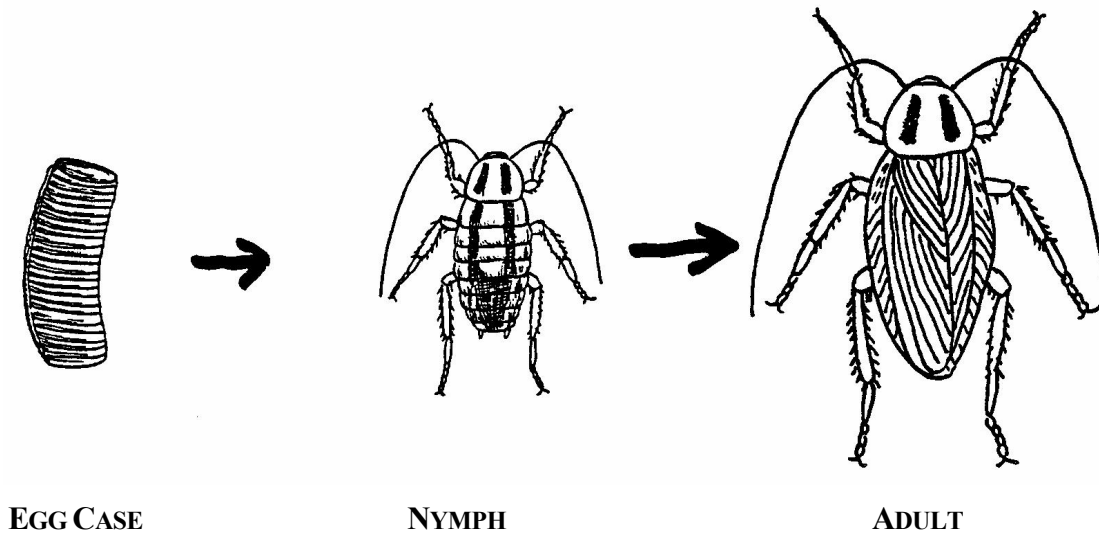


COCKROACHES



LIFE CYCLE OF THE GERMAN COCKROACH

I. HABITS

Cockroaches are tropical insects, although some species have been able to adapt to different climates and are easily maintained by humans in cities around the world. They are known to mechanically and biologically spread many types of bacteria, viruses and parasites from garbage, sewers and other places they inhabit to the food of humans. Cockroaches and their cast skins, egg cases and feces are known to cause allergic reactions in some people. Sensitization to cockroach allergens has been implicated as a direct cause of bronchial asthma, as evidenced by the increase in the incidence of childhood asthma, especially in lower socioeconomic conditions where cockroach densities are higher.

Cockroaches are flat, quick insects that hide easily in cracks and crevices. When at rest, the head is hidden under the pronotum. The head bears long antennae, eyes and mouthparts. Cockroaches have chewing mouthparts and can chew through paper, cloth or cardboard to reach available food such as sugar, candy, meat, milk products, bread and glue. They will also eat bookbindings, dead insects, human and animal wastes and all kinds of garbage. They contaminate the materials they contact with their feces. Because they are active mostly at night, they may not be noticed until their numbers have grown considerably.

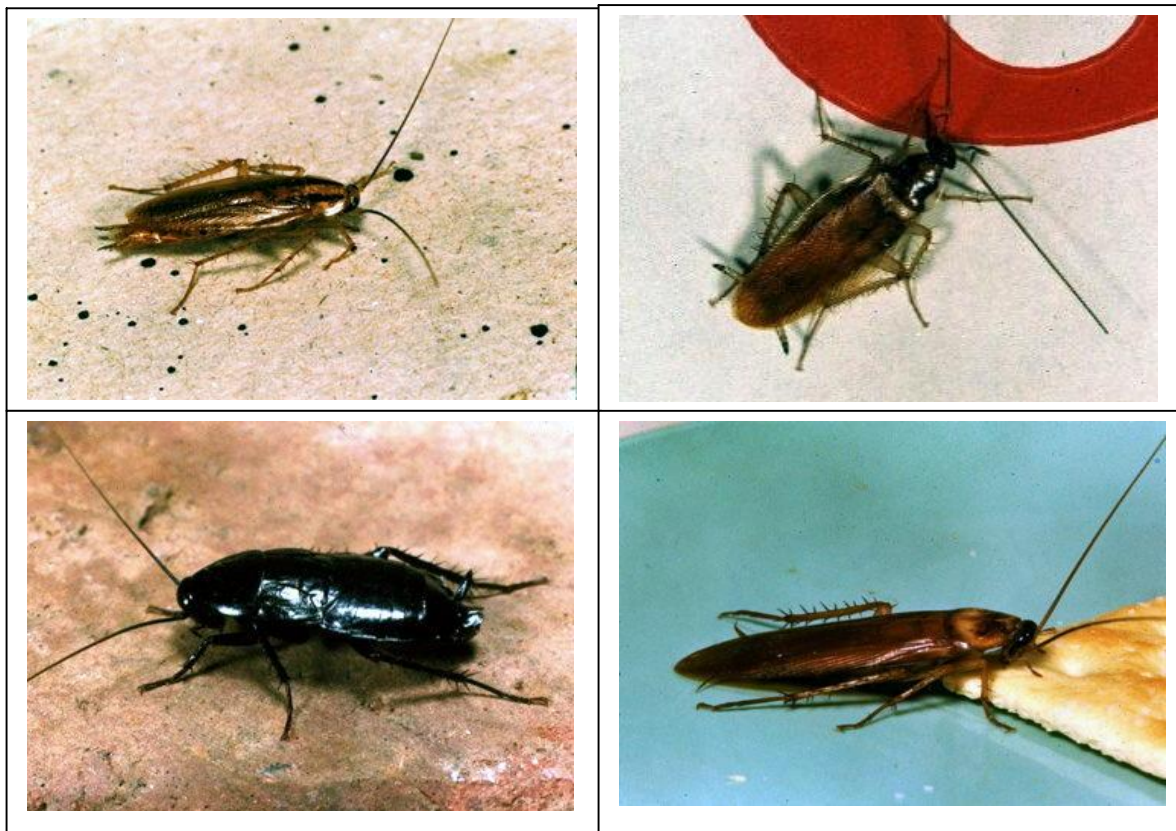
Cockroaches exhibit gradual, or incomplete, metamorphosis. The female produces an egg case (ootheca) a few days after mating. Each egg case contains 14 to 48 eggs, depending on the species. A German cockroach can produce four to eight oothecae in her lifetime, while the American cockroach can produce as many as 90. Most cockroaches drop or glue their egg cases in sheltered places such as cracks and crevices, except for the German cockroach that carries the attached egg case until a few hours before hatching. The nymphs that hatch from the egg case resemble very small adults, but lack wings and reproductive organs. They feed on available food and shed their skins (molt) several times in the few months it takes them to grow into adults. Adult cockroaches may live from only a few months

to a year or more, but in that time can cause large losses to residents and food service businesses by eating and contaminating food.

II. COCKROACH IDENTIFICATION

More than 3500 species of cockroaches are known worldwide, but the vast majority of these has remained in its natural habitats in woods, tropical forests or deserts, and has not inconvenienced humankind. A few species have taken up with humans and their environment and have become serious pests, as described above.

Four species of cockroaches cause problems in New Mexico (clockwise from top left): German, brown-banded, American and Oriental. Despite their common names, all four probably originated in Africa.



Photographs courtesy of Clemson University Cooperative Extension Service, <http://entweb.clemson.edu>

- A. The **German** cockroach (*Blattella germanica*) is a small species, measuring only 1/2 to 3/4 inch in length, and is pale brown with two distinct lengthwise dark bars or stripes on the pronotum. Both sexes have fully developed wings as long as the body. The female German cockroach carries the egg case attached to her abdomen until a few hours before the eggs

hatch. This species' preferred habitat is a warm, moist area with direct access to plenty of food and water; thus it is most commonly found in kitchens and bathrooms. In some areas, it is highly resistant to some insecticides.

- B. The **brown-banded** cockroach (*Supella longipalpa*) is a recently introduced form in the USA, having spread from Florida all over the country and into Canada in the 20th century. The brown-banded is a small species, like the German, but its wings and abdomen are marked by dark brown crossbands on a lighter tan color. The male's wings are longer than its body, but the female's wings are shorter and expose the stout abdomen. This species prefers the living rooms of dwellings. They may be found in high places and in furniture and appliances such as television sets, radios and clocks. Offices, stores, hospitals and homes are easily infested by this species.
- C. The **Oriental** cockroach (*Blatta orientalis*) is a black, inch-long roach found in cooler climates around the world. The male has wings almost as long as the abdomen, but the female's wings are so small as to give the appearance of a wingless form. The Oriental cockroach is also called a "water bug" because of its preference for cool, dark, moist, poorly ventilated areas in buildings. It can be found in sewers, basements, crawl spaces, and under sinks and cupboards; it rarely climbs above the basement and lower floor of a building.
- D. The **American** cockroach (*Periplaneta americana*) can reach two inches in total length, although most adults average about an inch and a half. It is reddish or dark brown and has fully developed wings in the adult stage. Adults tend to live a long time -- up to a year or more. Females have been known to reproduce parthenogenetically (without mating with males). The American cockroach prefers to inhabit warm, humid areas, being common in kitchens, food storage areas, basements, boiler rooms and sewers. It is a fair flyer, though it prefers to run in short dashes when alarmed. It does quite well in outdoor situations, as do many related species of *Periplaneta* the world over.

III. COCKROACH CONTROL

Prevention is the key to cockroach control. This involves keeping them out of buildings and discouraging infestations by eliminating harborage areas and through good sanitation. Chemical control of cockroaches is effective only when these preventive measures have been employed. (Portions of this section were obtained from the University of Florida Cooperative Extension Service publication: "Least Toxic Methods of Cockroach Control" at <http://edis.ifas.ufl.edu/IG105> and from the University of Florida and the American Mosquito Control Association Public Health Pest Control website at <http://vector.ifas.ufl.edu/>).

EXCLUSION

1. Cockroaches migrate easily through multi-unit dwellings via plumbing and electrical connections. Sealing gaps around plumbing, wall outlets and switch plates will prevent cockroaches from migrating from infested units to others.

2. Keep doors and windows closed and screened. Also, caulk cracks and gaps that may allow peridomestic cockroaches to invade from outdoors.
3. Peridomestic cockroaches frequently enter homes by coming up through dry drain traps. Periodically run the water in spare bathrooms, utility tubs and toilets to keep the drain trap filled and off limits to cockroaches. A fine mesh screen over floor sinks excludes Oriental cockroaches that may enter through the sewer pipe.
4. Fiberglass window screen over vent pipes on the roof will prevent cockroaches from migrating up from sewer connections and gaining access to attics and windows.
5. Groceries, produce and other packaged food products may have been stored in infested locations before they were purchased. Make an effort to visibly scan all grocery items for cockroach evidence before putting them away.
6. Children can transport cockroaches from school to home in book bags and lunch pails. Inspect these items on a regular basis.

SANITATION

Eliminate food and water resources:

German cockroaches can remain alive for approximately 2 weeks with no food or water and for 42 days if only water is available. Cockroaches can survive on tiny amounts of food such as crumbs, grease or food residue. During periods of drought the incidence of peridomestic cockroaches indoors will often increase as the large cockroaches invade structures in search of moisture. It is important to eliminate all sources of moisture that contribute to cockroach survival.

1. Indoor trash containers should be emptied frequently and kept clean both inside and out. Plastic bags lining trash containers can be kept closed with twist ties. This will prevent cockroaches from being attracted to the garbage area.
2. Filled indoor garbage containers should be removed from the home or food service establishment immediately and placed in outdoor containers with tight fitting lids or dumpsters.
3. Keeping the area around dumpsters or other outdoor garbage storage areas clean and free of debris will also prevent peridomestic cockroach infestations in the area.
4. Frequent emptying of sink strainers and running of the garbage disposal will prevent food buildup in the sink drain.
5. Washing dishes immediately after a meal will prevent cockroaches from consuming food residue on dishes. Unwashed dishes are a major source of food for German cockroaches.

6. Kitchen appliances (toasters, toaster ovens, microwaves, ovens, stoves, and refrigerators) should be kept clean and free of food particles and grease. Additionally, the areas underneath and behind these appliances should be kept grease- and crumb-free.
7. If pets are present, dry food should be kept in sealed containers. Do not leave food out all the time. Feed your pet at particular times and clean up after every meal.
8. Food storage areas should be well lit and food items stored above the floor. All foods products should be resealed after opening, stored in plastic snap-lid containers or kept in the refrigerator.
9. Shelves should be kept clean of food particles; do not use shelf paper, as that provides a hiding place for cockroaches. Regular cleaning of food storage areas and shelves not only eliminates spilled or scattered food but also disrupts cockroach populations that may be using the area as a harborage.
10. Regular sweeping/vacuuming of floors and furniture where people eat (i.e. kitchen table or in the living room in front of T.V.) helps to eliminate cockroach food sources.
11. In restaurants, leaking syrup under soda fountains provides both nutrients and water. This area should be cleaned frequently.
12. Tighten loose pipes, patch plumbing leaks and replace used washers in the kitchen sink and bathroom areas. Outdoor water spigots and sprinklers should also be checked for drips and leaks.
13. Water left in the sink or bathtub after dish washing or bathing also provides moisture for cockroaches. Drying out sinks and bathtubs after use eliminates these sources.
14. A common source of moisture is condensation under the refrigerator. This area should be frequently wiped dry or, if possible, place a pan under the appliance to collect water. The collection pan should be emptied frequently. Condensation on pipes (under the sink or in wall voids) is also a problem. Insulate these pipes if possible.
15. Pet water dishes and aquariums are also sources of moisture. Empty pet water dishes at night when cockroaches are foraging but the pet is indoors or asleep. Aquariums should have tight fitting lids or screens to prevent cockroach entry.
16. Be careful not to over-water indoor plants, because excess water is available to cockroaches.
17. Glasses, cups and soda cans containing water or liquid residue are common sources of moisture for cockroaches. Be sure not to leave these containers in bedrooms, sinks, on counter tops or other areas. Rinse and invert cups and glasses to dry immediately after use and dispose of soda cans in trash containers.

18. Steps should be taken to eliminate places where water collects outdoors (tires, cans, tree holes etc.). This will not only eliminate cockroach moisture sources but also mosquito breeding habitat.

Eliminate harborage:

The third critical element for cockroach survival is harborage. By nature, cockroaches avoid open, well-lit areas with frequent air movement. They prefer dark, warm cracks and crevices. Excess clutter provides numerous locations suitable for cockroach habitation. The elimination of these harborages (clutter) is important in controlling infestations.

1. Adult cockroaches can fit into cracks only 1.6 mm wide (about 1/16 of an inch). Any small gap or hole that leads to a void is a prime cockroach harboring area. Cracks and crevices of this kind should be sealed with caulking.
2. Removing clutter (boxes, bags, clothing, toys, food, books, papers etc.) eliminates cockroach harborages and breeding areas. It is essential to keep all areas of the home, especially the kitchen and bathroom, uncluttered and free of useless debris.
3. Outside, create a "hostile zone" around the perimeter of the building with gravel and removal of weeds, debris and trash.
4. Stack firewood far away from the house, as this is a prime harborage area for peridomestic cockroaches.
5. Filling in tree holes with cement also eliminates peridomestic cockroach harborage.
6. Keep shrubbery and ornamentals well trimmed.

KILLING METHODS

Trapping/physical removal: Sticky traps are used to monitor and reduce cockroach infestations. Sticky traps can aid in the determination of how severe an infestation is, which helps to determine what further control measures may be necessary. Additionally, any cockroaches caught in sticky traps are removed from the population, resulting in a reduction of the infestation. However, cockroaches cannot be eliminated through the use of sticky traps alone.

After monitoring the severity of a cockroach population through proper placement and use of sticky traps, physical removal of cockroaches will further assist in the reduction of a cockroach population. Physical removal may be accomplished through the use of specially designed vacuums equipped with high efficiency particulate air (HEPA) filters. It is important that a HEPA filter be used when vacuuming to trap cockroach particulate debris. Cockroaches are a tremendous source of allergens and the proteins found in their cast skins and dead bodies can create both asthma and allergies. A well-designed vacuum with HEPA filtering system can dramatically reduce or eliminate the potential for blowing particles from cockroach harborage areas out into the open.

Depending on the size of an infestation, efficient vacuuming can be a tremendous aid in the reduction of a cockroach population.

Baits: Insecticidal baits have proven quite effective in the control of cockroach pests, and have replaced broadcast spraying of baseboards and surfaces. Proper bait placement involves precision targeting for specific cockroach pests. For German cockroaches, baits can be placed exactly where they are most effective, especially in foraging and harborage areas. Current indoor bait formulations are applied as pastes, gels or bait stations. The bait station is one of the more popular application methods for cockroach baits. Insecticidal paste and gel formulations are injected into cracks and crevices or into wall voids to attain maximum exposure. Because of the way they are applied, baits have low risk to people and pets.

The baits in use today provide both primary and secondary kill of cockroaches. Through primary kill there is direct kill of the cockroaches that feed on the bait. Because current baits are often slow acting, the cockroaches that die from direct kill do so after they have returned to harborage areas, often after they have eliminated some of the bait through their feces. The fecal material and the dead cockroaches themselves are then consumed by other cockroaches, which are then also killed by the active chemical ingredient of the bait.

Insect Growth Regulators: Insect Growth Regulators (IGRs) are a group of compounds that disrupt the normal growth and development of insects. The IGRs are considered reduced-risk tools. They generally have very low toxicity to mammals because they act by disrupting hormonal processes that are specific to insects.

IGRs that mimic the juvenile hormones of insects are called juvenile hormone analogues (JHAs). JHAs interfere with the proper development of last instar cockroach nymphs. Instead of the nymphs molting into reproductive adults they molt into "adultoids", which often have twisted wings and are sterile. Because the adultoids are unable to reproduce, over time, the cockroach population begins to decline. JHAs are an effective method of long term German cockroach control. However, because JHAs eliminate reproduction but do not kill existing cockroaches they are very slow acting (from four to nine months to achieve control). JHAs are often combined with residual insecticides. In this manner most of the population can be eliminated quickly by the insecticide, and cockroaches that survive the insecticide treatment are then sterilized by the JHA.

Insect Growth Regulators are available in spray formulations or point source dispensers (IGR on filter paper contained in a permeable plastic station transmigrates throughout the infested area).

Dusts: Inorganic dusts, such as silica gel and boric acid, have been used frequently for indoor cockroach control. The dusts are applied with a squeeze-bulb duster into cracks and crevices under sinks, stoves, behind refrigerators, along baseboards, in electrical outlets, cabinets and wall voids. Silica gel is simply finely ground sand or glass that adheres to and absorbs the protective waxes on the cockroach cuticle, resulting in the death of the cockroach from dehydration. Boric acid is a stomach poison that is picked up by cockroaches walking across dusted areas. The boric acid adheres to the cockroach cuticle so when the cockroach grooms itself it ingests the boric acid and soon dies.

Chemical sprays: Crack and crevice treatment is the most effective way to apply chemical sprays. Cockroaches spent 80% of their time at rest in cracks and crevices. Most residual sprays used now are emulsifiable concentrates. Pyrethrins are designed for quick knockdown of roach populations by driving them from their hiding places and killing them quickly. They have little or no residual effect when used alone. In all cases, read the label for the correct application method, particularly when using in a food service or processing establishment.