UF IFAS Extension UNIVERSITY of FLORIDA

PI284

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Rodenticides[1]

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Background

Rodenticides are pesticides designed to kill rodents. They primarily target commensal mice and rats, but there are also select products for pocket gophers and voles. However, rodents are not the only species that can be poisoned by rodenticides. Practically any animal, including humans, can suffer severe effects from unintentional exposure to rodenticides; for example, birds can be killed from eating poisoned mammals or from eating pellets. According to the American Association of Poison Control Centers, over 10,000 cases of human exposure to rodenticides are reported yearly in the United States. Rodenticides vary widely in the hazard they present even though they are all designed to kill animals that are physiologically comparable to humans. This document will address those hazards for rodenticides that are currently registered in Florida.

Types of Rodenticides

Rodenticides may be broadly classified into two categories: anticoagulants and non-anticoagulants. An anticoagulant is commonly referred to as a blood thinner because it is a chemical that prevents or reduces coagulation of blood, meaning that it prolongs clotting time in affected animals. Deaths typically occur between four days and two weeks after rodents begin to feed on the bait. Table 1 lists currently registered rodenticide active ingredients in Florida, showing their classification and a general mode of action.

First-generation anticoagulants include the anticoagulants developed as rodenticides before 1970. These compounds are much more toxic when feeding occurs on several successive days rather than on one day only. Chlorophacinone, diphacinone, and warfarin are first-generation anticoagulants registered to control rats and mice in the United States.

Second-generation anticoagulants were developed beginning in the 1970s to control rodents resistant to first-generation anticoagulants. Second-generation anticoagulants also are more likely than first-generation anticoagulants to be able to kill after a single night's feeding. These compounds kill over a similar course of time but tend to remain in animal tissues longer than do first-generation ones. These properties mean that second-generation products pose greater risks to nontarget species that might feed on bait directly, like children, dogs, or songbirds. These rodenticides can also kill animals that might feed upon animals that have eaten the bait, including cats, dogs, owls, eagles, and hawks. Due to these risks, second-generation anticoagulant rodenticides are no longer registered for use in products geared toward consumers but are registered only for agricultural use, commercial pest control, and

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structural pest control markets. Second-generation anticoagulants registered in the United States include brodifacoum, bromadiolone, difenacoum, and difethialone.

Other rodenticides that currently are registered to control mice include bromethalin, cholecalciferol, strychnine, and zinc phosphide. These compounds are not anticoagulants. Each is toxic in other ways.

Formulations

Rodenticides are formulated either as a bait (toxicant mixed with an attractive food material) or as a tracking powder (a high-concentration toxicant on a nonfood carrier). All rodenticide tracking powders are Restricted Use Pesticides and require an RUP license to purchase or use them. Do not confuse these rodenticides with the nontoxic fluorescent dusts used to determine rodent travel routes, which are sometimes also called tracking powders.

Baits can be liquid baits or solid food-based baits. Liquid baits are water-soluble products dissolved in water and presented in special devices placed in bait stations in areas inaccessible to children, pets, and livestock inside structures. These are especially useful in areas where food is abundant, but water is scarce. Food-based baits can be paraffinized bait blocks (weather-proof blocks), extruded bait blocks, soft baits, and pelleted bait in a package called "place packs." These formulations are made to be secured by metal rods inside a tamper-proof bait station. There are also pellet baits that can be placed inside bait boxes, but these bait boxes must be secured to the ground or wall so they cannot be flipped over and spill the bait out.

Safe Use of Rodenticides

Rat and mouse poison products, if misused, can potentially harm you, your children, or your pets. Always read the product label and follow all directions when using pesticides.

Remember:

- Always store pesticides away from the reach of children, livestock, pets, and wildlife, such as in a locked utility cabinet or garden shed.
- Place traps or baits only in locations where children and pets cannot access them or inside tamper-proof bait stations.
- Pelleted and powdered forms of bait have higher potential for being shaken out, washed out of, or relocated by rodents from bait stations. Therefore, these forms of products should not be used in bait stations.
- Never store pesticides next to food, including pet food.
- Read and follow the instructions on the pesticide label.
- To prevent accidental poisoning of wildlife and pets that might eat a dead animal, promptly remove and dispose of carcasses of dead rodents.

Rodenticide products marketed to consumers include ready-to-use bait stations that are labeled according to the extent of protection they provide to young children and to dogs and whether they are weather-resistant. The rodenticide products sold at consumer outlets are ready-to-use bait stations.

- These products contain bait in the form of a block or a putty-like soft bait.
- The bait must be secured within the bait station that comes in the retail package.
  - If the bait station is refillable, up to one pound of bait may be packaged with the station to be used to fill and refill the bait station.
- Pelleted and powdered formulations of bait have higher potential for being shaken out, washed out of, or relocated by rodents from bait stations. Therefore, these products should not be used in bait stations.

More than a dozen ready-to-use bait station products are registered for use to control house mice. Some of those products are also registered to control rats. A ready-to-use bait station is one that is sold with a rodenticide bait packaged in or with it:

- Some ready-to-use bait stations cannot readily be opened and, therefore, are nonrefillable. Those products are to be discarded as directed by labeling after their bait contents have been consumed or contaminated.
- Other ready-to-use bait stations (Figure 1) are designed to be opened by users and refilled after the baits originally placed in them have been consumed or contaminated. These refillable bait stations are sold with additional bait to be used as refills.

Figure 1. Ready-to-use bait station.
Credits: UF/IFAS Pesticide Information Office

When used as directed, ready-to-use bait stations reduce access to bait by young children, pets, and nontarget wildlife while allowing the targeted rodents to enter and feed from them. These products come in several forms:

- Ready-to-use bait stations (Tier 1) that have been shown to be resistant to tampering efforts by young children and by dogs and that are weather-resistant may be used by homeowners indoors and outdoors within 50 feet of buildings. Professional applicators may use these bait stations inside or within 100 feet of buildings or structures such as trash receptacles (i.e., dumpsters).
- Tier 2 ready-to-use bait stations have been shown to be resistant to tampering by young children and by dogs but cannot be used outdoors because they are not considered to be weather-resistant bait stations.
- Tier 3 ready-to-use bait stations have been shown to be resistant to tampering by young children and can be used indoors in areas to which pets have no access.
- Tier 4 ready-to-use bait stations either have not been shown to be tamper-resistant or have not been tested in that regard. Therefore, Tier 4 stations may only be used indoors in areas to which young children and pets have no access, including residences where no young children or pets live or visit.

Rodenticide manufacturers may no longer sell consumer products:

- With more than one pound of poison.
- Containing any of four pesticides that pose the greatest risk to nontarget wildlife—the second-generation anticoagulants, brodifacoum, bromadiolone, difenacoum, and difethialone.
- Baits containing these poisons may still be used by pest control professionals in and around homes, agricultural buildings, and commercial buildings.

Nontarget wildlife and pets can be poisoned if they eat rodent baits, and so can predators or scavengers that consume rodents that have eaten certain poisons (Table 2).

Additional Information

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Table 1. Rodenticides by classification showing their general modes of action.

Rodenticide	Classification	Mode of action	Acute oral toxicity	Antidote	Primary poisoning risk	Secondary poisoning risk
Warfarin	Anticoagulant	Inhibition of blood clotting and capillary damage	Moderate to high	Vitamin K	Low (birds), moderate (mammals). Highly toxic to cats	Moderate (birds and mammals)
Chlorophacinone ([1]Restricted Use Pesticide)			High		Low (birds and mammals)	Low (birds), high (mammals)
Diphacinone ([1]Restricted Use Pesticide)			High		Low (birds and mammals)	Moderate (birds), high (mammals)
Brodifacoum			High		High (birds and mammals)	High (birds and mammals)
Bromadiolone			High		Moderate (birds), high (mammals)	Moderate (birds and mammals)
Difenacoum			High		Moderate (birds), high (mammals)	Moderate (birds), unknown (mammals)
Difethialone			High		High (birds), moderate (mammals)	High (birds), moderate (mammals)
Strychnine	Non-anticoagulant	Convulsant and respiratory failure	High	None. Supportive treatment for symptoms.	High (birds and mammals)	High (birds and mammals)
Bromethalin		Respiratory arrest	High		Low (birds and mammals)	Low (birds and mammals)
Cholecalciferol		Hypercalcemia	High	Calcitonin	Low to moderate (birds and mammals)	Low (birds and mammals)
Zinc phosphide ([1]Restricted Use Pesticide)		Prevents cellular energy production	High	None. Supportive treatment for symptoms.	High (birds and mammals)	Low (birds and mammals)

[1] Some products classified by EPA as Restricted Use Pesticides (license required to buy or use).

Table 2. Grams of selected rodenticide baits that must be eaten by animals to equal their LD_{50}.

Species (body weight, kg)	Zinc phosphide (2.5%)	Diphacinone (0.005%)	Warfarin (0.025%)	Brodifacoum (0.005%)
Rat (0.25)	0.45	16–25.5	58	1.4
Mouse (0.025)	[A]	70	37	0.2–0.43
Rabbit (1)	[A]	700	3,200	5.8
Pig (50)	40–80	150,000	200–1,000	500–2,000
Dog (5)	4–8	88	400–5,000	25–100
Cat (2)	1.6–3.2	588	48–320	1,000
Chicken (1)	0.8–1.2	[A]	4,000	200–2,000

[A] LD_{50} for the animal is not available.