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# AGRICULTURE AND FORESTRY RODENT PROBLEMS AND CONTROL IN ITALY

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**ABSTRACT:** Rodent pest problems and their control in Italy are reviewed. Two rats, *Rattus norvegicus* and *Rattus rattus*, and the field mouse, *Apodemus sylvaticus*, are often important pests both in rural and forestry areas. Other species, such as voles, *Microtus arvalis* and *Microtus (Pitymys) savii*, in orchards and in horticulture, and *Sciurus vulgaris* and *Myoxus (Glis) glis* in forestry, sometimes represent serious problems. For each species the kind of damage and control is recorded, and additional considerations are supplied to the public and private organizations responsible for rodent control.

This report is based on a recent survey I carried out through Italy with the aim of identifying both the importance and quality of rodent problems related to agricultural and forestry commodities.

Overall height species, with more or less intensity and regularity, affect field and forest yields in Italy (see Table 1). We specifically refer to four murids (two rats and two mice), two cricetids (voles), one muscardinid (dormouse) and one sciurid (squirrel).

Table 1. List of the more important Italian rodents affecting agriculture and forestry. Also reported are the types of damage to agriculture and forestry and the significance of the damage.

Species	Agriculture	Forest	Damage
<i>Rattus norvegicus</i>	-----	Tree-seedlings in nurseries	Sporadic and localized
	Sunflower seedlings and ears	-----	Relevant and diffused
	Maize seedlings and ears	-----	Relevant and diffused
<i>Rattus rattus</i>	-----	Ornamental shrubs (bark removal)	Frequent but localized
<i>Mus musculus</i>	Carnation in greenhouses	-----	Frequent but localized
<i>Apodemus sylvaticus</i>	Seedlings of Papilionaceae, Cucurbitaceae	-----	Relevant and diffused
	-----	Tree-seedlings	Relevant and diffused
<i>Microtus arvalis</i>	Apple orchards (root bark removal)	-----	Very serious
<i>Microtus (Pitymys) savii</i>	Citrus orchards (root bark removal)	-----	Very serious
	Artichoke	-----	Relevant and diffused
	-----	Pine trees (root bark removal)	Relevant and diffused
<i>Myoxus (Glis) glis</i>	-----	Pine trees, poplars (bark removal)	Frequent but localized
<i>Sciurus vulgaris</i>	-----	Pine trees, Ilex trees, poplars (bark removal)	Frequent but localized

## RATS

The negative effect of the brown rat, *Rattus norvegicus*, is quite important on sunflower and maize crops.

The problem is common to a large portion of the area under corn cultivation in Italy, covering approximately the whole Po Valley and all low-valley irrigated areas through the middle of Italy.

The crop is generally damaged at two distinct phenological phases: just after sowing and at waxy ripeness. In the first case, seedlings are systematically removed and eaten. This phenomenon is generally localized to the border rows of the crop but, in some cases, 40 to 50% of seeds may be destroyed and replanting is necessary.

Later on, waxy ripening cariopses are reached by the animal and eaten on the plant itself, whose many ears are destroyed.

Analogous attacks affect sunflower crops: seed may be destroyed just after sowing; successively, achenes are brought away from the head, when seed is filling.

Sunflower injury, however, is generally limited to plain, irrigated areas, and when ditches, channels, garbage heaps and suburbs are nearby.

As to the control techniques, the application of poisoned baits is frequently used with either whole or crushed cereals being treated with first-generation anticoagulants (particularly warfarin and coumachlor (0.0025%). Baits are placed in temporary bait stations along the borders of the fields frequented by rats, but sometimes the bait is also put out without any protection or any method of recovering consumed residual. This practice, however, does not generally imply serious risk for nontarget species. On the other hand, it gives the best results when applied just a week before the sowing or ripening phase of cariopses.

Plant barking, too, is a frequent type of rat damage occurring at the end of winter on some ornamental shrubs (particularly on Pittosporum tobira along the coastal strips of the peninsula surrounding towns. It is caused by a local form of the roof rat (Rattus rattus alexandrinus), normally established in trees and shrubs of city parks.

In some years damage intensity is really relevant, its nature being essentially aesthetic, due to the consequent diffused dry leafy branches.

In this specific case, because often we must operate under unfavorable environmental conditions, control techniques normally include an integrated application of different practices, such as distribution of baits poisoned with chlorophacinone inside suspended bait-containers, habitat alteration (e.g., removal of minor vegetation), and in local areas the destruction of nests located in trees and shrubs.

#### MICE

Mouse problems, when occurring regularly both in agriculture and forestry areas, are generally more important than the rat-caused ones.

In horticultural crops of Tuscany and Liguria, under both open field and greenhouse conditions, damage by the wild mouse, Apodemus sylvaticus, is often pronounced, especially on seedlings of pumpkin melon, watermelon and cucumber.

Particularly in floriculture during the winter, it is the house mouse, Mus musculus, that affects the yield of greenhouse carnations (Cariophyllum sp.) by gnawing off the flower buds.

In forestry Apodemus sylvaticus feeds actively on seedlings of conifers (Pinus pinea) and persistent leaf trees (Quercus spp., Castanea sp., Fraxinus spp.), in both nurseries and reforestation areas. Chemical control with toxic baits is not believed to always be appropriate in these cases. In fact, only in nurseries, when heavy attacks occur on subsequent years, chlorophacinone (0.005%) baits are distributed and protected in simple bait stations.

With Mus musculus and Apodemus sylvaticus in greenhouses, where it is possible to employ second-generation anticoagulants, they are presently well controlled by bromadiolone, difenacoum and brodifacoum. These are the only ones that give satisfactory results against these species.

However, when controlling both species with toxic baits, it is very important to use the best choice of basic edible material. The most widely used materials for this specific purpose are crushed soft wheat cariopsis, the naked canary seeds, and where possible, the oat flakes.

#### VOLES

Surely the major rodent problems that are observed today in Italy can be attributed to voles of Microtus genus. Especially orchards are damaged, both northern and southern ones, but also affected are some forestry plantations in the central part of the country and horticultural crops through several peninsular regions.

For over 15 years the field vole, Microtus arvalis, with cyclic populations, has represented the major problem affecting apple orchards in the Upper Adige region (provinces of Trento and Bolzano) in the northeast part of Italy (Werth 1973, Oberhofer, pers. comm.)

The species populates where frequent soil tillage is not applied and a grass cover is maintained. Plants may be damaged whatever their age with injury occurring by complete barking from the root system to crown area.

In the years of high population up to 15 to 20% of the whole apple orchard area in the region can be affected, with loss in yield being correspondingly important but as of this date not quantified.

Before its use was prohibited, the species was controlled by endrin spray applications on the grass cover. Nowadays, to control heavy attacks, localized baits (apple pieces treated with chlorophacinone 0.005%) are distributed near the rodent holes, sometimes protected under grass cover or placed in pipe sections (Werth 1973).

This active ingredient provides an acceptable control without any significant direct danger for nontarget species or hazard of secondary-poisoning.

For a few years, damages from another vole, Microtus (Pitymys) savii, have increased more and more throughout citrus orchards of southern Italy (Ciampolini et al. 1985; Bongo, Fideghelli, Benfatto, pers. comm.).

Also in this case the damage results in the removal of the bark of the root system and of the crown area of the plant, often causing its death (see Figure 1).

The phenomenon is increasing in its frequency and intensity and becomes apparent after both regular soil tillage management and chemical weed control interventions on the grass cover are neglected, and sprinkle irrigation is substituted for the traditional sliding system.

Some hundred hectares of citrus orchards have this problem in Sicily (provinces of Catania and Ragusa) (Benfatto, pers. comm.). The phenomenon is even more evident in Calabria (flat lands of Sibari, Lamezia, Gioia Tauro and Jonic versant), where approximate evaluations indicate about 10% of the cultivated areas are involved on both old and newly planted citrus orchards.

Citrus orchards of Basilicata and Apulia in southeastern Italy, even though less seriously, are also damaged.

Both just planted, young, and grown-up plants of orange, lemon, tangerine, clementine--all grafted on bitter orange--are indiscriminately attacked.

So far, a rational control program has not been defined or carried out as the problem arose relatively recently.

Anyway, the use of poisoned bait does not seem to be the best solution, as chlorophacinone, which is very active against Microtus arvalis, appears less effective against this species. On the other hand, we in Italy also find that the indiscriminate use of baits treated by second-generation anticoagulants on large open areas may present a potentially higher risk for nontarget species and the environment.

Prevailing opinion indicates that the application of an integrated control technique, where an experimental distribution of bait poisoned with bromadiolone, difenacoum and brodifacoum, only on small areas and for short periods, is complementary to the return to regular soil tilling and sliding irrigation.

Microtus (Pitymys) savii traditionally causes some other secondary but significant damages. Among these have been injuries to the root system of young forest conifers (Pinus spp.) in reforestation areas of central Apennines (Giunchi, pers. comm.).

Damages on several horticultural crops, especially to root systems and hearts of artichoke (Figure 1), also were often observed in Tuscany, Apulia and Sicily (Santini 1983).

#### DORMICE AND SQUIRRELS

Severe barking in young poplar plantations by edible dormouse, Myoxus (Glis) glis, may occasionally occur at the end of winter through some coastal forests of Tuscany (Santini 1984). Plants are attacked in the superior third of the trunk, the apical portion rapidly drying and some months later easily breaking by wind action.

Where not forbidden, owing to more and more diffused protectionism measures, dormouse populations may easily be controlled in different ways (Santini 1978). First, the species is strongly attracted by baits of entire cariopsis of maize or of dehulled sunflower seeds, placed inside suspended dispensers with small entry holes. Second, the species is very sensitive to chlorophacinone, and to all second-generation anticoagulants. Besides, owing to its both relatively submissive nature and marked gregarious behavior, this animal may be easily caught by a combined use of traps baited with maize or pine seeds.

The only indigenous tree squirrel in Italy, Sciurus vulgaris, is widely distributed over all the mixed forests of the western coastal strip of the Italian peninsula, which are today mostly part of protected natural parks.

In these biocenoses the species normally feeds on male flowers, young herbaceous cones and seeds of Pinus pinea and Pinus pinaster and on acorns of diverse Quercus species. About every 3 to 4 years during the winter, it causes large debarking on the apical portion of the trunk and of the lateral branches of young Ilex plants (Quercus ilex) (Figure 2).



Figure 1. Typical damages by voles, Microtus (Pitymys) savii, in cultivated lands of southern Italy to artichokes (left) and to the base of a citrus tree (right).



Figure 2. Young ilex plants (Quercus ilex) barked by Sciurus vulgaris in coastal forest of central Italy.

The resulting drying of the vegetation is above all an aesthetic damage, keeping in mind also the recreational function attributed to these forest habitats.

At the same time and for the same reasons, the control of this species in these biocenoses is practically impossible today: hunting or the application of toxic baits cannot be considered or suggested; and trapping, the only possible alternative method for such ecosystems, is completely useless because of the strong shyness of this species towards any kind of artificial devices.

#### PUBLIC AND PRIVATE RODENT CONTROL

With regard to the general problems managing the control of rodents strictly associated with agricultural and forestry productions in Italy, the following considerations must be reported.

Since in Italy, as just mentioned, wild rodents may cause various kinds and sometimes important problems for plant production, specific competence is still scarce in a lot of technical staffs of the public farmer-assistance organizations.

Apart from some remarkable exceptions, such as the farmer assistance centers of Upper Adige region, where the vole problems in apple orchards are carefully controlled and modern techniques are currently applied, there isn't in Italy a public extension service anywhere in the country that can exactly define specific problems and give positive ways to control or prevent wild rodent damage.

On the other hand, even though many private pest control societies exist, they provide service only against commensal rodents in the urban or suburban areas.

As a consequence a lot of farmers, at least until a few years ago, tried to overcome their contingent needs--among those already mentioned--based on the practical suggestions of rodenticide salesmen.

In this situation the results are rarely effective, and some management practices are often dangerous, not only for nontarget species but for the environment as a whole.

However, a recently divulged work through the Rodent Laboratory of the Department of Plant Production and Protection of Pisa University, in cooperation with the major societies engaged in rodenticides research, production and sale in Italy, seems now to produce a generalized more rational and correct use of active ingredients whose sale is now admitted in Italy for domestic and field use (Table 2).

Table 2. The concentrations of the common acute and chronic rodenticides sold in Italy are indicated as is whether or not they can be used (+) or are prohibited (-) for domestic or field use.

A. I.	% in bait	Domestic use	Field use
Zinc phosphide	1.0 - 2.5	+	-
Crimidine	0.1 - 0.15	+	+
Alphachloralose	3.00	+	-
		+	-
-----			
Coumafène	0.025	+	+
Coumachlore	0.03-0.025	+	+
Chlorophacinone	0.005	+	+
Bromadiolone	0.005	+	-
Difenacoum	0.005	+	-
Brodifacoum	0.005	+	-
Calcifero1	0.1	+	-

Generally we can conclude that acute rodenticides are today practically neglected, where not prohibited, for field use. As for anticoagulants, their use on open areas until now has been generally limited to the first-generation anticoagulants such as warfarin, coumachlore and chlorophacinone. As to the more toxic, second-generation chronic rodenticides, their field use is actually still restricted to official or authorized operators and subjected to a careful surveillance during the distribution.

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