



Cockroaches. . . Recognition and Control



*Philip J. Hamman and Roger E. Gold**

Cockroaches rank high on the homeowner's list of pest problems. Their presence in the home is objectionable and implies uncleanliness. Cockroaches contaminate food with excrement and salivary secretions, and they may leave an unpleasant odor. Cockroaches also carry disease organisms, although their role in transmitting diseases to humans is poorly documented.

Biology and Behavior

Cockroaches develop by gradual metamorphosis and have three life stages: egg, nymph and adult. Adult females produce small, bean-shaped egg capsules. The female usually drops the egg capsules or glues them to some surface soon after they are formed. However, the female German cockroach carries the capsule protruding from her body until the eggs are ready to hatch. Nymphs hatch from the eggs and emerge from the capsules. They resemble adult cockroaches, except that they are smaller and do not have fully developed wings. Their flattened bodies and long, spiny legs enable them to run rapidly and to squeeze into crevices and other dark hiding places.

Nymphs molt several times before becoming mature males and females. As indicated in Table 1, the time required to complete the life cycle varies from about 2 months to nearly 3 years depending on the species, food and water sources, and environmental conditions.

Most cockroaches are tropical or sub-tropical in origin and generally live outdoors. However, some species have adapted well to living with humans. Though it is true that they prosper in clutter, filth and grime, cockroaches at times infest even the most sanitary and well-organized homes and buildings.

Cockroaches enter buildings in infested boxes, grocery bags, beverage cartons, furniture and dried pet foods. They also enter around loose-fitting doors and windows, where electrical lines or water and steam pipes pass through walls, in seasoned firewood and through sewer lines.

Most cockroaches are nocturnal and appear during daylight only when disturbed or where there is a heavy infestation. They prefer warm, dark, humid shelters, and often move around the kitchen sink or drainboard. They prefer to rest in cracks around, under or inside cupboards and cabinets; where pipes or electrical wiring pass along or through a wall; behind window or door frames, loose baseboards or molding strips; under tables and chairs; in upholstered furniture; in bathrooms; in radio and TV cabinets; and in motor compartments of refrigerators, washing machines and other appliances. It is important to know where cockroaches are hiding in your home because these are the locations that must be cleaned and treated.

Cockroaches feed on a variety of plant and animal products, including meat and grease, starchy foods, sweets, baked goods and other unprotected kitchen goods. They also feed on materials such as leather, wallpaper paste and book binding and sizing.

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Common Species

There are approximately 3,500 species of cockroaches, but only 55 species are known to live in the U.S. In Texas, five cockroach species are really troublesome in homes and other buildings. The other cockroach species are not found in Texas or they breed and live outdoors. They may on occasion come inside the home, but outdoor species usually do not develop large populations inside homes and often die or migrate outdoors.

Cockroaches 1/2 Inch to 5/8 Inch Long

German Cockroach (*Blattella germanica*)

The adult German cockroach is light brown and 1/2 to 5/8 inch long. The head shield has two dark stripes which run lengthwise. Adults are fully winged but rarely fly. Nymphal German cockroaches are smaller and darker than adults and are wingless.

The German cockroach is the most prevalent cockroach in Texas and is more active than other domestic species. As indicated in Table 1, the German cockroach produces more eggs per capsule than most other species and has a developmental period as short as 2 months. Thus, troublesome infestations can develop rapidly from a few individuals.

This is the only domestic species in which adult females carry egg capsules protruding from their abdomens until the eggs are ready to hatch. In fact, few eggs will hatch if the capsule is detached from the female more than a day or two before hatching would normally take place.

These cockroaches thrive in all types of buildings, but are found most often in homes, apartments, condominiums and commercial food establishments. They usually enter tightly constructed homes with bottled drink containers, potatoes, onions, dried pet foods, grocery sacks, corrugated cartons and even furniture. German cockroaches usually seek dark shelters near moisture and food, such as in kitchens and bathrooms. However, when populations become large and food scarce, they appear in bedrooms and other less likely places.

Brownbanded Cockroach (*Supella longipalpa*)

The brownbanded cockroach is light gold to glossy dark brown, and is 1/2 to 5/8 inch long. It has transverse yel-

low bands across the base of the wings and across the abdomen. The wings of adult males cover their abdomens, while the females' wings are shorter. The yellow bands across the back are more pronounced on nymphs than on adults.

These cockroaches are quite active, and the adults, especially the males, fly rapidly when disturbed. Both adults and nymphs may jump to escape danger. The adult female carries her egg capsule for only a day or two before gluing it to a protected surface underneath or inside furniture, in a closet or on the ceiling in a darkened room. They can also be found in televisions and other appliances.

Brownbanded cockroaches are more apt to be found in homes, apartments, hotels, motels, nursing homes and hospitals than in restaurants, grocery stores and other commercial establishments. They prefer starchy foods and appear to have lower water requirements than other cockroaches. They can occupy drier locations within a building. Nymphs and adults frequently are found on ceilings in dark or dimly lit rooms, behind picture frames, in light switches, in upper walls of cabinets and closets, or on undersides of furniture and inside upholstered furniture. Because brownbanded cockroaches are found in so many locations they may be more difficult to control.

Cockroaches 1 Inch or Larger

American Cockroach (*Periplaneta americana*)

The American cockroach is the largest of the common species, growing to a length of 1 1/2 to 2 inches. It is reddish-brown with a light yellow band around the edge of the head shield. Adults of both sexes have well-developed wings, but seldom fly. They are, however, capable of gliding flights. Nymphal cockroaches are smaller than adults, grayish-brown in color and less fully winged.

The adult female usually drops her egg capsule within a day after it is formed. She often places the capsule near a food or water source or in a location where it can be covered with miscellaneous debris. Occasionally, she glues the capsule to some surface with secretions from her mouth. The capsule may be deposited outdoors in moist wood, in cracks in bark or in whorls of plants.

Table 1. Life history of common cockroaches in Texas.

	GERMAN	AMERICAN	BROWN-BANDED	ORIENTAL	SMOKYBROWN
Average number of eggs per capsule	37	15	16	14	24
Average number of capsules per female	7	58	10	14	17
Number of molts	5-7	10-13	7-9	7-10	9
Nymphal stage (days)	103	468	161	542	344
Life cycle (days)	40-251	320-1071	143-379	215-991	311-513
Average longevity of adults (days)	140	441	115	96	247
Approximate number of offspring per year from one female under favorable conditions	35,000	812	677	196	306



Fig. 1. German Cockroach, *Blattella germanica* (actual length)



Fig. 2. American Cockroach, *Periplaneta americana* (actual length)



Fig. 3. Brown-banded Cockroach, *Supella longipalpa* (actual length)

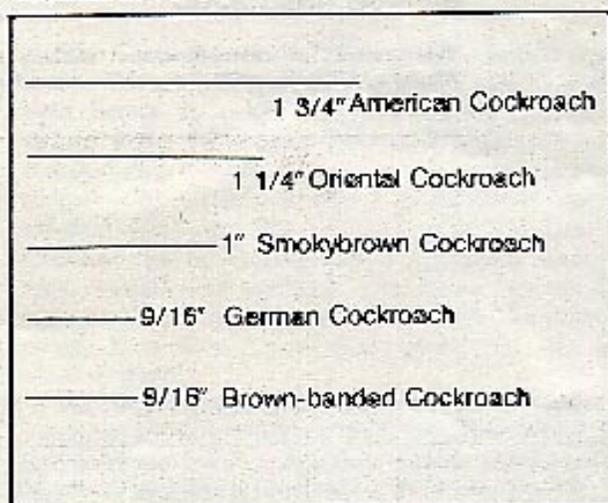


Fig. 4. Oriental Cockroach, *Blatta orientalis* (actual length)



Fig. 5. Smokybrown Cockroach, *Periplaneta fuliginosa* (actual length)

Relative Lengths of Common House-Occurring
Roaches in Texas



In the warm climate of Texas, American cockroaches often live out of doors in alleys, lawns, decayed trees and plants. They often enter and thrive in homes, commercial establishments and other buildings which provide favorable shelter and an ample food supply. They live mainly in dark, moist sites in kitchens, bathrooms, basements, steam tunnels, sewers and even in crawl spaces under buildings.

Oriental Cockroach (*Blatta orientalis*)

Adult oriental cockroaches are glossy dark brown to black. Females may be nearly 1 1/4 inches long, while males are 1 inch long. The male's wings cover most of the body, while the female's shorter wings are reduced to mere lobes. Neither sex can fly, and in fact, these cockroaches are rather sluggish and do not move very fast even when disturbed. Nymphal cockroaches are smaller than adults, dark brown to black, and have wing stubs without definite veins.

The adult female oriental cockroach usually carries her egg capsule for about a day, then drops it or attaches it to a protected surface near a food supply. These cockroaches appear to have a seasonal cycle in their development. They overwinter as large nymphs or adults, and are usually noticed in the spring when they mate. In the spring of the year, they migrate from buildings to the out of doors where they spend the summer months. In the fall, the next generation tries to find shelter indoors where they can spend the winter. Natural mortality usually reduces the number of adults in the population during the summer, fall and winter. These cockroaches are more frequently found in North and Central Texas.

Nymphs and adults are usually found near decaying organic matter. During warm, humid weather they inhabit lawns, compost piles, flower beds and dumps. However, in periods of drought or with the approach of cold weather, they move in masses into homes and other buildings. In buildings, these cockroaches inhabit high moisture areas such as sewers, drains and dark, damp basements. Their activities are somewhat restricted to the ground or below-ground levels of buildings.

Smokybrown Cockroach (*Periplaneta fuliginosa*)

The adult is slightly more than 1 inch long and is a uniform, very dark brown to black. The head shield is a solid dark color. Both males and females have wings longer than their bodies and are capable of flying or gliding. Nymphs are smaller than adults and have only partially developed wings.

Adult females usually carry their egg capsules for a day or two before attaching them to the outside surfaces of buildings and other protected sites near the ground.

These cockroaches live primarily outdoors and prefer woods, leaf litter, trash piles and other humid sites with abundant organic matter. They also hide under rocks, ground cover and building materials. They may enter homes with infested firewood during seasonal migrations. These species are most commonly found in South Texas.

Prevention and Sanitation

The key to successful cockroach control is the use of preventive measures. It is easier to prevent a cockroach invasion than to control an established population. However, the success of preventive measures requires care, planning and sustained effort. Cleanliness in the home and elimination of favorable breeding sites lessens the possibility of cockroach infestations and reduces the need for pesticides, but these practices will not always prevent invasions from outside sources.

Inspection. Prior to any cockroach control effort, cockroaches and their likely habitats should be identified. Because various cockroach species may live in the same building, it is essential to identify the species accurately and use control measures that take advantage of behavioral patterns and life requirements of the particular species. Also, frequent, thorough inspections will enable the homeowner to detect conditions which foster the development of infestations. In addition to examining all known or suspected cockroach hiding areas, incoming materials such as beverage cartons, groceries, dry cleaning, luggage and used appliances or furniture should be inspected for hitchhiking cockroaches and/or their egg cases. Destroy any egg cases found.

Sanitation. Proper sanitation, both indoors and outdoors, effectively limits cockroach populations. Do not leave unwashed dishes, kitchen utensils and uncovered food out overnight. Clean up all spilled liquids. Areas beneath and behind cabinets, furniture, sinks, stoves and refrigerators should be cleaned often, as should cupboards, pantry shelves and storage bins where particles of food frequently accumulate. Kitchen waste and excess refuse should be kept in cockroach proof containers and disposed of as frequently as possible. Dry pet food should be stored in tight containers away from the kitchen and other foods. If pets are fed indoors, left-over foods should not be allowed to remain in the feeding dish overnight. Outdoors, garbage cans, racks, platforms or slabs should be cleaned regularly.

Exclusion. Discourage cockroaches from entering the home by sealing any cracks of 1/8 inch or more in the foundation and exterior walls. Check the seal or caulking around air conditioning units, windows, doors, pipes or other openings into the home. Inside the home, eliminate all possible hiding areas and food sources. Repair cracks and holes in floors, walls and ceilings. Seal openings around plumbing fixtures, furnace flues, electrical outlets, window sills and walls, and along baseboards and ceiling moldings. Leaky water faucets and pipes should be repaired. Thresholds on doors should be as tight as possible and cracks in porches and stoops should be sealed.

Eliminate hiding places. Paper, cardboard, lumber, firewood and other debris next to the home provide excellent refuge for several cockroach species. Keep yard trash and stacks of firewood away from the home or garage to minimize the chance of cockroach invasion.

Cockroach traps. There are a number of cockroach traps which are inexpensive, convenient to use, dispos-

able and contain no toxic insecticide. Most are about the size of a large matchbox, are open at both ends and have the inside surface covered with a very sticky adhesive. Some may contain a slow-release food attractant. Cockroaches that enter the trap become immobilized by the adhesive. Trapping alone will not eliminate cockroach populations, but must be used in conjunction with preventive measures for maximum effectiveness. Trapping can reveal the hiding places and the severity of infestation, help monitor the effectiveness of control measures and detect population increases which may require an insecticide treatment.

Traps should be placed where cockroaches are likely to travel to and from feeding and hiding areas. It is best to place traps against walls and in corners where both ends are unobstructed. Reposition the traps if no cockroaches are caught after two to three nights. The number of traps required for a home or building will vary with the kind of cockroach present and the severity and location of the infestation.

Control

Electronic Pest Control Devices

Research on the effectiveness of several types of electronic pest control devices has shown that cockroaches are not repelled or controlled by ultrasonic sounds, vibrations, electro-magnetic forces, or pulsed electronic signals. Before purchasing any pest control device, review the scientific data to see if it supports the manufacturer's claims. Do not accept testimonial endorsements, and ask how the devices work.

Chemical Control

If it is determined that insecticide must be used to effectively control cockroaches, find their daytime shelters and carefully treat these areas. Regardless of the insecticide or formulation chosen, chemicals placed in or near regular hiding places provide much better control than those placed where cockroaches move only occasionally. Care should be taken to treat the cracks and crevices where cockroaches spend most of their time. Insecticide generally provides only temporary control within structures. Since some cockroach species invade homes and buildings from outside, they may reinfest dwellings once the insecticide dissipates. To solve this problem, outdoor populations must also be controlled. In certain situations cockroach baits can be used around the outsides of buildings.

Pesticides vary in formulation, method of delivery, biological activity, residual longevity and other characteristics. They also vary in their toxicity to the target organism and to humans and animals. It is important to be familiar with the product you are using, especially with its relative toxicity. Information about toxicity can be obtained from the product label, from the Material Safety Data Sheet or from an informed source such as the manufacturer or Extension Service representative. Always select the least toxic product available and buy it in the formulation which will cause the least exposure to the applica-

tor. Pesticides should be used only when all sanitation and other preventive measures have been used.

To eliminate an established cockroach infestation in a home or building, first implement those practices explained previously in the Prevention section. The type of chemical selected and the application method used depend on the location and nature of the infestation. No one chemical handles all cockroach problems, but a combination of the various types available may be effective. Select the appropriate combination of chemicals, formulations and application techniques to provide the desired level of control.

Residual sprays. These formulations are oil-based or water-based emulsions and water-based suspensions (wettable powders). They are available in ready-to-use pressurized containers or non-pressurized containers with built-in spray pumps. Residual sprays also can be purchased as concentrates to mix with water before applying with a compressed-air sprayer, plunger-type sprayer or paint brush.

Be careful when using oil-based insecticides; they may stain, dull or damage certain floor tiles, linoleum, painted surfaces, plaster, plastics, houseplants, carpets and carpet backing. Oil-based sprays can create a fire hazard when used near an open flame (pilot lights, gas stoves, furnaces). Water emulsions may stain wallpaper, light-colored carpets, draperies or other materials. They can short out electrical circuits, and are inferior to oil-based sprays on impervious surfaces such as glass or metal. Wettable powders must be frequently agitated in the spray tank, but they leave the most active residues, especially on porous surfaces such as unpainted wood, mortar or concrete block.

Residual sprays are generally easy and fast to apply. The spray should wet or dampen the treated surface; do not allow spray to puddle or run off. When treating for cockroaches, pay particular attention to cracks and crevices. Exposed surfaces, especially those used to prepare foods, should usually not be treated with sprays.

Dusts. Insecticide dust sometimes suffices as the only treatment for cockroaches, but is most often a supplemental treatment. Dusts generally have longer residual action than sprays, but are ineffective if they become damp. Dusts are useful in cockroach control because they can be placed deep in cracks, crevices and wall voids; under refrigerators and furniture; around pipes, tunnels and conduits; on very smooth or very rough surfaces; and in other places not treatable with other formulations. Do not use dusts for treating large surfaces because they leave unsightly deposits. Also, cockroaches avoid heavy deposits and will not walk through thick layers of the material. Use light pressure on the application device to minimize the amount of dust in living areas. Apply dusts as light, even residues that are barely visible.

Baits. Several cockroach baits are sold in ready-to-use containers. They also can be made using a combination of food attractants and a toxicant. If cockroaches will not feed on the bait, the insecticide has no effect. Thus, it is important not to contaminate stored bait with organic solvents, other insecticides, fungicides and fertil-

izers. Baits are usually long lasting and often work well in areas that cannot be effectively sprayed or dusted. Baits are often most useful when used in conjunction with a residual spray or dust. Baits give best results in buildings where there are few alternative food supplies. Always use a sufficient number of bait containers to adequately treat an area where cockroaches are to be controlled. Examine the bait containers frequently to ensure they remain fresh and the bait is not depleted.

Aerosols. Aerosol insecticides may or may not have residual activity. A non-residual spray alone may not provide a high degree of control, but when used with a residual spray or dust, a high degree of control can be achieved. Non-residual aerosols are useful for determining the location and extent of a cockroach infestation. Small amounts of pesticide applied to hidden areas and shelters force cockroaches to evacuate and move across previously treated surfaces. Residual aerosols should be used in the same manner as other types of residual sprays.

Inorganic insecticides. Boric acid and powders of silica aerogel and diatomaceous earth are examples of inorganic insecticides that can be used effectively for cockroach control in homes. These chemicals are low in toxicity to humans and pets, and retain their effectiveness long after initial application. Usually, a longer period of time is required to achieve control, but reapplications are greatly reduced. Apply boric acid, silica aerogel or diatomaceous earth in a light film to cracks and crevices and other cockroach hiding places. Avoid applications to moist or damp areas, especially when using silica aerogel or diatomaceous earth.

Insect growth regulators. Some synthetic compounds mimic natural hormones found in insects. When applied to cockroaches during their early developmental stages, they cause nymphs to molt into sterile adults. Insect growth regulators (IGRs) have low human toxicity, but have long residual effectiveness. For best results they must be applied along with residual insecticides to eliminate existing adults or other non-susceptible stages. Overall population reduction with IGRs usually takes several months.

The insecticides listed in Table 2 are suggested for cockroach control. For a complete listing of insecticide products sold for cockroach control, refer to Extension publication B-1373, "House and Landscape Pests."

Cockroach Control in Apartment Housing

German cockroaches are the most common insect pests for apartment dwellers in Texas. While people living in single family dwellings usually control these cockroaches for long periods of time on their first attempt, apartment dwellers usually find cockroach control to be a constant battle. Many Texans even feel they must live with "a few roaches" most of the time. This does not have to be the case.

Cockroach control in multi-family housing requires that residents understand certain key factors about cockroach behavior. Effective control procedures require that all

residents in the structure increase their general sanitation and exclusion control efforts. Alternatively, if the apartment management or landlord takes responsibility for cockroach control, they should require all residents to participate in the program.

German cockroaches frequently move between apartments using construction features such as shared electrical or plumbing services. In this case, insecticide application causes cockroaches to move out of treated apartments into adjacent units. This is why apartment dwellers may continue to have cockroach problems despite their sanitation efforts and the use of normally effective insecticide applications. Your neighbors, the apartment management and the pest control service personnel should understand that control efforts must be coordinated to be effective. Residents should insist that the apartment management and the pest control operator work together (and with neighbors) to design and conduct an effective control program.

Apartment dwellers can caulk cracks and crevices to keep cockroaches out of wall voids. Wall voids and plumbing systems can be treated with insecticide dusts which are effective for long-term control. Also, openings where plumbing and electrical connections enter walls can be caulked or plugged with steel wool or other materials to exclude cockroaches. Along with these extra steps to prevent cockroach movement between apartments, thorough sanitation and careful insecticide application should give effective control within any one unit. Careful, thorough insecticide applications cannot be made in only 2 or 3 minutes per apartment. If this is all the time a pest control service is spending, their efforts will fail. Residents should question their apartment managers about the quality of the pest control work and encourage them to place greater emphasis on this effort.

German cockroach problems may persist despite careful pest control efforts. In some areas, cockroaches have become resistant to particular insecticides. They usually develop their resistance in apartments or commercial establishments where routine insecticide treatments are made over extended periods of time. If you have difficulties controlling German cockroaches, consider changing insecticide products in order to use a different active ingredient. See the insecticide recommendations listed in Table 2 for further information. In recent years, German cockroaches in some regions seem to have become resistant to nearly all of the insecticides listed. Resistance to boric acid has not been noted to date.

Professional Control

If a severe, widespread or difficult cockroach infestation occurs, or if you are in doubt as to proper control measures, secure the services of a licensed professional pest control operator. Always discuss your role in cockroach control, particularly with exclusion techniques and sanitation. These professionals have the insecticides, application equipment and training to do a safe and effective job.

New Developments in Control

Traditional cockroach control in outdoor urban environments depends upon applications of insecticides around window and door frames and garbage containers. However, once insecticides dissipate (which may occur within 2 days under hot, humid, summer conditions), cockroaches may reinfest the premises, which necessitates additional chemical treatment. Entomologists at Texas A&M University are seeking solutions to this endless pattern of reapplication by learning more about cockroaches in urban areas. Entomologists with the Texas Agricultural Experiment Station are conducting research on cockroach habits, preferred habitats, population dynamics and interactions with natural enemies. Control techniques such as habitat modification, trapping, use of natural biological control agents and selective insecticidal treatments are being developed. These methods will be combined into environmentally sound control programs which can be used both indoors and outdoors.

Insecticide Safety Precautions

The Federal Environmental Pesticide Control Act of 1972 in part prohibits the application of any pesticide in a

manner inconsistent with its labeling. This means that a pesticide cannot be used unless it is registered for the specific pest. Consequently, some chemicals formerly used by homeowners and pesticide applicators can no longer be used legally.

Insecticide labels are subject to change, and changes may have occurred since this publication was printed. County Extension agents and Extension entomologists are notified as these changes occur.

The pesticide APPLICATOR is always responsible for the effects of pesticide residues as well as problems caused by residues that drift from the application site to other property. Always read and carefully follow instructions on the product label.

When using pesticides, always avoid prolonged chemical contact with skin. Wash exposed skin areas with generous amounts of soap and water. Launder clothing worn during application in hot water using phosphate detergent. Do not contaminate food, dishes, utensils or food preparation areas with insecticide. Any contaminated food should be discarded, and dishes and utensils should be thoroughly washed.

Table 2. Suggested insecticides and formulations for cockroach control.		
INSIDE THE HOME*	BAITS	OUTSIDE AREAS
Allethrin AE	Boric Acid B	Carbaryl S
Bendiocarb D	Propoxor B	Chlorpyrifos S,G
Boric Acid D, AE	Sulfuramid B	Fenvalerate S, AE
Chlorpyrifos S, D, AE	Chlorpyrifos B	Malathion S
Cyfluthrin S	Hydramethlynon B	Permethrin, S
Diatomaceous Earth D		
Deltamethrin		
Dichlorvos AE		
Fenoxycarb AE		
Fenvalerate AE		
Hydroprene AE		
Malathion S		
Methoprene S, AE		
Permethrin S, AE, D		
Phenothrin AE		
Propoxur AE		
Resmethrin AE		
Sumithrin AE		
Synergized Pyrethrins S, AE		
Tetramethrin AE		
S = spray; AE = aerosol; D = dust; B = bait; G = granules		
*Some products will have varying combinations of several active ingredients.		

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