Fire Ant Myrmecophiles: Behavior of *Myrmecosaurus ferrugineus* Bruch (Coleoptera: Staphylinidae) with Comments on its Abundance[1,2]

by
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ABSTRACT

Grooming behavior of *Myrmecosaurus ferrugineus* Bruch is described. The beetle is fed by trophallaxis from the epipharynx of worker red imported fire ants, *Solenopsis invicta* Buren. Predation on any ant caste by the staphylinid was not observed. Examination of all collection records indicate that this staphylinid is widespread but uncommon. The low abundance and lack of predatory behavior in this beetle precludes its use in a biological program for fire ants.

INTRODUCTION

Although defensive and feeding behavior of myrmecophilous staphylinids has been studied extensively (review by Wilson 1971), the majority of the work has been done on inquilines of New or Old World legionary ants. Although 25+ species of staphylinids have been associated with ants of the genus *Solenopsis* (Silviera-Guido et al. 1969; Collins and Markin 1971; Frank 1977), very little behavioral information is available. Frank (1977) identified specimens collected by me in fire ant nests from the southern United States as the introduced *M. ferrugineus* Bruch, the only *Myrmecosaurus* species present in North America.

This paper is part of a continuing study of potential biological control agents of imported fire ants. Behavioral observations, made on one of the specimens studied by Frank (1977) are presented. Since Frank's (1977) study of my specimens has provided a name for the species observed, I decided to

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[2]Mention of a proprietary product in this paper does not constitute an endorsement of this product by the U.S. Department of Agriculture.

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publish my observations as I have seen only one live specimen in 10 years of digging in fire ant mounds. Included are observations on the abundance of this species.

MATERIALS AND METHODS

The staphylinid, *M. ferrugineus* Bruch, was found in a nest of *Solenopsis invicta* Buren, collected 20 January 1970 at Tall Timbers Research Station, Leon Co., Florida. The colony was collected with soil in a 19-liter (5 gal) bucket. The inside rim was coated with talcum powder to prevent escape by the ants. At the laboratory in Gainesville, the soil containing the ants was transferred to a talced plastic washtub and allowed to stand overnight. Then 2 days after collection, the ants were separated from the soil by slowly adding tap water at a rate of ca. 1 drop/sec for 24 hours. Finally, the insects were removed from the water surface and placed in a clear plastic ant nest. The staphylinid was not detected during collection or initial processing of the ant colony. However, 4 days after collection, the staphylinid was discovered in the nest and was isolated for further study, by placing it in a 20 cm diameter plastic ant nest lined with a layer of moist Cellucotton®. Also placed in the nest were 4 dealate queens, ½ teaspoon of eggs and brood, and 50 workers of *S. invicta* from the original colony. Observations were recorded on a tape recorder and later transcribed. The staphylinid was observed intensively for 9 consecutive hours with many hours of supplemental observation to obtain behavioral information.

Subsequent fire ant colonies collected for other studies were processed by using the methods of Wojcik et al. (1977) and Jouvenaz et al. (1977). Myrmecophiles found in these collections were preserved and recorded. These data are used to discuss the distribution and abundance of *M. ferrugineus* in the United States.

BEHAVIORAL OBSERVATIONS

The staphylinid spent about half the time standing motionless, away from the ants. The remainder of the time the beetle wandered about the nest or stood in one spot grooming itself. Grooming included several procedures. In cleaning its antennae, the beetle pulled them down one at a time with a foreleg, and worked the antenna through its mouthparts starting with the last segment. The rest of its body the beetle cleaned with its legs: the abdomen was cleaned by the hind legs, the hind legs by the middle legs, and the middle legs by the forelegs. In each case the legs were cleaned down to and including

the tarsal segments. The fore-tarsal segments were cleaned by the mouthparts. Cleaning behavior occurred sporadically but it always followed feeding.

The staphylinid appeared to drink water by placing its mouthparts to the moist substrate and keeping them there for up to 2 minutes. No movement of the mouthparts was observed. This behavior was seen on 6 separate occasions.

The staphylinid wandered about the nest either with its abdomen held distally in a straight line or curled forward over its head or thorax. When walking with its abdomen held straight, the beetle did not noticeably move its antennae or abdomen. When walking with its abdomen curled forward, it waved its antennae and wiggled the abdominal tip from side to side. The beetle's posture was not dependent on its proximity to the ants.

In its movements in the nest, the staphylinid passed by and touched injured ants, freshly killed ants, eggs, larvae, pupae, and several large soil mites. On at least 3 occasions, the beetle was within 2 mm of a queen. The staphylinid did not appear to pay attention to any of these and was not observed to feed on any of them.

Approaching ants often examined the beetle by tapping with their antennae. The beetle either curled and shook its abdominal tip at the ant; or held the abdomen motionless and straight back. On several occasions ants were seen using their mandibles to grasp the staphylinid. In one case a large worker grasped the staphylinid at the thorax, rubbed its mandibles backwards along the beetle's abdomen to the tip, then walked away. In another case, an ant used its mandibles to grasp the tip of the beetle's abdomen. Then the ant slid its mandibles along the beetle's abdomen to its thorax. The beetle became very excited and waved its head, antennae, and abdomen. The ant released the beetle's thorax after about 20 seconds and walked away. In still another instance, the ant grasped the beetle by the head. The beetle curled its abdominal tip forward, shaking it rapidly at the ant. The ant let go, and moved away from the staphylinid, but it wandered aimlessly for a few minutes and held its antennae still (usually when an ant walks, the antennae move constantly). Presently, the ant "recovered" and acted normally.

The beetle was observed soliciting food from the ants on numerous occasions. While approaching the ant, the beetle rapidly shook its head and antennae. Then the beetle used its antennae to tap the ant's head and antennae (in the same manner an ant uses to get food from a nestmate) and thrust its head between the ant's mandibles to the ant's epipharynx. Food transfer lasted 5 to 10 seconds. On one occasion the beetle touched the epipharynx 3 times in quick succession for 5 seconds each time. Often when the beetle tried to solicit food as ants approached, the ants either ignored the beetle or fled. Once the beetle ran alongside an ant for 10 mm tapping the ant

unsuccessfully with its antennae. In only one observed case was an ant seen trying (unsuccessfully) to solicit food from the beetle.

The beetle solicited food from every ant it encountered until it was fed. Then it cleaned itself and remained motionless for an hour or two before it solicited food again. When the beetle was isolated from the ants and then reintroduced into the ant nest, it quickly solicited food. After the 2 days of intensive observation, the beetle was maintained in the nest with the ants for 6 more days, a total of 11 days after collection. During these 6 days, numerous feeding sessions between the beetle and the ant were observed. On the 6th day the beetle was isolated in a moist petri dish. The next day it was found dead, presumably drowned.

DISCUSSION

Previously, three genera of staphylinids, *Atemeles, Lomechusa,* and *Xenodusa,* have been reported to solicit and obtain food by trophallaxis from non-legionary ants without being subsequently attacked (Holldobler 1977). The first 2 genera are only known from the Palearctic region from the nest of *Formica* and *Myrmica* species ants. *Xenodusa* species are only known from the Nearctic region from the nests of *Camponotus* and *Formica* species ants (Wheeler 1910; Hoebeke 1976).

The behavior of *Myrmecosaurus ferrugineus* described in this paper is consistent with the behavior reported for other myrmecophilous staphylinids. The grooming behavior is different from that described by Akre and Rettenmeyer (1966). The act of grooming after feeding is one mechanism the beetle could use to acquire the colony odor. The beetle was never seen to rub any part of its body on the ants' bodies as other myrmecophiles have been observed doing. The passive defensive behavior implies complete integration of this species into the aggressive fire ant society. The curling and shaking of the abdominal tip into the face of the ants suggests a defensive pheromone similar in function to that demonstrated by another myrmecophilous staphylinid, *Pella japonicus* (Sharp) (Kistner and Blum 1971).

Collins and Markin (1971) stated that the *Myrmecosaurus* sp. was collected frequently in north and south Mississippi and once in Georgia (probably *M. ferrugineus,* Frank 1977). However Wojcik et al. (1977) and Jouvenaz et al. (1977) examined more than 2,000 nests (from 7 states) of the red imported fire ant, *S. invicta,* 109 nests (from 2 states) of the black imported fire ant, *S. richteri* Forel, 567 nests (from 2 states) of the tropical fire ant, *S. geminata* (F.) and 63 nests (from 1 state) of the southern fire ant, *S. xyloni* McCook for myrmecophiles. Only 8 specimens of *M. ferrugineus* (6 reported by Frank 1977) were found: 3 from Florida, 1 from Louisiana, and 4 from Alabama.

Although the entire ant nest was not usually examined, more specimens would surely have been collected if *M. ferrugineus* were abundant since 1,884 specimens of *Myrmecaphodius excavaticollis* (Blanchard) and 598 specimens of *Euparia castanea* Serville (Coleoptera: Scarabaeidae) were collected from these same nests (Wojcik et al. 1977). Thus *M. ferrugineus* is widespread, having been collected in 5 states (Collins and Markin 1971; Frank 1977; this paper), but populations are either small or the distribution is very patchy.

No predation by the staphylinid was observed under any circumstances, even though it had ample opportunity to feed on queens, eggs, larvae, pupae, worker ants, ant cadavers, or mites. The low abundance and lack of predatory behavior in *M. ferrugineus* precludes its use in a biological control program for fire ants. However, the 6 other known species of *Myrmecosaurus* from South America must be studied before this genus can be eliminated from consideration as a biological control agent.

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