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Efficacy of three anticoagulant rodenticides against Rattus rattus and *Meriones libycus* under laboratory conditions

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Abstract

Three anticoagulant rodenticides were used against *Rattus rattus* and *Meriones libycus* in choice and no choice feeding tests under laboratory conditions. In choice feeding tests, brodifacoum (0.005%) and chlorophacinone (0.005%) were more effective ($P<0.05$) than coumatetrahyl (0.0375%) against *R. rattus*. Brodifacoum (0.005%) and coumatetrahyl (0.0375%) were more effective ($P<0.05$) than chlorophacinone (0.005 %) against *M. libycus*. In no choice feeding tests, coumatetrahyl (0.0375%) and brodifacoum (0.005%) were more effective than chlorophacinone (0.005%) against *M. libycus* It was concluded that brodifacoum (0.005%) was more effective against *R. rattus* while, coumatetrahyl (0.0375%) was more effective against *M. libycus*.

Introduction

Commensal rodents, principally Norway rats and house mice, cause significant economic damage when present in insulated livestock buildings. In addition to consuming and contaminating food they possibly spreading diseases, they destroy insulation within walls and attics by their tunneling, gnawing and nest-building activities (Timm, 1987). Khan *et al*. (1982) reported that brodifacoum; bromadiolone and chlorophacinone at 0.005 percent level were more effective against field rats. El-Bahrawy and Morsy (1990) found that brodifacoum (0.003%) was more effective than flocomafen (0.005%) against *Rattus rattus* and *Mus musculus*.

The present study was carried out with the following objectives : to develop methods for establishing a rodent control programme in crop field in Riyadh region, to monitor and review the effectiveness of such control and to determine the efficacy of some rodenticides against *Rattus rattus* as a commensal rat and *Meriones libycus* as a wild rat inhabiting crop fields.

Materials and Methods

Commensal rats (*Rattus rattus*) were trapped alive from different areas in Riyadh city, while wild rats (*Meriones libycus*) were trapped and also collected alive from the desert areas surrounding Riyadh city by the use of ordinary wire box traps. They were identified by species and sexed using the keys given by Harrison and Paul (1991). The healthy rats from each specie were selected individually and caged for the experiment. Each rat was individually placed in a separate cage for acclimatization. They were fed normal diet and water for three weeks before testing.

Ten healthy rats from each specie were selected for each anticoagulant rodenticide. Commensal rats (*R. rattus*) and wild rats (*M. libycus*) were given choice feeding (wheat and formulated anticoagulant) for four days. At the same time another ten rats of each specie were given non-choice feeding (formulated anticoagulant alone). The anticoagulant rodenticides were (1) Klerat (=Brodifacoum, 0.005 %), (2) Racumin (=Coumatetrahyl, 0.0375%) and (3) Timborat super (=Chlorophacinone, 0.005%).

The exposure to choice and non-choice feeding extended to ten days under daily observations. Ten rats from each of the two species of rodents were kept on normal wheat under the same experimental condition as control.

Student's t-test was used to compare the efficacy of rodenticides against each specie of rat. All the data is given as means ± SD.

Results and Discussion

The results presented in Table 1, indicate that brodifacum (0.005%) and chlorophacinone (0.005%) gave 100% mortality rate against both *R. rattus* and *M. libycus*. Brodifacoum (0.005 %) was fairly accepted and produced 100 percent mortality of both *R. rattus* gangutrianus and *M. musculus* (Sheikher *et al*., 1987). Coumatetrahyl (0.0375%) was relatively less effective against *R. rattus* as it killed 87.5 percent within 10 days. However, the least amount of Coumatetrahyle (24.42 g/kg) killed 100 percent *M. libycus* within the shortest time 4.5 days, while the least amount of Brodifacoum (24.89 g/kg) and (26.39 g/kg) killed 100 percent of *R. rattus* and *M. libycus* at its concentration (0.005%) within 6.8 and 4.5 days respectively. Parshad *et al*. (1985) noted that Brodifacoum showed promising rodenticide properties producing 100 percent mortality in various rodent species at 0.005 percent concentration. Table 1 indicates that Brodifacoum (0.005%) is more effective ($P<0.05$) than Coumatetrahyl (0.0375%) against *R. rattus*, as the laboratory trials gave 100 percent kill after 6.8 feeding days on Brodifacoum. On the other hand, Coumatetrahyl (0.0375%) showed 87.5 percent kill after 10 feeding days. Chlorophacinone (0.005%) was however more effective ($P<0.05$) than Coumatetrahyl against *R. rattus*. Chlorophacinone (0.005%) caused 100 percent kill after 5.8 days, while Coumatetrahyl (0.0375%) caused 87.5 kill after 10 days against *R. rattus*. Field

Table 1: Mortality and bait consumption of two rat species in "choice feeding" tests usin three anticoagulant rodenticides

Poison and concentration	Rat species	Rat no.	Mean body Weight (g)	Exposure period (days)	Mean daily bait consumption (g/kg body wt.) Mean ± SD	Mortality %	Days to death	
							Mean ± SD	Range
Brodifacoum	*Rattus rattus*	10	192.50	4	24.89 ± 3.01	100.0	6.8 ± 065	6-7.5
(0.005%)	*Meriones libycus*	10	148.00	4	26.39 ± 1.24	100.0	4.5 ± 0.71	4-5.5
Coumatetrahyl	*Rattus rattus*	10	202.50	4	10.95 ± 3.14	87.5	10.0 ± 1.63	8-12
(0.0375 %)	*Meriones libycus*	10	188.75	4	24.42 ± 2.77	100.0	4.5 ± 0.58	4-5
Chlorophacinone	*Rattus rattus*	10	130.00	4	43.29 ± 2.66	100.0	5.8 ± 0.50	5-6
(0.005 %)	*Meriones libycus*	10	162.50	4	57.46 ± 11.60	100.0	14.8 ± 5.25	10-22

Table 2: Mortality and bait consumption of two rat species in "no-choice feeding" tests using three anticoagulant rodenticides

Poison and concentration	Rat species	Rat no.	Mean body Weight (g)	Exposure period (days)	Mean daily bait consumption (g/kg body wt.) Mean ± SD	Mortality %	Days to death	
							Mean ± SD	Range
Brodifacoum	*Rattus rattus*	10	157.25	3	26.70 ± 5.61	92.50	7.00 ± 2.16	5-10
(0.005%)	*Meriones libycus*	10	161.25	3	36.00 ± 3.40	100.0	8.00 ± 0.82	7-9
Coumatetrahyl	*Rattus rattus*	10	123.00	3	45.53 ± 10.29	92.0	7.25 ± 1.26	6-9
(0.0375%)	*Meriones libycus*	10	173.75	3	37.43 ± 6.15	100.0	6.50 ± 1.00	6-8
Chlorophacinone	*Rattus rattus*	10	122.75	3	45.40 ± 7.46	100.0	6.80 ± 0.50	6-7
(0.005 %)	*Meriones libycus*	10	156.25	3	37.48 ± 0.71	90.0	7.50 ± 5.25	7-9

trials revealed that Brodifacoum (0.002%) was significantly ($P<0.01$) more effective than Chlorophacinone (0.0075 %) and Coumatetrahyl (0.375 %) (Mathur and Prakash, 1982). No-significant differences ($P>0.05$) were observed between the effectiveness of Brodifacoum (0.005%) and Chlorophacinone (0.005%) against *R. rattus*. Brodifacoum (0.005%) and Coumatetrahyl (0.0375%) were more effective ($P<0.05$) than Chlorophacinone (0.005 %) against *M. libycus*. Brodifacoum (0.005 %) and Coumatetrahyl (0.0375%) caused 100 percent kill against *M. libycus* after 4.5 feeding days.

The results in Table 2 revealed that Coumatetrahyl (0.0375%) and Brodifacoum (0.005%) caused 100 percent mortality against *M. libycus* within 6.5 and 8.00 days, respectively. On the other hand, Chlorophacinone (0.005%) gave 100 percent mortality against *R. rattus* after 6.8 exposure days to poison bait. The least amount of Brodifacoum (36 g/kg) and Coumatetrahyl (37.43 g/kg) caused 100 percent mortality of *M. libycus*; while the least time to death of *M. libycus* was 6.5 exposure days in case of Coumatetrahyl (0.0375 %), but it was 6.8 exposure days against *R. rattus* treated with Chlorophacinone (0.005 %). In no-choice feeding trials, significant differences ($P< 0.05$) were observed between the effectiveness of Brodifacoum (0.005 %) and Coumatetrahyl (0.0375 %) against *R. rattus*. They showed about 92 percent mortality, while the mean daily bait consumption for both Brodifacoum (0.005 %) and Coumatetrahyl (0.0375 %) was 26.70 g/kg and 45.53 g/kg respectively. Mortalities of 100 percent in *R. rattus* diardii were achieved with two and four intermittent exposures to 0.075 per cent Coumatetrahyl (Lam, 1986). Both, Coumatetrahyl (0.0375%) and Brodifacoum (0.005%) were more effective against *M. libycus* than Chlorophacinone (0.005%). Coumatetrahyl (0.0375%) caused 100 percent kill against *M. libycus* after 6.5 exposure days, while Brodifacoum (0.005 %) gave 100 percent kill against the same rats after 8.00 exposure days. This study indicated that Coumatetrahyl (0.0375%) was more effective against *M. libycus* followed by Brodifacoum (0.005%) and Chlorophacinone (0.005%). Shoukry *et al*. (1986) found that Coumatetrahyl (0.0375%) was the best as a rodenticide for both *R. norvegicus* and *R. rattus* frugivorous. Also, *R. norvegicus* and Bandicota bengalensis were found to be more susceptible to Coumatetrahyl (Greaves and Ayres, 1969; Brooks *et al.*, 1980). The analysis of *R. rattus* diardii mortalities after two and four exposure to poison bait showed that Chlorophacinone was less effective than Warfarin and Coumatetrahyl (Lam, 1986).

Brodifacoum (0.005%) was effective than Chlorophacinone (0.005%) and Coumatetrahyl (0.0375%) against *R. rattus* in choice feeding tests. Our findings agree with those obtained by Dubock and Kaukeinen (1978); Khan (1981), Dubock (1982) and Mathur and Prakash (1982) who found that Brodifacoum (0.002%) was significantly ($P<0.01$) more effective than Chlorophacinone (0.0075 %) and Coumatetrahyl (0.0375%). Brodifacoum has also been demonstrated to be more effective in the field than other anticoagulants against many rat species. In the laboratory trails Khan *et al*. (1982) reported that Brodifacoum (0.005%); Bromadiolone (0.005%) and Chlorophacinone (0.005%) were effective against field rats. Similarly, *R. norvegicus*, *R. rattus* and *Mus musculus* were found to be more susceptible to Fumarin than the gerbils (Mathur and Prakash, 1982).

In choice and non-choice feeding trials, it was clear that Brodifacoum (0.005%) was more effective against

*R. r*attus as commensal rat, while coumatetrahyl (0.0375%) was more effective against *M. libysus* as a wild rat.

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