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Palaearctic Homolobinae (Hymenoptera: Braconidae) in the National Museums of Scotland, with host and distribution records and a key to British species

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Synopsis

A key to the species of *Homolobus* found or likely to be found in Britain is provided, and biological and distribution data for all Palaearctic species in the National Museums of Scotland are summarised. Some previous British records are discussed.

Key words: Hymenoptera, Braconidae, Homolobinae, *Homolobus*, British and Palaearctic species, *H. annulicornis*, *H. bohemani*, *H. carbonator*, *H. discolor*, *H. flagitator*, *H. infumator*, *H. truncator*, distribution, biology.

Introduction

The small braconid subfamily Homolobinae (cf. van Achterberg, 1979, but excluding Charmontini which is now accorded subfamily status) comprises fairly large, solitary koinobiont parasitoids of 'Macrolepidoptera' larvae. They are endoparasitic until the final instar when the parasitoid larva erupts from the host and concludes its feeding externally (Allen, 1982; Shaw & Huddleston, 1991), a process that invariably happens when the host is prepupal and afforded the protection of its cocoon or other retreat. The host remains (head capsule and skin) are usually left outside the parasitoid cocoon, which is spun inside the host's pupation site. Most species are more or less orange or yellowish brown, and nocturnal. Five species, all in the genus *Homolobus*, occur in Britain and all are strongly attracted to light; with the possible exception of *H. flagitator* (Curtis) they are all plurivoltine (thus having long adult flight seasons) and overwinter within host caterpillars, presumably as first instar larvae. (The statement by Shaw & Huddleston (1991) that *Homolobus* species overwinter in the cocoon is incorrect.)

Lyle (1914) produced a key to the five British species (as *Zele*), but it is over-simplified, applicable largely to the female sex, and also uses names that in three cases are no longer valid. In the context of a revision and redefinition of the entire subfamily, van Achterberg (1979) provided extremely detailed keys to the world fauna based on his subgeneric classification, as well as separate regional keys including one to all species known from the Palaearctic region. He also re-described all the known species, largely from type material. Because of its comprehensive nature, however, van Achterberg's (1979) monograph is unnecessarily complicated to use for identifying the restricted British fauna, and a simplified key is offered here as an inducement towards a recording

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scheme run by Dr Gavin Broad (*http://www.nhm.ac.uk/research-curation/staff-directory/entomology/g-broad/index.html*), which is focused on large Ichneumonoidea that are attracted to light in the British Isles. At the same time, a brief analysis of the 527 specimens of British and other Palaearctic Homolobinae in the National Museums of Scotland (NMS) is given.

The subfamily Homolobinae can be distinguished from other British Braconidae through the keys provided in Shaw & Huddleston (1991) or van Achterberg (1993). *Homolobus* has the following combination of characters: clypeus convex, more or less meeting mandibles; mandible twisted apically and with upper tooth much longer than lower tooth; occipital carina well developed medio-dorsally; antenna at least as long as fore wing (usually clearly longer) and with over 40 (usually 45–55) segments; vein r-m (in van Achterberg, 1979; 1993; = 2rs-m in Shaw & Huddleston, 1991) in fore wing present (i.e. fore wing with 3 cubital, or submarginal, cells); marginal cell of hind wing widening distally; hind tibial spurs unequal and long (inner spur more or less reaching middle of hind basitarsus); hind trochantellus simple (i.e. lacking small preapical teeth); metasomal tergite 1 sessile, at least about twice as long as wide, subparallel-sided (usually more narrowed just behind spiracles near basal 0.3); female ovipositor usually short and inconspicuous (but in one British species about two-thirds as long as hind tibia), with a subapical dorsal notch. Most species are orange or yellowish in colour (one British species is predominantly dark brown), and moderately large (fore wing length usually 7–11 mm). A single defining character, though not always easily seen, is the presence of an antescutal depression, situated dorsally towards the hind margin of the pronotum and bordered by carinae widening posteriorly to form a U or V shape (a somewhat similar though less carinate structure is found in Charmontinae, but members of that subfamily have vein r-m in the fore wing absent).

As it happens, each of the five British species falls into a different one of the five subgenera of *Homolobus* proposed by van Achterberg (1979). The following key includes also a sixth species, *Homolobus bohemani* (Bengtsson), which has not yet been found in Britain; however, it occurs in Scandinavia and it could conceivably occur here. If British specimens exist in collections they are most likely to be mixed with *Homolobus flagitator* (Curtis), as both species have a cross vein in the hind wing marginal cell, the ovipositor projecting to about the same extent (*ca* one-quarter the length of the hind tibia), and a rather duller coloration than the other more or less orange species found in Britain. Moreover, *H. flagitator* most nearly approaches *H. bohemani* in the length of the malar space. In addition to the characters given in the key, the two species can readily be separated by differences in the sculpture of the mesopleuron: densely rugose-striate and rather dull (less so in males) in *H. bohemani* but largely smooth and shiny in *H. flagitator*.

Van Achterberg (1979) showed that *Zele longicauda* Curtis, 1832, included by Fitton *et al.* (1978) in this group, does not belong to the Homolobinae.

The key that follows includes some wing venation characters that are useful for sorting alcohol-preserved or badly damaged specimens of *H. truncator* (Say), *H. infumator* (Lyle) and *H. annulicornis* (Nees).

Key to British species of *Homolobus*

1 Malar space (= distance from eye to mandibular socket) at least as long as width of base of mandible (Fig. 1); front and middle tarsus apically flattened with width of 4th tarsomere about equal to its length in ♀ and ca 0.6 times its length in ♂ [fore wing length *ca* 6–7 m] .... ***H.* (*Oulophus*) *bohemani*** (Bengtsson) [not British]

– Malar space shorter, at most about 0.7 times basal width of mandible; 4th tarsomeres of front and middle leg clearly longer than alternative 2

2 Marginal cell of hind wing with a cross vein (Fig. 2) 3

– Marginal cell of hind wing lacking cross vein (Fig. 3) 4

3 Pterostigma, antenna at least basally and most of body dorsally dark brown; ♀ antennal segments 3–6 (+) with a ridge on inner/lower side (Figs 4, 5) [fore wing length *ca* 8 mm; males unknown] .... ***H.* (*Homolobus*) *discolor*** (Wesmael)

– Colour more or less orange (sometimes yellowish with a dusky or khaki tinge); ♀ antennal segments 3–6 without a ridge [fore wing length *ca* 7–9 mm] .... ***H.* (*Oulophus*) *flagitator*** (Curtis)

4 Claws simple (i.e. lacking tooth or lamella, but can appear rather broad and fine spines may be visible) (Fig. 6); hind wing with basal part of SR considerably less thick than SC+R1; ♂ apex of hind tibial spurs rounded at one side, lacking a membranous tip (Fig. 7) [fore wing length ca 5–8 mm; hind tarsus coloured as tibia; ♀ antennal segments 3–6 lack ridge on inner/lower side; ♀ ovipositor sheath about 0.25 as long as hind tibia, often almost concealed in death] .... ***H.* (*Apatia*) *truncator*** (Say)

– Claws with at least a small subapical tooth or a more or less toothed lamella (Fig. 8); hind wing with basal part of SR almost as thick as SC+R1 or more so; ♂ apex of hind tibial spurs pointed, tip more or less evidently membranous 5

5 Hind leg with tarsus usually not or scarcely paler than tibia (exceptions occur in very large specimens); base of fore wing with distal part of 1A+2A curved (Fig. 9); ♀ antennal segments 3–6 (+) with a clear ridge on inner side (below centre); ♀ ovipositor sheath about a quarter as long as hind tibia, often almost concealed in death; ♂ metasoma usually orange, coloured as propodeum [fore wing length *ca* 7–9 (10) mm] .... ***H.* (*Chartolobus*) *infumator*** (Lyle)

– Hind leg with tarsus (especially segments 2–4) pale yellowish or whitish, strongly contrasting with orange tibia; base of fore wing with distal part of 1A+2A straight; ♀ antennal segments 3–6 virtually without ridge; ♀ ovipositor sheath more than half as long as hind tibia; ♂ metasoma usually largely brownish dorsally, darker than propodeum [fore wing length *ca* 9–11 mm] .... ***H.* (*Phylacter*) *annulicornis*** (Nees)

Homolobus material in NMS

Unless otherwise indicated, the reared material in NMS listed below is British.

Homolobus* (*Phylacter*) *annulicornis (Nees, 1834)
(= *testaceator* sensu Lyle, 1914, and Fitton *et al.*, 1978)

23 ♀, 15 ♂. **England**: V.C.s 23, 29, 31, 33. **Scotland**: V.C. 84. **Sweden**: Skåne. **France**: Côte d'Or, 'N. France'. Specimens collected v–ix(x), mostly vii–viii. Reared from the noctuid *Cosmia diffinis* (Linnaeus) (1), coll. 26.v.2002, em. 25.vi. 2002 (*P. Waring*).

The above rearing clearly indicates that the parasitoid is plurivoltine. Lyle (1914) stated that he knew of four (presumably British) rearings of this species (as *Zele testaceator* (Curtis)) from Noctuidae, but then cited only two, probably obtained on a single occasion, from *Orthosia* (as *Taeniocampa*) *populeti* (Fabricius). Van Achterberg (1979) gives four species of Noctuidae as hosts, and *H. annulicornis* is probably restricted to this family, albeit using a range of unrelated hosts within it. The cited hosts mostly relate to the summer generation, when it certainly uses arboreal species, but the inclusion by van Achterberg (1979) of *Xestia triangulum* (Hufnagel) gives an indication that this parasitoid gets through the winter by resorting to hosts feeding on low plants; hardly surprisingly in view of the paucity of arboreal noctuids with overwintering larvae.

Homolobus* (*Phylacter*) *meridionalis van Achterberg, 1979

7 ♀, 2 ♂. **Spain**: Almeria, Granada. Specimens collected early v.

No hosts appear to be known.

Homolobus* (*Oulophus*) *bohemani (Bengtsson, 1918)

9 ♀, 8 ♂. **Sweden**: Härjedalen, Norrbotten. Specimens collected vi/vii(viii) and ix.

No hosts appear to be known.

Homolobus* (*Oulophus*) ?*carbonator (Shestakov, 1940)

5 ♂. **Russia**: Far East, Primorsky Kray, Lasovsky Zapoviednik, 526 m, N 43°17′15″ E 134°07′10″, small treeless mountain top, Malaise trap 14.vii–4.viii.2001 (*M. Kuhlmann*).

The identity of these predominantly black specimens is not certain, as the male of *H. carbonator* was unknown to van Achterberg (1979). They differ from his redescription of the female in having the upper half of the mesopleuron centrally coarsely punctured, less developed subapical teeth on the claws (e.g. very weak on hind claw); the hind coxa more or less rugose above and with strong puncturation on sides and below; face and clypeus strongly but not closely punctured, with some transverse rugae developing in upper half of face; hind tarsus largely white but 5th segment yellowish and basitarsus sharply dark brown in basal third.

***Homolobus* (*Homolobus*) *discolor* (Wesmael, 1835)**

45 ♀. **England**: V.C.s 7, 9, 12, 15, 17, 22, 27, 28, 29, 34, 58, 60, 62, 64, 69. **Wales**: V.C. 44. **Sweden**: Halland. **Germany**: Niederbayern. Although specimens have been collected in all months from v to xi, records clearly peak in (v)vi(vii) and viii–x(xi). Reared from the following Geometridae: ?*Camptogramma bilineata* (Linnaeus) (1) (*S. Ward*), ?*Electrophaes corylata* (Thunberg) (1) (*R. I. Lorimer*), *Eupithecia tantillaria* Boisduval (1) (*P. Hatcher*),

Odontoptera bidentata (Clerk) (2) (*P. Hatcher*), *Peribatodes rhomboidaria* ([Denis & Schiffermüller]) (1) (*P. Hatcher*), *Selidosema brunnearia* (Villers) (1) (*M. R. Shaw*), *Alcis repandata* (Linnaeus) (1) (*M. R. Shaw*), *Cabera pusaria* (Linnaeus) (6) (*I. D. Ferguson, G. M. Haggett, M. Parsons, R. A. Softly, M. R. Shaw*), *Cabera exanthemata* (Scopoli) (2) (*M. R. Shaw*), *Campaea margaritata* (Linnaeus) (1) (*W. A. Watson*) and indet. geometrid (1). In two cases the parasitoid failed to make a cocoon, and the resulting adults failed to expand their wings fully.

This is clearly a thelytokous species – in fact the male of *H. discolor* appears to be completely unknown. The rearing and flight data suggest two main generations, with emergences in v/vi from the hosts in which overwintering took place (*S. brunnearia*, *A. repandata*, *C. margaritata* and ?*C. bilineata* in the above list), and in ix/x from its late summer hosts. Some emergences are recorded as viii from such hosts collected in vii (*E. tantillaria*, *O. bidentata* and *P. rhomboidaria*) which may suggest a further summer generation, but it seems possible that emergence in these cases had simply been accelerated by the rearing conditions. On the whole at all times of year the hosts, which are all Geometridae (and mostly Ennominae), are arboreal (but note ?*C. bilineata* and *S. brunnearia*); a reflection of the relatively high incidence of overwintering arboreal geometrid larvae. Hosts feeding on both conifers (*Taxus, Pseudotsuga*) and broadleaved trees and bushes are included in the above rearings.

Allen (1982) recorded that the parasitoid larva he reared 'devoured all the skin, save the head capsule' of its host, but it has been my experience that the host's integument is not normally consumed (see also comments on *H. infumator* and *H. truncator*, below).

Homolobus* (*Oulophus*) *flagitator (Curtis, 1837)
(= *geminator* (Lyle, 1914))

94 ♀ 71 ♂. **Scotland**: V.C.s 77, 88, 92, 96, 99, 101, 105, 106, 107. **Ireland**: V.C. H20. **Sweden**: Härjedalen. Specimens collected vi–x. Reared from *Scopula ternata* (Schrank) (1) (*R. Leverton*), *Chloroclysta citrata* (Linnaeus) (3) (*M. R. Shaw*), *Chloroclysta truncata* (Hufnagel) (1) (*R. P. Knill-Jones*), *Hydriomena furcata* (Thunberg) (1) (*S. Ward*) and indet. geometrid (1). All of these hosts were collected on *Vaccinium myrtillus* in iv–v and in each case the adult parasitoid emerged in vi of the same year.

The long flight time of *H. flagitator* suggests it is plurivoltine, involving as yet unknown summer hosts in its annual cycle, especially as the (relatively few) specimens collected in ix and x include males. However, a consideration of its known hosts in spring raises further questions, as only some of these hosts (*S. ternata*, *C. truncata*) overwinter as young larvae while two (*C. citrata* and *H. furcata*) do so as eggs (cf. Robineau, 2007) that probably contain fully developed first instar larvae (certainly so in the case of *H. furcata*; Shaw, pers. obs.). Although it could be argued that *C. truncata* larvae might have been misidentified as *C. citrata* (they were all identified by the same person, though not all coming from the same site), it seems much less likely that the record from *H. furcata* – which has a highly distinctive larva – was incorrect (though unfortunately the host remains and parasitoid cocoon are lacking). If these hosts were correctly identified and had been attacked as free-living larvae, *H. flagitator* would need to be active as an adult in very early spring, suggesting that it might overwinter as an adult. But a different, and perhaps more likely, possibility is suggested by the fineness of the ovipositor of *H. flagitator* in relation to those of the other British *Homolobus* species. This seems compatible with its being a facultative or obligatory egg-larval parasitoid (in the sense of being able to oviposit into developed first instar hosts before they hatch from the egg), in which case all of its above hosts could be attacked in the preceding summer. Unfortunately these various hypotheses given above only serve to emphasise how little is known about the life history of this parasitoid.

Although this species is best known in the British Isles from Ireland (whence it was described), Scotland (see above; also van Achterberg, 1979: 335 [note that Aviemore is in Scotland, not England]) and Wales (in BMNH; G. Broad, pers. comm.), there is some evidence for a widespread (though perhaps former) distribution in England as well. In addition to the single specimen known to Lyle (1914) from Guestling, Sussex, captured by Rev. E. M. Blomfield in 1889 [a male, *pace* Lyle] and now in Ipswich Museum (examined), I have seen a female from Orford, Suffolk, collected in August 2008 by J. J. F. X. King (Hunterian Museum, Glasgow). These English sites are both more or less coastal, but elsewhere in its predominantly north-western British distribution it occurs far inland.

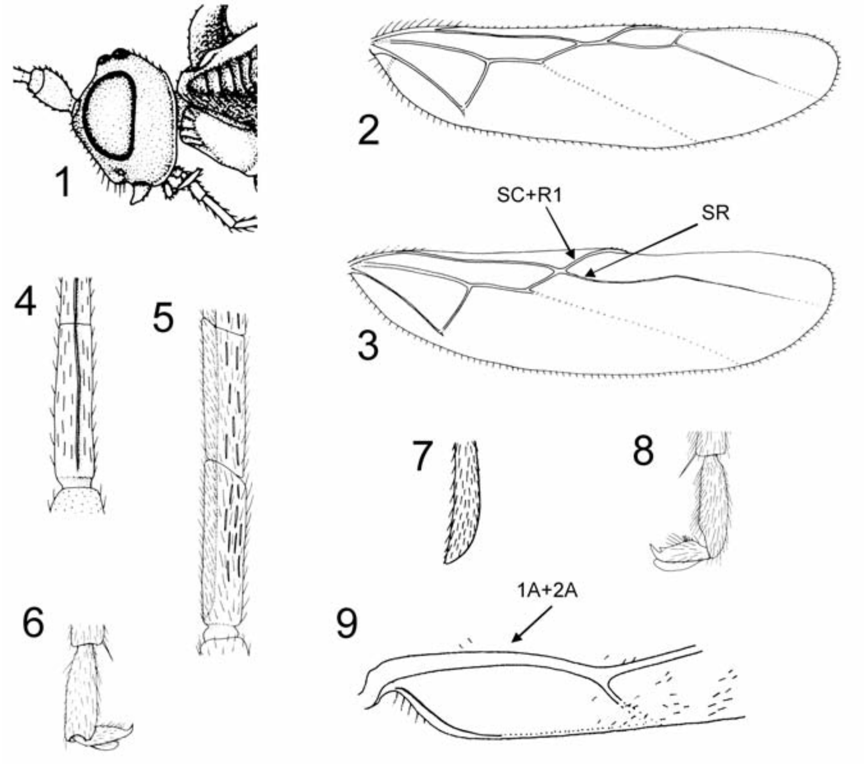
Van Achterberg (1979) gives a range of North American Geometridae as hosts of this Holarctic species, and two further Palaearctic geometrids that overwinter as small larvae, *Entephria caesiata* ([Denis & Schiffermüller]), which feeds on *V. myrtillus*, and *Alcis repandata* (Linnaeus) which was stated to be doing so. Although the association with *V. myrtillus* in Britain and perhaps Europe as a whole seems profound, some of the North American hosts had been collected from *Betula* and *Salix*.

Homolobus* (*Chartolobus*) *infumator (Lyle, 1914)

153 ♀, 52 ♂. **England**: V.C.s 3, 22, 23, 26, 28, 38, 57, 58, 63, 64, 65, 69. **Wales**: V.C.s 45, 49, 52. **Scotland**: V.C.s 76, 77, 84, 86, 87, 88, 89, 92, 95, 96, 98, 101, 105, 106, 107. **Sweden**: Skåne, Halland, Bohuslän, Gotland. **Germany**: Niederbayern. **France**: Côte d'Or, Vaucluse, Lot-et-Garonne, Dordogne. **Spain**: Madrid, Zaragoza. Specimens collected v–xi, most commonly (viii)ix–x(xi). Reared from the geometrids *Lycia hirtaria* (Clerck) (1) (*M. R. Britton*), *Lycia zonaria* ([Denis & Schiffermüller]) (1) (*D. Lloyd*), *Cleora cinctaria* ([Denis & Schiffermüller]) (1) (*M. R. Shaw*), *Alcis repandata* (Linnaeus) (1) (*B. Statham*), *Ematurga atomaria* (Linnaeus) (9) (*M. R. Shaw*), *Calamodes occitanaria* (Duponchel) (1, Spain) (*G. E. King*), *Compsoptera jourdanairia* (Serres) (5, Spain) (*G. E. King*). All of these hosts are in the subfamily Ennominae.

This is clearly a plurivoltine species; the Spanish adults reared by King emerged iii and iv from host larvae collected in ii and iii, but otherwise the only overwintering host in the above list is *A. repandata*, from which (as *Boarmia*) Lyle (1914) recorded it 'very many times' in describing this species from 11 females and 13 males. From the summer hosts, collected as caterpillars in vii, adults have emerged late vii–ix.

Allen (1982) remarks that the final instar larva was seen to 'consume the skin of the host' but that has not been my experience. Van Achterberg (1979) mistakenly implied that the specimen recorded by Lyle (1914) (as *Zele chloropthalma* (Nees)) from *Agonopterix alstromeriana* (as *Depressaria alstroemeriana*) is a part of the type series of *Zele infumator* Lyle (see below).



Figs 1–9. *Homolobus* spp. (from van Achterberg, 1979, with some minor modification). 1, *H. bohemani* (Bengtsson), head, lateral view. 2, 3, (stylised) hind wing, marginal cell: 2, divided by a cross vein; 3, not divided. 4, 5, basal flagellar segments of female of species exhibiting a ridge (different orientations). 6, 7, *H. truncator* (Say): 6, outer hind claw, female; 7, apex of outer hind tibial spur, male, lateral aspect. 8, 9, *Homolobus infumator* (Lyle): 8, outer hind claw, female; 9, part of base of fore wing.

Homolobus* (*Apatia*) *truncator (Say, 1828) (= *calcarator* (Wesmael, 1835) = *chlorophthalma* sensu Lyle, 1914). ?New to Britain (see below)

31 ♀, 21 ♂. **England** (2 ♀): Oxfordshire, Barrow Farm Fen, SU 468976 (V.C. 22), Malaise trap 19.vii–17.viii.1990 (*K. Porter*). **Sweden**: Gotland. **France**: Lot, Var, Corsica. **Italy**: Umbria. **Portugal**: Algarve. **Spain**: Madrid, Zaragoza. Captures in southern Europe have been from iv–x and the rearing data suggest that it has several annual generations. In northern Europe (Britain and Sweden) it has been collected in vii and in ix/x. Reared from both Geometridae: *Glossotrophia annae* Mentzer (1, Spain) (*G. E. King*), *Glossotrophia asellaria* (Herrich-Schäffer) (9, Spain) (*G. E. King*), *Glossotrophia rufomixtaria* (Graslin) (1, Spain) (*G. E. King*), *Rhodometra sacraria* (Linnaeus) (14, Spain) (*G. E. King*), *Casilda consecraria* (Staudinger) (4, Spain) (*G. E. King*), *Semiothisa clathrata* (Linnaeus) (1, France) (*M. R. Shaw*), *Pachycnemia hippocastanaria* (Hübner) (2, France) (*T. H. Ford*); and Noctuidae:

Calophasia platyptera (Esper) (1, Spain) (*G. E. King*), *Emmelia trabealis* (Scopoli) (1, France) (*M. R. Shaw*), *Catocala nymphagoga* (Esper) (1, Spain) (*G. E. King*). More doubtful hosts are the geometrid *Chlorissa etruscaria* (Zeller) (1, Spain) (*G. E. King*) [host remains are ?incompatible], and the noctuids ?*Mythimna* sp. (1, Spain) (*G. E. King*) [lacking host remains]. Most of the above hosts were feeding on low plants (but *C. nymphagoga* was collected from *Quercus ilex*). In two cases no cocoon was made (both adults had failed to expand their wings fully), and in another the host remains were enclosed within the parasitoid cocoon (giving the superficial impression that they had been consumed).

The specimen from *C. nymphagoga* is accompanied by host remains that appear to be of a penultimate instar; further observations are needed to ascertain whether the parasitoid can cause precocious prepupation by its host, as might be implied if the host remains are correctly associated.

The introduction of this species (as *Zele chloropthalma* (Nees)) to the British list by Lyle (1914) was on the strength of a single female specimen, whose locality was not given, in the Fitch collection reared by G. Elisha from *Agonopterix alstromeriana* (Clerk) (as *Depressaria alstroemeriana*) on 17.vii.1884. The criteria used by Lyle to determine it seem rather weak, but I have not been able to locate this specimen. It seems not to be in the BMNH (G. Broad, pers. comm.), either under *H. truncator* or, as might have been suspected from van Achterberg's (1979: 306–307) listing of a specimen there from the same host, under *H. infumator*. Although this specimen is not part of the type series of *Zele infumator* Lyle (*pace* van Achterberg, 1979) it would be of interest to relocate it and establish its identity. However, even if (as seems most probable) it proves to be the specimen determined (presumably correctly) by van Achterberg (1979) as *H. infumator* and it is therefore not *H. truncator*, the English specimens recorded above maintain this species' position on the British list.

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