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Social Parasitism in Ants

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When we think of ants, we often think of the life cycle of a typical ant species. A queen mates with a winged male during a nuptial flight, settles down alone to build a nest, and lays eggs that develop into workers that perform the work of the colony. The queen eventually lays eggs that become males and virgin females, and these reproductives will fly away on their own nuptial flights, mate, and form new colonies.

Many ant species, however, have departed from this standard formula of success and have evolved the ability to socially parasitize the colonies of other species of ants. These social parasites use begging and chemical disguises to trick the coworkers of another species to provide the benefits of food and labor at little or no cost. In the economics of animal behavior, where even small savings in energy can translate into more genes being passed on to the next generation, social parasitism in ants is often an evolutionary bargain.

There are many different degrees of social parasitism in ants. Some species sneak into the nests of other species and beg for food, but maintain a separate nest of their own. In other species, parasite queens enter the nests of hosts, kill the host queen, and take over the colony, tricking the host workers into feeding her and raising her young. In still other species, the parasite queens become completely dependent on their hosts, sometimes to the extent that the queens are carried around on the backs of host workers as helpless ectoparasites.

While all of the ant species employing the above strategies parasitize the efforts of their hosts *within the nests of hosts*, some ants have evolved the extraordinary capacity to use hosts to work in the parasite's own home nest. These parasite raiders steal pupae from the nests of other species, bring them back to their home nest, and allow them to develop into workers that will unwittingly work to keep the parasite colony alive.

How could such an intricate and bizarre behavior have evolved? Over a century ago, Charles Darwin proposed a mechanism by which this worker-stealing strategy could have arisen. Darwin suggested that ants may sometimes raid the nests of other species, stealing their pupae for food. If some of the pupae that a species brought back to their home nest as food developed into workers, and these workers then contributed to the functioning of the colony, a trait for stealing pupae and leaving them in the home nest might be favored by natural selection.

A preliminary stage of this parasitism strategy is seen in *Formica sanguinea* ants in Europe. This species can establish and independently run colonies of its own, but it sometimes steals pupae from other species and then employs the resulting workers for its own benefit. In more advanced instances of the worker-stealing strategy, parasites become totally dependent on workers from host colonies to keep their colony operating.

In the ant genus *Polyergus*, there are three examples of species totally dependent on recruited workers. These "Amazon ants" are large and ferocious with menacing mandibles. In their home nests, Amazon ant workers seem inept, unable to dig their own nest, raise young, or collect food. But when they raid the nests of host colonies, they become formidable fighters, Amazon ant colonies send scouts of their species out to explore areas surrounding the home nest, looking for host colonies. When a scout finds a colony to attack, it heads back to the home colony, leaving a scent trail as it goes. When the scout arrives at the home nest with information about a target colony, a large number of Amazon ant workers quickly surge out of the nest. They follow the scent trail and ferociously attack the host nest, using their deadly mandibles to kill any host workers that interfere. Then, the Amazon ants gather the pupae of the other species and return them to their home nest, where the pupae develop into workers that will perform the work of the amazon ant colony.

In a biological world where natural selection favors individuals possessing traits that help them pass as many genes as possible to future generations, it seems bizarre that the hosts of social parasites would work for the good of another species. But the behavior of hosts helping social parasites can persist because the genes directing hosts to work hard and to unquestioningly help others are highly effective in increasing their evolutionary fitness in most situations—that is, when they are working in their own nest. Host workers only help parasite species because they are tricked into doing so, much as when an eastern phoebe is tricked into feeding a brown-headed cowbird chick that appears in its nest. As such, social parasitism in ants can expand our understanding of evolutionary change. The parasite ants vividly illustrate the flexibility with which natural selection can solve the problems of survival. And the host ants reminds us that traits can be disadvantageous some of the time, as long as they are advantageous most of the time.

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