



## Rodents

### Introduction

Worldwide, rodents are the largest group of mammals with over 1,500 representative species. Only 15 are present in Britain, and include the squirrels, dormice and voles as well as the rats and mice. Being mammals rodents are warm-blooded and give birth to live young which they suckle.

They are distinguished from other mammals by the characteristics of their teeth, particularly their continually growing incisors.

All rodents have a single pair of incisor teeth in upper and lower jaws, which grow continuously throughout life. The word *Rodent* is derived from the Latin word 'rodere', which means to gnaw. Gnawing keeps them to a manageable level – if rodents did not gnaw the incisors would grow round and enter the upper jaw, preventing the rodent from feeding.

The curved shape of the incisors also imparts great strength to the bite. Rats and mice, given an edge on which to bite can, in fact, penetrate all types of wood as well as soft metals such as aluminium and lead. Also, the incisors project well beyond the lips so that the animal does not have to ingest any of the substance being gnawed.



Note the two upper and two lower incisor teeth. There are neither canines nor pre-molars the space they would occupy is known as the diastema. The remaining teeth are all molars, three top and bottom on each side.

Behind the incisors, on either side, there is a gap (diastema) through which rodents can eject unwanted or unpalatable material before it is ground up by the molar teeth and swallowed.

Rodent teeth hardness index

Object	Numerical Rating
Rat teeth	5.5



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Iron	4.0
Copper	3.0
Aluminium	2.0
Lead	1.5

The three most significant rodent pest species are commensal, which is they live in close associated with man, and may be dependent on him for food and shelter. This is a relationship that has evolved over many centuries.

The three species are:

- *Rattus norvegicus* - the common, Norway, sewer or brown rat
- *Rattus rattus* - the ship, roof or black rat
- *Mus domesticus* - the house mouse

These species have become so well adapted to living in close association with man that they have acquired a world-wide distribution. Their adaptability has enabled them to survive extremes of climate from the frozen tundra to the dry, barren desert.

The following are only guidelines to current British distribution and the pest control technician needs to be alert at all times for the unexpected and the unusual.

### **The Brown Rat - (*Rattus norvegicus*)**

The brown rat has only been recorded in Britain since early in the 18<sup>th</sup> Century. It is thought to have been introduced in shipping from Russia, and did not originate in Norway, despite one of its common names.

It is now by far the more abundant of the two rat species and is widely distributed in both urban and rural areas. It occurs both indoors, and outdoors away from human habitation, and is the species often associated with sewer systems.

### **The Black Rat – (*Rattus rattus*)**

The black rat probably originated in Southeast Asia and was thought not to have reached Western Europe until the Middle Ages, possibly returning with crusaders. Recently, however, remains have been discovered in Roman deposits in York and London dating back to the 3<sup>rd</sup> and 4<sup>th</sup> centuries.

Black rats are common throughout Europe and followed the Romans to Britain. The rats streamed into docks with European traders, along with cargo. But their death knell began to sound with the move to container shipping and little spillage. There are now none in London, where they were common until the 1950's.

Although once the dominant rat species in this country, it is now rare and confined to port areas.

Back in 1991, the Mammal Society reported to the government that the black rat is on the verge of extinction in this country, stating that there is now just a scattering of individual black



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rats. The disappearance of *Rattus rattus*, thanks to fewer dockland haunts and better hygiene, is posing an ethical dilemma for conservationists whose instinct is to save all threatened species.

Because of its rarity, the black rat will not be discussed any further.

### **The House Mouse – (*Mus domesticus*)**

The house mouse has been identified from pre-Roman, Iron Age deposits and is believed to have arrived in Britain around the 10th century BC. It is likely that it was once a wild species somewhere on the borders of Russia and Iran, and gradually spread with the practice of agriculture.

It is common in a wide range of urban and rural buildings all over Britain. Although mainly a house dweller, it may live outdoors for part or all of the year. It is not found in sewers.



### **Interesting Physical and Biological Abilities of Mice**

- A. They are capable of squeezing through an opening slightly larger than 6mm in diameter – about the diameter of a Biro pen.
- B. They are excellent climbers and can run up almost any roughened wall without breaking stride.
- C. Although preferring not to swim, mice can do so. More than once a live mouse flushed down a toilet has resurfaced a minute later.
- D. They can jump a vertical distance of 30.5cm from the floor on to an elevated flat surface.
- E. They can run horizontally along pipes, wires and ropes.
- F. They will develop thick long coats of hair when living in a cold environment – i.e. in a refrigerated store.



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- G. When feeding on coloured crayons or dyed rodent bait, will produce droppings based on the crayon/rodent bait colour. This is useful in confirming that rodents (mice) have consumed rodent bait.
- H Mice and rats may start fires by gnawing on electrical cables.
- I Mice are not blind but have poor vision and cannot clearly see beyond about 15cm. Beyond this distance they respond to outlines, not details.
- J May burrow, i.e. beneath external rubbish skips.

## Reproduction and Life Cycle

The life cycle of rats and mice is similar. They are capable of reproducing at the age of about 3 months. Pair-bonds are not formed as mating is carried out on an opportunistic and promiscuous basis. When a female becomes sexually receptive, her scent attracts all the local males. The female is receptive to the male for only a relatively short time (about 12 hours) in each cycle. Mating is brief and can take place with a number of males. Following mating and conception there is a relatively short period of pregnancy (gestation). Birth is followed by a similar time period, after which the litter is weaned.

There is, however, one factor, which can speed up this cycle considerably. This is termed post-partum oestrus. Unlike most mammals, rats and mice do not have to wait until the original litter is weaned and the female has ceased lactating before coming back into oestrus (i.e. receptive to mating). This means that the female rat or mouse may be willing to mate and can conceive again soon after the original litter is born. This only occurs when conditions are favourable for survival of the young. Commensal rodents may, therefore, give birth every 24 to 28 days, and this can give rise to very rapidly increasing populations. At very high densities, however, reproduction rates decrease to take account of the reducing availability of resources and the increasing competition within the population.

## The Need to Control Rodent Pests

### 1 Disease

Commensal rodents are responsible for spreading many zoonotic diseases – e.g. Diseases of animals that can be passed to man.

Commensal literally means “sharing one’s table”; living in close association with man.

Rodents may transmit disease to man in a number of ways including:

- A. By biting
- B. By infecting human food with their droppings
- C. By infecting human food with their urine
- D. By being eaten



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- E. Indirectly via the cat or dog
- F. Indirectly via bloodsucking insects
- G. Indirectly by dying in a water supply or beverage and contaminating it with organisms contained in its body at death.

## Examples:

### **A Weil's Disease**

About 50 – 70% of all rats in the UK are carriers of this disease.

The causative organism is the spirochaete bacteria *Leptospira interrogans*; serotype: Icterohaemorrhagiae. The bacteria can enter the human body via damaged skin (such as cuts and abrasions) or mucus membranes (mouth and nose). Infection can also result from direct contact with rodent carcasses, tissue and organs.

Leptospirosis is one of the major bacteria with which rats can live quite happily, unlike salmonella, which causes the animal to be ill. Rats contract leptospirosis while still pups, and carry it in their kidneys. They excrete the bacterium through their urine into the environment, where it can survive for up to 45 days in fresh water or in damp conditions, such as muddy river banks. However, the bacterium cannot multiply outside the body of the rat.

Groups most at risk have historically included farm workers and those whose jobs bring them into regular contact with rats. But with the increase in popularity of water sports over the last 15 years, Britain's canoeists, who number over one million, have found themselves at risk, representing nearly half of those affected by Weil's disease.

The onset of symptoms may be gradual or sudden and display all the signs of a severe influenza. The victim suffers from an acute headache, combined with muscular pains and a general feeling of weakness.

In acute cases left untreated, jaundice becomes intense and urine passage difficult, with solid bodies forming in the kidneys. Renal failure and kidney damage occurs simultaneously and death might follow.

Currently around 15% of Weil's disease victims die.

### **B Food Poisoning**

Rats and mice may infect foodstuffs with their droppings, which may harbour such food poisoning Organisms as the *Salmonella* bacteria or the microscopic eggs of tapeworms of the genus *Hymenolepis*.

### **2 To Prevent Damage**

As gnawing is an essential part of a rodent's life, both rats and mice cause considerable physical damage, with woodwork, soft metal pipes and electric cables



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being common targets. The damage caused by rodents from fire, burst pipes and subsidence caused by burrowing, result in considerable financial loss each year.

## **3 Contamination**

Rodent feeding habits are very wasteful – contamination by droppings and urine to foodstuffs result in more damage than through physical gnawing.

## **4 Distress**

The presence of pest infestation, such as by rodents may cause physiological stress in some people. The presence of pests is not conducive to a pleasant and productive working environment.

## **5 To comply with the Law**

The Food Safety (General Food Hygiene) Regulations 1995, require that food shall not be exposed to risk of contamination and that food rooms be kept in good repair and condition to prevent the risk of pest infestation.

**The Food Safety Act 1990**, makes it an offence to sell food which is unfit or contains foreign bodies, e.g. droppings or insect fragments. Furthermore, food premises with a serious pest problem could face closure procedures under the Food Safety Act. The loss of business in such instances can be considerable.

**The Prevention of Damage by Pests Act 1949**, requires the occupier of any land or buildings to notify the local authority of any rodent infestation (not applicable to agricultural land). The occupier may also be liable for any treatments and repair work required, along with removal of harbourages. This Act also requires local authorities to take steps to ensure that their district is kept free from rats and mice.

Under the **Health & Safety at Work Act 1974** employers have a legal obligation to ensure, as far as is reasonably practicable, the health, safety and welfare of employees. The presence of an infestation could result in unsafe working conditions.

## **The Signs of Infestation That May Be Encountered**

### **Sightings**

The sighting of a rodent is the surest sign of an infestation and should enable a positive identification of the species to be made. A newly dead body gives a reasonable indication that the infestation is still active. If live animals are seen frequently during the day it may indicate that a large infestation is present, or that the rodents' environment has been recently disturbed. However, sightings are not reliable indicators of the size of an infestation.

### **Gnawed Materials**

Gnawed materials in certain instances reveal the time when the rodents were present. Gnawed fresh foods change their appearance within 24 hours. Wood recently gnawed



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presents a fresh appearance for about a week. Also, the presence of teeth marks can allow rat and mouse infestation to be distinguished.

Rats often produce distinct serrated edges while a smoother edge is produced by the smaller teeth of the house mouse. Damaged grain may also give an indication. Rats tend to leave half grains; while mice nibble around the edges, leaving a core and many small pieces including grain husks. This is called “kibbling”.

## **Droppings**

This is a sign on which most inspectors rely. The shape and size of any droppings can often indicate the species that may be present. Brown rat droppings tend to be spindle shaped and generally are grouped together, black rat droppings are on average somewhat smaller, more sausage-shaped and more scattered. Mouse droppings are much smaller. Brown rats produce about 40 droppings a day, and house mouse about 80

If droppings are shiny and glistening this indicates an active infestation, but in dry, warm atmospheres these can become dull looking after only a few hours. The presence of small and large droppings of the same shape usually indicates a breeding population with small and large animals being present. Occasionally, other items may be confused with rodent droppings. For instance, around machinery small accumulations of grease may be mistaken for mouse droppings. Bat droppings are dark brown or black and vary between 4 and 8mm long, the same size or larger than a mouse dropping, Because they consist largely of fragments of insects, they crumble easily to a fine powder when pressed, whereas mouse and rat droppings are pasty when fresh and become increasingly hard as they dry.

The presence of droppings, on their own does not necessarily indicate an active infestation. Consequently, other signs should be looked for to confirm this. Before any control measures are undertaken, all droppings should be swept up and removed so that if further droppings are seen on subsequent inspections then the infestation must still be active.

## **Smell**

Rats and mice produce characteristic “stale” odours. This can be readily recognised, especially when infestations are long standing and occupy undisturbed indoor areas. Note, however, that this odour can remain for some time after the rodents have been controlled.

## **Urine Pillars**

Small mounds or “urine pillars” consisting of dirt, grease, dust and urine are sometimes formed in places, which are habitually used by **house mice**. They are indicators of a long established infestation.

## **Smears**

Through the habitual use of particular routes or runs dark coloured smear gradually form where the rodent brushes against a surface leaving a dark greasy deposit. These are typically seen around harbourage entrances, up walls and steps, on pipes and along beams and girders and wherever rats and mice run. The grease is produced naturally in the skin, but the marks are accentuated by the adhesion of dust and dirt. When fresh these deposits tend to be



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soft and easily scraped off, but they become brittle with age. When smears are thick, shiny and widely distributed they indicate a heavy infestation.

Smears are sometimes seen as characteristic “loops” beneath exposed ceiling joists. From their appearance it is often possible to determine which species made them. The loops left by the **black rat** are broken or discontinuous, confirming the agile climbing ability of this species. In comparison with the less agile **brown rat** which forms a continuous loop smear. Loop marks can sometimes also be seen in dust. Smears can remain long after an infestation has been eradicated so they are not reliable indicators of current infestation.

## Proofing – Exclusion of Rodents

Preventing rodents entering buildings and hence avoiding the requirement for control methods to be employed is the most desirable situation.

Proofing involves the introduction of physical barriers into specific points of the environment where rodents are most likely to gain access to a building or other site that needs to be protected.

Entry of rats and mice into buildings may occur by several routes; the most common being:

1. The bases of pedestrian, fire exit and service doors. The base of these doors should be proofed with bristle strip if there is a gap greater than 6mm.
2. Rat entry from the sewers may be prevented by ensuring that where an interceptor trap is fitted the water seal is effective, and that the caps of any rodding arms are in position. Broken manhole/drain covers and fresh air inlet grids replaced. Redundant drains (i.e. resulting from removal of WC pans) should be capped off.
3. Gaps around pipes passing through external walls and air bricks that are broken or with the holes being too large will allow rodent entry. Gaps around pipes should be sealed with fine sand/cement mortar or a galvanised steel template fitted; wire mesh covers should be fitted to air bricks so that all openings in excess of 6mm (1/4 inch) are proofed.

Other ways by which rats and mice enter buildings are by climbing the face of rough stonework and brickwork, by tunnelling under walls and through foundations, by walking along telephone and other cables and the branches of trees. Rats and mice also get carried into buildings with merchandise.

Climbing up brickwork may be minimised by painting a band 15cm (6in) deep and at least 60cm (2ft) up, along the wall concerned. High gloss paint should be used for the final coat and, if necessary, the bricks should first be rendered with smooth cement. The foundations of outside walls should be taken down to 60-90cm (2-3ft) below ground level. Holes in concrete floors and in foundations should be filled in with fine concrete or cement mortar. To prevent re-opening during setting, broken glass may be added where holes are very large.



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The person who is most likely to be aware of the specific locations where rodent proofing is required will be the pest control technician, and it therefore makes sense that we should advise the client that he should carry out this work, which is often very simple and can be undertaken at the time of the next routine service visit, or sooner.