

CARPENTER ANTS AS CARRIERS OF ENDOTHIA PARASITICA

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ABSTRACT.--The *behavior of carpenter ants has been well studied, and information from these reports as well as the presence of ants on chestnut trees made these insects good candidates as carriers of Endothia parasitica.*

Carpenter ants in the genus *Camponotus* excavate galleries in wood to form homes for their colonies. The galleries are started in spots of fungal decay, deep checks, knot holes, or other defects (Friend and Carlson 1937). *Camponotus herculeanus pennsylvanicus* was commonly found in chestnut telephone poles in Connecticut, and noted that in 1936 there were still 201,182 chestnut poles in use in this State (Friend and Carlson 1937). Colonies of all four major species of *Camponotus* can be found under rocks and in the ground, but their main nesting sites are standing dead trees or poles (Sanders 1964). Also Sanders (1964) reported that eight was the largest number of trees utilized by a single colony for nesting. There were underground entrances to 147 of 150 studied nest trees, with connecting tunnels under the forest floor litter. Sanders (1964) found 12 colonies in 54 trees on a (0.57 ha) woodlot in New Jersey. The two largest colonies each had tunnels covering about (0.02 ha) in shaded areas where heavy moss and organic debris had accumulated. This would mean that tunnels ranged out about 8 or 9 meters from the nest, assuming the nest to be at the center of a tunneled circle. Harold Fowler, currently working at Rutgers University, has observed carpenter ants in open areas traveling 30 to 35 meters from their nest to aphid colonies (personal communication).

Foraging is restricted by rainfall and temperature (Fowler and Roberts 1980), and foraging intensity varies from month to month. Pricer (1908) reported that the principal food of carpenter ants is honey dew from aphids, occasionally supplemented by insect body fluids and plant juices. Recent studies by Eisner and Happ (1962) demonstrated that particles 200 and 300 pm in diameter were not ingested by carpenter ants, and that 150 pm particles were trapped in the infrabuccal filtering pockets of the ants. Particles 10 pm and 100 pm were swallowed into the crop, with 10 pm particles being more commonly swallowed. Solid particles were not pumped into the midgut. Material can be stored in the crop for extended periods of time and then regurgitated to feed comrades. Crop contents from a single forager in the genus *Formica* may be shared by an entire colony in a matter of hours (Wilson 1957), and Eisner and Happ (1962) suggest that similar distribution might be expected

among *Camponotus*. Repeated regurgitation and comrade feeding effectively filters out even small particles which are ultimately ejected as bucal pellets.

Fowler and Roberts (1980) distinguished ground foragers, tree foragers, and aphid guards. They found that 13 percent of their foragers had more than 1000 pg of carbohydrates per ant, as opposed to other foragers with 100 to 500 pg and aphid-guardians with 20 to 100 pg carbohydrate per ant. They suggest that foragers may stock up on carbohydrates as an energy source to sustain their wide-ranging activities while aphid guards need little reserve energy for their tasks. The foragers with high content of carbohydrates may be serving as walking tank-cars to transport carbohydrates from source, to the nest. Since foraging activity was most intense in late June and early July, it was probably correlated with brood maturation and the associated increased nutrient demands (Fowler and Roberts 1980).

Ayre (1963; 1967) suggested that enzymes present in the crop might contribute to digestion of solid food material either in the crop or when crop contents were regurgitated on the food material. Ayers found amylase present and used this as evidence that fungi are an important food source for carpenter ants. He observed *Camponotus* chewing on commercial mushroom slices and on cultures of three different fungi isolated from rotting wood. The ants regurgitated their crop contents on the chewed areas and reingested the liquid. Ayre (1963; 1967) felt this demonstrated that *Camponotus* use fungi as a food source.

Methods and Results

Carpenter ants *C. pennsylvanicus* and *C. pennsylvanicus ferruginia* are frequently seen on chestnut trees in Connecticut, with *C. pennsylvanicus ferruginia* being more common. These ants tend colonies of aphids on leaves *Colaphis castaneae* and on young stems *Petchia virginiana*. We have collected aphid guardians and foragers of both carpenter ant species in the past two years. We surface-sterilized some in 70 percent EtOH for a few minutes and removed their crops to 2 percent water agar. We washed others with sterile water and plated the wash-water on 2 percent water agar. The resulting fungal colonies were transferred to potato dextrose agar for identification. Among 24 aphid-guardians tested July through September, none had *Endothia parasitica* in their crops. Eight others had no *E. parasitica* on their surfaces. Among 19 foragers, four carried *E. parasitica* in their crops (June, 1980; June, 1981) and three carried *E. parasitica* on their bodies (July, 1981). Foraging and feeding observations were made on three sets of three trees with (a) *E. parasitica* H and V strains (two inoculations of each), (b) *E. parasitica* as in (a), but with molasses applied weekly to the tree trunk above the inoculation sites, and (c) control trees with sterile agar medium inoculated into four holes and with molasses as in (b). Many foragers *C. pennsylvanicus ferruginia* were observed in July and August 1981 chewing on cankers receiving the (a) and (b) treatments in approximately equal numbers (no counts were made). Ants were never observed chewing on the control trees.

Conclusions

Since carpenter ants were clearly carriers of *E. parasitica* because of both their feeding and nest building behavior, we will continue to capture them for analysis and observe them in our chestnut experimental plots. Because carpenter ants prefer aphid honey dew they minimize their feeding on other sources, such as fungi, when aphids are available. Therefore, we will concentrate next year on foragers in the early spring, before aphid colonies are established, and when nest building activity is highest.

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