



Roof Rat Control around Homes and Other Structures

The roof rat, or black rat (*Rattus rattus*) is an Old World rodent species not native to North America that was identified in a Phoenix neighborhood in 2001. It poses both a health and safety hazard. The roof rat is implicated in the transmission of a number of diseases to humans, including murine typhus, leptospirosis, salmonellosis, rat-bite fever, and plague. It is also capable of transmitting a number of diseases to domestic animals and is suspected in the transference of ectoparasites from one place to another. 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. The rats will feed on the fruit and vegetative portions of many landscape and garden plants including the bark of trees. Their feeding and gnawing may completely girdle young trees. Roof rats will often eat the pulp from oranges while the fruit is still hanging on the tree, leaving only the empty rind.

The roof rat is one of three rodent species that were brought to this continent aboard ships in the 17th and 18th centuries. The other two are the Norway or sewer rat (*Rattus norvegicus*) and the common house mouse (*Mus musculus*). Norway rats and house mice are generally found throughout the continental U.S. wherever humans live. House mice are common in Arizona, and there have been unconfirmed sightings of the Norway rat in Phoenix. Until recently, roof rats ranged mainly along the lower half of the Eastern U.S. coast, throughout the Gulf states, and along the western portions of the Pacific coastal states; they had not been a problem in Arizona. Yet the roof rats identified in east Phoenix have found an ideal habitat among old growth citrus trees, palm trees and other mature landscaping, and abundant irrigation canals that may provide a suitable environment for these rats for some time. The number of roof rats identified and the increased area of infestation indicate that this rat is established in the affected area, at least temporarily. The rats were likely introduced into the area through some sort of freight—possibly a shipment of fruit or other food, or livestock feed or equipment.

Description

The roof rat is somewhat similar to the Norway rat and to native pack rats (*Neotoma* spp.) and cotton rats (*Sigmodon* spp.) in appearance. A quick or casual observation of any one of these rats can easily result in misidentification. However, the ecology and behavior of roof rats differ significantly from that of Norway rats and native rats. These ecological and behavioral differences are important to consider when implementing control methods.



Figure 1. Roof rat.

The proper identification of the species being controlled is a critical factor in the success or failure of the control methods used.

Probably the most easily recognized characteristic that differentiates the roof rat from native rats is the tail (*Figure 1*). Roof rat tails are hairless, scaly, and longer than the combined length of their head and body, whereas the tails of pack rats are hairy, have less apparent scales and are shorter than their head and body. Cotton rat tails are scaly, sparsely haired, and considerably shorter than the head and body. Norway rats are larger than roof rats and our native rats and have smaller eyes and ears. See Table 1 for some characteristics that can be used to identify these different rats.

Roof rat droppings are black, banana-shaped, and are about 1/4–1/2-inch long. However, identifying rat species from droppings alone is difficult and often misleading.

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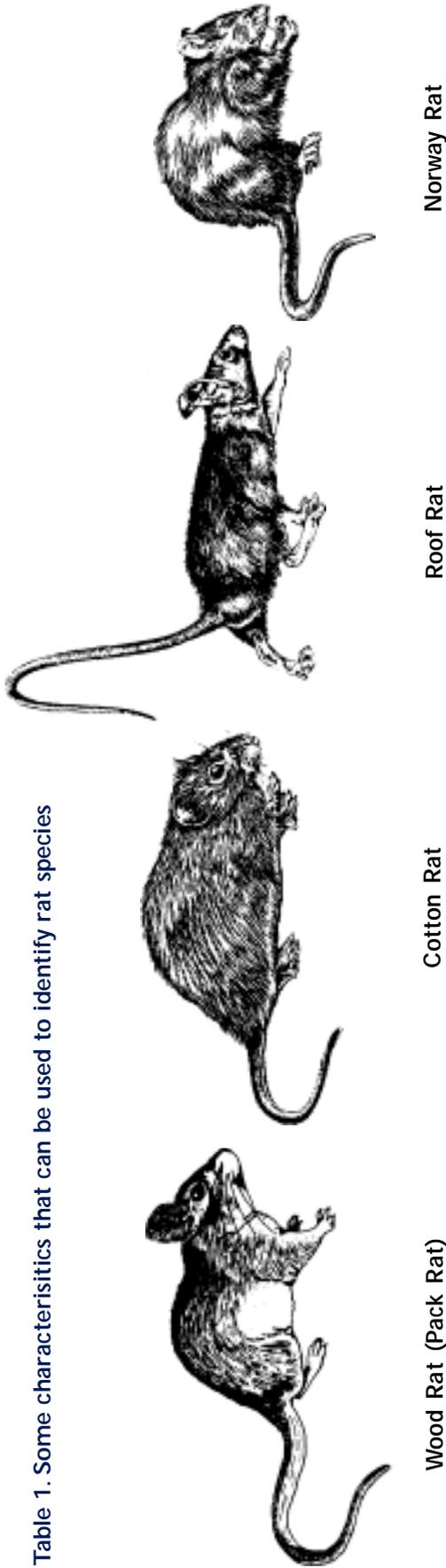
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THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
TUCSON, ARIZONA 85721

LAWRENCE M. SULLIVAN
Extension Wildlife Damage Management Specialist

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Table 1. Some characteristics that can be used to identify rat species



Wood Rat (Pack Rat)

Cotton Rat

Roof Rat

Norway Rat

| | | | | |
|-----------------------|--|--|---|--|
| SIZE | Head and body 6-8 inches | Head and body 5-7 inches | Head and body 7-8 inches | Head and body 8-10Inches |
| TAIL | Hairy. Bicolored, lighter below. About as long as head and body combined, 5-8 inches. | Scaly, sparsely haired. Bicolored, lighter below. Shorter than head and body combined, 4-5 inches | Scaly. Dark color. Longer than head and body combined, 8-10 inches. | Scaly, nearly hairless. Darker above lighter below. Shorter than head and body combined,, 4-8 inches. |
| COLOR | Gray to grayish-brown with lighter feet and underbelly | Coarse, blackish to grayish fur. Black guard hairs cause a grizzled appearance. | Several color phases. Tends to be blackish with a lighter underbelly. | Brownish-gray above, grayish below |
| EARS | Large, hairy | Large, but nearly concealed by fur. | Large, nearly naked | Small, covered with short hairs |
| SNOOUT | Blunt | Blunt with high "Roman" nose. | Pointed | Blunt |
| DROPPINGS | Blunt, 1/2 - 3/4 inch long, 3/16 - 1/4 inch dia. | Plae greenish or yellow, 3/8 inch long, 3/16 inch dia. | Pointed, banana shaped, 1/4 - 1/2 inch long, 3/16 inch dia. | Blunt ends, 3/4-1 inch long 1/4-3/8 inch dia. |
| MAMMARY GLANDS | 2 pair | 2 pair | 5 pair | 6 pair |

Ecology & Behavior of Roof Rats

Like Norway rats and native rats, roof rats are nocturnal (active at night). The most significant behavioral difference between the species, which has implications for control methods, is the aerial nature of roof rats. Roof rats prefer to forage for food above ground in elevated areas indoors and outdoors. They are agile climbers and travel through trees and along vines, wires, rafters, and rooftops. They often use trees and utility lines to reach food and to enter buildings, but can also be found foraging in dense ground cover. Like Norway rats, roof rats can swim and may use sewer systems to disperse to new areas.

Roof rats may nest in your neighbor's yard but find food in your yard. Outdoors, they can travel several hundred feet in a single night to find their survival resources. They prefer to nest in secluded areas above ground in such places as attics, soffits, overhead garage storage, in the vine cover of fences or buildings, and in wood piles or other stored materials where harborage can be found. They favor dense non-deciduous trees or trees with hollow cavities and the crowns of palm trees, especially when old fronds are not removed. Roof rats sometime 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.

Roof rats have a high reproductive potential and may breed year-round in warmer areas. Females produce 5 to 8 pups per litter with a possible 4 to 5 litters per year.

Food Habits

Roof rats are omnivores (plant- and animal-eating). They are very fond of fruit, especially oranges (*Figure 2*). In addition to citrus they will feed on fruit-producing ornamentals, dates, stored food, birdseed in feeders, insects, snails, and garbage. These rats will also feed on stored food and livestock feed and will contaminate much more than they actually eat. They obtain much of their water requirement from their food, but unless their diet includes a sufficient amount of succulent plant material,



Figure 2. Empty orange rinds remaining from roof rat feeding.

they will require a source of free water such as landscape irrigation.

Roof rats generally begin searching for food shortly after sunset. These rats may cache or hoard considerable amounts of solid food, which they will eat later. These food caches may be located in attics, in dense vegetation such as hedges, or in a variety of other hiding places generally near their nests.

Roof Rat Signs

Roof rat signs include smudge marks on surfaces from oil and dirt rubbing off their fur as they travel (*Figure 3*). Because of their propensity to climb, look for these smudges up high on structures, e.g. between rafters, as opposed to marks along walls near the floor which could be made by other rodent species. Because they are often living overhead, between floors or above false ceilings, there is less tendency to see signs of roof rat tracks, urine, and droppings.



Figure 3. Roof rat smudge marks.

Sounds in the attic are often the first indication of the presence of roof rats in a residence. At night when the house is quiet the rats may be heard scurrying about.

Prevention and Control of Roof Rat Damage

Roof rats are not protected by law and may be controlled by any legal means. Effective methods of roof rat control include exclusion, habitat modification, trapping, and poison bait. These are described below. The use of traps and/or poison baits can effectively provide short-term control of an existing roof rat problem, but using the methods of exclusion and habitat modification described in this publication can provide effective, long-term control by preventing roof rat infestation. Since the control of roof rats often involves some safety risks (the use of ladders, tools, toxic materials, etc.) as well as knowledge of roof rat behavior, the services of a private wildlife or pest control operator may be a viable option to a do-it-yourself approach.

Two control methods *not* recommended are chemical repellents and electronic devices. No chemical repellents are registered for rat control. There is no sound evidence that products sold as general animal repellents are effective in repelling rats. Devices marketed to frighten rodents by producing

high-frequency sounds are not effective, either. Rats become accustomed to these sounds quickly. Predation by domestic cats will have very little effect on roof rat populations.

HABITAT MODIFICATION

Modifying an area to make it less suitable and less attractive to roof rats should be the first step in controlling these rats. *Roof rats are very sensitive to changes in their environment.* Even slight habitat changes or modifications may cause these rats to move or redirect their activity patterns. General sanitation can do much towards reducing any type of rodent infestation by eliminating food sources:

- Secure garbage in proper rodent-proof containers.
- Store materials properly.
- Harvest citrus and other fruit in a timely manner and pick up fallen fruit promptly.
- Remove attractants such as pet foods, bird feeders, and standing water. Since these rats usually require free water, especially during hot, dry weather, any source of water can be a strong attractant.

Eliminate or at least drastically reduce the protective cover that is crucial to these shy rodents:

- Prune shrubs so that the ground below them is clearly visible.
- Mow, trim, or remove ground cover plants that grow over one foot in height.
- Stack firewood, lumber and other materials at least one foot away from walls and fences and at least 18 inches off the ground.
- Prune the crowns of palm trees and remove dead fronds.

Roof rats will easily travel along vines, tree branches, fences, and utility wires. Eliminating these aerial pathways can dramatically reduce roof rat travel:

- Eliminate or severely prune back vines growing on buildings and fences.
- Remove tree limbs that overhang roofs.
- Prune trees so that the branches do not touch fences, overhead wires, or the branches of adjacent trees.
- Prune the skirts of trees so that the branches do not hang down to the ground.

These habitat modifications must be kept in place and maintained constantly to continue to prevent infestations.

EXCLUSION

Roof rats often enter homes where pipes or utility wires enter a building or through garage doors that do not fit tightly, or through pet doors. Because roof rats are excellent climbers and can get through very small openings, excluding them from an area or structure is difficult, but still recommended. Rodent-proofing a home or other building requires *sealing all possible entry points*, especially where pipes or wires enter a building:

- Seal openings 1/2-inch wide or greater to the outside of a structure with concrete mortar, steel or copper wool, or

metal flashing. Pay close attention to possible entry points on the roof and along the roof line.

- Cover attic and foundation vents with 1/4-inch wire mesh or heavy wire screen and check periodically for rust and other damage.
- Use rat guards made from sheet metal 18–24 inches wide to prevent roof rats from climbing trees and walls (*Figure 4*). Rats will not be able to gain any footing and will be unable to climb on the smooth surface of the sheet metal. Form the sheet metal into a cylinder around tree trunks. Because roof rats are capable of jumping a vertical distance of over 3 feet, rat guards should be placed 4 feet above the soil and above adjacent shrubs or other items the rats could use to climb or jump above the metal guard.



Figure 4. Rat guard.

TRAPPING

Trapping is an effective control method for roof rats, and is especially recommended for control indoors. Rats killed with poison baits indoors may retreat to inaccessible locations to die and this can result in difficult-to-remove odor problems. Wooden snap traps and glue board traps can be used.

SNAP TRAPS

Common wooden, rat-size snap traps are effective for roof rats. The snap traps with an expanded, plastic treadle, such as the Victor Professional Rat Trap™, are particularly effective. The treadles on standard rat traps can be extended with hardware cloth or other materials.

- Bait traps with a variety of foods including peanut butter, nutmeats, fruit, or gumdrops. **Roof rats are afraid of new objects in their environment and may avoid traps for some time. Traps should be baited and left unset until the rats are feeding well on the bait.** This is called pre-baiting and in addition to markedly improving trap success, it will help prevent making rats “trap shy.” Rat odors on traps that have been visited by rats or have caught rats will attract other rats.
- After pre-baiting, tie baits to the treadle with fine wire, string, dental floss, or glue them. If traps are put where the rats will intercept them along their normal runways, they may not need to be baited.

- Place traps so that the treadle end is in the runway. For example, when rats travel along a wall or other vertical surface, they will travel right up against the wall, so traps must be positioned with the treadle facing the wall or if placed vertically, with the treadle down. Traps can be nailed to vertical surfaces such as beams or studs and secured to pipes with wires or duct tape.
- Arrange traps along well-traveled paths used by the rats. These include overhead beams, pipes, ledges, and sills. Some traps may be placed on the floor along walls, behind objects, and in dark corners, but most should be placed above floor level such as in attics, suspended ceilings, on top of stacked commodities, and on rafters and pipes.
- Traps located outdoors may be placed in bait stations (see description under *poison baits below*) to protect non-target animals. Some bait stations are tall enough to accommodate rat traps. If rats are entering the attic, traps can be effective if set in bait stations on the roof near where power or telephone lines enter the house. Such stations should be secured so that they won't blow off or be knocked off.
- Since roof rats prefer to travel off the ground, traps can be securely tied to the stringer boards of fences and along the horizontal support pole of chain link fences and to tree branches. Traps can be nailed to wooden fences. To secure traps to the horizontal poles of chain link fence or to pipes or tree branches, put an eye screw on each side of the trap and use heavy rubber bands or wire to hold the trap in place (Figure 5). Traps can also be secured with duct tape.



Figure 5. Snap trap.

Traps set outdoors on trees or fences should be set only from dusk to dawn to avoid accidentally trapping non-target species like squirrels and protected birds. These animals are diurnal (active during the day) while rats are nocturnal (active during the night).

GLUE BOARD TRAPS

Glue board traps can also be used to trap roof rats. Glue boards are available commercially in several sizes and consist

of a plastic base covered with very sticky glue. These traps catch rodents the same way flypaper catches flies. **Do not place glue boards where children, pets, or other non-target animals might contact them.**

- Place glue boards in the same locations as recommended for snap traps. Because of the elevated locations for proper roof rat trap placement, it may be difficult to place glue boards effectively.
- Replace glue boards often; they lose their effectiveness when covered by dust or insects. Effectiveness is also reduced by heat and moisture, therefore, it is recommended that glue boards be used only indoors.
- Glue boards may also be placed inside bait stations to protect non-target species.

POISON BAITS

Poison baits can be a very effective means of controlling roof rats when used alone or in combination with a trapping program. Note again that poisoned rats living in building or home will sometimes retreat to inaccessible areas to die, causing a significant, difficult to remove odor problem and attract insects.

ANTICOAGULANT BAITS

Many commercially available rodenticides (rodent poisons) contain anticoagulants. Anticoagulant baits are slow-acting and may require the target rats to feed on the bait for several days before death occurs. Roof rats are susceptible to all of the various anticoagulant rodent baits. However those baits containing the anticoagulants *bromadiolone* or *brodifacoum* may be faster acting and more effective on roof rats.

Anticoagulant rodent baits are formulated into pellets, in paraffin wax blocks, and in individual, sealed packets (the rats will chew through the packet to consume the bait). These packets are labeled to permit placement of the packets in small areas, in difficult to reach locations, and in bait stations out of the way of children, pets and non-target species.

The paraffin blocks secured in a bait station will be more difficult for the rats to carry off than the pellets, since roof rats have a tendency to move food items and cache them. Many commercially available bait stations contain a metal rod to which paraffin bait blocks can be secured. This method of supplying bait helps prevent the rats from transporting the bait to locations where children or non-target animals might have access to them.

NON-ANTICOAGULANT BAITS

Common non-anticoagulant rodenticides contain zinc phosphide or bromethalin. As opposed to anticoagulant baits which generally require multiple feedings to be lethal, the non-anticoagulant baits will be lethal in a single feeding if a sufficient amount of the bait is consumed. These baits are also available in the sealed, individual packets.

PLACING BAIT

Whenever poison baits are used, all label directions must be explicitly followed. To protect against non-target toxicity, poison baits should be placed in a manner which prevents access to the bait by children, pets, and other non-target species. Where children, pets, or other wildlife may have access, tamper-resistant bait stations are to be used in accordance with label instructions. Bait stations (Figure 6) may be available from local hardware or feed stores and pest control suppliers.



Figure 6. Bait station.

As mentioned previously for snap traps, roof rats are afraid of new objects in their environment. Bait stations may have to be in place for several days before these rats will enter them.

- **Follow label directions.** Rodent bait labels will provide specific directions for the use of that particular bait. The safest and most effective rodent baiting program will result from following these label directions explicitly. Labels will specify how, where and under what conditions the bait can be used.
- Place and secure bait stations in overhead locations as described above for snap trap placement. Ideally, bait stations should be placed outdoors, up high, along fences, in trees or in dense shrubbery. Bait stations can be secured with wires, screwed or bolted to wood supports, wired to stakes or heavy objects, and by a variety of other means dictated by the particular situation. Rats visiting bait stations will leave an odor that will attract other rats.
- Make sure *anticoagulant* baits are available long enough for the rats to consume them, since multiple feedings are generally required before a lethal dose is consumed. Most labels recommend that the baits be available for at least 10 days. Since the most dominant rats will feed on the baits before the subdominant rats, the period of time baits need to be available may extend to 2 weeks or more to be effective.
- Even though *non-anticoagulant* baits can be lethal in a single feeding, because of dominant rats feeding first, these baits

must also be available over an extended time, usually until all signs of feeding on the baits have ceased.

- Regardless of the rodent bait used, bait stations must be checked routinely for freshness and consumption. Replace consumed bait and bait that has become wet or moldy. Spoiled or stale bait will not be consumed by the rats and must be replaced.

Carcass Disposal

To protect human and non-target animal health, pick up and dispose of rodent carcasses soon as they are discovered. DO NOT handle dead rodents with bare hands. Pick up carcasses wearing disposable gloves or by placing a hand inside a plastic bag. The carcass, along with the disposable gloves or plastic bag used to handle the carcass, should be double plastic-bagged and disposed of in secured, outdoor trash containers.

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Figure 1 photo by Jack Kelly Clark, courtesy of University of California Statewide IPM Program.

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Figure 4. from Rex O. Baker

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