Evaluation of coumatetralyl against two predominant murid species

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SUMMARY

Coumatetralyl was evaluated in the laboratory against *Bandicota bengalensis* and *Rattus rattus*. Feeding tests with 0·0375 % coumatetralyl baits produced 100 % mortality after a single day feeding period in *B. bengalensis* and after a 10-day period in *R. rattus*. The anticoagulant bait is less palatable in comparison to plain bait. In the case of *R. rattus*, LFP_{50} and LFP_{98} and their 95 % confidence limits were 3·89 (2·62–5·77) days and 11·22 (6·1–20·65) days respectively. Median period of survival and its 95 % confidence limits of *B. bengalensis* and *R. rattus* were 4·7 (3·85–5·7) days and 11·2 (9·33–13·44) days respectively.

INTRODUCTION

The common house rat, *Rattus rattus*, and the Indian mole rat, *Bandicota bengalensis*, occur predominantly in the Indian subcontinent, causing severe damage in residential premises, godowns, poultry farms and field crops (Prakash, 1977; Chopra, Parshad & Guraya, 1984). For their control, zinc phosphide in the fields and warfarin in residential premises are being used. Zinc phosphide has the serious drawback of inducing poison aversion among rodents (Prakash, 1976), and resistance to warfarin by a number of commensal rodents has been reported in different parts of the world.

During the last few years, emphasis has been laid on the use of different anticoagulant rodenticides for the control of commensal as well as field rodents in the Indian subcontinent. This paper provides the results of laboratory evaluation of coumatetralyl (3-(α-tetralyl)-4-hydroxycoumarin) against *R. rattus* and *B. bengalensis*.

MATERIALS AND METHODS

The animals

The house rat, *R. rattus* and the Indian mole rat, *B. bengalensis* were trapped from stores and a sugarcane crop respectively at Ludhiana (lat. 30° 56′ N, long. 75° 52′ E). These animals were sexed, weighed and lodged individually in cages and acclimatized for ten days prior to experimentation. Usually equal numbers of healthy males and females were taken for each test.

Table 1. *Efficacy of coumatetralyl* (0·0375 %) *against* B. bengalensis *and* R. rattus

Species	No. of feeding days	Mean body weight (g) ±s.e.	Mean daily intake (g)/100 g body wt.		Poison ingested mg/kg (mean)	Mortality
			Poison bait	Plain bait		
		No-choice feeding				
Bandicota bengalensis	1	187·0±13·26	13·81±1·04	—	50·53	10/10
	3	185·0±15·75	10·78±0·48	—	117·16	10/10
	5	249·3±9·47	6·07±0·33	—	88·30	10/10
Rattus rattus	1	106·0±3·44	9·57±0·98	—	35·27	1/10
	3	71·5±2·59	10·19±0·61	—	112·81	3/10
	5	92·0±4·34	7·62±0·29	—	138·79	5/10
	7	102·7±8·53	6·87±0·24	—	158·65	7/10
	10	73·1±3·98	5·30±0·38	—	176·47	10/10
		Choice feeding				
Bandicota bengalensis	5 (2)	206·8±13·93	3·45±0·43	*5·67±0·43	60·93	9/10
Rattus rattus	10 (2)	90·9±6·48	1·66±0·31	*7·82±0·32	42·08	5/10

Figures in parentheses indicate the days for which the comparison between poison and plain bait intake has been made.

* Significant difference between poison and plain baits ($P < 0.01$, Student's t test).

Feeding trials

Feeding trials were conducted using 0·75 % commercial coumatetralyl which was added to wheat flour (*Triticum aestivum*) and 2 % sugar to obtain 0·0375 % poison bait.

Both 'no-choice' and 'choice' feeding trials were carried out. In the former, only poisoned bait was provided for a fixed number of days. In the 'choice' feeding trials an alternative unpoisoned bait (the same food as that in which poison was given) was provided and the position of the two containers was altered daily to avoid any place preference. After the completion of the feeding period, the animals were fed on laboratory diet and the symptoms of poisoning and time to death were recorded for three weeks. Water was available to rats *ad libitum*.

The median lethal feeding periods and their 95 % confidence limits were calculated by probit analysis (Finney, 1971), and median survival period (LT_{50}) and 95 % confidence limits of the rats were calculated after Litchfield (1949).

RESULTS AND DISCUSSION

The results of 'no-choice' feeding trials indicate that complete mortality of *B. bengalensis* can be achieved after feeding 0·0375 % coumatetralyl-treated baits for 1 day only. However, it took 10 days of continuous feeding of the same bait to record 100 % kill in *R. rattus* (Table 1). Three-day and 5-day 'no-choice' feeding trials also resulted in complete kill of lesser bandicoots. However, a 5-day 'choice' trial resulted in 90 % kill (Table 1). Earlier, 4 days of continuous feeding of 0·0375 % coumatetralyl bait had been recommended for obtaining absolute kill of *B. bengalensis* (Brooks, Htun & Naing, 1980). Additon of coumatetralyl affected the bait acceptance, as both the species of rats consumed plain food significantly more ($P < 0·01$) than the poison bait (Table 1). The effect of poison was observed in all the rodents as the intake of poison bait decreased after the third day in all the 'no-choice' feeding trials (Table 1). Ten days of continuous feeding of 0·0375 % coumatetralyl bait resulted in 100 % kill of *R. rattus*. However, in 10-days 'choice' trials, only 50 % mortality was recorded. Earlier, a complete kill of *R. rattus* was reported after feeding 0·025 % coumatetralyl for 15 days (Chaturvedi, Madsen & Thakore, 1975) and 0·05 % coumatetralyl for 7 days (Mukthabai & Krishnakumari, 1976). In the case of *Tatera indica* and *Meriones hurrianae*, 5–7 days of continuous feeding of 0·0375 % coumatetralyl bait is necessary for absolute kill (Greaves & Rehman, 1977; Mathur, 1982). In the present trials, absolute kill of *R. rattus* and *B. bengalensis* was recorded after mean intakes of 176·47 mg/kg and 50·53 mg/kg of active anticoagulant respectively (Table 1).

Table 2 gives the lethal feeding periods (LFP_{50} and LFP_{98}) and their 95 % confidence limits for 0·0375 % coumatetralyl-treated baits against *R. rattus* in 'no-choice trials'. For an expected 50 % kill less than 4 days and for 98 % mortality about 11 days of feeding is required. Median period of survival or lethal time (LT) taken for 50 % kill of *B. bengalensis* and *R. rattus* and their 95 % confidence limits are 4·7 (3·85–5·7) days and 11·2 (9·33–13·44) days respectively (Table 3). LT_{84} for these two species is 6·2 days and 14·4 days respectively.

Toxicity data of coumatetralyl reveals marked differences in the mortality of different species after feeding on a 0·0375 % dose. Based on the results of choice

Table 2. *Lethal feeding periods (LFP) for* Rattus rattus *and their 95% confidence limits*

Concentration of poison used	Slope of the probit regression line $b \pm$ S.E.	Lethal feeding periods	
		LFP_{50} (days)	LFP_{98} (days)
0·0375%	2·62 ± 0·16	3·89 (2·62–5·77)	11·22 (6·1–20·65)

Figures in parentheses indicate 95% confidence limits.

Table 3. *Survival times of rodents and 95% confidence limits*

Species	Dose (%)	LT_{16}*	LT_{84}	LT_{50}	Slope function(s)
Bandicota bengalensis	0·0375	3·26	6·2	4·7 (3·85–5·7)	1·38 (1·18–1·61)
Rattus rattus	0·0375	8·1	14·4	11·2 (9·33–13·44)	1·34 (1·18–1·53)

Figures in parentheses indicate 95% confidence limits.
* LT = Survival times of rodents in no-choice tests in which complete mortality occurred, expressed as the number of days to reach a particular mortality percentile.

feeding trials of present and previous studies, it is recommended that 5 days feeding of 0·0375% coumatetralyl-treated bait is necessary for controlling *B. bengalensis* and more than 10 days of feeding is essential for killing *R. rattus* effectively. This recommendation is being evaluated in field trials.

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