

SCHOOLS INTEGRATED PEST MANAGEMENT (IPM) FOR RATS AND MICE

Important Note

According to the Virginia Pesticide Control Act (Section 3.1-249.53), in order to apply ANY pesticide (including Raid®, Round-Up®, and other over-the-counter pesticides) in public areas of ANY educational institution, the applicator must first be certified by the Virginia Department of Agriculture and Consumer Services. In other words, it is illegal for uncertified teachers, staff, administrators, or contractors to apply pesticides on school grounds.

INTRODUCTION

Rats and mice can be a major pest problem in schools. They damage food, books, documents, and clothing. Damage to a structure occurs when rats and mice gnaw on structural components, including wiring, wood, and plastics. The gnawing on wire insulation can result in electrical shorts and fires. Rodents have also been implicated in the spread of dangerous human diseases. In short, structural risks, health risks, and a general lowering of environmental quality accompany any rodent infestation.

BIOLOGY AND IDENTIFICATION

There are several important rodent pest species. Correct identification is imperative. Each species behaves differently and therefore requires different management techniques. Table 1 and Figure 1 will help you to identify a pest rodent. Use the descriptions below to learn more about rodent habits.

Rats

There are two main pest rat species in Virginia, *Rattus rattus*, the roof rat, and *Rattus norvegicus*, the Norway rat. The roof rat is also known as the ship, black, or Alexandrine rat. The Norway rat is also known as the brown, wharf, house, gray, or sewer rat. Use Figure 1 to help you identify these rats. The following points about the behavior and biology of rats are helpful to understand when dealing with them:

1. Norway rats will generally build their nests in subterranean or ground level

locations. Roof rats, in keeping with their name, prefer to nest in elevated areas, including trees and storm drains.

2. Rats require water on a daily basis.
3. Rats can travel several hundred feet from the nest to forage for food and water.
4. Rats feed on a wide variety of food sources including trash, fruits, vegetables, meats, insects, grains, pet food, tree bark, and plant material.
5. Some rats can pass through openings as small as $\frac{3}{4}$ inch in diameter.
6. Rats can jump vertically at least 24 inches and horizontally at least four feet.
7. Rats can dive and swim underwater for as long as 30 seconds. Therefore, they can crawl up to and swim through the water trap of toilets and drains.
8. Rats chew on everything, including wood, metal, glass, plastic, and stone, in order to help keep their large front teeth sharp and shortened.
9. Rats are very wary of new items in their environment.

Mice

There is one main species of pest mouse, the house mouse, *Mus musculus*. Other types of mice, such as field mice and voles, can invade a structure but are only occasional invaders and prefer living outdoors. Often, people confuse immature rats with house mice. Use Figure 1 to determine if your pest problem is a house mouse or an immature rat. The following points are important to remember when dealing with mice:

1. Mice can get all of their moisture from their food if a ready water source is not available.
2. Mice search their entire home range daily to check for any changes to their environment.
3. The home range of a mouse is usually no more than 33 feet from their nest.
4. Mice may nest within appliances, in wall and floor voids, in false ceilings, behind counters, and within other similarly protected areas. If they are living outdoors, they prefer to nest in thickly vegetated or covered areas, such as in wood piles, rock piles, or leaf litter.
5. Mice can jump upward at least 12 inches from the ground.
6. Mice can fit through any opening $\frac{1}{4}$ inch in diameter.
7. Mice chew on everything, including wood, metal, glass, plastic, and stone, in order to help keep their large front teeth sharp and shortened.
8. Mice are good swimmers but seldom dive below surfaces.
9. Mice are very curious and will explore new items in their environment.

In general, rats and mice share many similar characteristics. Understanding these features is a very important aspect of rodent control. The following list gives some of these basic attributes:

1. Rats and mice usually search for food at night. If you happen to see a rodent during the day, that might mean there is a lack of food or the rodent population is high.
2. Mice and rats can run up almost any vertical surface including cinder blocks, wood, sheet metal, metal pipes, and cables.
3. Rodents prefer to travel along edges, using their whiskers as guides. Examples of edges include along the wall/floor junction, beside the foundation of a structure, or along pipes, utility wires, or rafters. Rodents are very wary of open spaces and will seldom cross uncovered areas.
4. Rats and mice have poor vision but powerful senses of smell, touch, hearing, and taste.
5. Rats and mice have very short generation times and can therefore populate a structure in a short amount of time.

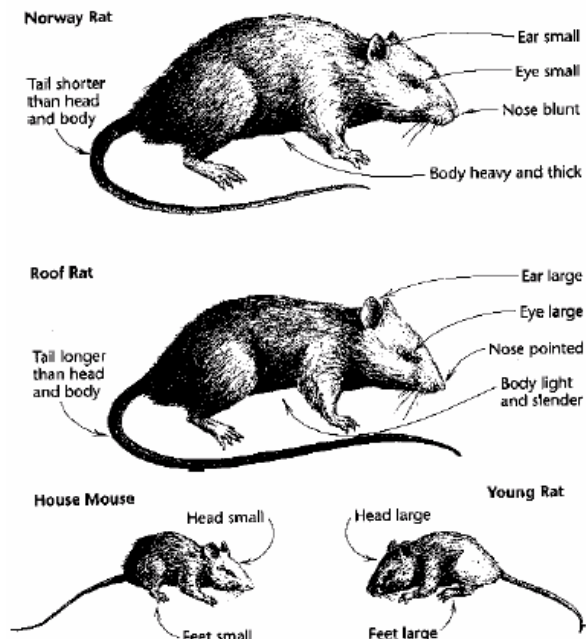


Figure 1. The differences between rats and mice.

PREVENTION

Rats and mice often can be kept from becoming a nuisance by limiting their access to nesting sites and food and water supplies. If rats or mice are killed through control techniques but food and water resources are still available it is likely that new rodents will eventually move in to take their place. The best way to limit rodent resources is through sanitation and maintenance. Prevention may require time and effort but can be a permanent fix to the problem if done correctly. Below are some of the most effective methods of prevention using sanitation and maintenance:

1. Store food (including pet food and grains) in glass, metal, or thick plastic containers with tight fitting lids.

2. Promptly and thoroughly clean up any spilled food materials.
3. Designate certain places within the school as areas for eating. Help students, teachers, and administrators understand the importance of only eating in these areas.
4. Garbage is often the main source of food for rats and mice. Keep all trash receptacles tightly covered and empty them often. Plastic trash bags will not keep rodents out so remove trash daily.
5. Remove any ready water sources. Fix leaking pipes, faucets, or irrigation systems. Also, if possible, remove standing water found in ditches, depressions, or other similar situations.
6. Remove fallen fruits and nuts from any outside trees.
7. Trim trees, bushes, grass, vines, or any other plants at least 12 to 18 inches away from the structure.
8. Seal any holes and cracks within the siding of the building that can be used by rats or mice to gain access into the structure. In a rodent management program, the best materials to use when sealing large holes and cracks include ¼ inch hardware cloth, 19-gauge or thicker sheet metal, plaster, or mortar. Smaller holes can be sealed using caulk or copper wool. Remember to look for holes in the building not only in the first three feet above the ground. Rats and mice will also enter a structure via the eaves, the roof, the attic vents, and where pipes and wires penetrate the walls and roof.
9. Weather strip around doors and windows and if possible use raised metal doorsills.
10. Seal air conditioning units well. These units provide warmth, a nesting site, and a ready source of water.
11. Repair broken sewer pipes. Rats will dig into and use broken sewer pipes as an entryway into a structure.
12. Cap drains with perforated caps that are firmly attached to the floor.
13. Clean up storage areas and other cluttered spaces, thus reducing nesting

sites and protected places where rodents feel comfortable moving around.

14. Remove wood piles, rock piles, and any other outdoor heaps of materials that may provide nesting sites for rats or mice.

MONITORING AND INSPECTION

Detection and monitoring are important in controlling mouse and rat problems. When inspecting an area for a rodent infestation, the following points will be helpful:

1. Remember that you are trying to find five main things: nesting areas, food sources, water sources, access points, and signs of rodent activity.
2. Search piles of trash, clutter, or debris for rodent nests.
3. Inspect for feces and urine. Use Figure 2 to identify the source of a fecal pellet.
4. Inspect for rub marks or other indications of activity. Since rodents pass over the same spot within their territory over and over again, they leave behind rub marks where body oils and dirt collect.
5. Look for holes and cracks through which rodents can pass both inside and outside.
6. If you feel rodents may infest an area, lightly dust the edges of the area with chalk dust or talcum powder. After a period of time, return and look for footprints and drag lines (made by tails) that indicate rodent traffic.
7. Inspect at night when rodents are most active. Use a powerful flashlight and watch for movement. Listen for gnawing sounds, squeaking, and rodent movement.
8. Temporarily close suspected holes and entryways with dirt, paper, or aluminum foil. After a few days, return to see if the material was removed or chewed through.

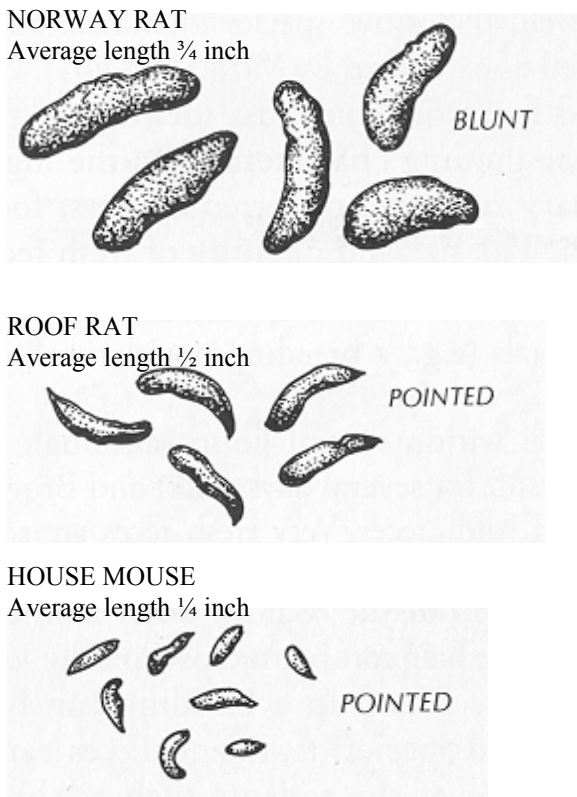


Figure 2. The difference between rat and mouse fecal pellets.

LEAST TOXIC CONTROL METHODS

The purpose of integrated pest management (IPM) is to reduce two things: the pest population and the amount of pesticides needed to accomplish that goal. With the exception of emergency situations, all other available control methods should be used prior to using a pesticide. Using poisons has several important risks that must be considered. These dangers will be addressed in the section titled "Poisons". Before any poisons are used in an IPM program, sanitation, maintenance, and other less toxic control measures should be utilized.

As a side note, several companies manufacture and advertise repellent sound devices for rodents. The Federal Trade Commission ruled these devices as being ineffective at controlling rats and mice.

Below are some of the most effective and least toxic methods available for ant control.

Physical Removal

One of the most common forms of rodent control is the removal of individuals by trapping. Rodent traps fall into three main categories: snap traps, live traps, and glue boards.

Snap traps make use of a trigger-induced killing mechanism. Upon being triggered by the presence of a rodent feeding on bait, the mechanism instantly snaps shut onto the mouse or rat, killing the individual. There are different sizes of traps, larger ones for rats and smaller models for mice. This type of trap is the most effective type of trap for use in dusty locations.

Live capture traps are available, but leave the unpleasant job of killing the rodents to you. These traps may or may not utilize bait to attract the rodents.

Glue boards are also an option. These are helpful in that they not only trap rodents but also can retain rodent hairs and fecal pellets of escaped rodents, allowing you to monitor the presence of rodents. Glue boards do not kill mice nor rats so should be inspected often in order to prevent unnecessary suffering of trapped individuals. Glue boards should be fastened to a base with nails or wire in order to prevent partially trapped individuals from dragging the traps away.

The following points will help your trapping program be more effective:

1. Always place traps flush against edges since rodents follow edges as they move from place to place.
2. Place traps near active holes and cracks and near clutter and other protected areas where rodents may frequent.
3. Place traps near fecal pellets and rodent urine.

4. Place traps near gnaw marks, rub marks, or other signs of rodent activity.
5. Secure all traps so those partially caught individuals can not drag the trap to an unknown location.
6. You may wish to bait your trap with food or nest material. Examples of effective food baits include hot dog, bacon, nuts, or sugary substances such as gumdrops or raisins. Cotton may be used as effective nest material bait.
7. As for the number of traps to use, there is not a definite number. Usually the more traps you can safely set, the better. Place traps wherever you find activity and try placing traps every three to four feet along a wall. Concentrate traps in one area at a time. After the area has been cleared of rodents, move on to the next area.
8. One of the most important things to remember about traps is when first placed they are foreign objects to the rodents. Rats and mice will treat foreign objects differently. Rats are wary of unfamiliar objects while mice are more curious. Therefore, depending on the rodent species, trapping may be instantly effective or may require patience.
9. Whenever removing live or dead rodents, wear gloves to protect yourself from harmful microorganisms.

Chemical Management

Sometimes sanitation, maintenance, and physical removal alone may not be enough to control an existing rodent problem. If mice and rats persist or if an emergency situation warrants control of a problem via other methods, chemical pesticides may be needed. Remember that Virginia law requires that all pesticides applied on school grounds must be applied by a certified applicator. All pesticides should be applied according to labeled directions. Applicators must wear protective clothing. Pesticides should never be applied where they might runoff into storm drains or sanitary sewers.

Whatever the control method you choose, it is imperative that you keep clear, accurate records of all actions taken.

There are several important negative aspects to the use of rodent poisons. The use of rodenticides has been overused. Because of this overuse some mouse and rat populations have developed resistance to the toxicants. In addition, the use of rodenticide can be a dangerous exercise. Rodents can pick up the toxic baits and move them to other areas of the school. Baits can end up in cafeteria food, in student lockers, and in wide-open areas where curious students may pick up and handle them. Therefore, rodenticides should only be used to handle emergency situations where rodents are out of control and other management techniques are insufficient alone.

Baits should not be used indoors. Intoxicated rodents that are disoriented may inadvertently wander into public areas. Imagine a school administrator having to deal with a dying rodent that has emerged into a school cafeteria. Additionally, rodents that have been baited indoors often die in hidden, difficult-to-reach areas. The result is a dead, decaying, malodorous body that can not be removed. The dead body also attracts new pests like flies and other insects.

The following suggestions will make the use of toxic baits more effective and safe:

1. Only use rodenticides outdoors.
2. Place all rodenticides in locked, tamper resistant bait stations and secure all bait stations so they are immovable.
3. Since rodents often move and hide their food, some forms of baits may be safer to use. Water baits and secured blocks of paraffin bait can not be removed and stored by rodents.
4. Use baits over long holidays when students are absent from the building.
5. For rats, bait stations should be placed about every 15 to 30 feet apart. For

mice, they should be about every six to eight feet apart.

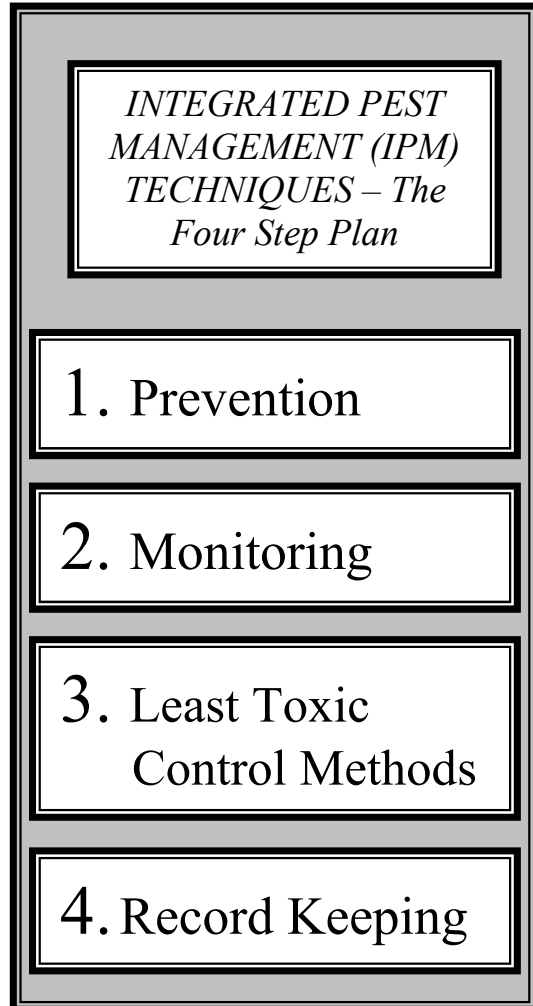
6. Place baits along the edges of walls, near rodent entryways, and in areas where known rodent traffic exists.
7. Remember to have patience since rats must become accustomed to changes in their environment. It may take a few days until the rats feel comfortable trying the baits.
8. Monitor frequently the amount of bait consumed. Replenish any missing bait until management goals have been reached.
9. Remember to always wear gloves when handling any sick or dead rodents.

RECORD KEEPING

Protect yourself against liability. Record all chemicals applied in a pesticide application IPM logbook on the facility's premises. Include the name of the applicator, the date of the application, the formulation used, and the brand name of the chemical used. Be sure to also document the location of application and the pest problem that initiated the chemical treatment.

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	Norway Rat	Roof Rat	House Mouse
Scientific name	<i>Rattus norvegicus</i>	<i>Rattus rattus</i>	<i>Mus musculus</i>
Other common names	Brown, wharf, or sewer rat	Black, ship, or house rat	
Adult weight	3 to 21 ounces	3 to 12 ounces	½ ounce
Snout	Blunt	Pointed	Pointed
Ears	Small and thick with short hairs	Large and thin without hair	Large, some hair
Tail coloration	Dark above, pale underneath	All dark	All dark
Fur	Brown with black; shaggy	Light brown, gray to black, smooth	Light brown to gray
Droppings	Capsule-shaped, pointed	Pointed and curved	Rod-shaped and pointed
Food requirement	1 ounce per day	1 ounce or less per day	1/10 ounce per day
Water source	Free water	Free water	Water from food; also need free water if dependant on a diet that is dry or high in protein
Climbing ability	Can climb	Active climber	Good climber
Nest locations	Mainly in burrows	Walls, attics, trees	Near/in stored material
Swimming ability	Excellent	Can swim	Can swim