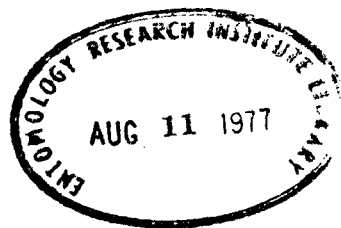
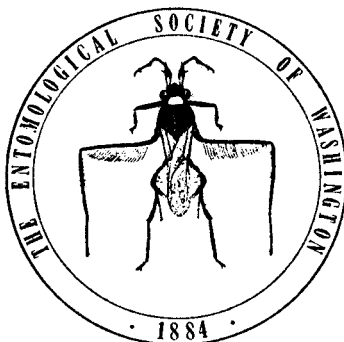


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ANT LARVAE: REVIEW AND SYNTHESIS

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ENEMIES OF ANT LARVAE

In all our papers on ant larvae we have cited, along with species descriptions, any reference to enemies. It would be more convenient for zoologists if we summarized all such information (together with citations) in a table, but the cost of publication would be prohibitive. Hence we give in Appendix C the taxa to which the enemies belong, the type of interaction and the genera (if cited) to which the ant hosts belong, leaving to interested parties the burden of finding the references in our earlier papers under the ant genus.

As far as known, the members of the chalcidoid family Eucharitidae parasitize ants exclusively. Twenty-two species in 14 genera have been recorded as taken with ants. Of these, 12 species in 9 genera are known to be brood parasites. The life histories of *Orasema viridis*, *Psilogaster fasciventris* and *Schizaspida tenuicornis* are known. "The two known endoparasitic members of the family, *Orasema costaricensis* W. & W. and *O. sixaolae* W. & W., attack the larvae of *Pheidole* and *Solenopsis*, respectively (Wheeler and Wheeler, 1937). The planidia were found embedded in the host bodies, with the posterior end fixed in the entrance hole in the integument and surrounded by a 'collar.' . . . It is not known whether the second and third instars are endo- or ectoparasitic, though mature larvae were free in the nest." (Clausen 1940: 227).

FOSSIL ANT LARVAE

The layman who thinks of fossils as bones and shells might be surprised that such a soft creature as an ant grub could ever be fossilized. But if a jellyfish can be fossilized; why not an ant larva? Furthermore the entomologist who has prepared whole mounts of small insects in the resin of *Abies balsamea* is not surprised to find ant larvae preserved in the resin of extinct trees.

The fossil larvae of four extinct species of ants have been recorded. Three are from the Oligocene Baltic Amber. "The larval and pupal stages of the Baltic ants were also in all respects as highly specialized and of the same structure as those of recent species. I have seen larvae and pupae of *Iridomyrmex geinitzi*, *I. goepperti* and *Lasius schiefferdeckeri*. The *Lasius* pupae are enclosed in cocoons, while those of *I. geinitzi* are naked, showing that the cocoon-spinning habit of the larvae had been lost in the *Dolichoderinae* as far back as the early Tertiary." (W. M. Wheeler 1914: 21.). *Iridomyrmex geinitzi* is figured on p. 87.

The fourth record (*Oecophylla leakeyi* Wilson and Taylor) is 197 larvae of various ages found in "rock" from the Lower Miocene deposits of Mfwangano Island, Lake Victoria, Kenya (Wilson and Taylor 1964).

SPECIALIZATION

To test our appraisals of degrees of specialization of taxa we have considered 46 characters (out of about 100 we use in descriptions) of 156 genera and treated them as follows: (1) Compare a character in a genus with the mode for that same character in the family (i.e., in the hypothetical typical ant larva), (2) Assign to that character a value according to the amount of its deviation—0 if the same or 1, 2 or 3. Most characters have only two values—0 and 1; all values are given in Appendix D. (3) Tabulate these values. (4) Total the values of all its characters to get the

C. ENEMIES OF ANT LARVAE

PHYLUM PLATYHELMINTHES

Raillietina spp. (poultry tapeworm). Ants may become infested in the larval stage. *Tetramorium*.

PHYLUM NEMATODA

Mermis spp., *Pelodera janeti*, *Allomermis myrmecophila*. Ants presumably become infested by worm larvae in the larval stage; infested adult ants are termed mermithogynes. *Aphaenogaster*, *Camponotus*, *Ectatomma*, *Formica*, *Lasius*, *Leptothorax*, *Myrmica*, *Neoponera*, *Odontomachus*, *Pachycondyla*, *Paraponera*, *Plagiolepis*, *Solenopsis*.

PHYLUM ARTHROPODA

CLASS ARACHNIDA

Spider. Predation. *Megaponera*.
Mite (*Pigmephorus* sp.) *Proceratium*.

CLASS INSECTA
ORDER COLEOPTERA

CARABIDAE: *Helluomorphoides latitarsis*, *H. ferrugineus*. Predation. *Neivamyrmex*. *Pseudomorpha laevis*. Predation. *Camponotus*. *Tachyura incurva*. Predation. *Formica*.

CHRYSOMELIDAE: *Clytra quadripunctata*. Predation. *Formica*.

CLAVIGERIDAE: *Adranes lecontei*, *Claviger testaceus*. Predation. *Lasius*.

HISTERIDAE: *Haeterius ferrugineus*, *Myrmetes piceus*. Predation. *Formica*, *Lasius*.

PSSELAPHIDAE: *Batrisodes delaportei*, *Ceophyllus monilis*, *Tmesiphorus costalis*. Predation. *Aphaenogaster*, *Lasius*.

SCARABAEIDAE: *Cremastocheilus armatus*, *C. stathamae*. Predation. *Formica*, *Myrmecocystus*.

STAPHYLINIDAE: *Atemeles* spp., *Dinarda dentata*, *Euryusa sinuata*, *Homoeusa acuminata*, *Lamprinus* spp., *Lomechusa strumosa*, *Myrmedonia limbata*, *Xenodusa cava*, undetermined staphylinid. Predation. *Atta*, *Formica*, *Lasius*.

ORDER LEPIDOPTERA

CYCLOTORNIDAE: *Cyclotorna monocentra*. Predation. *Iridomyrmex*.

LYCAENIDAE: *Lycaena arion*, *Liphyra brassolis*. Predation. *Myrmica*, *Oecophylla*.

ORDER DIPTERA

MUSCIDAE: *Bengalia* spp., *Ochromyia* sp. Predation. *Monomorium*.

PHORIDAE: *Metopina pachycondylae*. Social parasite (or commensal?). Undetermined phorid. *Pachycondyla*, *Formica*, *Gnamptogenys*.

SYRPHIDAE: *Microdon balipterus*. Predation. *Monomorium*.

FAMILY INDET.: Parasitism. *Dolichoderus*, *Technomyrmex*.

ORDER HYMENOPTERA

EUCCHARITIDAE: *Chalcura bedeli*, Ch. sp.; *Chalcuroides versicolor*; *Eucharis ascendens*, *E. bedeli*, *E. myrmeciae*, *E. scutellaris*; *Eucharomorpha wheeleri*; *Isomerata coronata*; *Kapala cuprea*, *K. floridana*, *K. terminalis*, K. sp.; *Oreasema argentina*, *O. coloradensis*, *O. constaricensis*, *O. duellojuradoi*, *O. minutissima*, *O. pheidolophaga*, *O. robertsoni*, *O. sixaolae*, *O. tolteca*, *O. viridis*, *O. wheeleri*; *Pseudochalcura gibbosa*; *Pseudometagea schwarzi*; *Psilogaster fasciventris*, *Ps. fraudulentus*; *Rhipipallus affinis*; *Schizaspidia calomyrmecis*, *S. convergens*, *S. doddi*, *S. polyrhachicida*, *S. tenuicornis*; *Stilbula cynipiformis*, *S. tenuicornis*; *Thoracantha bruchi*; *Tricoryna chalcoponerae*, *T. ectatommae*. HOST GENERA: *Calomyrmex*, *Camponotus*, *Cataglyphis*, *Ectatomma*, *Formica*, *Lasius*, *Myrmecia*, *Odontomachus*, *Pachycondyla*, *Pheidole*, *Pogonomyrmex*, *Polyrhachis*, *Rhytidoponera*, *Solenopsis*, *Wasmannia*.

EULOPHIDAE: *Melittobia acosta*. Experimental. *Formica*, *Lasius*.

ICHNEUMONIDAE: *Pezomachus sericeus*. Experimental. *Camponotus*.

PROCTOTRUPIDAE: *Tetramopria donisthorpei*, *T. femoralis*. Probably parasitism. *Tetramorium*.

FORMICIDAE: *Formica* (*Raptiformica*) spp., *Harpagozenus sublaevis*, *Polyergus* spp. Predaceous. *Formica*, *Leptothorax*. Thief ants, *Solenopsis* spp., feed on the brood of many genera of ants. All army ants (subfamily Dorylinae) include among their prey the brood of other ants.

PHYLUM VERTEBRATA
CLASS REPTILIA

Typhlops punctatus (blind-snake). Bequaert (1930: 167) found a snake in Liberia "literally stuffed with thousands of larvae and pupae of a small ant. Only a few workers were mixed with them and no other kind of food was present."

CLASS MAMMALIA

Any mammal that is capable of digging up or breaking open formicaries is a potential enemy of ant larvae, since these predators undoubtedly consume all stages indiscriminately. Direct evidence, however, is meager.

ORDER CARNIVORA

URSIDAE: *Ursus americanus* (black bear). Predation. *Camponotus*, etc.

ORDER PHOLIDOTA

MANIDAE: *Manis javanica* (scaly anteater). Predation.

ORDER PRIMATES

HOMINIDAE: *Homo sapiens*. Predation; reported eaten in Australia, Burma, California (Digger Indians), China, India, Japan, Siam, etc. *Camponotus*, *Oecophylla*; usually the genus was not mentioned.

ORDER XENARTHRA

MYRMECOPHAGIDAE: *Cyclopes* spp., *Myrmecophaga* spp., *Tamandua* spp. Predation.

D. CHARACTERS OF ANT LARVAE AND THEIR VALUE
AS USED IN COMPUTING THE SPECIALIZATION INDICES

BODY—Shape: pogonomyrmecoid 0; aphaenogastroid, myrmecioid, pheidoloid 1; dolichoderoid, leptanilloid, platythyreoid 2; attoid, crematogastroid, leptomyrmecoid, oecophylloid, rhopalomastigoid 3. Spiracles: 10 pairs, equal in size, not on papillae 0; on papillae, or metathoracic or AI largest, others smaller 1; eight or nine pairs 2; one pair 3. Spinules: present 0; absent 1. Protuberances: lacking 0; present 1. Anus: ventral or posteroventral and without lips 0; posterior, or with lips 1.

BODY HAIRS—Abundance: few to numerous 0; naked, nearly naked or dense 1. Variety: one type per genus 0; more 1. Shape: unbranched and smooth—slightly curved or straight 0, spinelike 1, flexible 1, uncinata 2, anchor-tipped 3; unbranched and denticulate—denticulate throughout most of length 1, flexible and denticulate throughout 1, denticulate on distal half 1, tip denticulate 1, flagelliform with denticulate base 2, uncinata and denticulate 2, flattened distally and with denticulate margin 2; bifid and smooth—tip bifid 1, half-bifid 1, deeply bifid with curled tips 2, deeply bifid with long flexible branches 2; bifid and partly denticulate—tip bifid and denticulate 1, half bifid and branches denticulate 1; multifid and smooth—branches short 1, branches long and flexible 1, branching dichotomously 1, branching dendritically 2; miscellaneous —7 shapes at 2 each.

HEAD—Shape: subhexagonal 0, other 1. Proportions: wider than long 0, other 1. Spinules: none 0, present 1.

HEAD HAIRS—Abundance: 40 or fewer 0, numerous or none 1. Shape: unbranched, smooth, straight or slightly curved 0, other 1. Variety: only one shape 0, other 1. Comparison with body hairs: differing in abundance, size and shape 0, other 1.

ANTENNAE—Position: at or above middle 0, below middle 1. Size: medium 0, large or small 1. Number of sensilla: three 0, other 1.

LABRUM—Size: medium 0, small or large 1. Proportions: breadth = twice the length 0, other 1. Shape: bilobed 0, other 1. Spinules on posterior surface: numerous 0, few 1, none 2. Sensilla: ten or fewer 0, more than ten 1, none 1.

MANDIBLES—Size: medium 0, large or small 1. Proportions: medium 0, stout or