



Rats and mole rats of sweet potato

Mastomys, Arvicanthis & Tachyoryctes species



Photo: William T. Stanley, Negaunee Collection Manager, Mammals, The Field Museum of Natural History

Natal multimammate rat, Mastomys natalensis.



Photo: Jonathan Beilby

Grass rat, Arvicanthis species.

SUMMARY: Rats and burrowing mole rats both attack sweet potato, but rats are the more serious pests. Although 12 species of rat are crop pests, only the multimammate and grass rat are distributed widely. Rapid population outbreaks, in East Africa at least, may be related to rainfall in December and January that encourages early breeding. Control relies on community action and early intervention, mostly using cultural methods. Chemicals are a potential danger to human health and the environment, as well as being costly and mostly unavailable to smallholders.

KEY SIGNS

Rats feed on sweet potato storage roots and can cause serious damage by digging through mounds or ridges to eat them, or by attacking them when exposed above ground. Mole rats burrow into the soil, eating storage roots from below.

MANAGEMENT

Prevention – what to do before signs are seen

Cultural approaches: A major difficulty with managing rats and mole rats is that farmers mostly wait until they see damage before taking action and, by then, the damage is far advanced and irreversible. There is also the problem of ineffective or dangerous methods being used, such as flooding burrows and use of toxic chemicals:

To overcome these problems, ecologically-based rodent management (EBRM) has been developed. This has been necessary because rats have become resistant to chemicals used previously, and also due to a better understanding of their risks to human health and the environment. The new approach aims to give farmers an appreciation of rodent biology and ecology and the factors influencing population changes of rats.

EBRM is based on two important approaches: (i) community action and (ii) early intervention. It uses the traditional methods devised by farmers, applying them when they will have greatest impact based on knowledge of rodent biology and ecology. This will be different for each species.

It may be possible to alter the time of planting so that harvests occur before maximum rat populations; there is also the possibility of selecting early-maturing varieties in localities where rats are a recurring problem.

During crop growth, procedures likely to reduce rat and mole rat populations and protect the growing crop include setting traps (snap, snare or live), although care must be taken to protect livestock and children from being hurt by them.

Encouraging owls is a practical way to control rats, but needs to be done with respect to community beliefs, as farmers may be superstitious (some communities consider owls evil omens, symbols of death and bad fortune). The reason for placing owl nesting boxes around the village and fields should be carefully explained. Experience shows that farmers will quickly see the wisdom of attracting owls compared to the damage done by rats. Contrary to most people's belief, cats are not very effective; they do not kill many rats, but only frighten them away.

Weeds should be removed from within and around sweet potato fields. Nile rats forage during the daytime and also nest above ground; removing weeds exposes them to predators. Previous outbreaks involving this species and also the multimammate rat have seen more damage in weedier plots of rice; the same may hold true for sweet potato.

Where losses are likely, early harvesting is an obvious solution and should be promoted.

Some other cultural control remedies used by farmers in Kenya, Uganda and Zambia, include:

- Planting the legume *Tephrosia vogelii* (commonly known as fish bean) randomly throughout the field and along the borders. This shrub contains rotenone, a fish poison and insecticide, so be careful when disposing of it.
- Using a mixture of cow dung and pepper placed in the burrows and burnt to smoke out the rodents.
- Pouring one-week old fermented cattle urine into the burrows to chase away mole rats.
- Digging deep ditches around sweet potato plantings to stop rodents from tunnelling straight into the field.

After harvest of sweet potato crops, collect the debris and bury or burn it; importantly, do not leave immature or broken storage roots in the field for rats to eat. Also, protect the harvest in storage from rat infestations.

Chemical approaches: Chemical control is not an appropriate method of managing this disease. Although fungicides would be effective, they are too expensive for most smallholders and often they are unavailable. If required in commercial planting, mancozeb or copper compounds would be suitable choices.

Control – what to do after signs are seen

Cultural approaches: A home remedy is based on use of the legume shade tree, *Gliricidia sepium* (it means 'rat killer'). Pound young leaves or bark, and mix with cooked rice, maize or other bait, or boil the *Gliricidia* with rice or other cereal grains. Bacteria convert chemicals in the leaves to substances similar to brodifacoum (an anti-coagulant used as a rat poison). These are less toxic than brodifacoum, so larger amounts must be eaten. Change the bait daily and protect children and pets by placing it in bamboo sections or tins.

CAUSE

Rats feed on sweet potato storage roots and can cause serious damage by digging through the mounds or ridges to eat them, or by attacking them when they are exposed above ground. Rats live above ground and nest on or in the ground or in trees, depending on the species. Species that cause outbreaks have high reproductive capabilities. The gestation periods of the multimammate rat and the grass rat are only 23 and 18 days respectively; as soon as they give birth they can conceive again. Mole rats burrow into the soil, eating storage roots from below. Mole rats live and breed in underground burrows. For mole rats, gestation is longer at about 7 weeks.

The following reasons have been suggested for rat outbreaks: (i) a long rainy season that provides more food and cover, allowing better survival (ii) a reduction in competition from other rat species, predators and disease, when there is a return to rains after consecutive dry years (iii) early breeding, when unusually heavy rains occur during the rainy season and the progeny join the main breeding season population later in the year.

Research in Tanzania has found that cumulative rainfall for December and January could be used to predict an outbreak 6 months in advance. Furthermore, calculations showed that if rainfall exceeded 366mm for December and January then control actions would be cost-effective, taking into account the amount of damage that was likely.

Africa has almost 400 rodent species but only about 5% are crop pests. Of these *Mastomys natalensis* (multimammate rat) and to a less extent *Arvicanthis* species (grass rats) are the dominant rodent pests of sub-Saharan Africa, and most often involved in rodent population explosions. Other species attacking sweet potato are the burrowing orange-toothed mole rat (also known as the East African mole rat, African mole rat or root rat) (*Tachyoryctes splendens*) and the greater cane rat (*Thryonomys swinderianus*), which is relatively slow breeding.

IMPACT

There were 32 recorded outbreaks of the multimammate rat in Africa from 1925-2005. *M. natalensis* was the most frequently involved, either alone or in a few instances with other *Mastomys* species or with *Arvicanthis* species. Most outbreaks occurred in East Africa, although a few were in southern Africa and West Africa, with a major outbreak across the Sahel in 1975-76. Most attention has been paid to impacts on maize, rather than root crops, so the loss of yield under normal circumstances and in outbreak years is not well documented.

DISTRIBUTION

Multimammate and grass rats are widely distributed and common. *M. natalensis* occurs over most of the continent, with other *Mastomys* species more locally present. *Arvicanthis* species live in the northern half of the continent. Both live in grasslands and wooded savannah, cultivated areas and in villages. By contrast, the orange-toothed mole rat occurs in the moist uplands of Ethiopia, Somalia, Kenya, Tanzania, Uganda and eastern Democratic Republic of the Congo.

FURTHER READING

A better rat trap. Journey to Forever. (http://journeytoforever.org/at_rats.html).

FARM: Forum for Agricultural Risk Management in Development. (<http://bit.ly/1URsLLQ>).

Fiedler LA (1994) Rodent pests management in eastern Africa. FAO Plant Production and Protection Paper 123. Rome: Food and Agriculture Organization of the United Nations. (<http://bit.ly/1K2sdwp>).

Singleton GR, Hinds LA, Leirs H, Zhang Z (1999) Ecologically-based management of rodent pests. ACIAR Monograph No. 59. 494p. (<http://bit.ly/1O3SonP>).

Singleton GR, Belmain SR, Brown PR, Hardy B, (2010) Rodent outbreaks: ecology and impacts. Los Baños (Philippines): International Rice Research Institute. 289p. (<http://bit.ly/1Hzwz0p>).