

Control Cockroaches in and Around Your Home

Introduction

Most people are very intolerant of cockroaches, and for good reasons; these pests can adversely affect human health in several ways. They can contaminate food, imparting an unpleasant odor and taste. They potentially can transmit disease organisms on their body parts. There are even instances where they have crawled on sleeping people and entered an ear canal (although rare)!

In addition to possible disease transmission, cockroach excrement and cast skins may cause allergies in some people. In fact, cockroach-induced allergies and asthma are some of the most serious problems caused by these pests. Symptoms of cockroach allergy include sneezing, runny nose, skin reactions, and eye irritation.

Asthma-related health problems from cockroaches seem to be most severe among children in inner-city areas, but they may also be significant even in nonurban children. In one study of 476 asthmatic inner-city children, half of the children's bedrooms had high levels of cockroach allergen in dust. That study also found that children who were both allergic to cockroaches and exposed to high levels of cockroach allergens had three times as many hospitalizations a year compared with other children.

The extent to which cockroaches transmit disease pathogens is unclear and often unrecognized. Some health officials (mistakenly) see no association between cockroaches and disease and think that cockroaches are merely nuisance pests. However, many organisms that cause human diseases have been found on the legs, other body parts, or fecal pellets of cockroaches. Several researchers have reported data indicating that the insects may be most commonly implicated in the transmission of *Salmonella*, a bacterium that causes gastrointestinal upset.

Which Kind of Cockroach Do You Need to Control?

The species of pest roaches that occur in Mississippi can be divided into two groups: "small roaches" and "large roaches." Generally speaking, small roaches are only about $\frac{1}{2}$ inch long as adults, while large roaches are more than 1 inch long as adults. Of course, the immature stages, known as nymphs,



German Cockroach, adult (about $\frac{1}{2}$ inch): This is the most economically and medically important cockroach in the world. This female is carrying an egg case. (Photo by Kansas Department of Agriculture, Bugwood.org)

of either group are much smaller than the adults. Newly hatched nymphs are less than $\frac{1}{8}$ inch long.

Although there are several cockroach species in the Southeast, the small roaches (primarily German cockroaches and to a lesser extent brown-banded cockroaches) and the complex of large roaches (smokybrown cockroaches, brown cockroaches, and American cockroaches) are the most common and the most problematic. Several other species occur in the state, but many of them breed outdoors and are only occasionally found inside. Because these other roach species do not normally establish reproducing populations inside our homes and buildings, they are not considered to be serious pests. However, it is still important to be aware of these species so you can avoid spending money unnecessarily and so you can address conducive conditions around your home that could sustain large populations. For example, if you found two woods roaches that were brought in with firewood, misidentified them as German cockroaches, and hired a professional pest control company to control German cockroaches, you would be wasting a lot of money. See the section on "Other Cockroaches" at the end of this publication for information on identification and biology of some of the less common cockroach species.

The first step in preventing or controlling cockroaches is to know which species you are trying to control. If you want your efforts to be successful, it is especially important to

distinguish between German cockroaches and the large roaches. Fortunately, this is easy to do because there is a big difference in the sizes of the adults. Adult German cockroaches are only about $\frac{1}{2}$ inch long and have two dark stripes on the front part of their back. Adult large roaches are more than 1 inch long. Because their habits and the methods used to control them are similar, it is not as necessary to be able to distinguish the different species of large roaches.

German Cockroach

This is the roach most dreaded and abhorred by homeowners and apartment dwellers alike. German cockroach, *Blattella germanica*, is the species most commonly involved in chronic indoor infestations. They occur worldwide and thrive indoors where they have ready access to food and water. German cockroaches are especially common and problematic in multifamily housing, as well as restaurants and other commercial facilities. They can also infest single-family homes. This is the species that is most often associated with cockroach-induced allergies in children and adults. It is also one of the most difficult roaches to control because it develops resistance to insecticides and "aversion" to baits.

Description: Adult German cockroaches range from light brown to dark brown, are slightly over $\frac{1}{2}$ inch long, and are easily identified by the two dark-brown stripes on the front part of the back. Although adults have wings, they are unable to fly, and the wings do not typically extend past the end of the abdomen. The wingless nymphs are smaller and have two dark-brown stripes down the full length of the back.

Biology: German cockroaches are indoor pests that are rarely seen outdoors because they can't survive outdoors. These roaches can't live without us. They only live and thrive where they can live in close association with humans. German



Heavy accumulations of German cockroach fecal deposits were revealed where cabinets were removed from the wall in a heavily infested kitchen. Airborne particles from German cockroach feces and shed skins are a common cause of asthma. (Photo by Blake Layton)

cockroaches are most common in kitchens and bath areas where they have ready access to food and water. Because of their small size and flattened body shape, cockroaches can easily hide in protected areas such as wall voids and cracks and crevices beneath and behind cabinets and cupboards. They shun light and prefer to forage under cover of darkness.

German cockroaches feed on a wide variety of organic materials, including human foods to which they can gain direct access, as well as crumbs and dried residues resulting from spills and splatters or dirty dishes. They also feed on pet food, as well as crumbs and spills that occur in pet feeding areas. In bath areas, roaches feed on dried sputum and other bodily emissions and on soiled clothing and diapers. They also feed on the dead bodies and excrement of other roaches.

Like other roaches, German cockroaches deposit their eggs inside a purse-like egg case, known as an "ootheca," which contains approximately three dozen eggs. Unlike most other roaches, German cockroach females carry their egg cases with them until, or just before, the eggs hatch. Like the adults, nymphs have chewing mouthparts and feed on the same food as adults. It takes 2–6 months for German cockroach nymphs to become adults, and adults can live as long as 9 months. Under favorable conditions, German cockroaches can develop high populations. Dried particles resulting from German cockroach feces, shed skins, and bodies of dead roaches are a key cause of asthma and allergy problems for people living in heavily infested buildings.

German Cockroach Control

Before beginning cockroach control efforts, be sure you know which species you are trying to control. Is it the German cockroach or one of the large roach species? Methods for treating German cockroaches differ considerably from those for smokybrown cockroaches or other large roaches. Also, there are quite a few nonpest/outdoor species of roaches in the state.

Because German cockroaches are strictly indoor pests, you need to focus all control efforts indoors. Sanitation is the most important management tool for German cockroach control. In single-family dwellings, good sanitation is often all that is needed to prevent infestations. When infestations occur, sanitation is still the backbone of the control effort, but there are many other useful methods. Consider the particular situation you are trying to control, and choose one or more of the methods discussed here to supplement your sanitation and exclusion efforts.

Sanitation: Although German cockroaches can occur in the most immaculately kept home or restaurant, they thrive especially well in cluttered, untidy conditions where they have ready access to food. Good housekeeping practices that limit the amount of food available to cockroaches

Key Steps for Control of German Cockroaches

- Declutter to make cleaning and treatment easier.
- Vacuum crumbs inside cabinets and behind and under appliances and furniture.
- Clean up food spills and other potential food sources.
- Store all food, pet food, garbage, and other food sources in bug-proof containers.
- Apply boric-acid dust to cracks, crevices, and voids according to label directions.
- Apply appropriate bait stations or gel baits according to label directions.
- Maintain good sanitation to limit availability of cockroach food sources.

greatly limit their ability to survive and reproduce, while also increasing the potential for successful control.

Store food in the refrigerator or in bug-proof containers so that cockroaches can't get to it. Clean up crumbs and dried accumulations of food resulting from spills, splatters, or boilovers. In addition to keeping the exposed surfaces of kitchen areas clean, it is important to avoid accumulations of dirty dishes and to clean under and inside cabinets to remove crumbs and other food sources. Keep stoves, toasters, microwaves, and other food-preparation appliances free of crumbs and dried food spills. Vacuum regularly, and clean inside cabinets and under and around appliances such as ovens, dishwashers, and refrigerators to prevent the accumulation of food in protected areas where roaches prefer to hide. Give special attention to preventing—or promptly cleaning—spills that run into cracks and crevices such as those that often exist between stoves or other appliances and adjacent cabinets.

Take the garbage out regularly, and line cans with garbage bags to prevent the accumulation of food on the inner walls of the can. Be aware that containers designated for recycling can be a prime breeding site if not properly maintained. Stacks of empty pizza boxes or empty drink containers can serve as fertile breeding grounds for cockroaches.

Other aspects of sanitation include regular cleaning of bath areas, cleaning around pet feeding areas, limiting the amount of time pet food is exposed, repairing water leaks or condensation problems, regular laundering to prevent accumulations of dirty clothes, and avoiding accumulations of debris, such as cardboard boxes, that can provide hiding places for roaches.

German cockroaches are most common in kitchen and bath areas where they have ready access to food and water. But



Systematic decluttering of cabinets and storage areas, followed by thorough vacuuming and cleaning, is a key step in controlling German cockroaches. (Photo by Blake Layton)

they will readily infest other areas of the house if food is available. Heavy populations will thrive in other living areas and around couches, recliners, beds, or other furniture if crumbs or other food particles are allowed to accumulate.

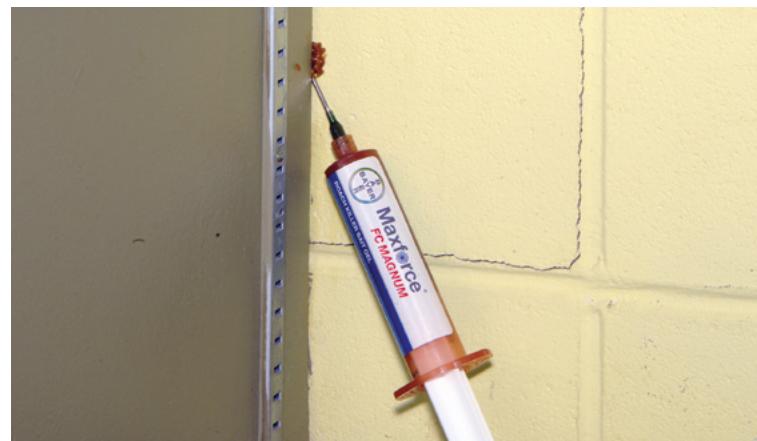
Exclusion: Because of their size and shape, adult German cockroaches can crawl through cracks less than $\frac{1}{8}$ inch wide, and nymphs can get through much smaller cracks. Caulk or otherwise seal cracks and crevices that provide access to wall voids and other potential refuges. Seal around entry points for plumbing and electrical conduit to prevent roaches from having easy access to good hiding places and to minimize movement between apartment units. Exclusion is especially important in multifamily dwellings. Although it is rarely possible to completely prevent German cockroaches from moving between apartments, any exclusion efforts that help reduce movement will aid control.

Traps: Several companies sell glue traps that can be used to catch cockroaches. Traps are useful survey tools to determine if, or where, infestations exist or to gauge the effectiveness of control efforts. **But they are not control tools and will not provide effective stand-alone control.**

Baits: Baits are the most effective treatments for controlling German cockroaches. They are safe, easy to use, and highly effective when used correctly (Table 1). When combined with good sanitation and exclusion practices, baits can provide effective control of German cockroaches with minimal use of insecticide. Gels, pastes, or childproof bait stations are especially useful for homeowners. Some baits are also formulated as dusts or fine granules, but these products are more useful for control of large roaches. Be sure to read and follow all label directions, especially when using baits in areas where food is prepared or stored.



Cockroach bait stations (left) or gel baits (right) are especially useful tools for control of German cockroaches. (Photo by Blake Layton)



When using gel baits, it is better to use multiple small placements of bait. Apply bait in or near areas where roaches hide. (Photo by Blake Layton)

Table 1. Examples of cockroach gel baits and bait stations.

Formulation	Active Ingredient	Brand Name (examples)
Gel Baits	Dinotefuran 0.05% gel bait	Hot Shot Ultra Clear Gel Bait
	Fipronil 0.01% gel bait	Maxforce FC Select Roach Bait Gel
	Fipronil 0.01% gel bait	Combat Max Roach Killing Gel
	Hydramethylnon 2.15% gel bait	Maxforce Professional Roach Killer Bait Gel
	Hydramethylnon 2.15% gel bait	InVict Gold Roach Bait Gel
	Indoxacarb 0.06% gel bait	Advion Cockroach Gel Bait
Bait Stations	Indoxacarb 0.3% gel bait	Raid Roach Gel
	Abamectin 0.05% bait station	Enforcer Roach Max
	Abamectin 0.05% + hydroprene 95% bait station	Raid Double Control Small Roach Baits + Egg Stoppers
	Fipronil 0.03% bait station	Combat Max Roach Killing Bait S (small roaches)
	Fipronil 0.03% bait station	Combat Max Roach Killing Bait L (large roaches)
	Fipronil 0.05% bait station	Maxforce FC Roach Killer
	Avermectin 0.05% bait station	Raid Double Control Small Roach Baits
	Avermectin 0.05% bait station	Raid Double Control Large Roach Baits
	Hydramethylnon 2% bait station	Maxforce Roach Killer Small Bait Stations
	Hydramethylnon 2% bait station	Combat Source Kill
	Dinotefuran 0.05% liquid bait	Hot Shot Ultra Liquid Roach Bait

Gel baits can be especially effective, but they must be used correctly. Use multiple placements of small amounts of bait—drops generally no larger than a pea (apply as per the label). Place baits in areas where they will be easily accessible to roaches but inaccessible to children and pets. Some gel bait labels recommend spacing bait placements every 2 feet, but read and follow directions for the specific product you are using. Reapply as often as required to maintain a constant supply of fresh bait. Unconsumed bait dries out over time and becomes unpalatable to roaches.

Do not apply insecticide sprays in areas where baits are used because the sprays can potentially repel roaches and prevent them from eating the bait. Additionally, some baits specifically

state on their label not to treat with a repellent insecticide. Baits work best when supplemented with good sanitation. After emptying cabinets and vacuuming crumbs, dead insects, and other debris, use a flashlight to identify roach hiding places and then place baits in these areas. Roaches feed on baits especially well when deprived of other food sources. German cockroach populations develop “bait aversion” if they are repeatedly exposed to the same bait. If they do not readily take the first bait you try, switch to another brand or type of bait. Some bait stations contain two different types of bait in the same station in an effort to avoid bait aversion.

Insecticide sprays: Insecticide sprays are generally less effective at controlling German cockroaches than large

roaches (Table 2). However, when applied properly, residual insecticide sprays can quickly reduce heavy indoor roach populations. Their use is sometimes necessary in special situations, such as in an empty apartment that is heavily

infested with German cockroaches. Be sure to choose insecticides that are specifically labeled for indoor use in kitchens or food preparation areas. Read the label carefully before treating, and follow all label directions when treating.

Table 2. Examples of insecticide sprays for cockroach control.

Formulation	Active Ingredient	Brand Name (examples)
Aerosol	Deltamethrin 0.05% + imiprothrin 0.1%	Raid Max Ant & Roach
	Permethrin 2%	Bengal Roach Spray II
	Permethrin 2% + pyriproxyfen 0.05%	Bengal Gold Roach Spray
	Esfenvlaerate 0.05% + synergists	Enforcer 20 Second Roach Spray
Ready-to-Use Sprays	Bifenthrin 0.05% + Zeta-Cypermethrin 0.05%	Ortho Home Defense Max
	Beta-Cyfluthrin 0.05%	Bioadvanced Home Pest Control
	Deltamethrin 0.03%	Raid Max Bug Barrier
	Deltamethrin 0.02%	Bonide Household Insect Control
	Deltamethrin 0.02%	Hi-Yield Kill-a-Bug II
Concentrate Sprays	Gamma-cyhalothrin 0.025%	Spectracide Bug Stop Home Barrier
	Cypermethrin 25.4%	Viper Insecticide Concentrate
	Cypermethrin 26%	Enforcer Over Nite Pest Control Concentrate
	Dinotefuran 40%	Alpine WSG

Products containing pyrethroid insecticides such as cyfluthrin, bifenthrin, deltamethrin, cypermethrin, or esfenvalerate will remain effective for several weeks, providing residual control of roaches that are exposed to treated surfaces. It is important to note that some level of pyrethroid resistance is common in German cockroaches, and as such, products containing a pyrethroid may have limited efficacy. These products are available as aerosol sprays, as dilute ready-to-use sprays, or as spray concentrates that must be mixed with water before application. Use sprayers that produce a small pin stream of spray that can easily be directed into cracks and crevices. Some aerosol sprays come with a small, plastic straw that makes it easier to inject spray into cracks and crevices.

If you are trying to control a heavy infestation, consider using an insect growth regulator (IGR), such as pyriproxyfen or hydroprene (Table 3), in combination with a residual insecticide spray, as discussed in the next section.

locate and treat all cracks, crevices, and voids where roaches can hide. Remove items from cabinets, and use a vacuum to clean crumbs, dead roaches, roach or mouse droppings, and other debris. **Note: Vacuums with a HEPA filter are recommended as they will trap many of the cockroach allergens, unlike traditional vacuums.** Clean surfaces with soap and water or liquid cleaners if necessary. Avoid spraying inner cabinet surfaces that will be directly exposed to stored food, dishes, and utensils. Use a flashlight to identify cracks and crevices that should be treated. Don't forget to look up, toward the upper back of the cabinet, and treat any voids or cracks you find there. Be sure to treat voids located behind, above, or underneath cabinets. Be aware of crevices that exist between cabinet backs and walls where roaches like to rest. In most cases, the deep cleaning part of this treatment process provides greater benefit for roach control than the insecticide spray. Wait for spray to dry before replacing stored items.

Table 3. Examples of insect growth regulators for cockroach control.

Formulation	Active Ingredient	Brand Name (examples)
IGRs	Hydroprene 9%	Gentrol IGR Concentrate
	Hydroprene 90.06%	Gentrol Point Source
	Pyriproxyfen 1.3%	Martin's I.G. Regulator
	Pyriproxyfen 10%	NyGuard IGR Concentrate

An insecticide treatment is only as good as the care taken in applying it. The key to success with residual sprays is to



Cockroach bait stations should be placed near areas where roaches hide and where they are inaccessible to children and pets. (Photo by Blake Layton)

Unfortunately, a single insecticide treatment, no matter how thoroughly applied, will rarely be sufficient to totally eliminate a heavy infestation. Be sure to re-treat in a few weeks, or follow up with some other type of supplemental treatment, such as baits. Always keep in mind that sanitation is the most important part of any roach control program.

Insect growth regulators (IGRs): IGRs (Table 3) work by disrupting the development of immature roaches and/or preventing eggs from hatching. These products are especially useful in control of German cockroaches. Although they are slow acting and do not actually kill adult roaches, IGRs have a long-term effect on cockroach populations by controlling immature roaches and/or interfering with reproduction. Hydroprene and pyriproxyfen are the active ingredients contained in most commercially available IGR treatments. Because IGRs provide long-lasting control and are effective against insecticide-resistant strains, it is a good idea to apply an IGR in combination with an insecticide spray. IGRs are also useful when applied in combination with baits because exposure to IGRs causes German cockroaches to eat more bait.

Aerosol foggers: Although many total-release aerosol foggers are labeled and sold for roach control, **aerosol foggers are not very useful or effective for cockroach control.** At first, they may seem to be a quick, convenient way to treat, but they are not necessarily the best or most efficient way to apply roach treatments. Most of the insecticide ends up on exposed surfaces where it is more likely to be contacted by humans and pets rather than roaches. Also, aerosols do not penetrate well into the cracks, crevices, and voids where roaches hide. Aerosol foggers may be useful in certain situations, such as for initial population reduction in empty apartments that are heavily infested, but they should be supplemented with other methods of control.

Insecticidal dusts: Dusts (Table 4) are an especially effective way to treat wall voids and other, otherwise inaccessible refuge areas. Most commercially available dusts contain deltamethrin, boric acid, diatomaceous earth, or silica gel. One of the advantages of insecticidal dusts is that, when applied to dry environments, they provide long-lasting residual control. Apply dust using a bulb duster or some other type of specialized dust applicator. Use the duster to inject small amounts of dust into cracks, crevices, and voids. When necessary, use a drill to make small access holes into voids. Avoid using too much dust, and do not apply dusts to exposed areas. **When dust has been applied properly, you should not be able to see that dust has been applied.** Dust applicators may be difficult to find locally, but you can order them from mail and Internet suppliers. A small, handheld bulb duster is sufficient for most home uses. Be sure to take appropriate precautions when treating around electrical outlets and switches.

Table 4. Examples of dust treatments for cockroach control.

Formulation	Active Ingredient	Brand Name (examples)
Dust	Deltamethrin 0.05%	Terro Ant Dust
	Deltamethrin 0.05%	Delta Dust
	Diatomaceous earth	Bonide Diatomaceous Earth
	Orthoboric acid 98%	Roach Prufe
	Orthoboric acid 99% Pyrethrins 1% + PBO 10% + Silica dioxide 40%	Harris Boric Acid Roach Powder Drione Dust

Hire a professional pest control company: If you don't have the time or inclination to do your own roach control, you can hire a professional pest control company to provide this service. Most pest control companies offer monthly or quarterly household pest-control contracts, with cockroaches being the primary target.

Professional pest-control technicians have access to effective insecticides and know how to use them safely. They know which treatments to use and how and where to apply them to control target pests while limiting unnecessary exposure. Still, they may need your help. Cluttered, overcrowded cabinets and closets can prevent proper treatment and make it difficult to obtain effective control, and poor sanitation can thwart the efforts of the best trained "bug man." Visit with your pest control technician to find out what you can do to facilitate control.

Large Roaches

The term "large roaches" refers to a group of closely related species including the smokybrown cockroach (*Periplaneta fuliginosa*), brown cockroach (*Periplaneta brunnea*), and American cockroach (*Periplaneta americana*). The smokybrown cockroach is one of the most common species, but it is not uncommon to have more than one species in the same area. Although these roaches occur throughout the state, they are more common in the southern region, where milder weather favors sustained outdoor populations (outdoors, but in close association with buildings or other man-made structures).

Description: Adults have long, thread-like antennae, spiny legs, and long leathery wings extending to, or beyond, the tip of the abdomen. Color and size vary depending on species, but adults of all three species are over an inch long. Adult smokybrown cockroaches are uniformly dark brown and approximately 1½ inches long. American cockroaches are somewhat larger, around 1½ to 2 inches, and reddish brown with lighter markings on the pronotum (front portion of the back). Brown



American Cockroach, adult (1½ to 2 inches): These are our largest roaches. Note the lighter-colored area just behind the head. (Photo by Blake Layton)



Smoky-Brown Cockroach, adult (about 1¼ inches): Smoky-brown cockroaches occur throughout the state, especially around the outsides of buildings. Note the uniformly dark color of the area just behind the head. (Photo by Michael Merchant, Texas Cooperative Extension, Bugwood.org)

Cockroaches look much like smokybrown cockroaches. Recently hatched nymphs are dark-colored with two white bands across the back. Older nymphs are shiny brown to reddish-brown and similar to the adults in general body shape, but they are smaller and lack wings. Because of the lack of wings, the segmented abdomen of the nymphs is obvious.

Biology: The biology of the large roaches is generally similar. Eggs are contained in a purse-like egg case, or "ootheca," which contains 12–24 eggs. The females deposit their oothecae in protected locations. It normally takes at least 6 weeks for eggs to hatch. Depending on species and environmental conditions, it takes from 9 to 20 months for the nymphs to become adults. Adults live for many months.

Although smokybrown cockroaches, as well as the other two species of large roaches, occur statewide, they are most common in the southern part of the state. High populations

of large roaches may be found living in sewer drains, under the siding of buildings, around dumpsters and garbage cans, in and around piles of lumber or refuse, and in various outdoor habitats such as palm trees, hollow trees, landscape mulch, and leaf litter. These roaches also breed and develop inside buildings, especially where they have access to dark, protected areas such as inside hollow concrete blocks, wall voids, soffit voids, attics, crawl spaces, and basements.

Large Roach Control

Because the large cockroaches (smokybrown cockroach, brown cockroach, and American cockroach) breed outdoors and indoors, control efforts for these pests must target both areas. In one of the most common situations, large roaches breed outside and occasionally invade the home but do not have established indoor populations.

Key Steps for Control of Large Roaches

- Identify and seal all potential entry points that provide insects access from outside.
- Move stacks of firewood, lumber, and other potential shelter sites away from the building.
- Keep outside garbage, pet food, and recycle items in bug-proof containers.
- Apply exterior perimeter insecticide treatments according to label directions.
- Use properly labeled insecticides indoors, around doors, and along baseboards as needed.

Sanitation: Although indoor sanitation plays a key role in managing indoor infestations of large roaches, sanitation efforts for large roaches should also be concentrated outdoors, in the area immediately surrounding the home. Keep outside garbage cans tightly covered. Store pet food in roach-proof containers and clean pet feeding areas regularly to prevent accumulations of spilled food. Avoid storing empty, unrinsed cans or drink bottles because the residues in these containers provide food for roaches. Avoid stacking firewood, lumber, boxes, or other refuse near the house, as these provide excellent shelter for roaches and other insect pests. Limit the use of organic mulches immediately adjacent to the house. This practice helps reduce cockroach populations and also reduces the potential for termites and home-invading ants. Ideally, organic mulches should not be used within 3–4 feet of the foundation. Use inorganic mulches like lava rock or pea gravel in this zone. Rake leaves and pine needles, and keep trees and shrubs pruned away from the house to minimize hiding places and ensure good ventilation. Do not allow ivy or other vines to grow on the side of the house because roaches and other insects hide and breed in this heavy vegetation.

Avoid planting palm trees too near the house because they provide excellent shelter for large roaches.

Exclusion: Exclusion is the most effective tactic home and building owners can use to prevent or reduce indoor invasions by large roaches and other insects. Because of their flattened body shape, even adult large roaches can easily crawl under poorly sealed doors. Install door sweeps on the bottoms of doors, and use foam strips or spring metal strips to seal around remaining door edges. Be sure window screens are undamaged and fit properly. Use caulking, foam sealant, steel wool, or other appropriate materials to seal around pipes and other potential entry points. Check soffit vents and other attic vents to be sure that they fit tightly and are properly screened, and make any other repairs or corrections necessary to make the building as bug-tight as possible.

Table 5. Examples of granular baits for cockroach control.

Formulation	Active Ingredient	Brand Name (examples)
Baits	Imidacloprid 0.5%	InVict Xpress Granular Bait
	Indoxacarb 0.22%	Advion Insect Granule
	Hydramethylnon 1% granular bait	Maxforce Complete Granular Insect Bait
	Orthoboric acid 5% granular bait	Niban Fine Granular Bait
	0.05% Abamectin B1	Avert Dry Flowable Cockroach Bait

Baits: Although gel baits (Table 1) can be effective against large roaches, granular baits (Table 5) and bait stations designed specifically for large roaches (Table 1) are more useful. Bait stations designed specifically for German cockroaches are too small. Granular baits are especially useful for controlling large roaches around exterior building perimeters. Granular baits are usually intended for outdoor use, for application around outside building perimeters, or for application in basements, attics, storage rooms, wall voids, and other non-living areas. Granular baits contain active ingredients such as boric acid, hydramethylnon, indoxacarb, or imidacloprid. In living areas, use childproof bait stations specifically designed for large roaches or gel or paste baits that can be placed where they are inaccessible to children and pets.

Note that granular baits intended for fire ants usually do not work against cockroaches, and baits intended for cockroaches and other pests usually do not control fire ants.

Insecticide sprays: Although indoor insecticide sprays are not the most effective way to control large roaches, they are sometimes useful as supplemental treatments. Indoor insecticide treatments for large cockroaches are formulated as aerosol sprays, ready-to-use trigger pump sprays, or liquid

concentrates that must be diluted with water and applied using hand-pressurized sprayers (Table 2). They contain active ingredients such as permethrin, bifenthrin, cyfluthrin, deltamethrin, esfenvalerate, or lambda-cyhalothrin. Apply these products as barrier treatments around doorways and other entry points, as well as along baseboards and beneath and behind appliances, to prevent roaches from entering or to control them shortly after they get inside. Read product labels for specific instructions.

Outdoor perimeter treatments: Outdoor perimeter sprays are especially useful for control of large roaches. Several insecticides are labeled for use around the outside perimeter of the house to control roaches and other pests (Table 6). These products contain active ingredients such as bifenthrin, cyfluthrin, lambda-cyhalothrin, or other pyrethroid insecticides. Many of them are labeled for application to exterior building surfaces, such as around doors and windows and the lower portion of the exterior wall, as well as to a band of ground around the perimeter. If the house has overlapping siding, remember that roaches like to hide in the resulting cracks; direct sprays into these areas. Most labels also allow treatment of crawl spaces, areas under porches, and similar settings. Outdoor perimeter treatments may be applied using a pump-up hand sprayer or a hose-end applicator. Some of these products are sold in a ready-to-spray, hose-end applicator. Be sure to read product labels carefully before purchase and follow all label directions.

Table 6. Examples of insecticides for outdoor perimeter treatments for large roach control.

Formulation	Active Ingredient	Brand Name (examples)
Liquid Concentrate	Cyfluthrin 0.75%	BioAdvanced Complete Insect Killer Concentrate
	Bifenthrin 7.9%	Talstar P Concentrate
	Bifenthrin 2.4%	Hi-Yield Bug Blaster Bifenthrin 2.4 Concentrate
Liquid RTU	Bifenthrin 0.05% + Zeta-Cypermethrin 0.0125%	ORTHO Home Defense for Indoor and Perimeter
	Bifenthrin 0.05%	Amdro Quick Kill Indoor/Outdoor Insect Killer

Hire a professional pest control company: One of the easiest and most effective ways to establish and maintain control of large roaches is to hire a professional pest-control company. Most companies offer quarterly or monthly services designed to control large roaches and other home-invading insects. Often, such services involve application of outdoor perimeter treatments. They might also include application of granular baits, as well as more targeted

application of insecticide sprays around potential entry sites and shelter areas. For control efforts to be successful, it is important for property owners to maintain effective exclusion and sanitation in and around the building.

Note that exterior perimeter treatments applied by pest control companies to control large roaches and other home-invading insects are not intended to control termites, and these treatments do not protect a building from termite attack. See Extension Publication 2568, *Protect Your House from Termites*, for information on termite control.

Other Cockroaches

Of the other species of roaches that occur in the state, brown-banded cockroaches and oriental cockroaches are fairly uncommon indoor pests. The remaining species discussed here are outdoor species that occasionally invade homes but do not normally establish breeding populations indoors. Several of them are relatively new arrivals to our area.

Brown-banded cockroach (*Supella longipalpa*): This roach is similar to the German cockroach in general size and appearance, but it differs in having two broad, dark bands across the back while lacking the two dark, longitudinal stripes German cockroaches have on their back. Like the German cockroach, the brown-banded cockroach is strictly an indoor species. Infestations of brown-banded cockroaches are uncommon in the state, but this pest can be difficult to control when it does occur.

Oriental cockroach (*Blatta orientalis*): This pest species is not often encountered in Mississippi. When it does occur, it is usually in basements and other moist, cool areas. Adults are dark brown and approximately 1 inch long. Adult males have short wings that do not reach to the tip of the abdomen, while females are essentially wingless, having only short stubs.

Asian cockroach (*Blatta asahinai*): Asian cockroaches look exactly like German cockroaches, but they differ greatly in behavior. Unlike German cockroaches, Asian cockroaches breed outdoors, fly readily, and are attracted to light. Asian cockroaches only recently entered the U.S. but are now well established in parts of Florida and other Southeastern states. They occur in the lower coastal counties of Mississippi, where the nymphs thrive in leaf litter, mulch, and similar outdoor settings, often building to large populations that go largely unnoticed. Because the adults are attracted to lights, they sometimes occur in buildings where they are mistaken for German cockroaches, but other than this problem of mistaken identity, Asian cockroaches are not really pests.

Cuban cockroach (*Panchlora nivea*): The Cuban cockroach is another relatively recent arrival that occurs in the extreme southern portion of the state. Adult females are about $\frac{3}{4}$ inch

long, while males are smaller, and both sexes are a striking pale green. As this coloration suggests, Cuban cockroaches prefer to live outdoors. The brown-colored nymphs live in mulch, leaf litter, and similar settings. Because of their preference for living outdoors, Cuban cockroaches are not considered pests.

Pale-bordered field cockroach (*Pseudomops septentrionalis*): This outdoor roach is expanding its range in the state and is now commonly seen as far north as Starkville. It is easily identified by the reddish-brown head and pronotum and the striking pale-yellow border around the pronotum and the outer margins of the wings. Some people might consider this to be a pretty cockroach. Adults are about the size of German cockroaches, but they are not considered to be a pest species.

Surinam cockroach (*Pycnoscelus surinamensis*): Surinam cockroaches are about $\frac{3}{4}$ inch long and broadly oval-shaped. They have a dark-brown pronotum with light-brown wings. These roaches live in the root/thatch area of lawns and other grassy areas in southern Mississippi. They are especially common from Hattiesburg south. Surinam cockroaches occasionally invade homes or are encountered on porches or carports, but they do not breed indoors.

Woods roaches (*Parcoblatta* spp.): Several species of woods roaches occur in the state. These are native roaches that are most commonly found under the bark of logs and dead trees and inside hollow trees. Woods roaches invade homes occasionally and are often brought inside with firewood, but they do not usually establish indoor populations.

Florida woods roach (*Eurycotis floridana*): This big, wingless roach occurs primarily in the extreme southern portion of the state. Even there, it is relatively uncommon. Adults are wingless (or appear to be), range from reddish-brown to almost black, and can be up to $1\frac{1}{2}$ inches long. These are primarily outdoor roaches, but they occasionally occur in garages, storage rooms, and similar settings.

Turkestan cockroach (*Periplaneta lateralis*): Although there have been sporadic, unconfirmed reports of this invasive roach in Mississippi, they are likely more common than realized. These roaches, often referred to as "red runners", are commonly raised by exotic pet enthusiasts as live food for their pets and are well-known to be excellent at escaping enclosures. Adult males (light brown in color with long wings) and females (dark brown in color with short wings) are both about 1 inch long and are easily confused with other species. Nymphs of these species tend to be brown on the front half of their body and dark brown to black on the back half. These roaches are common in crawl spaces, water meter boxes, and hollow block walls. This species has recently become more widespread in the Southeastern U.S. and its distribution in Mississippi is not clear at this time.



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Brown-banded Cockroach, adult (about $\frac{1}{2}$ inch): Brown-banded cockroaches can survive only indoors. They rarely occur in Mississippi. (Photo by Kansas Department of Agriculture, Bugwood.org)



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Oriental Cockroach, adults and nymphs (about 1 inch): Oriental cockroaches are not often seen in Mississippi. Note the dark color and the absence of functional wings in the two adults. (Photo by Daniel R. Suiter, University of Georgia, Bugwood.org)



Asian Cockroach, adult (about $\frac{1}{2}$ inch): Although they look exactly like German cockroaches, Asian cockroaches only breed outdoors and are not serious pests. (Photo by Blake Layton)



Cuban Cockroach, adult (about $\frac{3}{4}$ inch): Cuban cockroaches are sometimes seen resting on the sides of buildings, where they have been attracted by lights, but they do not breed indoors. (Photo by Blake Layton)



Pale-Bordered Field Roach, adult (about $\frac{5}{8}$ inch): These pretty, little roaches breed only outdoors and are not pests. This female is carrying an egg case. (Photo by Blake Layton)



Surinam Cockroach, adult (about $\frac{3}{4}$ inch): Surinam cockroaches are common in lawns and landscapes in southern Mississippi, but they only rarely enter buildings. (Photo by Blake Layton)



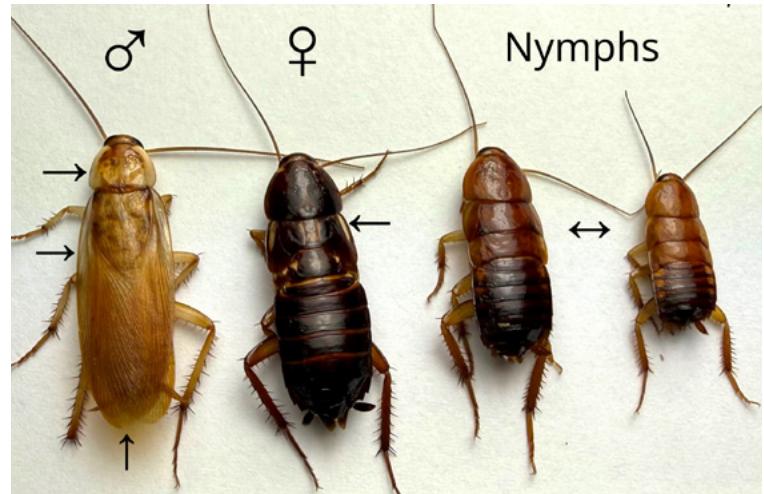
Woods Roach, adult male (about $\frac{7}{8}$ inch): Although they are occasionally seen indoors, woods roaches breed only outdoors and are not serious pests. (Photo by Blake Layton)



Woods Roach, adult female (about $\frac{7}{8}$ inch): Female woods roaches may have short, nonfunctional wings. (Photo by Blake Layton)



Florida Woods Roach, adult (about 1½ inches): These large, wingless roaches only occur along the coast, where they are uncommon pests in garages and storage buildings. (Photo by Blake Layton)



Turkestan roach, adult male (left) and female (second from left) both about 1 inch. These roaches are typically exterior pests but can occasionally make their way indoors. Note characteristic light colored markings at wing margins of adults and reddish-brown nymphs with dark abdomens. (Photo by Santos Portugal)

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