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Biology, early stages and description of a new species of *Adelognathus* Holmgren (Hymenoptera: Ichneumonidae: Adelognathinae)

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Abstract

Adelognathus leucotrochi Shaw & Wahl sp. nov. is described from Britain where it is a univoltine slightly gregarious koinobiont ectoparasitoid of late stage larvae of the tenthredinid sawfly *Nematus leucotrochus* Hartig feeding on *Ribes uva-crispa*. Defensive reactions by the host to prospecting females are described. The developmental biology of *A. leucotrochi* is described in detail: the host is only temporarily paralysed by the injection of a venom that has no other effect on the host, and eggs are laid on the host's dorsum without involvement of the ovipositor—that is, the egg issues direct from the genital opening. Prior to oviposition the adult female parasitoid prepares the site by spreading an adhesive substance from her ovipositor. Host-feeding by adult females occurs on haemolymph and sometimes also other tissues obtained at the site of a wound made always by the mandibles, but appears not to be obligatory. It may be concurrent or non-concurrent with oviposition; in the latter case, it may be either destructive or non-destructive. Larval development is very rapid, taking about 70 hr at 18–22°C, and the host continues to feed for approximately the first half of this period. Five larval instars were detected, and their cephalic sclerites are described and illustrated, as are those of the final instars of a further three species of *Adelognathus* for comparison. The rather featureless final instar larva is also figured, as is the tough cocoon in which the winter is passed as a prepupa. The biology of some idiobiont *Adelognathus* species is discussed in comparison with that of *A. leucotrochi*, and several other instances of eggs not issuing from the ovipositor in non-aculeate ectoparasitoid Hymenoptera, whether koinobionts or idiobionts, are briefly reviewed. It is concluded that this habit seems to arise rather easily when there is direct bodily contact between the adult and the host/prey, as indeed is the case in all carnivorous aculeates that do not practice continuous provisioning.

Key words: parasitism, Tenthredinidae, *Adelognathus chrysopygus*, *Nematus leucotrochus*, host-feeding, oviposition, ovipositor use, koinobiont, larval development, larval morphology, Britain

Introduction

The enigmatic ichneumonid subfamily Adelognathinae consists of the single genus *Adelognathus* Holmgren, with 46 described species occurring in the Holarctic (Yu *et al.* 2012). Its relationship to other subfamilies has been unclear, with Townes (1969: pp. 32–33) considering adelognathines somewhere near the Pimplinae, Tryphoninae, Labeninae, Xoridinae, and Agriotypinae. Quicke *et al.* (2009) placed it as the sister-group to Cryptinae, but that work is based upon only one gene and an inadequate morphological data set. Preliminary results from a more comprehensive molecular and morphological study (A.M.R. Bennett *et al.* in prep.) place it as the sister-group to a clade consisting of Ichneumoninae, Cryptinae, and Microleptinae.

Adelognathus species are all small insects, generally under 4 mm in length, and as far as is known they are exclusively external parasitoids of the larvae of sawflies (Hymenoptera: Pamphiloidea and Tenthredinoidea). Development may be solitary or in small gregarious broods (Fitton *et al.* 1982). While it is possible that strictly solitary species exist, most species are probably best regarded as fundamentally gregarious, with brood sizes of one to a few, in some cases with variation according to generation (Kopelke 1987). Although many *Adelognathus* species parasitize exposed hosts, some are associated with hosts that feed in more concealed sites (Fitton *et al.* 1982), in one case in a gall (Kopelke 1987). Both the large whitish eggs and the parasitoid larvae are, at least when

by stinging it at an apparently random position during a split-second attack, then (ii) she waits nearby for up to half an hour until the host becomes quiescent, when (iii) she revisits it and probes with the ovipositor, stinging the host on both sides behind the head (presumably into ganglia). Oviposition then proceeds onto the fully paralysed host, which does not subsequently recover sufficient activity to resume feeding, and more-or-less paralysed host larvae bearing eggs could be found in the wild on *Ribes* foliage. Bennett also reported (*in litt.* 1999) that, as in *A. leucotrochi*, the egg issues direct from the genital opening without passing down the ovipositor in any sense, and that host-feeding was at wounds inflicted by the mandibles. It should be emphasized that the hosts of *A. leucotrochi* were often only stung once and that, when additional stinging was needed to temporarily subdue the host, there was no effort made to sting the host at a precise site. Subsequently a further species, *Adelognathus difformis* Holmgren, has been recorded by Heitland & Pschorn-Walcher (2005) to be an idiobiont, in this case as a parasitoid of the nematine sawfly *Platycampus luridiventris* (Fallén) feeding on *Alnus*. As in the case of *A. chrysopygus*, eggs were deposited on the ventral surface of the paralysed host, though it is reported that eggs of the other certainly known idiobiont, *A. cubiceps*, are placed in a lateral position (Kopelke 1987)—but in that case on a concealed host.

The four female specimens (in RSME) of the koinobiont recorded by Fitton *et al.* (1982) as *A. granulatus*, now correctly *A. chrysopygus*, have been re-examined in comparison with female specimens of *A. chrysopygus* deposited in RSME that resulted from the studies of both Rahoo & Luff (3♀) and Bennett (6♀) as parasitoids of *P. pallipes*. The material from *P. pallipes* is very constant, but the koinobiont series differs by having the lower gena next to the mandible mostly dark (strongly yellow in the material from *P. pallipes*) and the second segment of the hind tarsus a little less elongate. The moderately extensive non-reared European material present in RSME separates rather cleanly along these lines. Both segregates run only to *A. chrysopygus* in Kasparyan's (1990) key, but it appears likely that two different species are involved. The resolution of this is, however, beyond the scope of the present work.

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