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Cockroaches

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What You Should Know

• There are 4 species of cockroaches that commonly infest structures in Utah.

• The cockroach species infesting your home or apartment will determine your control strategy.

• Cockroach control requires an Integrated Pest Management (IPM) approach, including altering the environment, eliminating food, water, and entry ways, monitoring, baits, insecticides, and more.

• Some cockroach populations are resistant to, or avoid insecticidal sprays and baits commonly used for control.

• Baits and inorganic dusts (i.e., boric acid), when used with non-chemical tactics, are the best insecticidal options.

• If applied near baits or traps, pyrethroid-based insecticides can disrupt a baiting/monitoring program by repelling cockroaches.

• Cockraoches can spread human pathogens and are a major source of allergens.

Introduction

Cockroaches are one of the most difficult structural pests to eradicate because of their ability to hide, rapid reproduction, and resistance to and avoidance of many commonly used insecticide sprays and baits. Using an integrated pest management (IPM) program can greatly increase the possibility of successful control. There are 4 cockroach species that commonly infest structures in Utah, each with a specific biology; identify invading cockroaches before you develop an IPM plan. Proper identification of any pest will allow you to understand its biology, and use it against itself!

Of the almost 4,000 cockroach species described worldwide, about 4 of them are considered pests in Utah. Cockroaches are unwelcome pests because of their dirty habits. Most house-dwelling cockroaches hide and reproduce in warm, humid places like sewers and garbage receptacles. From these areas, they can pick up food spoilage organisms and human pathogens. At night they come into areas where food and water are accessible, like the kitchen and bathroom, and spread diseases they carry on their body, or via defecation or regurgitation. They become a health risk when they walk on eating utensils, plates, cups, counter tops, etc. Some proteins produced by cockroaches are a major source of human respiratory allergens.

Fig. 1. German cockroach (*Blatella germanica*) snacking on a potato chip.[1]

This fact sheet covers the biology and management of the 4 commonly submitted pest cockroaches in Utah: 1) German cockroach (*Blatella germanica*), 2) American cockroach (*Periplaneta americana*), 3) Oreintal cockroach (*Blatta orientalis*), and 4) brownbanded cockroach (*Supella longipalpa*). The Cuban (*Panchlora nivea*) (Fig. 2), field (*Blatella vaga*) (Fig. 3), and wood cockroaches (*Parcoblatta spp.*) (Fig. 4) have also been found in Utah, but will not be discussed in this fact sheet.

Biology

Cockroaches develop via incomplete metamorphosis, meaning the immatures (nymphs) look like the adults, only smaller and without wings. They inhabit the same areas

Fig. 2. Cuban cockroach (*Panchlora nivea*) adult[2].

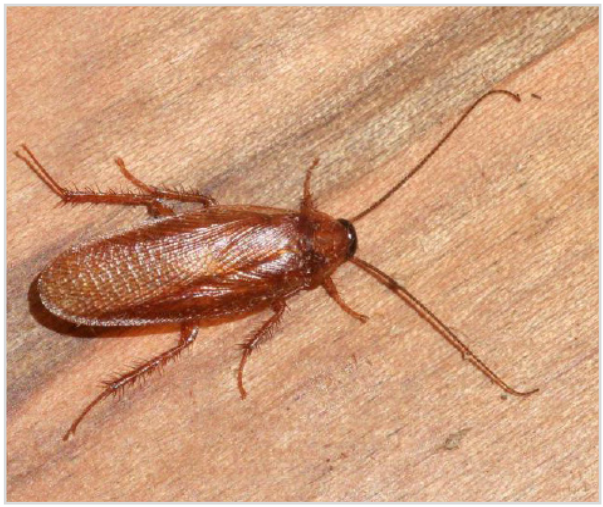

Fig. 4. Wood cockroach (*Parcoblatta spp.*) adult[4].

and feed on the same food items, however, immature cockroaches frequently feed on adult feces while in hiding. The number of developmental stages a roach goes through depends on the species, sex, environmental conditions, and availability of food and water.

Eggs are laid in cases called oothecae (Fig 5). The size and shape of the ootheca varies by species, from about 4 mm to over 10 mm. The number of eggs per ootheca also varies from 13 to 40, depending on the species. A female may deposit her ootheca after only a few hours of development, or whe may carry it for an extended period of time; sometimes it is not deposited until just before hatching. Oothecae may be deposited in various locations, also varying by species. The actual sizes of the ootheca and the adults can be viewed in Figure 13 on page 8.

Nymphs are smaller, wingless versions of the adults, but will often change colors/patterns with every molt (shedding of exoskeleton). Some adults have fully functional wings, while others have underdeveloped wings, or no wings at all. This varies by species and sometimes by sex within a species.

Most cockroaches prefer humidity and warmth, but one, the Oriental cockroach, prefers cooler areas with high humidity. They can feed on almost everything from grease stains to pet food, to the glue holding your furniture together! All stages of cockroaches spend about 75% of their time hiding together in small cracks and crevices around the house.

Cockroaches communicate through chemical cues (pheromones). Pheromones can be excreted through the body (cuticular) or via the feces. Aggregation/sex pheromones cause cockroaches of the same species to be highly attracted to a particular female, male, or site where food and water are plentiful. Pheromones for some cockroaches have been synthesized in a lab and may be used in a control program to attract roaches to a trap, or into an area treated with an inorganic dust (see

Fig. 3 . Field cockroach (*Blatella vaga*) nymphs and adults[3]. Field cockroaches are similar in appearance to German cockroaches.

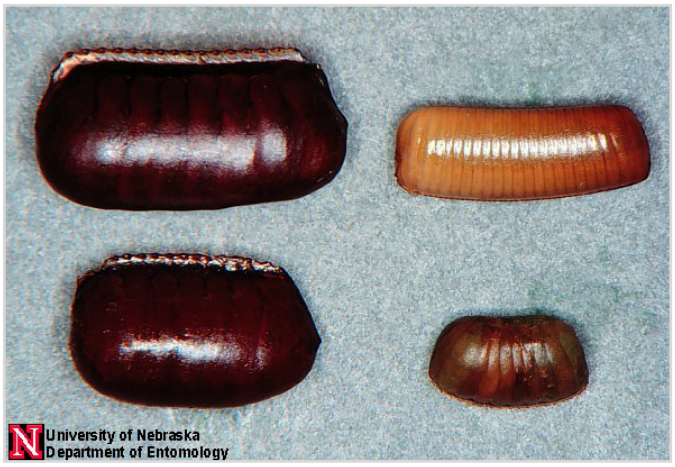

Fig. 5. Cockroach oothecae (egg sacs). Top left: Oriental; top right: German; bottom left: American; bottom right: Brown-banded[5].

Utah's Common Structure-Infesting Cockroaches

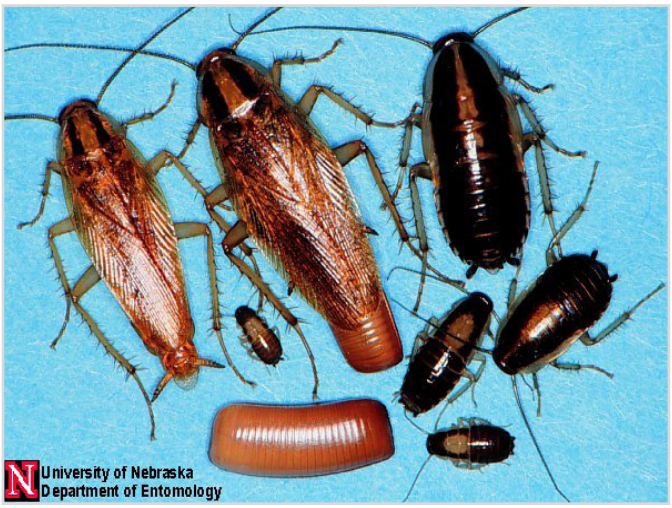

Fig. 6. German cockroach (*Blatella germanica*) life stages[5]. From top left, clockwise: male, female with ootheca (egg sac), immature stages, ootheca.

Fig. 7. Adult American cockroach (*Periplaneta americana*)[5]. From top left, clockwise: male, female, ootheca (egg sac), immature stages.

The German cockroach (*Blatella germanica*: Blattellidae)[1]

Description (Adults): Smaller (1/2 to 5/8" long); light brown with 2 black, longitudinal parallel lines behind the head (pronotum) (Fig. 6). Infrequently fly.

Males: Similar in appearance to female, but smaller and lighter in color.

Females: Similar to male, but slightly darker with a broader thorax (middle section).

Immatures: Stages 1 and 2 are dark brown with a light colored patch over the thorax. Immatures can stay in hiding and live off the adults' feces.

Eggs: Ootheca is about 1/4" to 3/8" long, two-toned brown/yellow in color, and contains 30 to 40 eggs; females produce 6 to 8 oothecae throughout their life. Ootheca is normally carried with the female until 1 to 2 days before hatching.

Life Cycle: Development from egg to adult can range from 54 to 215 days (average 103 days). Immatures molt from 6 to 7 times before reaching adulthood. Immatures will remain inactive and in hiding for 3 days before molting.

Key Habits: Prefer to hide on porous surfaces in small cracks near warm, humid/moist places such as kitchens and bathrooms, but anywhere food or snacks are consumed (game rooms, etc.). Feces contain aggregation pheromones that will attract other roaches; do not survive well outdoors.

American cockroach (*Periplaneta americana*: Blattidae)[1]

Description (Adults): Large ($1\frac{3}{8}$ to $2\frac{1}{8}$" long); brown, except for the lighter borders on the shield behind the head (Fig. 7).

Males: Wings extend slightly beyond the rear. Lifespan from 102 to 588 days (average 200).

Females: Winged, but wings slightly shorter than males. Lifespan from 102 to 588 days (average 440 days at room temperature). Produces about 9 to 10 oothecae over her lifespan.

Immatures: Resemble the adult in color but smaller and wingless.

Eggs: Ootheca about 3/8" long; length about 1.5 times width. There are 14 to 16 eggs per case. Deposited in various locations a few hours to 4 days after development (especially around food sources and moisture).

Life Cycle: Development from egg to adult can range from 168 days to over 2 years depending on temperature. There are from 10 to 13 immature stages.

Key Habits: Frequently found in commercial food preparation locations and in sewers, but can live in homes, apartments,etc. Can coexist with German cockroaches. Does not survive well outdoors.

Fig. 8. Adult male Oriental cockroach (*Blatta orientalis*)[5]. From top left, clockwise: female (largest), male, immature stages, ootheca (egg sac).

Oriental cockroach (*Blatta orientalis*: Blattidae)[1]

Description (Adults): Large (1 - 1 1/4" long); mostly dark brown to black and shiny (Fig. 8).

Males: About 1" long, smaller than female. Wings cover about 75% of the body.

Females: About 1 1/4" long; wings reduced to small wing pad-like structures on the thorax.

Immatures: Light brown in color becoming progressively darker with each molt.

Eggs: Ootheca 3/8" long, initially red/brown, transforming to black. There are about 16 eggs per egg case. Ootheca is usually deposited within 1 to 1.5 days of development, glued to surfaces near food and water.

Life Cycle: Development time from egg to adult ranges from 206 to 800 days (average 575 to 602, respectively, for males and females) depending on temperature. Adult males live about 160 days while females live from one month to about 180 days.

Key Habits: Prefer moist, humid locations, but can live outdoors under mulch, vegetation, rocks, patios, etc., tolerating extended periods of cold temperatures. Will move indoors during hot, dry periods, preferring cool basement areas near water (bathrooms, drains) and crawlspaces.

Fig. 9. Adult male Brownbanded cockroach (*Supella longipalpa*)[5]. From top left, clockwise: immature stages, female, ootheca (egg sac), male.

Brownbanded cockroach (*Supella longipalpa*: Blattellidae)[1]

Description (Adults): Small (about 1/2" long); brown, with light band behind the pronotum (Fig. 9). Wings progressively lighter from base to tip. Bell-shaped pattern on pronotum.

Males: Lighter in color than females, wings completely cover body; readily flies. Body tapers less from rear to head than females. Lifespan from 131-315 days (average 161 days).

Females: Winged, but wings slightly shorter than males, not completely covering whole body; cannot fly. Lifespan comparable to males. Can produce up to 14 oothecae during her life.

Immatures: 1st and 2nd stages are pale brown to cream colored. Third-8th instars have noticeable, pale colored horizontal bands on back, and black bell shape on pronotum.

Eggs: Ootheca about 1/4" long; length less than 2 times width. There are 13 to 18 eggs per case. Deposited within 24-36 hours of development in various locations, especially the underside of furniture, picture frames, walls, and ceilings. Hatch in about 50 days.

Life Cycle: Development from egg to adult ranges from 90-276 days depending on temperature (average is 161 days). There are 6-8 immature stages.

Key Habits: Frequently found in warm locations around 80°F, especially ceilings, behind picture frames, on the sides and undersides of furniture, small and large appliances that emit heat, etc. Prefer higher areas on walls (e.g., > 5'). Does not do well outdoors.

Management Options

General Control Options

Effective cockroach control involves the simultaneous use of multiple control tactics. This approach, called integrated pest management (IPM), will provide short-, and long-term control, reducing/eliminating the need for continual insecticide applications. The first step to a successful management plan is to have the cockroach(es) identified. Proper identification will provide critical information concerning the roach's biology and preferred habitat within your house, allowing the formulation of management strategies specific to your target pest.

-Inspections

Inspections include looking for live/dead roaches, feces, cast skins, and empty egg cases. Look in warm areas of high humidity, where food and water are readily available. Make sure to check areas like planters, pet dishes, fish tanks, and areas where condensation forms such as under the fridge/freezer.

Fig. 10. Adult, nymph, and ootheca stages of the German Cockroach (*Blatella germanica*) on a sticky trap[6].

-Monitoring

The goal of monitoring is to identify areas of concentrated cockroach populations and major harborage sites. To monitor, sticky traps without pheromones should be used (Fig 10). Pheromones will attract cockroaches from longer distances, and won't allow determination of which traps are located closer to populations. Thus, you will not be able to target control tactics to trouble areas. Check traps weekly and target bait and dust treatments to harborage areas near traps with high catch. The list below contains suggestions for trap placement[1]:

- beside or behind the toilet
- under the sink in the bathroom
- beside the shower or bathtub
- under the kitchen sink
- behind, under, or beside the refrigerator
- beside, under, or behind the stove
- in the back of each kitchen cabinet
- beside or under the water heater
- behind or beside the washing machine
- behind or beside the automatic dishwasher

-Roach-proofing

Successful cockroach management starts with eliminating entryways into the home. Cockroaches can come in from outside, or in bags/boxes, etc. brought into the home. Favorite entry ways are under doors, through cracks in the foundation, or along sewer/plumbing pipes/drains. To minimize roaches coming in from outside, use the following tactics:

- seal all entryways and hiding places 1/16th" or greater with silicone caulk. This includes every crack, gap, hole, space on the interior or exterior of the house.

- seal all areas where pipes and electrical wires come into the house, especially in the kitchen, bathroom, and basement

- install door sweeps or weather stripping on all windows and doors leading to the garage or outside, including the main garage door

- clean up all clutter and dispose of unnecessary items that may harbor cockroaches

- thoroughly examine items brought into the home from infested cockroach areas, grocery stores, storage areas, etc

-Change the environment

Cockroaches need moisture, food, and shelter to survive. Cleanliness and attention to minimizing available moisture and food sources are critical aspects to any cockroach management program. To make cockroach habitat inhospitable, try the following techniques that eliminate all sources of water, food, and shelter:

- fix all leaky faucet fixtures, pipes, drains, etc.

- dry sink/bath/pots/pans/dishes/etc. with a towel after every use

- do not store moisture saturated dish rags/sponges, etc. where roaches can access them

- empty the drip tray under frost free freezers weekly, and dry before replacing

- use screen to block access to faucets and drains

- use a dehumidifier in areas of excess moisture; empty

the unit frequently

- store food in air-tight, plastic containers

- do not leave food out overnight, including pet food, crumbs, etc.

- vacuum/wash all areas where food is made or consumed, including crumbs, grease stains on range, oven and walls, and areas where food accumulates

- remove unnecessary clutter from the home, especially cardboard, piles of paper or bags, wood, etc.

Non-Chemical Control Methods

If you don't like using insecticides in your home, there are non-chemical control methods available. Depending on the level of infestation, these tactics may or may not eradicate roaches, and should be used in conjunction with the previously mentioned control techniques, or to supplement a chemical control program.

- passive or pheromone trapping

For light infestations, sticky traps with or without a pheromone lure can be placed in areas where roaches have been seen or detected during monitoring, or in prime roach habitat (kitchen and bathroom). Frequently monitor traps and replace full or old traps.

- temperature treatments

Heat treatments can effectively eliminate roaches if the whole room/apartment can be heated to about 140-150F for 5 to 6 hours. Some pest management firms provide heat treatments for roaches and other pests. Cold treatment can be used most effectively on smaller, infested objects. Items must be sustained below 0^{o}F for several days to kill adults, nymphs, and oothecae.

- vacuuming

A thorough inspection coupled with vacuuming (hose attachment needed) is a quick way to reduce roach populations, however its effectiveness is limited to the thoroughness of your inspection. After vacuuming roaches, immediately remove the bag and freeze or put into a sealed container to prevent roaches from escaping. Vacuuming is best coupled with other control tactics.

- jar traps

Simple traps can be made from a glass jar. Place a glass jar upright on the floor, in a cabinet, or anywhere roaches are located. Glue or tape a paper towel to the outside of the jar so the roaches can climb to the top and fall in. Line the inner lip of the jar with petroleum jelly to keep roaches from crawling out. In the jar place a piece of beer-soaked bread, or another roach favorite, and leave out over night. In the morning inspect the jars. Captured roaches can be killed by screwing on the lid and freezing, or by pouring water and detergent into the jar.

Low-Hazard Chemical Control

Non-chemical control methods alone are not likely to eliminate roaches. Fortunately, there are many safe chemicals available for homeowners, that, when used with control tactics listed above, can provide adequate control of roaches.

- inorganic dusts

Inorganic dusts work like knives or sponges, cutting and/or absorbing the thin waxy layer (cuticle) on the outside of an insect's exoskeleton. Destruction of the cuticle causes an insect to dry out (desiccate) and die. Commonly used dusts include diatomaceous earth (DE), boric acid, and silicates.

Dusts are best applied as a very thin layer, about one particle thick on surfaces; too much dust will repel roaches. To achieve a thin layer, apply with a duster, or purchase a product that comes in a ready-to-use

Fig. 11. Boric acid dust in a ready-to-use "puffer" container[7].

duster container (Fig. 11). Avoid using dusts on exposed surfaces, such as counter tops, where they may be consumed or inhaled by people or pets. Avoid applying dusts on appliance motors, as they can cause damage. Dusts can also be effective wall void treatments because of their long residual effectiveness.

Boric acid can be purchased as a dust (Fig. 11), aerosol, liquid, or in bait form. Boric acid is unaffected by moisture so it can last indefinitely, and works as a stomach poison or desiccant; DE and silicates have to be re-applied on a regular basis, and are desiccants.

Active Ingredient	Chemical Group	Group Name
Abamectin	6	Avermectins, Milbemycins
Boric acid	*na*	Inorganic insecticide
Boron sodium oxide, tetrahydrate	*na*	Inorganic insecticide; disodium octaborate tetrahydrate
Fipronil	2B	Phenylpyrazoles (Fiproles)
Hydramethylnon	20A	Hydramethylnon
Imidacloprid	4A	Neonicotinoids
Indoxacarb	22A	Indoxacarb
Pyriproxyfen	7C	Pyriproxyfen
Silicon dioxide	*na*	Inorganic insecticide; silicates
Tralomethrin	3A	Pyrethroids/Pyrethrins

Table 1. Common active ingredients (AI) found in Utah-registered cockroach baits. AI's are the chemicals in the products that kill the roaches. Rotate chemical groups with different numbers to minimize cockroach resistance or avoidance. Avoided baits should be removed and eliminated from the chemical rotation.

While these products are low-toxicity, inhalation of dusts, especially Silicates, can cause silicosis or cancer. Pesticide-grade products are safest for homeowner use. Dusts should be used by the homeowner/tenant/etc. to supplement any control program.

- insect growth regulators (IGR's)

Insect growth regulators do not directly kill roaches, but will stop immature roaches from developing into adults, or make adults reproductively sterile. Because they don't immediately kill cockroaches, it will take time to see results. Other control tactics can be used in conjunction with IGR's to increase immediate knock-down of roach populations, while ensuring that surviving roaches will be unable to grow or reproduce.

Utah-registered IGR's labeled for use in domestic dwellings include products containing the active ingredient hydroprene (some products may contain additional active ingredients):

- Gentrol Aerosol with IGR
- Gentrol Point Source Roach Control Device
- Prescription Treatment Brand ULD BP-100 Plus Hydroprene IGR
- Raid Plus Egg Stoppers
- Zoecon Gentrol IGR Concentrate

- baits

Baits are the most effective, and safest insecticide options for your cockroach IPM program. The active ingredients in baits are slow acting, allowing roaches ample time to feed and ingest poisons. Some are very slow acting, allowing toxic chemicals to be passed through the feces, on which young roaches can feed.

Baits come in multiple formulations: liquid, gel, granular, and solids. The most popular formulation are the gels, which come packaged in ready-to-use (RTU) syringes, allowing easy application in out-of-the-way places (Fig. 12). Many baits are available for homeowner use, and some are only for licensed applicators. When using baits, be sure to rotate the class of active ingredient in the product. This will prevent roaches from developing resistance to or avoidance of baits.
Table 1 includes the common active ingredients in baits, and the chemical class to which they belong. To rotate classes, look at the active ingredient(s) listed on the front of the product packaging. (The active, and inert ingredients are chemical names followed by a

Fig. 12. Example gel bait in ready-to-use syringe containers[8].

percentage.) Use the information in Table 1 to purchase baits containing the same active ingredient for the first round of baiting. Then choose a bait with a different active ingredient for the second or third round of baiting, and so on. Baiting can be supplemented with the "inorganic insecticides" listed in Table 1. If rotating chemical classes, change all baits at the same time.

To maximize the effectiveness of baits, use sticky traps to locate areas of roach activity, and place baits nearby in protected areas. Observe the baits every few weeks to a month to see if they are still present, and haven't dried out. Replace, or reapply baits as necessary, remembering to rotate chemical classes every few months. If the baits are uneaten, the roaches may be avoiding them. Purchase new baits from another chemical class and try again. Avoidance of baits can be from the active or inert ingredients in the product you are using.

- other insecticides

The Utah pesticide registry contains 64 active ingredients --over 875 products--registered for cockroach control for household/domestic dwelling (indoor) use. Commonly used insecticides come in wettable powder, emulsifiable concentrate, aerosol, and dust formulations.

Because of avoidance and resistance to many of the common chemicals used for roach control, they are not highly recommended. Combining the previously mentioned tactics will provide greater control than traditional insecticides alone. Using only insecticidal tactics will not likely eliminate your roach problem.

Other insecticidal formulations do have their place, however. Insecticidal dusts benefit from the addition of an insecticidal chemical (e.g., pyrethroids) in addition to its physical desiccating properties. When used in hard-to-reach areas like wall voids and under appliances, they can provide longer residual effectiveness than liquid sprays or aerosols. Dusts are best applied as thin layers (one dust particle thick) with specialized dusting equipment, or from ready-to-use containers.

Aerosols can be effective at treating cracks, crevices, and hard-to-reach places like wall voids. Aerosols that contain boric acid or silicates may have a longer residual effectiveness than strictly pyrethroid-based sprays.

Wettable powder and emulsifiable concentrate formulations (mixed with water) may have success as contact insecticides (must physically contact roaches to work), in crack and crevice treatment, but will have little effect as residual products. Currently, the only non-repellent liquid insecticide registered for indoor roach treatments is the active ingredient Chlorfenapyr (group 13)[2].

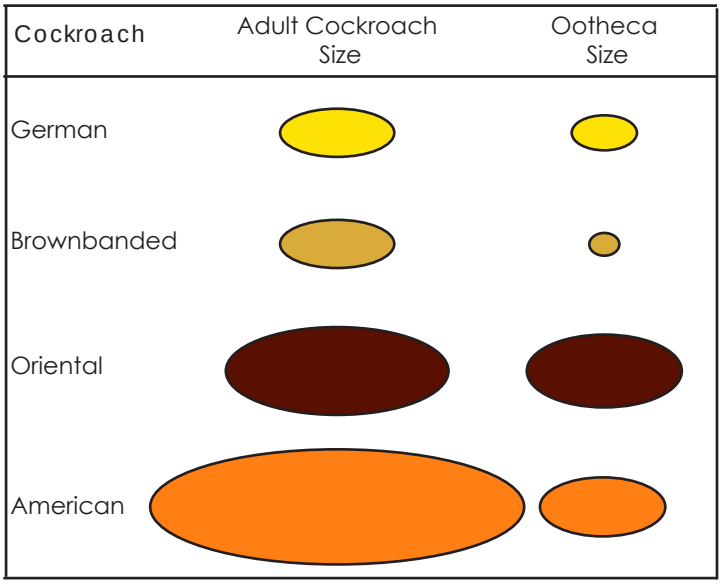

Fig. 13. Approximate adult and ootheca sizes of Utah's 4 common cockroach species: the German, brownbanded, Oriental, and American cockroaches.

Fogging does NOT equal fumigation. Whole structure fumigation with Vikane gas is an effective treatment for roaches. "Bug bombs" and other pyrethroid-based foggers will not kill roaches, but may repel/spread them to new locations. Foggers/bombs are NOT recommended for roach control.

Additional Reading

[1]Ogg, B., Ogg, C., and Ferraro, D. 2006. The Cockroach Control Manual, 2nd edition. University of Nebraska-Lincoln Extension.

[2]Smith, E.H., and Whitman, R.C. 2005. NMPA Field Guide to Structural Pests. National Pest Management Association, Chapter 4.

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