

Life History of an Ant Parasitoid



Adult *Orasema* wasp parasitoid in colony of *Pheidole*.
Photo courtesy of Alex Wild.

What is a parasitoid?

A parasitoid is an insect that takes nourishment from another insect and eventually kills that insect. True parasitoids are only known in a group of insects with a distinct larval and pupal stage. It is the larva that kills the other arthropod host. Adults are usually do not kill other insects, and instead feed on things very different from the larvae. Because they kill other insects, parasitoids are often considered important for the control of other insects, including those insects considered to be human pests.

What are myrmicine ants?

Ants belong to the insect family **Formicidae**. Based on fossils, we know that the first ants appeared about 100 to 120 million years ago. We currently recognize 16 higher level groups of ants (subfamilies) that evolved relatively early in the evolution of ants. Of these, the ant subfamily Myrmicinae includes the harvester ants, fungus-growing ants and the fire ants. The ant workers of myrmicine ants all have a functional sting that can cause reactions in humans and makes them a direct human pest. They can also have a very negative impact on insect diversity when they are invasive and introduced into a new habitat. Pest ants include the Little Fire Ant, *Wasmannia auropunctata*, the Imported Fire Ant, *Solenopsis*

invicta, and the invasive big-headed ant, *Pheidole megacephala*. Both *Solenopsis* and *Wasmannia* are considered among the top 100 most invasive insects.

What are eucharitid wasps?

The wasp family **Eucharitidae** are a diverse of insects known to exclusively attack a group of social insects, the ants. This family belongs to a larger group of wasps, the **Chalcidoidea**, which are an extremely diverse superfamily of mostly insect parasitoids. The chalcidoidea are highly diverse, with more than 500,000 species estimated to exist, although relatively few (23,000 species) are known to science. Eucharitidae include about 480 described species, with an estimated 300-500 species yet to be described.

All eucharitids are parasitoids of ant pupae. They mate outside of the ant nest, and deposit their eggs away from their ant host, either in or on plant vegetation. Eggs hatch and the minute active first-instar larvae, termed a planidium, about 0.12 mm in size, must find its way into the ant nest. They do this by various means, but always involving a foraging adult ant worker. The planidia may be associated with fruit, extrafloral nectaries, potential prey of the ants (such as thrips) or may just attach to the wandering ants. Once on the ant, they appear to make their way to a special cavity in the ant mouthparts called the infrabuccal pouch. They are able to survive within the pouch and are able to be transferred from foraging ants to nurse ants (those that care for the ant larvae) to the ant larvae themselves. These planidia must be transferred to the ant larvae. Once on the larva, the planidium burrows into the host and waits for it to pupate. When pupation occurs, the planidium moves to the ventral region of the ant pupal thorax and begins to feed. After consuming most, but not all, of the ant, the wasp finishes development, pupates and eventually leaves the nest to finish the cycle.

The ants treat the killers very well, and have been observed to protect the wasps when the ant nest is disturbed or threatened. Semiochemicals may help disguise the wasps.

We do not know exactly how the planidium gets into the nest. Does it always get carried in the infrabuccal pouch? Do the ants pick up the planidia while feeding or grooming? Do they transfer the larvae by trophylaxis (food exchange), or by some other means?

What are extrafloral nectaries?

Some eucharitid wasps place their eggs very close to Extrafloral Nectaries (EFN). These specialized plant structures secrete a sugary amino-acid rich liquid that is highly attractive to ants and other parasitoid adults. EFN nectar is often released as a result of damage to the plant. We have a theory that the eucharitids may damage the plant to increase nectar production, which in turn increases the possibility of ants interacting with newly emerged planidia. What do you think? If you have ideas or observations, let us know.



First-instar larvae (=planidia) of *Orasema simulatrix* (Eucharitidae) in an EFN of desert willow, *Chilopsis linearis*. Eggs are placed close to the EFN and larvae emerge and crawl to the nectary. Ants are known to feed at the nectaries. Photo courtesy of Judith Herreid.

What is Biological Control?

Biological Control is the natural control of pest insects using their natural enemies. Introduced pest species often lack the parasitoids that kept them in check in their native country of origin. We can control these pest by carefully selecting, studying and releasing their parasitoids, including *eucharitids*, against these invasive pests.

Heraty Laboratory, Department of Entomology
University of California, Riverside, CA
<http://hymenoptera.ucr.edu>