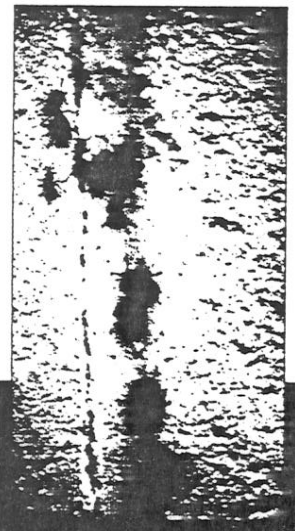
HOT ON THE TRAIL



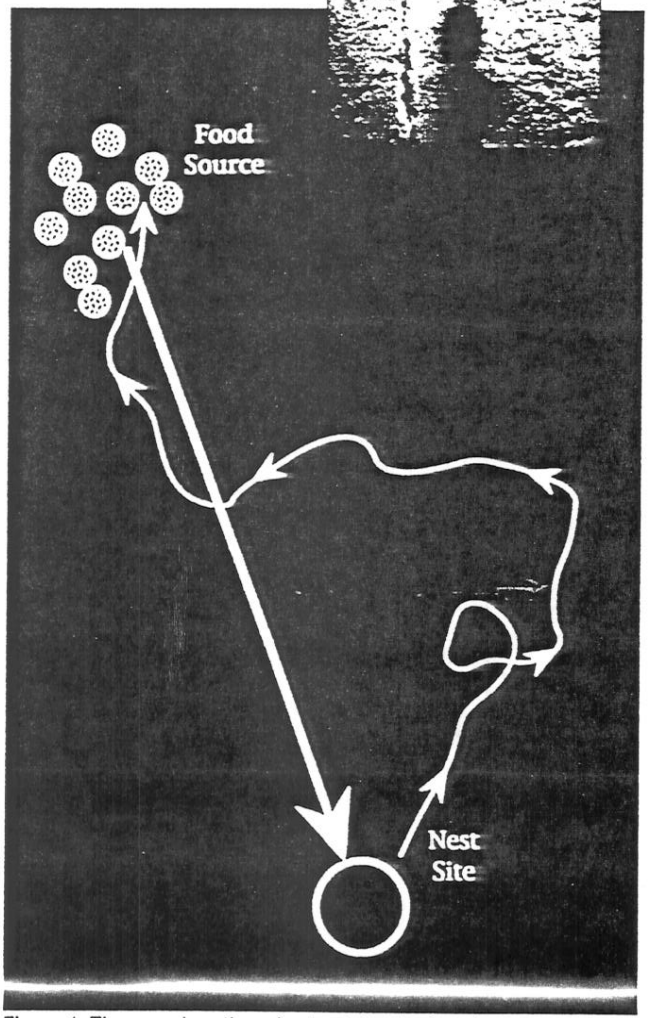


Figure 1. The search path and return trip of a foraging scout ant. Figure 2 (inset). Fire ants trail along a groove in a foundation wall. Structural guidelines such as pipes, conduits, wires and utility lines often serve as trails for many house-infesting ant species.

UNDERSTANDING TRAILING BEHAVIOR IS PERHAPS THE SINGLE MOST CRUCIAL FACTOR IN GAINING CONTROL OF AN ANT INFESTATION.

BY JOHN KLOTZ, DAVE WILLIAMS & BYRON REID

Go to the ant, thou sluggard: consider her ways.

This ancient passage from Solomon suggests we can learn from the study of ant behavior. In this article we will discuss the biology of ant trailing and then relate how this information can be used in the control of ants.

While trailing behavior in ants has been observed with fascination for centuries, it wasn't until the late 1700s that its chemical nature was understood. When the Swiss entomologist Charles Bonnet drew his finger across an ant trail he observed that the column of trailing ants became agitated and unable to continue their travels for some time. He hypothesized that some sort of chemical was being laid down by the ants as they trailed, and that the others then followed; hence the name "odor trails."

However, chemo-orientation is not the only type of trailing observed in ants. Ants also tend to follow edges, grooves and crestlines. This behavior is known as structural guideline orientation.

Communication in ants is based on chemical signals. An ant produces substances used to communicate. These substances are called pheromones, and they vary from alarm and nestmate recognition to the one we will focus on here: *recruitment*.

All of the pest ants use odor trails for orientation, but these trails differ from one species to another. Where the pheromones originate in the ant's body, their chemical composition, as well as how long they last, all vary from one ant species to the next. In fire ants, the trail chemical is produced by the Dufour's gland (named after its discoverer, Dufour) and is laid down by the stinger. This pheromone is made up of molecules that evaporate quickly. Thus, the fire ant's odor trail is short-lived. In comparison, the trail pheromones of some carpenter ant species, which are produced by the hindgut, will last for days on the trails. In both cases, however, the odor trails have the common purpose of communication — namely, recruitment to a resource.

TRAIL STRATEGIES. Figure 1 at left shows the strategy used by most ants in the re-

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cruitment process. A scout ant leaves the nest in search of food. In the random search pattern that follows, it takes a somewhat meandering path outward, until it finds food. It then feeds on the food source and heads straight back to the nest. Somehow on the outgoing trip it can keep track of its position with respect to its nest, and on the return trip it uses this information to take the shorter, more direct route home. On the way back to the nest, it lays down an odor trail.

Once back in the nest the scout ant alerts its nestmates to the food find, which encourages them to leave the nest. The recruited ants will follow the odor trail directly to the food source. In turn, each ant will reinforce the odor trail. *This behavior is a highly efficient means of exploiting a temporary food resource.*

In some instances, these odor trails can become more or less permanent, as in the case of ants that are visiting permanent food sources such as an aphid colony, a garbage area, or other sites in structures with permanent food and water. The trail can even be physically cut into the turf, as with carpenter ants that chew their way through the thatch layer.

Structural guidelines are another type of trail ants use to orient in their natural environment. These may include twigs and branches used to travel to and from the nest on foraging trips. Traveling along a branch lying on the forest floor is much quicker than negotiating a path through grass or leaf litter. In our man-made environment, guidelines consist of pipes, conduits, wires and other utility lines. Ants follow these guidelines to enter structures as well as to travel within them. These structural guidelines serve as natural highways for ants (see Figures 2 and 4).

Trailing along these chemical or structural guidelines is an important behavior of ants. The better we can understand it, the better we can exploit it for control purposes. In our inspections, we should observe trailing ants carefully to determine where they are getting into structures. Through close observation, we can find the source of the infestation. Following trailing ants is the best way to locate the nest site. A PCO can feed wandering ants a little honey or pieces of insects, and then follow them directly back to the nest site.

In order to apply this behavioral knowledge to actual control practices, let's look at two examples: Pharaoh ants and carpenter ants.

PHARAOH ANTS. Perhaps never is it more critical to consider trailing behavior than in baiting programs for Pharaoh ants. Baits cannot be placed in just any location and be expected to work. Pharaoh ant trails and their resources (both food and water) must be located for proper placement of baits and effective control. As an example, let's discuss the procedures to follow in an apartment complex with a Pharaoh ant problem.

An interview with each apartment dweller is a good way to begin to locate areas of ant activity, and it gives the PCO a chance to educate the customer about the bait control program. It is important for the customer to understand that it will take time for the bait to eliminate the ant problem. The customer should understand that delayed-action baits take time to accumulate a toxic dose in a colony, so that the entire colony can be eliminated. Sprays may be used several days after baits are applied to kill off any stragglers, but sprays should be avoided initially because they will cause satelliting (formation of new nests), will kill only a few foragers, and might contaminate bait stations.

A pretreatment survey should be conducted using a dab of peanut butter on a white index card. The cards are then placed in food and water locations throughout the apartment complex, as well as outside.

SURVEY CARDS. Inside, survey cards should be placed in the apartments and in other areas such as the lobby, kitchens, laundries, lounge areas and offices. At least eight to 16 cards should be placed in each apartment (usually two to four each in the kitchen, living room, bathroom and bedroom). Survey cards should be placed in any areas where the client has seen ant activity. Window sills should be used for card locations in the living room and bedroom of each apartment. Dead insects on window sills attract foraging ants, and the numerous cracks and crevices around window casings are ideal nest sites.

In the kitchen and bathroom, cards should be placed near sources of water, such as pipes and drains, sinks, countertops and toilets. Outside, survey cards should be placed near windows, around entrances and exits, and incoming and outgoing plumbing lines. It's important to position the cards along edges or other structural guidelines, where the ants are likely to travel. These cards should be left undisturbed for several hours, and then the number of worker ants on each card should be estimated and recorded on an inspection diagram.

This pretreatment survey enables the PCO to locate areas where ant activity is concentrated, so that baits are put out in areas of greatest ant activity. Monitoring will also help the PCO find small isolated colonies that otherwise might be overlooked and could cause reinfestation in the future. Where feeding occurs at survey cards, the trailing ants should be traced back to where they are entering from a crack or crevice, switch plate, pipe flange, etc. These entrance sites should be noted on the diagram, and the toxic baits should be placed here in the treatment program.

A good floor plan of an infested apartment complex can be used as the inspection diagram to document survey data and locate bait treatments (see Figure 3 below). Not only is this an invaluable tool for the PCO, it can also be used by the PCO to educate the customer about the ants and discuss treatment strategies. A floor plan helps you estimate how much bait or how many bait stations to use, and how much to charge the customer for treatment. For an average-size room, four to six bait stations, depending on the level of infestation, should be sufficient. A large apartment complex with a heavy infestation of Pharaoh ants will require more bait and application time, and will have the potential for a higher frequency of callbacks compared to a small apartment complex with a light, localized infestation.

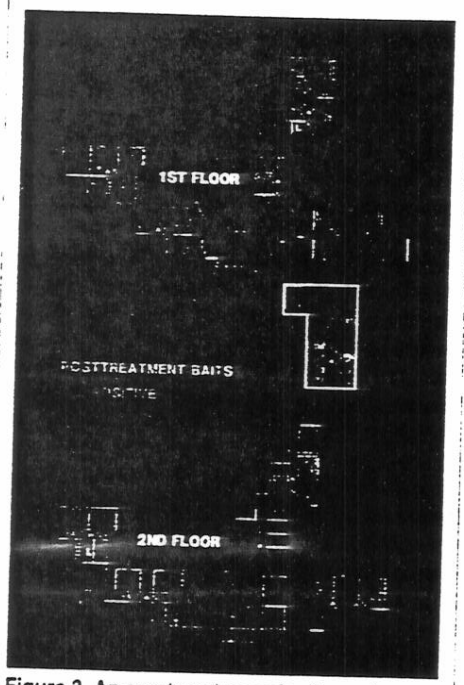

Figure 3. An apartment complex floor plan. Pharaoh ant infestation sites shown in red.

CARPENTER ANTS. Many of the techniques used for baiting Pharaoh ants will surely come in handy when baits become available for carpenter ants. Until that time, however, we will direct our recommendations to the more traditional techniques of carpenter ant control: spot and barrier treatments with residual insecticides. How can our knowledge of trailing behavior be applied to these methods of control?

In carpenter ant control, probably more so than with most other ant problems, the pretreatment inspection survey is the single most important component of a successful control program, because the nest site is often extremely difficult to find. Here again, the use of structural guidelines by carpenter ants should be emphasized for inspections. In accounts where control measures have failed it may be helpful to conduct a

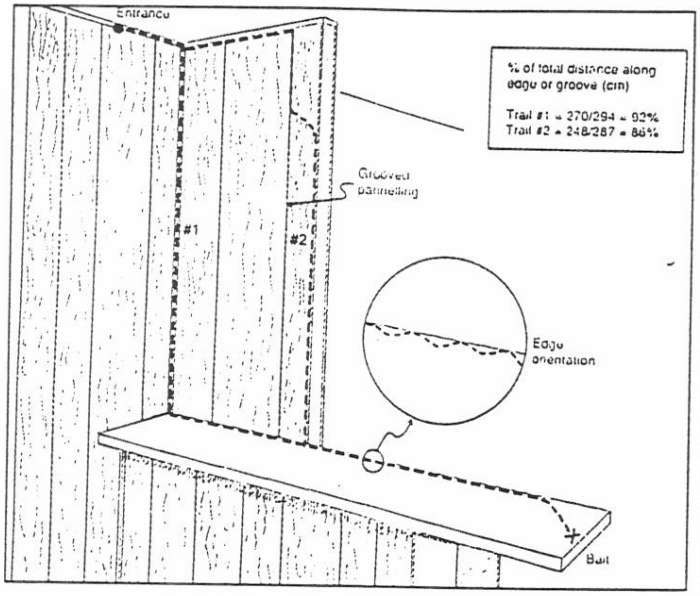

Figure 4. Edge following in odorous house ants. This is one of numerous types of structural guideline orientations that ants use.

night inspection, since carpenter ants are nocturnal. Just as with Pharaoh ants, a pretreatment survey (using insects or honey instead of peanut butter) may also help in determining areas of ant activity.

HEAVY TRAFFIC. In treatment, the PCO should focus on those areas where ants travel: behind pipe flanges and switch boxes where the ants travel along pipes or wires in wall voids. For treatment inside structures we recommend dusts be applied lightly to avoid the repellency that occurs when too much dust is present. PCOs want the ants to walk through the dust and pick it up, not walk around it.

On the outside perimeter, liquid sprays are applied in a band that is thoroughly and judiciously placed to prevent ants from trailing into a structure. If this is not carefully done to provide a continuous barrier, ants will find a break or bridge to cross over and infest structures.

Besides these important chemical control procedures, there are several nonchemical techniques that can be used to help out. Trim back vegetation that may provide runways for the ants onto the structure, and seal or caulk entryways into a structure.

In dealing with ants PCOs must always keep one step ahead of their trails, whether doing inspections to determine how the ants are getting into the structure and where they are travelling within it, or focusing treatment on those areas where ants are likely to travel. Incorporating these ideas on trailing behavior into ant control programs will enable PCOs to be more successful in finding and treating these pests, and will also allow for successful control while minimizing the use of chemical pesticides. **PCT**

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