

FIRE ANTS¹ ATTACKED BY PHORID FLIES^{2,3}

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ABSTRACT

Four species of the genus *Pseudacteon* (Diptera:Phoridae) were observed attacking fire ants in the *Solenopsis saevissima* complex (Hymenoptera:Formicidae). In descending order of frequency noted, the phorids were *Pseudacteon pradei* Borgmeier, *Pseudacteon wasmanni* Schmitz, *Pseudacteon tricuspidis* Borgmeier, and *Pseudacteon nudicornis* Borgmeier.

Two or 3 of the species were commonly taken at the same *Solenopsis* nest. The frequency of phorid attack on disturbed fire ants nests was several times greater than on undisturbed nests.

A number of species of the family Phoridae, known commonly as hump-backed flies, attack ants (Borgmeier 1931). The adult ant is particularly vulnerable; however, the pupal stage is also subject to attack. According to Clausen (1940) the entomophagous phorids must be classed as injurious from an economic point of view. This is due to their widespread parasitism of such beneficial arthropods as adult honey bees, coccinellid pupae, and spider eggs. Fire ants in the *Solenopsis saevissima* complex are at times a direct pest of agricultural crops (Boock and Lordello 1952, Ribeiro 1954) and at times are indirect pests since they attend and protect various Homoptera which are detrimental to several agricultural crops (Goncalves 1940, Gallo et al. 1970).

Pergande (1901) first recorded endoparasitism of ants by phorids. He observed a larva of *Apocephalus pergandei* Coqu. decapitate a worker of *Camponotus pennsylvanicus* DeGeer. He also observed females of this phorid attack *C. pennsylvanicus* and saw the ant attempt to defend itself.

An excellent account of the adult female behavior of the phorid *Pseudacteon formicarum* Verr. was reported by Wasmann (1918). The host ant in this case was *Lasius niger* Emery. Borgmeier (1931) reported parasitism of various ants by phorids. He listed the species of 5 genera known to parasitize *Atta* and *Acromyrmex*. He stated that all of the parasitic species which are known to attack ants are characterized by the possession of a heavily sclerotized ovipositor which can be compared to a hypodermic needle. Wasmann (1918) and Borgmeier (1931) both assumed that the phorids attacked ants in order to oviposit.

According to Borgmeier (1963), all species of the genus *Pseudacteon* seem to be parasitic on ants in one of the following genera: *Solenopsis*, *Lasius*, *Dorymyrmex*, and *Crematogaster*. About 20 *Pseudacteon* species are known from Brazil and Argentina, 4 from contiguous U.S., and 6 from Europe.

¹*Solenopsis saevissima* complex (Hymenoptera:Formicidae).

²Diptera: Phoridae.

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METHODS AND MATERIALS

To determine the number of phorids which frequented a nest of the *Solenopsis saevissima* complex, records were kept of both the number of flies and length of the observation. Many different mounds were observed; however, only a single mound was observed at any one time. These observations were made in the vicinity of Piracicaba, Sao Paulo, Brazil. First the mound was disturbed in order to obtain a greater number of workers on the surface. Then the loose dirt was smoothed and compacted to facilitate spotting the tiny phorids. This was done with an ordinary spade. As the phorids began to appear, they were captured by placing an inverted, 7-dram, clear plastic snap-cap vial over the phorid until contact was made with the soil surface. Often several attempts were necessary in order to capture a single fly. At times the same vial was used to collect 2 or more phorids, one after another. The observations were made at various times during daylight hours. While the collections were made, notes were taken on the behavior of the female phorids as they made their attacks.

Phorids from each nest were stored separately in labeled vials in 95% alcohol until they could be identified by Dr. Angelo Pires do Prado of the Department of Zoology, The State University of Campinas, Campinas, Sao Paulo, Brazil.

RESULTS

Observations on these phorids began 24 August 1972 when it was first noticed that these tiny flies were seeking out and attacking workers of the *Solenopsis saevissima* complex on the surface of nests in the Piracicaba area.

Upon examination of the phorids it was determined that there were at least 4 species involved: *Pseudacteon wasmanni* Schmitz, 1914; *Pseudacteon pradei* Borgmeier, 1925; *Pseudacteon nudicornis* Borgmeier, 1925; and *Pseudacteon tricuspis* Borgmeier, 1925.

PHORID SURVEY: In 630 min. of observations of disturbed mounds, 300 phorids were collected (average of 1 fly each 2.1 min.). In undisturbed mounds, 16 phorids were collected in 265 min. (average of 1 fly per 16.5 min.).

The maximum number of phorids were collected at a nest which was observed for 1 hr. This collection yielded 100 phorids or an average of 1 phorid each 36 sec.

During the first collecting periods, the numbers of specimens of *Pseudacteon* were noted, and species were not distinguished. All collections made after 17 October 1972 were separated to species of *Pseudacteon*. Of the 231 specimens collected after that date, the predominant species was *P. pradei* (137). The other numbers were: *P. wasmanni* (67); *P. tricuspis* (18); and *P. nudicornis* (9).

When several flies were taken at a single mound, there were usually 2 or 3 species represented. At no time were all 4 species collected at a single mound. The most disproportionate collection made on a single nest yielded 98 *P. pradei* and only 2 *P. wasmanni*.

BEHAVIOR OF PHORID FEMALES: A few minutes after the surface of a fire ant nest was disturbed, the phorids usually began to appear. They flew in low over the numerous ant workers moving about on the soil surface and began immediately to seek out hosts. The phorid would hover over the host at an elevation of from 1/2 to 1 1/2 cm for an instant before it would strike. In most

cases the ant perceived its aggressor and attempted to escape or defend itself. In the attack, the phorid quickly swooped down, hit the worker, and darted away at great speed. This process was repeated as the phorid located its next host. The foray of a single phorid lasted for several minutes during which many *Solenopsis* workers were attacked. Then the phorid landed on nearby foliage for a few minutes before renewing her attack.

Occasionally, the defensive display of the *Solenopsis* worker was sufficient to cause the *Pseudacteon* to select a new host. The ant was observed to defend itself by elevating and flexing the gaster.

After a successful attack by the phorid, the fire ant worker was often visibly stunned and occasionally remained motionless for a second or 2. At times, the ant fell over on its side during the attack. However, in other cases, the ant moved away rapidly, flexing its gaster.

DISCUSSION

Due to research of earlier workers including Pergande (1901), Wasmann (1918), and Borgmeier (1931) and because of the behavior of the phorids, an assumption that the species of *Pseudacteon* were ovipositing in the ants is reasonable. This is, however, an assumption, since all attempts to rear the parasites or dissect out the parasitic larvae failed. There is a need for further investigations including electron microscopic examination of the host ant exoskeleton, histological sectioning of host ants, and more sophisticated parasite rearing methods.

The 4 species of *Pseudacteon* reported here seem to be attracted to disturbed ants of *Solenopsis saevissima* complex or their nests. Undisturbed nests had fewer phorids hovering during a given period of time. Generally only 1 or 2 phorids were observed above the undisturbed nest. On the other hand, after a nest was disturbed, phorids were present in larger numbers. During 2 observations when no phorids were encountered above disturbed nests, the wind was blowing strongly enough to cause the ant workers difficulty in maneuvering on the surface. In natural surroundings these phorids probably gain easier access to the ants after something has disturbed the nest or during the period of the nuptial flight when there is increased activity of workers on the nest surface. These phorids could be important as population regulating factors for the *Solenopsis saevissima* complex. Studies are being continued in order to determine ecological requirements of the various species involved. They may possibly be used in programs aimed at manipulating populations of other species in the *S. saevissima* complex such as *S. invicta* Buren and *S. richteri* (Forel).

It is interesting to note that none of the species of *Pseudacteon* reported on here as parasitic on the *Solenopsis saevissima* complex in Brazil are present in the U.S.

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