

APPENDIX D

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The following Web sites offer pest identification and prevention / control measures for specific pests:

1. Illinois Department of Public Health's Prevention and Control Informational Sheets

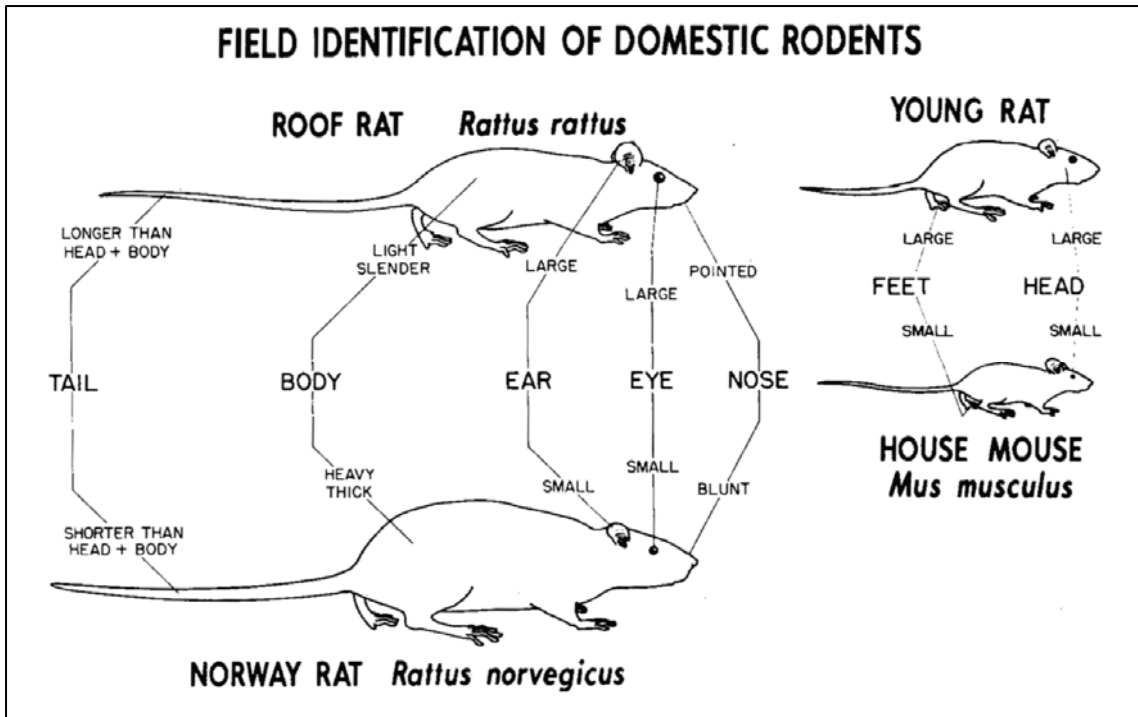
<http://www.idph.state.il.us/envhealth/entpestfshts.htm>

2. Center for Disease Control's Pictorial Keys to Arthropods, Reptiles, Birds and Mammals of Public Health Significance.

http://www.cdc.gov/nceh/ehs/Pictorial_Keys.htm

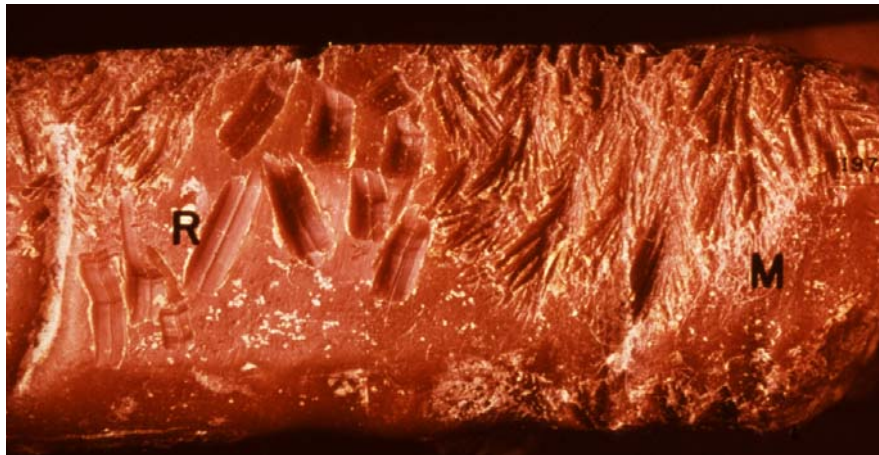
3. U.S. Environmental Protection Agency IPM in Schools: A How-to Manual

<http://www.epa.gov/pesticides/ipm/schoolipm/index.html>



Rat – Gnaw marks, one-eighth of an inch long

House Mouse – Gnaw marks, one-sixteenth of an inch long



House Mouse

Roof Rat

Norway Rat

Feces have pointed ends, one-fourth of an inch long, 50 droppings a day

Feces have pointed ends, one-half of an inch long, 180 droppings a day

Feces have pointed ends, three-fourths of an inch long, 30 to 180 droppings a day



**NORWAY
RAT**



**ROOF
RAT**



**HOUSE
MOUSE**



WEIGHT LENGTH NEST HOME YOUNG LITTERS
 (minus tail) LOCATIONS RANGE LITTER FEMALE

7-18 oz 200-500 g	7-10 in 18-25 cm	Burrows	100-165' 30-50 m	8-12	4-7
5-9 oz 10-250 g	6-8 in 16-20 cm	Walls, attics, trees	100-165' 30-50 m	4-8	4-6
.4-1 oz 12-30 g	2-4 in 6-9 cm	Walls, ceilings, burrows	10-35' 3-10 m	4-7	8

FOOD WATER HABITS &
PREFERENCE REQUIREMENT BEHAVIOR

**NORWAY
RAT**

**ROOF
RAT**

**HOUSE
MOUSE**

Meats, fish, nuts	15-30 ml daily	Steady eater, Cautious
Fruits, vegetables	15-30 ml daily	Steady eater, Cautious
Grain, cereals	<10ml/day or none	Nibbler, Curious

Tips for Effective Pest Management

House Mouse

The house mouse is the most successful rodent in adapting to life with people. It's found almost everywhere people are, feeding on human food, sheltering in human structures and reproducing at a rapid rate. The house mouse is the most troublesome and economically important vertebrate pest, contaminating millions of dollars worth of food, damaging property and causing electrical fires with its constant gnawing. Mice may enter a building from the outside and spread through a structure along pipes, cables and ducts. Although large numbers can build up in food service areas or trash rooms, one or a few mice can survive practically anywhere.

Many control failures against house mice are due to a lack of understanding of mouse biology and habits. A pair of mice can produce 50 offspring in one year. Because they seek food over a range of only 10 to 30 feet, traps, glue boards and bait must be placed close to the nest to be effective. *Remember that good inspections are critical for successful mouse control.*

Inspection

Sounds - Sounds are common at night where large numbers of mice are present; listen for squeaks, scrambling and sounds of gnawing.

Droppings - A house mouse produces many droppings per day; mouse droppings are frequently the first evidence that mice are present. However, be aware that large cockroaches and bats may produce droppings similar to house mice. Look along runways, by food near shelters and in other places mice may frequent.

Urine - House mice occasionally make small mounds known as "urinating pillars." These consist of a combination of grease, urine and dirt and may become quite conspicuous. Look for many small drops of urine using a blacklight. Urine stains will fluoresce under ultraviolet light. (Mouse urine spots are not as easy to detect as those made by rats.)

Grease marks - Like rats, mice produce greasy smears where dirt and oil from their fur mark pipes and beams.

Runways - Most mouse runways are indistinct trails free of dust and are not readily detectable.

Tracks - Look for footprints or tail marks on dusty surfaces or on mud; use a nontoxic tracking dust (like talc) to help locate mice within buildings.

Gnawing damage - Newly-gnawed areas on wood are light in color, turning darker with age. Look for small tooth marks and enlarged cracks beneath doors. Mice make wood chips with a consistency like coarse sawdust around baseboards, doors, basement windows and frames and kitchen cabinets.

Visual sightings - Mice are often active in daylight and this may not indicate a high population (as it does with rats). Use a powerful flashlight or spotlight at night to confirm mouse presence.

Nest Sites - Inspect garages, attics, basements, closets and other storage places for evidence of nests. Be alert to fine shredded paper or similar materials; these are common nest-building materials.

Mouse Odors - Mice produce a characteristic musky odor.

Estimating Numbers of Mice - The number of mice observed or food consumed is not reliable as a census



technique with mice. Unlike rats (which may travel widely within a building leaving tracks on many patches of dust), mice do not range widely.

- Read natural signs such as droppings, urine stains, tracks and damage.
- Make nontoxic tracking patches of talc at 20- to 30-foot intervals throughout a building. The more tracks seen in each patch and the more patches showing tracks, the larger the population is. The percentage of patches showing tracks will reflect the extent of the local infestation.
- Tracking patches is also an excellent means to evaluate a control operation. Compare the number of tracks or patches with mouse tracks before and after a control program.

Control and Management

Control and prevention of mice is a three-part process, which includes sanitation, mouse-proofing and population reduction with traps or baits. Sanitation and mouse-proofing will help prevent mice from entering buildings. When a mouse population already exists, some kind of lethal control is necessary. Otherwise, mice, which reproduce rapidly and can find food almost anywhere, will continue to be a problem.

Habitat and Harborage Reduction

Sanitation - Good sanitation makes it easier to detect signs of mouse infestation. It also increases the effectiveness of baits and traps by reducing available food. However, the best sanitation will not eliminate mice; they require very little space and small amounts of food to survive and reproduce.

- Store bulk foods in mouse-proof containers or rooms. In storerooms, stack packaged foods in orderly rows on pallets so that they can be inspected easily. A family of mice can live in a pallet of food without ever having to leave the immediate area.
- Keep stored materials away from walls and off the floor. A 12-inch to 18-inch yellow or white painted band next to the wall in storage areas permits easier detection of mouse droppings. This band and the areas around pallets should be swept often so that new droppings can be detected quickly.

Mouse-Proofing - Completely mouse-proofing a building is difficult because mice are reported to be able to squeeze through an opening as little as one-fourth inch high. To mouse-proof a building:

- Seal large holes to limit the movement of mice into and through a building.
- Plug holes in foundation walls with steel wool or copper mesh.
- Caulk and fit doors and windows tightly.
- Seal holes around pipes, utility lines, vents, etc., to make it difficult for mice to move in and out of wall and ceiling voids. (This limits mice to a smaller area and may make snap traps and glue boards more effective.)
- Do not prop open kitchen doors; install screen doors wherever possible.

Traps

Snap Traps. If used correctly, snap traps are very effective in controlling mice. They must be set in the right places, in high numbers and in the right position or mice will miss them entirely. *Always* place traps in areas that are inaccessible to students. Here are some tips to keep in mind when trapping mice:

- *Remember that mice rarely go further than 30 feet from the nest, only 10 feet in most cases.* If mice are sighted throughout a building, it means that there are many locations where you will have to set traps. Place snap traps not only wherever you see obvious signs of mice, but also in a three-dimensional sphere about 10 feet in diameter around those signs. Mice are good climbers and can be living above their main food supply in suspended ceilings, attics, inside vertical pipe runs and on top of walk-in coolers. Or they can be below, in floor voids, crawl spaces, or under coolers or other equipment.
- The best sites are those with large numbers of droppings since that means the mice are spending a lot of time there. Other good sites are along walls, behind objects, and in dark corners, particularly where runways narrow down, funneling the mice into a limited area.
- Successful trapping requires good mouse baits. Peanut butter, bacon, cereal and nuts are attractive to mice. Food baits must be fresh to be effective. Another bait is a cotton ball, which the female mice like to use for nest material. It must be tied securely to the trigger.
- Two or more traps placed next to each other will capture more mice than single traps.

- Probably the biggest mistake made in mouse trapping *is not using enough traps*. Use enough to quickly eliminate the mice.
- Great care must be taken to place traps out of the public view and to check them regularly.
- Mice can carry several diseases, so technicians should wash their hands after handling traps or other items that come in contact with mouse urine and feces. Use disposable latex gloves or tongs to handle dead mice. A bleach/water solution of at least three tablespoons household bleach per gallon can be used to sanitize traps.

Multiple-Catch Traps. Multiple-catch mouse traps catch up to 15 mice without being reset. Some brands are called "windup" traps; the windup mechanism kicks mice into the trap. Others use a treadle door. Live mice must be humanely killed.

Mice are curious and like to investigate new things. They enter the small entrance hole in the trap without hesitation. Odor plays a role too; traps that smell "mousy" catch more mice. Place a small dab of peanut butter inside the tunnel entrance to improve the catch.

- Mice are captured alive but may die in a day or two; dead mice may cause odors or attract insects. Some traps have a clear plastic end plate or lid so you can see if any have been captured.
- Check traps frequently; mice can get hung up in the mechanism and render the trap inoperative.
- Place the traps directly against a wall or object with the opening parallel to the runway, or point the tunnel hole toward the wall, leaving 1 or 2 inches of space between the trap and the wall.
- If mice are active, place many traps 6 to 10 feet apart. After the mouse infestation is eliminated, *maintenance traps* may be placed where mice have been numerous before. Additionally, traps also can be placed at potential entry points such as storerooms, loading docks, near utility lines and at doorways.

Glue Boards. Glue boards can be effective when other methods have failed against a "bait-shy" mouse or when food is abundant. As with other traps, placement is the key. Locations that are good for other types of traps are good sites for glue boards.

- Place glue boards in hidden locations away from areas where staff can view them. (One method is to place the glue board inside a tamper-resistant bait station.)
- Use the larger "rat-size" glue boards, which are more difficult for mice to escape from.
- Do not put glue boards directly above food products or in food preparation areas.
- Set glue boards lengthwise and flush against a wall, box, or other object that edges a runway.
- Move objects around; create new, narrow runways six inches wide to increase the effectiveness of glue boards.
- Put peanut butter or a cotton ball in the center of the board.
- Place the glue boards 5 to 10 feet apart in infested areas (closer if the population is large).
- If no mice are captured in three days, move the boards to new locations.
- If a trapped mouse is alive, kill it humanely before disposal. Replace the boards if they become covered with dust. Glue boards do not work well in cold areas.

Rodenticides

"Building out" mice and trapping are the most effective control methods. Rodent baits should be used only in emergency situations to supplement these methods. If there is a repeated need to use baits, it is likely that sanitation and mouse-proofing should be improved. Remember that rodent baits are poisons. Additionally, use of baits in schools represents special problems because of incidents where students have moved or tampered with rodent baits. In schools, baits should be used only after nonchemical control measures have been instituted.

Children, pets, wildlife and domestic animals must be protected by putting the bait in tamper-resistant bait boxes in inaccessible locations. *Using baits alone will not provide long-term control of mice.*

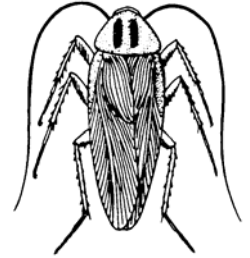
- Apply bait at several locations rather than relying on a few large placements.
- Use *fresh* baits labeled for mouse control. (*Never store baits with other pesticides; mice can detect tiny amounts of repellent chemicals that may cause mice to reject the bait.*)
- Place the baits in favorite feeding and nesting sites as determined by large numbers of droppings.
- Place the baits between hiding places and food, up against a wall or object to intercept the mice.
- Make bait placements 10 feet apart or closer in infested areas if they can be adequately secured.

- If bait is refused, try switching to a different type and replace the baits often.
- Use small bait stations which are more attractive to mice than the larger rat-type stations.
- Make sure that sanitation is such that no other food is readily available to mice.

Pest Management of Cockroaches

Cockroaches

Except for size, all cockroaches are relatively similar in overall shape and appearance. They are most active at night and stay in the dark whenever possible. (When they are seen in the open or in the light, it usually means that a large infestation is present.) Cockroaches also like to hide in cracks and crevices where their bodies can touch surfaces both above and below. As they grow to adulthood, they will seek hiding places (harborage) for their larger size. Cockroaches do not uniformly infest one room or all rooms. Knowing the basic biology of cockroaches give the pest control technician important clues to the source of a cockroach infestation. By considering the habits discussed below, one can increase the effectiveness of a cockroach management program.



The four most common kinds of cockroaches may be divided into two groups, depending on how they are managed. The “small” cockroaches include the German cockroach and the brown-banded cockroach; the “large” cockroaches are the oriental cockroach and the American cockroach.

- **Management of Small Cockroaches** - The German cockroach and the brown-banded cockroach are responsible for most pest complaints and pesticide use in public and commercial buildings. The degree of success of the control program depends not only on insecticides, but on management attention to good maintenance and housekeeping practices. Cockroaches and their egg capsules are being constantly introduced into buildings in packaging and boxes. *Consequently, both pest control staff and management must understand that an effective control program must include monitoring and inspection.*
- **Management of Large Cockroaches** - Although these large insects may wander along pipes throughout a building, in most parts of the county they live mainly at ground level or below. Prevention and treatment should focus on warm, moist areas such as basements, boiler rooms, pipe chases, sumps and elevator or sewer shafts.

MANAGEMENT OF SMALL COCKROACHES

The **German Cockroach** adult is one-half of an inch long with two black stripes behind its head on the “pronotum” (Appendix I). Young cockroaches (nymphs) are brownish black with a pale brown band down the middle of their back. The German cockroach is not only the most common cause of indoor pest problems, but also represents the largest number of control failures of any structural pest. It is most successful at infesting human structures and withstanding pest control activity. Successful cockroach control programs use several methods to bring the infestation under control.

Behavior and Harborage

Groups of cockroaches (aggregations) live in areas of high humidity and nearby food. They will find harborage (hiding places) into which they can fit closely. As the number of cockroaches increases and favorable harborage is filled, roaches are forced to leave the aggregation or remain in less favorable harborage. They are most active just before dawn and after dark.

To cockroaches, the most desirable harborage is in and around refrigerators, stoves, under sinks, and undisturbed cabinets, which provide both protection and food. Kitchen areas with high humidity, sink traps, leaking faucets, standing water and wet sponges are attractive to cockroaches. They also may be found in washrooms, because of their toilet bowls, sinks, wet wash cloths, and sometimes, water heaters.

While there is less food in washrooms, food areas are usually nearby or available through holes around plumbing pipes. These pipes provide additional harborage and areas where cockroaches can enter adjacent rooms.

In schools, German roaches are often found in student lockers or gym lockers. The two principle reasons for this are food left in lockers and roaches transported from home in the student's book bag or coat. In kitchen areas, roaches are most often brought in on supplies. What may be overlooked is that often nonfood supplies are a greater source of roach infestations than food supplies. Vending machines and recycling bins also can provide a frequently overlooked source of roach problems.

German cockroaches are not likely to leave favorable harborage unless conditions change. Such changes can be caused by:

- increase in the cockroach population,
- intensive cleaning,
- reduction of temperature or humidity,
- mechanical exclusion or
- pesticide applications.

If cockroaches find new locations with favorable conditions, they can move from one harborage to another, or develop new infestations. Outdoor infestations are found only outside heavily infested structures from which steady cockroach migrations occur and near dumpsters and garbage cans.

Control and Management

Inspection

With Flashlights - An active inspection with a bright flashlight is the most thorough method of locating cockroaches. The technician can search dark, undisturbed, or remote places of cockroach harborage that have not been properly inspected. Hand mirrors, magnifying hand lens or other small tools may be helpful to some technicians. *Identification of harborage is critical to an effective cockroach control program.*

With Traps - Use of sticky (glue) traps is a common inspection or monitoring method used for cockroach detection. Correct trap placement depends upon the technician's understanding of cockroach food-seeking (foraging) habits; place sticky traps behind kitchen appliances, in cabinets, supply rooms and similar locations.

Habitat and Harborage Reduction

Pest control technicians should explain to both staff and management that often changes in facility operations can reduce or eradicate the insect problem. These recommendations should include how staff can eliminate or restrict materials that support buildup of cockroach populations. *Site staff should understand that pesticide application alone will not control cockroaches satisfactorily.* Some specific actions that will reduce harborage include:

- Seal as many cracks and crevices in the kitchen and food storage areas as possible with a good silicone sealer. A review of monthly reports may indicate from time to time that other specific areas may need to be sealed.
- Repair holes in walls or floors and seal inaccessible areas that could become harborage for pests.
- Replace wood food storage shelves with wire shelves.
- Do not store infrequently used items in the same areas as frequently used items and food supplies.
- Repair all moisture problems.
- Do not keep recycled goods such as beverage containers, cans, paper, cardboard, etc. near the kitchen or food supply areas.
- Institute a good cleaning program. *Pesticide use without cleaning and sanitation will not produce long-term control of a pest infestation.*
- Recommend good lighting.
- Point out areas that need ventilation.

- Recommend reduction of clutter (particularly cardboard boxes) and excess product in cabinets or storage.
- Where practical, install air curtains to keep out flying insects.
- Recommend rotating stock.

Vacuuming as a Pest Control Method

A relatively new method of “cleaning out” a pest population is vacuuming. This is used to crash (greatly reduce) the cockroach population; it also removes dirt, food particles, etc. The “clean out” is followed by improved sanitation, pest prevention and, if needed, judicious use of pesticides. If vacuuming is used as a pest control method, be sure to use a vacuum cleaner with a HEPA (high efficiency particulate air) filter to avoid suspending materials in the air that can cause respiratory problems.

Pesticide Application

In attacking cockroaches, one should concentrate on monitoring the cockroach population and delivering pesticides into active harborage areas rather than “baseboard spraying.”

- Many types of sticky traps are available to help the technician pinpoint sources of cockroach infestation. Sticky traps are *not* intended for control, but rather to detect infestations and to evaluate and target control measures. Place sticky traps behind kitchen appliances, in cabinets and supply rooms.
- Containerized and paste or gel baits should be the standard insecticide treatment for cockroaches in many buildings. The small, plastic bait containers should be placed as close as possible to harborage sites where the cockroaches are actually living. Place the bait stations behind refrigerators, in cabinets and along edges of walls and in corners. Do not place them where students can find them. The two most common mistakes in using containerized baits are (1) not eliminating nearby food sources and (2) not using enough bait stations. Paste and gel baits are most effective when applied in small dabs. Baits are most effective when the cockroach population is low or moderate in size. If there is a large population, the bait in the stations may be entirely eaten before the cockroaches are eliminated. *Bait stations should not be contaminated by sprays or dusts that may be repellent.*
- When a moderate to large cockroach population is present, crack and crevice insecticide application is sometimes the most practical and effective way to apply insecticides. Use a narrow diameter extension tube in infested cracks and crevices to provide a thorough application of residual insecticide. (A crack and crevice treatment implies that the stream of insecticide is never visible during the spraying process.) Treat cracks and crevices under furniture, drawers, sinks, around pipes and in high cabinets. First remove utensils and supplies in cabinets; do not treat shelf surfaces.
- Space treatments should only be used to knock down a *heavy* cockroach infestation quickly so that other control measures can be used effectively. *The need for repeated fogging at short intervals indicates the cockroach population is rising, not decreasing.* Space treatments (fogs or aerosol applications) flush cockroaches out of harborage, causing them to cross residual pesticide applications, or the insecticide droplets land on the insects, killing them by direct contact. Such treatments lack crack and crevice penetration. Fog treatments should not be used in areas where facility staff are present. Prior to treatment, all exposed food and food contact surfaces should be effectively protected against pesticide contamination. After the application, food preparation surfaces should be cleaned before they are used for food preparation.

Follow-up

When a cockroach population has been controlled, the technician should continue to monitor the area with sticky traps and interview staff to detect cockroach problems before they become worse.

The ***Brown-banded Cockroach*** is less commonly a problem in buildings, but they also can build up large infestations where they find favorable harborage. Adult brown-banded cockroaches are the size of German cockroaches, about one-half of an inch long. The brown-banded cockroach has two transverse light bands near the head of the insect.

Behavior and Harborage

Brown-banded cockroaches, like German cockroaches, build up the highest populations in kitchens.

However, their tendency is to increase in warm rooms. They can be common around high cabinets and areas near stoves and warm motors, such as those in refrigerators, electric clocks, light timers, televisions and radios.

Control and Management

Inspection

Inspection for the brown-banded cockroach is essentially the same as for German cockroaches. However, brown-banded cockroaches will be more scattered and less attracted to moisture.

Habitat and Harborage Reduction

Habitat and harborage reduction is essentially the same as for the German cockroach.

Pesticide Application

- Boric acid powders may be used in inaccessible areas. (Boric acid powders should NOT be over-applied so there is a visible residue.)
- Bait stations with a long active period are effective, but should not be contaminated by sprays or dusts that may be repellent. Place an adequate number in or near harborage. Do not use where students can find them.
- If baits do not control the cockroaches, use a crack and crevice application to provide a thorough application of residual insecticide: under furniture, drawers, sinks, around pipes and high cabinets. First remove utensils and supplies in cabinets; do not treat shelf surfaces.

Follow-up

The long egg hatching time of the brown-banded cockroach requires treatments to be monitored with sticky traps.

MANAGEMENT OF LARGE COCKROACHES

The ***Oriental Cockroach*** is often called the “waterbug.” Adult oriental cockroaches are very dark brown or shiny black. The female is slightly longer than the male, about 1 1/4 inch to his 1 inch. Unlike other domestic cockroaches, the female does not develop wings, but produces only short triangular wing pads. The male has wings, but they are short and broad, leaving about one-fourth of the abdomen exposed.

Behavior and Harborage

Oriental cockroaches favor crawl spaces, spaces between the soil and building foundations, the undersides of stoops and sidewalks, landscaping mulches, water meters, basements and their floor drains and other such moist places. These cockroaches frequently live in floor drains that lead directly outside; these drains also are used as entrances to buildings. The oriental cockroach prefers starchy foods and may build up around garbage cans. They tolerate cooler temperatures, and they are usually found near humid areas.

Control and Management

Inspection

Search areas of high humidity, such as basements or areas near leaking pipes. Place sticky traps in basements to capture individual insects that may enter from floor drains.

Habitat Alteration

- Caulk all cracks around pipes and other areas where holes penetrate through ground level walls.
- Stop water leaks, screen equipment overflow drains and take overflow water away from buildings; keep drain traps full of water or capped.
- Remove rotting leaves from window wells.
- Replace mulch around the foundation with plastic porous ground cover and gravel.
- Move garbage cans away from wet areas.

- Stop erosion that causes soil voids around foundations.
- Ventilate moist enclosed spaces.

Pesticide Application

- Large bait stations or other baits are effective when properly placed in appropriate quantities. Particular attention must be paid to pesticide degradation due to moisture.
- If oriental cockroaches are entering from the outdoors, apply insecticides as outside barriers when they can be safely used in areas of known infestation. Use insecticide formulations that are not readily absorbed by porous surfaces (concrete floors, bricks, stones, soil, etc.). Apply them in cracks and crevices.

Follow-up

Numbers observed in the spring may appear low or under control but may build up by midsummer.

The *American Cockroach*, like the oriental cockroach, is sometimes called the waterbug. Adult American cockroaches are large (1 1/3 to 1 1/2 inches) reddish-brown insects.

Behavior and Harborage

Large populations of American cockroaches live in warm moist habitats. They are most often found in boiler rooms or other harborage with water heaters, floor drains, water sumps and warm moist basements.

Control and Management

Inspection

Search areas that provide warmth and high humidity. Place sticky traps in areas where American cockroaches may enter a building.

Habitat Alteration

- Caulk cracks around plumbing and other penetrations in walls, screen equipment drains and floor drains. Keep drain traps full of water or cap them.
- Remove items stacked in attached garages, entry ways, etc.
- Replace mulch near doors and window wells with plastic porous ground cover and gravel.
- Ventilate humid places.

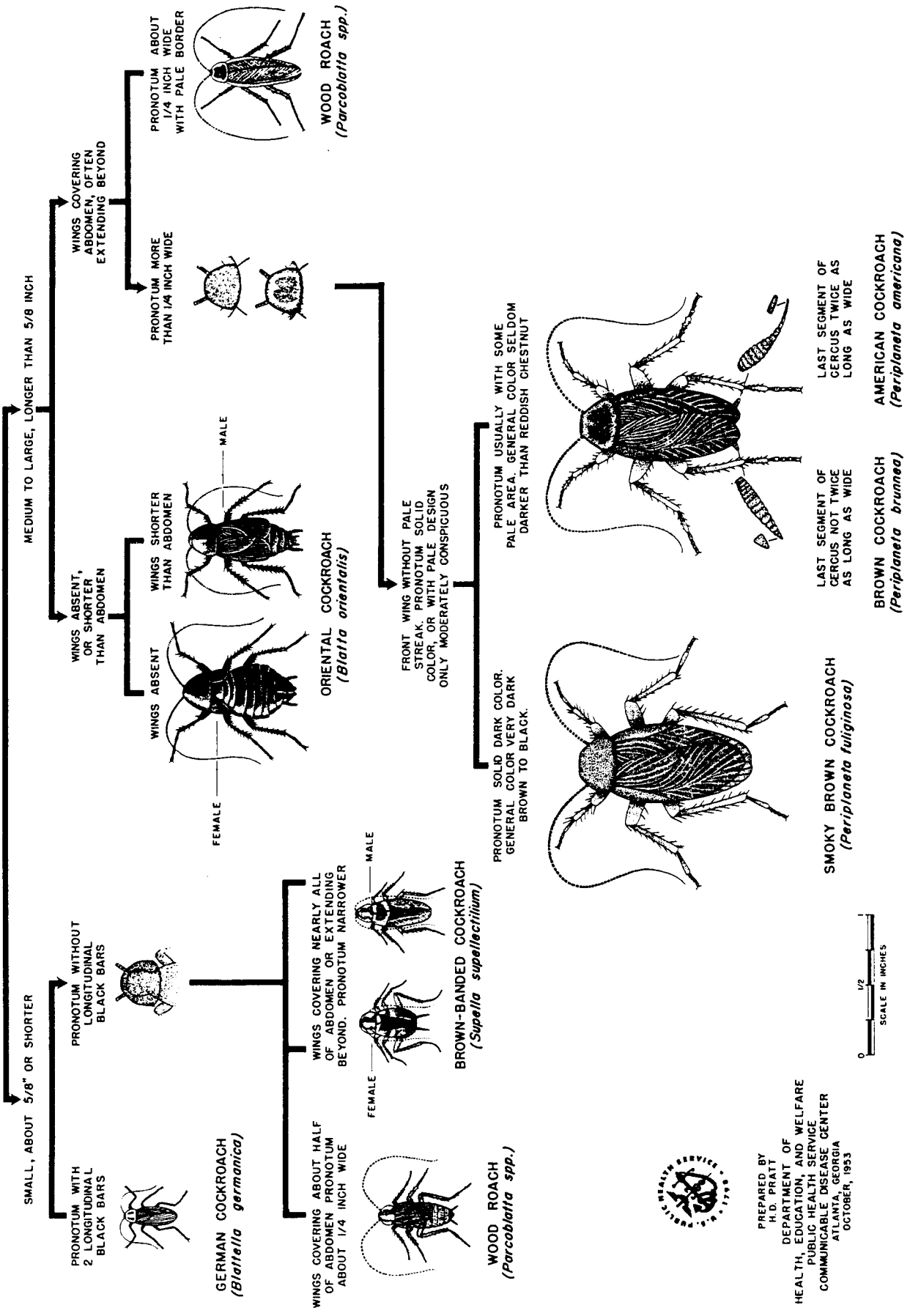
Pesticide Application

- Many of the methods that control the oriental cockroach also will control the American cockroach.
- If American cockroaches are entering from the outdoors, apply insecticides as outside barriers when they can be safely used in areas of known infestation. Use insecticide formulations that are not readily absorbed by porous surfaces (concrete floors, bricks, stones, soil, etc.). Apply them in cracks and crevices.

Follow-up

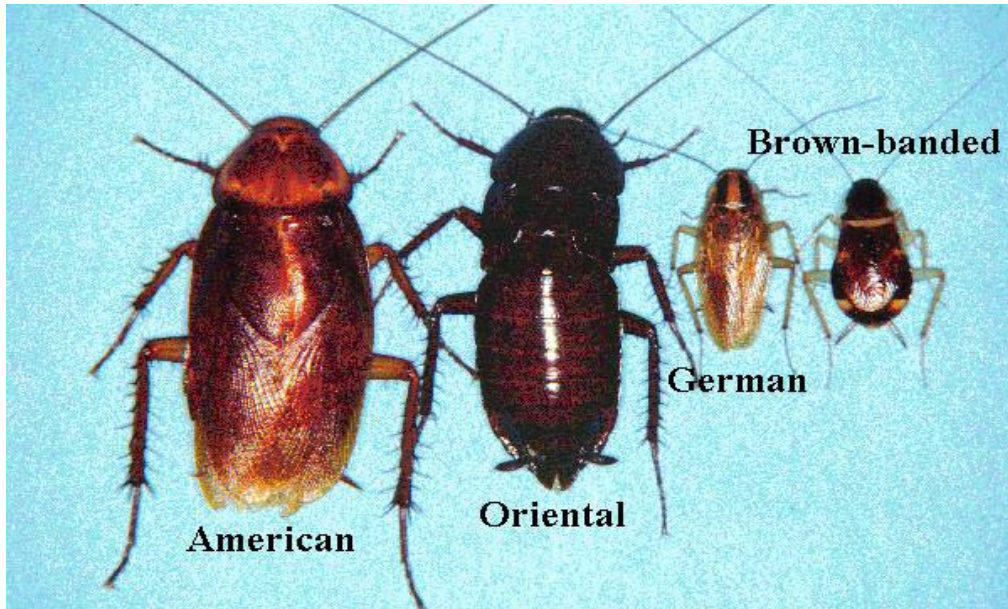
Ongoing monitoring with sticky traps is important due to the long life span of this cockroach.

PICTORIAL KEY TO SOME COMMON ADULT COCKROACHES



PREPARED BY
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PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA
OCTOBER, 1953





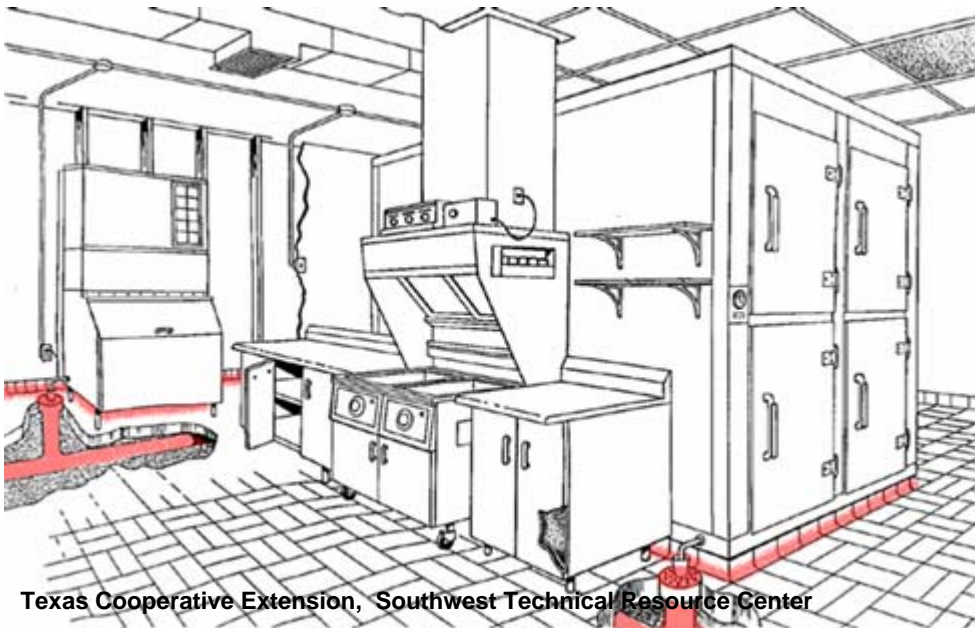
American Cockroach



•Identification:

- Reddish-brown with yellow band around pronotal shield
- 1 3/8 to 2 1/8 inches
- Ootheca black-brown without lateral indentations

Treatment Areas for American Cockroach



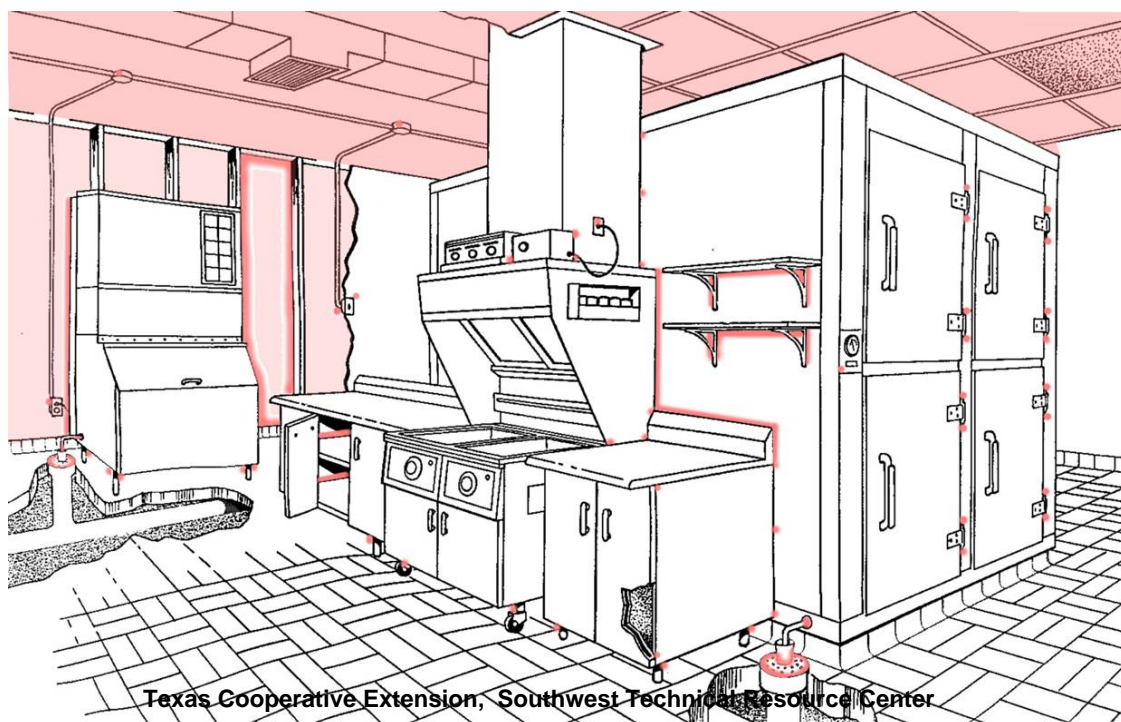
Texas Cooperative Extension, Southwest Technical Resource Center

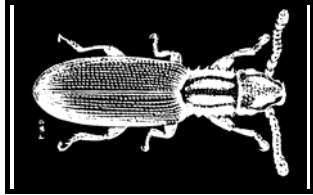
German Cockroach



- Identification:
 - One-half of an inch long
 - Two black stripes behind head
 - Very Prolific
 - Public Health Threat

Treatment Areas for German Cockroach





Pantry Pests

Many kinds of moth larvae and beetles attack cereal products, flour and other dry foods derived from plants. Flour beetles, saw-toothed grain beetles and Indian meal moths are some of the more common ones. These insects can be found in opened packages or containers of grains or plant materials and in the cracks and crevices of cabinets or cupboards. In schools or other public buildings, infestations often originate by means of food packages brought into the structure. Sometimes they may even gain entrance to unopened packages. Because most pantry pests are capable of flying, they may enter buildings that way. Once inside the building, these insects will spread through other food and the infestation will increase.

Habits and Damage

The young (larvae) and some adults of these insects feed on grains (rice, barley, corn, wheat, and bird seed), grain products (oatmeal, cornmeal, pasta, breakfast cereals, flour, cake mixes, pancake flour, and dry pet food), nuts, dried fruits, and other dried plant materials (dried flower arrangements, ornamental corn, seed displays and pictures made with seeds). Several types of beetles (cigarette beetles and carpet beetles and relatives) also will feed on spices.

All life stages (egg, larva, pupa, adult) of these insects may be present simultaneously in infested products. The adult beetles and moths are frequently seen in cupboards, on counters and cabinets and around windows. Beetle infestations frequently can be identified by the old larval skins left in the stored product. Indian meal moth larvae spin webbing threads throughout and over the surface of the infested product and the mature larvae frequently leave their food source to complete development to the adult. These migrating larvae are usually noticed as they crawl in cupboards and across walls and ceilings.

Prevention

To help prevent infestations:

- Whenever possible, buy food in small quantities so that it will not be stored for a long period.
- If foods are kept for long periods (a month or more), remove them from their original containers and store them either in airtight glass, metal, or plastic containers or in the refrigerator.
- Caulk cracks and crevices where food debris could accumulate.
- Clean up any spillage in cabinets immediately and thoroughly.
- Give food storage cabinets a thorough cleaning at least once a year.

Control and Management

Inspection

Inspections for pantry pests are essentially the same as for small roaches. In addition, you should check all packages of cereal products.

Habitat and Harborage Reduction

Habitat and harborage reduction for pantry pests is essentially the same as for small roaches. Additionally, you should check all packages of cereal products *and discard infested materials*. Sanitation is the primary method of population reduction where infested stored products are found.

Pesticide Application

- If an infestation is difficult to eliminate, insecticides registered for use in the infested area should be carefully applied to cracks and crevices.
- Reinspect problem areas frequently.

Follow-up

Ongoing monitoring and inspection plans should be put into effect in all kitchens and food-storage areas. A complete pest management program is recommended for these operations. Clear communication with staff is important. Cleaning and sanitation procedures should be monitored constantly.

Bees and Wasps

Of all insect species, the honey bee is perhaps the most beneficial. There is, of course, honey: about 200 million pounds of it is produced commercially each year. But the honey bee makes its greatest contribution by pollinating plants. More than one half of all fruit and vegetable crops are pollinated by honey bees. Wasps contribute by preying on many pest insects harmful to crops. Without bees and wasps, our menu would be very limited.

Unfortunately, bees and wasps can be a threat to human health. Each year, 50 to 100 people die from bee and wasp stings. Most die from an allergic reaction to venom within one hour of the sting. About 1 percent of the population is allergic to bee and wasp venom. Those allergic to stings should carry emergency epinephrine injection kits as directed by their doctors.

IDENTIFICATION

Though related, bees and wasps differ in important ways. Most wasps have a narrow “waistline” where the front portion of the abdomen tapers to become a small tube as it attaches to the middle body section, the thorax. Bees do not have this narrowing of the abdomen. Another difference is that bees feed nectar and pollen to their young (larvae), while wasps feed their larvae insects and spiders. Yellowjackets and hornets also scavenge food including fruit, sweets, meats and carrion.

One thing bees and wasps have in common is that some species are *solitary* and others are *social*. A *solitary* bee or wasp lives alone, making its own nest and raising its own larvae. Individuals of *social* species live together in colonies consisting of many “workers” and one or more “queens.” The workers specialize in different tasks, and cooperate to raise the queen’s offspring. These species should be considered a greater threat to humans than solitary species. This is because social species, such as honey bees and yellowjackets, will defend an entire colony, and have more individuals available to do so. Solitary species, such as mud dauber wasps, defend their nest alone.

BEES

Honey Bee (Apis mellifera)



The honey bee is a half-inch long, hairy, honey brown insect. They should not be confused with yellowjackets, which are black and bright yellow wasps. Honey bees live in extra large colonies of up to 50,000 individuals. Their colonies can grow this large because they survive winter, even in northern states. The nest consists of several tiers or “combs” made of beeswax. It is located in cavities of

trees, rock formations and buildings. In spring, a colony may produce a “swarm.” This occurs when a newly produced queen flies off with about half the colony’s worker bees to establish a new colony. These swarms often come to rest on trees and houses while scout bees search for a good spot for a new nest. If possible, such swarms should be tolerated, as they are in transit and usually leave within two to four days.

Bumble Bee (Bombus spp.)



The familiar buzzing, fuzzy yellow and black striped bumble bee is unmistakable. Up to 200, one-half- to 1-inch long bumble bees inhabit nests in old rodent burrows, under porches and in wall voids.

Carpenter Bee (Xylocopa virginica)



This bee is a bumble bee look-alike that has a shiny, all-black abdomen, whereas the bumble bee’s abdomen is fuzzy, black and yellow. Unlike bumble bees, carpenter bees are solitary. Females chew one-half-inch diameter holes in wood and bore tunnels that run several inches into the wood.

Inside, eggs are laid and the resulting larvae develop on a mixture of pollen and nectar. Males guard the nest by buzzing intruders, but their defense is a bluff: male bees cannot sting.

WASPS

Paper Wasps (Polistes spp.)



Paper wasps are perhaps the most common wasps around structures. They are also known as “umbrella wasps” because their nests look like umbrellas hanging upside-down from eaves and overhangs. There are many species, but the typical paper wasp is up to three fourths of an inch long, reddish brown in color with a long, cylindrical abdomen. A paper wasp nest is a single comb of hexagonal cells made of a papery material the wasps form by chewing

wood and mixing it with saliva. Larger nests can harbor up to 75 paper wasps including larvae and pupae developing within the cells. To feed the larvae, paper wasps capture insects, especially caterpillars. Late in the year, colonies of paper wasps, yellowjackets and hornets produce new queens that abandon the nest (it will not be reused) and seek shelter for winter. Many find their way into structures and are later seen crawling sluggishly across the floor when temperatures rise in late winter or early spring.

Yellowjackets (Vespula spp., Paravespula spp.)



More people are stung by yellowjackets than any other type of wasp or bee. Notoriously aggressive, the yellowjacket’s shiny yellow and black striped abdomen is an unmistakable warning. Often mistakenly called “bees,” yellowjackets are in fact wasps. They construct paper nests up to several feet across that contain combs arranged like the floors of a building covered by a papery envelope. As many as 3,000 (many more in warmer states)

wasps can be present in the yellowjacket colony. Nests of the Eastern yellowjacket (*Vespula maculifrons*) are located in the ground, while the German yellowjacket (*Paravespula germanica*) nests in cavities including crawlspaces, attics and wall voids. Adults consume nectar and sweets, but feed the larvae on captured insects. When temperatures cool in late summer, yellowjacket numbers peak just as their insect food supply begins to decline. They scavenge more aggressively at this time, taking food from trash containers and picnickers. When disturbed, yellowjackets can sting repeatedly; their stingers are not barbed nor lost

after stinging like those of honey bees.

Hornets (*Dolichovespula maculata* and *Vespa crabro*)



Bald-Faced Hornet

The so-called bald-faced hornet (*Dolichovespula maculata*), about three-fourths of an inch long, black and white, with white face, is actually a larger yellowjacket species. Its nest is the familiar basketball-size papery oval hanging from tree limbs and sometimes structures. Colonies are relatively small, containing up to 700 wasps. An even larger wasp is the European hornet (*Vespa crabro*). This is a true hornet, more than an inch long and reddish brown in color with dull orange stripes. Nests occur in trees and in attics and wall voids of structures near forested areas.



European Hornet

Mud Daubers (*Sceliphron caementarium*, *Chalybion californicum*, *Tropoxylon* spp.)



Mud dauber wasps are named for their habit of constructing tubular nests of mud plastered on the exterior surfaces of structures. Inside the nest, these wasps place spiders they have paralyzed by stinging, as food for their larvae. Mud daubers are solitary wasps about three-fourths of an inch long. Our common mud dauber (*S. caementarium*) is brownish-black with yellow markings. Its nests are about 2 inches long. Organ pipe mud daubers (*Tropoxylon* spp.) are black and construct nests that can be a foot long and resemble the pipes of a pipe organ. The blue mud dauber (*C. californicum*) is a shiny, dark blue wasp that lays its eggs in the nests of other mud daubers.

Cicada Killer (*Sphecius speciosus*)



Up to 1.5 inches long, this is the largest wasp in the Midwest. Cicada killers are mostly black with yellow markings on the abdomen. This solitary species nests in small burrows. The female searches trees for a cicada, stings it and tucks the paralyzed cicada under its body. The wasp either drags the cicada to its burrow, or launches itself from a tree and glides back to the burrow. Inside it lays an egg on the cicada, then covers the burrow with soil. The stingless male guards the nest. Larvae consume the paralyzed cicada and emerge as adult wasps the following spring.

MANAGING BEES and WASPS

The most important element of wasp and bee control is to *destroy the nest*. Aerosol “wasp and hornet” sprays can be used to knock down bees/wasps around the nest. Small amounts of pesticides (dust and wettable powder formulations work well) applied into the nests of carpenter bees and cicada killers provide good control. Nests of mud daubers also can be treated this way or by simply scraping them off structures. To prevent reinfestation, finishes (paint, etc.) can be applied to unfinished wood to discourage carpenter bees.

In some cases, attempting to destroy a nest becomes a greater health risk than simply tolerating and avoiding it. But nests, especially those of social species, should be destroyed if they are close enough to humans to pose a stinging threat. The nests of honey bees, bumble bees, yellowjackets and hornets should always be approached with caution, preferably at night when most of the workers are present but reluctant to fly. Try not to

carry a light, as wasps and bees may fly toward it. Instead, set the light aside or cover it with red cellophane (insects cannot see red light). If there is direct access to the nest, a fast-acting dust or wettable powder formulation can be applied. If possible, inject the material into the nest. If you must approach these nests during daytime, a quick knockdown aerosol can be used to keep the bees/wasps at bay, while you treat the nest as above. Heavy clothing or a “bee suit” can be worn for added protection.

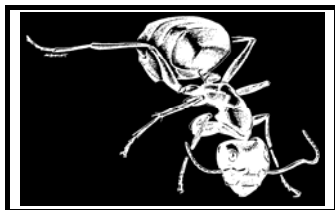
Sometimes, yellowjacket and honey bee nests occur in voids such as vents, attics, crawlspaces or hollow walls. Destroying nests in these locations can be difficult, often requiring the services of pest management professionals. Honey bee nests contain honey that must be removed after the bees are eliminated because it will rot and attract secondary pests. Also, be mindful that nests may be located several feet away from the point at which the bees/wasps are entering the structure. Simply applying pesticides into the entrance holes may not be sufficient. It may be necessary to drill into the structure to enable injection of pesticides directly into the nest. Entrance holes should never be plugged, even after treatment, because the bees/wasps will look for other ways to get out of the nest and have been known to chew their way into living quarters, endangering persons inside. Also, use extreme caution when performing bee/wasp control from a ladder.

Another special case occurs when large numbers of yellowjackets forage in public areas such as parks, schools and zoos. Attracted to human food, especially meats and sweet liquids, wherever it is being prepared, eaten or discarded, yellowjackets pose an increased threat to humans. Control is often difficult. When located in wooded areas, the nests can be difficult if not impossible to find and treat. Yellowjacket baits and traps can kill large numbers, but there can be a lot more where they came from and the problem may continue. Other types of pesticide applications for control of yellowjackets in outdoor recreation areas are rarely effective. Consequently, management of yellowjackets should focus on prevention, such as keeping food enclosed. Tight-fitting lids should be kept on outdoor trash containers and they should be moved away from people. In the end, not eating in infested outdoor areas may be the only sure way to avoid being stung.

NOTE: When pesticides are used, it is the applicator’s legal responsibility to read and follow directions on the product label. Not following label directions, even if they conflict with information provided herein, is a violation of federal law.

For more information, contact the Illinois Department of Public Health, Division of Environmental Health, 525 W. Jefferson St., Springfield, IL 62761, 217-782-5830, TTY (hearing-impaired use only) 800-547-0466.

Ants



It is important to note that of the ants found indoors, only a few species are responsible for the majority of infestations. Identification of the ant helps the technician identify possible sites of the infestation. However, baits can be placed in infested areas while the technician is having the ants identified.

If ants are found in a building, an important first step is to determine whether the ants are from a colony located *inside* or *outside* the structure.

Indications that a colony is inside are when:

- ant workers are consistently found inside over a long uninterrupted period
- nest building is observed inside (Look for wood shavings of carpenter ants, "dumping" of materials by ants, etc.)
- the colony is located in the upper floor of a building, or
- inside swarming is observed.

Indications that a colony is outside are when:

- ants inside can be "trailed" outside
- ants outside can be seen coming inside
- nesting sites outside are near the structure with an inside infestation - look for mounds next to the foundation, or trees with large carpenter ant colonies touching an infested portion of the building or
- ants nest under slabs or swarm inside, but workers do not forage inside.

Whether the colony is inside or outdoors, ants that are known to tend aphids for the sweet liquid ("honeydew") that they produce often seek food inside before this food is available outdoors. After populations of aphids and similar insects increase (in late spring), ants may disappear. They may return in dry weather seeking moisture, but often will not be seen until the next spring. When pest control efforts occur during this period, it is often difficult to tell whether the pest management methods are effective or whether the ants left the building because of other food sources.

Control and Management

Inspection

- Get all information possible by talking to the staff.
- Observe ant worker movement and plot on a diagram if need be. Try to target "hot spots" of the infestation.
- Use traps baited with a grease and a sugar or syrup or other ingredients like peanut butter and cookie crumbs.

Inside - Inspect holes and cracks where workers enter, old or new moisture stains, food accumulations (such as bird seed or food for classroom pets), activity near appliances (dishwasher and washing machines), near showers, in drawers, adjacent rooms or rooms above and below activity.

Outside - Inspect for workers behind vines, shrubs, other plants near the building, expansion joints, slabs, patio blocks, bricks, boards, plant pots, under and inside wooden columns and pillars, outside door and window frames, window wells, where telephone wires and air-conditioning refrigerant pipes enter building walls, trees that harbor colonies and provide access to buildings by overhanging limbs that touch, water meters and storm drain inspection manholes. Outside of ground-level rooms, inspect plants for aphids being tended by ants.

Habitat and Harborage Reduction

- Caulk where pipes enter walls and seal masonry cracks. Check utility lines, air conditioning, refrigerant pipes, phone lines, etc.
- Tighten door and window frames.
- Repair water leaks.
- Trim vegetation so it does not touch the building.
- Remove items stacked close to buildings such as boards, stones, etc. that encourage ant nests; screen openings in hollow pillars, columns and ventilators

Pesticide Application

- Whenever possible, baits should be used to control ant colonies. Use baits with slow-acting stomach poisons or with insect growth regulators. Baits are excellent in sensitive areas, such as computer rooms. When using baits always remember that students will not leave baits alone if they know where they are located. *Do not spray or dust around baits - ants and other insects can detect tiny amounts of repellent chemicals.* Never store baits or bait

- materials where they can be contaminated with any other odors, especially fumes of pesticides.
- If the nest is located indoors, use the “crack and crevice” treatment method; use dust in wall voids or canned pressurized liquid pesticides fitted with a tube for crack and crevice application. (Tubing can be obtained in long lengths and can be threaded through construction elements to treat areas distant from the pressurized can.)
- Apply wettable powder or microencapsulated spray formulations where pesticides may be absorbed into porous surfaces.
- Drill holes where practical into areas such as false floors in sink cabinets, window frames, wall panel grooves and other voids to deliver the pesticide where it is needed.
- Outdoors, use bait stations designed for outdoor use or insecticide granules labeled for control of ants outside.

Follow-up

Reinspect the facility or contact staff with troublesome ant control problems within one week to 10 days depending on the control strategies. If using insect growth regulators (IGRs), remember that IGRs take longer than dusts to show results. Remember, pesticide treatments can repel ants and make them active in other areas. Colonies with multiple queens may break up into several colonies.

Black Carpenter Ant

The large, black workers range in size from one-fourth of an inch to almost one-half of an inch. (Carpenter ants are usually entirely black, but some carpenter ants may be reddish-black.) Outside workers can be confused with field ants, which do not enter structures. Workers will search for food 30 feet or more from the colony.

The colony may be found in wood (such as a fallen log, tree hole, stump or a structure wall). When carpenter ant workers dig nest tunnels, they chew out small pieces of wood. Unlike termites, they do not eat the wood; they drop it out of the nest area or pile it in one place. This pile of carpenter ant shavings, called sawdust, is very soft and is made up of pieces like a fine chisel would make. (Gritty construction sawdust in attics or on sills can be left over from construction or repairs and may be mistaken for carpenter ant shavings.) Carpenter ants do not put mud into their tunnels like termites; carpenter ant tunnels have very smooth sides. A nest or colony might harbor several thousand ants. Large colonies of carpenter ants can cause structural damage, but the colony more likely will be found partially in structural wood and partially in void spaces (such as between roof boards, between studs under windows or between subflooring and shower bases).

Black carpenter ant workers forage for sweet foods (such as honeydew from aphids and juices from ripe fruit) and insects. Indoors, they like sweets, meats, fruit juices and moist kitchen refuse.

Control and Management

Inspection

A thorough inspection is critical to successful control of carpenter ants. It is important to discover whether carpenter ants are nesting inside or outside. If ants are nesting inside:

- their presence usually indicates a moisture problem in the building and
- they have excavated tunnels (galleries) for harborage in structural wood.

Carpenter ants are often found near a roof leak or other damp wood. In many cases, Carpenter ants make their nests in wood that has been wet and infested by a brown rot fungus. Dark fungus stains on the wood are an indication of the presence of such moisture. Moisture in wood can be caused by

- improper attachment of wooden additions, dormers and hollow wooden columns that absorb moisture
- porch floors, door sills, down spouts or areas where water collects or drains toward the building
- regular gutter overflow pouring rainwater down the side of the building as well as back onto roof boards and soffits, etc.
- leaking roof valleys
- improper flashing, especially around chimneys, vents and skylights
- improper roofing or holes in the roof
- window sills directly exposed to rain, or
- lack of ventilation in any area where moisture accumulates, such as around any leaking plumbing or drains (especially shower drains), unvented attics and crawl spaces, or unvented dishwashers, washing machines, ice machines, etc.

The many nesting sites, foraging entrances and food and moisture sources offer clues for inspection and location of the nest. The area where the majority of ant activity is seen may identify a nest site if entry from the outside can be ruled out. Carpenter ants are more active at night, so inspecting the area with the aid of a flashlight may be helpful.

Habitat and Harborage Reduction

- Where nests are located inside, remove and replace infested structural wood.
- Repair or seal areas where moisture dampens wood.
- Wherever possible, caulk and screen area where ants can enter the building.
- Ventilate indoor spaces where moisture accumulates, grade soil so water drains away from the building where necessary and repair roofing, guttering etc.
- Trim trees where branches touch a structure or overhang roofs.

Pesticide Application

- Eliminating colonies and nesting sites is a primary way to eliminate carpenter ant infestation.
- Place baits in areas where foraging ants can discover them. *Carpenter ants are more difficult to control with baits than other species.* Place baits in areas inaccessible to students.
- Remember to use enough bait stations to control the colony.
- Use pesticidal dust or pressurized canned aerosols when nests are found in wall voids. Sprays are less effective.
- Avoid using flushing agents because hundreds of ants may remain unaffected and can relocate the colony in a matter of hours or less to trunks, storage boxes, furniture drawers and other voids.
- Aphids or other honeydew producing insects should be treated with pesticides, such as oils or soaps, that will not eliminate beneficial predators and parasites.
- If a tree with rotted areas is present, one should contact a professional who can determine if it should be removed.

Follow-up

Carpenter ant infestations often cannot be controlled in one visit. Thorough inspection is needed to make management effective. Monthly inspections also assure that necessary repairs have been made.

Pavement Ant

The Pavement ant is brown or black and about one-eighth of an inch long. Pavement ants nest outside under rocks, at the edge of pavement, door stoops and patios. They commonly move their colonies inside between the foundation and sill plate. Outside, pavement ants tend honeydew-producing insects and feed on other insects and seeds.

Pavement ants store debris in certain areas of the colony or nest. When this area is needed to enlarge the nest, workers remove materials such as sand, seed coats, dead insect parts and sawdust from the building construction and dump them outside the colony. Colonies located on foundation walls drop debris over the side in a pile on the basement floor.

Control and Management

Inspection

- Inspect along the sill plate in the basement and around heat ducts and baseboards in areas where ant workers are active.
- Look for foraging in the kitchen; such activity may indicate a nest in the basement below or just outside.
- Outside, look for tiny mounds next to the building near windows and doors or nest openings under stones.

Habitat and Harborage Reduction

- If ants are a chronic problem in the building, remove stones that shelter ant colonies.
- Improve indoor sanitation, including the elimination of moist garbage in dry weather.
- Caulk observed ant entrance points.

Pesticide Application

Inside:

- Place baits in areas where foraging ants can discover them. *Always* place baits in areas that are inaccessible to students.
- If baits do not eliminate the colony, apply dusts or sprays in cracks and crevices of baseboard molding where activity is noticed. *Continue to search for the nest.*
- Treat cracks around kitchen sinks and cabinets.
- Treat cracks along foundation walls, under sill plates and cracks near heat ducts.
- Be careful not to contaminate heat or air-conditioning ducts.
- Treat cracks in slab foundations as well as the base of outside door jambs.

Outside:

- If baits applied inside fail to control the colony, treat nests.
- Treat cracks and entry points.

Follow-up

Follow-up is usually not needed, but where control is unsuccessful, an intense inspection is required.

Odorous House Ant

The odorous house ant is brownish-gray in color and around one-eighth of an inch long. The body of the odorous house ant is relatively soft and can be easily crushed. When this occurs, a foul odor is released. Outdoor nests are shallow and are located under stones and boards. Inside, a colony can nest in many types of cavities. The workers trail each other. Outside they actively tend honeydew-producing insects and take flower nectar. Inside, workers seem to prefer sweets.

Control and Management

Inspection

- Begin by investigating locations where ant activity is observed.
- Always inspect outside close to the location of inside activity. Look under stones and boards for colony openings and activity.
- Do not use sprays with pyrethrins (which irritate but may not kill), causing the colony to split itself and relocate, as with the pharaoh ant.

Habitat and Harborage Reduction

- Remove stones and boards harboring odorous house ant colonies.

Pesticide Application

- Bait stations with a long active period are effective, but should not be contaminated by sprays or dusts that may be repellent. Place an adequate number in or near harborage. *Always* place baits in areas inaccessible to students.
- If baits do not eliminate the colony, use dusts or residual sprays applied in cracks and crevices in the area of entering worker trails. Ant colonies should be sought outside as well as inside, unless its location inside prevents its reaching the outside.
- Control populations of honeydew-producing insects on plants near the building. Use pesticides registered for insects on plants. To maintain predator and parasites of these plant insects, use low-toxicity pesticides such as insecticide soaps and oils.

Follow-up

Impress the staff with the need to control honeydew insects on plants and to eliminate nest harborage near structures.

Pharaoh Ant

The pharaoh ant is a tiny ant, dull-yellowish to light-orange in color and not much more than 1/16 inch long. Ants prefer warmer buildings and warm areas (80 F to 85 ° F.) in buildings for nesting. These ants are active year-round in large buildings. Nesting sites include wall voids, cracks in woodwork, stacks of paper, envelopes, harborage in desk drawers, etc. It is common to find many colonies in one building and, perhaps, several in one room. Colonies have multiple queens and increase by dividing: one portion of the colony going with each queen. No swarms have been recorded, so new infestations are apparently transferred by moving infested objects.

Pharaoh ants trail each other and are attracted to grease, meats, insects and sweets. These harborage and food preferences bring it to coffee areas, kitchens, paper and other supply storage, office equipment, medical storage, laboratory benches and many kinds of biological cultures.

Control and Management

Inspection

- Inspect where sanitation needs improvement.
- Ants are found where food is available, particularly sugars: where coffee is made, lunches eaten and in desks where snacks are stored.

- Inspect storage room spills, laboratory media, unwashed cups, areas near vending machines and kitchens.
- Pharaoh ants are easily baited. Use small, nontoxic disposable peanut butter baited cups to demonstrate where ants are seen (such as desk drawers and opened food boxes).
- Look at sources of water. These ants are attracted to dripping faucets; they drown in standing water or other liquid held overnight. Floating ants are frequently the first sign that these ants are present.

Habitat and Harborage Reduction

- Reduce stored supplies.
- Clean, rearrange and rotate supplies to expose nests.
- Clean food areas before the end of the work day and empty water containers that stand overnight.

Pesticide Application

- *Spraying can cause pharaoh ant colonies to break up into several smaller colonies and spread the infestation; baits are the most effective way to control these ants.* Several baits are available for pharaoh ant control. Place a bait station where every positive monitoring trap was located. *Always* place baits in areas that are inaccessible to students.
- Set commercial bait stations. One that uses a stomach poison well accepted by ants and a grain-based bait that includes ground insects are specifically manufactured for pharaoh ant control.
- Use a commercial bait of mint apple jelly and boric acid. Inject small dabs of the material into cracks and crevices where ants are observed.

Follow-up

Reinspect by monitoring bait cups. When sprays or dusts are used, or when colonies are disturbed by inspection or habitat alteration, colonies may move or split.

Bats and Bat Exclusion

Bats are among the most unique and fascinating of all animals. No other mammals can fly. Bats use echolocation to find flying insects at night much like sonar helps ships locate objects under water. Bats also have good night vision. They are not blind, as myth would have it.



While Midwestern bats feed exclusively on insects, consuming many pest species, they prefer to expend the least amount of energy to obtain the most food. Thus, bats typically capture larger insects, such as night-flying moths, and do not live up to their reputation for controlling mosquitoes.

Correctly considered beneficial animals, in certain situations, bats, however, pose a threat to human health.

Histoplasmosis is a disease associated with bat guano and bird droppings. When droppings accumulate for years, a fungus (*Histoplasma capsulatum*) can grow and produce spores that may cause histoplasmosis when inhaled. Where bat or bird droppings accumulate, in an attic for example, care should be taken to avoid contracting this disease. Clean up generally involves wetting the droppings before removal and wearing personal protective equipment, including a HEPA-equipped respirator or self-contained breathing apparatus (SCBA). Removal of large amounts of guano or droppings from structures should be left to experienced professionals familiar with proper removal procedures. For more information on histoplasmosis and clean-up procedures see the following Web sites:

<http://www.idph.state.il.us/health/infect/reportdis/histo.htm>

www.cdc.gov/niosh/tc97146.html

Perhaps the greatest health risk from bats is rabies. In Illinois, rabies is found in bats more than any other wildlife species. Yet it should be noted that typically less than 5 percent of bats *tested* for rabies are found to be rabid. In the bat population as a whole, the percentage of rabid bats is much smaller – less than 1 percent.

Rabies is a viral disease causing encephalitis (brain inflammation) in humans and animals. Humans can become infected when bitten by a rabid bat. Transmission also can occur when an infected bat's saliva (but not blood, urine or feces unless these are mixed with spinal fluid – as can happen when a bat is beaten or crushed) comes in contact with a person's eye,

nose, mouth, a scratch or wound. Contact with aerosolized bat saliva, especially where large numbers of bats are roosting, also can transmit rabies to humans, although this type of transmission is quite rare. For further information on rabies, contact your local health department or visit:

www.idph.state.il.us/health/infect/reportdis/rabies.htm

Of less importance are parasites associated with bats. Fleas, lice, mites and bat bugs can infest bats, birds and other animals. Some may transmit diseases to humans. If the host animals are killed or leave their nests or roosts, the parasites look for alternate hosts and may wander into the living spaces of structures. They may bite people and domestic animals, but most parasites cannot live long away from their preferred hosts. Control can often be accomplished by simply vacuuming the parasites and carefully discarding the vacuumed material. Sometimes, bat parasites such as bat bugs may have to be eliminated by application of pesticides labeled for this purpose.

HANDLING BAT EMERGENCIES

Bats flying outside at night pose little risk. However, bats flying outside in daytime, flopping around on the ground, landing on or near someone, or roosting in accessible locations should be avoided, as should any bat found indoors. Bats typically enter structures in spring. Buildings, where bats may be roosting, should be inspected at this time. During daylight hours, inspect attics, rafters, walls, chimneys, porches and cellars for roosting bats, bat guano, crystallized urine or musty ammonia odor. Also inspect for exterior openings that will allow bats to enter the structure.

If a bat is found indoors, the structure should be thoroughly inspected for the presence of roosting bats. Structure-infesting bats pose a health risk and must be prevented from entering occupied rooms. When bats are found roosting inside a structure, the building should be inspected for routes by which the bats might gain access to the living quarters. Such passageways might include ductwork, false ceilings, attic doors, chimney, holes in walls, and gaps around pipes and wiring. Every effort should be made to seal openings large enough for bats to squeeze through (see exclusion procedures below).

Rabid bats may exhibit no obvious abnormalities, so all contact with bats should be avoided. Where there is a likelihood of encountering bats, such as at children's outdoor camps, people should be instructed not to touch bats. Similarly, *people should NOT be allowed to occupy a room in which bats are found*, until it is certain that no bats remain in the room and that the room has been sealed to prevent their re-entry.

Any bat suspected of having physical contact with a person should be captured and submitted for rabies testing. Bats can be captured using gloves, by netting, or by covering them with a box or can, then sliding a piece of cardboard or other stiff material under the container to trap the bat inside. It is advisable to wear heavy leather gloves to avoid bites and scratches. Your local health department, animal control office or veterinarian can assist you with submitting the bat to a laboratory for rabies testing. If the bat tests negative, rabies treatment can be avoided.

If a bat bites or has physical contact with a person, the wound or contact area should be washed immediately with soap and water. Unfortunately, bat bites and scratches are small

and may go unnoticed. In certain situations it may be impossible to know if contact with a bat has occurred. These situations occur when a bat is found in the same room with a sleeping person, infant or young child, persons with diminished sensory or mental capacity, or persons under the influence of alcohol or drugs. *Whenever a bat has physical contact with a person, or is suspected of coming in contact with a person, the bat should be captured, if possible, and the incident should be reported immediately to a physician and local health authority to assess the need for rabies treatment.*

The incubation period (time from exposure to appearance of symptoms) varies from days to years, but is usually one to three months. The initial symptoms of rabies in humans may be flu-like and progress to anxiety, confusion, agitation, insomnia, hallucinations, delirium and other abnormal behavior. To be effective, treatment should begin as soon as possible after exposure. Once symptoms appear, rabies is almost always fatal, although a recent experimental treatment appears promising.

BAT EXCLUSION

Like most birds and other wildlife, all 12 species of bats inhabiting Illinois are protected by law. Species most commonly found in structures include the little brown bat (*Myotis lucifugus*) and big brown bat (*Eptesicus fuscus*). These species have a wingspan of less than 12 inches and weigh one-half ounce or less. Four other species are classified as endangered species. It is unlawful to harm or kill a bat. Only under special circumstances are permits to kill bats granted by the Illinois Department of Natural Resources.



Big Brown Bat

Popular “home remedies” for eliminating bats are temporary, ineffective, and/or illegal. No pesticides are registered for bat control. Moth crystals (naphthalene) can be temporarily effective, but the typical attic requires 3 to 5 pounds to be used and changed every few weeks. Other types of repellents may not be registered for use as bat repellents and, therefore, cannot legally be used to harm or repel bats. Bright lights, as well as fans and air-conditioners (used to cool down the roosting area), may be effective but temporary controls. In addition, ultrasonic and electromagnetic devices do not effectively repel bats, rodents or insect pests, despite advertising claims.

Exclusion remains the best way to prevent and control bats in a structure. Bats can be excluded by sealing exterior openings larger than one-half-inch, using caulk, expandable foam, plywood, mortar, metal flashing, steel wool or one-fourth-inch mesh screen or netting. Make sure doors, windows and vents have screens and are securely framed; chimneys are capped; and gaps around utility lines are plugged.

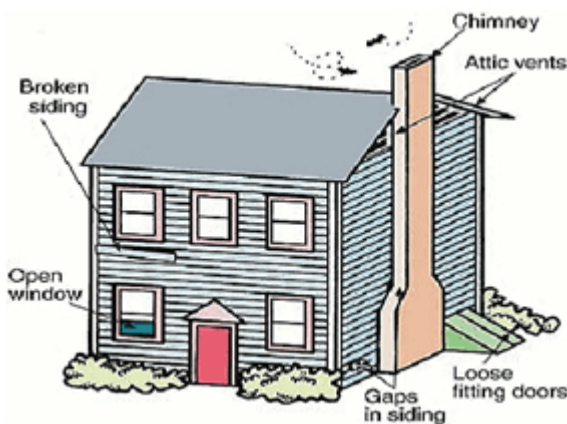
In May and June, one or two “pups” are born to pregnant bats in Illinois. By the end of July, the young bats have taken wing, though they will continue to nurse until able to feed themselves exclusively on insects. Most bats, especially those in northern Illinois, leave their roosting places in September and early October to migrate south, where they will overwinter in caves, rocky ledges and cliffs, and occasionally accessible walls and attics. Therefore, bat entry points in structures are best sealed during the months of September through April,

when no bats *are present*. Proper exclusion at this time will prevent bats from entering the structure in spring. Only at certain times can exclusion be performed while bats are roosting within the structure. This involves sealing openings after the young bats are old enough to fly (August or later in Illinois).



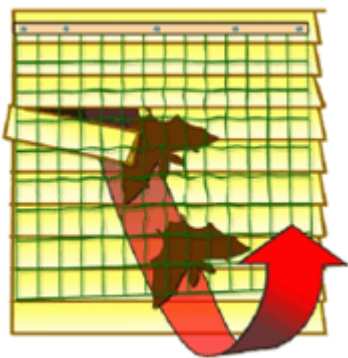
Some skill is required to identify all entry points and to apply exclusion materials to openings. Openings through which bats are entering and exiting a structure may be identified from inside the structure by entering the roosting area, an attic for example, on a sunny day when light can be seen through the openings. Another method is to turn on a bright light in the attic at night and look for light escaping through the openings on the building's exterior. Dark stains may be seen around and beneath openings used by bats. These result from bat guano and from "rub marks" where oils and dirt accumulate as bats pass through the openings. Yet another method of finding bat

entry points is to watch for bats leaving the structure at dusk to make their evening feeding flights.



When all openings are identified, a "one-way valve" can be applied to each opening. One-way devices are those that allow bats to leave the structure, and prevent them from reentering. These can be as simple as a sheet of plastic or plastic bag attached above the opening and allowed to hang flush against the building's exterior. The plastic should be wider than the opening and long enough to hang at least one foot below it. The sides (but not the bottom) of the plastic can be attached to the building by staples or duct tape, to prevent wind from lifting the flap. At dusk,

the bats will find their way out beneath the plastic flap, but will not be able to lift the flap to reenter the structure.



Similar devices can be constructed from screening or polypropylene netting of one-fourth-inch mesh, or a short length of PVC pipe can be positioned in the opening. A tube sock should be fitted around the outside end of the pipe and allowed to hang down with the toe cut out. Bats will exit the pipe and crawl through the sock to get out but will not be able to reenter through the collapsed opening in the toe of the sock. Once all resident bats have exited the structure, the one-way devices can be removed and the openings immediately sealed as described above. Again, this type of exclusion should NOT be performed when young bats, incapable of flying, are

present (typically May-July).

Although exclusion is the best way to rid structures of bats, knowledge and timing are critical for effective "bat proofing." Especially in older construction, there may be several

bat entry points that can be difficult to discover. If all openings are not found and sealed, bat problems will continue. Installing sealing materials and one-way devices also can be difficult because bat entry points are often several feet off the ground, requiring the use of ladders (note that falling is a much more common accident than being bitten by a rabid bat). For these reasons, bat exclusion may be best left to professionals. A list of wildlife control specialists, who may be familiar with bat exclusion procedures, can be obtained from the Illinois Department of Natural Resources (217-782-6384).

Illustrations courtesy of Penn State University and the University of Missouri.

For more information, contact the Illinois Department of Public Health, Division of Environmental Health, 525 W. Jefferson St., Springfield, IL 62761, 217-782-5830, TTY (hearing-impaired use only) 800-547-0466.