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Evaluation of Toxicity and Acceptability of Difethialone Treated Baits in Indian Desert Gerbil, *Meriones hurrianae* Jerdon

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ABSTRACT

Difethialone, a second generation anticoagulant rodenticide was assessed for its susceptibility and acceptance in baits against *Meriones hurrianae*. Fresh loose bait containing difethialone (25 ppm) prepared in pearl millet grain resulted in 100 per cent mortality during no-choice test in one day feeding. Mean period to death was 5.90 days with an average poison intake of 1.17 $\pm$ 0.09 mg/kg/day. Poison bait acceptability was fairly good as observed by non-significant differences in the consumption pattern of poisoned and plain bait in choice test. Single day exposure of difethialone (0.0025%) accounted for 70 per cent mortality of test animals from 5 to 11 days (Av. 7.86), whereas, two days exposure yielded 90 per cent mortality in choice test. The compound did not induce bait shyness in the surviving test animals. The death of the gerbils was due to excessive bleeding through nose, anal aperture and ears. These trials revealed that difethialone is a potent rodenticide for containing this predominant rodent species inhabiting the Indian arid agro-ecosystem.

INTRODUCTION

Indian desert gerbil, *Meriones hurrianae* (Jerdon) is one of the most predominant rodent species and constitutes around 60 per cent of the rodent population in the Thar Desert (Tripathi *et al.*, 1992). Present day rodent management technology is mainly based on use of an acute rodenticide, zinc phosphide. This acute poison has a serious drawback of inducing poison aversion and bait shyness among gerbils (Prakash and Jain, 1971), thus limiting the repeated use of zinc phosphide for some time. Moreover, at least 2-3 days of pre-baiting is essentially required for using acute poisons.

With the advent of second-generation anticoagulants, which are very effective as single dose, many compounds viz., brodifacoum, bromodiolone and flocuomafen have been evaluated against desert rodents. These have shown great potential as rodenticides at 0.005 per cent a.i. in baits against the predominant rodent pest species of arid region (Mathur and Prakash, 1981 a and b; AICRP RC, 1986; and Jain *et al.*, 1991). Difethialone another anticoagulant rodenticide of the same series, has also proved its potency against a number of rodent pests. However, such information is lacking on *M. hurrianae*. In the present study, the susceptibility and acceptability of difethialone ([(Bromo-4'- [biphenyle-1-1'] -yl-4)-3-tetrahydro-1,2,3,4-naphthyl-1]-3-hydroxy-4-2H-1-bentothiopyran-one-2) have been evaluated against *M. hurrianae*.

MATERIAL AND METHODS

The experimental desert gerbils, *M. hurrianae* were live trapped from crop fields and grasslands near Jodhpur (Lat. 26°18' N and Long. 73°1' E). These animals had no prior experience of

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feeding on any anticoagulant or toxic poison. After capture, the gerbils were sexed, weighed and lodged individually in wire mesh cages for acclimatization in laboratory for two weeks prior to initiation of experiment. Following the guidelines of EPPO (1975) the sub-adults, sick animals and pregnant females were discarded. Equal number of males and females (5 each) of uniform body weight were selected for the study.

The trials were conducted as per the standard procedure following Prakash and Mathur (1981) and Jain *et al.* (1991). For achieving the desired test concentration of 0.0025 per cent, difethialone premix (0.125% a.i. concentrate) was mixed with whole pearl millet grain (*Pennisetum typhoides*). In no-choice tests, only poisoned food was provided for 24 h, whereas, in the choice tests, an alternate un-poisoned bait (same food in which test poison was given) was provided in a separate container. Water was provided to experimental animals *ad libitum*. After the completion of feeding period the treated rodents were fed on laboratory diet for one month and symptoms of poisoning and time to death were observed. Consumption of plain and poison bait was also recorded to work out pre- and post-treatment feeding pattern of test gerbils. The active ingredient of difethialone ingested by the test animals was worked out on the basis of poison bait consumption.

RESULTS AND DISCUSSION

No choice tests: Difethialone (0.0025%) showed high potency in killing 100 per cent test gerbils in one day exposure under no choice conditions. The consumption of the poison bait and the resultant active ingredient intake of the test anticoagulant were 4.64±0.39 g and 1.17±0.09 mg kg^{-1}, respectively. Gerbils started dying on 4th day of treatment and mortality continued up to 10th day (Av. 5.90 day). The maximum number of deaths occurred between 5 and 7 days. The mean days to death for females was shorter (4.8 days) than those of males (6.6 days); this might be due to higher intake of the active ingredient by females (1.22 mg kg^{-1}) than males (1.12 mg kg^{-1}) (Table 1). However, there was no significant difference in the toxicity data of both sexes. The post-treatment feeding pattern of the test animals showed a steep decline of food intake (Fig. 1). The dead gerbils recorded excessive bleeding through nose, anus and mouth, confirming the anticoagulant toxicity of difethialone.

Table 1. Toxicity, bait acceptability and mortality of *M. hurrianae* after feeding on difethialone (0.0025%) treated pearl millet bait

Mean body weight (g)	Feeding period (days)	Bait consumption (g/100g body weight) Mean ± SE		Poison ingested mg/kg	Mortality (%)	Days to death	
		Poison bait(I)	Plain bait (II)	Mean ± SE		Mean ± SE	Range
A. No choice							
105 ± 3.57	One	4.64 ± 0.34	-	1.17 ± 0.29	100	5.9 ± 0.57	4-10
B. Choice							
96.6 ± 6.00	One	3.87 ± 0.47*	4.07 ± 0.71*	0.75 ± 0.14	70	7.86 ± 0.92	5-11
88.78 ± 3.24	Two	4.64 ± 0.59*	5.74 ± 0.43*	1.16 ± 0.14	90	7.44 ± 0.95	4-13

Choice tests: In comparison to no-choice tests, mortality of merion gerbils decreased to 70 per cent in choice test, when exposed to freshly prepared loose bait of defethialone (0.0025%) for one day. This may be due to availability of an alternate plain food leading to reduced consumption of poison bait (3.87 g) in choice test than that of no-choice test (4.64 g). However, when the feeding period was increased to two days the consumption was also increased. This resulted in increased intake of a.i of poison yielded 90 per cent mortality of test gerbils. The death period ranged between 4 and 13 days (Av. 7.44 days). The consumption of plain bait and difethialone treated bait was significantly at par under both the treatment periods, indicating that the anticoagulant bait was fairly well acceptable and

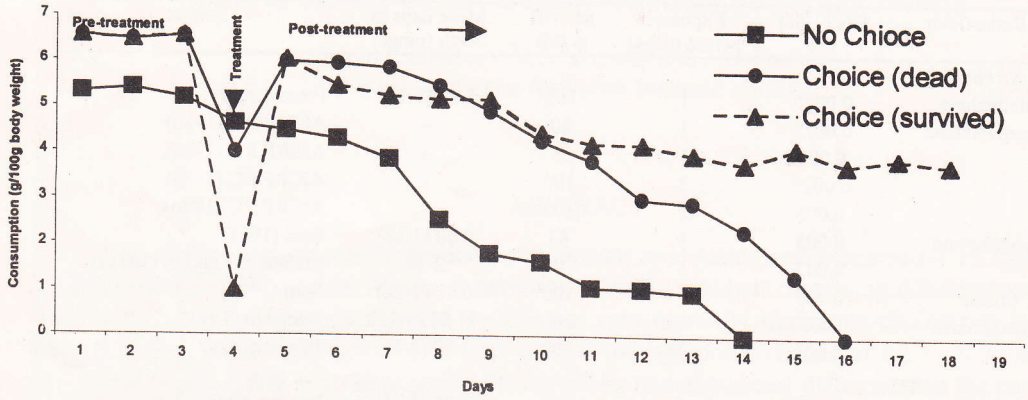

Fig 1. Feeding pattern (pre and post-treatment) of *M. hurrianae* due to difethialone (0.0025%) poison baiting for one day exposure

palatable to the desert gerbil (Table 1). In general, the death period was slightly extended (5-11, Av. 6.3 days) in the choice test. Like no-choice test, no significant variation was noticed in the toxicity data between both the sexes in this experiment also.

No information is available on toxicity of difethialone to *M. hurrianae* except the report of Saxena *et al.* (1992) which revealed cent per cent kill of these gerbils in choice and no-choice tests with difethialone 0.025 per cent. This dose was ten times higher than the dose tried in the present study. Perusal of literature on other rodent species indicated that present findings are in line with the observations made earlier by Kumar *et al.* (1996) and Kumar and Shylesha (1997), where the authors have reported 100 per cent kill of *Bandicota bengalensis* and *Mus musculus* in one day exposure of difethialone (0.0025%) in no-choice.

The other second generation anticoagulants *viz.*, brodifacoum and bromadiolone at (0.002 and 0.005 per cent), respectively, required at least three days feeding for cent per cent kill of merion gerbils (Mathur and Prakash, 1981a; AICRP RC 1986 and Jain and Tripathi, 1988). Single day exposure of bromadiolone in no-choice test yielded 80 and 88 per cent mortality of desert gerbil at 0.0025 and 0.005 per cent respectively (AICRP RC 1986). Similarly brodifacoum (0.005%) resulted in 83per cent mortality of this species after single day exposure in no-choice tests (Soni, 1981). However, in choice tests three days feeding was required for achieving effective mortality. Flocoumafen, another potent anticoagulant rodenticide of the same generation, recorded cent per cent mortality of *M. hurrianae* at 0.0025 and 0.005 per cent conc. in no-choice tests, however, the lower concentration (0.0025%) needed 8-17 days for such results as compared to 5-12 days at higher concentration (0.005%) (Jain *et al.*, 1991). Thus all the three anticoagulant rodenticides of present generation are effective at 0.005 per cent conc. in baits, whereas, in the present study difethialone had shown similar toxicity at 0.0025 per cent concentration (Table 2). On the contrary, the first generation anticoagulants such as, chlorofacinone, coumatetraly, warfarin and fumarin required much longer feeding period (7 days) for effective kill of desert gerbils (Mathur and Prakash, 1981b).

Thus the present findings prove that difethialone is a fairly palatable rodenticide and also superior to other existing second generation anticoagulants in managing the menace of Indian desert gerbils.

Table 2. Comparative efficacy of second-generation anticoagulants against *M. hurrianae*

Rodenticide	Conc. (%)	Exposure period (days)	Mortality (%)	Mean days to death (range)	Source
A. No choice					
Difethialone	0.0025	1	100	5.90 (4-10)	Present study
Bromadiolone	0.0025	1	80	-	AICRP RC (1986)
	0.005	1	88	-	AICRP RC (1986)
	0.0025	3	100	-	AICRP RC (1986)
	0.005	3	100	-	AICRP RC (1986)
Brodifacoum	0.005	1	83	8.00 (3-12)	Soni (1981)
	0.002	3	100	2-14	Mathur & Prakash (1981a)
B. Choice	0.005	3	100	6.60 (4-12)	Soni (1981)
Flocoumafen	0.0025	1	100	11.37 (8-17)	Jain *et al* (1991)
	0.005	1	100	7.60 (5-12)	Jain *et al* (1991)
Difethialone	0.0025	1	70	7.86 (5-11)	Present study
	0.0025	2	90	7.44(4-13)	Present study
Bromadiolone	0.005	3	80	-	AICRP RC (1986)
Brodifacoum	0.002	3	100	7.70	Mathur & Prakash(1981a)
	0.005	3	100	9.20	Mathur & Prakash(1981a)
Flocoumafen	0.0025	1	87.5	15.5 (13-22)	Jain *et al.*(1991)
	0.005	1	60.0	7.83 (5-13)	Jain *et al.* (1991)

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