

### SAFELY MANAGING AN ARGENTINE ANT INFESTATION

**CORRECTLY IDENTIFY THE SPECIES** Argentine ants, *Linepithema humile*, are brown, slender, and about one-eighth inch long. They usually nest under boards, stones, tree stumps, and potted plants. Consult University of California Pest Note #7411 (www.ucipm.ucdavis.edu) or take specimens to your UC Cooperative Extension office (see county pages of your local phone directory).

### **BIOLOGY AND BEHAVIOR**

• Argentine ants are the most common ants in California, and their nests are believed to cover much of the state as one huge supercolony, making eradication impossible.

### CHECKLIST FOR MANAGING ANT INFESTATIONS

- Identify the ant species to maximize the effectiveness of your management strategy.
- Monitor by inspecting perimeters of buildings. Examine plants that support honeydew-producing insects.
- Include sanitation as your main preventive strategy. Clean up food debris in classrooms, empty classroom garbage daily, rinse recyclables before storing, place outdoor garbage cans and dumpsters away from doorways. Use soapy water to clean up ant trails.
- Exclude ants by caulking cracks and holes around foundations, and around pipes and wires. Seal indoor cracks and crevices. Band the trunks of honeydew-covered trees and shrubs with sticky materials such as Tanglefoot<sup>®</sup> so ants cannot reach their favorite food source.
- Communicate! Keep teachers and other staff informed of pest management actions.
- Educate staff and students so they can help prevent reinfestation and encourage successful treatment.
- ✓ Use least-hazardous chemical practices if necessary such as bait stations and bait gels. Sprays kill only the few ants you see – you'll miss the millions living safely in inaccessible nests. It's important to use slow-acting baits that reach the queens and think about ant management as an area-wide project.

- Argentine ants obtain protein from eating insects, including many pests, but they usually prefer honeydew, which is a sweet excretion produced by aphids, scales, mealybugs and whiteflies. You'll often find these ants in trees and shrubs that are infested with honeydew-producing insects.
- Ants often come indoors to find food during summer and fall when honeydew production declines.
- Ants feed each other by transferring food mouth to mouth, so slow-acting baits are more effective than sprays because foraging ants survive long enough to transfer the poison to other workers and the queens.
- Colonies begin to shrink soon after the bait kills the queens.
- Both sugary and protein-containing baits may be necessary to manage Argentine ants.

### **INSPECTION AND MONITORING**

- Examine plants for aphid, scale, mealybug, and whitefly infestations, especially during the spring.
- Look for outdoor nests next to buildings, along sidewalks, around trees and shrubs, and under boards, stones, tree stumps, and potted plants. Nests consist of thousands of worker ants and several larger queens, plus microscopic eggs, tiny white larvae, and pupae that resemble grains of rice.

### WHAT IF YOU SEE ONLY A FEW ANTS?

You may not mind seeing ants outdoors, but even a few can be objectionable in classrooms, teachers' lounges or food service areas. Often a few stragglers are scouting new feeding or nesting sites, and within hours you may have a steady trail of ants streaming in. Vacuum or use soapy water to clean up trails – in a labeled spray bottle combine 1 tablespoon dish soap and 1 quart water.

### WHAT YOU CAN DO TO MANAGE ANTS

### **TEACHERS**

- Keep classrooms clean by allowing food and beverages only in designated areas, then cleaning thoroughly.
- Ask students to remove food from lockers, cubbies, and desks daily.
- Keep any food, including pet food, stored in sealed containers.
- Take classroom pets home during severe ant infestations.
- Clean up the teachers' lounge before heading home every day.
- Communicate with custodial staff about special needs or ant sightings.

### **FOOD SERVICE STAFF**

- Store food in containers with tight lids made of plastic, glass, or metal.
- Keep indoor garbage in lined, covered containers and empty daily.
- Clean food spills promptly.
- Clean food-soiled dishes, utensils, and surfaces by the end of each day.
- Maintain clean shelves in storage areas.
- Communicate with maintenance staff about repairing leaks, and custodial staff about emptying garbage daily and vacuuming up ant trails.

### **CUSTODIAL STAFF**

- Vacuum up ant trails using a strong vacuum or wipe up with soapy water.
- Empty garbage daily from classrooms and food service areas.
- Place outdoor garbage containers on hard, cleanable surfaces and at least 50 feet away from building entrances.
- Wash all garbage containers regularly wash those outdoors at least monthly and keep area around them clean.
- Collect litter from school grounds at least once weekly.
- Have recyclables collected at least once weekly.
- Communicate pest management roles to staff and students, including removing food or food wrappers from lockers, cubbies, and desks on a daily basis.
- Clean floors and vacuum carpets daily in areas where food is served, and at least weekly in other areas.
- Eliminate spills in storage and receiving areas and maintain clean shelves.

### **MAINTENANCE STAFF**

- Caulk cracks and crevices.
- Weatherstrip doors and windows.
- Fix leaky pipes under sinks.
- Apply a sticky substance such as Tanglefoot<sup>®</sup> around trunks of trees and large shrubs infested with honeydew producers. Trim any branches that contact buildings.



### WHAT IS INTEGRATED PEST MANAGEMENT (IPM)?

Integrated pest management is a widely accepted approach to pest management that results in effective suppression of pest populations while minimizing hazards to human health and the environment.

# FOR MORE

Visit DPR's School IPM web site at:

cdpr.ca.gov/schoolipm/

### CHEMICAL CONTROL OPTIONS (Least-hazardous)

**DUSTS** – Injected into wall voids and cracks and crevices. Active ingredients include boric acid, diatomaceous earth, and silica aerogel. The ants die by drying out.

**BAITS** – Exempt from notification and posting requirements if bait is confined in a self-contained trap (bait station), or formulated as gel or paste applied to cracks and crevices. Active ingredients include abamectin, boric acid, fipronil, and hydramethylnon. Using aerosols or other sprays often reduces the effectiveness of baits. The ants you see foraging are only the tip of the iceberg – if you kill these with a fast-acting spray, thousands more will soon replace them. This is why it's important to use slow-acting baits that reach the queens via mouth-to-mouth feeding of the workers. Think about management as an area-wide project.

**NOTE:** Dusts and liquid insecticides are not exempt from Healthy Schools Act (HSA) requirements.

Written by Nita Davidson with assistance from Chris Geiger\*, Tom Babb, Lisa Ross, Nan Gorder, Sewell Simmons, Belinda Messenger, Madeline Brattesani, and Veda Federighi (DPR); Tanya Drlik (Marin County Model IPM Plan for Schools); Sherry Bryan (Ecology Action); Ingrid Carmean (Carmean Consulting); and Mike Rust (UC Riverside, Department of Entomology). Image courtesy of Orkin, Inc. \* now of the San Francisco Department of the Environment



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# Pestinfo

### INTEGRATED PEST MANAGEMENT FOR SCHOOLS

### SAFELY MANAGING A COCKROACH INFESTATION

German cockroaches, *Blattella germanica*, commonly infest classrooms and food service areas. The less common brownbanded cockroach, *Supella longipalpa*, also lives indoors, but prefers warm environments and often lives near electrical appliances. You'll often find the Turkestan cockroach, *Blatta lateralis*, and the oriental cockroach, *Blatta orientalis*, living underneath cracked and raised asphalt and concrete. The American cockroach, *Periplaneta americana*, usually lives in sewers and basements. The smokybrown cockroach, *Periplanenta fuliginosa*, and field cockroach, *Blattella vaga*, live outdoors, but occasionally come inside.

### CHECKLIST FOR MANAGING A COCKROACH INFESTATION

- ✔ Identify the roach species to maximize the effectiveness of your management strategy.
- Monitor thoroughly with sticky traps (such as roach motels). Continue to monitor hotspots even after roaches are gone.
- ✓ Include sanitation as your main preventive strategy. Clean up food debris in classrooms, offices, and lounges; empty classroom garbage daily; rinse recyclables before storing; place outdoor garbage cans and receptacles away from doorways.
- Exclude roaches by caulking cracks and holes, and sealing spaces around permanent fixtures such as bulletin boards and cabinets.
- ✓ Use mechanical devices such as a strong vacuum to force roaches out of their hiding places.
- ✓ Use least-hazardous chemical practices, if necessary, such as bait stations and bait gels. Sprays tend to scatter roaches. You may kill a few, but most will survive and return.
- Communicate! Keep teachers and other staff informed of pest management actions.
- ✓ Educate staff and students how they can help prevent reinfestation and encourage successful treatment.

### WHAT DO ROACHES WANT MOST?

Food, shelter, and water! Eliminate these as much as possible and you'll drastically reduce infestations.

### **BIOLOGY AND BEHAVIOR**

- Active at night if you see them during the day, you have a heavy infestation!
- Live in cracks and crevices near food sources
- Prefer to crawl along edges of counters or floors rarely venture into the middle of rooms
- Scatter when they sense vibration such as the sound of pesticide sprays

### **INSPECTION AND MONITORING**

- Locate hiding places by putting sticky traps (such as a roach motel) on the floor next to walls and under refrigerators, dishwashers, sinks, and ranges.
- Monitor on a regular basis and note how many per trap and the age range. Lots of young roaches they're smaller and wingless indicate you have an active infestation.
- Use a flashlight and small mirror to check behind or under cabinets and appliances.
- Flush out roaches with a hair dryer, not aerosol pesticides.
- Once you locate the source of roaches, you can restrict management to those specific areas.

### HOW MANY ROACHES ARE TOO MANY?

You may be able to tolerate a few roaches in garbage areas, but zero in kitchens or the teachers' lounge. Keep the threshold in mind when you monitor. Remember that even one female German cockroach can produce thousands of offspring.

### WHAT YOU CAN DO TO MANAGE ROACHES

### **TEACHERS**

- Keep classrooms clean by allowing food and beverages only in designated areas, then cleaning thoroughly.
- Take classroom pets home during roach infestations – their food and water support visiting roaches.
- Ask students to remove food from lockers, cubbies, and desks on a daily basis.
- Eliminate cockroach hiding places by removing out-of-date notices from walls and reducing clutter.
- Clean up the teachers' lounge before heading home every day.
- Communicate with custodial staff about special needs or roach sightings.

### **FOOD SERVICE STAFF**

- Store food in containers with tight lids made of plastic, glass, or metal.
- Store and seal food waste (from prep and serving areas) in plastic bags before removal.
- Remove waste at the end of each day.
- Keep indoor garbage in lined, covered containers.
- Clean food spills promptly.
- Clean soiled dishes, utensils, and surfaces by the end of each day.
- Keep shelves in storage areas clean.
- Take supplies out of boxes and store on pallets or open metal shelving – keep pallets away from walls.
- Communicate with custodial staff about emptying garbage daily, cleaning behind appliances

   including refrigerators, ice-makers, and vending machines – and washing floors and vacuuming carpets daily in areas where food is served.

### **CUSTODIAL STAFF**

- Vacuum roach hiding places using a strong vacuum with a crevice attachment. Vacuum twice, about five minutes apart. During the first pass, the roaches will scatter because of the air current. They'll resettle by the time you vacuum again.
- Empty garbage daily.
- Place outdoor garbage containers on hard, cleanable surfaces at least 50 feet away from building entrances.
- Wash all garbage containers regularly wash those outdoors at least monthly and keep area around them clean.
- Collect litter from school ground areas at least once weekly.
- Have recyclables collected at least once weekly.
- Keep drains clean this also prevents infestations of drain flies.
- Empty and thoroughly clean lockers and desks at least twice per year (e.g., winter break and at the end of each school year).
- Annually clean under and around rarely moved furniture (e.g., staff desks, bookcases, filing cabinets).

### **MAINTENANCE STAFF**

- Repair cracks and crevices in walls, floors and pavement.
- Seal openings around potential cockroach runways (electrical conduits, heating ducts, plumbing).
- Caulk permanent bulletin boards, mirrors and other wall fixtures.
- Cover floor drains with screens.
- Seal all permanently installed furniture and cabinets at points of attachment, under counter tops, and inside to prevent harborage of pests in the gaps.

### CHEMICAL CONTROL OPTIONS (Least-hazardous)

**INSECTICIDAL DUSTS** – Injected into wall voids and cracks and crevices. Active ingredients include boric acid, diatomaceous earth, and silica aerogel. The roaches die by drying out.

**IGRs** – These prevent immature roaches from reproducing and stimulate mature roaches to feed (good idea to place near bait). Available products contain the active ingredients hydroprene or pyriproxifen.

**BAITS** – Exempt from notification and posting requirements if bait is confined in a self contained trap (bait station), or formulated as gel or paste applied to cracks and crevices. Good sanitation encourages roaches to be more interested in baits. Active ingredients include abamectin, boric acid, fipronil, hydra methylnon, and imidacloprid.

**NOTE:** Dusts and insect growth regulators (IGRs) are not exempt from Healthy Schools Act requirements, although the ones described here are considered least hazardous when used according to label directions. **Don't be tempted to spray roaches they'll scatter and then return with a vengeance.** 

Written by Nita Davidson with assistance from Chris Geiger\*, Tom Babb, Lisa Ross, Nan Gorder, Sewell Simmons, Belinda Messenger, Madeline Brattesani, and Veda Federighi (DPR); Tanya Drlik (Marin County Model IPM Plan for Schools); Sherry Bryan (Ecology Action); Ingrid Carmean (Carmean Consulting); and Mike Rust (UC Riverside, Department of Entomology). Image courtesy of Orkin, Inc. \* now of the San Francisco Department of the Environment



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### PREVENTING MICE AND RATS FROM INVADING YOUR SCHOOL

When mice or rats invade a school, they chew on anything that resembles food or nesting material, including cardboard boxes, books, art projects, plastic bags and their contents, and electrical wires. Mice and rats also make a mess by urinating and defecating wherever they feed, and leaving smelly trails of urine and droppings. Both mice and rats can transmit parasites, diseases, and aggravate allergies.



The house mouse, *Mus musculus*, lives throughout the United States in open fields as well as in structures. Indoors, mice live in wall voids, above drop ceilings, in drawers and cupboards, on high shelves, and in clutter. They prefer to feed on grains, but will nibble on anything. They can fit through 1/4-inch spaces – that is, under most doors.

### **A PACK OF RATS**

The Norway rat, *Rattus norvegicus*, also known as the sewer rat, lives throughout California. Its burrows are found along building foundations, beneath trash piles, around gardens, and in unused sewers and storm drains. Indoors, Norway rats prefer living close to the ground floor in basements and wall voids. The roof rat, *Rattus rattus*, lives in the Western half of California in trees, woodpiles, and debris. Roof rats are good climbers and indoors like to live in attics and ceiling voids. Both rat species are omnivorous – they'll eat almost anything.

Roof Rat

### **CHECKLIST FOR MANAGING MICE AND RATS**

### **MECHANICAL CONTROL**

### RATS

✓ When setting traps, be aware that rats are cautious, so prebaiting will get them used to feeding from the trap. Snap traps work well when prebaited – keep them out of the reach of children. Sticky traps (or glue traps) are not as effective as snap traps. Rats will usually sense and avoid them.

### MICE

- ✓ Place snap traps in corners with the trigger facing out. Traps can be placed along walls with the trigger end toward the wall. Be aware that at many schools and offices, staff or students who have discovered a live or dead rodent affixed to a glue trap have raised a ruckus. (It's the issue of a quick death with a snap trap or a slow, tortuous death with a glue trap.)
- ✓ Ultrasonic devices. Don't waste your money. There is no evidence that these devices consistently repel rodents.

### **CHEMICAL OPTIONS**

- ✓ Prevention through exclusion and sanitation is the most important way to avoid rodent visitors inside school buildings and on school grounds. If a rodenticide is necessary because of high populations, enclose the poisoned bait in a tamperresistant bait station. See UC IPM's Pest Notes #7483 (house mice) and #74106 (rats) for guidance.
- ✓ If mice suddenly invade an inaccessible place such as a ceiling void, don't scatter pellet bait. Mice sometimes move the bait from well-hidden to public places.

### WHAT YOU CAN DO TO HELP MANAGE RODENTS

### **TEACHERS**

- Allow food and beverages only in designated areas.
- Minimize clutter in the classroom. Mice love to nest in fabric, stacks of construction paper, and other art supplies. Store these in large plastic boxes with tightly fitting lids.
- Store food in tightly sealed containers, including chow for students, classroom pets, and your own consumption. Remove edible art projects from walls. Ask students to remove food from lockers, cubbies, and desks daily.
- Communicate with custodial staff about evidence of rodents such as gnaw marks, destroyed material, or droppings.

### FOOD SERVICE STAFF

### Food-serving areas

- Clean floors, counters, cabinets, and tables, and vacuum carpets daily in areas where food is served.
- Remove garbage at the end of each day.

### Kitchen

- Store and seal food waste (from prep and serving areas) in plastic bags before removal.
- Clean food-soiled dishes, utensils, appliances, cabinets, shelving, and surfaces by the end of each day.

### Food-receiving and storage areas

- Maintain an inspection procedure for all received goods, and establish procedures for rejecting anything that's infested, leaking, or contaminated.
- Store nonperishable food in pest-proof containers, not in cardboard boxes.

 Place received goods on clean shelves or mobile storage carts.

### CUSTODIAL/MAINTENANCE STAFF Indoors

- Seal all electrical conduits, heating ducts, pipes, and pipe chases. Don't seal potential rodent entry points with gnawable material such as rubber, plastic, or wood.
- Weatherstrip doors and windows. Repair all broken panes in windows or skylights. Keep indoor garbage in lined, covered containers and empty daily.

### Outdoors

- Clean all garbage containers regularly. Make sure all outdoor garbage containers have plastic liners and tight-fitting, spring-loaded lids. Don't let garbage spill over the container.
- Empty garbage cans in outdoor lunch areas immediately after lunch and remove any food debris on the ground.
- Collect and move recyclables and stored waste off site at least once weekly.

### **GROUNDS STAFF**

- Avoid planting fruit-bearing trees the fruit attracts roof rats. Harvest fruit, including citrus, before you start a rat feeding frenzy.
- Don't plant vegetation directly against buildings because this provides shelter and runways for rodents.
- Thin out or eliminate dense ground covers such as ivy it creates a perfect rodent habitat.

### THINK OF PREVENTION BEFORE RODENTS INVADE

Before the rodents invade, let's consider the main preventive strategies and how we can avoid rodent invasions in the first place.

### **EXCLUSION**

### **Rodent-proof the School**

Build in pest-proofing strategies that prevent rodent access, make the school easier to clean, and minimize tempting food and nesting material.

### SANITATION

### **Deny Food**

Keep the school clean of food scraps. Keep food and beverages only in designated areas.

### HORTICULTURAL FIXES

### **Deny Access**

Trim trees and shrubs 3 to 6 feet away from buildings and keep vines off building walls.

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# 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

# PEST NOTES

University of California Agriculture and Natural Resources Statewide Integrated Pest Management Program

### Publication 7411

### Table 1. Identifying Features of Common Household Ants.<sup>1</sup>

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

<sup>1</sup> 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

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.

substances, dead or live insects, dead

animals, and sweets.

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.

### 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).



Figure 4. Velvety tree ants.

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



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.

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 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.

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

ent st c ant onuse borate-based products<sup>2</sup> Grants Kills Ants Liquid Ant Bait Terro Ant Killer II Liquid Ant Bait Gourmet Liquid Ant Bait Combat Ant Killing Gel Combat Quick Kill Formula 3 Maxforce FC Ant Killer Bait Gel<sup>3</sup>

### Table 2. Common Ant Bait Products.<sup>1</sup>

Example product names

Raid Ant Baits III

Drax SF Ant Gel<sup>3</sup>

Combat Source Kill

Amdro Kills Ants Killing Bait

Enforcer AntMax Bait Stations

Active

ingredient

avermectin B

hydramethylnon

(abamectin)

<sup>1</sup> Effectiveness varies according to ant species and product

<sup>2</sup> Borate products may include the following active ingredients: borax (sodium tetraborate decahydrate), disodium octaborate tetrahydrate, or orthoboric acid.

<sup>3</sup>May be available for professional use only.

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 yearround. 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 vour 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,

Formulation: application/bait

solid: bait station/protein

solid: bait station/protein

liquid: bait station/sugar

liquid: bait containers/sugar

liquid: refillable dispensers/

gel: cracks/sugar

sucrose solution

gel: cracks/protein

gel: cracks/sugar

solid: bait discs/protein

solid: bait discs/protein

dry: ant stake bait stations/protein

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 slowacting. 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 plantbased 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-



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

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.

### REFERENCES

Greenberg, L., J. H. Klotz, and J. N. Kabashima. Aug. 2007. *Pest Notes: Red Imported Fire Ant.* Oakland: Univ. Calif. Agric. Nat. Res. Publ. 7487. Also available online, http://www.ipm.ucdavis. edu/PMG/PESTNOTES/pn7487.html.

Klotz, J. H., L. Hansen, H. Field, M. K. Rust, D. Oi, and K. Kupfer. 2010. *Urban Pest Management of Ants in California*. Oakland: Univ. Calif. Agric. Nat. Res. Publ. 3524.

Klotz, J. H., L. Hansen, R. Pospischil, and M. K. Rust. 2008. *Urban Ants of North America and Europe: identification, biology, and management.* Ithaca, N.Y.: Cornell Press.

Klotz, J. H., M. K. Rust, and L. D. Hansen. Aug. 2009. *Pest Notes: Carpenter Ants.* Oakland: Univ. Calif. Agric. Nat. Res. Publ. 7416. Also available online, http://www.ipm.ucdavis.edu/PMG/ PESTNOTES/pn7416.html. Mallis, A. 2011. *Handbook of Pest Control*. 10th ed. Richfield, Ohio: GIE Media Inc.

Reynolds, C. A., M. L. Flint, M. K. Rust, P. S. Ward, R. L. Coviello, and J. H. Klotz. 2001. *Key to Identifying Common Household Ants.* UC Statewide IPM Program. Also available online at http://www.ipm. ucdavis.edu/TOOLS/ANTKEY/.

Wilen, C. A., D. L. Haver, M. L. Flint, P. M. Geisel, and C. L. Unruh. March 2006. *Pest Notes: Hiring a Pest Control Company*. Oakland: Univ. Calif. Agric. Nat. Res. Publ. 74125. Also available online, http://www.ipm.ucdavis.edu/ PMG/PESTNOTES/pn74125.html. �

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University of California Agriculture and Natural Resources

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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# YELLOWJACKETS AND OTHER SOCIAL WASPS

Integrated Pest Management for Home Gardeners and Landscape Professionals

Only a few of the very large number of wasp species in California live a social life. These species are referred to as social wasps. Some social wasps are predators for most or all of the year and provide a great benefit by killing large numbers of plantfeeding insects and nuisance flies; others are exclusively scavengers. Wasps become a problem only when they threaten to sting humans. In California, yellowjackets are the primary pests among the social wasps.

# IDENTIFICATION AND LIFE CYCLE

In Western states there are two distinct types of social wasps—yellowjackets and paper wasps. Yellowjackets are by far the most troublesome group, especially ground- and cavity-nesting ones such as the western yellowjacket (Figure 1), which tend to defend their nests vigorously when disturbed. Defensive behavior increases as the season progresses and colony populations become larger while food becomes scarcer. In fall, foraging yellowjackets are primarily scavengers, and they start to show up at picnics and barbecues, around garbage cans, at dishes of dog or cat food placed outside, and where ripe or overripe fruit are accessible. At certain times and places, the number of scavenger wasps can be quite large.

Paper wasps are much less defensive and rarely sting humans. They tend to shy away from human activity except when their nests are located near doors, windows, or other high-traffic areas.

Typically, previously mated, overwintering yellowjacket and paper wasp queens begin their nests in spring when the weather becomes warm. The queen emerges in late winter to early spring to feed and start a new nest. From spring to midsummer, nests are in the growth phase, and larvae require large amounts of protein. Workers forage mainly for protein at this time usually other insects—and for some sug-

PEST



Figure 1. Western yellowjacket.

ars. By late summer, however, the colonies grow more slowly or cease growth and require large amounts of sugar to maintain the queen and workers; foraging wasps are particularly interested in sweet things at this time. Normally, yellowjacket and paper wasp colonies live only one season. In very mild winters or in coastal California south of San Francisco, however, some yellowjacket colonies survive for several years and become quite large.

### Yellowjackets

The term "yellowjacket" refers to a number of different species of wasps in the genera *Vespula* and *Dolichovespula* (family Vespidae). Included in this group of ground-nesting species are the western yellowjacket, *V. pensylvanica*, which is the most commonly encountered species and is sometimes called the "meat bee," and seven other species of *Vespula*. *V. vulgaris* is common in rotted tree stumps at higher elevations, and *V. germanica*, the German yellowjacket, is becoming more common in many urban areas of California, where it frequently nests in houses.

These wasps tend to be medium sized and black with jagged bands of bright yellow—or white in the case of the aerialnesting *D. (formerly known as V.) maculata*—on the abdomen and have a very short, narrow "waist," the area where the thorax attaches to the abdomen.

Yellowjackets commonly build nests in rodent burrows (Figure 2), but they some-



Figure 2. Yellowjacket nest in an underground rodent burrow in spring (top), summer (center), and early fall (bottom). The nest becomes larger during the summer as yellowjackets add new comb layers, each containing developing larvae. The colony declines in late fall when workers die off.

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University of California Agriculture and Natural Resources Statewide Integrated Pest Management Program times select other protected cavities, such as voids in walls and ceilings of houses, as nesting sites. Colonies, which are begun each spring by a single reproductive female, can reach populations of between 1,500 and 15,000 individuals, depending on the species.

The wasps build a nest of paper made from fibers scraped from wood mixed with saliva. It is built as multiple tiers of vertical cells, similar to nests of paper wasps, but enclosed by a paper envelope around the outside that usually contains a single entrance hole. If the rodent hole isn't spacious enough, yellowjackets will increase the size by moistening the soil and digging. Similar behavior inside a house sometimes leads to a wet patch that develops into a hole in a wall or ceiling.

Immature yellowjackets are white grublike larvae that become white pupae. The pupae develop adult coloring just before they emerge as adult wasps. Immatures normally aren't seen unless the nest is torn open or a sudden loss of adult caretakers leads to an exodus of starving larvae.

Aerial-nesting yellowjackets, D. arenaria and D. maculata, build paper nests that they attach to the eaves of a building or that hang from the limb of a tree. The entrance normally is a hole at the bottom of the nest. These aerial nesters don't become scavengers at the end of the season, but they are extremely defensive when their nests are disturbed. Defending D. arenaria sometimes bite and sting simultaneously. Wasp stingers have no barbs and can be used repeatedly, especially when the wasp gets inside clothing. As with any stinging incident, it is best to leave the area of the nest site as quickly as possible if wasps start stinging.

### Paper Wasps

Paper wasps such as *Polistes fuscatus aurifer, P. apachus,* and *P. dominulus* are 1-inch-long slender wasps with long legs and a distinct slender waist (Figure 3). Background colors vary, but most Western species tend to be golden brown or darker with large patches of yellow or red. Preferring to live in or near orchards or vineyards, they hang their paper nests in protected areas, such as under eaves, in attics, or under tree branches or vines. Each nest hangs like an open umbrella from a pedicel (stalk) and has open cells that can be seen from beneath the nest (Figure 4). Sometimes white, legless, grublike larvae can be seen from below. Paper wasp nests rarely exceed the size of an outstretched hand, and populations vary between 15 to 200 individuals. Most species are relatively unaggressive, but they can be a problem when they nest over doorways or in other areas of human activity such as fruit trees.

### Mud Daubers

Mud daubers (Figure 5) are black and yellow thread-waisted solitary wasps that build a hard mud nest, usually on ceilings and walls, attended by a single female wasp. They belong to the family Sphecidae and aren't social wasps but might be confused with them. They don't defend their nests and rarely sting. During winter, you can safely remove the nests without spraying.

### INJURY AND DAMAGE

Concern about yellowjackets is based on their persistent, pugnacious behavior around food sources and their aggressive defense of their colony. Usually stinging behavior is encountered at nesting sites, but sometimes scavenging yellowjackets will sting if someone tries to swat them away from a potential food source. When scavenging at picnics or other outdoor meals, wasps will crawl into soda cans and can sting your lips or the inside of your mouth or throat.

Reactions to wasp stings vary from only short-term, intense sensations to substantial swelling and tenderness, some itching, or life-threatening allergic responses. These reactions are discussed in detail in *Pest Notes: Bee and Wasp Stings*. (See References.) Of specific concern is a condition that results from multiple-sting encounters, sometimes unfamiliar to attending health professionals, that is induced



Figure 3. Paper wasp.



Figure 4. Paper wasp nest.



Figure 5. Mud dauber.

by the volume of foreign protein injected and the tissue damage caused by destructive enzymes in wasp venom. Red blood cells and other tissues in the body become damaged, and tissue debris and other breakdown products are carried to the kidneys, to be eliminated from the body. Too much debris and waste products can cause blockages in the kidneys, resulting in renal insufficiency or renal failure. Patients in this condition require medical intervention, which can include dialysis.

### MANAGEMENT

Most social wasps provide an extremely beneficial service by eliminating large numbers of other pest insects through predation and should be protected and encouraged to nest in areas of little human or animal activity. Although many animals prey on social wasps—including birds, reptiles, amphibians, skunks, bears, raccoons, spiders, praying mantids, and bald-faced hornets—none provides satisfactory biological control in home situations.

The best way to prevent unpleasant encounters with social wasps is to avoid them. If you know where they are, try not to go near their nesting places. Wasps can become very defensive when their nest is disturbed. Be on the lookout for nests when outdoors. Wasps that are flying directly in and out of a single location are probably flying to and from their nest.

Usually, scavenging wasps won't become a problem if there is no food around to attract them. When nuisance wasps are present outdoors, keep foods including pet food and drinks covered or inside the house, and keep garbage in tightly sealed garbage cans. Once wasps discover food, they will continue to hunt around that location long after the source has been removed.

If wasp nests must be eliminated, it is easiest and safest to call for professional help. In some areas of California, personnel from a local mosquito and vector control district may be available to remove nests. To determine if this service is available in your area, call the Mosquito & Vector Control Association of California at (916) 440-0826. If a rapid solution to a severe yellowjacket problem is essential, seek the assistance of a professional pest control operator or consider installing bait stations.

### Trapping Wasps

Trapping is one method that can be employed to try to reduce yellowjacket problems. Trapping isn't suggested for other social wasp species.

Lure traps. The easiest to use are lure traps (Figure 6), which are available for purchase at many retail stores that sell pest control supplies. Lure traps can help reduce the number of localized foraging workers, but they don't eliminate large populations. Lure traps contain a chemical that attracts yellowjackets into the traps, but the common lure in traps, heptyl butyrate, attracts primarily the western yellowjacket and not other species. Meat such as chicken can be added as an attractant and is believed to improve catches of the German yellowjacket and *V. vulgaris*. Replace meat frequently, because yellowjackets aren't attracted to rotting meat. Also, periodically check the trap to remove trapped yellowjackets and make sure workers are still attracted to the trap. Lures need to be replaced periodically; follow trap directions regarding replacement.

To reduce the number of yellowjackets foraging in specific areas such as patios, picnic tables, concession stands, and Dumpsters, place lure traps with hepytl butyrate around the periphery. In large areas such as parks, place traps about 200 feet from the area to be protected and about every 150 feet along the circumference. In backyards, place them along the edge of the property line as far away from the patio or other protected area as possible. To intercept foraging yellowjackets, it is important to place the traps between the area to



Figure 6. Yellowjacket lure trap.

be protected and the native landscapes serving as nesting sites. Typically yellowjackets will forage about 1/4 mile. See Figure 7 for a suggested placement for traps.

**Water traps.** Water traps generally are homemade and consist of a 5-gallon bucket, string, and protein bait such as turkey, ham, fish, or liver. Fill the bucket with soapy water, and suspend the pro-



Figure 7. Placement of lure traps (represented by stars) to protect a picnic area in a park. Place the traps about 200 feet from the protected area and about 150 feet apart. In a backyard situation, place the traps around the periphery of the property as far away from the patio or other protected area as possible.

tein bait 1 to 2 inches above the water. A wide mesh screen over the bucket will help prevent other animals from reaching and consuming the bait. After the yellowjacket removes the protein, the yellowjacket flies down and becomes trapped in the water and drowns. Like the lure trap, these traps also work best as queen traps in late winter to early spring. In summer and fall they might assist in reducing localized foraging workers but usually not to acceptable levels. Place water traps away from patio or picnic areas, so wasps aren't attracted to your food as well.

### **Bait Stations**

In the past, poison bait products were available to reduce yellowjacket populations later in the season when their prey is no longer available and some species turn to scavenging. However, reliable products were taken off the market in the early 2000s. Esfenvalerate products that recently became available haven't been shown to be effective in research trials.

### Discouraging or Eliminating Nests

Early in the season, simply knocking down newly started paper wasp nests will cause the founding female to go elsewhere to start again or to join a neighboring nest as a worker. As there is little activity around newly started wasp nests, they are very difficult to find. Wasps are more likely to be noticed after nests and populations grow. Nest removal for controlling subterranean or cavity-dwelling yellowjackets isn't practical, because the nests are underground or otherwise inaccessible.

### Nest Sprays

Aerosol formulations of insecticides labeled for use on wasp and hornet nests can be effective against yellowjackets and paper wasps, but the products must be used with extreme caution. Wasps will attack if they sense a poison being applied to their nests, and even the freeze-type products aren't guaranteed to stop all wasps that come flying out. It is prudent to wear protective clothing that covers the entire body, including a veil over your face and gloves. In addition, you need to wear protective eyewear and other clothing to protect yourself from pesticide hazards.

Wasps are most likely to be in the nest at night, but even after dark and using formulations that shoot an insecticide stream up to 20 feet, stinging incidents are likely. Underground nests can be quite a distance from the visible entrance, and the spray might not get back far enough to hit the wasps. Partially intoxicated, agitated wasps are likely to be encountered at some distance from the nest entrance, even the day after an insecticidal treatment. Hiring a pest control professional will reduce risks to you and your family; in some areas of California, this service might be available through your local mosquito and vector control district.

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### REFERENCES

Akre, R. D., A. Green, J. F. MacDonald, P. J. Landolt, and H. G. Davis. 1981. *The Yellowjackets of America North of Mexico*. USDA Agric. Handbook No. 552.

Ebeling, W. 1975. *Urban Entomology*. Oakland: Univ. Calif. Agric. Nat. Res.

Mussen, E. C. Sept. 2011. *Pest Notes: Bee and Wasp Stings*. Oakland: Univ. Calif. Agric. Nat. Res. Publ. 7449. Also available online, www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7449.html.

### SUGGESTED READING

Sacramento-Yolo Mosquito & Vector Control District, www.fightthebite.net. \*

University of California scientists and other qualified professionals have anonymously peer reviewed this publication for technical accuracy. The ANR Associate Editor for Urban Pest Management managed this review process.

To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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University of California Agriculture and Natural Resources

WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

#### ANR NONDISCRIMINATION AND AFFIRMATIVE ACTION POLICY STATEMENT

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# What is a Pesticide?

Pesticides are chemicals designed to be harmful to a target pest and are purposely introduced into the environment to do their job of managing insects, plant diseases, weeds, rodents, or other pests. Fertilizers are not pesticides, although some products may also contain pesticides.

# The Label is the Law

Be sure to read and follow the pesticide label, as pesticides can be toxic to humans and the environment. Use the required personal protective equipment (PPE) when applying pesticides. If no PPE requirements are listed on the label, gloves and safety glasses are almost always required by California regulations.

### PRECAUTIONARY STATEMENT

### Hazards To Humans & Domestic Ani CAUTION:

Harmful if absorbed through skin or inhaled. Avoid spray mist. Wash thoroughly with soap and water clothing before reuse. Avoid contamination of feed Environmental Hazards: This product is toxic to f Physical and Chemical Hazards: Contents under Do not puncture or incinerate container. Exposur not use this product in conduits, motor housings, because of possible shock hazard. Do not use on

### FIRST AID: IF ON SKIN OR CLOTHING:

# **Licensing Requirements**

If you want the option to apply pesticides incidentally as part of a maintenance gardening business, you have three requirements:

1. AMaintenance Gardener Qualified Applicator Certificate in category Q (QAC-Q) from the Department of Pesticide Regulation (DPR). This certification only allows incidental use of general use pesticides, not restricted pesticides.

2. A Maintenance Gardener Pest Control Business License from DPR.

3. Register your business in the counties where you intend to work.

## **Contact us**

If you have questions or need more information, please contact your local county agricultural commissioner's office or call toll-free 1-877-378-5463 (1-87PestLine).

# Information

www.cdpr.ca.gov/docs/license/ maintgardeners.htm



Report pesticide incidents on DPR's CASPIR app. It's available at the Apple and Google app stores.



# MAINTENANCE GARDENERS & PESTICIDE SAFETY





# Best Pre-Application Practices

- Employees must be trained and provided required personal protective equipment (PPE) and information for the closest emergency medical center.
- Evaluate weather conditions.
- Know the type of pest you wish to control.
- Evaluate pest management options that are best for human health and the environment.
- Inspect application equipment.
- Use a measuring device when mixing/loading a pesticide; never exceed the maximum rate.

# **Best Application Practices**

- Do not mix, load or apply without wearing required PPE.
- Do not use restricted materials if you have only a Maintenance Gardener Category Q certificate.
- Do not apply in adverse weather (i.e. rain, wind).
- Do not over-spray.
- Do not apply when people, pets or beneficial insects are around.

# What are beneficial insects?

Beneficial insects are those that provide natural control against pests.



# Best Post-Application Practices

- Change and wash clothing after applying pesticides.
- Wash and shower as soon as possible.
- Do not launder contaminated clothing with regular laundry.

# **Best Storage Practices**

- Keep pesticides in their original containers.
- Do not leave pesticides unattended (this includes back of truck or on a sidewalk).
- Keep pesticides in locked compartments (but not in the passenger cab).
- Do not store pesticides inside the home.
- Keep application equipment in safe working condition and secured to vehicles during transportation.

# **Best Disposal Practices**

- Do not pour leftover pesticide down the drain.
- Properly dispose of empty containers according to label.