

Hymenoptera: Parasitoid Wasps 1 (Parasitoid Wasps 1)

Parasitoid wasps are an artificial grouping of Hymenopteran families that share similar life strategies, but are not necessarily related. It is therefore a polyphyletic group. It has been used here to group these families for convenience, but does not have taxonomic value.

Parasitoid wasps have been split between 20 separate Scottish Invertebrate Species Knowledge Dossiers. This first dossier includes species of conservation concern, summary family information, distribution data and identification guides for all Parasitoid wasps. The other dossiers provide detailed species lists for each super family and family known to occur in Scotland (as appropriate). The appropriate knowledge dossier for each family is indicated in the summary family information below.

A. NUMBER OF SPECIES IN UK: 6,418 (includes 28 introduced species)

B. NUMBER OF SPECIES IN SCOTLAND: 3,234 (200 only known from Scotland in UK context, 1,754 species certainly known to occur in Scotland, 1,479 which UK country of specimen collection is unknown, includes 12 introduced species)

C. EXPERT CONTACTS

Please contact scotland@buglife.org.uk for details.

D. SPECIES OF CONSERVATION CONCERN

Listed species

None – insufficient data.

Other species

A fairly large number of parasitoid wasps have been recorded only once, or in only one very restricted area, in Scotland. Among the biggest and most conspicuously distinctive are the acaenitine ichneumonids *Coleocentrus excitator*, which is probably a parasitoid of the cerambycid beetle *Asemum striatum* and is known in Britain from just a single specimen from the Black Wood of Rannoch (Shaw, M. R. 1986. *Coleocentrus excitator* (Hymenoptera: Ichneumonidae) new to Britain. *Entomologist's Gazette* 37 221-224), and *Acaenitus dubitator*, a parasitoid of the weevil *Cleonis pigra* (Nationally Notable B species) and known in Britain only from a short stretch of the East Lothian coast (Shaw, M. R. & Wahl, D. B. 1989. The biology, egg and larvae of *Acaenitus dubitator* (Panzer) (Hymenoptera, Ichneumonidae: Acaenitinae). *Systematic Entomology* 14 117-125). However, as long as the habitats remain in their present states there seems to be no obvious additional threat to either species.

Several other conspicuous species previously known only from Scotland in the British Isles appear not to have been seen since the first half of the 20th century - e.g. the pimelines *Pimpla arctica*, collected on Soay (Skye) in 1909, and *Dolichomitus diversicostae*, reared from the cerambycid *Acanthocinus aedilis* and collected in the 1930s and 40s in Deeside and at Nethy Bridge (probably in the latter cases at the saw mill that was then sited there, which processed Scottish timber also from further afield). It is unclear whether or not populations of these species still exist in Scotland; certainly much more collecting effort would be needed to assert with any confidence that they do not.

Particular threats

Because parasitoid wasps live at a high trophic level and are (often) extremely specialised – not infrequently being at least locally, and sometimes absolutely, monophagous – they are particularly prone to (local) extinction, especially if the population levels of their hosts oscillate. If there is no effective metapopulation structure local extinctions will be permanent, with a consequent contraction of distribution (and perhaps range). It is ironic that this very large group (about a quarter of the British insect fauna) is at the same time among the least understood and the most generally vulnerable of all our invertebrates, and our lack of knowledge has to be counted as a serious conservation issue in itself (cf. Shaw 1996, 2006; Shaw & Hochberg 2001, all listed in Other Information below).

Clearly any potential host of a parasitoid wasp that is itself of conservation concern should be investigated carefully for the presence of associated parasitoids, which (depending how host-specialised they are) may be at even more risk than their host. This approach offers probably the best way to generate lists of genuinely and demonstrably vulnerable parasitoid wasps, such as the microgastrine braconid *Cotesia melitaearum* which is restricted to the Marsh Fritillary butterfly (*Euphydryas aurinia*), with recent rearings in Britain only from Scotland. However, this will not paint the whole picture, as there are plenty of rare and probably endangered parasitoids that use common hosts – and rare hosts most often have only common and oligophagous parasitoids (unless the host has abnormal biology or is very phylogenetically isolated). Sadly, however, for the majority of parasitoid wasps there is literally no biological information whatsoever, making it all but impossible to assess their needs and conservation status.

E. LIST OF SUPER FAMILIES AND FAMILIES KNOWN FROM SCOTLAND

The table below summarises species data for each of the super families (S) and families (F) of Parasitoid wasps known to occur in Scotland, and indicates which Scottish Invertebrate Species Knowledge Dossier includes the appropriate detailed checklist. The table indicates the total number of species known to occur the UK (UKT), total number of species known to occur in Scotland (ScT), number of species only known from Scotland in a UK context (ScO), number of introduced species known in the UK (IUK) and number of introduced species known to occur in Scotland (ISc). Furthermore, it is not clear which UK country some specimens have been recorded from, therefore species that are certainly known to occur in Scotland (C) and those that are only known from the UK and lack a country of origin (Uc) are also detailed in the table below. Species which are known from specimens of unknown country of origin may or may not occur in Scotland, or the UK.

Parasitoid wasps are extremely poorly recorded, with many species only known from a single specimen. As is clear from the data summarised in the table below, some super families and families are better recorded than others, although all are poorly recorded. This group would benefit hugely from increased recording.

| Family / Superfamily | | Parasitica Dossier | Species Summaries | | | | | | |
|----------------------|-------------------|--------------------|-------------------|-------|-----|-------|-----|-----|-----|
| | | | UKT | ScT | ScO | C | Uc | IUK | ISc |
| F | Aphelinidae | 2 | 42 | 9 | 0 | 3 | 6 | 2 | 1 |
| F | Braconidae | 3 | 1,310 | 455 | 37 | 387 | 68 | 0 | 0 |
| S | Ceraphronoidea | 4 | 89 | 71 | 0 | 6 | 65 | 0 | 0 |
| F | Encyrtidae | 5 | 234 | 36 | 6 | 31 | 5 | 7 | 3 |
| F | Eulophidae | 6 | 526 | 320 | 2 | 11 | 309 | 2 | 1 |
| F | Eupelmidae | 7 | 17 | 8 | 0 | 0 | 8 | 0 | 0 |
| F | Eurytomidae | 8 | 93 | 58 | 0 | 3 | 55 | 0 | 0 |
| S | Evanioidea | 9 | 8 | 1 | 0 | 1 | 0 | 1 | 1 |
| F | Ichneumonidae | 10 | 2,514 | 1,370 | 124 | 1,154 | 215 | 7 | 0 |
| F | Mymaridae | 11 | 92 | 31 | 0 | 8 | 23 | 0 | 0 |
| F | Perilampidae | 12 | 10 | 2 | 0 | 1 | 1 | 0 | 0 |
| S | Platyastroidea | 13 | 358 | 136 | 18 | 64 | 73 | 0 | 0 |
| S | Proctotrupeoidea | 14 | 326 | 83 | 9 | 66 | 17 | 2 | 0 |
| F | Pteromalidae | 15 | 623 | 594 | 2 | 6 | 588 | 0 | 0 |
| F | Signiphoridae | 16 | 2 | 1 | 0 | 0 | 1 | 0 | 0 |
| F | Tetracampidae | 17 | 7 | 3 | 0 | 0 | 3 | 0 | 0 |
| F | Torymidae | 18 | 113 | 42 | 2 | 12 | 30 | 7 | 6 |
| F | Trichogrammatidae | 19 | 37 | 13 | 0 | 0 | 13 | 0 | 0 |
| S | Trigonalyoidea | 20 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |

F. DISTRIBUTION DATA

- a) The upcoming British Isles check list, parts of which are already available in draft at <http://www.nhm.ac.uk/research-curation/staff-directory/entomology/g-broad/index.html>, will attempt to indicate (by E, S, W, I, M) occurrence of species in England, Scotland, Wales, Ireland (the whole island) and the Isle of Man. This should assist conservation and recording initiatives, which currently are mostly organised through similar divisions of the British Isles.
- b) For a few groups of Ichneumonoidea the collection at the National Museums of Scotland has been catalogued in outline, giving distributional records at Vice County level or more precisely for rarely collected species, in the following papers:
 - i) Kasparyan, D. R. & Shaw, M. R. 2008. British and European Phytodietus Gravenhorst (Hymenoptera: Ichneumonidae, Tryphoninae) in the National Museums of Scotland with a key to European species of the subgenus Neuchorus Uchida and descriptions of three new species. *Entomologist's Gazette* 59 184-198.
 - ii) Kasparyan, D. R. & Shaw, M. R. 2009. A new species of Hadrodactylus Foerster (Hymenoptera: Ichneumonidae, Ctenopelmatinae) from Britain and mainland Europe, with a review of material of the genus in the National Museums of Scotland. *Entomologist's Gazette* 60 251-258.
 - iii) Shaw, M.R. & Kasparyan, D.R. 2003. Some genera of British and European Mesoleiini (Hym., Ichneumonidae: Ctenopelmatinae) in the National Museums of Scotland, including a new species of Mesoleius and a further twenty species new to Britain. *Entomologist's Monthly Magazine* 139 17-28.
 - iv) Shaw, M. R. & Kasparyan, D. R. 2005. British and European Tryphonini, Exenterini, Eclytini and Idiogrammatini (Hym., Ichneumonidae: Tryphoninae) in the National Museums of Scotland, including 19 species new to Britain. *Entomologist's Monthly Magazine*. 141 1-14.
 - v) Schwarz, M. and Shaw, M. R. 1998. Western Palaearctic Cryptinae (Hymenoptera: Ichneumonidae) in the National Museums of Scotland, with nomenclatural changes, taxonomic notes, rearing records and special reference to the British check list. Part 1. Tribe Cryptini. *Entomologist's Gazette* 49 101-127.
 - vi) Schwarz, M. & Shaw, M. R. 1999. Western Palaearctic Cryptinae (Hymenoptera: Ichneumonidae) in the National Museums of Scotland, with nomenclatural changes, taxonomic notes, rearing records and special reference to the British check list. Part 2. Genus Gelis Thunberg (Phygadeuontini: Gelina). *Entomologist's Gazette*, 50 117-142.
 - vii) Schwarz, M. & Shaw, M.R. 2000. Western Palaearctic Cryptinae (Hymenoptera: Ichneumonidae) in the National Museums of Scotland, with nomenclatural changes, taxonomic notes, rearing records and special reference to the British check list. Part

3. Tribe Phygadeuontini, subtribes Chiroticina, Acrolytina, Hemitelina and Gelina (excluding Gelis), with descriptions of new species. *Entomologist's Gazette* 51 147-186.
- viii) Schwarz, M. & Shaw, M.R. 2010. Western Palaearctic Cryptinae (Hymenoptera: Ichneumonidae) in the National Museums of Scotland, with nomenclatural changes, taxonomic notes, rearing records and special reference to the British check list. Part 4. Tribe Phygadeuontini, subtribes Mastrina, Ethelurgina, Endaseina (excluding Endasys), Bathythrichina and Cremndina. *Entomologist's Gazette* 61 187-206.
- c) There is an embryonic recording scheme for nocturnal ichneumonoids (mainly more or less orange and often large species, including the genus *Netelia* and the subfamily Ophioninae) run by Gavin Broad (g.broad @ nhm.ac.uk); distribution data will be available on the NBN Gateway on a genus by genus basis, with *Netelia* the first to be mapped.
- d) A recording scheme for Chalcididae (a small group of mostly relatively big and distinctive Chalcidoidea with swollen hind femora) is run by Steve Compton (S.A.G.Compton@leeds.ac.uk).

G. IDENTIFICATION GUIDES

- a) Barnard, P.C. (ed.). 1999. *Identifying British Insects and Arachnids: an annotated bibliography of key works*. Natural History Museum and Cambridge University Press. [Pages 197-319 of this comprise a structured and annotated list of keywords and other identification literature for the order Hymenoptera in Britain up to the end of 1997. Only selected works (e.g. keys including most or all British taxa in the group concerned) after that date are listed below. The very many recent papers that deal with just one or two British species are usually referenced as part of the annotation in the upcoming British Isles check list (see above) and not repeated here.]
- b) Broad, G.R. & Shaw, M.R. 2005. The species of four genera of Metopiinae (Hymenoptera: Ichneumonidae) in Britain, with new host records and descriptions of four new species. *Journal of Natural History* 39 2389-2407.
- c) Shaw, M. R. 2006. Notes on British Pimplinae and Poemeninae (Hymenoptera: Ichneumonidae), with additions to the British list. *British Journal of Entomology and Natural History* 19 217-238.
- d) 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.
- e) Shaw, M. R. & Quicke, D. L. J. 1999. The British genera of Braconinae (Hym., Braconidae). *Entomologist's Monthly Magazine* 135 95-101.

- f) Royal Entomological Society Handbooks for the Identification of British Insects are in preparation for parasitoid wasps as follows, but may take some years to complete:
 - i) Eulophidae (excl. Tetrastichinae)
 - ii) Ichneumonidae: key to subfamilies, biological outlines, guide to identification works.
 - iii) Ichneumonidae: Cryptinae: Cryptini
 - iv) Ichneumonidae: Banchinae
 - v) Ichneumonidae: Diplazontinae
 - vi) Ichneumonidae: Pimplinae, Poemeniinae, Rhyssinae (2nd edn)
 - vii) Ichneumonidae: Metopiinae
 - g) Draft keys to groups of nocturnal Ichneumonoidea (more or less orange species) are available from Gavin Broad in connection with the recording scheme (see above).
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H. OTHER INFORMATION

- a) Overview literature (further more detailed references are included within these texts and a more exhaustive list is available on request at scotland@buglife.org.uk):
 - i) Askew, R. R. 1971. *Parasitic insects*. Heinemann.
 - ii) Achterberg, C. van 1993. Illustrated key to the subfamilies of the Braconidae (Hymenoptera: Ichneumonoidea). *Zoologische Verhandelingen* 283 1-189.
 - iii) Bouček, Z. & Rasplus, J. Y. 1991. *Illustrated key to West-Palaeartic genera of Pteromalidae (Hymenoptera: Chalcidoidea)*. INRA.
 - iv) Buhl, P.N. & Notton, D. G. 2009. A revised catalogue of the Platygastriidae of the British Isles. *Journal of Natural History* 43 1651-1703.
 - v) Clausen, C. P. 1940. *Entomophagous insects*. McGraw-Hill (reprinted 1972, Haffner)
 - vi) Fitton, M. G., Shaw, M. R. & Austin, A. D. 1987. The Hymenoptera associated with spiders in Europe. *Zoological Journal of the Linnean Society* 90 65-93.
 - vii) Gauld, I. D. 1988. Evolutionary patterns of host utilization by ichneumonoid parasitoids (Hymenoptera: Ichneumonidae and Braconidae). *Biological Journal of the Linnean Society* 35 351-377.
 - viii) Gauld, I. & Bolton, B. (eds). 1988. *The Hymenoptera*. OUP/BM(NH) (2nd Edn 1996).
 - ix) Gauld, I. D. & Hanson, P. (eds). 1995. *The Hymenoptera of Costa Rica*. OUP/NHM. [Contains a wealth of general biological information, comprehensively reviewed]

- x) Godfray, H. C. J. 1994. *Parasitoids: behavioural and evolutionary ecology*. Princeton.
- xi) Goulet, H. & Huber, J. T. (eds). 1993. *Hymenoptera of the world: an identification guide to families*. Agriculture Canada. [Available online: http://www.esc-sec.ca/aafcmonographs/hymenoptera_of_the_world.pdf]
- xii) LaSalle, J. & Gauld, I. D. (eds). 1993. *Hymenoptera and biodiversity*. CABI/NHM.
- xiii) Noyes, J.S. 1998. *Catalogue of the Chalcidoidea of the world*. Biodiversity Catalogue Database and Imaging Library CD-ROM Series. ETI Biodiversity Centre, Amsterdam, Netherlands. [a continuously updated version available at <http://www.nhm.ac.uk/research-curation/research/projects/chalcidoids/>]
- xiv) Quicke, D. L. J. 1997. *Parasitic wasps*. Chapman and Hall.
- xv) Shaw, M. R. 1994. Parasitoid host ranges. In Hawkins, B. A. & Sheehan, W. (eds) *Parasitoid community ecology* 111-144. Oxford University Press.
- xvi) Shaw, M. R. 1997. *Rearing parasitic Hymenoptera*. AES, Orpington.
- xvii) Shaw, M. R. 1996. Hymenoptera in relation to insect conservation in Scotland. In Rotheray, G.R. & MacGowan, I. (eds) *Conserving Scottish Insects* 55-64. Edinburgh Entomological Club.
- xviii) Shaw, M.R. 2002. Host ranges of *Aleiodes* species (Hymenoptera: Braconidae), and an evolutionary hypothesis. In Melika, G. & Thuroczy, C. (eds) *Parasitic wasps: evolution, systematics, biodiversity and biological control* 321-327. Agroinform, Budapest.
- xix) Shaw, M. R. 2006. Habitat considerations for parasitic wasps (Hymenoptera). *Journal of Insect Conservation* 10 117-127.
- xx) Shaw, M. R. & Hochberg, M. E. 2001. The neglect of parasitic Hymenoptera in insect conservation strategies: the British fauna as a prime example. *Journal of Insect Conservation* 5 253-263.
- xxi) Shaw, M. R. & Huddleston, T. 1991. Classification and biology of braconid wasps (Hymenoptera: Braconidae). *Handbooks for the Identification of British Insects* 7(11) 1-126.
- xxii) Shaw, M. R., Stefanescu, C. & Nouhuys, S. van 2009. Parasitoids of European Butterflies. In Settele, J., Shreeve, T., Konvička, M. & Van Dyck, H. (eds) *Ecology of Butterflies in Europe*: 130-156. Cambridge University Press.
- xxiii) Waage, J. & Greathead, D. (eds) 1986. *Insect parasitoids*. Academic Press, London. (*Symposium of the Royal Entomological Society of London* 13).

- xxiv) Yu, D.S, Achterberg, C. van & Horstmann, K. 2005. World Ichneumonoidea 2004 – taxonomy, biology, morphology and distribution. DVD/CD Taxapad, 2005. Vancouver, Canada.
- xxv) Yu, D.S & Horstmann, K. 1997. A Catalogue of world Ichneumonidae (Hymenoptera). *Memoirs of the American Entomological Institute* 58 1-155.
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This document provides information on species known to occur in Scotland at the time of publication. This document does not provide a definitive list of species occurring in Scotland. The list of species known to occur in Scotland may change as further information is gathered.

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