Vertebrate Pest Conference Proceedings collection

Proceedings of the 8th Vertebrate Pest Conference (1978)

University of Nebraska - Lincoln *Year* 1978

BIOLOGY, DAMAGE AND CONTROL OF THE EDIBLE DORMOUSE (*Glis glis* L.) IN CENTRAL ITALY

L. Santini
Instituto di Entomolgia Agraria dell'Universita' degli Studi, 56100 Pisa, Italy

BIOLOGY, DAMAGE AND CONTROL OF THE EDIBLE DORMOUSE (*Glis glis* L.) IN CENTRAL ITALY

L. SANTINI, Instituto di Entomolgia Agraria dell'Universita' degli Studi, 56100 Pisa, Italy

ABSTRACT: The remarkable increase in the number of colonies of edible dormouse (Glis glis L.) registered in the litoranean industrial cultivations of Pinus pinea L. in northern Tuscany over the last ten years and the grave damage to the production of pine-seeds consequent on it has created the necessity of studying systems which may reduce the dormouse menace. Going on what has previously been discovered about the habits of the species in this particular habitat, three different methods of control were experimented: direct capture in their nests, which were in this case cavities in the tree trunks which woodpeckers' activities had made accessible to the dormice; capture by means of specially built artificial nests; distribution of bait composed of pine seeds poisoned with chlorophacinone. All three systems - the first two of which can be conveniently used together - are worth further investigation and experiment, considering their results, to examine their individual advantages.

INTRODUCTION

The past ten years have seen a generalized and constant increase in the edible dormouse (Glis glis L.) populations in the ambit of certain coastal forests of Tuscany (central Italy).

This arboricolous paleartic rodent is widely diffused in Italy and a common inhabitant of mixed latifoliae and conifer forests, but its presence has assumed the dimension of a plague in the ancient litoranean forest of Migliarino, near the town of Pisa.

This forest covers a flat, almost rectangular area of about 3000 ha bounded by Ligurian Sea to the west, and a wide expanse of cultivated land on the other sides.

At the present day the forest consists on the whole of umbrella pines (Pinus pinea L.) in close association with ilex (Quercus ilex L.) and oak-trees (Quercus peduncolata Ehrh.). It is largely the result of intense reafforestation carried out 150 years ago, in view of a later industrial exploitation of the pine seeds. In fact nearly 5000 tons of pine cones have been gathered there each year since the beginning of the Century, from which the pine kernels are mechanically extracted and the seeds removed, on the spot. These seeds are a product of high commercial value and are totally absorbed by the confectionary industry at home and abroad.

The fact that the dormouse is overrunning this forest in particular has brought a grave situation in the production of umbrella pines so much so that opportune and drastic measures have had to be implemented to control their increasing number. In the period between 1969 and 1975 alone, the annual reduction in production attributed to the dormouse was 1550 tons of pine cones, for the total sum of 110 million liras (calculated in 1976).

Since the Italian literature on the subject is scarce and vague (Zocchi, 1957; De Rosa, 1959; Bazzea, 1966), we considered it necessary to undertake a series of experiments using traditional old methods, already empirically employed locally, on a scientific basis, and at the same time perfecting some new ones. This experimental program was, of course, preceded and accompanied by observations on the biology and ethology of the species in this particular environment.

BIOLOGICAL NOTES

1. Hibernation and Activity

The edible dormouse is an animal which, at the onset of winter weather, goes into a long period of hibernation. This means that in the litoranean forests of Tuscany it is active on an average for about 186 days a year, from late Spring until well into the Autumn (see Table 1).

2. Natural Nests

The edible dormouse is a species of pre-eminently crepuscular and nocturnal habits and passes the daylight hours in inactivity, inside various types of refuge.

For the particular forest which we are interested in, its shelter is the cavity inside the trunk of the more ancient plants. The dormouse usually reaches them through holes pecked out by birds of the genera Picus and Dendrocopus.

During the summer these cavities are occupied by single females (who give birth there and raise their young) and by whole groups of varying size and mixed sex. These refuges, in daytime, give shelter to practically the whole dormouse population. They do not seem to build a true nest or to remodel old ones of blackbirds (magpies or crows in this environment) as they do in younger forests where such cavities are infrequent.

It can however be generally said that this animal has a marked tendency to occupy, and sometimes in large number, any sort of natural cavity (or even those artificially predisposed) as a permanent refuge.

Table 1. Length of hibernation and active phase of Glis glis L. in central Italy.

Year	Appearance of first active specimens	Last active specimens observed	Length of active phase (days)	Length of hibernation (days)
1970	30 April	1 November	186	186
1971	5 May	5 November	184	188
1972	12 May	6 November	178	185
1973	10 May	10 November	184	169
1974	28 April	30 October	187	197
1975	15 May	5 November	174	182
1976	6 May	14 November	202	167
1977	30 April	2 November	196	
			Average 186.4	182

Another interesting fact, with reference to dormouse control, is that these animals tend to remain within their refuge during the daylight hours. That is to say, when they are threatened by an unexpected danger, such as man, they usually do not flee from the cavity, but draw back into its furthest corner.

On the other hand, we have not been able to gather much information as to the nature and whereabouts of winter hibernation refuges. We are, however, able to say that this animal only partly uses the aforesaid cavities for this purpose and, in any case, only those with a south-facing entrance-hole well protected from inclement weather conditions. Casual observations lead us to believe that they hibernate in subterranean cavities at the base of old plants amongst the tangled roots.

3. Feeding Habits.

Systematic observations over a period of 8 years have helped us to form a clear picture of the feeding habits of this species and the damage it causes to fructification in the forest of Migliarino (Fig. 1).

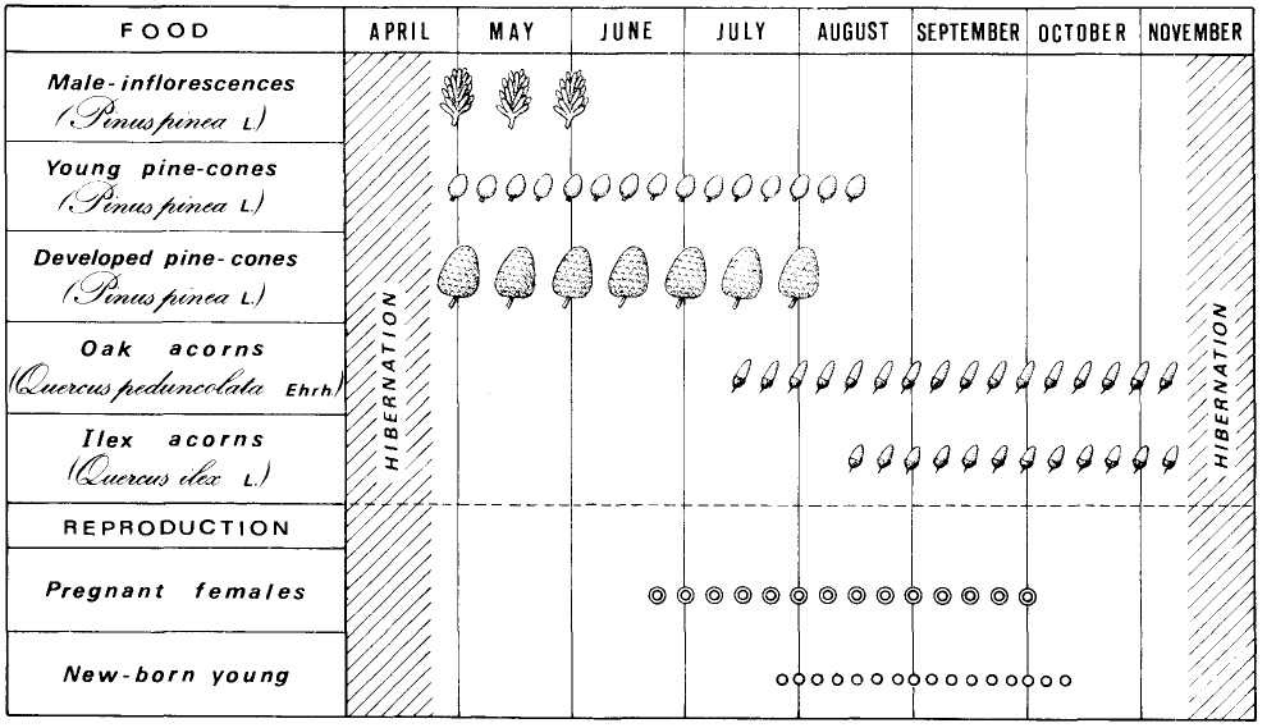

Figure 1. Principal foods and reproduction of Glis glis L. in litoranean pine-forests of central Italy.

Immediately after awakening from hibernation in May, the animal devours huge quantities of male inflorescences of Pinus pinea, just when they are heavy with pollen. This fact is also clearly evident since their excrement is a bright yellow color in this period.

However, the dormouse's principal source of sustenance in the period between its awakening and the first ten days of August is drawn essentially from young cones (in their first or second year of growth), when they are still the size of a walnut. The animal feeds on them greedily and it is in this phase that the greatest damage is caused to future production. At the same time, it attacks and destroys the bigger cones too (in their third year of development) when they have not yet acquired a woody consistency.

From the third week in July on, the dormouse increasingly turns its attention to those still unripe acorns of oak (Quercus peduncolata) which are nearer maturity and, following this, to those of the ilex (Quercus ilex). After the first half of August the dormouse leaves the pine cones completely alone and acorns become its staple diet until onset of hibernation.

It is obvious that the dormouse integrates its diet with other animal and vegetable foods which it comes across occasionally; we have seen that it enjoys the unripe fruits of Cupressus sempervirens, Taxodium mucronatum, Malus communis, Crataegus oxyacantha, Rubus fruticosus which are all fairly common in this forest. We have also found repeatedly in their stomachs the remains of large insects (Orthoptera, Coleoptera) and Ghasteropod Mollusca (Helicidae), not to mention birds' eggs and nestlings.

Careful observations on the trophic behavior of this species has permitted us above all to obtain evidence about some aspects which have proved to be extremely useful in developing the techniques for controlling this pest.

One of these is the dormouse's marked tendency to gregariousness in the second part of the summer, in correspondence to the fructification of the oaks and ilex. In fact those plants in the forest which bear the most fruit become at the moment of fructification irresistably attractive to dormice, which converge on them, at night-time, in hordes from all directions. These concentrations obviously lead to a rapid exhaustion of the fruits of one or more plants close to one another, thus causing the animals to move on to new feeding grounds in the forest.

4. Reproduction and Fertility.

Figure 1 also indicates the period when pregnant females and newborn litters are present in the forest of Migliarino. The relative data refer to the years 1971-1977 and are the result of direct examination of 1850 adult females and of all the young captured in their natural nests.

We found the first pregnant females in the last days of June. Their numbers increase until they reach a peak in the first ten days of August. The quantity of gravid females decreases from then on, but they are still present through September and, sometimes, in the first days of October.

From observations carried out in the natural conditions, pregnancy would seem to last about 29-30 days, and the number of young per litter ranges from 4 to 7, with a minimum of 2 and a maximum of 11.

Some interesting aspects of behavior which influenced our decision as to the choice of techniques for dormouse control, described below, were discovered in this case. We in fact observed that when nesting sites are limited, two or sometimes even three females may share a nest and raise their young together. We found quite large mixed groups of young in these communal nests (up to 24 at one time).

It also became apparent that the females are able, when disturbed, to transfer their litter quickly, at night-time, to a safer place.

CONTROL METHODS

The techniques developed and experimented to control dormice in the forest of Migliarino are essentially three in number and only applicable when the species is active.

1. Capture in Natural Nests.

This method was essentially devised at the beginning of the Century (Biondi and Righini, 1910) and was exclusively to capture animals for human consumption. It exploits a particular behavior pattern of this species, which is its marked tendency to seek shelter and build nests inside cavities in tree trunks and to hide in the darkest part thereof when molested during the daylight hours.

One person alone is able to carry out all the following operations:

1. Reach the entrance hole of the cavity (by means of a ladder and spiked shoes);

2. Block the hole and other secondary ones with rags;

3. Insert a piece of rag impregnated with burning sulphur and tied on the end of tempered steel wire (this is called "lance" and its high ductility makes it easy to shape as required). The sulphur dioxide liberated from the burning sulphur rapidly makes the animals sluggish;

4. Extract the animals' bodies using the opposite end of the lance which is shaped into a hook.

This method has been applied for seven years now (1971-1978). Each year three workmen have worked 1000 ha each. In view of the fact, already mentioned, that dormice tend to move in great numbers from one area of the forest to another, where food is abundant, each worker chose from time to time which area to work in, within his zone, thus concentrating his efforts to where animals were feeding.

Working alone, he would find the nests, and inspect them regularly about once every twenty days, since it has been found that the nests, once free, are soon re-occupied by other dormice, which are usually pregnant females or females with new-born young.

In our experience over these years we have found that each worker manages to visit on an average 22 nests in the space of an 8-hour working day.

In the last two years (1976 and 1977), to augment the results, the management of the forest of Migliarino has instituted a bounty for the workers, a sum of money based on the number of specimens captured by them.

Results of seven years' trials are reported in Table 2.

Table 2. Results of direct manual capture of Glis glis L. in natural nests of Migliarino Forest.

Year	Trial period	No of captured specimens					
		Young	%	Sub-ad. and ad.	%	Total	%
1971	I.V - 31.X	657	16.77	3261	83.23	3918	13.33
1972	20.VII - 5.XI	3478	65.17	1859	34.83	5337	18.16
1973	17.VII - 20.X	200	10.47	1711	89.53	1911	6.50
1974	1.VII - 30.XI	3525	58.09	2543	41.91	6068	20.64
1975	16.VII - 4.X	1314	43.24	1725	56.76	3039	10.34
1976	5.VII - 28.X	2668	48.55	2827	51.45	5495	18.69
1977	18.VII - 24.X	1242	34.25	2384	65.75	3626	12.34
7	26 months	13,084	44.51	16,310	55.49	29,394	99.99

Although this method is empirical, when it is effectuated systematically, with suitable rotation, it gives very valid results. It also offers the possibility of eliminating a high percentage of the pregnant females and newborn young.

2. Trapping with Artificial Nests.

This method was developed through observation of the fact that dormice have a marked tendency to seek refuge, during the daylight hours, in the natural and artificial cavities available. On the basis of analogous observations, Heim De Balsac (1927) suggests traps for catching dormice. De Rosa (1959) suggests use of similar means to eliminate this pest from nut-groves in southern Italy.

Developing this concept, we designed simple wooden rectangular boxes (46x18x18 cm) provided, at one end, with a circular entrance hole (Ø 6 cm) and, at the other, a sliding closure for inspection and specimen removal. The entrance hole is surrounded, on the inside, by a funnel-shaped ring of steel strips, sharpened at their extremity, to impede any animals escaping (Fig. 2). These artificial nests are fixed to fruit-bearing trees (ilex or oak), at the height of four meters (10 or 13 feet), if possible at the junction of branches and trunk. Dormice which come from nearby to feed on these plants at the dusk, once the night's activity is over, tend to remain where they have eaten. It therefore often happens that they enter these artificial holes placed in the same plants or near-by ones.

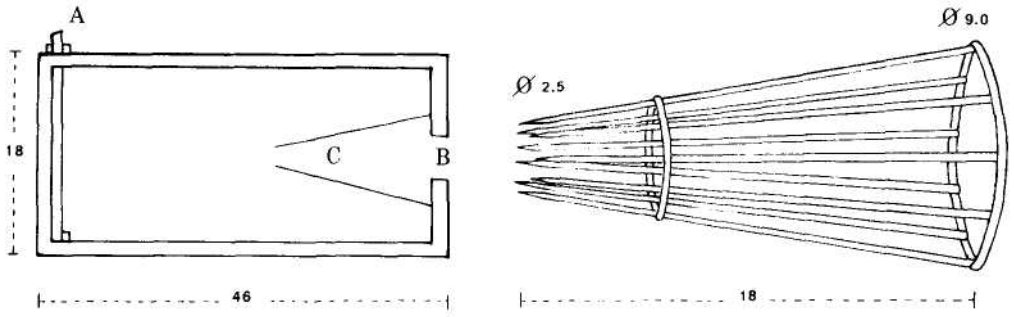

Figure 2. Left: longitudinal schematic section of an artificial nest for dormouse capture; A, sliding closure for specimen removal; B, circular entry hole (Ø 6); C, device preventing animal from re-exit. Right: detailed drawing of the same device as in C. All reported dimensions are in cm.

These trials were begun in 1974, in a small area of the forest at a time (100 ha), over a period of three months from August to November when the dormice prefer to eat acorns rather than pine-cones and they gather in large numbers in oaks and ilex.

We used 100 artificial nests, placing one in every hectare, moving them three times to a complete different zone. Periodic inspection and fixing the nest in place required the work of four people.

Analogous trials were carried out in 1975, with far better results (Table 3). This time we placed the same number of nests, but 8 to 10 per hectare, where the abundant remains of dormice feeding indicated greatest concentration of specimens.

Table 3. Results of trapping with artificial nests against Glis glis L. in Migliarino Forest.

Year	Trial period	No captured specimens					
		Males	%	Females	%	Total	%
1974	1.VIII - 30.X	808	53.16	712	46.84	1520	38.66
1975	1.VIII - 30.X	1272	52.74	1140	47.26	2412	61.34
2	Six months	2080	52.90	1852	47.10	3932	100

3. Poisoning with Chiorophacinone Baits.

In developing a technique for poisoning the population of Glis glis we used an anticoagulant, chlorophacinone.

We decided on this compound for two reasons. One, it has already proved effective against other species of wild rodents close to edible dormouse (Giban, 1973), and the other, that it seemed opportune to have some indications, if only incomplete, as to the dormouse's susceptibility to this rodenticide.

Before setting up tests in the forest, we carried some out in the laboratory on a small number of animals. Twenty dormice (10 males and 10 females) were captured in four successive phases (in groups of 5 at a time) during the summer and autumn of 1975 in the forest of Migliarino. They were kept in single cages (50x50x30 cm) and fed with de-husked pine seeds. After a 15 day acclimatization period, they were offered for a 10-hour nocturnal period (from 8 p.m. to 6 a.m.) pine seeds treated with chlorophacinone (0.005% in paraffin oil) and water ad libitum. After the treatment period they were once more given normal pine seeds and kept until death.

The results are in Table 4 and substantiate that the species is highly sensitive to chlorophacinone. In 4.5 days on an average, 100% mortality was brought about.

This product also caused death in dormouse with a minimal consumption of bait as has been reported for other species of rodents (Rowe et al., 1968).

Bearing this in mind we proceeded to carry out trials in forest conditions during the summer of 1976 (August 1 to September 31). We chose two pilot areas of 80 ha each, both heavily infested by dormice. The bait (de-husked pine seeds with 0.005% chlorophacinone in paraffin oil and red coloring added) was laid down for the animals in special bait-stations. A wooden box with a wide slit opening for access and a removable roof for re-filling (Fig. 3) was used. They were attached 4-5 m from the ground to trunks and branches of trees at a density of 1-2 per ha. Initially each bait-station was provided with 2 kg bait and inspected and re-filled every two days, until no more was consumed.

This experiment, although limited in extension, gave us interesting information on the behavior of the dormouse. It is amazing how quickly the animals find the bait, even at the great distance, through their very acute sense of smell and how willingly many of them accept it. This fact is important since it lets us avoid pre-baiting techniques when controlling the dormouse pest with poisoned bait.

Bait consumption was intense in the three nights following the first distribution, even when natural food was plentifully available, falling off rapidly and ceasing altogether on about the 10th day.

Four days after treatment the area directly involved and those surrounding were systematically searched for the bodies of poisoned animals. A high number of dead and dying specimens (255 in all) were found on the fifth day onwards, both on the ground and on the branches of the trees, but never inside the nests.

Not having at our disposition a method for evaluating the dormouse population before treatment and after, we cannot quantify our results exactly.

No adverse incidents involving protected species occurred. However, there is a risk, not to be undervaluated, that needs to be looked into. The consequences of bodies of poisoned animals lying around, which may be devoured by other species living in the same environment is an unknown quantity of great proportions.

Table 4. Bait consumption and days to death in Glis glis L. given a sole diet of 0.005% chlorophacinone in pine-seeds/paraffin oil for one night (10 hours).

Specimens			Night of test (1975)	Amount of consumed bait (g)	Number of days to death
No	Sex	Weight (g)			
1	M	195	10-11 August	2.100	3
2	M	185	"	1.950	3
3	F	190	"	2.150	4
4	F	185	"	2.125	4
5	M	180		2.200	3
6	M	175	5-6 September	2.000	3
7	M	180		2.150	4
8	F	185	"	2.300	5
9	F	180	"	2.185	3
10	M	175	"	2.125	4
11	F	200	25-26 September	2.300	4
12	F	205	"	2.450	3
13	M	190	"	2.050	4
14	M	230	"	2.255	4
15	F	235		2.345	5
16	F	290	5-6 October	2.825	9
17	F	285		2.605	4
18	M	255	"	2.425	6
19	F	250		2.900	10
20	M	290	"	2.210	6
Average		213		2.282	4.55
Standard Deviation		40.44		0.253	1.93

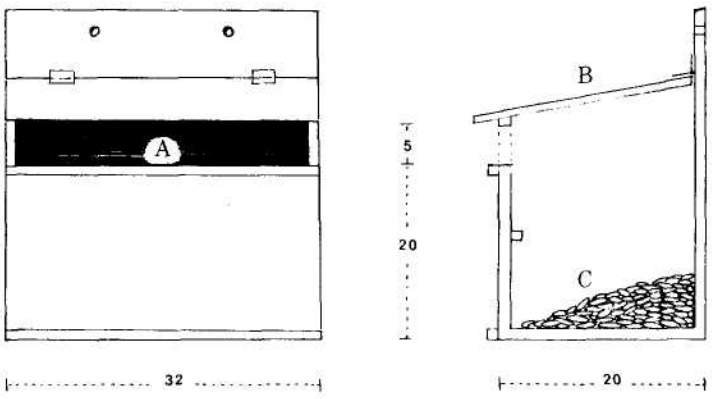

Figure 3. Special bait-station for Glis glis L. A, slit opening for dormouse access; B, removable roof for inspection and bait supply; C, bait-position. All reported dimensions are in cm.

CONCLUSION

We may assume, given the results of these first experiments, that the dormouse population may effectively be controlled, when the occasion arises, in different ways. The suitability of this or that method, or combination of methods, will depend on the requirements of the particular situation in hand.

The first method is by direct capture in natural refuges and enables us to reduce a population's density through systematic elimination of a high number of pregnant females and newborn dormice.

A useful alternative to the previous method is offered by artificial nests, as and where, for environmental or organizational reasons, it is not practicable. It also allows for a more rational organization of the work, which may thus be confined to those areas of the forest which, being richer in food, attract a greater number of specimens.

The use of chlorophacinone baits seems to be particularly interesting and promising in the field of chemical control. The high sensitiveness of dormice to this anticoagulant and their readiness and eagerness to consume bait treated with it is very encouraging.

LITERATURE CITED

BAZZEA, A. 1966. I nostri boschi hanno un tenace nemico. Vicenza Econ. XXI (2):104-106.

BIONDI, L. and E. RIGHINI. 1910. II pino da pinoli (U. Hoeply Ed.). Milano, p. 97-101.

DE ROSA, M. 1959. Ghiri, Moscardini e Nitele. Informatore Agrario XV, p. 1219.

HEIM DE BALSAC, H. 1927. Les nichoirs artificiels adoptes par certains micromammiferes. Rev. Francaise de Mammalogie, Paris, I:45-46.

ROWE, F.P. and REDFERN. 1968. Laboratory studies of toxicity of anticoagulant rodenticides to wild mice (Mus musculus L.). Ann. Appl. Biol. 61(2):322-326.