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## Cockroach Biology and Management

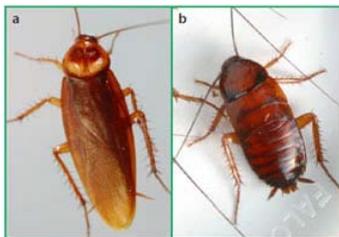
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Cockroaches are among the most common insect pests in homes, schools, and businesses. They like to eat many of the same foods we do and are especially troublesome wherever food is prepared or served. They also may transfer disease-causing organisms. Fortunately, cockroaches can be controlled with a little knowledge about their biology and behavior, attention to sanitation, and effective use of commercially available insecticides.

### Identifying cockroaches

Cockroaches have flattened bodies and heads that, when viewed from above, are concealed by a plate-like structure called a pronotum. They move surprisingly fast with their elongated, spiny legs. Their long, thin antennae help them find food and feel their way in the dark (which is when they are most active). Cockroaches can be brown, black, tan, reddish orange, or pale green. Most have wings, and in some species they are short and non-functional.



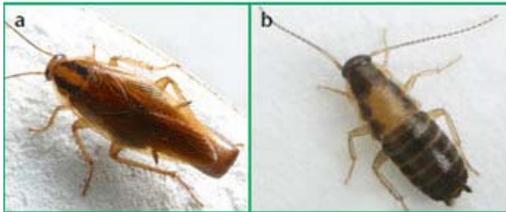
**Figure 1. American cockroach adult (a) and nymph (b), also known as the palmetto bug or waterbug.**

The most common types of cockroaches in Texas are the American cockroach, *Periplaneta americana*; German cockroach, *Blattella germanica*; oriental cockroach, *Blatta orientalis*; and smokybrown cockroach, *Periplaneta fuliginosa*. German cockroaches spend their lives indoors. American cockroaches are long-lived, reaching adulthood and sexual maturity in an average of 600 days. As adults, they usually live 1 to 2 years.

American, oriental, and smokybrown cockroaches live mostly outdoors but may move indoors in search of food or water. Cockroaches also infest homes when brought in with groceries or boxes, and, once established, can readily move within structures such as from apartment to apartment.

**American cockroaches**, also known as waterbugs or palmetto bugs, are more common in commercial buildings and are one of the most common cockroaches in sewer systems. The largest cockroach in Texas, it can grow 1½ to 2 inches long. Both the adult male and the female can fly. Adults are reddish brown (Fig. 1a), with tan to light-yellow bands outlining the pronotum. Young nymphs are grayish brown, but after the first few molts, they become more reddish brown (Fig. 1b).

**German cockroach** adults are ½ to ¾ inch long and are light brown with two dark stripes on the pronotum (Fig. 2a). Both males and females have wings extending to the end of their abdomens but they do not fly. Nymphs have wing pads and two dark stripes extending down the entire thorax and abdomen (Fig. 2b).



**Figure 2. Adult (a) and nymph (b) German cockroaches. The adult female in this picture carries an egg case (ootheca) that will produce 30 to 40 small nymphs.**

German cockroaches are the most prolific of indoor cockroaches and can produce a generation in about 100 days. They are one of the most widespread insect pests to public health in urban homes, apartments, and restaurants. They transport germs and are associated with allergies and asthma.



**Figure 3. Smokybrown cockroach adult (a) and large nymph (b).**

German cockroaches do not live outdoors in Texas. The Asian (*Blattella asahinai*) and field (*Blattella vaga*) cockroaches look very similar to German cockroaches and may be found outdoors in some areas of the state.

**Smokybrown cockroaches** are also large. Adults reach 1¼ to 1½ inches long. They are dark brown to black and their wings extend beyond the abdomen in both sexes (Fig. 3a). Their antennae are as long as or longer than their bodies. Younger nymphs are black with two white bands on the body and white-tipped antennae (Fig. 4); older nymphs are uniformly reddish brown (Fig. 3b).



**Figure 4. Very young smoky-brown cockroach nymph.**

The smokybrown cockroach is common outdoors, especially in the more humid areas of Texas and other southern states. They prefer living in protected, moist, warm sites, away from moving air. Common habitats are ground cover, mulch, palm fronds, soffits, eaves of attics, and tree holes. Smokybrown cockroaches reach maturity in an average of 600 days, and adults typically live 3 to 9 months.



**Figure 5. The adult oriental cockroach is nearly jet black with short wings. (Image from Clemson University, bugwood.org.)**

**Oriental cockroaches** are dark brown to black and grow to about 1¼ inches long. They do not fly and their wings remain short, even as adults. The female's wings are smaller than the male's, which extend only slightly over half of the body (Fig. 5). Nymphs are uniformly reddish brown to black. The development time from egg to adult averages 575 to 600 days and adult oriental cockroaches live 1 to 6 months. They prefer cooler, ground-level sites such as basements, crawl spaces, and wet areas.

**Turkestan cockroaches**, *Blatta lateralis*, are becoming more common in Texas, especially in western parts of the state. Males and females look strikingly different (Fig. 6). The brownish yellow adult males are 1/2 to 7/8 inch long. The pronotum has a pale margin, as do the upper corners of the front wings. The female Turkestan cockroach is similar to the oriental cockroach—shiny, dark reddish brown with short wings. However, the outer bases of the wings are pale like the male Turkestan cockroach.



**Figure 6. Male (a) and female (b) adult Turkistan cockroaches. (Images by Robin McLeod.)**

This species is native to Asia but was introduced to California and is expanding its range into Texas. It has become one of the most common outdoor cockroaches in El Paso, where it is found in compost, leaf litter, and potted plants; in expansion joints of sidewalks; and around water meter boxes.

### Cockroach Biology

Cockroaches have a three-stage life cycle: egg, nymph, and adult. Mature females produce 12 to 36 eggs at a time, depending on the species. The eggs are protected in a bean-shaped capsule, or ootheca (oh-oh-THEE-kah). The number of oothecae that females produce depends on the species. The female cockroach carries the egg capsule until it is mature or she finds a secluded spot to glue it to a surface or drop it. Some females carry it until just before the eggs begin to hatch. After hatching, nymphs tend to stay in dark, protected cracks and crevices, which they often share with adult cockroaches.

At average indoor temperatures, it takes a German cockroach nymph 50 to 60 days to develop into an adult. The optimum temperature for German cockroaches is around 80 degrees F. Warmer temperatures shorten their development time and increase the potential for population growth.

Most cockroach species are nocturnal—they hide during the day and come out at night to look for food. For example, the German cockroach spends about 75 percent of its life in narrow cracks and crevices, from 1/32 to 3/16 inch wide. From these harborages, adults emerge at night to search for food and water.

If you see cockroaches during the day, it usually means there are a lot of them around. They tend to congregate near sources of heat and moisture, which accelerates their growth and reproductive rates.

### German cockroach control



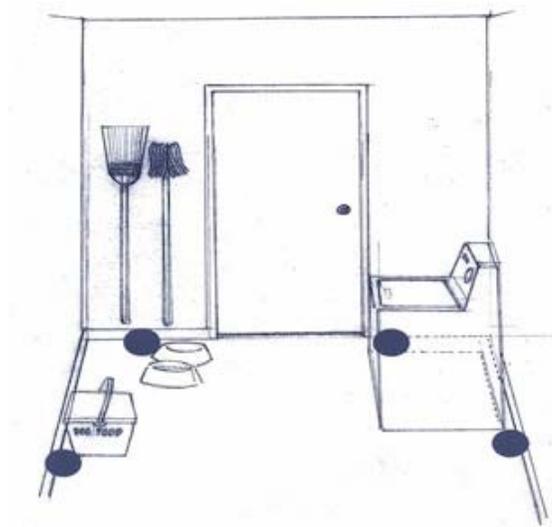
**Figure 7. Sticky card placed within a cupboard for monitoring cockroaches.**

Cockroaches are best controlled through an integrated pest management process of inspection, sanitation, exclusion, and the use of low-toxicity insecticides.

### Inspect

First, determine where cockroaches enter the home and where they live. The larger types, such as American and smokybrown cockroaches, often enter a home or business through poorly sealed doors, roof soffits, or floor drains.

If you are unsure where cockroaches are entering, place sticky card monitors, also called “roach hotels” or “glue boards,” next to doors, behind laundry appliances, under stoves and refrigerators, or in other locations where cockroaches may travel or hide. Sticky cards trap cockroaches and other crawling insects (Fig. 7). They are most useful for monitoring and less effective for controlling cockroaches. Nevertheless, they can provide some control, especially for low numbers of larger cockroaches.



**Figure 8. Dots showing possible sticky card placement for**

### **monitoring cockroaches.**

To make a home less hospitable for cockroaches, reduce clutter, keep mops and wet items off of floors, and eliminate food and water (such as empty pet bowls each night). Sticky cards (Fig. 8) placed along walls and cabinet edges in utility rooms and near exterior doors help monitor cockroaches and provide some control, especially for outdoor species.

When German cockroaches are the problem, look for favored harborages or daytime hiding places. German cockroaches prefer cracks and crevices in warm locations near water and food. Look for tiny droppings deposited around cockroach harborages. The droppings look like crushed pepper and stick to surfaces where cockroaches congregate. A good flashlight is essential for spotting cockroaches and their signs.

Use a household hair dryer to flush cockroaches out of hidden areas. Cockroaches dislike high temperatures and moving air and will flee when hot air is directed into a harorage. Once you identify harborages, treat or seal them to prevent further use.

### **Remove food, water, and harorage**

Good cleanup and sanitation practices are essential to effective cockroach control. When food or water is scarce, cockroaches must search farther each night to survive. Good sanitation puts stress on cockroach populations and increases the effectiveness of baits and other insecticides.



**Figure 9. Placing cockroach bait station under a stove. Stations are most effective if placed along a wall or cabinet edge.**

Clean the floors and counters and fix water leaks to remove moisture sources. Seal cracks and crevices where cockroaches hide or enter buildings. Use a good-quality caulk or sealant to close the gaps around sinks and plumbing, in walls, and along kitchen splash

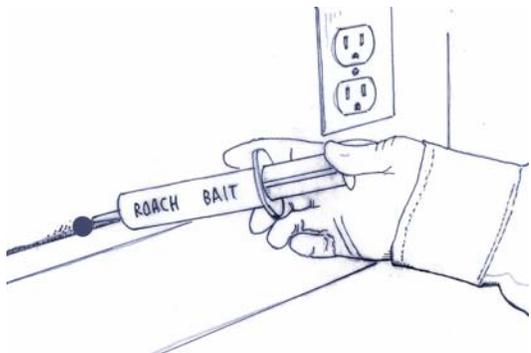
guards.

### Control cockroaches safely

Traps alone do not provide sufficient control of well-established cockroach infestations. For them, you will need to use a vacuum cleaner, bait, dust, or spray.

**Vacuums.** Vacuum cleaners can be useful in removing both cockroaches and their food sources under stoves and behind refrigerators. In addition to removing cockroaches, a vacuum cleaner helps remove crumbs and other food that cockroaches depend on. Make sure the vacuum has a HEPA filter that can filter out the finest dust particles because cockroach harborages often contain allergens that can cause asthma or make breathing difficult for some people.

**Baits.** A food mixed with an insecticide, baits are among the most effective insecticides for controlling cockroaches in homes. Cockroaches feed on the bait and return to their hiding places to die. Baits are most effective when few other food alternatives are available.



**Figure 10. Place baits in cracks and crevices where cockroaches hide. Many small, pea-sized placements are more effective than fewer, larger ones.**

Using baits indoors. The most common consumer bait formulations come in ready-to-use plastic bait stations or tubes containing gel baits. When using pre-baited containers, always use enough stations to effectively treat infested rooms—at least one bait station within 1 to 2 feet of every suspected cockroach harborage. Follow the package directions.

Place the bait stations near garbage cans, under sinks, along cabinet edges, near cracks in corners, or under dishwashers, refrigerators, or stoves (Fig. 9). Place them horizontally or glued to a vertical location (Fig. 10). When using gel baits, it is more effective to use many small placements (ideally, no larger than pea-sized) than a few large ones. Avoid over-application so that the bait is easily seen or drips from the application site.

Examine the baits regularly and replenish them as needed to keep them fresh and in supply for the cockroaches to eat. Baits work most effectively when cockroaches can feed freely and return to their harborages to die.

Remove old, dried-up bait by removing the bait station or scraping off the bait with a putty knife. Avoid applying other pesticides such as dusts or sprays close to bait stations because cockroaches will avoid contaminated baits.

If a bait does not control the cockroach population within 2 to 3 weeks, try a different bait with a new active ingredient. Switch active ingredients regularly to avoid creating resistant cockroach populations.



**Figure 11. Applying dust to a wall void where plumbing pipes enter the wall.**

**Dusts.** Some insecticides are sold in a dust form that can be applied into wall voids that are difficult to treat with other forms of

insecticides. Dusts also can be transferred easily from one treated insect to another during contact in harborage areas.

Effective dusts for cockroach control include some plant-based insecticides and boric acid, which remains one of the more effective cockroach control insecticides, especially when used properly.

Do not apply boric acid or other dusts in the open or on countertops or shelves where they can contaminate surfaces contacted by dishes, food containers, people, or utensils. Good sites for using dusts include voids around plumbing (Fig. 11); under the dishwasher, refrigerator, and stove; and in cracks and crevices where baits cannot be applied.

Dusts are most effective when applied lightly so that the residues are barely visible. Cockroaches will avoid heavy dust deposits. The best way to apply dusts is to shake the container with the lid or cap on, remove the lid, and puff the dust lightly into the void space. Applying dusts with a spoon is ineffective and will always use too much insecticide. Use a damp cloth to immediately clean up any visible residues after a dust application.

**Total-release aerosols and sprays.** While efficient for killing flying insects and insects on exposed surfaces, total-release aerosols (bug bombs) generally do not eliminate cockroaches because they do not penetrate the cracks where most cockroaches hide. Likewise, insecticide sprays are not nearly as effective as baits are for eliminating German cockroach infestations.

If you use sprays or bug bombs, follow the directions carefully and remove or cover all dishes, cookware, and utensils. Over-application of any pesticide is not only ineffective, but can be dangerous to you and your family.

## Controlling other cockroaches outdoors

American, oriental, and smokybrown cockroaches are usually found outdoors and in nonfood areas of homes and commercial buildings. They become pests when they enter a home or business. If you are unsure where cockroaches are getting in, use sticky card monitors.

Outdoors, look for dark, moist areas close to decaying organic food sources. Cockroaches can live in compost piles, ground cover plants, hollow trees, mulch, old stumps, palm fronds, woodpiles, sewer manholes, and underground water meters.

American and oriental cockroaches use floor drains as common points of entry into buildings. To minimize this risk, keep P-traps filled with water to create a barrier between the sewer and the home or business.

Check the threshold seals under doors and ensure that roof soffits are screened to keep cockroaches outdoors.

## Baits

Granular baits for cricket and cockroach control work well, especially outdoors in ground covers and mulched plant beds. Lightly sprinkle the bait according to the label directions. Avoid applying visible mounds of bait that might attract dogs or cats.

Containerized bait stations are available for large cockroaches. Place the stations against walls, especially around doors and other suspected entry points.

**Insecticide sprays** can also help manage outdoor cockroaches or treat them in garages and home utility areas. Spray suspected cockroach harborages and entry points such as building perimeters, doors, soffits, and water boxes. In garages and utility rooms, spray the room edges and places that are unlikely to be contacted by children or pets.

Tips for professionals:

- Vary the type of insecticides used against German cockroaches. Rotating both baits and sprays 1 or 2 times a year reduces the risk of insecticide resistance, especially in apartments that are treated regularly for cockroaches.
- When rotating insecticides, switch between insecticides with different modes of action. See <http://www.illac-online.org/teams/mode-of-action/> for more information about insecticide resistance management.
- Pyrethroid insecticides are highly repellent to German cockroaches. Using baits and non-repellent insecticides such as chlorfenapyr or boric acid may improve control in difficult cases.
- Always carry a clean rag and putty knife for cleaning up old bait residues and oversprays from liquid or dust applications.
- A good monitoring program can help you identify areas of cockroach activity as well as document the effectiveness of your control program. Recording the number of cockroaches in traps can be time-consuming, but may be useful, especially in sensitive accounts or ones with many cockroaches.

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