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CONTROL OF THE HOUSE MOUSE (*Mus musculus* L.) IN THE NETHERLANDS

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ABSTRACT: Rodent control is carried out by local authorities, extermination companies or the owners of infested premises. The control of the house mouse, especially in food-handling establishments, is a problem that has existed for some years. Testing in the laboratory indicates a warfarin resistance although the application of new rodenticides like bromadiolone, calciferol and difenacoum has given good results. A "manual" for the control of suspected warfarin resistant house mice is given.

INTRODUCTION

The Department of Pest Control works under the jurisdiction of the Ministry of Health and Environmental Protection and gives information and on-the-spot advice on the control of rodents and arthropods (insects and mites). The control of rodents in the Netherlands is carried out by municipal services, extermination companies and private citizens. The number of control actions, carried out by municipal services was approximately 123,000 in 1975, 13,000 of which were directed towards the house mouse. During the last few years the number of complaints regarding the house mouse has increased alarmingly, especially in food stores, restaurants and homes for the aged, etc. where one is confronted with both damage and annoyance.

RODENTICIDES REGISTERED FOR HOUSE MOUSE CONTROL

Acute Rodenticides

Crimidin (2-chloro-4-dimethylamino-6-methylpyrimidin), thallium sulfate and zinc phosphide give poor results and are not allowed in areas where food is stored. Only alphachloralose can be used successfully in premises with low temperature conditions (less than 12°C).

Chronic Rodenticides (Anticoagulants)

Anticoagulants are mostly used by control operations, perhaps to a total of 95% in all cases. Besides warfarin and chlorophacinone, cumatetralyl and pyranocoumarin are also used. Anticoagulants are registered in the form of "read-to-use" baits, powders or contact dusts.

Warfarin Resistance

During the last few years, the number of complaints about the problems of control have increased. The unprofessional application of warfarin will stimulate this increase. A number of mice were caught, from various locations, and investigated for their susceptibility to warfarin at the Laboratory of the Dutch Plant Protection Service. The results of these tests are shown in Table 1.

Table 1. Laboratory tests on warfarin resistant house mice, the mice feed 21 days on baits containing 0.025% warfarin or 0.00625% chlorophacinone.

Location	Tested on	Number of mice	Number of death	Death occurred after.....days	Survivors	Remarks
Zoetermeer	Warf.	9	0	--	9	--
Control	Warf.	9	9	4, 6 (6), 7, 11	0	--
Maarsse	Warf.	10	3	5, 6, 18	7	5 survivors tested on chlorophacinone
Maarsse	Chloroph.	5	5	4, 8, 9, 10, 11	0	--
Amsterdam	Chloroph.	7	4	10, 10, 12, 22	3	0.005% chloroph.

House mice died on a diet containing 0.00625% chlorophacinone after surviving previous tests with warfarin. In the field the same phenomenon was observed, namely the fact that after a long period of control with warfarin the house mouse could ultimately be exterminated with chlorophacinone.

NEW RODENTICIDES

After a long period of time some new rodenticides were officially offered for registration in the Netherlands. Approval is anticipated in the near future. One of the new rodenticides is calciferol (vitamin D₂) for use against house mice. In England, and especially in the London area, the local authorities are quite enthusiastic about the efficacy of this vitamin, as the number of complaints concerning house mice decreased enormously. Used at a concentration of 0.1% in baits, it is very well

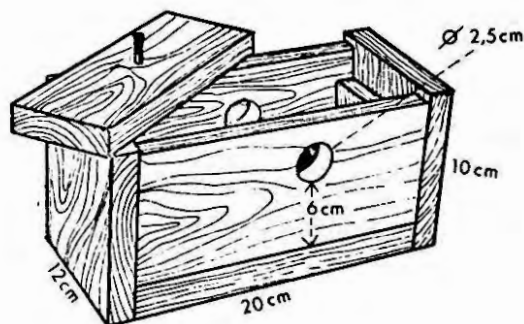
accepted by the mice. Baits are, for instance, dehusked oats or dehusked canary grass seeds, which are easily impregnated (1:40) by the vegetable oil containing 4% calciferol. Warfarin resistant house mice were also killed by this product. Investigations in Denmark and England indicate the good rodenticidal properties of calciferol (Lund, 1977; Rowe *et al.*, 1974).

A new anticoagulant rodenticide is a compound named bromadiolone. Our first experiment in the field (house mice in a food store house) was rather encouraging and we will certainly do further testing. In the United States bromadiolone is considered to be a most promising controlling agent (Marsh, 1977).

Another new anticoagulant rodenticide is difenacoum, registered in the Netherlands in February 1978 under the trade name Ratak: a ready to use bait containing 0.005% a.i. In England it is marketed in some other formulations. Difenacoum has been found to be a valuable rodenticide against warfarin resistant house mice in laboratory tests in England, U.S.A. and Denmark (Bull, 1976; Hadler *et al.*, 1975; Lund, 1977). Tests carried out in the laboratory of the Dutch Plant Protection Service indicate the efficacy of Ratak (100% mortality; after 4 days of ingestion, death occurred after 7 days). In the field trials (food store houses) the acceptance of the bait was excellent and resulted in a 100% mortality.

HOW TO DEAL WITH CASES OF SUSPECTED WARFARIN RESISTANT HOUSE MICE IN FOOD-HANDLING ESTABLISHMENTS

1. Determine the presence of mice and the location where they eat or hide.
2. Estimate roughly the number of house mice.
3. Determine the kind of untreated baits that the mice might prefer over other available food, e.g. freshly dehusked oats or canary grass seeds. Do not use any grain of poor quality. Always use bait boxes (see design below).



4. Set out the chosen poisoned bait (50 grams per bait box) in as many places as necessary. In the Netherlands the preference is given to the use of chlorophacinone (mix 1:40 with 1% powdered sugar added) or the use of difenacoum which has just recently been registered.

5. Check the next days the amount of bait taken by the mice and if necessary replenish the supply after removing the old bait. Mice do not like contaminated baits.

6. During a period of 2 or 3 weeks control the intake of food and thus the presence of mice.

7. When the population of mice is eradicated fill some of the bait boxes with fresh unpoisoned bait and check the amount of bait eaten by mice (if any).

8. Give all the information needed to make the premises mouse-proof and let the owner or manager be attent to mice permanently.

However, even if the best control measures are taken, the best mouse-proofing is done, and the best sanitation precautions are taken, we will probably never completely and forever get rid of this smart rodent, the house mouse (Marsh and Howard, 1977).

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