

NOTES ON RODENT CONTROL

Rodent Control

Introduction

The word rodent comes from the Latin *Rodere*, meaning "to gnaw". All rodents are characterised by their teeth. The incisors (front teeth) are reduced to a single pair above and below. The gnawing habit of rodents wears these to a chisel shaped cutting edge, and they continue growing from open roots throughout the life of the animal.

There are 14 extant rodent species in Britain (five of which have been introduced by man): dormice (Family Gliridae) and voles (family Cricetidae) are not pests; only the mice and rats (Family Muridae) are serious pests and are dealt with in this section. Squirrels (Family Sciuridae) are dealt with separately.

In Britain we have two species of rat, the common (or brown) rat, *Rattus norvegicus*, and the ship (or black) rat *Rattus rattus*[1]. The ship rat's distribution is now severely limited in Britain, so much so that many conservationists believe these should be a protected species. This species, which only lives in association with man, is more vulnerable to control measures than the common rat which has largely replaced it over the past 100 years.

Of the mice, only the house mouse, *Mus musculus*, is a pest in urban environments, although field mice (wood mice and yellow-necked mice, *Apodemus* spp.) can be a problem in rural homes in the autumn and winter. Where these species enter homes control is the same as for house mice. Control methods for rats and mice are similar and are dealt with together below.

Rodenticides

Nature and development

Rodenticides are chemicals that kill rodents. They usually need to be ingested, that is either eaten in the form of a bait or taken into the body via the mouth while grooming. Rodenticides fall into two categories.

- Acute: these are quick acting and effective but often painful in their action;
- Chronic: these are slow acting, often multi-feed baits that generally cause minimal pain in their action.

An ideal rodenticide would have the following features:

- Toxic in small amounts
- Palatable to all pest species
- Slow acting
- Toxic only to the pest species
- No difference in susceptibility with age, sex or strain
- No development of immunity or physiological tolerance
- Minimal hazard to man and domestic animals
- Readily biodegradable
- Easily formulated
- Humane

Most modern rodenticides fulfil many of these points, although the similarity between the physiology of rodents and man presents difficulties. Therefore rodenticides need to be selective in their application (i.e. presented in such a way that only the target 'rodents' contact them).

Until the early 1950s, only acute single dose rodenticides were available. Examples of these were yellow phosphorus, Red Squill and zinc phosphide. These chemicals were always applied as a bait for the rodent to feed on. The baits were very effective but if the rodents did not ingest a lethal dose of the poison first time, they quickly learned to recognise and avoid the baits. This avoidance gave rise to the terms "poison shyness" or "bait shyness".

Ingesting a sub-lethal dose of these baits may have been due to the rodent feeling "ill" as it ate the bait or to the neophobia (new object avoidance) exhibited by many rodents. Pre-baiting (the placing of bait containing no rodenticide) to encourage the rodents to feed, partly overcame the problem of sub-lethal dosing. However, it remained very difficult to achieve the desired 100% mortality with these rodenticides. Leaving a residual population of rodents soon leads to a recovery in their numbers, as they reproduce rapidly compared to most mammals.

In the 1950's, "anticoagulants" were introduced. These chemicals prevent the clotting mechanism in mammalian blood. They had been used in medicine for the treatment of thrombosis (a condition caused by thickening of the blood) for several years. They work by preventing production of prothrombin which is required for blood clotting. When used as a rodenticide the rodents die of internal haemorrhage (blood loss) resulting from minor damage to blood vessels caused by the hurly-burly of their daily activity.

The success of these anticoagulants is that they have a chronic effect. When eaten by rodents at low concentrations in baits, symptoms of illness develop slowly and so the animals do not associate the symptoms with the bait. The symptoms (and death) appear to be relatively painless, so feeding continues until a lethal dose has been consumed, which may take several days.

Over reliance on the early anticoagulants, notably warfarin, caused resistance to develop in rat populations and the fight to develop new chemicals to control rodents has mirrored the fight to develop new insecticides to combat resistance. There are now two generations of anticoagulant baits.

- First Generation: warfarin, chlorophacinone, diphacinone and coumatetralyl. Some degree of resistance has built up against these baits.
- Second Generation: includes brodifacoum, bromadiolone, difenacoum and flocoumafen.

The second generation anticoagulant baits are very effective, even against warfarin-resistant rodents. They have very high toxicity to rodents, so much so that a single feed is often sufficient to provide a lethal dose but they still have the chronic anticoagulant action.

Rodenticide formulations

There are many ways in which the rodenticide can be presented to the animal. These are known as formulations and a knowledge of the advantages and disadvantages of different formulations is important when selecting a rodenticide for a particular species and habitat.

Baits are the most common way to present a rodenticide to the pest species. They can either be edible or drinkable. Both edible and drinkable baits frequently contain coloured dyes. This is principally a safety measure used to indicate when a bait has been eaten by a non-target organism. In the UK all anticoagulant rodenticides are coloured either red, blue, purple, grey or green.

Edible Baits. Rats and mice are catholic in their taste, feeding on whatever is available. However, they do have a general preference for cereals and so these usually form the base of edible baits. Most edible baits are pre-prepared by the manufacturers, either ready mixed, or ready to use.

Some edible baits come as loose cereals, others are formed into blocks, pellets or rods using wax. These are still cereal based and usually also contain a mould inhibitor (paranitrophenol or dehydroacetic acid). Such preparations prevent spillage and keep the bait palatable for longer periods, especially in damp or humid conditions. However, there is some evidence to suggest that they are less palatable than loose cereal baits.

If palatability of the bait is a problem a rodenticide concentrate should be used, added to a bait of the technician's own making. Under such circumstances the bait most likely to succeed is the one on which the rodent pests are already feeding. Addition of vegetable oil in the bait mix (5% w/w) usually further enhances the palatability.

Bait presentation is important. It must be easily available to rodents but not to non-target species. Most pest controllers use bait trays or bait boxes and there are many types and designs on the market. Tamper-resistant boxes can be employed where there is a risk of non-target (including human) access and all bait remaining after the operation is completed must be removed and destroyed safely. See the HSE/MAFF Guidelines on Safe Use of Rodenticides on Farms.

Liquid Baits. A liquid bait is particularly useful in dry and dusty conditions or where water supply is limited. Most rodents require access to water, particularly rats. Mice also drink water when available but they can under some circumstances gain sufficient moisture from their diet. Therefore, providing water in dry conditions is often an ideal way of delivering a bait.

Usual methods of presentation for liquid baits are trays or drinking fonts such as those used in poultry houses. These should be sited in areas where rodents are active. Liquid bait points present a greater risk to non-target species than edible baits because the rodenticide is usually at a higher concentration and because a larger quantity can be ingested by a non-target organism in a given time. Therefore, such bait points should be used only in areas with restricted access and frequent visits to replenish the bait and maintain liquid levels are essential.

Contact Dusts. Rodents spend up to one fifth of their waking time grooming. By placing an inert dust mixed with a rodenticide preparation on rodent runs (either directly on the surface or in boxes), the rodent running through the dust will collect it on its fur and later ingest it whilst grooming.

The dust is applied to the rodent runs either with a spoon or dust gun. It should only be applied to areas from which it can be removed after the operation is completed. Rodent uptake of the dust can easily be seen by observing fresh footprints in smoothed-over dust. If the runs are not obvious in the first place, tracking dust (an inert preparation containing no rodenticide) should be used.

Rodenticidal dusts are particularly useful where there are problems with palatability, or getting the rodents to take baits. However, great care must be taken with their use as the concentration of active ingredient is higher than that used in baits and contamination of adjacent areas is relatively easy through rodent movements and air currents.

Rodenticidal Gels. These products, recently introduced, work on the same principle as contact dusts but using a gelatinous paste as the rodenticide carrier. They have the advantage of being less likely to contaminate surrounding areas by air currents.

Rodenticidal Wicks. These products are another recent development. The system uses two fibre wicks impregnated with rodenticide. These are incorporated into a tube which can be placed in the runs. The tube allows access for house mice but not for any animal that is markedly larger. The system works by the mouse brushing against the wick which transfers rodenticide onto the mouse's fur. This is then ingested by subsequent grooming.

Before any rodenticide is used a full COSHH assessment should be undertaken.

Other Rodent Control Methods

Gassing. This technique is only available for use outdoors at a minimum distance of 3 metres from buildings. Tablets or powder are applied to the rodent burrows and the burrows are then sealed. Toxic gas is usually liberated by the preparations on contact with moisture and, unable to escape through the blocked entrance, travels through the burrow system, asphyxiating the rodents.

In the UK, there are two such products cleared for use. Cymag, a fine white powder consisting of a mixture of calcium and magnesium cyanide, which generates the highly toxic gas hydrogen cyanide. This can be either spooned or pumped into the burrows before the entrances are sealed. The gas swiftly kills all resident rodents and, if sufficient precautions are not taken, it will also swiftly kill the operator or bystanders. It is essential that staff using this product have received full training in its use and necessary safety precautions. An antidote to hydrogen cyanide is available and a kit should always be carried when using the product. Furthermore, Cymag should never be used without a minimum of two persons present. These safety precautions must be strictly observed.

The second product involves applying phosphine gas liberated from tablets placed in the burrow system. These can be applied either from the tube or flask or via a specially designed applicator. As with Cymag, the full set of safety precautions must be observed when using products liberating phosphine gas.

The use of gas or gas liberating powders and tablets should be avoided in wet blustery weather.

Trapping. Spring, or break-back, traps and live traps are available for rats and mice, as well as sticky board traps for mice. These are extremely useful in areas where it is not possible to use rodenticides, for example in some food production areas.

Always wear gloves when setting traps to ensure that you don't leave them contaminated with human odours and, if a non-poison bait is required, chocolate is recommended (it smells more than cheese and rodents like it). All traps must be checked at least once per day and any captures in box traps humanely destroyed.

Trapping rodents is manpower intensive but can be very successful and is sometimes the only available option. Great care must be taken to avoid cruelty to the rodents.

[1] Note some common rats are brown and most ship rats are brown rather than black. These different species can be distinguished by the smaller size, sleeker body and tail, and the longer ears of the ship rat.