0.4× as long as hind basitarsus. Fore wing with ramulus absent or represented by tiny stub; radius (vein RS)

weakly sinuous; vein 2r&RS weakly curved and slightly thickened near junction with pterostigma; hind wing nervellus intercepted slightly above middle, CU slightly reclivous, cu-a strongly reclivous.

Colour: pale reddish, following areas ivory: inner and outer orbits; clypeus; parallel median longitudinal lines on mesoscutum, meeting medially, anteriorly meeting lateral lines covering length of mesoscutum; scutellum except antero-medially; pronotum dorsally and ventrally; tegula; subalar ridge and four areas of variable extent on mesopleuron, antero-dorsally and ventrally, postero-dorsally and ventrally; ventral 0.4 of metapleuron; upper division of metapleuron; area around propodeal spiracle, posterior end of propodeum (weakly), often median weak spot on propodeum; anterior 0.5 of 1st metasomal segment; proximal edges of femora and distal edges of trochantelli; lateral stripe on metasoma. Metasoma a little darkened ventrally, ovipositor sheath pale reddish. Wing membrane clear; pterostigma brown, ivory very proximally and distally.

### *Ophion ellenae* Johansson, 2019

1♀, 1♂ ENGLAND: Cheshire, Jodrell Bank (VC 58) ex *Hadena bicruris* (Hufnagel, 1766) on *Silene dioica* (L.) Clairv. coll. 26.vii.1973, coc. by 9.viii.1973, em. 1.vi.1974 (♂) and 13.vi.1974 (♀) (M.R. Shaw)\*\*. 1♂ ENGLAND: Derbyshire, Holloway (VC 57) ex *H. bicruris* coll. viii.1977, em. 7.vii.1978 (F. Harrison)\*. 1♂ WALES: Anglesey, Llangristiolus (VC 52) ex *H. bicruris* on *Silene dioica* coll. 26.vii.1981, coc. viii.1981, em. 28.vi.1982 (M.R. Shaw)\*\*. 1♀ SCOTLAND: Argyll, Kintyre, Glencardoch (VC 101) ex *Hadena confusa* (Hufnagel, 1766) on *Silene uniflora* Roth. coll. 26.vii.1994, coc. viii.1984, em. 14.vii.1995 (M.R. Shaw)\*\*. 1♀ SCOTLAND: Mull, Loch na Keal (VC 103) ex *H. confusa* on *S. uniflora* coll. 24.vii.1994, coc. viii.1994, em. 12.vii.1995 (M.R. Shaw)\*\*. 1♂ ENGLAND: Cumbria, Rockcliffe (VC 70) ex *H. confusa* on *S. uniflora* coll. 11.viii.1994, coc. 25.viii.1994, em. 7.vii.1995 (G. Thomson)\*\*. 2♂♂ DENMARK: Jelling ex *H. confusa* coll. vii.2016, em. vi.2017 (J. Voogd)\*.

New to Britain. Brock (1982) cited the Jodrell Bank specimens under *O. pteridis*. Johansson & Cederberg (2019) suggested that the specimens from *Hadena* cited by Brock (1982) under *O. pteridis*, which they had not examined, might belong to a species other than *O. inclinans*, which has proved to be the case. Contrary to Johansson & Cederberg (2019), specimens of *O. ellenae* invariably have a small gap between the lateral ocellus and eye and a slight undulation on the first metasomal tergite (confirmed for Swedish specimens by N. Johansson, pers. comm.).

### *Ophion inclinans* Johansson, 2019

1♀, 1♂ ENGLAND: Lancashire, Manchester, East Didsbury, Fletcher Moss (VC 59) ex *Apamea unanimitis* (Hübner, [1813]) on *Phalaris* coll. ix.1977, coc. x/xi.1977, em. 26.vii.1978 (♂) and 9.viii.1978 (♀) (M.R. Shaw)\*\*. 2♀♀, 2♂♂ ENGLAND: Kent, Stodmarsh (VC 15) ex *A. unanimitis* coll. 21–28.ix.1993, em. 21.vii–3.viii.1994 (J. Platts)\*\*. 1♀, 1♂ ENGLAND: Kent, Chislehurst (VC 16) ex *Lacanobia oleracea* (Linnaeus, 1758) on *Chenopodium* coll. 15.x.1972, em. 30.vi.1973 (♀) and 5.vii.1973 (♂) (M.R. Shaw)\*\*. 1♀ ENGLAND: Lancashire, Manchester, East Didsbury (VC 59) ex *L. oleracea* on *Persicaria* coll. 15.ix.1974, em. 20.vii.1975 (M.R. Shaw)\*\*. 1♂ ENGLAND: Warwickshire, Solihull (VC 38) ex ?*Mamestra brassicae* (Linnaeus, 1758) on *Urtica* coll. 28.viii.1973, em. 18.vii.1974. (M.R. Shaw)\*\*. 1♂ ENGLAND: Hampshire, Leckford (VC 12) ex *Lacanobia* sp. on *Berberis vulgaris* coll. 10.ix.1977, em. vi.1978 (W. Gilchrist)\*\*. 1♂, doubtfully determined, ENGLAND: Wiltshire, Salisbury (VC 8) ex *Deilephila elpenor* (Linnaeus, 1758) (Sphingidae) on *Epilobium* coll. ca. 25.vii.1975, em. ca. 18.viii.1975 (S.J. Edwards). Neither cocoon nor host remains present; although the specimen is large it is no larger than the biggest from *Lacanobia* and the same-year emergence recorded strongly suggest that the host has been confused.

The specimens from *A. unanimitis* are noticeably smaller than those from *Lacanobia* and their identity needs further investigation; Johansson & Cederberg (2019) found two barcode clusters within their sequenced *O. inclinans*, potentially supported by some minor morphological differences, but not differing in size (N. Johansson, pers. comm.). Brock (1982) had treated the

East Didsbury, Chislehurst and Solihull specimens as *O. pteridis* and, based on Brock's prior determination, Short (1978) figured the cephalic sclerites of the final instar larva of the East Didsbury specimen from *L. oleracea* as *O. pteridis* (slide in NMS). Johansson & Cederberg (2019) tentatively placed reared specimens (that they had not examined) cited by Brock (1982) as *O. pteridis* from *Ceramica pisi* and *Hadena* spp. to this species, but suspected that they could belong to other close species, which is indeed the case (see *O. arenarius* and *O. ellenae*, respectively).

#### *Ophion kallanderi* Johansson, 2019

1♀ SCOTLAND: Selkirkshire, Scabcleuch (VC 79) ex indet. Lepidoptera pupa in leaf litter under *Salix* coll. 9.iv.1983, em. 11.vii.1983 (K.P. Bland)\*\*. The moderately robust host pupa, which may be of a noctuid (assessed MRS), contains the rather insubstantial parasitoid cocoon, but is not ruptured. Emergence was off-centre at the head end of the host pupa through an untidily chewed hole.

This species was discerned by Johansson & Cederberg (2019) from the '*O. parvulus*' concept of Brock (1982) who had recognised that there were univoltine host-associated entities within what appeared to him to be a plurivoltine species (*i.e.*, but without having suggested that it was an aggregate).

#### *Ophion longigena* Thomson, 1888

1♀, 3♂♂ ENGLAND: Norfolk, Bodney (VC 28) ex *Cucullia chamomillae* ([Denis & Schiffermüller], 1775) coll. 22.vi.1999, em. In period 18.vi–7.vii.1999 (G.M. Haggett/R. Leverton)\*\*. 1♀ NETHERLANDS: Binnenveld ex *C. chamomillae* coll. 29.v.2020, em. 5.vi.2021 (R. Majoor)\*. 1♀, 2♂♂ ENGLAND: Sussex, Aldingbourne (VC 13) ex *Cucullia lychnitis* Rambur, 1833 coll. 17–27.vii.2000, em. in period 29.vi–1.vii. 2001 (S. Patton)\*\*. 1♂ ENGLAND: Berkshire, Lardon Chase (VC 22) ex *C. lychnitis* coll. Not recorded, em. 28.vi.2001 (A.P. Foster). Neither cocoon nor host remains present. 1♂ ITALY: S. Tyrol, Taufers–Clusio (Eselweg) ex *C. lychnitis* on *Verbascum nigrum* L. 8.vii.2004, em. 8.vi.2005 (M.R. Shaw)\*\*. 1♂ HUNGARY: Bugac National Park ex mixed *Cucullia asteris* ([Denis & Schiffermüller], 1775) and *C. lychnitis* coll. 2009, em. 20.v.2010 (B. Benedek/C.W. Plant). Neither cocoon nor host remains present. 1♂ FRANCE: Ardèche, La Volute ex *Cucullia caninae* Rambur, 1833 on *Verbascum* sp. coll. not recorded, em. 18.iii.1991 (B. Goater)\*\*.

#### *Ophion matti* Johansson, 2019

1♂ IRELAND: Co. Waterford, Tramore (VC H6) ex *Hadena caesia* ([Denis & Schiffermüller], 1775) em. 2.v.1990 (B. Skinner)\*.

New to (Britain and) Ireland. In Sweden, *O. matti* and *O. ellenae* have different hosts and N. Johansson (pers. comm.) pointed out that this specimen should be *O. matti*. The single male conforms to the identification criteria of Johansson & Cederberg (2019), with stronger punctuation than *O. ellenae*, particularly on the scutellum.

#### *Ophion mediterraneus* Johansson, 2021

1♀ ENGLAND: Cornwall SX110508 [Fowey] (VC 2) ex *Polymixis lichenea* (Hübner, 1813) coll. 14.iii.1993, emergence not recorded (J.L. Gregory)\*\*.

New to Britain. Described from specimens from Andorra, Morocco and Spain (Johansson 2021), one non-reared English specimen was barcoded and clustered clearly with *O. mediterraneus*. The reared specimen listed above is very similar to the barcoded specimen and both agree with the description of *O. mediterraneus*, except that they are darker with the pale markings inconspicuous. The sternopleural angles of the epicnemial carina are sharply right-angled and nearly aligned with the pleural angles, which together with the long fore wing ramulus, means that *O. mediterraneus* could easily be confused with *O. mocsaryi*.

*Ophion minutus* Kriechbaumer, 1879

4♀♀, 1♂ ENGLAND: Berkshire, Silwood Park (VC 22) ex *Agriopis leucophaearia* ([Denis & Schiffermüller], 1775) (Geometridae) on *Quercus* coll. 7–9.v.2007, em. in period 9–12.v.2008 (M.R. Shaw)\*\*. 5♀♀ 1♂ with same collection data, but emergence in period 29.iv–7.v.2009\*\*. 1♂ ENGLAND: Huntingdonshire, Monks Wood (VC 31) ex *A. leucophaearia* coll. 14.v.2009, em. 5.v.2010 (M.R. Shaw)\*\*. 1♂ ENGLAND: Devon, Hembury Woods (VC 3) ex *A. leucophaearia* em. iv.2003 (B.P. Henwood). Neither cocoon nor host remains present. 1♂ SCOTLAND: Argyll, Glen Nant (VC 98) ex *Agriopis aurantiaria* (Hübner, [1799]) coll. 27.vi.2015, em. 16.v.2016 (M.R. Shaw)\*\*. 1♀ FRANCE: Seine-et-Marne, Fontainebleau ex *A. aurantiaria* coll. 15.v.1989, em 22.iv.1990 (T.H. Ford)\*\*. 2♂♂ ENGLAND: Huntingdonshire, Monks Wood (VC 31) ex *A. ?aurantiaria* on *Quercus* coll. 14.v.2009 em. 29.iv and 13.v.2010 (M.R. Shaw)\*\*. 1♂ ENGLAND: Berkshire, Silwood Park (VC 22) ex *Agriopis marginaria* (Fabricius, [1777]) on *Betula* coll. 11.vi.1994, em. 1995 (M.R. Shaw)\*\*. 1♀ GERMANY: North Rhine-Westphalia, Düsseldorf ex *A. aurantiaria* or *A. marginaria* on *Acer campestre* L. coll. 1.v.2019, em.10.iii.2020 (L. Wirooks)\*. 1♀ same data but on *Malus* coll. 2.vi.2019, em. iii.2020\*. 1♀ same data but *A. leucophaearia* on *Quercus* coll. 4.v.2022, em. v.2023\*. 1♂ FRANCE: Seine-et-Marne, Fontainebleau ex *Erannis defoliaria* (Clerck, 1759) (Geometridae) coll. 15.v.1989, coc. 26.vi.1989, em. 1990 (T.H. Ford)\*. 1♂ FRANCE: Var, Cavalaire ex *Orthosia cruda* ([Denis & Schiffermüller], 1775) on *Quercus suber* L. coll. v.1988, em. 1989 (T.H. Ford)\*.

The delayed emergence, following a second winter in the cocoon, of six out of the eleven individuals from the *A. leucophaearia* cohort from Silwood Park is remarkable and is not reflected by any of the other rearings of *Ophion* species recorded in this paper. There were no discernible departures from standard rearing methods that might account for it. The specimen recorded from the only noctuid host, *O. cruda*, is rather large and, although undoubtedly representing an unusual occurrence, the host identity is probably correct even though host remains are lacking.

*Ophion mocsaryi* Brauns, 1889

1♀ ENGLAND: Lancashire, Ainsdale (VC 59) ex *Agrochola* or *Xanthia* [sensu lato] sp. ('noctuid sp. 4') on *Salix repens* L. coll. 5.vi.1975, coc. 16.vi.1975, em. 15.v.1976 (M.R. Shaw)\*\*. 1♂ ENGLAND: Lancashire, Ainsdale (VC 59) ex *Agrochola* or *Xanthia* [sensu lato] sp. ('noctuid sp. 2') on *Salix repens* coll. 5.vi.1975, coc. vi.1975, em. 5.v.1976 (M.R. Shaw)\*\*.

The sorting category 'noctuid sp. 2' for one of the Ainsdale specimens produced 5 adults of *Agrochola lota* (Clerck, 1759) and one of *Cirrhia icteritia* (Hufnagel, 1766); however, contemporary data-labelling suggested the latter as the more likely host. The other category, 'noctuid sp. 4', produced no adult moths and may or may not have been distinct. Brock (1982) cited the two Ainsdale specimens. As discussed above under *O. confusus*, Johansson & Cederberg (2019) report a rearing of the very similar *O. confusus* from *Agrochola lota* in Sweden, whereas the specimens identified here (and identified as such by N. Johansson in 2018) match the diagnosis of *O. mocsaryi* better. To add to the confusion, the name *O. mocsaryi* has probably been misapplied and may need to be changed (N. Johansson, pers. comm.).

*Ophion ocellaris* Ulbricht, 1926

1♂ ENGLAND: Cheshire, Abbots Moss (VC 58) ex *Achlya flavicornis* (Linnaeus, 1758) (Drepanidae, Thyatirinae) on *Betula*, coll. 17.vii.1973, coc. by 9.viii.1973, em. 27.v.1974 (M.R. Shaw)\*\*. 1♂ ENGLAND: Devon, Liverton (VC 3) ex *A. flavicornis* 1993 (B.P. Henwood)\*. In addition, confidently determined as this species, is a rather undersized unemerged cocoon partly enclosed by host larval remains from ENGLAND: Berkshire, Snelsmore Common (VC 22) ex *A. flavicornis* on *Betula* coll. 7.vii.1979, coc. 30.vii.1979 (M.R. Britton)\*\*. Also considered to belong to this species: SCOTLAND: Inverness-shire, Dundreggan (VC 97) ex same host on *Betula* coll. 24.vi.2023, coc. 10.vii.2023, yet to emerge (M.R. Shaw)\*\*.

Brock (1982) based his statements (on *Platophion*) partly on the basis of the above 1970s material. Short (1978) figured final instar larval cephalic structures from the Abbots Moss specimen (slide in NMS), correctly as *O. ocellaris*.

*Ophion paraparvulus* Johansson, 2019

1♂ SCOTLAND: Ayrshire, Ailsa Craig (VC 75) ex unidentified Lepidoptera pupa coll. 16.vi.1984, em. vii.1984 (R.P. Knill-Jones)\*. The moderately large host pupa, which may be of a noctuid (assessed MRS), contains the parasitoid cocoon which has only marginally broken through the host cuticle. Emergence was off-centre at the head end of the host pupa through an untidily chewed hole.

New to Britain. This species was discerned by Johansson & Cederberg (2019) from the '*O. parvulus*' concept of Brock (1982) who had recognised that there were univoltine host-associated entities within what appeared to him to be a plurivoltine species (*i.e.*, but without having suggested that it was an aggregate).

*Ophion parvulus* Kriechbaumer, 1879

1♂ FRANCE: Aude, Pouzols-Minervois, ex *Dryobotodes* sp. (possibly *monochroma* (Esper, 1790)) on *Quercus (ilex L. etc.)* coll. 26/31.v.2012, em. iv.2013 (M.R. Shaw)\*\*. The parasitoid cocoon within the host pupa has not broken through the cuticle. Emergence was off-centre at the head end of the host pupa through an untidily chewed hole. Johansson & Cederberg (2019) report rearings from two other species of arboreal Noctuidae, but feeding on *Salix*.

*Ophion perkinsi* Brock, 1982

1♀ SCOTLAND: Midlothian, Middleton Quarry (VC 83) ex *Hadena confusa* Hufnagel, 1766, on *Silene latifolia* Poir. coll. 27.vii.1995, em. 10.vii.1996 (K.P. Bland)\*.

This is the first host record for *O. perkinsi*, which is rather rarely collected (Brock 1982; Johansson & Cederberg 2019), and perhaps unexpected, given that *O. ellenae* is the more usual parasitoid of *H. confusa*.

*Ophion scutellaris* Thomson, 1888

3♀♀ ENGLAND: Suffolk, Cavenham Heath NNR (VC26) ex *Xestia xanthographa* ([Denis & Schiffermüller], 1775) coll. 29.iv.1979, cocs v/vi.1979, em. 29.ii.1980 (1♀) and 11.iv.1980 (2♀♀) (M.R. Shaw)\*\*; 1♀, 2♂♂ ENGLAND: Oxfordshire, Stonesfield (VC 23) ex *X. xanthographa* coll. 12.v.1979, cocs v/vi.1979 (one observed 4.vi.1979), em. 25.iii.1980 (1♂), 1.iv.1980 (1♂) and 3.iv.1980 (1♀) (M.R. Shaw)\*\*; 1♀, 1♂ ENGLAND: Berkshire, Sreatley, Fairmile (VC 22) ex *X. xanthographa* coll. 22.iv.1978, cocs v/vi.1978, em. 11.iv.1979 (M.R. Shaw)\*\*; 1♂ ENGLAND: Norfolk, East Wretham NR (VC28) ex *X. xanthographa* coll. iv.1995, em. 29.iii.1996 (G.M. Haggett)\*; 1♂ ENGLAND: Cambridgeshire, Chippenham Fen NNR (VC 29) ex *Noctua fimbriata* (Schreber, 1759) coll. 9.v.1995, coc. v.1995, em. 10.iii.1996 (M.R. Shaw)\*\*. A cocoon was collected in moss at the base of a living *Fraxinus* tree at the Chippenham Fen site on 9.v.1995 from which a ♀ em. 31.iii.1996 (M.R. Shaw)\*.

Brock (1982) cited both of the host species listed here, but not from this material. Prior to Johansson & Cederberg (2019), some specimens of the smaller *Ophion wuestneii* Kriechbaumer, 1892, had been misidentified as *O. scutellaris*, although none had been reared.

*Ophion slaviceki* Kriechbaumer, 1892

1♀ ENGLAND: Devon, Braunton Burrows (VC 4) ex *Agrotis vestigialis* (Hufnagel, 1766) coll. 8.v.2007 under moss, cocoon formation and emergence not recorded (B.P. Henwood)\*\*.

With detailed justification, this species was raised from synonymy with *Ophion luteus* (Linnaeus, 1758) by Johansson & Cederberg (2019), under which name its biology was discussed by Broad, Schnee & Shaw (2015).

*Ophion splendens* Johansson, 2019

1♀ ENGLAND: Oxfordshire, Oxford (VC 23) ex *Cucullia verbasci* (Linnaeus, 1758) coll. 3.vii.1970, em. 28.v.1971 (M.R. Shaw)\*. 1♂ ENGLAND: Norfolk, Caston (VC 28) ex *Noctua*

*interjecta* Hübner, [1803] coll. ii.1999, em. 20.vi.1999 (G.M. Haggett). The supposedly associated host pupa, from which a parasitoid has emerged through a moderately neatly chewed hole obliterating the entire capital extremity, is present but larval exuviae are not. As there is no sign of a parasitoid cocoon within the host pupa it seems that the remains are probably mis-associated and might more reasonably be ascribed to an Ichneumoninae species (cf. Shaw, Kan & Kan-van Limburg Stirum 2015), although there is less reason to suspect the identity of the host species. Porter (1997) states that *N. interjecta* larvae overwinter when about half-grown, so oviposition in autumn of 1998 into a well-grown – even early final instar – host may have occurred. That said, the rearing data of the two above specimens taken together do not present an unequivocal view of voltinism and phenology.

The Oxford specimen was cited by Brock (1982) as *O. costatus*, and its larval cephalic structures were figured by Short (1978) under that name (slide in NMS) following Brock's earlier determination. The Caston specimen had been determined by Brock in 1992 as *O. parvulus*, but that was probably influenced by the apparent emergence from the host pupa. *Ophion* species identified as *O. costatus* prior to Johansson & Cederberg (2019) belong to *O. brocki* Johansson, 2019, and *O. splendens* (the true *O. costatus* is actually a rather dissimilar species in the *O. parvulus* aggregate).

### *Ophion sylvestris* Johansson, 2019

1♂ ENGLAND: Cambridgeshire, Chippenham Fen (VC 29) ex *Noctua comes* Hübner, [1813] coll. 9.v.1995, coc. v.1995, em. 4.iv.1996 (M.R. Shaw)\*\*.

This specimen had been determined as *obscuratus* by Brock in 2002; Brock's (1982) concept of *O. obscuratus* was recognised as comprising four species by Johansson & Cederberg (2019).

### *Ophion variegatus* Rudow, 1883

2♂♂ ENGLAND: Berkshire, Maidenhead Thicket (VC 22) ex *Omphaloscelis lunosa* (Haworth, 1809) on grasses coll. 9.iv.1979, em. 20.ii.1980 (M.R. Britton/M.R. Shaw)\*\*. 1♂ ENGLAND: Norfolk, Caston (VC 28) ex *Mythimna impura* (Hübner, [1808]) coll. 4.v.2000, coc. v/vi.2000, em. 20.iv.2001 (G.M. Haggett)\*\*. 1♀ ENGLAND: Oxfordshire, Stonesfield (VC 23) ex *Mythimna* sp. on grasses coll. 12.v.1979, coc. v. 1979, em. 28.iv.1980 (M.R. Shaw)\*\*. 7♀♀, 6♂♂ ENGLAND: Oxfordshire, Bradwell Grove (VC 23) ex *Mythimna impura* (Hübner, [1808]) on grasses coll. 31.v.2002, cocs vi.2002, em. in period 13–25.iv.2003, except for 1♂ 3.iv.2003 and 1♀ much later than the rest, 25.v.2003 (M.R. Shaw)\*\*. 1♀ ENGLAND: Oxfordshire, Ipsden (VC 23) ex *Mythimna ?ferrago* (Fabricius, 1787) on grasses coll. 17.v.1978, coc. 4.vi.1978, em. 11.v.1979 (M.R. Shaw)\*\*. 1♂ SCOTLAND: Banffshire, Macduff (VC 94) ex *Mythimna conifera* ([Denis & Schiffermüller], 1775) or *M. ferrago* coll. 24.v.2001, coc. vi.2001, em. 24.iv.2002 (R. Leverton)\*\*. 1♀ ENGLAND: Hampshire, Lyndhurst (VC 11) ex *Noctua interjecta* Hübner, [1803] coll. 19.v.1975, coc. ca 16.vi.1975, em. 11.iv.1976 (M.R. Shaw)\*\*. 2♀♀ ENGLAND: Lancashire, Ainsdale (VC 59) ex *Agrochola* or *Xanthia* sp. ('noctuid sp. 3') on *Salix repens* L. coll. 5.vi.1975, coc. vi.1975, em. 2.iv and 6.iv.1976 (M.R. Shaw)\*\*. 1♀ NETHERLANDS: Gelderland, Planken-Wambuis ex *Xestia baja* ([Denis & Schiffermüller], 1775) coll. 2.v.2014, em. 7.iv.2015 (M.R. Shaw)\*\*. 1♂ MALTA: Buskett ex *Lasiocampa quercus* (Linnaeus, 1758) 25.xii.2010 (M. Zerafa)\*. The cocoon is typical of *O. variegatus*, being relatively slender and almost unicolorous light grey-brown with almost no central paler band, but host remains are absent. There is no sign of the parasitoid larva having cocooned within a tough and characteristic cocoon of *L. quercus*, and the specimen is not appreciably larger than those reared from medium-sized noctuids, suggesting that if the host determination is correct the parasitoid would have (anomalously) killed the host before it was fully grown.

Brock (1982) included the Lyndhurst and Ainsdale specimens in his account of *O. obscuratus*, which he regarded as a highly diverse species. Johansson & Cederberg (2019) recognised and characterised several distinct species, but emphasised continuing problems in delimiting species within the former *O. obscuratus* aggregate. The Maltese specimen was cited by Mifsud, Farrugia & Shaw (2019), and the host determination questioned there, as it continues to be here. This

specimen has been sequenced for the COI barcoding gene and groups with other *O. variegatus* specimens, but there are distinct barcode clusters within this group and some differences in morphology, such as the shape and position of the epicnemial carina (G. Broad, unpub. data).

### *Ophion ventricosus* Gravenhorst, 1829

1♀, 2♂♂ ENGLAND: Lancashire, Silverdale (VC 60) ex *Phigalia pilosaria* ([Denis & Schiffermüller], 1775) (Geometridae) on 'hedgerow' coll. 5/6.1975, em. iv.1976 (W.A. Watson)\*\*. 1♂ SCOTLAND: Stirlingshire, Rowardennan (VC 86) ex *P. pilosaria* coll.17.vi.2018, coc. vi.2018, em. 11.v.2019 (M.R. Shaw)\*\*.

Brock (1982) cited the three specimens from Silverdale.

## DISCUSSION

Almost all *Ophion*, when known, parasitise Noctuidae, but one species-group that includes *O. cortesi*, *O. minutus* and *O. ventricosus* parasitises Geometridae and another, including *O. ocellaris*, which has been regarded as a separate genus *Platophion* Hellén, 1926, by some authors, parasitises Thyatirinae (Drepanidae). There is good reason for regarding the species related to *O. minutus* and *O. ventricosus* (the *ventricosus* aggregate of Johansson 2021), but not the *areolaris* group (= '*Platophion*'), as relatively basal within Ophioninae (Schwarzfeld, Broad & Sperling 2016; Johansson & Cederberg 2019; Johansson 2021; Shimizu & Maeto 2023) and, indeed, the undoubtedly basal ophionine *Heinrichiella obscura* (Gravenhorst, 1823) is a parasitoid of Geometridae (Shaw & Voogd 2019). Thus, use of Noctuidae as hosts appears to be a derived trait in *Ophion* that led to substantial radiation.

Johansson & Cederberg (2019) recognise five species (*O. parvulus*, *O. paraparvulus*, *O. kallanderi*, *O. costatus* and *O. tenuicornis* Johansson, 2019) in the entity previously known as *O. parvulus*. Reared specimens of the first three of these are present in the NMS collection, and in each case the *Ophion* cocoon was formed within the pupal case of the host. In all other rearings reported here (but *cf. O. splendens*) the parasitoid larva has fully erupted from the host prepupa and spun its cocoon within the host's prepared pupation site but externally to the host remains (which sometimes adhere to the cocoon), except for a single case in which a rather undersized *O. ocellaris* cocoon formed partly within the prepupal integument of its host. This may, however, have owed something to poor husbandry and malnutrition, and the parasitoid adult failed to develop.

In so far as we can judge from this material, host repertoires seem usually to be very tight involving single or at least very close genera. After rejection of probable host misidentifications, apparent exceptions are *O. inclinans*, *O. mocsaryi*, *O. splendens* and *O. variegatus* and it seems possible that in some cases unresolved aggregates may remain, as suggested for *O. inclinans* and *O. mocsaryi* by Johansson & Cederberg (2019). Among several lacunae there is very little reared material in groups related to *O. mocsaryi* (including *O. confusus*, *O. brocki* and *O. splendens*), yet these can be rather common woodland species in Britain. Other species never to have been reared include *O. crassicornis* Brock, 1982, not particularly common, but widespread. It is also noteworthy that the almost ubiquitous *Ophion obscuratus* Fabricius, 1798, has never been reliably reared. This species, as defined by Johansson & Cederberg (2019), is on the wing from autumn to early winter, presumably searching for low-feeding noctuid larvae which are rarely reared, as was

the case for the common *Ophion slaviceki*, found to be a parasitoid of *Agrotis* larvae (Broad, Schnee & Shaw 2015). Despite considerable progress, there is taxonomic work still to be done on the *obscuratus* aggregate. Another aggregate addressed by Johansson & Cederberg (2019) is the group of species previously confused under the name *Ophion pteridis*. As reported here, there are British rearings of *O. arenarius*, *O. ellenae*, *O. inclinans* and *O. matti*. We have seen one non-reared Scottish specimen of *O. norei* Johansson, 2019, but the true *O. pteridis* has not been found in Britain.

As noted above, most *Ophion* species parasitise Noctuidae larvae (exceptions are *O. cortesi*, *O. minutus*, *O. ventricosus* and *O. ocellaris*, and presumably other species in these two clades) and – as is probably the case for all Ophioninae – oviposit into late-instar hosts. Because many *Ophion* species, some quite common, have still not been reared there are undoubtedly good discoveries waiting to be made by anyone willing to collect, and competent to identify, final instar noctuid larvae on a broad front, perhaps particularly from field-layer vegetation. Deposition of reared specimens (with cocoon and host remains also preserved) in research-active museum collections is strongly encouraged, and host repertoires may then become clearer as material is accumulated.

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