

## Evaluation of brodifacoum against house murids of Garhwal Himalaya (India)

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MS received 5 March 1987; revised 18 August 1987

**Abstract.** Brodifacoum (WBA 8119) was tested at various concentrations (0.02, 0.01, 0.005, 0.0025 and 0.00125%) by choice tests in laboratory against house murids viz *Rattus rattus gangutrianus* Hinton and *Mus musculus* Linnaeus of Garhwal Himalaya. It was fairly acceptable and produced 100% mortality of both the target species at all levels of its concentrations except at 0.00125% level causing 83.3% mortality in *Rattus rattus gangutrianus* and 100% in *Mus musculus*. The mean period of mortality is increased with the decrease in the concentration, the range being 3–17 days. In house trial a short exposure of 1-night of moist brodifacoum (0.0025%) bait after pre-baiting for 3-nights produced 100% murids mortality which was significantly ( $P < 0.01$ ) higher than that achieved in a similar trial with dry brodifacoum bait.

**Keywords.** Brodifacoum; murids; *Rattus rattus*; *Mus musculus*; bait; pre-baiting.

### 1. Introduction

A new anticoagulant, brodifacoum (3-(3-4-bromobiphenyl-4-yl)-1, 3-4-tetrahydronaphthyl)-4-hydroxy-coumarin) showed promising rodenticidal properties producing 100% mortality in various rodent species at its 0.005% concentration (Hadler and Shadbolt 1975; Dubock and Kaukeinen 1978; Dubock 1980; Soni and Prakash 1984; Parshad *et al* 1985). The acceptability and the efficacy of this compound against house murids viz. *Rattus rattus gangutrianus* Hinton and *Mus musculus* Linnaeus in a different climatic zone of Garhwal Himalaya (long. 78°–47'E, lat. 30°–13'N and Alt. 570 m) are reported in this paper.

### 2. Materials and methods

For laboratory evaluation of the compound 3 male and 3 female healthy animals of *R. r. gangutrianus* and *M. musculus* were individually caged for each set of experiments and acclimatized for 15 days before the start of experiments. The compound was tested at 0.02, 0.01, 0.005, 0.0025 and 0.00125% concentration by choice-test. Dry 'koda' (*Eleusine coracana*) flour was used as rodenticide carrier. Treated bait was exposed for 48 h in one of the food cups and simultaneously untreated food was presented in the other food cup. In the pre- and post-treatments daily consumptions of food (untreated 'koda' flour) were also recorded and water was provided *ad libitum* throughout the experiment.

For house trials separate sets of 5 houses (replicates) were treated with 0.0025% brodifacoum in dry 'jhangora' (*Echinochloa frumentacea*) grains (trial-H1) and moist boiled 'jhangora' (trial-H2). Bait was exposed for 1-night from 10 pm to 6 am. The

pre- and post-treatment censuses were carried out by placing dry 'jhangora' grain in trial-H1 and moist boiled 'jhangora' in trial-H2 for 1-night after pre-baiting for 2-nights. The pre-treatment census baiting also functioned as pre-baiting for the treatment. The mortality of murids in houses was calculated from the weights of census bait eaten, as follows (Handerson and Tilton 1955).

$$\text{Mortality (\%)} = 100 \left( 1 - \frac{t_2 \times r_1}{t_1 \times r_2} \right),$$

$t$ , census bait take from treated house;  $r$ , census bait take from reference house;  $t_1, r_1$ , pre-treatment census bait takes;  $t_2, r_2$ , post-treatment census bait takes.

### 3. Results and discussion

Both the murids consumed statistically equal amounts of 'koda' flour ( $P < 0.05$ ). However, when 0.02% brodifacoum was used in bait, *R. r. gangutrianus* consumed significantly ( $P < 0.05$ ) more poison bait than plain food (table 1). The higher acceptance of 0.02% brodifacoum bait over plain food might be due to the presence of large amount of sugar content furnished by sugar-based liquid concentrate of the compound. The daily food consumption, on treatment days and 1 day after treatment differed non-significantly with the pre-treatment normal food consumption (table 1). These results signify an absence of poison aversion and bait shyness. Evidently ill effect of treatment did not appear till 1 day after treatment. Nevertheless, many workers have suggested that the brodifacoum bait was fairly acceptable on first day but thereafter acceptability declined (Soni and Prakash 1984; Parshad *et al* 1985).

In the laboratory conditions brodifacoum showed promising efficacy against *R. r. gangutrianus* producing 100% mortality at all concentrations tested except at 0.00125% level when the kill was 83.33%. Present *R. rattus* appeared to be more susceptible to brodifacoum than reported from other ecological regions (Redfern *et al* 1976; Dubock and Kaukeinen 1978; Parshad *et al* 1985). In the present study, *M. musculus* proved to be more susceptible to the chemical as its mortality was 100% even at 0.00125% concentration. The higher susceptibility of *M. musculus* over *R. rattus* to brodifacoum is also evident from their acute oral LD<sub>50</sub>, 0.40 mg/kg body weight (Redfern *et al* 1976), and 0.65 mg/kg body weight (Dubock and Kaukeinen 1978) respectively. Efficacy of brodifacoum against *M. musculus* is very much similar to the findings of Dubock and Kaukeinen (1978). In contrast a high degree of innate tolerance of brodifacoum has been observed in *M. musculus* of the Thar desert (Soni and Prakash 1984). The mean periods of mortality after treatment were observed to increase with the decrease in the concentration of rodenticide in the bait (table 1). The periods of mortality appeared to be linked with the amount of active ingredient ingested by the rodents.

In the houses of the present study, 1-night exposure of moist brodifacoum bait produced significantly ( $P < 0.01$ ) higher rodent mortality than that of the dry rodenticidal bait (table 2). In reference houses moist census bait consumption was almost triple to that of dry alternative (table 2). Therefore, significant higher efficacy of moist bait of brodifacoum over dry one (table 2) can be attributed to its high acceptability. Siddiqui and Khan (1982) have also observed that moist baits are more

Table 1. Acceptability and efficacy of brodifacoum baits in laboratory.

Species	Dose of brodifacoum (%)	Consumption in g/100 g body weight (Mean ± SE)							Time taken to death (days)	Mean (range)
		Pre-treatment daily consumption		Treatment (2-days)		Daily consumption on treatment days	Consumption of brodifacoum in 48 h mg/kg body weight*			
		a	b <sub>1</sub>	b <sub>2</sub>	Plain food			Plain bait 1 day after treatment		
<i>R. r. gangeticus</i>	0.02	7.65 ± 0.27	8.24 ± 0.20	7.14 ± 0.28	7.68 ± 0.10	7.77 ± 0.67	16.53 ± 0.42 <sup>A</sup>	4.33 (3-4)		
	0.01	8.12 ± 0.33	8.44 ± 0.38	7.6 ± 0.32	8.05 ± 0.17	7.83 ± 0.46	8.52 ± 0.38 <sup>B</sup>	5.00 (4-6)		
	0.005	8.03 ± 0.68	8.06 ± 0.42	7.90 ± 0.38	7.90 ± 0.33	8.95 ± 0.24	4.06 ± 0.21 <sup>C</sup>	5.17 (4-7)		
	0.0025	7.98 ± 0.27	7.56 ± 0.40	7.94 ± 0.34	7.7 ± 0.22	7.85 ± 0.31	1.90 ± 0.10 <sup>D</sup>	8.17 (6-10)		
	0.00125**	7.53 ± 0.08	7.40 ± 0.24	7.46 ± 0.42	7.40 ± 0.20	7.58 ± 0.43	0.94 ± 0.30 <sup>E</sup>	10.40 (8-12)		
<i>M. musculus</i>	0.0025	10.18 ± 0.24	10.20 ± 0.48	9.46 ± 0.28	9.83 ± 0.11	10.07 ± 0.73	2.56 ± 0.12 <sup>A</sup>	7.70 (4-11)		
	0.00125	11.03 ± 0.41	10.78 ± 0.58	10.90 ± 0.72	10.83 ± 0.19	11.18 ± 0.28	1.35 ± 0.07 <sup>B</sup>	9.20 (4-16)		

Mean consumptions b<sub>1</sub> vs b<sub>2</sub>, a vs b and a vs c differ non-significantly in all the corresponding dose except that at 0.02% dose b<sub>1</sub> vs b<sub>2</sub> differ significantly at 1% level.

\*Ranks A, B, etc. are given on the basis of critical differences for *R. rattus* (0.734) and *M. musculus* (0.342) at 5% level; \*\*brodifacoum produced 100% mortality of both the murid species at all the concentration except that at 0.00125% concentration mortality of *R. rattus* was 83.33%.

**Table 2.** Results of brodifacoum baiting in residential premises.

Trial	Treatment	Pre-treatment census bait g/night	Post-treatment census bait g/night	Rodent mortality (%)
H1	Brodifacoum dry bait	57.40 ± 9.33	32.80 ± 5.84	50.17 ± 2.22 <sup>P</sup>
H2	Brodifacoum moist bait	182.20 ± 9.63	0.00 ± 0.00	100.00 ± 0.00 <sup>C</sup>
Reference:	Rodenticide free food			
	Dry	51.40 ± 1.54 <sup>B</sup>	59.20 ± 3.21	+ 15.17
	Moist	161.80 ± 6.89 <sup>A</sup>	166.60 ± 4.80	+ 2.97

±, Show SE of means; +, shows increase in rodent population: A vs B and C vs D differ significantly at 1% level.

acceptable to rodents. The high rodent mortality after 1-night baiting of moist brodifacoum bait holds promise for its use in the residential premises. The short exposure of moist brodifacoum bait after 3-days pre-baiting with plain food (moist) reduces the poisoning hazards to children and pets, making the control operation more acceptable by the people.

### Acknowledgements

Authors are grateful to Dr H R Singh, Department of Zoology, University of Garhwal, Srinagar Garhwal, for providing the necessary laboratory facilities and to the citizens who permitted us to carry out our studies in their houses.

### References

- Dubock A C 1980 The development and practical use of the novel anticoagulant rodenticide brodifacoum; *Plant Prot. Bull. (Taiwan)* **22** 223-238
- Dubock A C and Kaukeinen D E 1978 Brodifacoum (Falon rodenticide), a novel concept; *Proc. 8th Vert. Pest Conf.* Sacramento, California, USA, pp 127-137
- Hadler M R and Shadbolt R S 1975 Novel 4-hydroxy-coumarin anticoagulants active against resistant rats; *Nature (London)* **253** 275-277
- Henderson C F and Tilton E W 1955 Tests with acaricides against the Brown Wheat Mite; *J. Econ. Entomol.* **48** 157-161
- Parshad V R, Ahmad N and Chopra G 1985 Laboratory and field evaluation of brodifacoum for rodent control; *Int. Biodeterior.* **21** 107-112
- Redfern R, Gill J E and Hadler M R 1976 Laboratory evaluation of WBA 8119 as a rodenticide for use against warfarin-resistant and non-resistant rats and mice; *J. Hyg.* **77** 419-426
- Siddiqui J A and Khan J A 1982 Food preference of soft-furred field rat, *Rattus meliada pallidior* Ryley; *Z. Angew. Zool.* **69** 107-119
- Soni B K and Prakash I 1984 Efficacy of brodifacoum against the house mouse, *Mus musculus*; *Pesticides* **18** 15-17