



## Pest-proofing Your Home

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COLLEGE OF AGRICULTURE & LIFE SCIENCES

Cooperative  
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# PEST-PROOFING YOUR HOME

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**az1677**

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## Introduction

The presence of pests inside a home is a concern for most homeowners. Many people are disturbed by the presence of even a single pest organism and are likely to control the invaders themselves or call a pest management company. In fact, many of the creatures we encounter in our homes can be prevented from entering in the first place by using simple techniques collectively referred to as **“pest-proofing”**. It is important to realize that not all creatures invading homes are “pest” species. In Arizona more than 15,000 species of insects have been identified across the state, but more than 95% are either harmless or beneficial to humans. In addition to insects, pests include other arthropods such as spiders, mites, ticks, and scorpions; vertebrates such as reptiles, birds, and mammals; and plants that are weeds. A pest is any living organism that interferes with human interests or is harmful to humans or their possessions including pets, livestock, and crops.

It is interesting to learn about pests in and around our homes, and understand the ecological role they play. However, we do not need to compromise our own interests and invite them into our homes to live. This document shows how your home can be modified to exclude unwelcome visitors and make it less attractive to them. Generally, pest problems can be solved without having to kill all of them, and often without using pesticides.

Pest-proofing includes several methods of preventing pests from entering into homes or similar structures. If done correctly, pest-proofing your home saves you money by reducing pest management costs, and more importantly, reduces potential pesticide exposure. Far too often, the homeowner resorts to purchasing over-the-counter pesticides to ‘solve’ pest problems and then uses the product repeatedly. Costs can dramatically increase in this way, and lead to frustration, especially when the purchased pesticide is not applied correctly, is over-applied leading to pest avoidance (pests moving to another spot to avoid the pesticide), or is not the appropriate solution for the pest problem. For example, a gap under a door (Fig. 1) may be an entry way for pests that reside elsewhere but come in searching for food. Simply excluding pests from your home by following some general measures provided in this document will give you the best approach to manage unwanted visitors where you live, learn, work or play. Many professional companies provide pest-proofing services. Generally pest-proofing is money well invested! A ‘hidden’ benefit of pest-proofing homes is an improvement in energy efficiency of the building, resulting in a welcome reduction in utility bills.

## General Pest-Proofing Measures

### Indoors

**1. Install door sweeps and repair thresholds at the base of all exterior entry doors.** No outside light should be visible underneath exterior doors when viewed from the inside at



Fig. 1. This locked door is wide open to pests! (Note gaps under door).

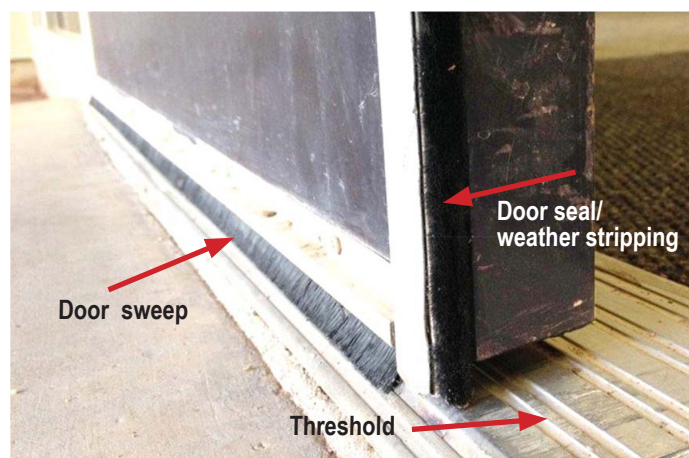


Fig. 2. Exterior door of a building showing a brush door sweep, door seal/ weather stripping and threshold. Ensuring that these are in good condition is one of the first steps in pest-proofing.

floor level. The bottom of garage doors can be fitted with a brush or rubber seal (not vinyl as it performs poorly in cold weather). Fig. 2 shows an example of a door sweep, seal and threshold. Sliding glass doors can be sealed by lining the bottom track with foam weather stripping.

- 2. Door seals.** Be sure to inspect all seals of doors including the tops and sides. This is especially important for double doors that lack a central vertical support (Fig. 3).
- 3. Self-closing doors.** All doors opening to the exterior of a building should be self-closing. Where this is not possible, a second door (e.g., screen door) should be installed. This is particularly important for areas prone to scorpion activity so that they might be stopped in their tracks before they enter into the main interior of the building (Fig. 4).
- 4. Screen all openings.** Install screens (20 mesh) on doors or windows that can be opened, and on all ventilation openings (Fig. 5). Keep screens in good condition and promptly repair tears or loose edges. This stops the entry of many pests.





Fig. 3. Doors with worn-out door seals can be identified by light coming in through the gaps around the door.



Fig. 5. Mesh screen installed on a window.



Fig. 4. Arizona bark scorpion entering under exterior door.



Fig. 6. Sealing cracks/gaps around window and door frames keeps pests out  
Photo: US Gov. Public Domain image.

However, certain tiny pests (e.g., aphids and leafhoppers) can get through standard mesh screening. The only way to deny entry to these small pests is to keep windows and doors closed. Periodically clean the space between the window and the screen to discourage scavenger insects such as dermestid beetles from breeding and feeding in the organic matter accumulating in these areas.

**5.Fill cracks.** To exclude rodents, lizards and insects look for cracks/gaps around windows, doors and in fascia boards. For small cracks, use good-quality silicone sealant (Fig. 6). Silicone lasts longer than latex caulking materials, as it expands and contracts more effectively with changing temperatures. For larger openings, fill with a strong material that matches the structure such as wood, cement, sheet rock or mortar.

**6.Seal all utility openings.** Include penetration points of pipes and wires, outdoor faucets, gas meters, and laundry

vents. Cracks should be cleaned and any peeling material removed. The hole can then be filled with a suitable sealant. Wider openings should be filled with copper mesh before sealants are applied. Check to make sure escutcheon plates are well seated around plumbing in bathrooms and the kitchen, and are not loose (Fig. 7).

**7.Repair plumbing and roof leaks.** To reduce water availability to pests, inspect plumbing regularly. Check ceiling tiles and the false floor under sinks, as a problem may not be apparent. Water damage can weaken walls and ceilings creating additional entryways and be a water source for mold to develop (Fig. 8).

**8.Use airtight storage containers.** This applies not only to human food items but also to pet foods (Fig. 9). Certain small ants can gain access into ordinary jars by following the thread, but most pests can be kept away using airtight containers. Food in other containers should be stored in the refrigerator or freezer.

**9. Employ good sanitation procedures.** Vacuum up all food crumbs. Promptly clean up spills. Do not let soiled dishes or



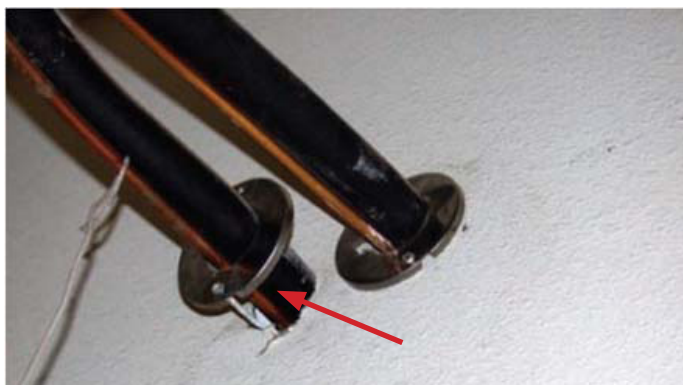


Fig. 7. Loose escutcheon plate revealing pipe entry-point in wall.



Fig. 8. Ceiling tiles indicating a roof or plumbing leak.



Fig. 9. Airtight food containers keep pests out.

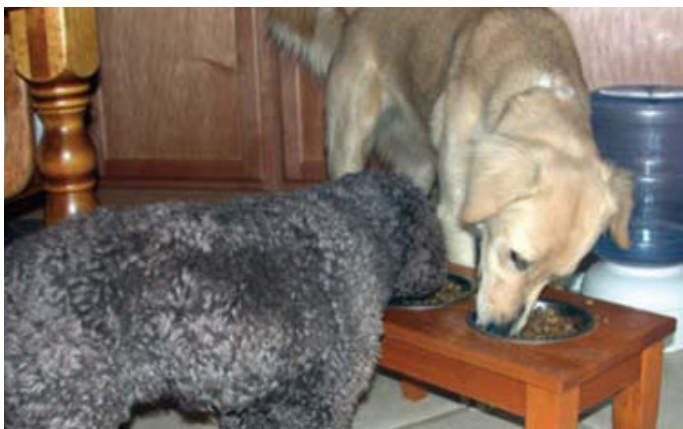


Fig. 10. Keep pet food off the floor.



Fig. 11. A homeowner inspects under his kitchen sink for leaky pipes or pest activity.

containers sit out overnight. Clean under kitchen appliances as frequently as possible. Keep pet feeding dishes off the floor and clean them regularly. (Fig. 10)

**10. Regularly inspect pest-vulnerable areas.** Certain areas of your home, such as kitchens and bathrooms, are particularly suitable for pest populations to develop because food, warmth, and moisture are present. Take extra time to look for pest-conducive conditions and signs of pests (e.g., shed skins, excrement, sawdust) (Fig. 11).

## Outdoors

**1. General yard clean up.** Encourage everyone to participate in yard clean up, including children (Fig. 12). Remove accumulated landscape debris, such as leaves and grass clippings from the yard and around the foundation (Fig. 13) remembering to clean out window wells and drainage guttering periodically (Fig. 14). Vines, shrubs and tree limbs growing close to walls provide pests with access to the building (Fig. 15). Prune shrubs and tree limbs at least 18-24 inches away from the building exterior walls to eliminate pest entry points. Organic landscaping mulch should be placed so it does not come into contact with structural wood (siding, posts, etc.).

**2. Use pest-resistant trash receptacles.** Lids should be kept closed, especially at night. Trash receptacles, including dumpsters, should be steam cleaned at least quarterly.

**3. Pest-proof your compost bin.** A well-maintained compost bin is not likely to generate significant pest problems. Do not compost any meats, fish, bones, oils, fatty foods, or dog/cat manures. Burying food waste into the center of the pile will reduce smells that attract pests. Ensure that each layer remains slightly damp and turn or poke holes in the pile every week or two. Consider using rotatable compost bins on stands (Fig. 16) that are easy to turn over for uniform composting. Harvest finished compost at the bottom of the bin every three to six months. To avoid rodents and other small animals gaining access to the bin or creating a burrow therein, make sure the lid closes securely and line the bottom and sides of the bin with hardware cloth (galvanized wire mesh). Piling rocks or bricks around the outside is also helpful because it serves as a barrier against





Fig. 12. Kids can help in yard clean up too!



Fig. 15. Vines growing on the walls provide pests with access to the building.



Fig. 13. Fallen leaves and other debris around the building provides harborage for pests and also holds moisture which can weaken the foundation.



Fig. 16. Compost bins on stands are easy to rotate.



Fig. 14. Clean out grates and drain covers periodically.

burrowing animals.

**4. Fill cracks and seal all utility openings on the outside of your home or building.** See Nos. 5 and 6 under 'Indoors' (page 4). Make sure to use sealants that are designed for outdoor use, that expand and contract with changing temperatures.

**5. Install wire mesh.** Use wire netting to cover gaps under and between rooflines (Fig. 17), or ¼-inch hardware cloth over the attic, roof, chimney and crawl space vents in order to prevent entry of birds, bats, squirrels, and rodents (Fig. 18). Wear gloves when installing hardware cloth, as the wire edges are extremely sharp. The crawl spaces under houses are attractive to many pests such as widow spiders, scorpions, feral cats, and rodents. These larger animals may create further insect and health problems (e.g., fleas, ticks, etc.).

**6. Conduct regular maintenance checks.** This requires a specific walk-around to inspect areas of previous insect activity and ensure all pest-proofing measures are intact





Fig. 17. Gaps under roofline can attract birds and rodents.



Fig. 18. Wire netting helps to keep birds and rodents out, but needs to be monitored and maintained.

(Fig. 19). People who choose not to tackle these activities can hire a professional landscape and/or pest management professional to do it for them. Many companies offer pest-proofing advice and monthly monitoring, as part of their services.

**7. Encourage birds and bats.** They are excellent predators of pests. Birds and bats won't find access to the attic of your house if you've already sealed or screened openings.

**8. Plant flowers and native shrubs.** This will help to encourage many beneficial insects. For example, alyssum attracts flower flies and tiny parasitic wasps. As long as no one in the family is allergic to bee/wasp stings, you can set aside an area of your yard away from the house for insect attracting plants.

Pest-proofing will reduce almost all incidents but it is



Fig. 19. Ensure that access panels are not left open.

extremely difficult (if not impossible) to create a completely bug-free area, and generally, it is not necessary. In most cases, a vacuum cleaner or broom is the best response to the occasional bug that wanders in from outdoors. Let's take a detailed look at our more troublesome visitors and provide specific methods to pest-proof your home against them.

## I. GENERAL PESTS IN ARIZONA

### A. Ants

Several ant species may be found in or around the home. They enter houses in search of food from early spring through late fall when their normal food is not readily available outside. Usually their presence is merely annoying but there are certain species that are undeniably problematic.

**The southern fire ant (*Solenopsis xyloni*)** is native to Arizona and is commonly found around homes (Fig. 20). Fire ants do not usually pose a threat to healthy adults, although



Fig. 20. Southern fire ant. Photo: Eli Sarnat, Bugwood.org.





Fig. 21. Southern fire ant mound.



Fig. 23. Carpenter ant Photo: Jim Baker, Bugwood.org



Fig. 22. Thief ant. Photo: AntWeb.org.

they can be dangerous for people who are sensitive or allergic to the stings, or young, elderly, or infirm people.

In the event of a reaction to a fire ant sting, call the **Arizona Poison & Drug Info Center at 1-800-222-1222, or 911** if the reaction is serious (e.g., swelling of throat, lips and mouth, difficulty swallowing, abdominal cramping, diarrhea, nausea and vomiting, breathing distress, decreased blood pressure and loss of consciousness).

Southern fire ants love bare, exposed ground or portions of turf adjacent to pavements (Fig. 21). So, using glyphosate (Roundup®) to control weeds in your landscape can generate significant problems since this herbicide completely destroys the plants in the treated area. Maintaining healthy turf is the most effective way of discouraging fire ants from around your home, but it will not eliminate them. Fire ant baits applied in small amounts directly to colonies are extremely effective. Light irrigation after bait application promotes rapid uptake of baits. Read and follow label directions for best results. **Managing fire ant colonies in your landscape will reduce the possibility of satellite nests developing near or under**

**your home, which might result in these ants coming into your home in search of food.**

**Thief ants (*Solenopsis molesta*)** (Fig. 22) are closely related to the southern fire ant. Thief ants take their name from their habit of nesting close to, and in some cases inside, the nests of other ants and then stealing their food and eggs or larvae.

Thief ant colonies may be found indoors and outdoors. Nests are large and often have tiny tunnels connecting to the nearby nests of larger ants. Outside, they can be located under rocks, around walkways and house foundations, and in rotting wood or exposed soil. Indoor nests may be found behind small crevices (particularly woodwork, baseboards, and masonry) and under floors. These ants forage for foods with a high fat and protein content such as grease, cheese, meat, and various seeds. It is important to note that due to their small size, they can easily enter packaged foods. Do not eat food contaminated with thief ants, they are poisonous if ingested. Unlike most other ants, they do not appear to feed on sweets. They travel great distances in search of food, and once a source is located, they form a trail of ants from the food to the nest.

**Carpenter ants (*Camponotus* spp.)** are also problematic to humans. Although they are important in nature and enhance the decay of dead wood, they are structural pests (Fig. 23). Several species of carpenter ants are encountered in western states.

Carpenter ants prefer moist, softened wood and colonies are often established within buildings in areas where water leakage occurs (Fig. 24). These may include areas such as porch pillars, around bathtubs, around/under sinks, roof leaks, poorly flashed chimneys, and poorly sealed windows and doorframes.



Fig. 24. Carpenter ant damage Photo: R. Werner, Bugwood.org

If an initial colony of carpenter ants is established outside within 300 feet of a building, satellite colonies may then be formed inside the building. Look for outside nests in decayed wood, such as old firewood, dead trees, stumps, logs, or decorative landscape timbers. If a carpenter ant colony has been identified in the yard, take steps to control it before it migrates into the home.

When carpenter ants are spotted inside dwellings, it does not mean that a colony has also been established inside the house. They may simply be foraging for food. This is called non-seasonal foraging. Outdoor colonies typically forage during the spring and summer only.

### Preventing Ant Infestations

1. Employ good sanitation procedures.
2. Store food in airtight containers.
3. Seal all cracks and openings into buildings as completely as possible. This is an exceptional challenge because ants are tiny and seemingly can crawl through any hole. Key areas to check include around air conditioning units, windows, doors, utility pipes, furnace flues, electrical outlets, and along baseboards and ceiling moldings.
4. Repair plumbing and roof leaks.
5. Prune back tree limbs, shrub branches, and other vegetation touching the house (especially from air vents).
6. Eliminate wood-to-ground contact. Firewood must be stacked away from the foundation and elevated off the ground. Organic mulch should not be placed up against the wood siding of a home.

7. Perform regular checks of the yard and house. Inside, inspect the edge of carpets, along walls and baseboards, and near water sources, since ants in our arid environment will move indoors in search of water. Outside, look around vegetation, along lawn and sidewalk edges, and under mulch. When foraging ants are found, try to trail them back to their colony location.
8. Instruct members of the family on how to identify and avoid fire ants and their nests.
9. In the case of carpenter ants, it is crucial to locate and destroy their nest. A pest management professional can assist; they will use a reduced-hazard pesticide if requested.
10. Killing foraging ants is not an effective management strategy. Ant trails can be cleaned up using soap and water, while foraging ants can be vacuumed up and discarded outside. Find out why the ants are present in your home (e.g., spilled food, unconsumed pet food), and remediate these conducive conditions.
11. Use ant-specific baits when the situation warrants it. Please note, baits for carpenter ants, thief ants and others may contain different attractants, thus one bait will not control all species. Identify the ant species you are dealing with and check the product label to ensure the selected product is effective against this species. For help with ant identification, contact a pest management professional or your local Cooperative Extension county office.

### B. Bed Bugs

Bed bugs are unwanted pests in the home since they feed on the blood of humans (Fig. 25). They inject saliva during



Fig. 25. Adult bed bug with nymphs.



feeding which can produce large itchy swellings, and these areas may become infected if scratched. In addition, bed bugs create odors that are unpleasant and they leave fecal spots on bed sheets, bed components, and near hiding places. Bed bugs are not effective vectors of disease-causing pathogens.

### Prevention

1. When staying overnight away from home, carefully check your room for signs of bed bugs; refuse to stay in a room that you suspect is infested. Keep your suitcases and other luggage off the bed, as far as possible on a hard surface not adjacent to the bed, during your overnight stay.
2. Launder all clothing from overnight trips. Unworn clothing can be placed in the clothes dryer for 20 minutes on a heat setting allowed by the clothing manufacturer. All worn clothing should be laundered with detergent and dried in a dryer or dry cleaned.
3. At the direction of a pest management professional, there may be certain sanitation activities that you can do to assist in the management effort including:
  - a. Vacuuming the home regularly, paying attention to bed components, upholstered furniture, and along edges of carpet/flooring
  - b. Laundering bedding (including comforters and bedspreads)
  - c. Installing a good quality encasement for mattresses, box springs, and pillows
  - d. Reducing clutter, especially in the bedrooms
4. Do not buy secondhand beds, bedding or other furniture. Do not take home any furniture that has been discarded, awaiting trash pickup.
5. Seal all cracks and crevices along the edges of flooring and walls. Repair cracks in plaster, wallpaper, and paint on the walls and ceilings. Discard loose wallpaper and drapery that cannot be cleaned.
6. There are some 'do-it-yourself' products that are available to homeowners, but these should be used with extreme caution and are generally not effective. Do not use chemicals of any kind on mattresses or bedding, unless they are labeled for this use. Do not use 'bug bombs' (total release foggers) since they are ineffective against bed bugs.
7. Because bed bugs are very difficult to eradicate, it is best to contract the services of a reputable pest management professional that has experience dealing with bed bug infestations. They will use two or more management



Fig. 26. Booklouse Photo: Charley Eiseman

methods to control the infestation and are best informed on pesticides that are effective against the growing pesticide resistant bed bug populations. For more information on bed bugs and their management, see publication on bed bugs available at <http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1625-2014.pdf>.

### C. Booklice

Booklice (or psocids) may look like lice but they are not related. An adult booklouse is usually smaller ( $1/16$  inch long) than an adult head louse, and is pale brown, gray, or translucent white in color (Fig. 26). Living in damp environments, these booklice feed on mold and mildew. They can be found on books and papers, in sink drains, in wall cavities around leaking pipes, on stored food products, and on floor rugs. Outside, booklice live in bird or mammal nests, vegetation, under tree bark, and even in animal fur. Although annoying, booklice rarely cause significant damage to your books or papers.

### Prevention

1. Maintain the relative humidity below 50%. Fix leaks and use a dehumidifier where appropriate. Install a vapor barrier in spaces with dirt floors such as crawlspaces or basements to reduce the relative humidity.
2. Keep your home clean and remediate any mold or mildew promptly using an appropriate household cleaner.
3. Use airtight food storage containers.
4. Remove paper clutter.

5. Store cardboard boxes, books, and important documents off the floor.
6. Bring in only enough firewood for immediate needs; do not store it inside your home.

## D. Cockroaches

There are at least 20 different species of cockroaches in Arizona; ten of these are native and rarely encountered in homes. Cockroach pests established in urban areas of Arizona include: **American** (Fig. 27), **Brown-banded**, **German** (Fig. 28), **Oriental**, **Surinam** and **Turkestan** (Fig. 29, 30) cockroaches. Oriental cockroaches are more common at higher elevations.

Most cockroaches are tropical or sub-tropical in origin and generally live outdoors. However, some species have adapted well to living indoors with humans. Though it is true that they thrive in clutter, filth and grime, occasionally cockroaches infest even the most sanitary and well-organized homes. Cockroaches will feed on any unprotected kitchen goods, contaminating food with excrement and salivary secretions. Some will also eat leather, wallpaper paste and other glues, and bookbinding.

Cockroaches are often carried into homes in cardboard boxes, infested foodstuff (especially dried pet foods), and on seasoned firewood. They can enter directly by crawling around loose-fitting doors and windows, where electrical lines or water and steam pipes pass through walls, and via sewer lines.

Most cockroaches are nocturnal. When they appear during daylight it is usually because they have been disturbed from a hiding place or there is a heavy infestation in the structure. Most prefer warm, dark, humid shelters, and often move around the kitchen or bathroom sink due to water availability. They prefer to rest in cracks around, under, or inside cupboards and cabinets; where pipes or electrical

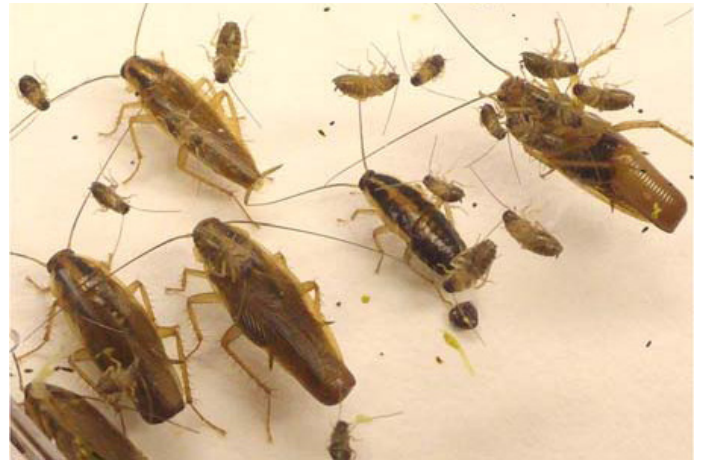


Fig. 28. German cockroach adults and nymphs.



Fig. 29. Turkestan cockroach adults; female (left) and male (right).



Fig. 27. American cockroach adults and nymphs.



Fig. 30. Turkestan cockroach nymphs. Photo: Nathaniel Long.

wiring pass along or through a wall; behind window or door frames, loose baseboards or molding strips; under tables and chairs; in upholstered furniture; in bathroom vanities; in radio and TV cabinets; and in motor compartments of refrigerators, washing machines, and other appliances. It is important to





Fig. 31. Telephone handset heavily stained with German cockroach feces.

know where cockroaches are hiding in your home so these areas can be targeted for management activities.

Some cockroach species are known to transmit disease-causing organisms. They are most often implicated in the transmission of *Salmonella*, a causal agent of food poisoning. German cockroaches also elicit respiratory problems in individuals sensitive to the allergens they produce. Cockroach feces contains allergens, and it can leave unsightly stains on walls and other surfaces (Fig. 31).

### Prevention

1. Employ good sanitation procedures, both indoors and outdoors, to effectively limit cockroach food sources. Do not leave unwashed dishes, kitchen utensils, and uncovered food out overnight. Clean up all spilled liquids on the counters, kitchen table, and floors. Areas beneath and behind cabinets, furniture, sinks, stove, microwave oven, and refrigerators should be cleaned often, as should cupboards, pantry shelves and storage bins where particles of food frequently accumulate. Kitchen waste and excess refuse should be taken outside to the garbage dumpster daily. Dry pet food should be stored in airtight containers in a location separate from human food. If pets are fed indoors, leftover foods should not be allowed to remain in the feeding dish overnight. Garbage cans should be cleaned regularly, inside and out. Items held for recycling (e.g., pop bottles, empty food cans, milk jugs) should be rinsed and drained of food debris before holding for recycling efforts.
2. Eliminate clutter, especially stacks of paper, lumber, and firewood, as well as yard debris.
3. Seal any cracks ( $\frac{1}{8}$  inch or larger) in the foundation and exterior walls. Check the seal around air conditioning units, windows, doors, pipes or other openings into

the home. Repair cracks and holes in floors, walls, and ceilings. Seal openings around plumbing fixtures, furnace flues, electrical outlets, windowsills and walls, and along baseboards and ceiling moldings. Thresholds on doors should be as tight as possible and cracks in porches and stoops should be sealed.

4. Repair plumbing leaks since most cockroach species are attracted to water sources.
5. Place low UV light bulbs in outside fixtures next to doors. If you are installing new fixtures, avoid installing them directly above doorways.
6. Enlist the services of a pest management professional for cockroach species that are very hard to control (e.g., German and brown-banded cockroaches). They will use targeted baiting to eliminate them.

### E. Crickets

Crickets may be considered a nuisance because of their constant chirping; however, none of them bite humans or vector diseases. Several species of crickets are found in Arizona, but only two are problematic in homes.

**The Indian house cricket (*Gryllobates suppicans*)** feeds on a wide range of food sources (e.g., human food crumbs, pet food, and plant debris) and can damage fabrics, leaving the surface roughened from pulling or picking the fibers loose while feeding. It is light yellowish/brown or tan in color with darker bands and spots, and about 1 inch long when mature (Fig. 32). The females are wingless, but the males have short wings that they rub together to produce their songs. They often gather around foundations and doors outside and readily come indoors underneath unprotected doorjams and through cracks or openings. They are the only type of cricket

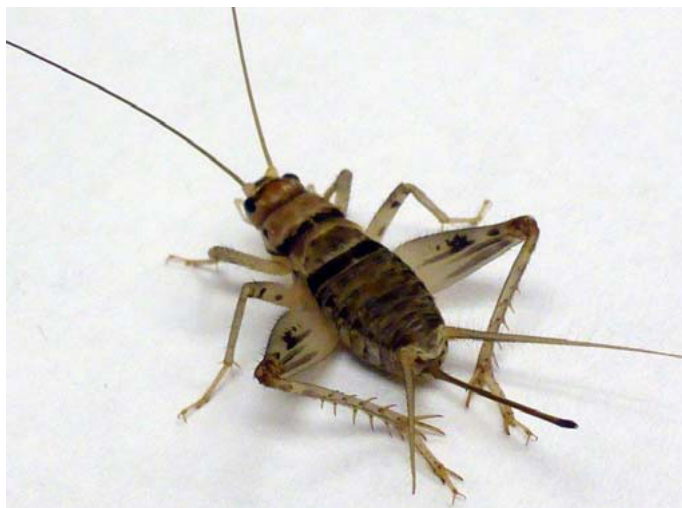


Fig. 32. Indian house cricket female.



Fig. 33. Field cricket male. Photo: Joseph Berger, Bugwood.org.

that can live and produce young indoors. They typically hide during the day and come out at night to feed.

The other nuisance species is the **field cricket** (*Gryllus* spp.). These are larger (slightly more than 1 inch when mature) than Indian house crickets and usually dark brown to shiny black (Fig. 33). These crickets prefer to live and breed outdoors where they feed on several kinds of plants.

Occasionally, field crickets invade homes and buildings in search of hiding places but do not produce young indoors. Field crickets are known to chew on and damage woolens, cottons, silks, synthetic fabrics, furs, and carpeting. Clothes with perspiration stains or food spills are particularly attractive. Outdoors, they may damage young garden plants and annual flowers.

## Prevention

1. Conduct a detailed inspection of the outside of your home. Make sure doors and windows fit tightly. Change door sweeps and adjust thresholds and door seals as needed. Use sealant and weather stripping to fill all openings, cracks, gaps, and holes in foundation, siding, windows, doors, screens, and other possible entry points.
2. Avoid planting shrubs and ground covers that extend up to or near the house foundation. Remove ground-level vegetation, dead plant material, and general debris that could serve as hiding places or breeding sites near the house.
3. Keep all doors closed except when in use. Make sure all doors and windows are tight fitting.
4. Maintain sanitary conditions in the kitchen, and do not leave food out overnight.
5. Check potted plants for Indian house crickets.
6. At night, limit the use of outside lighting, which attracts crickets, and draw curtains in lit rooms.



Fig. 34. Earwig. Photo: Joseph Berger, Bugwood.org.

## F. Earwigs

Earwigs are predaceous insects that live outdoors in damp environments, although when populations are crowded they may feed on seedlings. Contrary to general myth, earwigs do not climb inside ears. In fact, on the pestiferous scale they are ranked low in importance. Their only significance is the occasional small damage to certain flowers and some vegetables. They are not carriers of any disease and do not bite humans, although they appear formidable with a pair of curved abdominal pincers (Fig. 34). European earwigs are known for invading homes at certain times of the year. A high population of earwigs usually follows a wet spring.

## Prevention

1. Earwigs do not require much more than general exclusion measures such as caulking (sealing) cracks, fitting doorjamb, and screens etc.
2. Earwigs are more common in newly built homes within the first year, or in homes that have recently been flooded. Reduced humidity over time will discourage them.
3. At night, limit the use of outside lights, and draw curtains in lit rooms because earwigs are attracted to lights.
4. Potted plants present a good habitat for earwigs, so raising them off the ground to allow air circulation and light penetration alters the habitat and earwigs leave. Before bringing in potted plants from your porch/patio, check for any hitchhiking earwigs.

## G. Fleas

Fleas are small ( $\frac{1}{8}$  inch), wingless insects that feed on the blood of animals and people. Americans spend about \$9 billion a year controlling fleas, which makes flea control one of the biggest expenses for pet owners. In Arizona, the **cat**





Fig. 35. Cat flea. Photo: Pest and Disease Image Library, Bugwood.org.

**flea (*Ctenocephalides felis*)** causes most problems (Fig. 35). These fleas do not normally live on humans, but rather on cats, dogs, and wildlife. They will bite people who handle infested animals. Flea bites cause small, red, itchy bumps, and are most often found on the ankles and lower legs of humans. Wash with soap and water for relief from itching.

### Prevention

1. Monitor pets closely for fleas.
2. Change and launder pet bedding regularly.
3. Bathe and brush pets regularly.
4. Enlist the services of your veterinarian to treat your pet with one of the topically applied products for flea control. Your pet should be carefully monitored (until the product is absorbed).
5. Vacuum regularly and discard the cleaner bag or empty the dust basin. Concentrate your effort where your pet rests, such as under furniture, cushions, along walls, and pet bedding.
6. Avoid flea collars when possible.
7. Exclude bats and wild birds from your home by maintaining good bug screens over air vents in your attic. Maintain chimney structures so that birds and bats cannot use them for roosting or nest sites. These animals can carry their own fleas.
8. Maintain a landscape that is less inviting for flea development. Keep the lawn mowed short to create a drier environment. Avoid piles of sand and gravel around the home for long periods. Avoid overwatering lawns.
9. Outdoor flea populations can be effectively controlled with commercially available insect-killing nematodes, however these require high humidity in the environment

and it might be necessary to irrigate the treated area following application. These safe biological control agents will kill flea larvae and pupae commonly found in pet resting areas and dog runs. They are applied in lieu of using a mixture of a growth regulator and an adult insecticide. Diatomaceous earth (DE) can also be used in these areas for flea control.

## H. House flies

These familiar gray and yellowish flies (*Musca domestica*) (Fig. 36) are attracted to food and fecal odors. The larvae (maggots) live in and feed on decaying organic material including fecal matter and garbage. More than simply being a nuisance they are primary carriers of a variety of disease causing organisms including those causing typhoid, cholera, dysentery, and food poisoning (salmonellosis). Diseases are spread through the flies' physical contact with unprotected food following contact with contaminated fecal matter.

### Prevention

1. Follow the guidelines for general exclusion as listed earlier in this publication.
2. Create dry compost by scattering it around the bin so that it will dry rapidly. A moist compost bin will be a breeding site for house flies. Flies will not lay eggs on dry manure.
3. Clean up animal fecal material in timely fashion and dispose of properly.
4. Plant flowers and flowering bushes to attract predators and parasites that can help manage flies.
5. Employ correct sanitation methods within the home to eliminate possible breeding sites. Outside garbage cans / dumpsters should have tight-fitting lids and be emptied and cleaned regularly. Locate garbage receptacles away from building entrances.



Fig. 36. House flies mating.



Fig. 37. Moth fly (drain fly). Photo: Whitney Cranshaw, Bugwood.org.

## I. Moth Flies

Moth flies are so named because their furry wings and feathery antennae make them look like miniature moths (Fig. 37); however, they are actually a unique group of small flies. They are also known as drain flies, filth flies, and sewage flies, named after the breeding sites in which they reside. Fly larvae feed on the rich organic decaying matter in these breeding sites. In the urban environment, they are commonly found in clogged roof gutters, under potted plants, in garbage cans, around septic tanks, in moist compost, and poorly cleaned drains, particularly in outflow pipes of toilets and sinks.

### Prevention

1. Unused sewage pipes must be cleaned and capped off.
2. Drains and sink overflows need to be cleaned at least annually. Use an enzymatic drain cleaner followed by very hot water, and if necessary clean manually with a stiff brush. Bacterial or enzymatic cleaners are effective. Some contain live, beneficial bacteria that destroy organic material inside the drains, removing the habitat in which the moth flies breed.
3. Repair plumbing leaks along with any other moisture problems around the home.
4. Check to make sure your compost bin is a dry environment. Scatter moist compost around the bin to dry it out faster.
5. Regularly clean out roof gutters.

## J. Silverfish and Firebrats

Silverfish and firebrats are also known as “bristletails” (Fig. 38). They are wingless insects with two long, slender antennae, and a flat carrot-shaped body, covered with scales, that tapers down to three long “bristles” at the end. Both silverfish and firebrats move fast in a wriggling motion, resembling the swimming action of a fish. Silverfish live and develop in damp

(prefer 75 to 95% relative humidity), cool (70 to 80° F) places, while firebrats prefer places above 90° F. Adult silverfish and firebrats are about ½ inch in length.

Silverfish are most often discovered in sinks and bathtubs, though they can also be present in kitchens and basements. Silverfish are frequently introduced with newly installed dry wall, feeding on the paper backing and occasionally large populations form within new buildings where the walls are still damp from plaster and fresh lumber.

Firebrats normally live outdoors under rocks, leaves and inside bird nests where heat and moisture are generated by the natural composting process. However, they are also known to occur in homes around furnaces, water heaters, inside fireplaces, and within the insulation surrounding hot water pipes.

Silverfish and firebrats are mostly nocturnal, foraging at night. They prefer vegetable matter with a high carbohydrate and protein content. Indoors however, they will feed on almost anything, including dried meat, other insects, starch, paper, glue, sugar, molds, cereals and fabric containing cotton, linen, rayon and silk. They seldom damage fibers of animal origin such as wool or hair. These insects are hardy and can live without food for up to one year.

Silverfish and firebrats are considered pests because they consume and stain foods, fabric, books and wallpaper. Damage is manifested as yellowish stains and notched edges, although this is not usually observed. Significant damage is only found when a large infestation has been present in an area over long periods of time.

### Prevention

1. Rotate stored fabric and stacked paper products twice a year.
2. Maintain sanitary conditions in the kitchen and bathrooms. Clean up any spilled food.
3. Repair leaky plumbing and install adequate extraction fans in laundry and bathroom areas.



Fig. 38. “Bristletails”: Left-silverfish (Photo: Joseph Berger); right-firebrat (Photo: Clemson Univ.-USDA, Bugwood.org).



4. Lower the relative humidity inside the home using one or more dehumidifiers.
5. Light dark areas where firebrats and silverfish have been found; this forces the insects out of their shelter to new sites where they can be managed more easily.
6. Eliminate wood-to-ground contact. Landscape mulch should not be placed right up next to the house.
7. Enlist the services of a pest management professional if preventive methods fail. Eradicating these insects can be difficult as they often reside in protected places (e.g., between wall partitions, in insulation materials).

## K. Vinegar Flies / Fruit Flies

Vinegar flies are so named due to their attraction to the sour odor of fermentation and bacterial waste. They are also known as fruit flies or pomace flies. Vinegar flies are mainly found on wet decaying plant matter or overripe / rotting fruit.

Adults are small ( $\frac{1}{8}$  inch long), light yellow-brown to dark brown with darker markings on the thorax, and reddish eyes (Fig. 39). Larvae are maggots that have a creamy white body that tapers from a wider posterior to a fine point towards the head, which is not darkened.

### Prevention

1. Remove any rotten fruit or decaying vegetation.
2. Follow the guidelines for general exclusion. For example caulking (sealing) cracks, fitting door sweeps and screens, etc. Consider that these small flies only require tiny entry points.
3. Create dry compost by scattering and turning the bin so that it will dry rapidly.
4. Compost bins, garbage cans and dumpsters should have tight-fitting lids and be cleaned regularly. All garbage containers should be located as far from building entrances as possible.
5. Cover or containerize over-ripe fruit that the flies can access.



Fig. 39. Vinegar fly. Photo: Joseph Berger, Bugwood.org.

## II. STRUCTURAL PESTS

Structural insects are those that attack structural wood of the house. The main pests responsible are carpenter ants (previously mentioned), termites, powderpost beetles, and rodents.

### A. Carpenter Ants

Refer to the general pest section above, under Ants (page 8).

### B. Carpenter Bees

Carpenter bees resemble bumble bees. They are large ( $\frac{3}{4}$  to 1 inch long), heavy-bodied, with a fuzzy yellow or black thorax, and a blue-black to black colored abdomen with a green or purplish metallic sheen. Carpenter bees are solitary bees that do not live in a colony like honey bees. They do, however, tend to accumulate in certain areas.

Technically, they are a “wood-boring insect”, but they are not really considered a true structural pest. They will not spread throughout the structure, but they will attack any outside wood that is not painted or otherwise finished. Carpenter bees get their name from their ability to drill through wood and nest in the hole (Fig. 40). Their drilling creates a near-perfect hole, approximately  $\frac{1}{2}$  inch in diameter. The hole is usually located on the underside of the wood surface; including siding, decks, overhangs, fence posts and window frames. Although the hole appears to be only an inch or two deep, it rarely ends there.

Along with the coarse frass (insect excrement) and sawdust found underneath the nest entrance, there are usually dirty-yellow streaks of fecal matter staining the wood below the hole. If you are near a nest, you will likely be buzzed by the male carpenter bee on guard. He is loud and aggressive, but does not have the ability to sting you. The female can sting but she is normally very docile. A single pair (male and female) occupies each nest.



Fig. 40. Carpenter bee. Photo: Johnny N. Dell, Bugwood.org.

## Prevention

1. Coat all unfinished wood with paint or varnish, even the areas you don't see, such as under windowsills, banisters, and railings. If using paint, use two coats of a good exterior primer and follow up with at least one coat of finish.
2. Cover exposed wooden structures with aluminum sheathing; eliminate any spaces where the bees will find the wood. They can squeeze through small places ( $\frac{1}{4}$  inch or larger), so you have to be very thorough.
3. Use pressure-treated wood for constructing any outdoor project such as decks and playhouses. Pressure-treated wood needs no paint, but can be painted.
4. Cedar wood provides some protection over pine lumber, but even cedar is utilized if the conditions are right. Unfortunately, California redwood is not a good alternative wood since it is often utilized by the eastern carpenter bee, is expensive, and the wood is very soft (suitable for decorative uses only).

## C. Termites

In nature, termites function as decomposers that break down dead wood that accumulates in and on the soil. The beneficial products of this breakdown process are returned to the soil as humus. Termites are social insects and the makeup of the colony is very complex. Although there are at least 17 species of termites known to live in Arizona, we have primarily two different types of termites, the drywood (Fig. 41) and subterranean termites (Fig. 42, 43). These insects are beneficial in nature, but occasionally destructive pests of wood. Their presence in structures is seldom noticed until damage is discovered or the termites swarm within the building.

### Differences between Drywood and Subterranean Termites

#### *Drywood termites*

- i. Nest in wood; ground contact unnecessary.
- ii. Larger insects ( $\frac{1}{2}$  inch long); tunnels and chambers usually larger. Alates (swarmers/ winged individuals) have reddish-brown or orange colored heads.
- iii. Galleries often cut across grain of wood; attack both softer "spring" wood and harder "summer" wood.
- iv. Do not commonly build exposed shelter tubes.
- v. Fecal material in form of hard, dry pellets appearing like saw-dust in galleries or in piles outside (Fig. 44).
- vi. Smaller, slower-growing colonies so damage is generally less severe.



Fig. 41. Drywood termite workers, soldiers and alates.

#### *Subterranean termites*

- i. Nest in soil; connection with soil usually necessary.
- ii. Generally smaller insects ( $\frac{1}{4}$  to  $\frac{3}{8}$  inch long); therefore, tunnels and chambers usually smaller. Alates (swarmers/ winged individuals) have dark brown or black colored heads.
- iii. Galleries usually run parallel to grain in the softer "spring wood".
- iv. Frequently build free-standing shelter tubes or covered runways of mud and fecal material (Fig. 45).
- v. Fecal material is soft and used in constructing nest and shelter tubes.
- vi. Larger, rapidly-growing colonies work faster, damage often more severe.

## Prevention

1. When considering purchasing a house, ask questions about its construction. The most common form of house construction in Arizona is a floating slab, which is quite susceptible to termite attack. Termites enter where the slabs meet the walls and through hidden expansion joints. Monolithic slab construction contains no joints and is therefore more resistant to termite entry. However, it is not termite-proof. Some settling will occur regardless of how the slab is constructed, and over time cracks may appear. Most new homes are treated with a continuous chemical barrier (termiticide) beneath and next to the slab that is guaranteed to protect a home from subterranean termites for a specified amount of time.
2. Eliminate wood-to-ground contact, i.e. wooden porches should be separated from the building proper and wooden steps should rest on a concrete base at least 6 inches above grade. Wood partitions and posts should be installed in basements after the concrete floor is poured and should never





Fig. 42. Subterranean termite soldiers and workers. Photo: Alexander J. Yelich, Univ. of Arizona.



Fig. 43. Subterranean termite alate.

extend into or through concrete. Keep soil or mulch away from wood siding. Remove all wood construction scraps from the site; do not bury them in soil near the house foundation.

3. Keep wooden planters, trellises and raised beds away from foundations.
4. Keep firewood away from house and elevated off the ground.
5. Promptly repair leaks and faulty water drainage.
6. Fill any cracks in your foundation. Seal any openings particularly where utility pipes and wires penetrate the building walls.
7. Eliminate standing water, which pools against the foundation. Re-grade the ground so that water drains away from the house.
8. Plant landscape shrubs and trees away from the house foundation, leaving a gap of at least 1 foot
9. Adjust turf sprinklers and drip irrigation emitters so they are not soaking the home walls or foundation.
10. Conduct regular maintenance checks. The homeowner should be encouraged to inspect their homes at least



Fig. 44. Drywood termite fecal pellets. Photo: Sanjay Acharya.



Fig. 45. Subterranean termite shelter tubes. Photo: Larry Ralph Jr., [www.indiancrawlspacerepair.com](http://www.indiancrawlspacerepair.com).

once a year for signs of termite activity. Pay particular attention to additions such as porches, or patios, and any area where wood contacts the ground. Look for mud tubes, holes in wood with clean galleries cut across the grain, pellets or sawdust, piles of wings and swarming insects. If there are suspicious signs found during a walk-around, the homeowner should request a professional inspection. Contact the Arizona Office of Pest Management at (602) 255-3664 or visit <https://opmssl.azda.gov/MyOPMBuss/> for information regarding company licenses.

## D. Wood-boring Beetles

The most common wood boring beetles can be classed in three groups: the true powderpost beetle (Fig. 46) (lyctid), the false powder beetle (bostrichid), and the deathwatch beetle (anobiid). Attack by these pests is characterized by small to medium sized holes (around 1/16 to 1/8 inch in diameter) in



Fig. 46. Powderpost beetle. Photo: Pest and Disease Image Library, Bugwood.org.

the infested wood where adult beetles have exited. Another bostrichid beetle known as the lead-cable borer is capable of boring through lead cable coverings, causing electrical damage.

If you live in a home older than 25 years that contains a sub-area crawl space, it is highly recommended to have your home inspected for the presence of these wood-boring beetles.

### Prevention

1. Look for wood-boring beetle activity in any wooden artifacts or lumber introduced into the home. If the wood is infested, holes will be present with accompanying piles of fine powder.
2. Seal wood surfaces with paint, polyurethane, or water sealants. This will protect wood from moisture problems and help prevent the beetles from penetrating the wood. For aging wood, first sand down any cracks or other entrance points before sealing.
3. Although expensive, consider installing a new central heating and air conditioning unit if not present already, to help chronically infested buildings. With the advent of such systems, the cases of beetle damage have dramatically reduced and significant problems are not likely even with the more persistent species.
4. Correct lumber moisture problems commonly found in the crawl spaces. The crawl space should be well ventilated and have an intact vapor barrier. Plastic sheets can also be installed to keep the lumber from getting too moist.
5. Enlist the services of a pest management professional if preventive methods fail. Borate-based products are

an effective insecticide option, and can be applied to unprotected wood using a brush or a hand-held pump sprayer. They are particularly appropriate for extensive use in the case of log homes. Borate products will also help in the prevention of carpenter ants, carpenter bees, termites, fungus and wood rot.

## III. HEALTH RISK PESTS

In the event of an allergic/systemic reaction to a bite or sting, call the Arizona Poison & Drug Info Center at 1-800-222-1222, or 911 if the reaction is serious. Try to safely collect the animal. Correct identification and timely action may be important to avert a potentially life-threatening reaction.

### A. Bees and Wasps

Renowned for their painful sting, these insects often produce an unreasonable amount of fear. The sting venom can cause a violent, hypersensitive histamine reaction, but only in a small percentage of the population. Most bee and wasp species are actually quite docile and sting only when their colony is disturbed.

Bees and wasps are considered a highly beneficial group of insects. Honey bees pollinate plants and provide us with honey and wax (Fig. 47). Predatory wasps (or their larvae) eat unwanted insects (Fig. 48, 49). Having digger bees, solitary bees, or wasps nesting in your yard is usually not a problem, but a honey bee hive should be removed. Contact a local pest management professional for their services.

#### Africanized Bees

**Do not attempt to destroy Africanized bee colonies yourself, contact a pest management professional. These bees can cause life-threatening allergic reactions (anaphylaxis) in sensitive individuals.**



Fig. 47. Pollination by honey bees. Photo: Padmanand Madhavan Nambiar.





Fig. 48. Western yellow jacket. Photo: Whitney Cranshaw, Bugwood.org.



Fig. 50. Honey bees in an irrigation box.



Fig. 49. Yellow paper wasp. Photo: Dave Beaudette.

It should be assumed that all bees are Africanized when encountering wild bees in Arizona. Swarms encountered are made up of a queen and workers locating new nest sites. At this time, the swarms do not have brood to protect and are not generally aggressive. If you see a swarm around your home, it is highly likely that it will move on in a day or so without any intervention. However, if the swarm locates a suitable nesting site such as a hole in an outside wall of your home or on an irrigation box lid, allowing the bees to enter, they may move inside the wall or box (Fig. 50). Do not attempt to seal the hole when the bees are active. It is best to call a pest management professional to manage the bees at this point before they are established and have brood to protect.

**RESPOND APPROPRIATELY TO BEES AND WASPS.** If you encounter bees buzzing around your head, do the following:

- a. Stop.
- b. Place your hands over your face and look through gaps between your fingers.
- c. Look around for the hive.
- d. Walk briskly away from the hive.

**DO NOT FLAP OR SWAT AT THE BEES, AS THIS IS THE WORST THING THAT YOU CAN DO!!!!** If you are stung or the bees bump you, do the following:

- a. Cover your head and face with clothing or your hands.
- b. Run to a building or shelter and go inside; or if outdoors in a natural area run until the bees have abandoned you.

**DO NOT DIVE INTO A SWIMMING POOL; THE BEES WILL WAIT FOR YOU LONGER THAN YOU CAN HOLD YOUR BREATH!**

### Prevention

1. Eliminate favorable nest sites. Use a good quality silicone sealant to fill cracks and holes in walls and trees. Remove any trash or debris that might serve as a shelter, such as overturned clay pots. Ground-nesting insects can be discouraged by allowing the soil to dry out completely, and by mulching or planting a ground cover over large patches of bare ground.
2. Apply paint or varnish to outdoor wooden structures.



Fig. 51. Conenose bug, *Triatoma rubida*. Photo: Charles Hedgcock.



Fig. 52. Pack rat (wood rat).

3. Eliminate the unnecessary water sources in your yard. Put window screening over rainspouts and water meter boxes.
4. Avoid home entrance by placing insulation around doorframes and sealing window frames.
5. Cover food when eating outdoors.
6. Gather and discard fruit dropped from trees.
7. Use pest-resistant trash receptacles. Lids should be self-closing with a tight seal.

## B. Conenose Bugs and Pack Rats

Conenose bugs are also known as kissing bugs, assassin bugs, Mexican bedbugs, and Walapai (Hualapai) tigers (Fig. 51). Their bite can cause life-threatening allergic reactions (anaphylaxis) in sensitive individuals. There are approximately 15 different species in the U.S., but the most troublesome and numerous are found predominantly in Arizona, New Mexico, Texas, and California. Conenose bugs are often associated with pack rats.

### Pack Rats (*Neotoma* spp.)

Also referred to as “wood rats” or “trade rats”, pack rats are widely distributed over much of North America. They are small mammals with large ears, large dark eyes and a fairly long tail that is sparsely covered with hair or, depending on the species, well furred with long hair (Fig. 52). Their fur is soft; dorsal fur is colored cinnamon, brown, gray, yellowish gray or creamy buff; feet and ventral parts are generally much lighter in color; the tail is blackish or buff, paler on the ventral surface.

Pack rats are much larger than mice and tend to resemble the introduced Norway rat or roof rat in general size and appearance. The head and body length is about 5 to 11 inches and the tail is 3 to 9 inches long. Dens are usually situated on the ground, measuring 3 to 5 feet in height and diameter. Tree nests are sometimes made but are somewhat smaller. One animal may inhabit several nests, and in good feeding areas, a den may be occupied for several years. Pack rats live alone except when mating or rearing young.

### Prevention

1. Conduct regular maintenance checks to reduce the number of kissing bugs present in and around the home. During daylight hours, the bugs seek dark places to shelter, so inspect beneath flowerpots, outdoor furniture, wood piles, and any other dark, sheltered, hiding places. Also periodically examine dark, quiet areas inside the home around mid-spring to mid-fall, focusing on sleeping areas.

Outside, look for pack rat nests around the home. Their nests, called dens or ‘middens’, are complex structures consisting of several chambers, with piles of stored food and debris. They can be built on the ground, among rocks or tree bases, or among tree branches, or in abandoned nests and burrows of other animals. In the desert, pack rat dens are common in cholla cactus bases, using the cactus spines as a protection from predators. Pack rats are very attracted to small, bright, shiny objects such as coins, small pieces of jewelry, broken bits of mirrors, metal spoons, etc. and often pick these up, leaving sticks, nuts, cactus pieces or other materials in ‘trade’. After removing any rodents from the nest, pick up the nest using gloves or pliers or similar tools and destroy by burning or dispose of in an enclosed plastic bag, as the nests may contain kissing bugs, fleas or other parasites. Destroy only those



nests close to the dwelling. By leaving distant nests intact, the kissing bug has an alternative site to inhabit; this may discourage migration into the home. A pest management professional can be contacted to remove the rodents and their nests.

2. Seal all cracks and openings into buildings. Entry into the home does not require a large opening. Make sure window screens fit tightly, weather-strip outside doors, and screen chimneys and vents.
3. Close curtains at night in lighted rooms to avoid attracting the bugs to your house.
4. For those sensitized and at risk for anaphylactic shock, take steps to avoid being bitten when asleep, such as using netting around the bed.
5. Stack logs, lumber, and firewood in neat piles at least six inches off the ground and at least 24 inches away from building walls.
6. Replace UV emitting bulbs with low UV alternatives in outside fixtures.
7. Keep all doors closed except when in use. Make sure all doors and windows are tight fitting. Do not prop doors open, especially after dark.

## C. Mosquitoes

Mosquitoes are one of the most important insect pests that affect the health and well-being of humans and domestic animals worldwide. If environmental conditions are favorable, seasonally large populations can occur in Arizona. Female mosquitoes require a blood meal for egg production. While feeding, they can transmit a number of disease-causing organisms to humans and animals including those causing West Nile fever, St. Louis encephalitis, dengue fever, and chikungunya.

Over 40 different species of mosquitoes have been collected in Arizona. Most are only nuisance pests and do not transmit disease, while other species can constitute a public health threat. The four most troublesome mosquito species in Arizona are the **western encephalitis mosquito** (*Culex tarsalis*), the **yellow fever mosquito** (*Aedes aegypti*) (Fig. 53), the **malaria mosquito** (*Anopheles freeborni*), and the **southern house mosquito** (*Culex quinquefasciatus*) (Fig. 54). The **dark rice field mosquito** (*Psorophora columbiae*) commonly bites during the day, but are not competent vectors.

### Prevention

1. Remove all possible sources of water around your house since mosquitoes need water to complete their life cycle.



Fig. 53. Yellow fever mosquito. Photo: Muhammad Mahdi Karim.



Fig. 54. Southern house mosquito. Photo: James Gathany, CDC.

Check flowerpots, birdbaths, pet watering bowls and other containers for excess water. Store boats, canoes, and other recreational equipment so that they do not collect rainwater. If there is a tree with a cavity that collects water, apply a suitable filling or treatment (such as *Bacillus thuringiensis*; see No. 4 below) inside the cavity; or have the tree removed if it is not structurally sound.

Keep rain gutters free of leaves and other debris that prevent water from draining. Repair leaky outside faucets. Correct or report drainage problems in ditches along public or private roadways.

2. Maintain landscape or recreational water features to eliminate mosquito populations. Clean out water containers for pets, birdbaths, and fountains twice a week. Maintain swimming pools according to manufacturer recommendations. For ponds, mosquito-eating fish (*Gambusia*) can be introduced. Many county Vector Control offices provide the fish free of charge. The Maricopa County Vector Control Office can be contacted at (602) 506-0700 to schedule pickup times.
3. Correct drainage problems in yards and playing fields



Fig.55. Overirrigation and poor drainage result in flooded fields like this one, which serve as mosquito-breeding grounds.



Fig.56. Mosquito larvae.

to prevent rain and irrigation water from pooling for prolonged periods (Fig. 55). Organic acids can be used to improve soil drainage. It is quite common in Arizona to have compacted soils, and these products are very useful for opening up the soil to speed up water penetration.

4. Use bacterial products in breeding sites to destroy developing mosquitoes. *Bacillus thuringiensis israelensis*, or *Bti*, and *Bacillus sphaericus* (*Bs*) are common soil-inhabiting bacteria that are commercially available. These bacteria kill mosquito larvae (Fig. 56) but will not harm fish, birds, pets or other wildlife.
5. Install and maintain tight fitting window and door screens to keep mosquitoes out of the home.
6. Use mosquito repellents when working in the yard or lounging on the porch/patio near or after dusk. For information on choosing an insect repellent see publication available at <http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1311.pdf>.
7. Express concern to the proper authorities when mosquito numbers in your neighborhood seem intolerable.

A community-wide effort may be needed to reduce mosquitoes to tolerable levels. To file an environmental complaint, contact your county vector control office. The Maricopa County Vector Control Office can be reached at (602) 506-6616, or complaints can be submitted online at: <http://www.maricopa.gov/EnvSvc/Complaints/Forms/ComplaintForm.aspx>.

8. For more information on mosquitoes and their management, see publication available at <http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1221-2013.pdf>.

## D. Rodents

The house mouse (*Mus musculus*) is the most common, costly, and troublesome rodent in the United States (Fig. 57). The gnawing and nest building activities of this pest can cause structural damage, including electrical shorts and fires. They consume and contaminate food meant for humans, pets, and livestock. In addition, they are also health risk pests since they can transmit pathogens that cause food poisoning (salmonellosis). House mice are almost always found closely associated with humans. Although they can survive outdoors, they will try to move indoors as the weather gets cooler. Indoors, they will nest in any suitable hidden and undisturbed spot with a nearby food source. Nests are made of untidy piles of any material they can collect, such as paper, cardboard, wires, wood shavings, etc., but the insides are lined with softer and more finely shredded materials such as cloth. House mice have an extremely high reproductive potential and they breed year-round in favorable conditions.

The roof rat or black rat (*Rattus rattus*) is an Old World rodent species not native to North America (Fig. 58). In addition to consuming and contaminating stored food and feedstuffs, roof rats will gnaw on wiring (posing a fire hazard), and tear up insulation to use it for nesting material. They will



Fig. 57. House mouse. Photo: National Institutes of Health.





Fig. 58. Roof rat. Photo: Centers for Disease Control.

feed on the fruit and vegetative portions of many landscape and garden plants including tree bark.

Roof rats are nocturnal (active at night). They prefer to forage for food above ground in elevated areas indoors and outdoors. Being agile climbers, they can travel through trees and along vines, wires, rafters, and rooftops. They prefer to nest in secluded areas above ground in places such as attics, overhead garage storage, in the vine cover of fences or buildings, and in wood piles or other stored materials where a place of shelter (harborage) can be found. Roof rats will also burrow in the ground especially in hot, dry environments. In these areas, they may use trees, materials stored on the ground, concrete slabs, and sidewalks to support shallow burrows.

## Prevention

Although poison baits and trapping are two methods used against rodents, these only provide short-term control. The use of exclusion and habitat modification can provide an effective, long-term solution.

1. Seal any gaps and holes in the outside structure of the house, from ground level to rooftop. Pay special attention to utilities entering the walls of the house (air conditioning lines, water pipes, electrical lines, and cable lines). A gap of a ¼ inch (the diameter of a pencil) will permit entry of young mice, and a gap of a ½ inch is large enough for young rats to enter a structure.
2. Check door sweeps, seals, and thresholds; adjust or install new ones as needed.
3. Repair any previous rodent damage in your home. Use a strong material such as cement, mortar, or appropriate silicone sealants to fix gaps. Stuffing copper wool or steel wire mesh into rodent spaces only provides temporary protection. Filling cracks with a soft material like cloth

will not stop the rodents from burrowing and they will use the cloth for bedding.

4. Install wire mesh over attic, roof, chimney, and crawl space vents. Use ¼-inch hardware cloth.
5. Employ proper sanitation procedures and eliminate places where the rodents can hide or make nests.
6. Use appropriate pest-resistant food storage containers. For example, bird seed should be stored in metal cans with a metal lid, while glass jars/bottles may be used for storage of other food items. Plastic generally is not the best type of food storage container, since rodents can chew through them.
7. Clean up the yard from clutter and ensure the compost bin is pest-proof (see general pest-proofing measures).
8. Repair any leaky faucets or pipes when encountered.
9. Garbage containers should be self-closing, and be kept clean.
10. Harvest citrus and other fruit in a timely manner and pick up fallen fruit promptly.
11. Prune shrubs so that the ground below them is clearly visible from a bended knee position. Prune back shrubs and trees 24 inches away from a structure. Don't let tree branches overhang your house. Mow, trim, or remove ground cover plants that grow over one foot in height.

## E. Scorpions

More than 40 species of scorpions occur in Arizona. Scorpions are nocturnal (night-active) or diurnal (day-active), predatory animals that feed on a variety of insects, spiders, centipedes, and other scorpions. The larger scorpion species feed on the smaller scorpions, insects, and even small vertebrates, such as small lizards, snakes, and mice.

The **bark scorpion** (*Centruroides sculpturatus*) (Fig. 59) is the only species in Arizona of medical importance. Around 3 inches in length, it can be distinguished from other native scorpions by the slender pincers, the presence of a tooth or tubercle at the base of the stinger (Fig. 60) and the long triangular sternum (all other Arizona species, have a fivesided, or a pentagonal sternum) – these features may require magnification to be observed clearly.

The sting of the bark scorpion can be life threatening. When stung the victim may experience local pain, sensitivity to touch, heat, and cold, numbness, tingling and possible extremity weakness. In children, who are at highest risk, “roving eye”, hyperactivity and abdominal cramps have been reported. The majority of stings occurring in healthy



Fig. 59. Arizona bark scorpion female with young ones.

young adults may be managed at home with basic first aid measures and follow-up. First aid should include cleaning the site with soap and water, cool compress, elevating the affected limb to approximately heart level, and administering aspirin or acetaminophen as needed for minor discomfort. Generally, a healthy adult experiencing a scorpion sting will simply experience discomfort and will require no medical attention. However, they should contact a physician or the Arizona Poison & Drug Info Center at 1-800-222-1222 for advice and assistance if distressed. **If a scorpion has stung a child (especially a child under the age of 9 years or less than 70 lb. in weight) or an elderly or infirm individual, consider this as a medical emergency and call 911 immediately.**

Scorpions are a normal and desirable component of the Arizona ecosystem. They enter houses frequently (see Fig. 4; page 2), but are easily excluded using basic pest-proofing procedures. Scorpions are often found in newly developed areas (those less than 3 years old), where construction has disturbed the scorpion territory. Homes located near normally dry riverbeds (arroyos), or agricultural fields/orchards may experience an influx of scorpions during summer rains and after irrigation.

### Prevention

1. Ensure doorways are fitted with tight-fitting door-sweeps and weather-stripping so no light can be seen around the door when viewed from inside the home. Adjust or replace the door threshold, as needed.
2. Move loose boards, woodpiles, rocks, and debris away from areas immediately surrounding homes. Wear leather gloves and exercise caution when moving these objects in yards. Discard items that are no longer useful; stack other items neatly and elevate wood 6 inches above the ground.

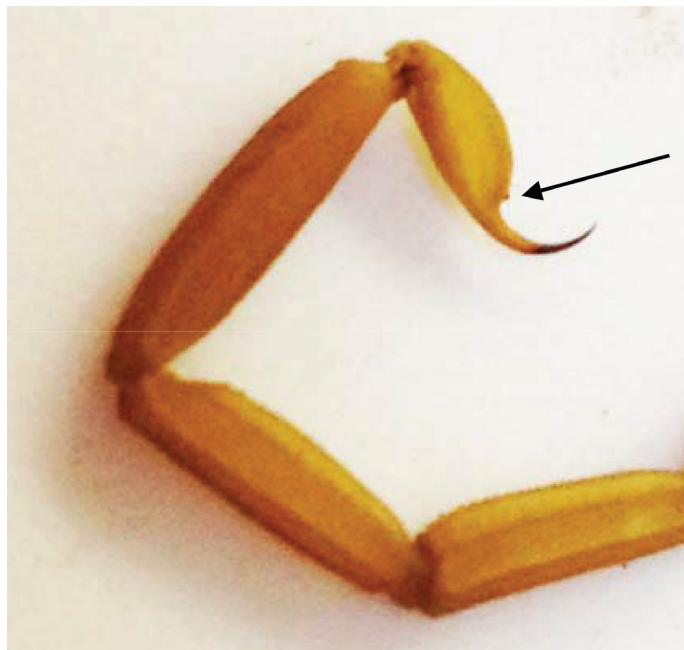


Fig. 60. Arizona bark scorpion stinger with tooth at the base.

3. Teach family members about scorpions (how to identify, the danger they pose).
4. Check any pair of shoes for scorpions before putting them on. Do not store shoes or boots outside, especially overnight.
5. Remove vegetation and debris that could serve as a hiding place next to the house.
6. Trim trees and shrubs so there is at least a 24-inch clearance from walls. Prune away any branches that overhang the house.
7. Protect an infant's crib by placing the legs of the crib in clean wide-mouthed glass jars (scorpions cannot climb the clean glass). Pull cribs away from walls; bark scorpions can climb vertical walls, but make little progress across ceilings.
8. Monitor for scorpions around the outside of your house after dark. Use a portable (battery-operated) camp light equipped with a black (UV) fluorescent bulb. Scorpions glow brightly under black light and are extremely conspicuous up to several yards away. Once collected we recommend that the scorpions be released back into the wild away from dwellings. **Repeated collections and releases far away from the house are more effective than repeated pesticide applications.**
9. For more information on scorpions and their management see publication available at <http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1223.pdf>.

Other scorpion-like creatures such as pseudoscorpions, solifugids, and whipscorpions might be occasionally encountered





Fig. 61. Scorpion/spider-look-alikes: Left-pseudoscorpion (Photo: Christian Fischer); middle-solifugid/wind scorpion. (Photo: Braboowi); right-whip scorpion/vinegaroon. (Photo: Thomas Brown).

in Arizona (Fig. 61). They are beneficial components of the ecosystem and should not be killed. Following the general pest-proofing guide will exclude most of these beneficial arthropods. Catch and release any of these creatures if they are found in your house.

## F. Ticks

Although there are many species of ticks in Arizona, humans are likely to encounter only four. Three of these, the brown dog tick (*Rhipicephalus sanguineus*), American dog tick (*Dermacentor variabilis*), and the Rocky Mountain wood tick (*Dermacentor andersoni*) are “hard ticks”, which belong to the family Ixodidae. The fourth species, the adobe tick (*Argas sanchezi*) is a “soft tick” belonging to the family Argasidae. Like most other arachnids, adult ticks and immatures (nymphs) have four pairs of legs; the larvae (hatchlings) have three pairs. All ticks require blood from a vertebrate host to survive and complete their development.

Ticks are the most common transmitters of vector-borne diseases in the United States. When a tick feeds it takes up whole blood, extracts the water (about 70- 75% volume) and injects the water back into the host. For this reason, they efficiently vector a variety of disease causing organisms such as bacteria, spirochetes, rickettsiae, protozoa, viruses, nematodes, and toxins. A single tick bite can transmit multiple pathogens as well as create secondary infections and allergic reactions.

The brown dog tick (Fig. 62) feeds primarily on dogs, but readily bites humans. It is the most pestiferous species from the standpoint of the Arizona homeowner because it is a parasite of their canine pets. During its lifecycle, the brown dog tick frequently drops off its host then climbs up walls and vegetation and reattaches to a passing host. Larvae can survive as long as eight months and adults as long as 18 months without feeding.

## Prevention

1. Regularly inspect pets for ticks. Remove any ticks from the dog with tweezers. Grasp as much of the tick’s body as possible firmly, and apply gentle outward pressure slowly to allow the tick to loosen its mouthparts. Do not smash or tear the tick in the process. Do not use an irritant such as alcohol or nail varnish. Afterwards wash the feeding site with soap and water and apply a dry dressing over the wound if necessary.
2. Keep lawn mown (2 to 3 inches in height).
3. Remove leaf litter, brush, and woodpiles around houses and at the edges of yards.
4. Open up tree and brush growth in your landscape to allow more sunlight into the yard. This reduces the amount of suitable habitat for deer, rodents, and ticks.
5. Dress properly (white or light-colored clothing to make attached ticks more visible) and tuck pant legs into socks when hiking. It is best to avoid tall grass and shrubs.
6. Apply a repellent on shoes, socks, and pant legs if entering tick-infested areas.

## G. Venomous spiders

Spiders are predators that feed on insects and other arthropods. They are all beneficial in our environment, and most are harmless. In the United States more than 20,000 different species have been identified but only four are harmful to humans. In Arizona, a few desert recluse species and the Western widow are the only spiders whose bites require medical treatment.

The recluse spiders (*Loxosceles* spp.) found in Arizona are often mistakenly referred to as the brown recluse. The true brown recluse spider (*Loxosceles reclusa*), however, does not occur in Arizona, but resides in the Midwest and Pacific Northwest of the United States. The closely related Arizona species are quite similar to the brown recluse and can be



Fig. 62. Adult brown dog tick female (left) and male (right). Photo: Centers for Disease Control and Prevention.

distinguished only by an expert. The most common Arizona species are *Loxosceles arizonica* and *L. deserta*.

Adult brown recluse spiders are brown in color and the body is about ½ inch long (Fig. 63). Their legs are long and delicately covered with short, dark hairs, and the leg span of the adult is about 1 inch. Distinguishing characteristics include the three pairs of eyes arranged in a semicircle on the anterior top of the cephalothorax (combined head and thorax) and a violin-shaped marking immediately behind the eyes. This marking also gives them the common name “fiddleback” or “violin” spider.

Most recluse spiders are found living in groups. Males, females and even spiderlings are capable of venomous bites creating a disease state now known as **necrotic arachnidism**.

The bite itself is often unnoticed and the severity of the reaction varies greatly between individuals. In the case of necrotic arachnidism, the bitten area becomes painful, swollen and blisters within hours. This site will progress into what has classically been described as a **bulls-eye lesion** with a dark center of dead skin outlined by white skin tissue and set on a red and inflamed background. It takes several weeks for the blackened area to fall away, leaving a pit of scar tissue. On rare occasions, the response involves a large amount of tissue destruction and a serious life-threatening systemic reaction.

The common term “black widow” specifically refers to the eastern species *Latrodectus mactans*, which **does not occur** in Arizona. The western widow species *Latrodectus hesperus*, however, is very similar in appearance to the true black widow. Females have shiny black or dark brown bodies about ½ inch long and long slender legs, with a leg span of about 1.5 inches. They have the characteristic reddish hourglass shape on the underside of their abdomen (Fig. 64). Like the recluse spider, the initial bite itself may not be felt immediately; local pain does follow shortly after envenomation. The venom can cause abdominal pain similar to appendicitis as well as pain to muscles and even the soles of the feet. Other symptoms include alternating salivation and drymouth, paralysis of the diaphragm, profuse sweating



Fig. 63. Adult recluse spiders: male (left), female (right).

and swollen eyelids. Most healthy people recover in two to five days; rare fatalities are due to heart and lung failure. No fatalities have been reported in Arizona. Male widow spiders are much smaller than the females, and are patterned with red, brown and cream (Fig. 65).

In the case of a spider bite causing pain, concern, or reaction, contact your physician or the Arizona Poison & Drug Info Center at 1-800-222-1222 as soon as possible for advice and assistance. If possible, collect the undamaged spider to aid diagnosis and correct treatment procedures. Initial first aid would be to clean the site well with soap and water. Apply



Fig. 64. Female black widow spider: dorsal view (left), ventral view showing red hourglass mark (right).



Fig. 65. Male black widow spider. Photo: David Kirkeby.



a cool compress over the bite location and keep the affected limb elevated to about heart level. Aspirin or acetaminophen may be taken to relieve minor symptoms.

## Prevention

1. Perform routine, thorough house cleaning, particularly in storage areas (closets, basements, attics, etc.) and behind outside shutters. Regular dusting and clutter reduction removes hiding places. Pay particular attention to storage cupboards, doors, windows, vents, and along foundations. Do not place your hands where you cannot see.
2. Reduce clutter in garages, attics, and basements.
3. Trim weeds and heavy dense vegetation around the building foundation and remove firewood, building materials, and debris to discourage insects and spiders from living next to a structure.
4. Install tight-fitting window screens and door sweeps.
5. Replace light bulbs with low UV emitting bulbs in outside fixtures, which are less attractive to insects and the spiders that feed on them.
6. Follow the guidelines for general exclusion e.g. sealing cracks, fitting door sweeps and eliminating other possible entry points to prevent spiders from moving indoors.
7. Vacuum webs, unwanted spiders, and egg sacs on a weekly basis. To be extra careful, remove the vacuumed bag and discard in an outside garbage container immediately after vacuuming.
8. Learn to recognize the recluse and widow spiders and instruct other members of the household.
9. Wear gloves and a long-sleeved shirt when collecting firewood from outdoor woodpiles. Place wood from outside directly on fires. Do not store indoors.

## IV. STORED PRODUCT PESTS

Stored product pests can be grouped into beetles, moths, and mites. These include *granary weevil* (*Sitophilus granarius*), *rice weevil* (*Sitophilus oryzae*), *flour beetles* (*Tribolium* spp.), *cigarette beetle* (*Lasioderma serricorne*), *drugstore beetle* (*Stegobium paniceum*), *sawtoothed grain beetle* (*Oryzaephilus surinamensis*) (Fig. 66), *Indian meal moth* (*Plodia interpunctella*) (Fig. 67), *Angoumois grain moth* (*Sitotroga cerealella*), and *grain mite* (*Acarus siro*). These stored product pests are not usually harmful even when consumed. Most are introduced through infested food materials, but others make their own entry into homes. Additional invaders such as ants,



Fig. 66. Sawtoothed grain beetle. Photo: Pest and Disease Image Library, Bugwood.org.



Fig. 67. Indian meal moth, larvae and webbing. Photo: Clemson University- USDA, Bugwood.org

roaches, and firebrats may also feed on pantry foods. Certain ant species (e.g., thief ants) are toxic and can make people ill if ingested in significant quantities.

Stored food pests are economically important. They are responsible for the loss of millions of dollars every year in contaminated products and are also responsible for the damage of important heritage artifacts in museums. Large populations of stored product pests may develop in unused or undisturbed foods that were infested when purchased. The warm Arizona climate can allow many of these pests to reproduce quickly producing several generations per year. The most commonly attacked products are cereal grains, spices, and nuts, but all food items are susceptible. Certain non-food items such as dried flowers, stuffed furniture, and toys can conceal infestations.

## Prevention

1. Clean the kitchen pantry / cupboards and other food storage areas on a regular basis. Use a flashlight to ensure cleaning is thorough.
2. Organize your shelves so that older food products will be used before newer ones. Reduce clutter and excess products in cabinets or storage. Also, dispose of all infested and old or outdated products.
3. Store materials that are not commonly infested such as animal bedding, paper products, and canned goods away from those that are regularly infested.
4. Keep pet and other food items in pest-resistant containers.
5. Seal cracks (especially wall penetrations) that join with other rooms.
6. Repair moisture and ventilation problems.
7. Eliminate cardboard as much as possible. Replace cardboard cartons with sealable glass or plastic containers.

## V. FABRIC PESTS

Two groups of pests are responsible for destroying fabric: clothes moths and carpet beetles. The clothes moth damages fabrics over a period of 1 to 3 months (Fig. 68). The larva eats only fibers or materials of animal origin, such as woolen rugs and clothing, hair, fur, feathers, taxidermy mounts, and felt.

Clothes moth larvae prefer to feed in protected locations such as under collars, inside hems, on the backside or in cracks at the edges of woolen carpets, under furniture, and inside storage containers. Rarely, if ever, will these insects be found infesting garments or items that are used or moved regularly. The larvae tend to crawl about as they feed and eat the nap from the fabric surface (Fig. 69). If the larvae remain for a long time, deeper damage and noticeable holes may appear. Adult clothes moths are buff colored and about  $\frac{1}{4}$  inch long. They are seldom seen; they avoid light and remain hidden. Adults do not feed or cause any damage.

Carpet beetle larvae (Fig. 70) can create a considerable amount of damage if left undisturbed and they leave numerous cast skins. The larvae feed on dried foods and materials of plant and animal origin within the house such as woolen rugs, blankets, clothing, furs, hides, feathers, and other animal feeds, etc. (Fig. 71). They also feed on dead insects that may be trapped in inner wall spaces. Adult beetles do not usually cause damage indoors. They feed on pollen and nectar, and can be brought in on cut flowers. They are good fliers and can move from room to room, seeking spots



Fig. 68. Clothes moth damage.



Fig. 69. Clothes moth larva with its case. Photo: Kathryn Robinson, Bugwood.org.



Fig. 70. Carpet beetle adult and larva. Photo: Clemson Univ.-USDA Coop.Extn., Bugwood.org.





Fig. 71. Sweater damaged by carpet beetles. Photo: Clemson Univ./USDA Coop. Extn. Bugwood.org

to lay their eggs, such as air ducts, closets, under furniture, or under baseboards.

Today clothes moths and carpet beetles are less problematic since many fabrics are synthetic and not from a natural origin. Dry-cleaning and other sanitation methods have also reduced the populations of these pests.

### Prevention

1. Vacuum frequently and be sure to dispose of the contents regularly. Special attention should be given to cracks, corners and underneath rugs and furniture.
2. Clean fabrics before putting into storage. Periodic brushing of stored fabrics or placing them in the sunlight for several hours is also helpful. The larvae tend to avoid light and brushing will destroy or dislodge eggs, larvae, and cocoons.
3. For long-term storage, gather fabrics and place them in tightly sealed chests, boxes, or storage closets.
4. Dry clean or dispose of infested clothing, cloth, blankets, and other fabrics. Small items can be freeze-treated by placing them in the freezer for a week

**Never use mothballs.** Mothballs contain naphthalene or paradichlorobenzene, which can produce harmful effects when they enter your body by inhalation.

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