Important Terms for Structural and Public Health Pest Control

Definitions for Pest Control Categories 7 and 8

Category 7 - All applicators using pesticides in, on, or around food handling establishments, human dwellings, institutions such as schools and hospitals, and industrial establishments. This certification covers the use of pesticides in the control of general pests and wood-destroying organisms by all means other than fumigation, and covers all elements of "wood-destroying organism" certification.

Category 8 - State, federal or other governmental employees using pesticides in public health programs for the management and control of pests having medical and public health importance.

Food handling area (www.denver.gov)

A **food handling establishment** is an area or place, other than a private residence, where food is held, prepared, and /or served.

Food areas of food handling establishments include areas for receiving serving, storage (dry, wet, sold, frozen, raw) packaging, edible waste storage, and enclosed processing systems.

Non-food areas of food handling establishments include garage rooms, restrooms, floor drains to sewers, entries and vestibules, locker rooms, boiler rooms, garages, mop closets, and storage (after canning or boiling).

Rodent bait stations in areas accessible to children or pets must be tamper-proof (pestcontroladvice.net)

Bait formulation is a pesticide active ingredient mixed with food or another attractive substance. Insecticide baits are used in and around buildings to control pests such as ants, cockroaches, and flies. Baits are often used to control vertebrate pests such as rodents and birds. They work best when sanitation is good so there are few other food sources to compete with them. Often small amounts are placed in many locations because the target pests move in and out of an area.

Cold fogger (www.rollbackmalaria.com)

Cold foggers use small motors to produce a high power, low pressure air stream with small droplets of insecticide.

- **Advantages:** No fog to cause traffic hazard. Little or no smell. Lower noise level. Some ready to use formulations, no mixing is required.
- **Disadvantages**: Longer application time. Fog barely visible so it is difficult to see where the treatment is going. Higher technical skill of applicator needed and regular calibration required.

Contact treatment is the application of a wet spray to kill insects immediately.

Crack and crevice treatments target hiding places and entryways. (www.bedbugsupply.com)

Crack and crevice treatments are applications of small amounts of insecticides into cracks and crevices where pests may hide or may move in and out of rooms or enter buildings. Dust formulations are often used in these cases. Dusts may quickly lose their effectiveness in humid or wet areas. Do not use them around people with respiratory problems.

General treatments are applied over large areas. (www.tn.gov)

General treatments are applied over broad areas, such as walls, floors, or ceilings, or outdoors.

Non-residual insecticides are those applied to kill insects only during the time of treatment and are applied either as space treatments or contact treatments.

Residual insecticides are products that are applied to kill insects over several hours or longer and are applied as general, spot, or crack and crevice treatments.

Applicators must wear the proper safety equipment when making a space treatment (www.northernpo.co.uk)

Space treatment is the dispersal of insecticides into the air by foggers, misters, aerosol devices, or vapor dispensers to control flying insects and exposed crawling insects. Labels often require that fans and pilot lights be turned off.

Spot treatments are applied to limited areas where pest s are likely to occur but that will not be in contact with food or utensils and will not ordinarily be contacted by workers.

Thermal fogger (www.solutionsstores.com)

Thermal foggers, as the name suggests, use heat in the fogging process. Thermal foggers use heat to vaporize a fogging solution and spray it out in form of a fog. Thermal foggers are equipped with a heat barrel that gets preheated to high temperatures using either a propane gas or electricity depending on the type of a fogger. The fogging solution is in a liquid form, and when it gets pumped into the heat barrel, it instantly is vaporized. This allows the fogger to produce large count of particles in extremely small size, which all together forms a dense cloud of fog.

- **Advantages**: High flow rate allows shorter application time. The dense visible fog is visible so you can see where the application is going. Better dispersion and higher density spray droplets increases chance of hitting flying insects.
- **Disadvantages**: Higher cost of diluent. Strong smell and possible staining. Dense fog is a traffic hazard. Noisy equipment. Smaller particles can drift off target and are easier to disrupt with winds.

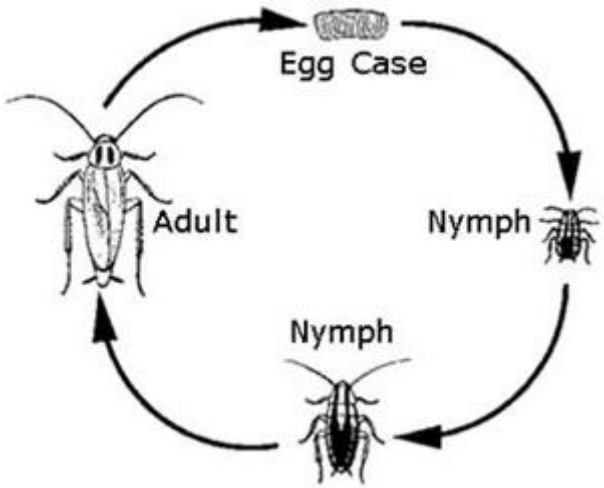
Ultra Low Volume is the application of an insecticide as small particles (0.1 to 50 microns in diameter) in a volume of 0.5 gal or less per acre. For the control of public health vectors and pests, insecticide formulations are dispersed in concentrations of 10-90% active ingredients at flow rates up to 18 fluid ounces per minute. The insecticide must be delivered within certain droplet size parameters to be effective. The optimum droplet size for effective (=90% mortality) mosquito control by space spraying via ground application equipment is 8–15 microns. For comparison, the diameter of a human hair is about 30 microns.

Cockroach Control

Written by: Michael F. Potter and G. Mark Beavers

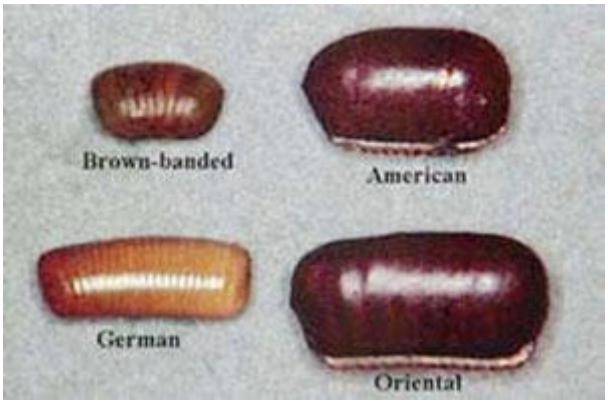
Cockroach Biology

Cockroaches are flattened, brownish, fast-moving insects, with long, slender antennae. They undergo gradual metamorphosis with three life stages: egg, nymph, and adult. Females produce small, brown, bean-shaped egg cases that are left in out-of-the-way places. Several immature cockroaches (nymphs) emerge from each egg case. The smaller, wingless nymphs live with or near adults and feed on the same items. They gradually become larger and develop wings.



Life cycle of a cockroach: gradual metamorphosis (cockroach-pictures.com)

Cockroaches are among the most common insect pests found in buildings. Their presence is repulsive to most people. These insects are especially problematic where food is prepared and sanitation is poor. **Cockroaches move freely from filth to food so they can transfer microorganisms that cause food poisoning and other illnesses.** They may contaminate food, kitchen utensils, and other items, and leave an unpleasant musty odor. In addition, many people are allergic to cockroach excrement and their cast-off skins, resulting in wheezing, watery eyes, and skin rashes.



Eggs of common cockroach species (Univ Mn. Ext.)
Average eggs/case: Brown-banded (14), American (15), German (60+) Oriental (18)

Cockroaches or their egg cases can be brought into buildings in produce boxes, beverage cartons, or grocery bags. American and Oriental cockroaches can crawl through cracks and openings around windows and doors, and through sewer and drain lines. While cockroaches thrive where sanitation is poor, even the cleanest home or restaurant can become infested. Cockroaches readily migrate from one room to another along plumbing and electrical lines and through cracks and openings within walls.

Cockroaches are most active at night. They hide during the day in cracks, crevices, and other dark, secluded areas which provide warmth and humidity. They leave their hiding places at night in search of food. Cockroaches will eat most anything, including food scraps, glue, hair, soap, fabrics, and filth.

Common Pest Species

Female German cockroach carrying egg case.
Note 2 dark bars behind the head (www.pestrx.com)

German Cockroach

The German cockroach is the most common and important public health species. Adults (about 1/2 inch long) are light brown with two parallel dark bars on the shield-like area behind the head. The nymphs are

smaller and darker with a tan stripe down the middle of the back. German cockroaches have the shortest life cycle of the pest species, which allows them reproduce very rapidly. This makes control difficult. **A single mated female can produce an infestation of several thousand new roaches in less than a year.**

German cockroaches require warmth, moisture, and food so they are **most common in kitchens, bathrooms, and eating areas**. They prefer hiding in cracks and crevices under sinks and toilets; beneath refrigerators, ice machines, dishwashers, and stoves; next to trash containers; and inside cabinets and pantries. These cockroaches also congregate in clocks, microwave ovens, and other electronic equipment. When populations are large or food is scarce, they can be found in bedrooms, closets and other non-food areas. German cockroaches spend most of their time hidden in cracks and crevices, but can be quite mobile. They **often travel between rooms or adjoining apartments along utility pipes and wires, and within wall voids**.

American cockroach

American Cockroach

The American cockroach is the **largest species (1-1/2 inches long) found in Kentucky**. This reddish-brown to brown insect has a pale yellow band around the edge of the shield behind the head. Adults have well-developed wings but seldom fly. Nymphs are smaller and wingless. The developmental rate of the American cockroach is much slower than the German cockroach, usually requiring more than a year to develop from egg to adult.

American cockroaches **prefer dark, moist areas, such as in basements and crawl spaces**. They are often found in floor drains, sump pumps, pipe chases, and laundry areas. Other preferred sites are **boiler rooms, steam heat tunnels, and sewers**. During warmer months, this cockroach may be found outdoors and around outbuildings and woodpiles.

Male Oriental cockroach with wings that cover about half of the back.

Oriental Cockroach

The Oriental cockroach is shiny black or dark brown, adults are about 1 inch long. Females have very short wings while males have wings that cover about half the abdomen. Development from egg to adult may require one to two years. it is one of the filthiest cockroach species because it **commonly infests cool, dark, damp places (e.g., sewers and basements) where it feeds on garbage, human waste, and decaying organic matter**. The nymphs and adults are comparatively slow-moving and are generally found at ground level. They often live in floor drains and sump pumps. During warmer months, Oriental cockroaches can live outdoors beneath leaves and plant mulch.

Brown banded cockroach (stopbuggingmenow.com)

Brown Banded Cockroach

The brown-banded cockroach is much less common than the German cockroach but can be an occasional problem. Correct identification is important because it has different hiding places and habits than the German cockroach. The brown-banded cockroach is similar in size to the German but does not have the dark lengthwise stripes on the region behind the head. Instead, there are two transverse yellow bands across the base of the wings. The brown-banded cockroach does not stay near water like the German cockroach, it can be found anywhere in a building. This species is more often found in homes and apartments than in restaurants and other commercial food-handling establishments. **Preferred locations include upper areas of ceilings, walls, cabinets, and closets; behind picture frames and wall decorations; and beneath or inside furniture. It attaches its pea-sized egg capsules to hidden surfaces, such as the undersides of dressers and tables.**

Cockroach Management

Cockroaches may hide in many places so a thorough inspection is essential to locate as many of these sites as possible. During inspections, consider the unique habits and preferred harborage sites of the different species. **A bright flashlight, inspection mirror (for inspecting underneath, above and behind construction elements), and a set of screwdrivers, pliers, etc., to access equipment and other potential hiding places, are essential tools for conducting a professional cockroach inspection.**

Using pyrethrins aerosol to flush cockroaches during an inspection (paramountexterminating.com)

The use of a flushing agent (natural pyrethrins) can also help to reveal hidden pockets of cockroaches. Pyrethrins are highly irritating to cockroaches and force them into the open. Sticky traps and glue boards are useful tools for pinpointing areas where cockroaches may be hiding. Placed monitoring traps at strategic locations, such as beneath sinks or behind refrigerators, and positioned flush against walls, corners, or at the junction of two or more construction elements. When foraging for food, cockroaches prefer to travel along edges and corners where two surfaces meet, rather than in the open.

Cockroach inspections must be organized and methodical. Otherwise, areas harboring cockroaches may be missed. This is especially true when in restaurants and other commercial food handling establishments where there are countless cracks and crevices. Begin at a door or corner and inspect one 3- to 5-foot "zone" (extending from floor to ceiling) at a time. Continue around the perimeter of each room (kitchen, dining area, etc.), inspecting sinks, ovens, dishwashers, cabinets, and any wall-mounted fixtures or equipment. Make periodic "side trips" toward inner portions of rooms, i.e., away from wall areas, to inspect equipment, tables, etc.

Food, moisture, and shelter for cockroaches (sparkspace.com)

Successful cockroach control requires a combination of techniques. Cockroaches flourish where food, moisture, and shelter are readily available so **sanitation is an important step** in preventing problems. Crumbs, spills, grease, and other food debris should be cleaned. Unwashed dishes, kitchen utensils, and food should not be allowed to set overnight. Loose food should be stored in tight-fitting containers, and garbage, cardboard boxes. Paper bags should not be allowed to accumulate. Items in food storage areas should be removed from cardboard boxes and stored off the floor on stainless steel racks. Moisture leaks should be repaired and floor drains routinely sanitized.

Another element of cockroach management is **exclusion or pest-proofing**. This involves the use of sealants such as caulk, foam, copper mesh, or cement. Sealing cracks, crevices, and other openings likely to harbor cockroaches eliminates the need to repeatedly treat these areas with insecticides. It is also a good idea to caulk or plug any openings where plumbing pipes or wires pass through walls or floors. This is especially useful in apartments to reduce migration of cockroaches between adjoining units.

Although good sanitation and exclusion are important, **insecticides are usually required to eliminate a serious existing cockroach problem.** Safe, effective treatments depend the type of insecticides used and how they are applied. Cockroaches spend very little time out in the open. **Focus on finding and treating cockroach harborages rather than exposed surfaces.** Besides being more effective, directed placement of insecticides into cracks, wall voids, and other hidden locations ensures that residues will not contaminate food or food preparation surfaces, or be contacted by children or pets.

Insecticides

A variety of insecticide active ingredients and formulations is available for cockroach control.

Residual insecticides are commonly used. They provide effective control that lasts from a few days to several months. Cockroaches are killed by residual treatments if they remain on a treated surface long enough to absorb a lethal dose of insecticide. Residual insecticides may be formulated and applied as liquid or aerosol sprays, dusts, granules, or baits. Liquids and aerosols are typically injected into cracks and crevices, while dust formulations are used primarily for treating wall voids and hollow spaces beneath cabinets and appliances.

Baits are also used widely in cockroach control and contain such active ingredients as hydramethylnon, sulfluramid, boric acid, and abamectin. Cockroach baits contain a slow-acting insecticides incorporated into a food attractant. The insects find and feed on the bait and crawl away to die, usually within a few days. Bait

carried back to the nesting area also kills other cockroaches after being expelled in the sputum and feces. Some baits come pre-packaged with the insecticide and food attractant within a plastic, child-resistant container. Others are formulated as pastes, dusts, granules, or gels. Since baits must be ingested to be effective, they **must be placed within a few feet of where cockroaches are likely to be living.**

Non-residual insecticides are those products applied to obtain control of cockroaches only during the time of treatment. Pyrethrin or resmethrin are often used in conjunction with residual products to locate and "flush out" hidden infestations of cockroaches. They can also provide rapid (although short-lived) knockdown of cockroaches present at the time of application. Non-residual insecticides are usually applied with aerosol or ultra low volume (ULV) equipment, and directed into areas suspected of harboring cockroaches. Indiscriminant dispersal of non-residual insecticides into the air (i.e., fogging or space treatment) in kitchens, dining rooms, storage areas, etc., should be avoided because it will only disperse and drive cockroaches deeper into wall voids and other protected locations.

Because cockroaches are typically found in areas where food is prepared or stored, special care must be taken not to contaminate food, dishes, cooking utensils, or food preparation surfaces. Before treatment, these items should be removed, placed in plastic bags, or covered with polyethylene sheeting. Before treatment, it is essential that all insecticide labels be read in their entirety. Some products can only be used in "non-food" areas such as garbage rooms and mop closets, where foods are never processed, prepared, served, or stored. Other insecticides can only be applied into cracks and crevices to limit potential contact with food or food preparation surfaces. As with any insecticide application, the label is the best guide.

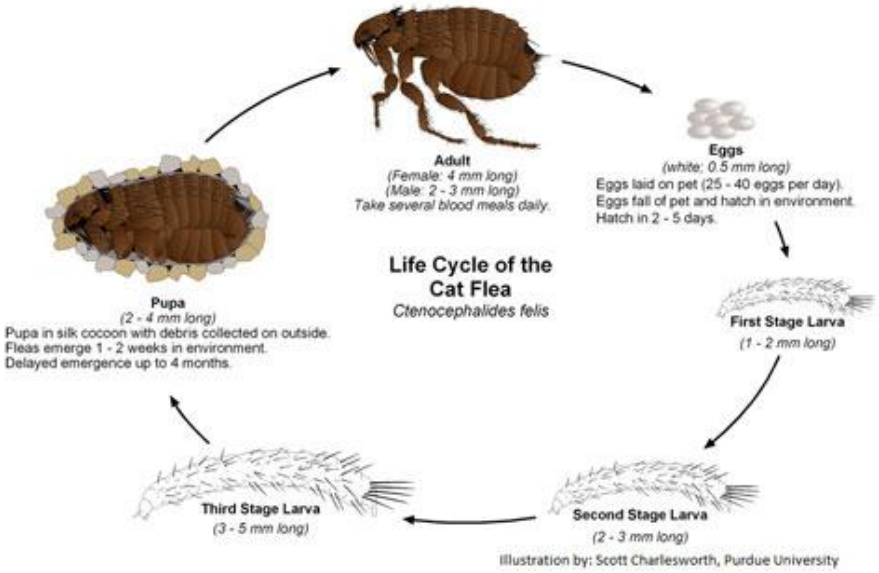
Flea and Tick Control

Written by: Michael F. Potter and G. Mark Beavers

Fleas

Fleas are small (1/16 inch), wingless, blood-sucking insects. Their bodies are flattened from side to side which allows them to move easily through the hairs of the host. In addition to the pain and discomfort caused by their bites, infected fleas can transmit diseases such as the plague and parasites such as the dog tapeworm. The cat flea, which feeds on cats, dogs, and some wild animals is the most common species found in Kentucky. If the host dies or is removed from the home, the adult fleas will actively seek a new host. Some of the worst problems with fleas occur when a family moves into a home that previously had pets.

Fleas undergo complete metamorphosis consisting of four stages: egg, larva, pupa, and adult. Adult cat fleas lay several hundred eggs (up to 50 per day) on the animal. The eggs soon fall off into bedding or carpeting where pet sleeps or spends most of its time. After hatching, the larvae feed and develop on organic debris, especially adult flea feces (primarily dried blood), which accumulate along with the eggs in animal resting and bedding areas.



Larvae remain hidden deep in bedding, carpet fibers, beneath furniture cushions, and in other protected areas where pets sleep or spend time. Before becoming adults, the larvae transform into pupae within a silken cocoon. Pupae remain inside the cocoon for 2 to 4 weeks, sometimes longer. The pupal stage is relatively resistant to insecticides, which is why some adult fleas are seen for an extended period, even after the home and pet are treated.

Adult cat fleas (the biting stage) spend virtually their entire life on the animal. Therefore, effective control of fleas requires treatment of the pet in conjunction with treatment of the premises.

Management

Effective flea control requires a systematic program consisting of inspection, client education, treatment of the pet, and treatment of the premises.

Prior to treatment, the pet owner should:

- Remove all toys, clothing, and stored items from floors, under beds, and in closets, in order to provide access for treatment.
- Remove pet food and water dishes, cover fish tanks, and disconnect their air pumps.
- Wash, dry clean, or destroy all pet bedding.
- Vacuum all carpets, floors, throw rugs, and upholstery, especially in areas where pets rest or sleep.

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Vacuuming removes many eggs, larvae, and pupae
(photo: brighterimagecarpet.com)

Vacuuming removes many of the eggs, larvae, and pupae developing within the home. It also stimulates pre-adult fleas to emerge sooner from their insecticide-resistant cocoons, thus hastening their contact with insecticide residues in the carpet. By raising the nap of the carpet, vacuuming improves the insecticide's penetration down to the base of the carpet fibers where the developing fleas live. Vacuuming should be thorough, especially in rooms or areas where pets rest or sleep. **After vacuuming, the vacuum bag should be sealed in a garbage bag and discarded in an outdoor trash container.**

Treating the Home

Once fleas become established in a home, insecticides are almost always needed to control them. Always read and follow label directions on the insecticide container. Other than the person performing the application, people and pets should be out of the house during treatment. People and pets should also remain off treated surfaces until the spray has dried. Drying may take several hours, depending on carpet type, ventilation, and method of application. Opening windows and running the fan or air conditioner after treatment will speed up drying and minimize odor.

Many flea control products are available for home treatment. **The most effective formulations contain both an adulticide effective against the biting adult stage, and an insect growth regulator (IGR) to provide long-term suppression of the eggs, larvae, and pupae.** Most homeowners will find aerosol formulations easier to apply than liquids. It is essential that the application be thorough and include all likely areas of flea development. **Carpets, throw rugs, under and behind beds and furniture, and beneath cushions on which pets sleep should all be treated. Pay particular attention to areas where pets spend time or sleep, as these will be the areas where most flea eggs, larvae, and pupae will be concentrated.** Hardwood and tile floors generally do not require treatment, but should be thoroughly vacuumed and mopped.

Pet owners should expect to see some fleas for 2 weeks or longer following treatment. Provided all infested areas were treated initially, these "survivors" are probably newly emerged adults, which have not yet succumbed to the insecticide. Instead of re-treating the premises immediately, they should continue to vacuum. As noted earlier, vacuuming stimulates the insecticide-resistant pupae to hatch, bringing the newly emerged adults into contact with the insecticide sooner. If adult fleas continue to be seen beyond 2-4 weeks, retreatment of the premises (and pet) may be necessary.

Treating the Pet

The pet should be treated, preferably on the same day as the house. Adult fleas spend virtually their entire life on the animal—not in the carpet. Untreated pets will continue to be bothered by fleas. They may also transport fleas in from outdoors, eventually overcoming the effectiveness of the insecticide applied inside the home.

Pets can be treated either by a veterinarian or the pet owner. A variety of on-animal formulations are available that may be prescribed by veterinarians. Some contain an insect growth regulator (IGR) to prevent eggs from hatching. Although the collar contains no adulticide, it prevents flea eggs from hatching for several months. For optimum results, the collar should be placed on the pet before flea season begins (April-May). Similar results can be obtained with a tablet formulation that is administered orally to pets once a month as a tablet. When a female flea bites a treated animal, the flea ingests the active ingredient, which then passes into her eggs and prevents them from hatching. Like Flea Egg Collar**, pet owners should ideally begin using the tablets before flea season begins. Doing so will greatly reduce the chances of developing a serious flea problem later in the summer.**

Spot Treatment for Flea Control

Pet owners should always read the pesticide label. Certain products can be used only on dogs, and some list specific treatment procedures for puppies and kittens. **Do not treat pets with the same products used to treat carpeting or the yard. It is essential that pets be kept off treated carpets and surfaces until the spray has completely dried.** De-fleaing the pet is an essential step in ridding a home of fleas; however, pet owners must also treat the pet's environment (the home). Having the pet dipped or using a flea collar will not, in itself, eliminate fleas in an infested home.

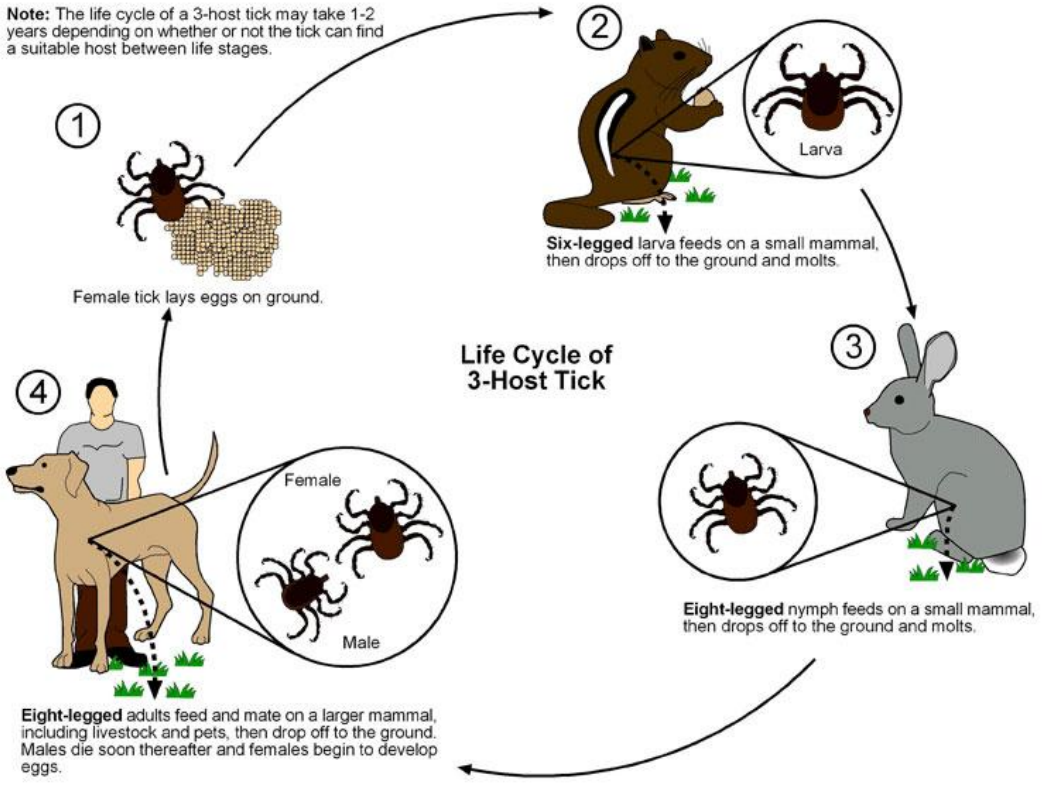
Treating the Yard

Most flea problems in Kentucky can be eliminated by treating the pet and inside the home. **In cases where pets spend most of their time outdoors, it may also be necessary to treat the yard**. Outdoor flea treatment should focus on areas where pets rest, sleep, and run, such as doghouse and kennel areas, under decks, along fences, and next to the foundation. It is seldom necessary to treat the entire yard or open areas exposed to full sun. Some can be applied with a hose-end or pump-up sprayer. Long-term suppression of fleas infesting kennels or outdoor areas can be enhanced with formulations containing a light-stable insect growth regulator (IGR).

Ticks

Ticks are 8-legged bloodsucking arthropods that are more closely related to mites and spiders that to insects. The species of human health concern in Kentucky are commonly found in woodland, mixed shrub, and overgrown areas where they feed on a variety of small, medium, and large animals and humans. In addition to taking blood meals, some ticks are able to transfer pathogens from infected to uninfected hosts.

Development of a tick from egg to adult generally takes about a year. Ticks have four life stages: egg, larva, nymph, and adult. The three active stages feed on the blood of mammals, birds, reptiles, or amphibians, depending on the species of tick. **The common ticks in Kentucky feed on three different hosts to complete their development.** They are on a host for only a few days at a time to feed, most of their life is spent on the ground digesting their blood meal and molting to the next life stage. Since they cannot jump or fly, the larvae, nymphs, and adults climb onto tall grass, weeds, or brush to wait for a suitable host to pass. Initial contact with humans is usually made on the foot, ankle, or lower leg. Once aboard, they crawl upward until constricted by skin folds or tight clothing, often attaching behind the knee, waist, armpit, or base of the scalp. Ticks are especially common along overgrown borders and paths, since these areas are frequented by passing hosts. **Ticks are seldom found in open areas or sunny, mowed yards.**

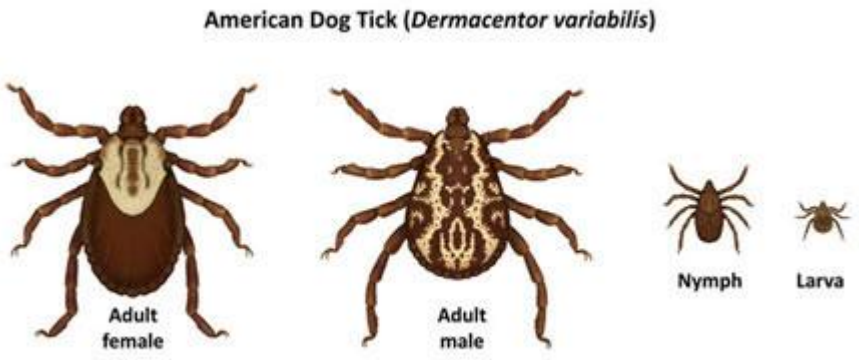


Life cycle of the American dog tick - a 3 host tick (photo: Purdue University)

Common Ticks in Kentucky

Common ticks affecting humans in Kentucky are the American dog tick (*Dermacentor variabilis*) and the lone star tick (*Amblyomma americanum*). Both readily feed on humans and pets. Another species, the blacklegged tick *(Ixodes scapularis*), is becoming increasingly common.

American Dog Tick



(photo: CDC drawing)

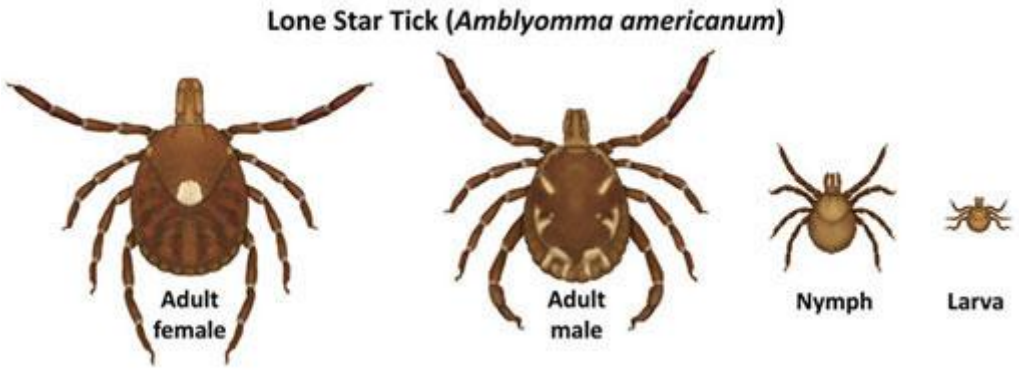
The **American dog tick occurs throughout the state.** Males and females are reddish brown with silvery white markings. Females with a relatively large silver area behind the head grow from about 3/16 long to about 1/2 inch long after feeding. Males have fine silver lines on the back. The larvae and nymphs of this 3-host tick feed primarily small mammals, especially white-footed mice and voles. Adults feed on larger hosts such as medium to large wild mammals, livestock, humans, and especially dogs. Adult ticks may remain attached for 10 to 12 days.

Overwintering adults seek blood meals from mid-April through late May. During this time, they remain low on vegetation, especially along animal runs, trails, roadsides, and forest boundaries surrounding old fields or other clearings. Few ticks can survive in large sunny, open areas with little shade or in wet lowlands.

The American dog tick is the most important vector of Rocky Mountain spotted fever in the US; it is a vector of tularemia, and also can be responsible for cases of tick paralysis. It does not transmit Lyme disease.

After a large blood meal, this female American dog tick dropped to the ground and laid a mass of more than 1,000 eggs (photo: University of Nebraska)

Lone Star Tick



All stages of the lone star tick will feed on humans, including the tiny larva or "seed tick" (photo: CDC drawing)

All stages of the lone star tick attack animals and humans. Adults and immature stages can be recognized by their distinctly long mouthparts. Males and females are reddish brown. The **female has a distinct white spot on her back**; males have pale white lacy markings.

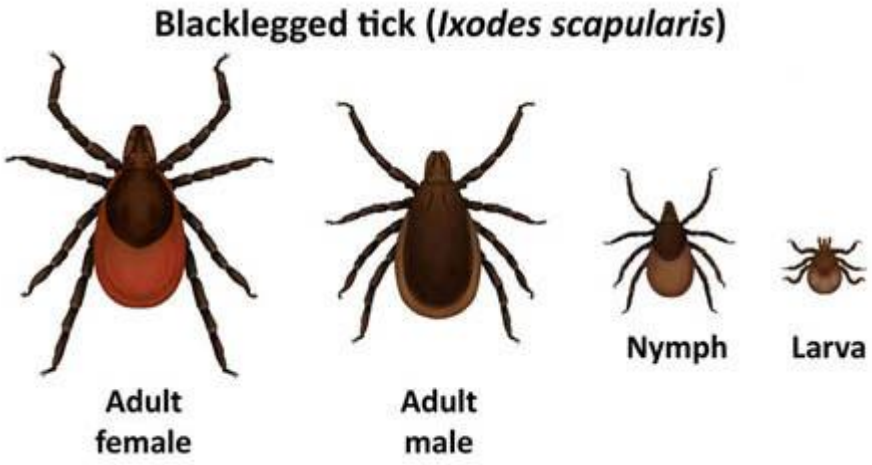
This 3-host tick feeds on many animal species. Raccoons, striped skunks, and Virginia opossums are important hosts for immature lone star ticks. Areas that support large deer herds usually have significant tick populations.

Painful bites from many lone star seed ticks

Nymph and adult lone star ticks become active as early as March, attaching to feed for 3 to 5 days before dropping off to molt. Peak numbers feed during May and June. Adults are found more frequently on medium to large animals including humans, dogs, and deer. Larvae (seed ticks) are active in July and August. Hundreds to thousands from a single egg mass climb onto vegetation to wait for passing hosts. The larvae normally feed for 2 to 3 days, then drop from the host to digest the blood meal and molt to the nymphal stage.

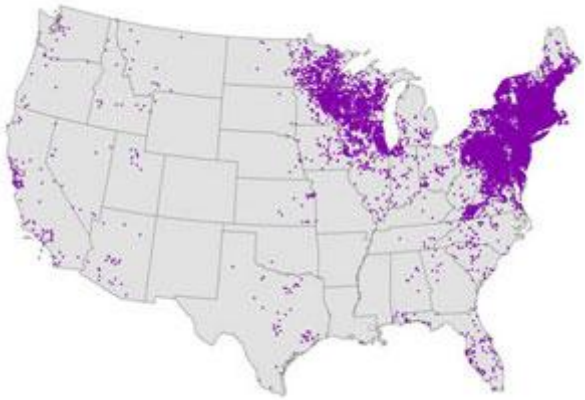
These ticks are most numerous in shaded areas with enough ground cover for small animal hosts and occasional large animals. Engorged ticks tend to drop off when their host is inactive and crawl to humid, shaded or protected sites. This species is a serious pest of humans and domestic animals. The bites result in intense itching which can last for 2 to 3 weeks. **The lone star tick is not a vector of Lyme disease but can carry human ehrlichiosis and is associated with red meat allergy.**

Blacklegged Tick



(photo: CDC drawing)

The blacklegged tick *(Ixodes scapularis*) is being found more frequently in Kentucky. Unlike other Kentucky ticks, **adult males and females are active from October to April**. Females have long mouthparts, orange red bodies, and a dark plate over part of their backs. Males, which do not feed, have a dark plate over their backs. The larvae and nymphs of this 3-host tick live in moist leaf litter near the edge of woods.



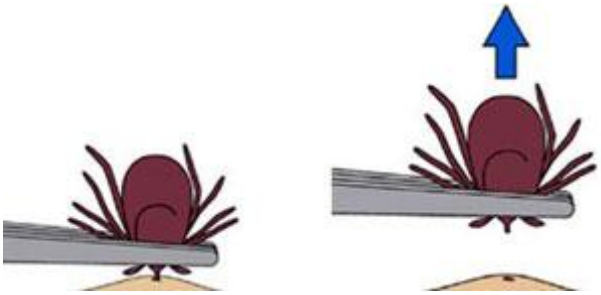
Reported cases of Lyme disease - 2013 (CDC map)

The **blacklegged tick is the main vector of Lyme disease in the north east and north central states**. While this tick occurs across the southern US, the incidence of Lyme disease in this region is very low.

How to Remove an Attached Tick

An infected tick usually has to attach and feed for several hours before it can transmit a disease organism to its host. It is important to check regularly for ticks and remove them immediately to reduce the chance of becoming infected with diseases like erlichiosis or spotted fever.

Use fine-tipped tweezers to grasp the tick as close to the skin's surface as possible. Pull upward with steady, even pressure. Don't twist or jerk the tick; this can cause the mouth-parts to break off and remain in the skin. If this happens, remove the mouthparts with tweezers. If you are unable to remove the mouth easily with clean tweezers, leave it alone and let the skin heal.



After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol, an iodine scrub, or soap and water.

Dispose of a live tick by submersing it in alcohol, placing it in a sealed bag/container, wrapping it tightly in tape, or flushing it down the toilet. Never crush a tick with your fingers.

Do not squeeze or crush the tick's body, it may force disease organisms into the wound. Petroleum jelly, hot matches, and other "folk" methods of removal should be avoided.

Itching can be relieved by applying topical ointments such as those containing hydrocortisone. **Keep the tick. Place it in a container with alcohol for at least three weeks. Should any disease-related symptoms appear, the identity of the tick may help the physician with a diagnosis.** The Entomology Department at the University of Kentucky will identify ticks at no charge. Specimens should be accompanied by the date and county from which the tick was collected.

Avoiding Tick Bites

Here are things you can do to avoid tick bites:

- Avoid walking through brushy areas with tall grass especially from April through July.
- Walk in the center of trails to avoid brushing up against vegetation where ticks might be waiting.
- Wear light-colored clothing and long pants tucked into boots or socks. Ticks will be easier to spot, and it will be more difficult for them to attach to your skin.
- Consider applying insect (tick) repellent to shoes, cuffs, socks, and pant legs. Products containing diethyl toluamide (DEET) or permethrin are most effective, but be sure to read and follow directions for use on the container.
- Regularly inspect family and pets carefully after they have been in tick-infested areas. Promptly remove any ticks.
- Showering or bathing may help to remove ticks that have not yet attached.

Tick Control on Pets

Free-roaming pets are much more likely to become infested than are pets that are confined. Fencing yards prevents pets from picking up ticks from surrounding areas. Fencing also discourages dogs and other large animals from introducing ticks onto the property. **Ticks on pets can be controlled using sprays, dips, dusts, and insecticide-impregnated collars.** Pet owners should be advised to consult with their veterinarian for appropriate products to use on their pet.

Pet pens and runs also can be sprayed to control ticks that may be present in those areas. Products labeled for tick control outdoors are usually labeled for use in these areas as well. Do not contaminate food or water.

Tick Control in Landscapes

Ticks are sometimes a problem in yards, especially when pets are kept outdoors. **Ticks also can be a serious problem in parks, camps, picnic sites, and other recreational areas**. A good way to determine if ticks are present is to drag a 3-ft x 3-ft white flannel cloth through suspected areas. Ticks will attach and be visible against the white background. **Tick populations can be reduced in these areas by mowing and trimming lawns and other vegetation, thus creating a less favorable habitat for ticks and their wild hosts. Wood, brush piles, and other accumulated debris should also be removed.**

Insecticide sprays are most effective when directed into areas where ticks and their animal hosts are likely to frequent. Pay particular attention to borders and fences between wooded or brushy areas and the lawn, around ornamental plantings, beside foot paths, and the dog house. A single application during late April or May is often all that is required, although treatment may need to be repeated in June.

The ground and vegetation up to a height of about three feet should be thoroughly wetted with the insecticide. The insecticide should be applied according to label instructions. Children and pets should be kept off treated areas until the vegetation is completely dry. Treating the entire lawn is of little benefit since ticks avoid direct sunlight and normally will not infest areas that are well maintained.

Controlling Ticks Indoors

Tick control indoors is seldom required in Kentucky. This is because the American dog tick and lone star tick are rarely found indoors except on the pet. **Indoor treatment is necessary only for the brown dog tick**, which is relatively rare in Kentucky. Controlling this tick is difficult because of its many possible hiding places inside the home. After feeding, brown dog ticks drop off the dog and conceal themselves in cracks and crevices, where they can survive without another blood meal for several months.

Management of the brown dog tick in homes requires frequent inspection and removal of ticks from pets. Pet bedding should be laundered, and rugs, floors, and furniture should be routinely vacuumed, especially along baseboards and under and behind furniture.

Insecticides are almost always required to kill ticks hidden in protected areas. Treatment should focus on cracks and crevices along baseboards and molding, around door and window frames, underneath furniture, beneath the edges of carpeting, behind loose wallpaper, and in similar areas where ticks might conceal themselves. Pay particular attention to areas where the dog spends time. Ticks tend to crawl up walls and other vertical surfaces, so it will be necessary to treat cracks and crevices up high as well as low.

Homeowners should be reminded to follow label directions and always keep children and pets off treated surfaces until the spray has dried. Because the eggs and immatures may take several weeks to hatch or molt, retreatment may be necessary to eliminate all ticks emerging from hidden areas.

Mosquito Control

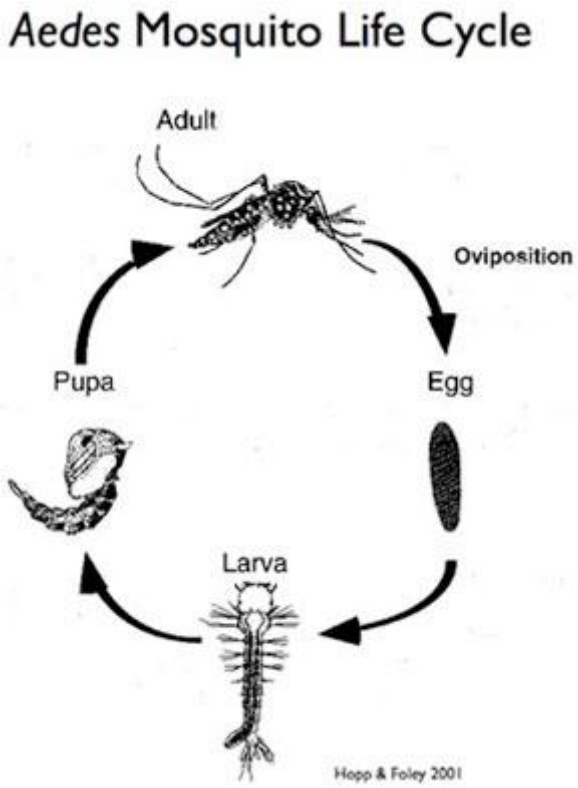
Written by: Michael F. Potter and G. Mark Beavers

Mosquitoes

The persistent and painful bites of mosquitoes are usually just a nuisance. However, these insects have done more harm to human health and well-being than any other insect group. Some species can carry debilitating diseases such as malaria, yellow fever, dengue, chikungunya, and most recently Zika. The most recent threats to human and animal health in Kentucky have been the outbreak of West Nile and the chronic problem of the dog heartworm nematode. Many mosquito species feed on wild and domestic animals but some have *the* potential to transmit diseases from animals to humans. For example, bird-feeding mosquitoes are important in moving encephalitis viruses within the bird population, species that also feed on mammals can transmit these diseases to horses and humans.

Kentucky has over 50 mosquito species. Only the females are blood feeders; males visit flowers for nectar and other plant juices. Female mosquitoes need an additional source of protein (in the form of a blood meal) before they can develop eggs. Females also feed on nectar and plant juices, using this food source for flight and metabolism.

Biology and Habits



Mosquito life cycle (www.stanford.edu)

Mosquitoes undergo complete metamorphosis consisting of four stages: egg, larva, pupa, and adult All stages except the adult occur in water. Mosquitoes are generally small (less than 1/2-inch) and fragile. Their most obvious characteristics include one pair of wings with scales on the wing veins and hind margin, and an elongated beak with piercing mouthparts. Mosquitoes are often confused with midges, punkies, biting gnats, and other flies.

Mosquito with long beak. Fuzzy scales on wing veins is a mosquito characteristic.(www.mosquito.org)

Mosquito eggs are elongate and about 1/40-inch long. They turn dark brown or black when ready to hatch. Depending on the species, eggs are laid singly or in batches of 50-400. Most groups of mosquitoes deposit them on the surface or along the margins of quiet pools of water. However, floodwater and salt marsh mosquitoes, as well as many tree-hole breeders, place them above the waterline in sites that are subject to flooding, overflow, or rainwater. Each mosquito species lays its eggs in a specific type of site.

Mosquito larvae (wrigglers) are legless and have a thorax that is much which is wider than the head or abdomen. Most have a distinct head and prominent breathing tube extending from the last abdominal segment. This stage lasts about 7 days in warm water, longer in cool water.

Mosquito larvae can breed most any naturally occurring collection of fresh, brackish, or polluted water. Depending on the species, breeding sites may be water in tin cans, vehicle tires, hoofprints, treeholes, or still pools along the margins of rivers, streams. Mosquito larvae are quite mobile and will quickly dive to the bottom if disturbed. They will return to the surface shortly. Mosquitoes cannot breed in large bodies of water with steep plant-free edges because the larvae cannot withstand wave action. Most mosquito larvae feed by filtering out microorganisms and organic particles in the water, or by "browsing" microorganisms growing on solid surfaces. Mosquito larvae molt 4 times as they develop, the final molt is to the pupal stage.

The pupa (tumbler) stage, which is shaped like a large comma, is short, usually 2-3 days. It has a pair of breathing horns on top of the thorax and paddle-like flaps on the end of the abdomen. The pupa swim actively with a tumbling motion and is easily disturbed. When alerted, it will swim to deeper water. The adult mosquito emerges from the pupal case at the surface of the water.

Male mosquitoes usually live 1 to 2 weeks. Females with ample food may live for several months. However, during the summer, survival may be closer to 2 weeks. Some species have only one generation a year. Others may have 4 or more generations per year. Mosquitoes are must abundant in late summer.

Some mosquito species can fly no more than a few city blocks, while others can travel up to 20 miles. Most are active only at night, although some feed during the day. When they are not active, adult mosquitoes rest in quiet areas with high humidity. Examples include: dense vegetation, along drainage ditches, in sewers, and under the eaves of buildings.

Common Mosquitoes in Kentucky

The Asian tiger mosquito (*Aedes albopictus*) is **black with white bands on its legs and a distinctive single thin white band along the middle of the thorax**. It is an aggressive daytime biter that has the potential to transmit several diseases including dengue, yellow fever, La Crosse encephalitis, eastern equine encephalitis, West Nile virus, Zika virus, and dog heartworm. It **breeds in artificial containers, principally vehicle tires**. The movement and improper storage of used tires is the primary means of dispersal in this country.

(photo: Susan Ellis, Bugwood.org)

The eastern tree hole mosquito *(Aedes triseriatus*), is black with silver-white scales on the sides of the thorax. There are no bands on the legs. This mosquito breeds in tree holes, tires, and other artificial containers. Its bites are painful and annoying but it does not fly far from its breeding site. This species is the principal vector of La Crosse encephalitis in Kentucky.

(photo: Susan Ellis, Bugwood.org)

The inland floodwater mosquito (*Aedes vexans*) is a medium-sized brown mosquito with narrow rings of white scales on the feet and a "V"-shaped notch at the middle of each band of white scales on the upper surface of the abdomen. Common breeding sites are rain pools, floodwaters, roadside puddles, and just about all temporary bodies of freshwater. The eggs are laid on the ground above the waterline and hatch when flooding occurs. Adults can fly long distances from their breeding sites with flights of 10 miles being common. Adults are vicious biters and are especially annoying at dusk and after dark. They rest during the day in grass and other vegetation. This mosquito overwinters in the egg stage. It is a secondary vector of eastern equine encephalitis.

(photo: Texas Agricultural Experiment Station, Texas A & M University)

Anopheles quadrimaculatus is a large, dark-brown mosquito with 4 dark spots near the center of each wing and dark legs. This species is the most important vector of malaria in the eastern U.S.and can be found in houses. Its bite is less painful than many other mosquitoes and often goes unnoticed. The larvae develop in permanent, freshwater pools, ponds, and swamps that contain aquatic vegetation or floating debris. City park ponds, sluggish streams, and shallow margins of reservoirs and lakes can contain many larvae. During the day adults rest in cool, damp, dark shelters such as buildings, caves, and under bridges. These mosquitoes feed at night and will readily enter houses to feed on humans. Cows, horses, mules, pigs, and chickens are also attacked. Adults usually remain within one-half mile of their breeding site. Breeding occurs throughout the summer months.

(photo: Edward McClellan, Center for Disease Control and Prevention)

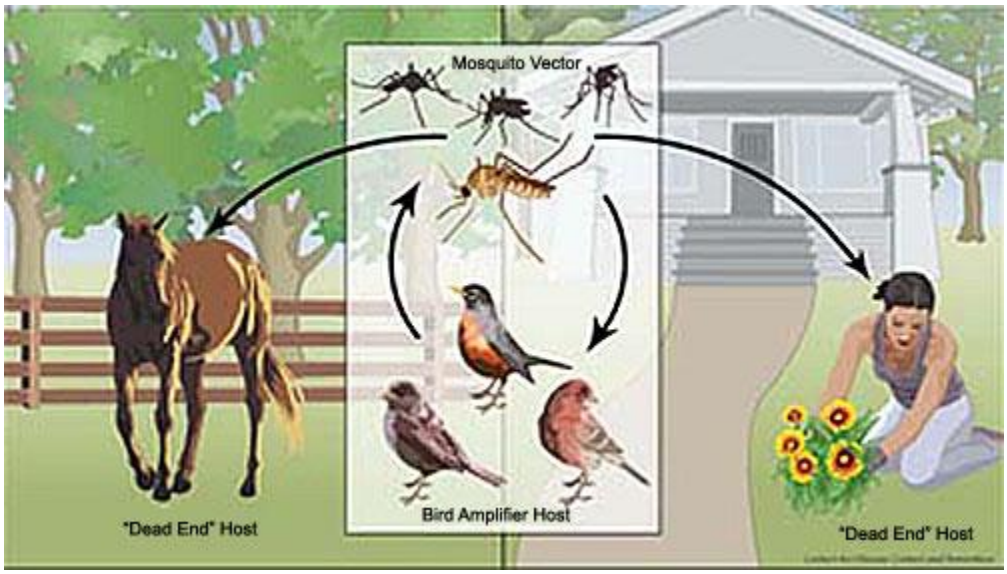
The common house mosquito (*Culex pipiens*) is brown with cross bands of white scales on the abdomen and no other prominent markings. It is a vector of St. Louis encephalitis and dog heartworm. Breeding occurs in rain barrels, tin cans, tires, storm-sewer catch basins, street gutters, polluted ground pools, cesspools, open septic tanks, etc. The flight range is restricted unless great numbers are produced. Adults are active only at night and can be found resting during the day in and around houses, outbuildings, and various shelters near their breeding places. They commonly enter houses.

(photo: Ari Farajollahi, Bugwood.org)

Mosquitoes and Diseases in Kentucky

Mosquitoes are not naturally infected with disease agents. They must be acquired by feeding on infected individuals before they can pass them to healthy ones. For example, a person bitten by *Anopheles quadrimaculatus*, a potential vector of malaria, does not mean that he or she will contract malaria unless the mosquito had first fed on an individual suffering from the parasite. This is unlikely to occur in Kentucky.

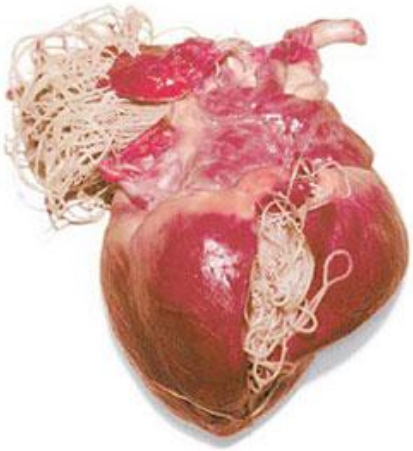
West Nile virus (WNV) is one of the most common arthropod-borne viruses (arboviruses) in the U.S. It is maintained and transmitted among birds, primarily by *Culex* mosquitoes. A person can become ill if they are bitten by an infected mosquito. Infected individuals may experience an abrupt onset of fever, nausea, vomiting, and severe headaches. These symptoms usually develop within 5 to 7 days after someone is bitten. People of any age may contract the disease. However, disease incidence is greater and symptoms more severe in people 60 years or older. Mortality rates range from 2 to 20 percent, with the highest mortality occurring in the oldest age groups.



WNV normally cycles between house mosquitoes and birds.
Mosquitoes can pass the virus to people, horses and other mammals. (www.cdc.gov)

Humans become infected with West Nile virus only after being bitten by a mosquito that had formerly contracted the pathogen from an infected bird. There is no person-to-person transmission via mosquitoes, because the virus concentration in human blood never reaches a sufficient level to infect biting mosquitoes. Humans and horses are considered to be "accidental" or "dead end" hosts for this disease. This means that the amount of virus in their blood is too low for mosquitoes that feed on them to become infected. Disease outbreaks are most likely to occur from mid-summer through early fall when *Culex* populations are at their peak.

Dog heartworm is caused by a filarial worm, *Dirofilaria immitis*. It is a serious disease for most dog breeds. Several mosquito species can transmit this parasite. A mosquito can ingest immature stages of the worms, called microfilariae. After several days, the infected larvae are transmitted via the mosquito's mouthparts to a healthy dog when the mosquito feeds again. The larvae grow and eventually migrate to the right ventricle of the dog's heart where they mature and reproduce. The adult female worm can grow to approximately 11 inches and the male 6 inches.



Large numbers of adult dog heartworms can develop in the host dog.

Mosquito Surveillance

An effective mosquito management program cannot be planned or implemented unless surveys are made to determine which species are present, their relative abundance, and the location of breeding sites. Also, an understanding of the biology of the species involved is essential so that control efforts are not only directed at the proper habitat but also at the right time. Surveys can be labor intensive but they allow personnel to focus control efforts on the species that are causing a problem. This avoids unnecessary intrusion into areas which do not need to be treated, which saves time and money.

Surveys for eggs and egg-laying sites can be a useful predictor of mosquito abundance. Mosquito egg surveys for floodwater mosquitoes are often used to schedule an effective pre-hatch application of insecticide. Oviposition traps constructed with a black-painted jar or open can, a wooden paddle serving as the oviposition site, and a little water in the trap, have proven valuable in sampling for Asian tiger and eastern treehole mosquitoes.

Dipper for sampling mosquito larvae (www.clark.com)

Larval surveys are the primary means of deciding whether control measures should be applied to aquatic sites. A white dipper equipped with a long handle is the collecting tool most often used. Brown larvae can be easily seen on a white utensil. Some “stealth” is required when dipping for mosquito larvae because they quickly swim to deeper water when disturbed. The surveyor must also not overlook obscure larval sites, such as cattle hoof prints in wet pastures or on the edges of water holes and ponds. For examining tree holes, artificial containers, and similarly inaccessible cavities. A large-capacity rubber suction bulb and flexible extension tube can be used to draw out the water into a white metal pan.

New Jersey light trap (www.cdc.gov)

The New Jersey light trap is an important survey method for collecting adult mosquitoes. The trap consists of an incandescent bulb, which serves as the attractant, and a fan to draw nearby mosquitoes into the killing chamber. Carbon dioxide (a respiratory gas given off by animals) is a strong attractant to mosquitoes. For this reason, dry ice is often used in conjunction with light traps, resulting in significant increases in the number of mosquitoes caught.

Light traps are relatively inexpensive and are easy to set up. They are most useful in determining the presence or absence of a particular mosquito species, and in demonstrating population trends. However, light traps are not effective for determining the absolute number of mosquitoes in an area. Light traps collect only those mosquitoes that are active at night and are attracted to lights. Therefore, light traps may not necessarily collect all the mosquito species present in the area. Another disadvantage of light traps is that they are not selective. They also collect moths, flies, beetles, and other insects attracted to light. Despite these limitations, light traps are an important surveillance tool.

Another technique used in adult mosquito surveillance is the landing/biting count. This method uses humans or animals as the attractant. They wait motionless at a specific location. Mosquitoes are counted as they land to feed and may be they collected with a battery-powered aspirator. This technique is very useful because only those species that bite that particular host will be collected. This technique requires that the host be bitten, and therefore is not recommended when there is a high risk of disease transmission.

Control Techniques

Most successful mosquito management programs concentrate on control of the larvae. This stage of the insect's life cycle is concentrated in specific, identifiable areas. Larval mosquito control can be accomplished either by removing or reducing breeding sites, employing biological control agents, or by applying chemical larvicides (insecticides) to breeding sites that cannot be eliminated.

Breeding Site Reduction

The most effective way to control mosquitoes is to find and eliminate their breeding sites. Eliminating large breeding areas such as swamps, or sluggishly moving streams or ditches may require community-wide effort. The initial investment is usually high but significant savings can be realized over time. In these operations, expert advice must be available to prevent potential environmental problems. For example, filling a swampy area may block normal drainage patterns, creating new breeding sites or interfering with aquatic life.

Clean up breeding sites (www.artemisbiosolutions.com)

In addition to reducing large mosquito breeding sites, individual property owners can take the following steps to prevent mosquito breeding on their own premises.

Dispose of tin and soda cans, old tires, buckets, plastic sheeting, or other containers that can collect and hold water. Water should not be allowed to accumulate at the base of flower pots or in pet dishes for more than 5 days.
Clean debris from rain gutters and remove standing water under or around structures, or on flat roofs.
Drain childrens' wading pools when not in use (or at least change the water weekly).
Change the water in bird baths at least once a week. Remove, drain, or fill tree holes and stumps with mortar.
Eliminate seepage from cisterns, cesspools, and septic tanks.
Eliminate standing water from around animal watering troughs.
Irrigate lawns and gardens carefully to prevent water from standing for several days.
Keep the grass mowed around ponds and other bodies of water, taking care to keep clippings out of the water.
Maintain ponds according to good management practices. Keep banks steep and remove emergent aquatic vegetation which shelters mosquitoes. Stagnant ponds and waste lagoons also can produce very large numbers of mosquitoes.

Biological Control

Nematodes, planaria, microsporidia, and even other predaceous mosquitoes such as *Toxorhynchites* mosquitoes show some promise against mosquito larvae. However, the **most effective biological control agents are predaceous fish: the mosquito fish and the common guppy, which feed feed voraciously on mosquito larvae.**

Chemical Control

The use of insecticides is a temporary measure that should be limited knocking down high populations on in situations for which no other alternatives exist.

(1) **Larviciding is the most efficient and effective method and should be the basis of any chemical control program**. Solving a mosquito problem by killing the larvae is the most logical approach because the mosquitoes are being controlled before they become a nuisance. The application of larvicides should only be made at sites where mosquito larvae of the target species are present. The degree of control obtained with larvicide applications depends upon the amount of pollution in the water, as well as the type and amount of vegetative cover present. Where vegetative cover is heavy, granular formulations frequently provide better control than emulsions or oil spays. Repeated insecticide treatments may be needed, especially after heavy rainfall.

(2) Adulticiding is less efficient and should be used only for supplemental or emergency purposes, such as active transmission of a mosquito-borne disease. Adult mosquito control programs are most successful if large areas are to be treated. In general, adulticiding only provides a temporary reduction of populations. However, this may be the most practical technique for local problems or in the event of a disease outbreak. In addition, some adult mosquito species can fly long distances, often making it necessary to supplement larval control measures with adult control.

Aerial Application

Application of insecticides by fixed-wing aircraft or helicopters is a common practice in some areas. However, this is generally not feasible for most areas in Kentucky due to high costs and potential environmental concerns. Aerial applications are most useful under emergency conditions, or when the areas to be treated are too large or inaccessible for treatment with vehicle-mounted equipment.

Aerosol Applications

Aerosol applications are applied to control mosquitoes using specialized equipment that dispenses insecticides in extremely small droplets. Aerosols work as a contact toxicant and have no residual effect. Consequently, they are effective only as a space treatment against actively flying adults. Aerosols are dispensed from the application device and allowed to drift as a fog with the wind through the target area. This technique is effective only where there is little wind. Aerosols can treat a swath of approximately 300 feet. Because the primary activity period for most pest and vector mosquitoes is during the evening hours, aerosol applications are usually most effective during this period.

Aerosol sprayers produce small particles (www.citybugs.tamu)

Indoor Control

Mosquitoes found inside buildings can be killed with most household aerosol sprays that are labeled for flying insect control indoors. Aerosol space sprays containing synergized pyrethrins often produce rapid results. Doors and windows should be kept closed for 15-30 minutes after spraying. Only products labeled for flying insects should be used.

Repellents

Repellents can protect humans from mosquito bites for 1-12 hours, depending on how much a person sweats and rubs the skin, and the percentage of active ingredient in the repellent. Repellents are formulated and sold as aerosols, creams, and liquids. **Repellents containing ingredients such as diethyl-meta-toluamide (DEET) or dimethyl carbate are most commonly used.**

The area of skin to be protected should be covered evenly, because mosquitoes will find and bite spots left untreated. It is often helpful to apply repellents on outer clothing as well as the skin because many mosquitoes can bite through thin, tight-fitting clothing. Do not apply repellents to the eyes, nostrils, or lips.

Repellent logo helps select effective products (www.epa.gov)

DEET is a very effective repellent but should be used according to the product label. Do not apply DEET to the hands of young children. In addition, in very rare cases, use of this product may cause skin reactions. If a reaction to DEET is suspected, wash the affected area and contact the local poison control center.

Additional Control Measures

Vegetation Management

Many adult mosquitoes prefer to rest on weeds and other vegetation. Trimming or eliminating areas of dense vegetation will force mosquitoes to find other, more distant, resting sites.

Mechanical Barriers

Mosquitoes can be kept out of buildings by keeping windows, doors, and porches tightly screened with 12-18 mesh screening.

Insect Electrocutors

Insect electrocutors (“bug zappers”) that use ultraviolet light as an attractant are generally ineffective at reducing outdoor populations of mosquitoes or their biting activity. Light traps using ultraviolet light do capture large numbers of flying insects, including mosquitoes, when used inside buildings. Numerous other devices, including ultrasonics and mosquito-repellent plants, are available which claim to attract, repel, or kill outdoor infestations of mosquitoes. These devices are generally ineffective, too.

Public Education

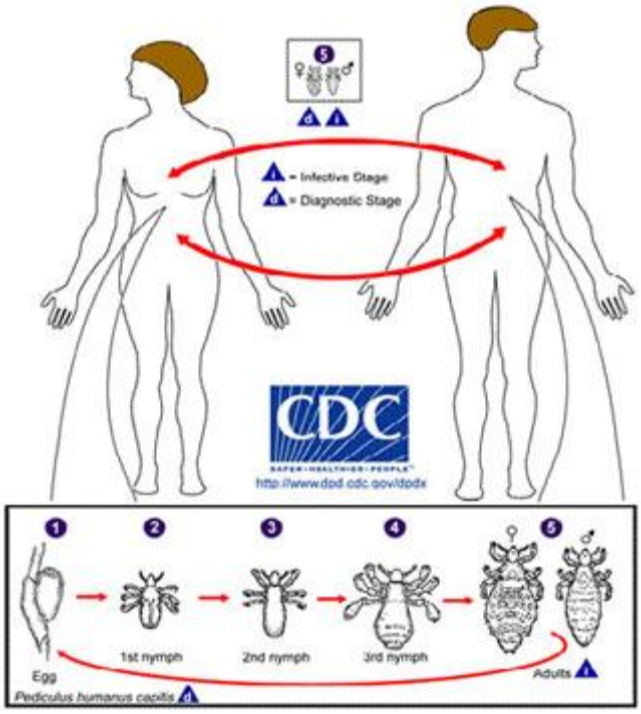
All good public health programs must include community-wide education of the public to gain and maintain support. This is especially important with mosquitoes. Widespread spraying for mosquitoes can produce anxiety and concern over the effects of pesticides on human health. Homeowners can be of great help by managing their own property to eliminate breeding sources of several mosquito species. The effectiveness of any area-wide public health program can only be helped if people understand the program's benefits and limitations.

Lice, Mite, and Bed Bug Control

Written by: Michael F. Potter and G. Mark Beavers

Lice

Pediculosis is the term used to indicate that an animal or human is infested with lice. These insects are parasites of warm-blooded animals and humans. Lice spend their entire life on their hosts and can only survive off them for 1 or 2 days. Species that feed on animals (like hog lice or cattle lice) may bite humans but cannot live on them.



Lice undergo gradual metamorphosis:
egg, 3 stages of nymphs, and the adult (www.cdc.gov)

Three species can be found on humans: head louse, body louse, and pubic louse. All use piercing-sucking mouthparts to feed on blood. Irritation from their bites causes significant itching; movement of the insects on the body is disturbing. Symptoms of long-term infestations are scarred, hardened, pigmented skin resulting from continuous scratching of louse bites. Feeding wounds may become infected from scratching and poor hygiene.

Pediculosis symptoms: hardened, pigmented skin.
Body lice visible on sock. (web.stanford.edu)

The first indication of head lice is itching and scratching caused by the bloodsucking habits of the louse. Examination of the hair and scalp will usually reveal the crawling forms (nymphs and adults) and yellowish white eggs **(nits**) attached to the hair shafts close to the scalp. Usually all life stages can be seen with the naked eye, although a flashlight and hand lens are helpful. Red bite marks or scratch marks are often seen on the scalp or neck.

Head lice and body lice must be
identified by where they live (www.ces.ncsu.edu)

The head louse is by far the most common of the three. Head lice are small (1/12 inch long) insects that are white or gray. Head louse infestations are usually limited to the head, preferring the nape of the neck and the area behind the ears. They move quickly to avoid light making them difficult to see. It may be easier to find nits (louse eggs) glued to the hair than lice, especially if only a few are present in thick, long hair. Nits can be mistaken for dandruff or residues of shampoo. However, nits will not wash off or blow away. The presence of nits does not mean that in infestation is active. It is difficult to tell the difference between a live nit and one from which the insect has already hatched.

The head louse nit (egg) remains glued to the hair shaft (www.livescience.com)

Head lice are especially common on children between the ages of 3 and 10. In fact, an estimated 10% of elementary school children each year are infested. Large numbers of children come into close personal contact in day cares and schools, where lice may be transferred directly from infested children. Hats and coats are often shared or hung together in the same closet, permitting transfer of lice from one child to another. Transfer of head lice can also occur by using infested combs and brushes, or resting one's head on upholstered furniture or pillows recently used by an infested person.

Body lice and head lice are virtually impossible to tell apart other than by their behavior. Body lice prefer to live in clothing except when they crawl onto the body to feed. **Outbreaks of body lice are usually associated with large numbers of people living in close quarters under poor sanitation.** Transfer of body lice can occur from shared bedding or clothing.

The head/body louse is distinctly different from the "crab" shape of the pubic louse (www.medscape.com)

Pubic lice (or crab lice) infestations usually are limited to the pubic area. However, they may also be found on eyebrows, eyelids, or other hairy areas of heavily infested people. They are transferred directly between individuals.

Management and Prevention

While specifics vary, the general principles of lice control are similar for all 3 species. There are four (4) **key steps to eliminating head lice and preventing their return:**

1. The child or infected person(s) should be treated with a medicated shampoo formulated specifically to control lice. Several different products are available through pharmacists and physicians. Follow the directions on the package. Some products require retreatment in 7-10 days. If one family member is found to be infested, all others should be examined. Only those showing evidence of lice should be

treated. All infested family members should be treated at the same time to prevent reinfestation from one person to another

2. Remove all eggs using a fine-tooth nit comb. Most louse control shampoos do not kill all the nits. Surviving eggs will hatch within 7-10 days, continuing the cycle of reinfestation. Dead nits also tend to remain attached to the hair, causing uncertainty about reinfestation. Nits are most easily removed by combing while the hair is slightly damp. They can also be picked out with fingernails, or cut out with a small safety scissors.

Nit comb (www.stayitchfree.com)

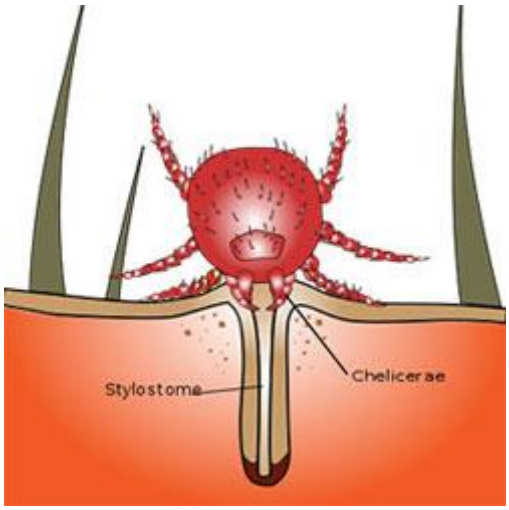
3. All personal articles that have been in contact with the infected individual should be deloused. Normal laundering with hot, soapy water (125° F for 10 minutes) or dry cleaning will kill lice and nits on clothing, bed linens, and towels. Combs and brushes should be soaked for 10 minutes in a pan of very hot water. (Note: steps 1-3 should be performed at the same time to avoid reinfestation).
4. To reduce the chance of reinfestation, children should be instructed not to share hats, clothing, or brushes with their classmates. Each child should have a separate storage space for hats and other clothing at home and school to prevent contact with other garments. If this is not possible, coats should be hung on hooks so they do not touch, or on the backs of students' chairs.
5. Elimination of a head lice outbreak in a school, nursing home, or similar shared facility requires prompt, coordinated action and administrative support to prevent the spread of lice to uninfected individuals. Unless all affected persons are treated, the condition will continue.
6. Treatment of the premises or clothing with insecticides is not required and not recommended for the control and prevention of head, body, or crab lice. The lice cannot survive for any length of time off of their human host.

Mites

Mites are very small arthropods that are closely related to ticks. Mite larvae have six legs whereas the nymphal and adult stages have eight. Most species of mites are pests of agricultural crops. However, certain types of mites are parasitic on humans.

Chiggers

Chiggers are the larvae of a family of mites that are sometimes called redbugs. The adults are large red mites often seen running over pavement and lawns. Chiggers are extremely small (0.5 mm) and are difficult to see without magnification. The six-legged larvae are hairy and yellow-orange or light red. They are usually encountered outdoors in low, damp places where vegetation is rank and grass and weeds are overgrown. Some species also infest drier areas, however, making it difficult to predict where an infestation will occur.



Chigger feeding (www.healthline.com)

Chiggers overwinter as adults in the soil, becoming active in the spring. Eggs are laid on the soil. After hatching, the larvae crawl about until they locate and attach to a suitable host. The larvae do not burrow into the skin but inject a salivary fluid which produces a hardened, raised area around them. Body fluids from the host are withdrawn through a feeding tube. Larvae feed for about 4 days and then drop off and molt to nonparasitic nymphs and adults. Chiggers feed on a variety of wild and domestic animals, as well as humans. The life cycle (from egg to egg) is completed in about 50 days.

Most people react to chigger bites by developing reddish welts within 24 hours. Intense itching accompanies the welts, which may persist for a week or longer if not treated. Bites commonly occur around the ankles, waistline, armpits, or other areas where clothing fits tightly against the skin. Besides causing intense itching, chigger bites that are scratched may result in infection and sometimes fever. Chiggers in North America are not known to transmit disease.

Persons walking in chigger-infested areas can be protected by **treating clothing (cuffs, socks, waistline, sleeves) or exposed skin with tick repellents**. Some repellents should only be used on clothing; and it is important to follow label directions. People who suspect they may have been attacked by chiggers should take a soapy bath immediately and apply antiseptic to any welts. A local anesthetic will provide temporary relief from itching.

Regular mowing and removal of weeds and brush make areas less suitable for chiggers and their wild hosts. Mowing also enhances penetration and performance of miticides, should they be required. Chigger populations can be further reduced by treating infested areas with residual miticides. Applications should be thorough but restricted to areas frequented and suspected of being infested.

Scabies

The sarcoptic itch mites, or scabies mites, infest the skin of a variety of animals including humans. Scabies mites are transmitted by very close personal contact. The types of *Sarcoptes* inhabiting the skin of mammals are considered different forms of *Sarcoptes scabei* and they can exchange hosts to some degree. (For example, canine

scabies mites can be temporarily transferred from dogs to humans, causing itching and lesions on the waist, chest, and forearms.)

An itchy red rash is the common reaction to a scabies infestation. (www.healthline.com)

Human scabies mites are very small (0.30 mm to 0.45 mm long). They commonly attack the thin skin between the fingers, the bend of the elbow and knee. These mites burrow into the skin, making tunnels up to 3 mm (0.1 inch) long. At first, the mites cause little irritation but after about a month an itching sensitization begins. A rash appears in the area of the burrows and the itching becomes intense. Because the **symptoms of scabies mite infestations are delayed by about a month**, other members of the household besides those showing symptoms may be harboring the mites. **It is important that everyone in the infected family or living group go through the treatment regime.** A scabies infestation should be handled as a medical problem and is readily diagnosed and treated by most physicians.

Scabies mites can only survive off of a human host for about 48 hours. Therefore, there is no need to treat the premises with an insecticide. However, the clothing and bedding used by infested individuals should be washed in hot water or dry cleaned at the same time the person is treated.

Bird/Rodent Mites

The northern fowl mite is common on many birds that nest in buildings.

Bird and rodent mites that occasionally infest buildings are usually associated with wild or domestic birds or rodents. The mites normally live on the host or in their nests, but migrate to other areas of the structure when the animal dies or abandons the nest. Rodent mites often become a nuisance after an infestation of mice or rats has been eliminated. **People usually become aware of the problem when they are attacked by mites searching for an alternate food source.** Their bites cause moderate to intense itching and irritation. Rodent and bird mites are very tiny, but usually can be seen with the naked eye. They are about the size of the period at the end of this sentence.

Bird nests on buildings can be sources of temporary mite problems.

The first step in controlling bird or rodent mites is to eliminate the host animals and remove their nesting sites. Often, the nests will be found in the attic, around the eaves and rafters, or in the gutters or chimney. Gloves should be used when handling dead animals. A respirator should also be worn when removing nest materials to avoid inhaling fungal spores and other potential disease-producing organisms associated with the droppings.

After nests are removed, the **areas adjacent to the nest should be sprayed or dusted with a residual insecticide such as those products labeled for flea control.** Space or ULV treatments with non-residual materials (e.g., synergized pyrethrins) can be used in conjunction with residual sprays. Space treatments are especially useful when the mite infestation has dispersed widely from the nesting site. In this case, more extensive treatment with residual and non-residual insecticides may also be necessary in other areas of the structure where mites are observed. A vacuum cleaner or cloth moistened with alcohol can be used to eliminate mites crawling on open surfaces.

Bed Bugs

Bed bug (www.extension.umn.edu)

Adult bed bugs are about 1/4-inch long insects with **reddish-brown, with oval, flattened bodies**. They can live in almost any crevice or protected location. The most common place to find them is the bed or where people sleep. This is especially true during the early stages of a problem. As infestations grow larger, the bugs tend to move beyond beds into other locations making control more difficult. **Infestations are usually detected by the welts and irritation caused by the bites, and the fecal smears and blood spots visible on pillowcases, sheets and mattresses. Heavy infestations of bed bugs are also accompanied by a distinct musty odor.**

Reactions to bed bug bites vary with the individual. (www.aad.org)

Bed bugs usually bite people at night while they are sleeping. They pierce the skin with an elongated beak through which they withdraw blood. Usually, they are full in 3 to 10 minutes. The bite is painless so the person seldom realizes they are being bitten. Bed bugs do not live on people like head or body lice do, they only visit to feed. **When finished, they crawl to a crack or crevice to digest their meal.** Both nymphal and adult bed bugs need a blood meal to molt or lay eggs. Bed bugs can survive without a blood meal for about 2 to 6 months in temperature controlled buildings. It is usually impractical to leave buildings unoccupied in hopes of 'starving out' an infestation. When infested dwellings such as apartments are vacated, bed bugs often disperse to nearby units, or reduce their activity until the unit is reoccupied.

Reactions to bites vary from person to person. They may be delayed days or even weeks. This makes it difficult to determine where or when the bites actually occurred. Many develop an itchy red welt within a day or so. Others have little or no reaction. Studies conducted in bed bug-infested apartments suggest about 30% of people do not react even when bitten repeatedly over time. Bed bugs feed on any skin that is exposed while

sleeping (face, neck, shoulders, back, arms, legs, etc.). Mosquitoes may be blamed for the welts and itching. Because of this, infestations may go a long time unnoticed, and can become quite large before being detected.

The medical significance of bed bugs is limited to itching and inflammation or infection of their bites. While bed bugs can harbor various pathogens, they have not been shown to transmit them to humans. Bed bugs can substantially reduce quality of life by causing discomfort, sleeplessness, anxiety, and embarrassment. According to some health experts, the added stress from living with bed bugs can have a significant impact on the emotional health and well-being of certain individuals.

Eggs, nymphs, and adult bed bugs and fecal spots on a mattress (M. Potter, University of Kentucky)

Bed bugs are challenging to eradicate because they can hide in so many places. Inspections must be thorough and elimination is not always a certainty. Whenever resources allow, it's prudent to enlist the services of a professional. Experienced pest controllers know where to look for bed bugs, and have an assortment of tools at their disposal. Nonetheless, owners and occupants can assist the professional in several important ways. Affording access to all living areas is crucial, and excess clutter will need to be removed. Belongings strewn about rooms offer many places for the bugs to hide, and impede inspection and treatment. Since bed bugs can disperse throughout a building, it often will be necessary to inspect adjoining rooms and apartments as well.

Bed bugs are a growing problem in schools and daycares. Typically, they are introduced by students or staff living with an infestation at home. Pinpointing where the bugs exist can be challenging because there may be no or sleeping areas for the insects to congregate. Similar challenges occur when bed bugs are found in offices, libraries and retail stores. Usually, only small numbers of bed bugs are spotted, often on a student's clothing, backpack, chair or desk. While this does not necessarily confirm that the child's residence also has bed bugs, the parents should be notified that the home should be inspected, preferably by a professional. Teachers, nurses, and staff should be educated about the bugs and what they look like. Bed bugs should also be considered if a student frequently has reddened itchy welts; however, such reactions can be for reasons other than bed bugs.

Bed bug incidents in schools are best handled by knowledgeable pest control firms. Widespread insecticide treatment of classrooms, hallways, buses, etc. is unnecessary, ineffective, and imprudent. Effort instead should be spent checking chairs, desks, lockers, coat rooms, etc. in the vicinity of where the bugs were found, and treatment should be focused on those specific areas. Canine inspections can also be useful in finding small numbers of bed bugs in schools and other establishments where there are no beds.

Management

Bed bugs are challenging to eradicate. Since they can hide in so many places, inspections must be thorough and elimination is not always a certainty. Proper preparation for a bed bug treatment is very important, especially when infestations are heavy and the bugs are widely dispersed. More limited preparation may be adequate for light infestations where bed bugs typically are confined to sleeping areas (beds, sofas, and recliners).

Mattress encasements will trap bed bugs (M. Potter, University of Kentucky)

Although most furnishings need not be discarded, this may be necessary in some cases. This is especially true of heavily infested beds, sofas and recliners where bugs and eggs often live in hard-to-reach places. Consequently, pest control firms may recommend such items be discarded, especially when in poor condition. When infested items are discarded, bagging or wrapping them prevents dislodgement of bugs enroute to the trash. In the case of beds, a more economical option is to encase both the mattress and box spring in a protective cover like those used for allergy relief.Once the encasement is installed and zipped shut, any bugs which happen to be inside are entombed and eventually will die. These covers help to protect newly purchased beds and make it easier to spot and destroy any bugs residing on the outer surface during subsequent examination. Encasements will not, however, keep bed bugs from crawling onto a bed and biting a sleeping person.

General housecleaning measures, (e.g. vacuuming floors and surfaces), seldom reach where bed bugs hide. Repetitive vacuuming may not be worth the effort, especially compared to other important preparatory activities. Targeted vacuuming of bed bugs and infested harborages, however, can help remove some of the bugs before other treatment measures are undertaken. Bed bugs and especially the eggs can be difficult to dislodge. **Optimum results will be achieved by moving and scraping the end of the suction wand along infested areas such as seams and fabric folds of beds and sofas, and the perimeter edge of wall-to-wall carpet. Bed bugs can survive the high speed trip down a vacuum, so it's important to carefully dispose of the vacuum contents in a sealed trash bag afterwards.**

Heat treatments are effective but tend to be more costly than conventional bed bug treatment methods. (M. Potter, University of Kentucky)

Some pest control firms utilize specialized heating equipment to de-infest furnishings, rooms, and entire dwellings. The **procedure involves heating the infested item or area to temperatures that are lethal to bed bugs.** The thermal death point is determined by temperature and length of exposure. Bed bugs and their eggs will die after 90 minutes of exposure to 113oF. However, they will die within 20 minutes if exposed to 118°F. Portable heaters and fans are used to gradually heat the air to about 120° - 130°F while monitoring with strategically placed sensors. By carefully controlling the temperature, bugs and eggs are killed wherever they may be without damaging household items.

While the methods listed above are helpful, insecticides are widely used by most pest control companies. A variety of EPA-registered materials are available formulated as liquids, dusts and aerosols. **Pyrethrins and pyrethroids are the most common compounds used to control bed bugs and other indoor pests**. Pyrethrins are botanical insecticides derived from chrysanthemum flowers. Pyrethroids are synthetic chemical insecticides that act like pyrethrins. **Unfortunately, some bed bug populations have become resistant to pyrethrins and pyrethroids.**

Baits used to control ants and cockroaches are ineffective in this case since bed bugs must bite and feed on blood. Professional-use insecticides tend to be more effective than bed bug sprays sold by retailers. Bleach, alcohol, cigarette lighters, etc. should NOT be used to control bed bugs. Besides being ineffective, such actions can result in fires and other dangerous outcomes.

Insecticide applications require treating all areas where the bugs are found or tend to hide or crawl. This takes considerable effort and follow-ups are usually needed. Companies typically treat seams, folds and crevices of bed components, chairs and sofas but usually will not spray the entire sleeping surface or seating area. They also do not spray bed sheets, blankets or clothing. These items should be hot washed or heated in a dryer.

Rodent Control

Written by: Michael F. Potter and G. Mark Beavers

Rodents

Rats and mice are remarkably well-adapted for living in close association with humans. Three common species of rodents live in close association with humans: the **Norway rat**, **roof rat**, and **house mouse**.

Mouse droppings (photo: tristatewildlife.com)

The **greatest economic loss is not from how much these rodents eat but what must be thrown out because of damage or contamination**. Food, clothing, furniture, books, and many other items are contaminated by their droppings and urine or damaged by their gnawing. Rodents damage doors, walls, insulation, and other structural components by their gnawing and burrowing. They also gnaw through utility pipes and electrical wiring, causing fires, indoor flooding, power outages, and equipment failure. **Rats and mice can also transmit diseases**, most notably salmonellosis (bacterial food poisoning), when food is contaminated by infected rodent feces. Other rodent-borne diseases include plague, murine typhus, rat-bite fever, rickettsial pox, and hantavirus.

Wiring chewed by rats (photo: tristatewildlife.com)

Description, Biology, and Habits

The Norway rat, also called the brown or sewer rat, is the largest domestic rodent. An adult weighs about 12 to 16 ounces. Its stocky body is covered with coarse, reddish brown fur. The head is small, with close-set ears and a blunt muzzle. The tail is shorter than the combined length of the head and body. Norway rats live about one year and reach sexual maturity in 2 to 3 months. Females have 4 to 6 litters each year with 6 to 12 young per litter.

Outdoors, Norway rats commonly nest in burrows alongside buildings, fences, and under bushes or debris. They use the same routes daily and their feet make a beaten path along the ground. **Indoors, these rats prefer to nest in the lower portions of buildings in wall voids, underneath floors, in crawlspaces, and beneath or inside equipment or stored items**.

Norway rats eat essentially the same foods as humans, including meats, vegetables, and cereal grains, as well as garbage. They require water each day when feeding on dry food. Rats tend to be more cautious than mice in their foraging and feeding habits. Their **average foraging range from the nest is about 50-150 feet** but will travel further if food or water is scarce. Like all commensal rodents, Norway rats are active primarily at night and prefer to travel along walls and edges rather than crossing open areas.

The tail of a roof rat is longer than its body

Roof rats are not common in Kentucky. These rats are smaller and sleeker than the Norway rat, weighing about 8 to 12 ounces when fully grown. The tail is longer than the combined length of the head and body, the muzzle is pointed, and the ears are large.

Roof rats are excellent climbers and are usually found above ground level. Nests may be located indoors, in attics, roof areas, or ceiling voids. They often enter buildings by using tree limbs, utility lines, or fences. They also nest outdoors, in trees, vines, or on the roof or sides of buildings. Occasionally, they will nest in underground burrows like the Norway rat. Roof rats consume many types of foods, but **prefer vegetables, fruits, seeds, and cereal grains.**

The house mouse is the smallest domestic rodent (greenbeeremoval.com)

The **house mouse** is the smallest domestic rodent. Adults are 2.5 to 3.5-inches long, with a 3- to 4-inch semi-hairless tail. They are gray to brown with large ears. Mice only live about a year but are prolific breeders. Females produce 6 to 10 litters continuously throughout the year with 4 to 7 young per litter.

House mice may live indoors or outdoors. Outdoors, they often live among weeds and shrubbery or near building foundations, inside garages, crawl spaces, or outbuildings. **When food becomes scarce in the fall, mice often move indoors. Inside buildings, mice commonly nest within walls, ceiling, and cabinet voids, furniture, and large appliances.**

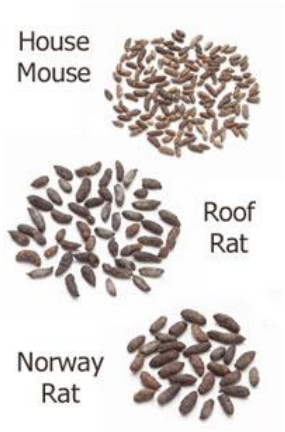
Mice feed on a wide variety of foods but prefer seeds and cereal grains. They are also fond of foods high in fat and protein such as nuts, bacon, butter, and sweets (a useful point to remember when selecting baits for snap traps). Mice are "nibblers" and may make 20 to 30 visits to different food sites each night. Compared to rats, mice forage only short distances from their nests, usually not more than 10-25 feet. When food and shelter are adequate, their foraging range may be only a few feet. For this reason, traps and other control devices must be placed in areas where mouse activity is most apparent. Similar to rats, mice prefer to travel adjacent to walls and other edges (another important point to remember when positioning control devices). Mice are very inquisitive and will investigate each new object placed in their foraging territory. Therefore, if control devices are not initially successful, try moving them to a different location.

Control

You must "think like a rodent" to control them successfully. Keep in mind the behavioral traits noted above for each species. Begin with a thorough inspection of the premises, relying on the following signs as indicators of rodent activity:

Droppings

Droppings are the most common indicators of rodent presence and provide valuable clues where to place control devices. They are usually found where rodents travel, near their shelters, or other places rodents frequent. The shape and number of droppings can tell the species of rodent involved, the approximate size of the infestation, and whether the infestation is old or new. Fresh droppings are usually soft, shiny and dark but can harden in a matter of hours. Old droppings are dull and often covered with dust. Active infestations can best be determined by removing old droppings and noting the presence of new droppings.



Rat and mouse droppings are distinct:

- Adult Norway rat droppings are about 3/4-inch long and capsule-shaped, with blunt ends.
- Roof rat droppings are about 1/2-inch long and pointed on one end.
- Mouse droppings are 1/8- to 1/4-inch long with at least one of the ends pointed.

(Image source: www.motoco.com)

Runways/Rub Marks

Rodents are creatures of habit. They consistently use the same routes between food, water, and harborage. Outdoors, runways can be found next to walls, along fences, and under vegetation. Active runways are smooth, well packed, and free of vegetation. Indoors, runways may be found along walls, edges, and between stored items. As a rat moves along walls and through tight spaces, its body hairs often leave a dark, greasy deposit on surfaces. These “rubmarks” may be seen at ground level (along floor-wall junctions) or overhead beneath beams and rafters.

Norway rat burrow and run (www.masonspestcontrol.co.uk)

Burrows

The Norway rat prefers to nest in burrows, whereas the roof rat and house mouse only burrow occasionally. Rat burrows are usually found under concrete slabs, alongside building foundations, or beneath shrubbery and debris. Active burrows usually are smooth and compacted at the entrance, and free of dust and cobwebs. To determine if a burrow is active, stuff wads of paper into the opening or cave in the burrow with soil and recheck it the following day. Rat burrows usually consist of a main entrance and two or more "bolt" holes.

Tracks

Rodent footprints or tail marks can sometimes be found on dusty surfaces or in mud. To better see tracks in dust, hold a flashlight so that the beam is directed across the tracks at an angle. A tracking patch made of talc or flour can further help to determine if rodents are present.

Gnaw Marks

Mice and rats gnaw on all types of objects. Mice often gnaw small, clean-cut holes about one inch in diameter in boxes, bags, door sweeps, etc. Gnaw holes from rats are larger (about 2 inches in diameter), and often contain rough, torn edges. Rats often gnaw on the bottom of wood doors, joists, and other structural members.

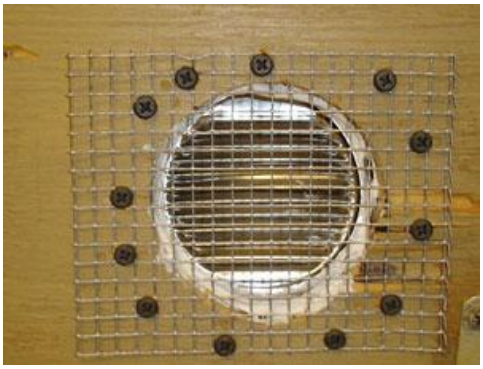
Rat-gnawing (www.maine.gov)

Sanitation

Rodents must have food and shelter to survive. Whatever can be done to limit availability of these essential resources will help to reduce rodent problems. This is especially true for rats, which require considerably more food, water, and shelter than do mice. Garbage should be kept in rodent-proof containers and picked up regularly. The same is true for pet food and bird seed. Weeds and unnecessary vegetation should be removed, especially when they are adjacent to building foundations. (Weed seeds are a favored food of mice and the vegetation serves as rodent harborage). Rubbish, lumber, rock piles, and old equipment should be eliminated, as should standing water. Where practical, boxes, crates, and other items should be stored at least 18 inches off the ground and 12 inches away from walls. Storing items in this manner makes them less attractive to rodents. It also makes it easier to inspect, clean, and install rodent control devices.

Rodent-Proofing

Along with proper sanitation, the best way to avoid rodent problems in buildings is to prevent their entry. Mice are able to squeeze through extremely small openings no wider than the diameter of a pencil (1/4-inch). Rats can enter through cracks the size of a quarter (1/2-inch). Cracks and openings under doors, around windows, in building foundations, vents, and where plumbing, electrical, and air conditioning lines enter the structure should all be sealed. Permanent sealants such as cement, sheet metal, and hardware cloth are preferred.



Exclude rodents with screens (www.doyourownpestcontrol.com)

Traps

Trapping can be a very effective form of rodent control, especially against mice. If signs indicate that you do not have a large rodent population, traps are generally preferred over pesticides because they are less hazardous to use around children and pets. In addition, because rodents are captured by the trap, they are not as likely to die in walls or other inaccessible areas and create odors. Snap traps are widely available and easy to use. Trapping efficiency can be enhanced by baiting the trigger with such foods as peanut butter, bacon, raisins, or fruit. Snap traps with an expanded trigger catch significantly more mice than conventional designs. Snap traps should be oriented perpendicular to the wall, with the trigger end against the vertical surface.

Multiple-catch trap (www.dhshouxin.com)

Automatic multiple-catch traps are very effective against mice. Mice enter these traps out of curiosity for new objects placed in their territory. One type of multiple-catch trap requires winding and flips mice into a holding

chamber. Another model operates using the principle of a trap door. Both devices can capture and hold several mice before needing to be emptied. Multiple-catch traps can be oriented with the entrance hole either perpendicular or parallel to the wall.

Glueboards

Glueboards are also very effective against rodents, especially mice. Mice become entangled in the glue when they run over the boards. Captured mice soon die of suffocation. **Along with traps, glue boards are a preferred method of control in homes and other sensitive locations where pesticides are a concern.** Glue traps can be purchased ready made, or can be custom made using bulk glue and plywood cut to varying sizes to fit the particular job requirements. Should the glue from a glue board contact the fur of a pet or the skin of a child, it can be removed with mineral or vegetable oil.

Using Traps Effectively

Regardless of the type of trap or glueboard that is used, they should be placed against walls, behind objects and appliances, and in secluded areas where droppings, damage, and other signs of rodents are evident. Rodent control devices should also be installed in areas where there is potential for rat or mouse entry (e.g., on both sides of exterior doors, and near utility openings in walls). Rodents have limited foraging ranges so it is important to use several trap placements. Traps and glue boards for mice should be spaced no more than 10 feet apart in areas where mouse activity is apparent, closer if the infestation is severe. Rat traps can be spaced 15 to 20 feet apart.

Traps and glue boards should be checked daily and dead rodents disposed of in plastic bags. Decomposing rodents attract flies, dermestids, and other insects which can lead to additional problems if not removed. Wear gloves when handling rodent carcasses to prevent any chance of disease spread. Record the location of each control device and which placements caught rodents. Keep trap catch records to identify areas of high rodent activity. Adjust the rodent control activities in these areas (e.g., adding more traps, exclusion, weed control) accordingly.

Rodenticides

Specific pesticides, known as **rodenticides**, are available for rodent control. The three main types are: poison baits, tracking powders, and fumigants.

Poison Baits

Poison baits are rodenticides that are formulated as **food-based toxicants containing seeds or grain to attract the rodents**. Many baits are anticoagulants that kill by interfering with normal clotting of the rodent's blood. This causes the rodent to die from internal bleeding. The newer anticoagulants are normally lethal to rodents after a single feeding. However, the rodent usually lives for 3 to 5 days before it dies. The older anticoagulants required several feedings and two or more weeks for death to occur.

There are some non-anticoagulant rodenticide baits. Most of them kill rodents after a single feeding. Some kill rodents in 2-3 days by causing paralysis. One causes an excess of calcium in the blood which leads to heart failure in 3-4 days. Zinc phosphide kills rodents in 1-24 hours by forming phosphine gas in the circulatory system.

Commercial baits, in pelleted or meal form, are available in sealed plastic, cellophane or paper packets (known as "place" packs), as loose bait, or molded into paraffin (wax) blocks. The wax block formulation is very useful for both outdoor and indoor baiting locations because it resists dampness and moisture.

Regardless of which bait formulation is used, **be sure to place baits in areas that are inaccessible to children, pets, and wildlife or in tamper-resistant bait stations.** Dogs, in particular, will seek out and find baits placed in areas that are accessible. Other than when placing baits directly into a rodent burrow, it makes good sense to confine baits in an enclosed bait box.

Bait boxes help to

- reduce accidental contact with people and non-target animals
- keep bait fresh by protecting it from dirt, moisture, and dust
- provide a protected and attractive place for rodents to feed
- allow label, company contact number, and other pertinent information to be provided at the baiting site.

If rodent baits must be installed in locations that are accessible to children and non-target animals, they must be placed in tamper-resistant bait boxes. These boxes are constructed of metal or non-crushable plastic, have a locking mechanism, and have a specific internal design that confines the bait within the station. In order to be considered truly tamper-resistant, the **station must also be secured to the mounting substrate** (ground, floor, wall, fence, etc.). This can be done with a stake, nail gun, length of chain, "liquid nails," or by securing the station to a weighted paving block.

Tamper-proof bait box

As with traps, **proper bait placement is critical**. Place bait in all areas suspected of harboring rodents, along routes of travel, and where they are likely to enter buildings. Several placements will produce better results than just a few. Baits that are not being fed upon may need to be repositioned. Rodent bait should be replaced at least monthly because rats and mice are not attracted to old, moldy bait.

Tracking Powder

Using a hand duster to apply tracking powder

Some rodenticides are formulated as **"toxic dusts," known as tracking powders. Tracking powders may contain anticoagulants or non-anticoagulants.** Small amounts of tracking powder are placed along rodent runways, burrows, wall voids, and other concealed locations, usually using a hand duster. **Power dusters should not be used** because they would spread the pesticide too widely. Rodents pick up the toxicant on their fur and feet and ingest it while grooming. **Tracking powders are especially effective against mice**, which groom themselves and their nestmates almost continuously. Tracking powders should only be placed in inaccessible areas or in the bottom of tamper-resistant bait stations. As with any pesticide, care must be taken not to contaminate food preparation surfaces or other surfaces that may be contacted by people or pets.

Fumigants

Certain rodenticides are also formulated as **poisonous gases (fumigants)**. The most common use of these products is for gassing burrows. This is a fast and effective way to control burrowing rodents (e.g., Norway rats) in outdoor locations. **Fumigants are extremely dangerous.** Always read and follow pesticide label directions.

Wasps, Hornets, Yellowjackets, and Spiders

Written by: Michael F. Potter and G. Mark Beavers

Stinging Insects

Yellowjacket, wasp, and hornet stings are a health threat to humans and animals. About 50 people die in the United States each year from allergic reactions to the venom of these insects. However, thousands have significant allergic reactions. Wasp, hornet, and yellowjacket workers foraging away from the nest are seldom aggressive but they often attack people who come too close to their nest. Nests that pose a threat should be treated and eliminated carefully.

Yellowjackets, wasps, and hornets use their stingers to paralyze the insects that they capture to feed their developing larvae. The stingers also are used to defend their colony from intruders. The barbed stinger of a honey bee limits it to one sting but the barbless stingers of yellowjackets hornets and wasps can be used multiple times.

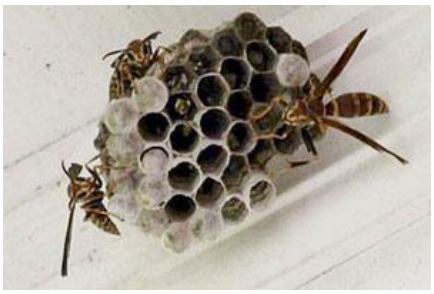
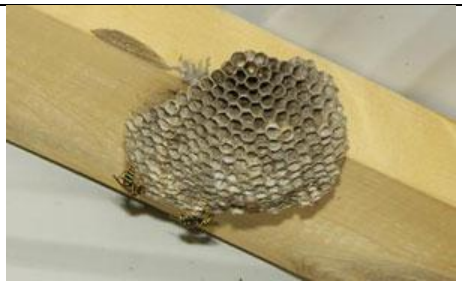
In addition to the pain of the puncture, the injected venom can trigger a local or allergic reaction. Wasp, hornet and yellowjacket stings can be life-threatening to persons who are allergic to the venom. People who develop hives, difficulty breathing or swallowing, wheezing, or similar symptoms of allergic reaction should seek medical attention immediately. Itching, pain, and localized swelling can be somewhat reduced with antihistamines and a cold compress.

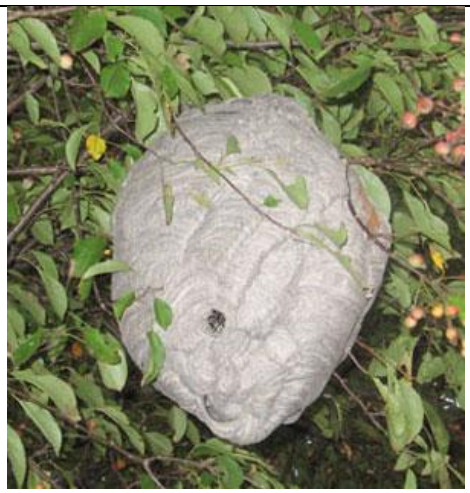
(photo: Yellowjacket stinger (apolloxpestcontrol.com))

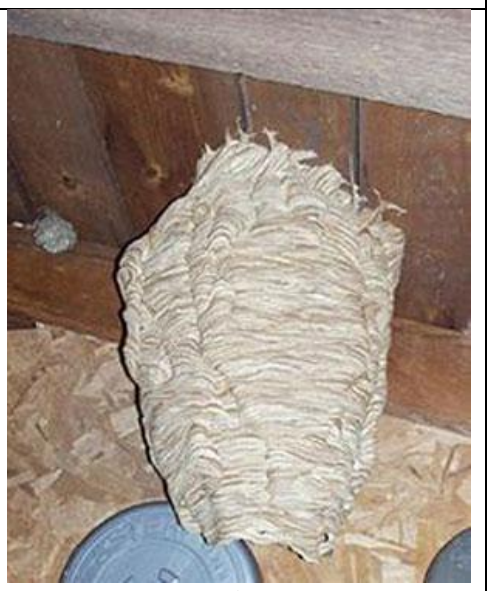
Local reactions to wasp and hornet stings peak at about 48 hours and usually get better in 5 to 10 days.

(www.webmd.com)

Paper wasps, hornets, and yellowjackets build nests of a paper-like material made with their salivary secretions and finely chewed wood fragments.

 *Common paper wasp getting wood fibers for its nest.*	The red and brown common paper wasp typically builds an open umbrella-shaped nest in a protected site under an eave or ledge. These red-brown wasps with yellow markings are not as aggressive as yellowjackets or hornets but will respond to control attempts.	 *Open umbrella-shaped nest of the common paper wasp under an eave. New workers will soon emerge from closed cells. (www.wrbctv.com)*
 *European paper wasp (ento.psu.edu)*	The yellow and black European paper wasp (which resembles a yellowjacket) is relatively new to Kentucky. Its open-faced nest may be built under an eave or in a shelter. Paper wasps can be a problem when they nest over doorways, decks, or places where people are regularly active.	 *European paper wasp nest (Joseph Berger, Bugwood.org)*

 *Baldfaced hornet (Johnny N. Dell, Bugwood.org)*	The black and white baldfaced hornet is far more difficult and dangerous to control than the paper wasps. Its large, enclosed nest usually is attached to a tree, bush, or occasionally, side of a building. It may contain 200 to 400 of these inch-long hornets by late summer. They can respond very aggressively when the nest is approached or disturbed. Nests that are near doorways or foundation shrubbery may need to be treated to eliminate the risk of people being stung.	 *Typical football-shaped aerial nest.*
 *Yellowjacket (Jon Yuschock, Bugwood.org)*	Yellowjackets are stout-bodied yellow and black insects that are often considered the most dangerous of stinging insects. They build underground paper nests, often using abandoned burrows of chipmunks or mice or holes in loose soil around shrubbery or landscape timbers. These stocky yellow and black insects strongly defend their nest against people or pets that might accidentally approach it. Nests may contain several hundred workers by	 *Underground Yellowjacket nest entrance (Mohammed El Damir, Bugwood.org)*

	late summer, making control attempts dangerous.	
 *European hornet (David Stephens, Bugwood.org)*	The European hornet is a large (1½-inch-long) brown and orange insect with dark wings. When away from the nest, it will only sting when threatened. However, these hornets will work together to defend their nest against anyone who comes too close. This insect is a woodland species that builds its large paper nest in natural cavities, especially in hollow trees. Often the nests are 6 feet or higher above the ground. Occasionally, the hornets will select a protected, undisturbed spot in a barn, attic, or wall void. An average hornet nest will have 200 to 400 workers by late summer and they can become aggressive if they feel threatened. Because of its intimidating size and appearance, the European hornet is sometimes mistakenly identified as the giant Asian hornet, which does not occur in the US.	 *European hornet nest*

Basic Life Cycle

Yellowjackets, wasps, and hornets have similar life cycles. All form annual colonies that with the exception of fertilized queens, die in the fall. The only survivors are mated queens that spend the winter under bark and in other sheltered locations. They emerge in the spring to establish new colonies. Queens select a nesting site, then work alone to build a small paper nest in which they lay a few eggs. The queens will capture and sting insects to feed to the larvae developing in the individual cells of the paper nest. In about a month, sterile female workers will emerge and assume hunting, nest building and brood care duties. The queen stays at the nest and lays eggs. New males and queens are produced in late summer to early fall. Mated queens then move to winter shelter. The workers die during the fall leaving the abandoned nest to disintegrate. While nests are not re-used, other queens may select the site to build their own.

Management

Yellowjackets and hornets defend their nests. Wear protective clothing and be sure people and pets stay out of the danger zone. A full wasp suit, sealed at the wrists, ankles, and collar, should be worn to protect against stings. Nests that are not near doorways or areas where people are active can be left to collapse in the fall. The remnants can be removed and if practical, the structure should be modified to keep it from being used the following season.

(aucklandpestcontrol.wordpress.com)

Insecticide dust formulations can be puffed into nest entryways, especially underground yellowjacket nests, for effective control. Do not block the nest opening so foraging wasps or hornets can be exposed to the treatment when they return. Do not seal openings used by wasps or hornets nesting in attics or wall voids.

Baldfaced hornet nests have a single opening, usually toward the bottom, where the wasps enter and exit. It is critical that the paper envelope of the nest not be broken during treatment or the irritated wasps will scatter in all directions, causing even greater problems.

Aerosol formulations designed to shoot a stream of insecticide from 15 to 20 feet away allows safe treatment from a distance. The insecticides in these products cause quickdown of the target pests; however, some insects may only be partly disabled and can still sting. Do not stand underneath a nest when treating.

In some cases, it may be best to make the insecticide application at night when the colony is less active. Pinpoint the nest opening during the day so you will remember where to direct your treatment after dark. Approach the nest slowly. Shining the beam of your flashlight directly into the nest entrance may startle the wasps. Direct the beam to the side to illuminate the nest indirectly. If possible, place the light on the ground rather than in your hand as wasps tend to fly toward light. As with hornets, yellowjackets are extremely aggressive when the nest is disturbed. European hornets do fly at night.

Wait at least a day following treatment before removing the nest to ensure that all of the wasps are killed. Make a repeat application if hornets continue to be seen.

Foraging yellowjackets and hornets can be a problem in early fall as these insects switch from an insect diet to searching for sugars.

Other Management Options

• **Sanitation**—The best way to reduce the threat of foraging hornets, wasps, and yellowjackets is to minimize attractive food sources. People eating outdoors should keep food and beverages covered. Spills and leftovers should be cleaned up promptly. Trash cans should be equipped with tight-fitting (preferably self-closing) lids. Similar sanitation recommendations should be made to commercial establishments, including ice cream parlors, outdoor cafes, and supermarkets. Whenever possible, trash cans and dumpsters should be located away from serving tables, loading dock doors, and other entrances. Trash cans should be equipped with a plastic liner and emptied and cleaned frequently. Maintaining high levels of sanitation earlier in the summer will make areas less attractive to yellowjackets later in the year. This strategy is especially useful for parks and recreation areas.

• **Avoidance**—Combined with sanitation is the best strategy in most situations.Yellowjackets foraging away from their nests are seldom aggressive and usually will not sting unless provoked. Resist the temptation to "swat" at the wasps. Be careful when drinking from beverage cans which may contain foraging individuals. Avoidance may also be the best advice if a yellowjacket (or hornet) nest is located in a tree or other out of the way location.

• **Repellants**—A dilute solution of ammonia and water (approximately 6 fluid ounces of ammonia per gallon of water) sprayed in and around trash cans and sponged onto outdoor tables and food preparation surfaces may help to repel yellowjackets from these areas. Use household ammonia, not bleach.

• **Traps**—Although only of marginal benefit, traps are available which may catch impressive numbers of yellowjackets when properly baited and positioned. Business establishments such as outdoor cafes may find these traps worthwhile when used with other approaches.

Spiders

Hundreds of species of spiders live in Kentucky. These predators are an important part of the food web. Some, such as garden and cellar spiders, construct webs to help entrap their prey. Wolf spiders are free-roaming hunters. Many live in lawns, gardens, and around foundations so they regularly enter homes and buildings as accidental invaders. Only a few species can live indoors for extended periods. Spiders generally will not attempt to bite unless they are held or accidentally trapped against the skin. While they have fangs and venom, most are harmless because their fangs that are too small or weak to puncture human skin. However, bites of some spiders are dangerous.

Black widow spider with its egg sac

Black Widow Spider

Black widow spiders are common in Kentucky. They live in concealed outdoor locations: piles of rocks, piles of firewood, and dark corners of garages, basements, and out-buildings. The female black widow is about 1/2-inch long, shiny black, and usually has a red hourglass mark on the underside of the abdomen. However, the hourglass mark may be reduced to two separate spots. Spiderlings and male spiders are smaller than females and have several red dots on the abdomen's upper side.

Widow spiders belong to the cobweb spider family and spin loosely organized trap webs. The webs are usually found outdoors under objects such as rocks and ground trash or under an overhanging embankment. In good areas, mature females can be found every few feet. When found indoors, they are usually under shelves, appliances or heavy furniture; not out in the open like other cobweb spiders. Black widow spiders are timid and will only bite in response to being injured. People are usually bitten when they reach under furniture or pick up objects under which a spider is hiding.

Black widow venom is a nerve toxin that acts rapidly. The victim suffers painful stiffness of the abdomen and usually a tightness of the chest. Blood pressure and body temperature may rise and sweating, localized swelling, and a feeling of nausea may occur. In about 5% of the bite cases the victim may go into convulsions and die if not given medical attention. First aid for black widow spider bites involves cleansing the wound and applying ice packs to slow absorption of venom. Victims should seek medical attention promptly.

Brown Widow Spider

Many have heard or read about the brown widow spider. It is gray to brown with white and black markings on the top surface of the bulbous abdomen. The "hourglass" marking on the under surface of the abdomen is yellow to orange, and the legs have dark bands. The brown widow is a tropical species that has been found in Florida, Georgia, Texas, and multiple localities in southeastern Louisiana and Mississippi as far north as a county bordering Tennessee. It is not known to occur in Kentucky.

The violin marking on the back of the brown recluse is not always distinct. (www.doyourownpestcontrol.com)

Brown Recluse Spider

The brown recluse spider ranges from a dark cream color to dark brown. The abdomen is darker than the rest of the body. It has a **violin-shaped, dark mark on top of the leg-bearing section of the body** so it is sometimes called the "fiddler or violin" spider. Brown recluse spiders also have 3 pairs of eyes rather than 4 pairs as do most other spiders.

The brown recluse roams at night seeking its prey. During the day, it hides in dark cracks and corners, where it may spin a poorly organized web. This shy spider will try to escape if disturbed but will bite if cornered. Some people are bitten while they sleep because they roll onto a brown recluse spider while it is hunting in the bed. More often the victim is bitten while putting on a shoe or piece of clothing that the spider is using as a hiding place.

The bite of the brown recluse is usually painless until 3 to 8 hours later when it may become red, swollen, and tender. Later, the area around the bite site may develop into an ulcerous sore 1/2-inch or larger diameter. Healing often requires a month or longer, and the victim may be left with a deep scar. Prompt medical attention can reduce the extent of ulceration and other complications that may develop. Persons bitten by a spider which they think is a brown recluse should try to collect the specimen and bring it to a qualified individual for identification. Positive identification by an expert will help the physician decide on the appropriate course of treatment. All spider bites are puncture wounds that may become infected and resemble brown recluse bites.

Other Spiders Found in Homes and Buildings

Yellow Sac Spider

Yellow sac spiders may account for more human bites than any other spider. Yellow sac spider silk lair and eggs. (Joseph Berger, Bugwood.org)

The yellow sac spider is common on foliage, under leaf litter, stones, and boards. It lives around and in buildings under the window sills and vinyl siding. While it is an outdoor spider, it can wander indoors and become established. Sac spiders hide in silk tube-like retreats in corners of walls and ceilings during the day and hunt for prey at night. Like the brown recluse, these spiders can come in contact with people as they move about at night. An aggressive spider, this species may account for more human bites than any other species. It will bite repeatedly if kept in contact with the skin. Sac spider venom is toxic to the skin so its bite can resemble that of the brown recluse but usually heals more quickly.

Inspect for sac spiders by looking for sacs in upper corners of rooms, ceilings, behind pictures, on window molding, blinds or curtains. During the day, sac spiders may be inside these sacs so vacuuming is an excellent method of control. Remove and discard vacuum cleaner bags to prevent re-infestation.

Cellar Spider

Cellar spiders have small bodies and long, thin legs. They hang from their irregular cobwebs in damp basements and crawlspaces. They are not known to bite people but large numbers of them can live close together in an extensive tangle of webbing.

Barn Spider

The barn spider is an orb weaver spider, a group that spins flat webs with radiating lines and concentric circles to trap their prey. Their webs are anchored to an overhang, like a porch or seldom-used door. The spider hangs on its web at night and hides in a crevice during the day. They seldom bite but the sticky webs are easy to walk into.

Wolf Spiders

Wolf spiders are common accidental invaders in homes. (www.uky.edu)

Wolf spiders are intimidating because they run fast and some species are relatively large. They rarely bite and it is no more dangerous or painful than a bee sting. Wolf spiders found indoors are often mistaken for brown recluse spiders. However, brown recluse spiders are very secretive and are almost never seen out in the open.

Inspection Tips

(innovativepestcontrol.com)

Thorough inspection of cracks, corners, and other dark, undisturbed areas with a bright flashlight will help determine the location and extent of a spider infestation. Pay particular attention to basements, attics, crawl spaces, closets, under/behind beds and furniture, inside shoes, boxes of stored items, and between hanging clothing. Spiders also may be found living above drop ceilings, behind baseboards, and inside ductwork or registers. Brown recluse spiders can live in utility sheds, woodpiles, and underneath lumber, rocks, and accumulated debris. Protect yourself from bites by wearing work gloves when inspecting inside boxes or when moving stored items.

Brown recluse in sticky trap (horizonpestcontrol.com)

Use glueboards or sticky traps to find where spiders are active and to monitor control efforts. Placed flush along walls and in corners, glueboards and sticky traps are useful monitoring tools and will also capture large numbers of spiders. Brown recluse and black widow spiders also live outdoors in barns, utility sheds, woodpiles, and underneath lumber, rocks, and accumulated debris. To avoid being bitten, wear work gloves when inspecting inside boxes or when moving stored items.

Spider Control

Eliminating a spider infestation involves two basic principles:

- **altering the environment in and around a building to make it less attractive** to spiders; and
- **finding and destroying as many spiders as possible**.

The following measures can be used to control all spiders:

1. Routine, thorough housecleaning is the best way to eliminate spiders and discourage their return. A vacuum cleaner or broom effectively removes spiders, webs, and egg sacs.
2. Spiders prefer quiet, undisturbed areas such as closets, garages, basements, and attics. Reducing clutter in these areas makes them less attractive to spiders.
3. Large numbers of spiders often congregate outdoors around the perimeter of structures. Migration indoors can be reduced by moving firewood, building materials, and debris away from the foundation. Shrubs, vines and tree limbs should be clipped back from the side of the building.
4. Install tight-fitting window screens and door sweeps to exclude spiders and other insects. Inspect and clean behind outdoor window shutters.
5. Consider installing yellow or sodium vapor light bulbs at outside entrances. These lights are less attractive than mercury vapor, fluorescent, or incandescent bulbs to night-flying insects which, in turn, attract spiders.
6. To further reduce spider entry from outdoors, insecticides can be applied as a “barrier treatment” around the base of the foundation. Pay particular attention to door thresholds, garage and crawl space entrances, including foundation vents. Wettable powder or microencapsulated “slow-release” formulations are most effective.

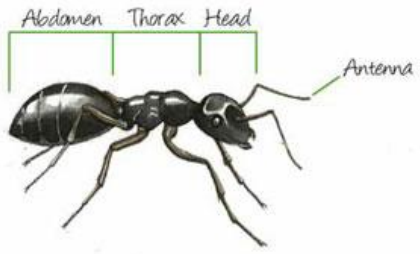
General Pests

Written by: Michael F. Potter and G. Mark Beavers

Ants

Ants are the most frequent and persistent pests encountered around homes and buildings. Dozens of different species occur around homes and buildings, each has unique characteristics that may influence the most effective control method to use. In Kentucky, the most common house-invading ants include pavement ants, carpenter ants, acrobat ants, and odorous house ants.

Besides being a nuisance, ants contaminate food, build unsightly mounds, or cause structural damage by hollowing out wood for nesting. Most species of these social insects live in belowground colonies. Exceptions include carpenter ants and acrobat ants that live in moist wood. Some species enter buildings in search of sweet or fatty substances. Others live in lawns and gardens or under rocks, patios, or sidewalks. While many of these species do not enter buildings, the mounds of fine soil that they bring to the surface while excavating can be a nuisance.

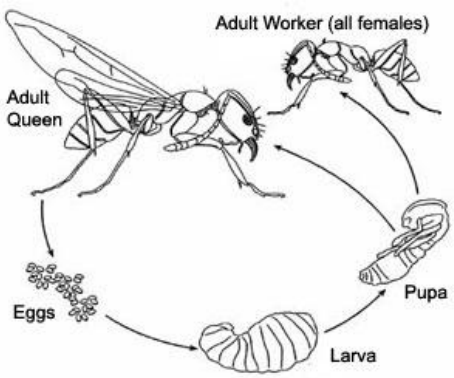


Wingless worker ant with elbowed antennae and narrow waist between thorax and abdomen. (www.antark.net)

Ants range from less than 1/8-inch to 1/2-inch long. Most have black bodies but some are yellow or red. All have chewing mouthparts. Ants undergo complete metamorphosis with 4 life stages: egg, larva, pupa, and adult.

Ants are social insects that live in cooperative, intermingling colonies consisting of hundreds to thousands of individuals. There are different types of individuals (castes) in each colony that perform specific functions. All ant colonies contain one or more egg-laying queens. The eggs hatch into grub-like larvae must be fed and cared for by sterile female workers. The workers feed and care for the queen and developing brood. In addition they maintain and expand the nest and forage for food and water. Like all social insects, ants share food. Workers lay down invisible odor trails, which they follow. In many species, the trail of ants is distinct enough to be followed back to the nest.

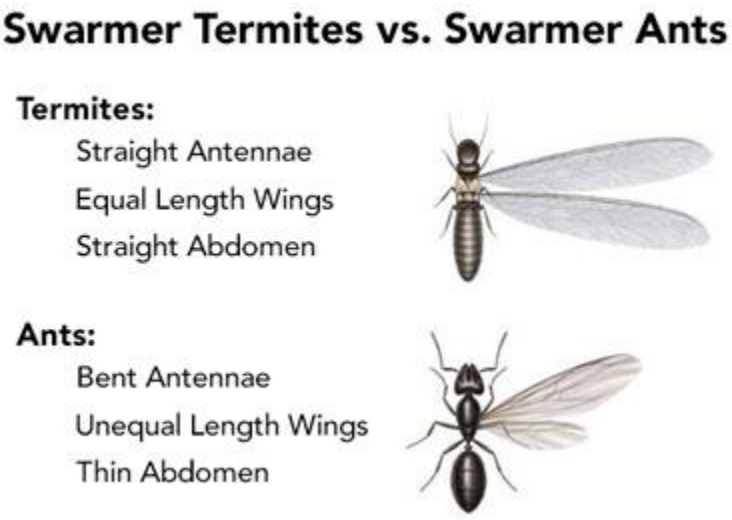
At certain times of the year, ant colonies produce winged individuals known as swarmers that emerge from the nest to mate and establish new colonies. When a swarm of ants emerges inside a home, it's an indication that a nest is present within the structure. Fortunately, the success rate for swarmers establishing new colonies inside buildings is low.



Most adult ants are sterile workers. Winged males and females are produced at certain times of the year. (www.animalspot.net)

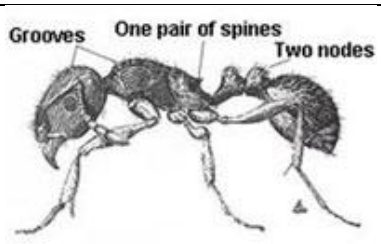
Winged ants can be distinguished from termites:

- Ants have a narrow (pinched) waist similar to wasps, while termites are virtually the same width from end to end.
- Ants and termites each have four wings; however, the front wings of ants are longer than the hind wings. The 4 wings of termites are equal in size and length.
- The antennae of ants are bent or "elbowed"; termite antennae are straight.



Antennae, waist, and wings of termites and ants are very different. (www.tigertermite.com)

Common Ants



Pavement ant (www.ucanr.edu)

nest under objects on the ground (JJ Neal)

Pavement Ant

Pavement ants are 1/8th inch long with dark brown to black bodies. They nest under stones, boards, sidewalks, and other objects laying on the ground and pile the excavated soil in mounds around the entrance. They also may become established in bare ground next to foundations or under landscape mulch. Usualy they pick sites near a water source. These ants seldom nest indoors but workers will enter buildings in search of food.

Pavement ants can feed on a variety of foods but prefer those that are greasy or sweet. Worker ants may forage for food up to 30 feet from the colony and readily set up trails to help them to move to from food sources at night.

(allpestcontrolcompany.com)

Odorous House Ant

The odorous house ant has become the **most common and difficult ant species to control in homes and buildings**. These small (1/8-inch long) dark-bodied ants form distinct trails along outdoor and indoor surfaces.

Odorous house ants will nest in virtually every imaginable location: under pavement, stones, mulch, woodpiles, flower pots, and house siding, foraging indoors for food and moisture. Nests also occur indoors within wall cavities, appliances, potted plants, etc., especially near a moisture source.
The **nests tend to be mobile;** colonies relocate fast and often in response to changes in weather and disturbance. Odorous house ant colonies tend to **have numerous, egg-laying queens and the primary colonies may split into smaller ones** for no apparent reason. Ants foraging indoors feed on all manner of foods, ranging from the trash can to the cereal bowl. They apparently prefer foods with a high sugar content. **Baits can be used to control odorous house ants.** Foraging workers collect and carry the bait back to the nest. The slow-acting insecticides do not kill the workers before they have had a chance to share the

	bait with the queen and developing immature ants. Baits must be placed where ants are active but where children and pets cannot reach them. It may require two weeks or longer to obtain control with a bait.

Occasional Invaders

The clover mite has a very long front pair of legs.

Clover Mites

Clover mites are accidental invaders that can be temporary nuisances in homes and buildings during cool, rainy spring weather. They can be especially abundant in homes and buildings surrounded by thick, succulent growth of well-fertilized lawns. The mites feed on grass and broadleaf plants in turf but may crawl from those areas to homes and buildings. They can enter structures through gaps around windows and exterior doors.

The clover mite is easily recognized by the pair of very long front legs that are attached to its small dark body. These mites leave a red-brown stain when crushed that makes them appear to be blood feeders; however, they will not harm people or pets, nor will they infest household products. They are a temporary nuisance that cannot survive long indoors.

A soapy rag or wet sponge can be used to clean mites from surfaces. Wipe carefully to avoid crushing the mites and causing stains. The crevice tool of a vacuum cleaner may also be useful.

Over-fertilized lawns create situations that are ideal for mite numbers to explode. A barrier spray of a residual insecticide may reduce movement of the mites from grasses to patios, decks, or house walls. Treat at the base of all exterior doors, garage, and crawl space entrances, around foundation vents and utility openings, and up underneath siding. It may also be useful to treat around the outside perimeter of the foundation in a 2- to 6- foot-wide band along the ground, and 2 to 3 feet up the foundation wall according to label directions.

Millipedes are slow-moving decomposers with 2 pairs of legs per body segment. (David Cappaert, Bugwood.org)

Millipedes

Millipedes are ½ to 1½-inch long gray or brown cylindrical worm-like arthropods. They have a pair of antennae and 2 pairs of short legs on each body segment. Millipedes are common under moist leaf litter and in heavily mulched landscapes where they feed on decaying organic matter. The life cycle of these decomposers includes egg, nymph and adult stages.

Large numbers of millipedes become active during their mating season, crawling over lawns and sidewalks, and occasionally entering buildings. **They are a nuisance but do not cause damage nor can they live long indoors.** Prevent invasion by removing leaves and compost around buildings and by sealing cracks in foundation walls and around doors, basement windows, crawl spaces, and vents.

Spraying a 10-foot wide strip around the foundation is helpful in control. Repeat applications may be necessary during periods of heavy migration.

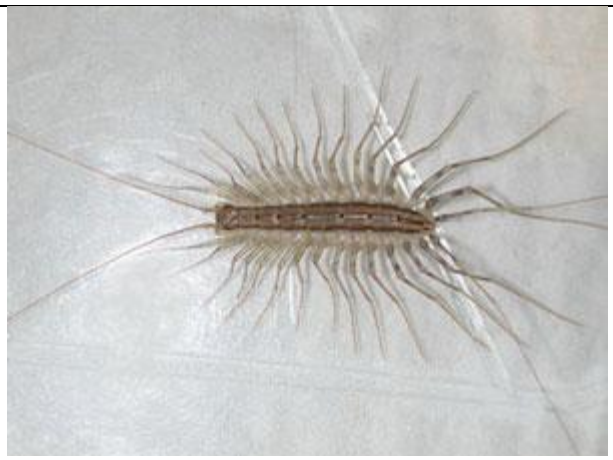
(Joseph Berger, Bugwood.org)

Centipedes

Centipedes are **fast-moving predators that use sharp fangs to inject venom into the insects and other small creatures on which they feed.** They are usually active at night and hide in cracks or under objects. These arthropods prefer dark, humid areas under rocks, mulch, leaf litter, or beneath loose bark in rotting logs. Individual centipedes may live for a year or more.

Centipedes can enter homes by crawling under doors. They may enter through most any small opening, such as where pipes or wires enter a structure. Once inside, they favor undisturbed areas in garages, bathrooms, basements, and crawl spaces that provide hiding spaces and food. Long-legged house centipedes are relatively common in houses. They run across the floor very quickly, stop suddenly for a moment and then run off again, trying to crawl under something if they can.

As with millipedes, **problems with these pests often coincides with excessively wet weather**; patience and



House centipede

Centipedes are fast-moving predators that have 1 pair of legs per body segment.

drier conditions often will correct the problem. The most effective, long-term measure for reducing entry of centipedes and their prey is to **minimize moisture and hiding places, especially near the foundation.** Remove leaves, grass clippings, heavy accumulations of mulch, boards, stones, boxes, and similar items lying on the ground. These items often attract and harbor pests. Any that cannot be removed should be raised off the ground.

Silverfish (J. Hahn, University of Minnesota)

Firebrat (Mohammmed El Damir, Bugwood.org)

Silverfish and Firebrats

Silverfish and firebrats are **flat, wingless insects that are about 1/4- to 1/2-inch long.** They have **three long "bristletails" at the end of their body**. The stages in their gradual metamorphosis life cycle are: egg, nymph and adult. These scavenging insects feed at night on stored foods, paper, or almost anything containing proteins or carbohydrates. They hide in cracks and crevices during the day. Silverfish prefer cool, moist places while firebrats settle in hot, humid areas. Poorly ventilated attics or leaky roofs and can provide good living conditions for them.

Silverfish and firebrats are primarily nuisances but usually cause little damage. In rare situations, large infestations may damage paper, book bindings, wallpaper, cereals, starched fabrics, leather, fur, silk and rayon.

When silverfish or firebrats are seen or their damage is suspected, inspect basements, closets, storage areas, and other potential sites to determine the source of the problem. Use sticky traps to help determine where silverfish and firebrat numbers are the highest. Concentrate management efforts at the source of the infestations.

(www.bugguide.net)

Booklice

Booklice (or psocids) are pale to light brown soft-bodied insects with long antennae. They are **not related to the blood-feeding "true" lice that infest humans and animals.** Barklice live in damp, warm, undisturbed situations: under bark, grass, leaves, damp wood, or similar places. Sometimes, they are "accidental invaders" that can become established in houses, warehouses, and libraries, etc.

Booklice can thrive in any material that can support mold growth. **Some can feed on starchy material such as the paste or glue of book bindings, stored foods, stacks of books, newspapers, etc.** Boxes of stored books or papers provide ideal living sites, which gave them the name "booklice". In addition, these insects can live wall voids or behind loose wallpaper. Locating the site or source of the infestation is the key to eliminating the problem. Then, the source of the insects can be destroyed. **It is important to lower the humidity in places where booklice are living.** This single step will not end the problem but should reduce it substantially.

Fabric Pests

Varied carpet beetle (Kansas Department of Agriculture, Bugwood.org)

Varied carpet beetle larva (www.enviro-tec.co.uk))

Larder beetle (Joseph Berger, Bugwood.org)

Larder beetle larvae (www.bugguide.net)

Carpet Beetles

In addition to attacking natural fiber carpets, carpet beetles also will attack as wool, furs, silk, feathers, felt , leather, and some stored products. Long term, undetected infestations can result in significant damage to clothing, bedding, floor coverings and other articles. There are many species of these common scavengers. The varied carpet beetle and the larder beetle are common in Kentucky.

Varied carpet beetles are about 1/10-inch long black beetles with an irregular pattern of white, brown, and yellow scales on their hard wing covers. These beetles feed outdoors on nectar and flower pollen. They are attracted to sunlight and are often found at windows in early spring.

Beetles undergo complete metamorphosis so the hairy, worm-like larvae look very different from the adults. They prefer dark, undisturbed places where they feed on a variety of natural products: natural fibers, furs, feathers, hair, processed meals and mixes, spices, cereals, and dried pet foods. They also can feed on accumulations of dead insects in ceiling light fixtures, wall voids, and attics, in addition to pet hair. These insects are very common in houses and buildings.

Larder beetles feed on a variety of animal-related materials: feathers, skins, and carcasses. Around the kitchen and food storage areas, they can feed on fur, hair, hides, feathers, cured meats, stuffed animals, pet food, and cheese. Infestations frequently can be traced to dried pet food that contains enough meat and bone meal and animal fat to allow development of this insect. They can live on fat accumulations behind stoves or in grease deposits in fume hoods. They also can develop in dead rodents, bats, or birds trapped between walls or in chimneys, heating ducts or crawl spaces, or accumulations of dried insects in window or ceiling light fixtures can be a food source for these beetles.

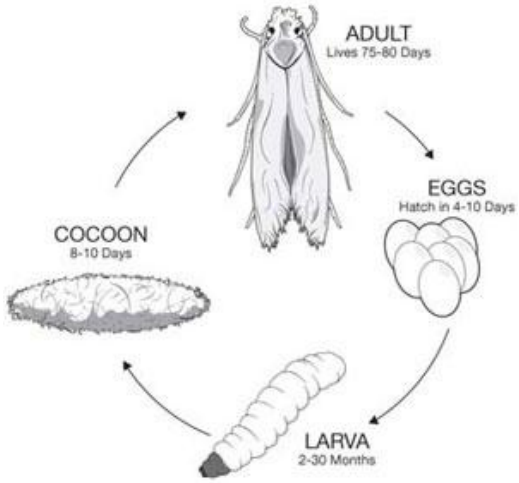
The key to ending carpet beetle problems is to find and remove the source. Then, the area must be

cleaned thoroughly, including cracks and crevices where larvae and eggs may have accumulated. Crack and crevice insecticide applications may be needed to end the infestation.

Webbing clothes moth (www.entomology.ca.uky.edu)

Case-making clothes moth (www.entomology.ca.uky.edu)

Clothes Moths



Clothes moths undergo complete metamorphosis, damage is caused by the larvae (www.mynaturalpest solutions.com)

The **caterpillar larvae of clothes moths are well-known pests of stored woolen, cotton, and silk garments. These scavengers also will eat hair, fur, silk, felt and feathers.** They use their chewing mouthparts cause irregular surface feeding or holes eaten completely through the fabric. Mature larvae that have finished feeding often leave the infested items and crawl slowly over walls or ceilings to find places to pupate. The adult (moth) stage does not cause any damage.

The **casemaking clothes moth** is light brown with has three dark spots on each wing. The larva lives in a silken case that includes pieces of infested item. It may travel a long distance to protected cracks or along the juncture of a wall and ceiling where the caterpillar will attach the case to a surface and pupate.

The larvae of the **webbing clothes moth** usually spin silken feeding tunnels over the infested item. It is

Clothes moth damage (www.saga.co.uk)

common to find them feeding under cuffs, collars, and other hidden parts of clothing.

Serious clothes moth infestations can develop undetected in a home, causing significant damage to clothing, bedding, floor coverings and other articles. Clothing and blankets in constant use are seldom damaged, nor are rugs that get a normal amount of traffic or are routinely vacuumed. Edges of carpeting next to walls or underneath furniture are often attacked. Clothes moths may also be found infesting upholstered furniture (both inside and out), and in air ducts where the larvae may be feeding on lint, shed pet hair and other bits of debris. Infestations may also originate from bird or animal nests, or an animal carcass present in an attic, chimney or wall void.

Clothes moths are seldom seen because they avoid light. They prefer dark, undisturbed areas such as closets, basements and attics, and tend to live in corners or in folds of fabric. Clothes moth adults do not feed so they cause no injury to fabrics. However, the adults produce eggs which hatch into the fabric-eating larvae.

Prevention is a very important part of fabric pest control. This can be done by cleaning fabrics correctly and storing them in tight containers with moth crystals.

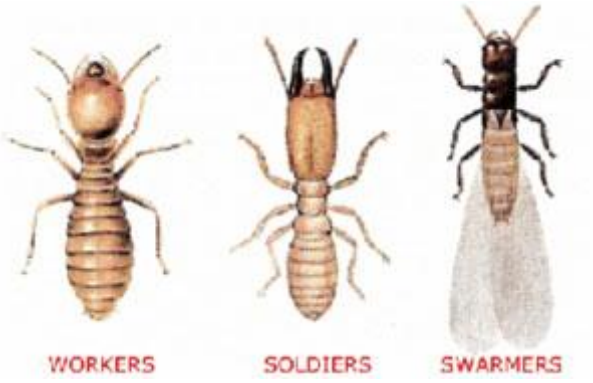
Wood-destroying Organisms

Written by: Michael F. Potter and G. Mark Beavers

Subterranean Termites

Subterranean termites are so named because their colonies usually are located belowground with the workers attacking wood above ground. **Termites cause billions of dollars in damage and control costs each year.** They primarily feed on the cellulose and lignin found in plant cell walls. Bacteria and protozoa that live in the intestinal tract of these insects help to digest these materials.

Termites are social insects that live in colonies in which there is a division of labor between different types of individuals (castes): winged reproductive queens and males, workers, and soldiers.



Termite castes (www.unitedsprayingservice.com)

"Swarmers", the winged reproductives, emerge from the colony between March and June. After mating and finding a suitable site, the queen's wings break off and she begins to lay eggs from which workers will hatch.

The white, soft-bodied workers are the largest group in a colony. Some construct the tunnels and galleries needed for colony growth and clean and maintain them. They use bits of soil and excrement to build shelter tubes and to close breaks in the surface of infested wood. Other workers gather food and water.

Soldier termites have large heads with powerful jaws. They guard the nest from attack by ants and other invaders. Soldiers must be fed and groomed by workers.

Signs of infestation include:

1. **emerging "swarmers" in the spring**,
2. **earthen (mud) tubes extending over foundation walls, support piers, sill plates, floor joists, etc.**

The mud tubes are typically about the diameter of a pencil, but sometimes can be thicker. Termites construct these tubes for shelter as they travel between their underground colonies and the structure. To help determine if an infestation is active, the tubes may be broken open and checked for the presence of small, creamy-white worker termites.

A vacant tube does not necessarily mean that the infestation is inactive; termites often abandon sections of tube while foraging elsewhere in a structure.

Mud tube (www.greenninjapestcontrol.com)

Termite-damaged wood is usually hollowed out along the grain, with bits of dried mud or soil lining the feeding galleries. Wood damaged by moisture or other types of insects (e.g., carpenter ants) will not have this appearance. Occasionally, termites bore tiny holes through plaster or drywall, accompanied by bits of soil around the margin. Rippled or sunken traces behind wall coverings can also be indicative of termites tunneling underneath.

Soil in termite galleries in wood (www.narragansetpestcontrol.com)

Often, there will be no visible indication that the home is infested. Termite infestations can go undetected for years, hidden behind walls, floor coverings, insulation, and other obstructions. Termite feeding and damage can even progress undetected in wood that is exposed because the outer surface is usually left intact.

Termites must have wood for food and usually need soil for moisture. **Wood in contact with soil is ideal for termite development.** Termites occasionally become established without soil contact when a leaky roof or pipe provides moisture. Infestations may become established under concrete slabs, garage floors, patios, and dirt filled porches. Termites may then enter the building through structural wood or foundation walls adjacent to the slab. In houses built partly or completely on slabs, termites enter through expansion joists, cracks, and utility openings. **The presence of a colony can be determined by probing wood near the foundation or soil or by observing earthen "shelter tubes" on foundation walls or wood.**

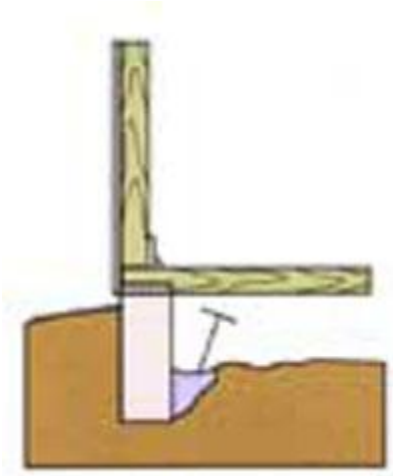
Treatment

Barrier Treatment

For years, the standard method of controlling subterranean termites was to apply a liquid termiticide to the soil. The goal is to create a continuous chemical barrier around and under the building in order to block all potential routes of termite entry. Termites attempting to penetrate the treated soil were either killed or repelled. In actual practice, there are many obstacles to achieving such a barrier. **Many potential termite entry points are hidden behind walls, floor coverings, and other obstructions. Even where access for treatment is possible, it is hard to uniformly wet soil and achieve thorough coverage.** A typical "barrier" treatment may involve hundreds of gallons of pesticide injected into the ground alongside the foundation, beneath concrete slabs, and within foundation walls.

Liquid barrier treatment (www.epestsupply.com)

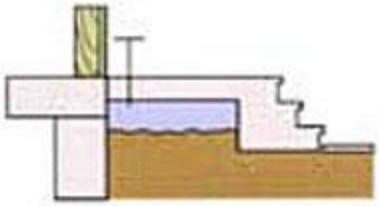
Trenching



Trenching (www.epestsupply.com)

For outside basement walls (where the footing is deep) a V-shaped trench is dug against the wall. It should be deep enough to insure penetration to the footing. After trenching, use a perforated hollow rod to inject insecticide to the footing of the basement wall. When treating concrete block or brick foundation walls, drill them above the grade line and flood all voids with insecticide.

Drilling



Drilling (www.epestsupply.com)

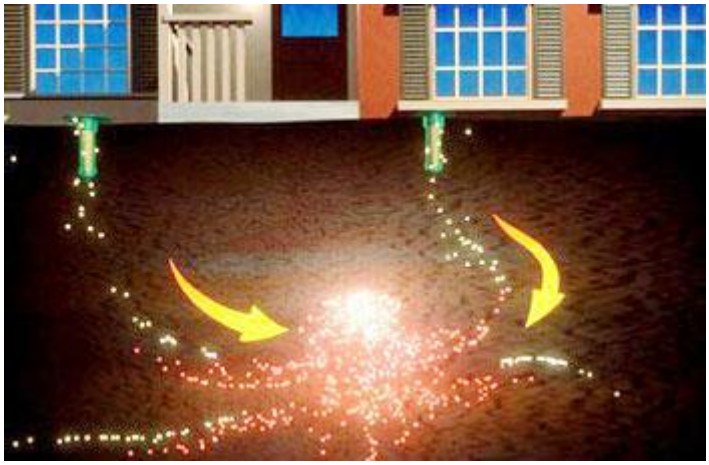
To treat the slab-constructed buildings, saturate the soil beneath the slab. **Inject insecticide either through holes drilled in the slab or by drilling and rodding horizontally under the slab.** Either method must be done carefully since things such as heat pipes and vapor barriers may be located under the slab. **Soil treatment prior to pouring the slab is the best method of prevention.**

Treat filled porches by: drilling the slab from the top; drilling the porch foundation horizontally at each end next to the building and injecting the chemical by rodding; or by making openings in the foundation wall, excavating the porch fill immediately under the slab, and drenching the soil with insecticide.

Baits

Termite baiting employs a very different approach. Small amounts of material containing a slow-acting insecticide are placed in stations to knock out populations of termites foraging in and around the structure.

Foraging termites consume the bait and share it with their nest mates, resulting in a gradual decline in termite numbers.



Foraging termite workers find belowground bait stations (DowAgroSciences)

Some baits may even eradicate entire colonies. A comprehensive baiting program then seeks to maintain a termite-free condition on the customer's property through ongoing inspection, monitoring and re-baiting as needed.

Termite bait station (www.aaaexterminating.com)

The baits consist of paper, cardboard, or other palatable food, combined with a slow-acting substance lethal to termites. The bait must be "tasty" enough that termites will readily consume it, even in the presence of competing tree roots, stumps, woodpiles and structural wood. If the bait kills too quickly, sick or dead termites may accumulate in the vicinity of the bait stations, increasing the chance of avoidance by other termites in the area. Delayed-action also enhances transmission of the lethal agent to other termites, including those that never fed on the bait. Entire colonies can be eliminated in this manner, although total colony elimination is not always necessary to afford structural protection. There are different methods of termite baiting. Some are

inserted belowground in the yard, while others are installed inside the building in the vicinity of active termite mud tubes. On some properties, baits may constitute the only form of treatment; on others, they may be supplemented with a partial or complete liquid application.

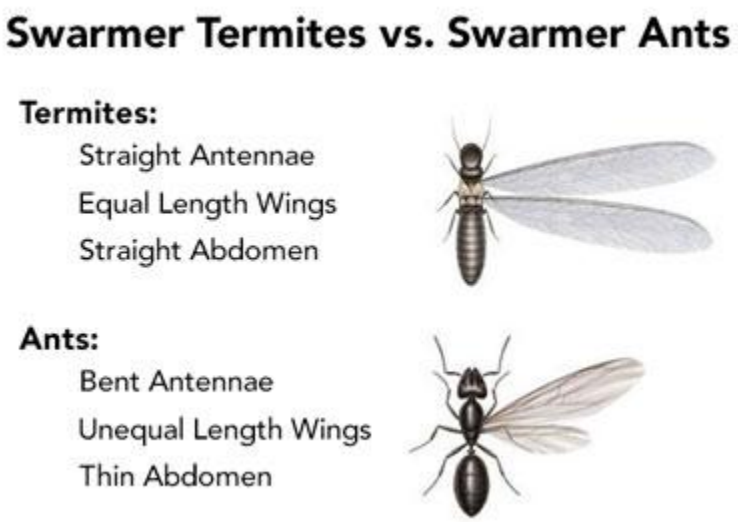
Carpenter Ants

Carpenter ant castes
Winged male, female, and different sized workers (L. Hansen)

Carpenter ants vary in size, measuring up to 1/2-inch long and may range in color from red to black. They prefer to live in moist wood. **Their nests are most likely to be found in wood dampened by water leaks around sinks, bathtubs, poorly sealed windows/ door frames, roof leaks, or poorly flashed chimneys**. Nests are especially common in moist, hollow spaces such as the wall void behind a dishwasher, or in a hollow porch column. Carpenter ants do not eat wood but simply hollow it out to create galleries to raise their brood. **They chew along the grain leaving smooth tunnels that are free of sawdust or soil.** Since there often will be no external signs of damage, probing the wood with a screwdriver helps reveal the excavated galleries. Another technique for locating hidden nests is to tap along baseboards and other wood surfaces with the blunt end of a screwdriver, listening for the hollow sound of damaged wood. Structural damage increases with the time a colony is present in a structure.

Carpenter ants feed on protein and sugar. Outdoor food sources can be living and dead insects and the sweet liquid honeydew excreted by aphids and other sap-feeding insects. Indoors, carpenter ants may feed on meats and pet food, as well as syrup, honey, sugar, jelly, and other sweets.

Winged ants can be distinguished from termites by comparing certain features. Ants have a narrow (pinched) waist similar to wasps, while termites are virtually the same width from end to end. Ants and termites each have four wings; however, the front wings of ants are longer than the hind wings. The four wings of termites are equal in size and length. Finally, the antennae of ants are bent or "elbowed"; termite antennae are straight.



Antennae, waist, and wings of termites and ants are very different. (www.tigertermite.com)

The best method to control carpenter ants is to locate and destroy the nest, replace damaged or decayed wood, and eliminate existing moisture problems. This can be a difficult and challenging task.

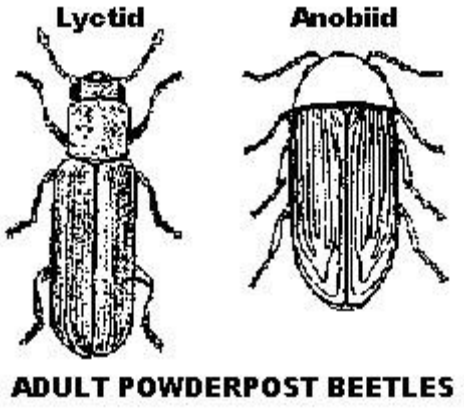
Powderpost Beetles

The name powderpost beetle is used to for several species of small (1/8 to 3/4 inches long) boring insects that reduce wood to a fine, flour-like powder during their development. Damage is done by the grub-like larvae as they chew narrow, winding tunnels in wood.

Powderpost beetle "shotholes" and sawdust (townandcountrysolutions.com)

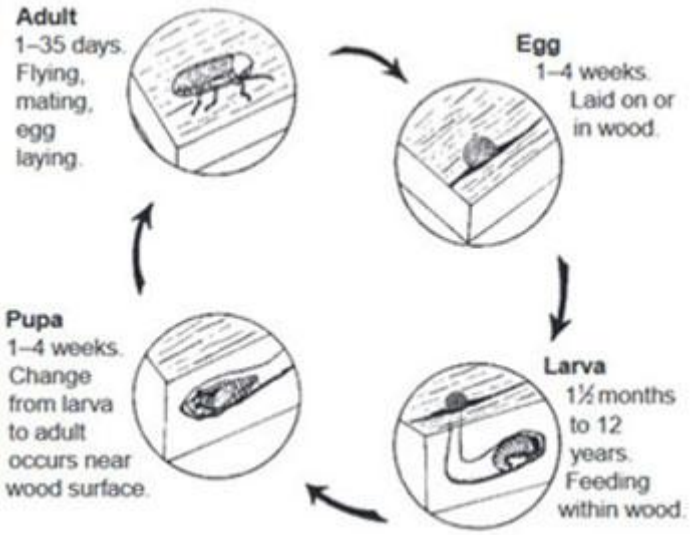
Powderpost beetles normally breed in the dead branches and limbs of trees. However, they can attack stored lumber, rafters, joists, finished wood, and furniture products. Infestations usually begin when the beetles lay eggs in wood that is being stored and cured. New adults emerge later from the finished product. **Old items of furniture and wood antiques are especially vulnerable to attack by these insects.**

Infestations are discovered after noticing small, round "shotholes" in the wood surface. These are exit holes where adult beetles have chewed out of the wood after completing their development. In addition, slight jarring of the wood causes a fine powder to sift from these holes. When the wood is cut or broken, the interior reveals galleries filled with a finely packed powder which is sawdust-like waste produced by the feeding of grub-like larvae. Newly-emerged adults mate and lay eggs on or below the surface of bare (unfinished) wood. The eggs hatch into tiny larvae which bore into the wood, emerging as adults 1-5 years later.

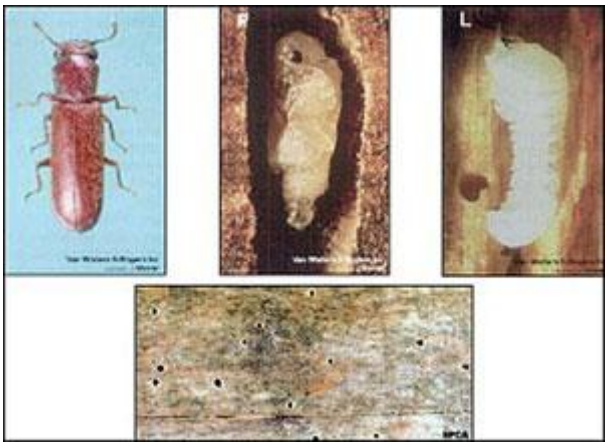


(M.F. Potter, University of Kentucky)

There are several species of powderpost beetles. The **most common are Lyctid powderpost beetles and Anobiid powderpost beetles**. The adults are small (about 1/3 inch long) and usually reddish-brown to nearly black.



The stages in the life cycle of powderpost beetles are: egg, larva, pupa and adult.
(apolloxpestcontrol.com)



Adult, pupa, larva, and damage of lyctid powderpost beetle (www.peipestcontrol.com)

Lyctid powderpost beetles attack only products manufactured from hardwoods , e.g., oak, ash, walnut and hickory. Infestations are most often found in wood paneling, molding, window and door frames, plywood, hardwood floors, and furniture.

Imported tropical hardwoods are especially prone to lyctid beetle attack because of poor storage and drying practices prior to shipment to this country. **Articles made of bamboo also are commonly infested**. Rafters, joists, studs and other structural framing of homes are not normally attacked by lyctid beetles since these wood members are almost always constructed from pine or other softwoods. Lyctids rarely infest wood older than 5 years. Thus, **infestations generally are encountered in new homes or newly-manufactured articles**. In almost all cases, infestation results from wood that contained eggs or larvae at the time of construction.

(Bugguide.net, Iowa State University)

Anobiid powderpost beetles may **attack both hardwoods and softwoods**, which means that infestations may be found in all the same places as Lyctid beetles, as well as in structural timbers (beams, sills, joists, studs, subflooring, etc). Maple, beech, poplar and pine are especially susceptible to attack. **Anobiids prefer to infest wood which is damp; therefore, infestations usually begin in moist, poorly-ventilated areas** such as crawl spaces, basements, garages and utility sheds. Under favorable conditions of moisture and temperature,

infestations may spread upwards into walls and upper levels of the structure, including furniture. Infestations may occur as a result of using infested lumber, or from beetles flying in from outdoors or being carried in on firewood. Infestations develop slowly but wood can be re-infested year after year.

To prevent infestation or to control existing infestation, wet all surfaces thoroughly with insecticide. Furniture and other movable objects may be fumigated in special chambers.

Longhorned Beetles

Longhorned beetle adult (Clemson University USDA Cooperative Extension Slide Series, Bugwood.org)

Longhorned beetle larva (Lacy L. Hyche, Auburn University, Bugwood.org)

Longhorned beetles are large (½ to 3 inches long) and brightly colored. They have long, thin antennae which may be longer than the body. Eggs are usually laid on unseasoned, rough-sawed timbers or logs. The larvae, called roundheaded borers, feed in the wood. They bore large, oval holes as they move through the wood. The stages in the life cycle of the long-horned beetle are: egg, larva, pupa, and adult.

Old house borer adult
(Pest and Diseases Image LIbrary, Bugwood.org)

Old house borer larva
(Clemson University USDA Cooperative Extension Slide Series, Bugwood.org)

The only longhorned beetle species that requires control in structures is the old house borer. The adult is about 3/4 inch long, grayish-brown to black, and has two white patches on the wing covers. Its galleries have distinctive ripples on the interior surface. The old house borer usually damages only pine sapwood.

For control of old house borer, infested timbers must be drilled and pressure-treated to force the insecticide throughout the gallery system. Fumigation under a tarpaulin may sometimes be required.

Carpenter Bees

Carpenter bees resemble bumble bees but the upper surface of their abdomen is bare and shiny black; bumble bees have a hairy abdomen with at least some yellow markings.

Comparison of bumble bee and carpenter bee
(www.doyourownpestcontrol.com)

Carpenter bees rear their young in tunnels that they chew into weathered softwood. The entrance hole and tunnels are perfectly round and about 1/2-inch in diameter. Coarse sawdust often accumulates beneath the entry hole. Females lay their eggs along it in a series of cells. Each is provisioned with a ball of pollen on which the larvae feed. The new adults emerge in late summer. Female carpenter bees may excavate new tunnels for egglaying, or enlarge and reuse old ones. They may cause extensive damage over time.

Carpenter bee larvae in galleries (www.myfavoritegardenshop.com)

Wood Rot

Cubical brown rot is a type of decay that causes wood to shrink and separate into brown cubes that split against the grain. Advanced stages of brown decay result in dry, powdery wood that cannot support much weight and crumbles easily.

Cubical brown rot (www.basementsystems.com)

White rot is a white, stringy and mushy. It tends to be more common in hardwoods.

White rot (www.stewartpaint.com)

Severe wood decay occurs only in wood with a moisture content greater than 20%. Most wood-rotting fungi grow only on wood which is subject to wetting by rain, roof leaks, plumbing leaks, condensation, or contact with moist soil. Fungi take their food from the wood as they grow and reduce the strength of wood, often making it brown and crumbly or white and stringy. Discoloration and powdery mold growth below the surface of wood should not be confused with decay although it indicates the surface of the wood has had greater than 20% moisture at one time. The moisture content of the wood may be measured with a moisture meter to accurately determine the need for control.

Fungicides will not stop wood decay once it has started, though they may slow its progress. **The key to complete control of wood decay is to eliminate the source of moisture.** This may be done through proper drainage, breaking control between wood and soil, proper ventilation, the use of vapor barriers, and waterproofing foundations. In some situations, pressure-treating lumber with preservative chemicals may prevent attack.

The term "dry rot" has been used to describe decayed wood that has since dried and ceased to decay. Moisture is required for wood decay to occur, so no literal “dry rot” exists.