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Laboratory evaluation of anticoagulant treated baits against Indian field mouse, *Mus booduga* Gray

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Abstract. The toxicity of warfarin (0·025%), bromadiolone (0·005%) and brodifacoum (0·005%) to the Indian field mouse, *Mus booduga* Gray was determined. A single feeding of bromadiolone or brodifacoum resulted in 83% mortality, while the same mortality was obtained with warfarin only after 6 days of continuous feeding. A single day feeding of a single dose chronic poison was effective against *M. booduga* than multiple dose chronic rodenticide.

Keywords. *M. booduga*; no-choice tests; mortality; susceptibility; warfarin; second generation anticoagulants; bromadiolone; brodifacoum.

1. Introduction

The Indian field mouse, *Mus booduga* Gray is a predominant rodent pest in irrigated lands nesting in shallow burrows with single or branched tunnels, particularly in South India and causes damage to paddy, ragi, sorghum, sugarcane and chillies at seedling, growth and harvest stages (Chandrahas 1974; Purushotham and Mohana Rao 1979). In Andhra Pradesh it breeds from August to February with a gap in summer months (Mohana Rao 1980). The field mice can be controlled either by placing baits such as cracked rice or bajra with 1% groundnut oil treated with 1–2% zinc phosphide or by using 0·025% warfarin or fumarin in the preferred bait. Of late the second generation anticoagulants emerged in view of the bait shyness developed with zinc phosphide and resistance with warfarin by a number of rodents. However, the use or value of rodenticides against *M. booduga* can be assessed basing on data from laboratory and field investigations. The present study aimed at evaluating the two second generation anticoagulants along with the warfarin (rodafarin 'C'), helps to make good the deficiency.

2. Materials and methods

Mice captured around Tirupati (Andhra Pradesh) were acclimatised to laboratory conditions for 2 weeks by maintaining them individually on food (Mohana Rao *et al* 1978) and water *ad libitum*. Experimental groups consisted of equal number of males and females.

The mice were provided with anticoagulant treated baits for 1, 2 and 3 days in case of second generation anticoagulants; 2, 4 and 6 days for warfarin separately. Daily intake of poisoned bait was recorded by offering freshly prepared bait every day, besides

noting down the day of mortality of the animal. The mortality due to poison was confirmed by autopsy and signs of anticoagulant poisoning.

Technical grade bromadiolone (1%) and brodifacoum (0·25%) were mixed with cracked bajra (*Pennisetum typhoides*) to give 0·005% concentration. Warfarin (0·5% technical grade) was mixed with the bait to give 0·025% concentration. The methods provisionally recommended by WHO (1976) were followed for determining the susceptibility of rodents to anticoagulant rodenticides.

3. Results

Data on the no choice tests with two anticoagulants *viz*, bromadiolone and brodifacoum (tables 1 and 2) show that both these poisons caused complete mortality within two weeks. A single feeding of bromadiolone and brodifacoum mixed baits resulted in 83% mortality; while 100% mortality was obtained after two and three feedings respectively. Warfarin is the least effective giving 83% kill after 6 days of continuous feeding (table 3). The mean days taken for causing 83% mortality using bromadiolone, brodifacoum (in single dose) and warfarin (in multiple dose) was 9·2, 9·4 and 8·6 days respectively. Mortality occurred after day 3, on consumption of bait containing either bromadiolone or brodifacoum, whereas, death occurred only after day 5 when fed on warfarin treated bait. Bait intake in no-choice tests was high up to 4–5 days which later declined possibly due to the development of symptoms of anticoagulant poisoning. In case of all the three rodenticides, increase in the number of feedings resulted in the lowering of the time taken to die.

4. Discussion

A single day feeding of second generation anticoagulants resulted in 83% mortality (in 9 days) in *M. booduga*. Mathur and Prakash (1980) noted 66% mortality (in 7·6 days) in *Funambulus pennanti* with a single feeding of brodifacoum mixed bait. The combined sex mortality for brodifacoum (in 6·25 days) on *Gerbillus gleadowi* was 50% (Soni and Prakash 1981). A similar study by Renapurkar and Kamath (1982) revealed 75, 80 and 100% mortality (in 10 days) for *Rattus rattus*, *R. norvegicus* and *Bandicota bengalensis*. Fifty and 35% mortality (in 7·4 and 5·6 days) were obtained from a single feeding of 0·002% brodifacoum and 0·005% bromadiolone respectively in cotton rat, *Sigmodon hispidus* (Gill and Redfern 1980). Meehan (1978) reported 100% mortality (in 6·8 days) in *R. norvegicus*. The mortality (83% in a single dose) seen in *M. booduga* using bromadiolone and brodifacoum indicate that these chemicals are effective in single dose against test species. Since there is no appreciable attenuation, in the time taken for death between 1 and 2 feeding periods and since the maximum mortality was evidenced in single dose feeding itself, control of *M. booduga* with single day feeding of either of these two poisons may be expected in the crop fields. Although the average time to elicit 83% mortality for all the three poisons was around 9 days, the use of single dose anticoagulants saves a lot of bait material and the manual operations involved as against the warfarin, a multiple dose poison.

The evaluation of warfarin against *R. rattus* (Agarwal *et al* 1979); *R. argentiventer* (Buckle *et al* 1980); *B. bengalensis* (Brooks *et al* 1980); and a variety of desert rodents (Mathur and Prakash 1981) has been made. The range and mean days to death using

Table 1. Toxicity of 0·005% bromadiolone to Indian field mouse, *Mus booduga* Gray.

Feeding period (days)	Body weight (g) Mean ± SD	Poison bait consumed (g) Mean ± SD		Bromadiolone consumed (mg/kg) Mean ± SD		Mortality	Days to death	
		Dead	Survived	Dead	Survived		Mean	Range
1	9·78 ± 0·6	2·23 ± 0·19	1·70	11·39 ± 1·36 (10·26–13·77)	8·09	5/6	9·20 ± 4·86	6–17
2	11·41 ± 1·6	3·62 ± 1·48	2·90	15·74 ± 6·00 (11·03–25·87)	13·06	5/6	7·60 ± 4·21	5–15
3	11·00 ± 1·0	6·80 ± 1·22	—	31·31 ± 7·59 (24·44–43·93)	—	6/6	7·00 ± 3·63	4–14

Table 2. Toxicity of 0·005% brodifacoum to Indian field mouse, *Mus booduga* Gray.

Feeding period (days)	Body weight (g) Mean ± SD	Poison bait consumed (g) Mean ± SD		Brodifacoum consumed (mg/kg) Mean ± SD		Mortality	Days to death	
		Dead	Survived	Dead	Survived		Mean	Range
1	8·49 ± 0·28	1·72 ± 0·26	1·50	10·22 ± 1·58 (8·43–12·12)	8·42	5/6	9·40 ± 3·04	6–14
2	10·40 ± 0·77	4·90 ± 0·38	—	23·92 ± 3·33 (21·26–30·00)	—	6/6	7·00 ± 3·43	5–13
3	10·75 ± 1·40	5·78 ± 1·48	—	27·20 ± 7·38 (17·03–37·14)	—	6/6	6·66 ± 3·44	4–13

Table 3. Toxicity of 0·025% warfarin to Indian field mouse, *Mus booduga* Gray.

Feeding period (days)	Body weight (g) Mean ± SD	Poison bait consumed (g) Mean ± SD		Warfarin consumed (mg/kg) Mean ± SD		Mortality	Days to death	
		Dead	Survived	Dead	Survived		Mean	Range
2	9·92 ± 1·05	5·15 ± 0·22	4·73 ± 2·08	126·51 ± 9·26 (115·88–132·90)	124·40 ± 17·20 (104·65–136·11)	3/6	11·3 ± 4·04	7–15
4	9·89 ± 0·56	8·25 ± 0·68	7·37 ± 0·32	208·39 ± 22·62 (176·61–228·64)	188·09 ± 4·04 (185·23–190·95)	4/6	9·0 ± 4·69	6–16
6	10·09 ± 1·27	10·38 ± 0·95	10·50	266·86 ± 27·12 (232·91–297·75)	246·47	5/6	8·6 ± 1·95	6–11

warfarin in *M. booduga* can be comparable to the other species. In 2, 4 and 6 days feeding of warfarin, mortality started from day 6 and lasted up to day 16 and the maximum kill occurred between 6 and 10 days. Similar mortality rates were noted for bromadiolone and brodifacoum when used for 1 day only (tables 1 and 2). Comparing susceptibility of warfarin to *M. booduga* with other species, it is revealed that they are less susceptible than *Tatera indica, Meriones hurrianae* (Mathur and Prakash 1982) and *B. bengalensis* (Sridhara 1979; Brooks and Bowerman 1974). Thus it can be concluded that 0·005% bromadiolone and brodifacoum is more toxic and active against *M. booduga* than warfarin, giving a satisfactory mortality with single day feeding period.

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