# ANTS

*Integrated Pest Management in and around the Home*

Ants are among the most prevalent pests in households. Ants also invade restaurants, hospitals, offices, warehouses, and other buildings where they can find food and water. On outdoor and sometimes indoor plants, ants protect and care for honeydew-producing insects such as aphids, soft scales, whiteflies, and mealybugs, increasing damage from these pests. Ants also perform many useful functions in the environment, such as feeding on other pests (e.g., fleas, caterpillars, and termites), dead insects, and decomposing tissue from dead animals.

There are more than 12,400 species of ants throughout the world. In California, there are about 270 species, but fewer than a dozen are important pests (Table 1). The most common ant in and around the house and garden in California is the Argentine ant, *Linepithema humile* (formerly *Iridomyrmex humilis*). Other common ant pests include the Pharaoh ant (*Monomorium pharaonis*), odorous house ant (*Tapinoma sessile*), thief ant (*Solenopsis molesta*), southern fire ant (*S. xyloni*), and pavement ant (*Tetramorium caespitum*). The velvety tree ants *Liometopum occidentale* and *L. luctuosum* nest in trees and are common outdoor species in landscapes.

Less common, but of great importance, is the red imported fire ant, *S. invicta*, which gained a foothold in Southern California in 1998. In some areas, competition from the Argentine ant has slowed the spread of the fire ant. Carpenter ants, *Camponotus* species, and velvety tree ants also invade buildings in California. Although they don't eat wood as termites do, they hollow it out to nest and may cause considerable damage. For more information about red imported fire ants or carpenter ants, see *Pest Notes*: *Carpenter Ants* and *Pest Notes*: *Red Imported Fire Ant* listed in References.

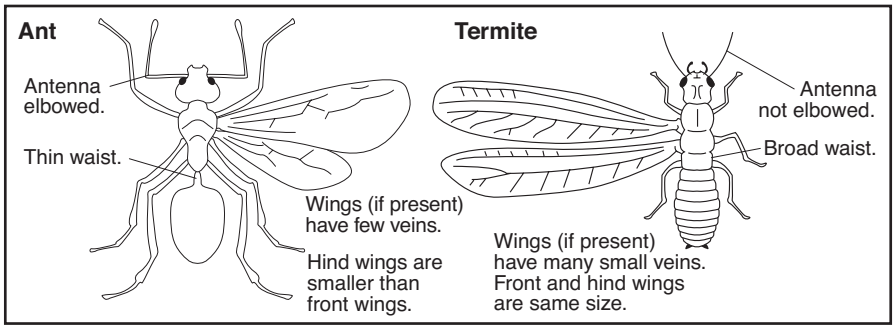


**Figure 1. Distinguishing features of ants and termites.**

## IDENTIFICATION

Ants belong to the insect order Hymenoptera and are close relatives of bees and wasps. Ants are familiar insects that are easily recognized, especially in their common wingless adult forms, known as workers. However, winged forms of ants, which leave the nest in large numbers in warm weather to mate and establish new colonies, are often mistaken for winged termites, which also leave their nests to mate. Ants and termites can be distinguished from one another by three main characteristics (Figure 1):

- The ant's body is constricted, giving it the appearance of having a thin waist, while the termite has a broad waist.
- The ant's hind wings are smaller than its front wings, while the termite's front and hind wings are about the same size. However, shortly after their flights, both ants and termites lose their wings, so wings usually aren't present.
- Winged female and worker ants have elbowed antennae, while the termites' antennae aren't elbowed.

Ants undergo complete metamorphosis, passing through egg, larval, pupal, and adult stages (Figure 2). Larvae are immobile, wormlike, and don't resemble adults. Ants, like many other hymenopterans such as bees and wasps, are social insects with duties divided among different types, or castes, of adults. Queens conduct the reproductive functions of a colony and are larger than other ants; they lay eggs and sometimes participate in feeding and grooming larvae. The sterile female workers gather food, feed and care for larvae, build tunnels, and defend the colony; these workers make up the bulk of the colony. Males don't participate in colony activities; their sole purpose is to mate with the queens. Workers feed and care for males, which are few in number.

For additional information about how to identify different ant species, see the *Key to Identifying Common Household Ants* at http://www.ipm.ucdavis.edu/TOOLS/ANTKEY.

## LIFE CYCLE AND HABITS

Ants usually nest in soil; nest sites vary with species but are often found next to buildings, along sidewalks, or in close proximity to food sources such as trees or plants that harbor honeydew-producing insects. Ants also construct nests under boards, stones, tree stumps, or plants and sometimes

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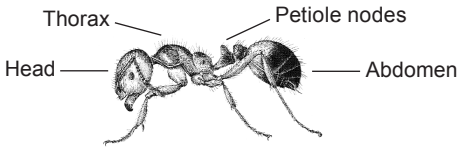
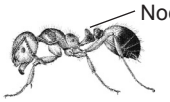
**Table 1. Identifying Features of Common Household Ants.**[1]

Effective management approaches vary with ant species. Use behavioral characteristics such as food and nesting preferences along with physical characteristics to identify ants. A first step in identifying ants is to use a magnifier to determine if they have one or two nodes at the petiole, the first portion of the abdomen.




| One-node ant   | | Two-node ant   | |
|---|---|---|---|
| **Argentine ant** (*Linepithema humile)*<br>**Food:** sweets, sometimes proteins<br>**Nest:** outdoors in shallow mounds<br>**Physical description:** 1/8 inch, dull brown |  J. K. Clark | **Pavement ant** *(Tetramorium caespitum)*<br>**Food:** sweets, proteins, grease<br>**Nest:** in lawns or under stones or boards; builds mounds along sidewalks and foundations or near water<br>**Physical description:** 3/16 inch, dark brown to black |  J. K. Clark |
| **Carpenter ant** (*Camponotus* species)<br>**Food:** sweets<br>**Nest:** in tree stumps, firewood, fence posts, hollow doors or window frames; deposits sawdustlike frass outside nests<br>**Physical description:** large, workers vary from 1/4 to 1/2 inch, black or bicolored red and black |  J. K. Clark | **Pharaoh ant** *(Monomorium pharaonis)*<br>**Food:** fats, proteins, sweets<br>**Nest:** in wall or cabinet voids, behind baseboards or insulation, or outdoors in debris<br>**Physical description:** 1/16 inch, yellow or honey-colored to orange |  J. K. Clark |
| **Odorous house ant** (*Tapinoma sessile)*<br>**Food:** sweets, sometimes proteins<br>**Nest:** in shallow mounds in soil or debris or indoors in wall voids or around water pipes or heaters<br>**Physical description:** 1/8 inch, dark brown to shiny black, very strong odor when crushed |  D.-H. Choe | **Red imported fire ant** *(Solenopsis invicta)*<br>**Food:** sweets, proteins<br>**Nest:** in mounds with multiple openings in soil or lawns and sometimes in buildings behind wall voids<br>**Physical description:** workers vary from 1/16 to 1/5 inch, reddish with dark brown abdomen |  J. K. Clark |
| **Velvety tree ant** (*Liometopum occidentale)*<br>**Food:** sweets and insects<br>**Nest:** in dead wood such as old tree limbs, stumps, and logs<br>**Physical description:** workers vary from 1/8 to 1/4 inch, brownish-black head, red thorax, velvety black abdomen, very distinct odor when crushed |  D. Rosen | **Southern fire ant** *(Solenopsis xyloni)*<br>**Food:** proteins and sweets<br>**Nest:** in small mounds with flattened, irregular craters in wood or under rocks<br>**Physical description:** workers vary from 1/8 to 1/4 inch, amber head and thorax, black abdomen, golden hairs cover body |  J. K. Clark |
| | | **Thief ant** (*Solenopsis molesta)*<br>**Food:** greasy and fatty, sometimes sweets. Steals food and ant larvae from other ant nests.<br>**Nest:** outdoors in soil or under rocks or decaying wood, indoors behind wallboards or baseboards<br>**Physical description:** 1/32 inch, yellow to light brown |  J. K. Clark |

[1] See the *Key to Identifying Common Household Ants* at http://www.ipm.ucdavis.edu/TOOLS/ANTKEY for more information and line drawings on identifying species.

under buildings or other protected places. The primary ant that nests indoors in California is the Pharaoh ant. In temperate climates, this species nests in warm, moist locations such as inside wall voids, under flooring, or near hot water pipes or heating systems, but is also found nesting outdoors in warmer parts of California. See Table 1 for nesting sites of other species. Food preferences vary among ant species but may include fruits, seeds, nuts, fatty substances, dead or live insects, dead animals, and sweets.

Ants often enter buildings seeking food and water, warmth and shelter, or refuge from dry, hot weather or flooded conditions. They may appear suddenly in buildings if other food sources become unavailable or weather conditions change.

Although there is some variation among species, a single newly mated queen typically establishes a new colony. After weeks or months of confinement underground, she lays her first eggs. After the eggs hatch, she feeds the white, legless larvae with her own metabolized wing muscles and fat bodies until the larvae pupate. Several weeks later, the pupae transform into sterile female adult workers, and the first workers dig their way out of the nest to collect food for themselves, the queen (who continues to lay eggs), and subsequent broods of larvae. As numbers increase, workers add new chambers and galleries to the nest. After a few years, the colony begins to produce winged male and female ants, which leave the nest to mate and form new colonies.

Argentine ants differ from most other ant species in California in that their nests are often shallow, extending just below the soil surface. However, under dry conditions they will nest deeper in the soil. In addition, Argentine ant colonies aren't separate but linked to form one large "supercolony" with multiple queens. When newly mated queens disperse to found new colonies, they are accompanied by workers rather than going out on their own as most other species do.

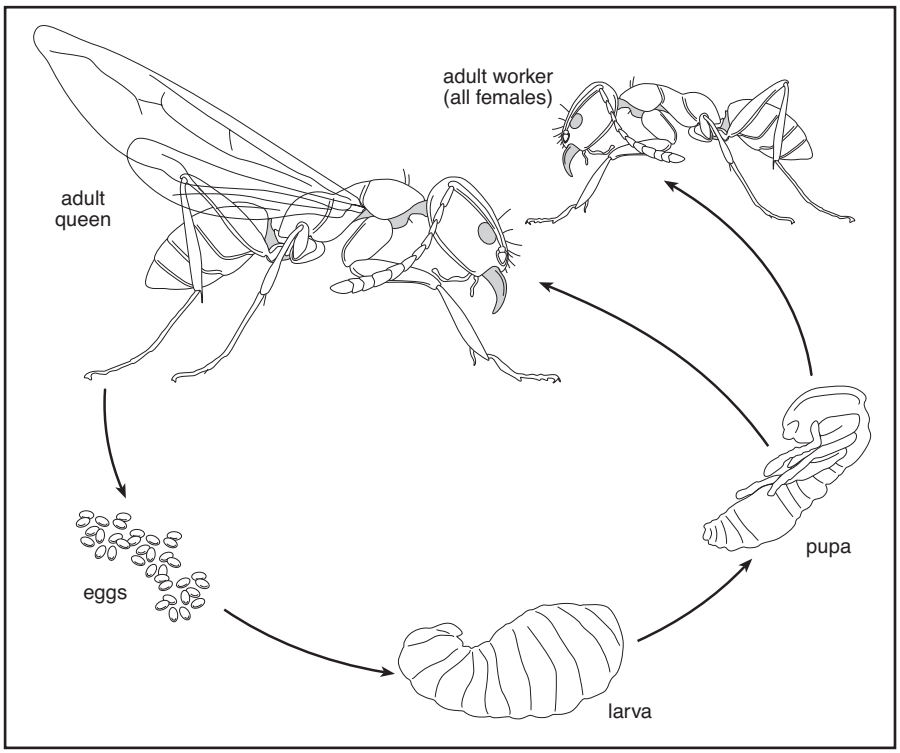



**Figure 2. Life cycle of the Argentine ant.**

**Figure 3. Argentine ants tending aphids on ceanothus.**

**Figure 4. Velvety tree ants.**

## DAMAGE

Inside buildings, household ants feed on sugar, syrup, honey, fruit juice, fats, and meat. Long trails of thousands of ants may lead from nests to food sources, causing considerable concern among building occupants. Outdoors ants are attracted to honeydew that soft scales, mealybugs, and aphids produce. This liquid excrement contains sugars and other nutrients. Frequently outbreaks of scales and aphids occur when ants tend them for honeydew, because the ants protect scales and aphids from their natural enemies (Figure 3).

Ants can bite with their pincerlike jaws, although most species rarely do. However, the velvety tree ant (Figure 4) is an aggressive biter. A few ants sting, including native fire ants and harvester ants, which are primarily outdoor species and are the most common stinging ants in California. An aggressive stinging ant, the red imported fire ant has been found in various Southern California counties. If you suspect a fire ant infestation, report it to your county agricultural commissioner. For more information about red imported fire ants, see *Pest Notes: Red Imported Fire Ant* listed in References.

## MANAGEMENT

Ant management requires diligent efforts and the combined use of mechanical, cultural, sanitation, and often chemical control methods. It is unrealistic and impractical to attempt to totally eliminate ants from an outdoor area. Focus your management efforts on excluding ants from buildings or valuable plants and eliminating their food and water sources. Reducing outdoor sources of ants near buildings will reduce the likelihood of ants coming indoors.

Remember that ants often play a beneficial role in the garden. Become aware of the seasonal cycle of ants in your area and be prepared for annual invasions by caulking and baiting before the influx. Different species of ants respond to management practices differently. For management information specific to a particular species, see the *Key to Identifying Common Household Ants* at http://www.ipm.ucdavis.edu/TOOLS/ANTKEY. For videos related to ant management in the home, go to http://www.ipm.ucdavis.edu/ants.

### *Monitoring and Inspecting*

Regularly inspecting your home for ants or ant entry points is an important part of an IPM program. Monitor for ants near attractive food sources or moist areas. Ants may invade kitchens, bathrooms, offices, or bedrooms. Inspect under sinks, in cupboards, and along pipes and electrical wires. Look for large trails of ants or for just a few stragglers. Straggling ants are scouts randomly searching for food or nesting sites. When you spot ant trails, try to follow the ants to where they are entering the building and to the nest if possible. Look indoors and outdoors for holes or cracks in foundations or walls that provide entry points to buildings.

### *Exclusion and Sanitation*

To keep ants out of buildings, caulk cracks and crevices around foundations and other sites that provide entry from outside (Figure 5). Ants prefer to make trails along structural elements, such as wires and pipes, and frequently use them to enter and travel within a structure to their destination, so look for entry points in these locations. Prior to caulking, some pest management professionals may apply products containing silica aerogel (sometimes combined with pyrethrins in professional products such as EverGreen Pyrethrum Dust) into wall voids before sealing them up.

Indoors, eliminate cracks and crevices wherever possible, especially in kitchens and other food-preparation and storage areas. Store attractive food items such as sugar, syrup, honey, and pet food in closed containers that have been washed to remove residues from outer surfaces. Rinse out empty soft drink containers or remove them from the building. Thoroughly clean up grease and spills. Remove garbage from buildings daily and change liners frequently.

Look for indoor nesting sites, such as potted plants. If ants are found in potted plants, remove the containers from the building, then place the pots for 20 or more minutes in a solution of insecticidal soap and water at a rate of 1 to 2 tablespoons of insecticidal soap per quart of water. Submerge so the surface of the soil is just covered by the water-soap solution.

Outdoor ant nests may be associated with plants that support large populations of honeydew-producing insects such as aphids, soft scales, mealybugs, or whiteflies. Avoid planting such trees and shrubs next to buildings, or manage honeydew-producing insects. Keep plants, grass, and mulch several inches away from the foundation of buildings, because these items provide nesting sites for ants. Fix leaky faucets and sprinkler heads; these attract thirsty ants.

### *Trees and Shrubs*

When numerous ants are found on plants, they are probably attracted to the sweet honeydew deposited on the plants by honeydew-producing insects such as aphids or soft scales. Ants may also be attracted up into trees or shrubs by floral nectar or ripening or rotten sweet fruit. These ants can be kept out by banding tree trunks with sticky substances such as Tanglefoot. Trim branches to keep them from touching structures or plants so that ants are forced to try to climb up the trunk to reach the foliage.

When using Tanglefoot on young or sensitive trees, protect them from possible injury by wrapping the trunk with a collar of heavy paper, duct tape, or fabric tree wrap and coating this with the sticky material. Check the coating every one or two weeks and stir it with a stick to prevent the material from getting clogged with debris and dead ants, which will allow ants to cross. Ant stakes with bait can also be used around trees.

### *Baits*

Ant baits contain insecticides mixed with materials that attract worker ants looking for food. Baits are a key tool for managing ants and the only type of insecticide recommended in most situations. Ants are attracted to the bait and recruit other workers to it. Workers carry small portions of the bait back to the nest where it is transferred mouth to mouth to other workers, larvae, and

**Figure 5. Caulking ant entryways is a key element of an ant IPM program.**

### WHAT TO DO IF YOU HAVE AN ANT EMERGENCY

- Determine what the ants are attracted to and remove the food source.
- Vacuum trails, wipe them with soapy water, or spray with window cleaner.
- Locate entry points then caulk openings or plug with petroleum jelly.
- Put out bait stations or apply gel bait at entry points.
- Baits take time to work, so continue to clean up trails.
- Indoor sprays aren't usually necessary.

queens to kill the entire colony. Bait products must be slow-acting so that the foraging ants have time to make their way back to the nest and feed other members of the colony before they are killed. When properly used, baits are more effective and safer than sprays.

Baits are available in several different forms. For residential users, the most readily available forms are solids or liquids that are prepackaged into ant stakes or small plastic bait station containers. These products are easy to use and are quite safe if kept away from children and pets. Some products dry up rapidly and must be frequently replaced to manage a large population. A few boric acid products are liquids that are poured into refillable containers or applied as drops on cards.

**Table 2. Common Ant Bait Products.[1]**

| Active ingredient | Example product names | Formulation: application/bait |
|---|---|---|
| avermectin B (abamectin) | Enforcer AntMax Bait Stations<br>Raid Ant Baits III | solid: bait station/protein<br>solid: bait station/protein |
| borate-based products[2] | Drax SF Ant Gel[3]<br>Grants Kills Ants Liquid Ant Bait<br>Terro Ant Killer II Liquid Ant Baits<br>Gourmet Liquid Ant Bait | gel: cracks/sugar<br>liquid: bait station/sugar<br>liquid: bait containers/sugar<br>liquid: refillable dispensers/ sucrose solution |
| fipronil | Combat Ant Killing Gel<br>Combat Quick Kill Formula 3<br>Maxforce FC Ant Killer Bait Gel[3] | gel: cracks/protein<br>solid: bait discs/protein<br>gel: cracks/sugar |
| hydramethylnon | Combat Source Kill<br>Amdro Kills Ants Killing Bait | solid: bait discs/protein<br>dry: ant stake bait stations/protein |

[1] Effectiveness varies according to ant species and product
[2] Borate products may include the following active ingredients: borax (sodium tetraborate decahydrate), disodium octaborate tetrahydrate, or orthoboric acid.
[3] May be available for professional use only.

Reusable bait stations or dispensers are more useful than prepackaged baits for difficult ant problems. Reusable stations can be opened, checked, and refilled as needed. This is particularly important for liquid baits, which may be rapidly consumed or dry out. Some stations have removable cups that can be filled with two or more types of baits to offer ants a choice. Bait stations protect baits from photodegradation and disturbance by children. Some types of bait stations can be permanently installed into the ground or attached to outside walls or pavement in areas around schools or other buildings where ants are a frequent problem. The bait stations may be hidden in mulch so they aren't immediately visible to children or pets.

Gel formulations of pesticide baits are packaged in small tubes. They are applied in small cracks and crevices where ants are entering. Gel products are now available to home users as well as professionals and can be a useful tool in an IPM program.

Ant baits contain carbohydrates (e.g., sugars), proteins, oils, or a combination of these as attractants along with an active ingredient (toxicant). Different attractants are more effective against different species of ants and at different times of the year. In the case of Argentine ants, sweet baits are attractive year-round. Protein baits are attractive to Argentine ants primarily in the spring. However, other ant species such as thief ants and Pharaoh ants prefer protein or greasy baits year-round. Fire ants prefer baits containing oils. See Table 1 for information on food preferences. Offering a small quantity of each kind of bait and observing which one the ants prefer is a good way to determine what to use.

Look for the active ingredient listed on the label of bait products. Some examples of active ingredients include hydramethylnon, fipronil, boric acid (borate or various forms of sodium borate), and avermectin B (abamectin). Table 2 lists some common ant bait products organized by active ingredient. Bait products are constantly being improved. Look for new active ingredients and improvements to current products. Avoid products packaged as granules that contain the active ingredients cyfluthrin or permethrin. Although these products may be mistaken for baits, they are actually contact insecticides that rapidly kill foragers and don't control the colony. Likewise, bait stations with propoxur or indoxacarb aren't very effective, because the active ingredient is too fast-acting.

To improve bait effectiveness, be sure to remove any particles of food, residues of sweet liquids, or other attractive material from cracks around sinks, pantries, and other ant-infested areas. For the most effective and economical control, use baits only when there is an ant problem. Treatments made in late winter and early spring when ant populations are just beginning to grow will be most effective. Ant preferences can change throughout the year; to increase your success rate, set out different formulations of various bait products in a single baiting station, giving ants a choice. Don't use any insecticide sprays while you are using baits, and check and refresh bait stations regularly. Baits can dry up or become rancid and unattractive over time.

Use baits primarily outdoors. Use indoors only if there is a serious infestation and you can't find the spot where ants are entering the building: otherwise you could attract ants indoors. Outdoor baits draw ants out of buildings. Place bait stations where ants can easily find them, but avoid placing them in areas that are accessible to pets and small children. Place baits near nests, on ant trails beneath plants, or along edges where ants travel. Space them every 10 to 20 feet outside around the foundation and at nest openings,

if they can be found. Effectiveness of baits will vary with ant species, bait material, and availability of alternative food. To achieve wide distribution of the bait so the entire colony will be killed, the bait toxicant must be slow-acting. Control with baits isn't immediate and may take several weeks or more to be complete.

**Refillable Bait Stations for Argentine Ant Management.** Currently the most effective baits available to consumers for Argentine ants are the borate-based baits. Prepackaged bait stations usually contain 5.4% borate. They can be effective at killing foragers in the home but are less effective at managing major infestations, because foragers are killed before they can bring the bait back to the colony.

Liquid borate products with a lower percentage of active ingredient (0.5 to 1.0% concentration in a sugar-water solution) will have more impact on the colony, although it may take several days to a week to see results and they need to be used in larger, refillable bait stations. Products with the lower concentration of borates (e.g., Gourmet Liquid Ant Bait) are registered for home use but are difficult to find in stores and may have to be ordered online.

Several refillable bait stations are available including the Ant Café, Antopia, Ant-No-More, and KM AntPro. University of California research with the KM AntPro dispenser has shown that it can be effective when properly installed and maintained outside the home (Figure 6). Usually at least one dispenser is installed around each side of a house and placed in shady areas where ants trail. Stations must be checked regularly and refilled as necessary. For more information about installation and maintenance, see the video on refillable bait stations at http://www.ipm.ucdavis.edu/PMG/menu.ants.html.

## *Indoor Insecticide Treatments*

If ants can be thoroughly washed away and excluded from an area, indoor insecticide sprays aren't necessary. Vacuuming up ant trails or sponging or mopping them with soapy water may be as effective as an insecticide spray in temporarily removing foraging ants in a building. Soapy water removes the ant's scent trail, especially if thorough cleaning is done at the entry points. Some soap products such as window cleaners can kill ants on contact but leave no residual toxicity. Certain plant-based oils (e.g., peppermint, rosemary, clove, orange, and thyme) are formulated in pesticide-type products to be applied for this purpose, although as food-based products they aren't required to be registered as pesticides. These types of products typically provide excellent contact activity but have limited residual activity against ants.

## *Outdoor Insecticide Treatments*

A common practice used to prevent ants from coming indoors is to apply a perimeter treatment of residual sprays around the foundation. Commonly used insecticides include the pyrethroids bifenthrin, cypermethrin, and lambda-cyhalothrin. All are available in retail products, but products available to professionals provide longer residual control than home-use products.

Spraying around the foundation won't provide permanent control, because it kills only foraging ants without killing the colony and the queens. Typically the foragers represent only a small proportion of the colony. On occasion, barrier sprays make the situation worse by trapping ants indoors. Perimeter treatments may appear to knock down the population, but ants will quickly build back up and invade again.

To try to achieve long-term control, some pest control companies offer every-other-month perimeter spray programs. Perimeter treatments pose more risk of environmental upset than baits in bait stations and are less effective than a bait-based IPM program. Because of water quality concerns, the California Department of Pesticide Regulation has recently adopted regulations limiting the use of perimeter treatments with pyrethroid insecticides.

Baits in refillable bait stations provide the safest effective treatment for do-it-yourself ant management outdoors. Combined with the exclusion and sanitation practices discussed above, this approach should manage most home ant invasions. If a problem persists, the best option is to hire a pest management professional trained in IPM or IPM-certified by a reputable organization. These professionals have access to more effective materials (such as fipronil) and application equipment that can prevent contamination of the environment. For more tips on hiring a professional, see *Pest Notes: Hiring a Pest Control Company* listed in References.

**Figure 6. Place bait stations or dispensers, such as this KM AntPro dispenser, outside the house in shady areas where ant trails are seen.**

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**This and other Pest Notes are available at www.ipm.ucdavis.edu.**

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