

EVALUATION OF A COMMERCIAL WAX-BOUND BAIT CONTAINING 0.0375% COUMATETRALYL AGAINST *RATTUS TIOMANICUS* (MILLER)

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RINGKASAN

Kajian memberi makanan dagangan jagung bersalut lilin yang mengandungi racun, coumatetralyl kepada tikus, *Rattus tiomanicus* Miller, telah dijalankan di makmal untuk menentukan kesannya terhadap umpan tersebut. Makanan tersebut yang hanya mengandungi racun sebanyak 0.0375% telah diberi kepada tikus dalam tempoh dua, empat, enam, lapan dan sepuluh hari dan masing-masing mengakibatkan kadar kematian sebanyak 25%, 65%, 90%, 95% dan 100 peratus. Kesan yang berbeza terhadap tiap-tiap tikus tersebut dapat dilihat dalam ujian itu. Enam puluh peratus dari tikus-tikus tersebut yang terkena racun dalam lima hingga lapan hari telah mati dengan menunjukkan tanda-tanda sakit yang teruk. Tempoh pemberian makanan yang berkesan yang membawa maut (LFP 50) ialah 2.9 (2.0–3.7) hari untuk tikus betina dan 3.2 (1.9–4.2) hari untuk tikus jantan. Tiada perbezaan yang besar ($P > 0.05$) terdapat di antara purata jantina tersebut. Dua ekor tikus jantan dan seekor tikus betina telah dapat hidup dalam tempoh enam dan lapan hari selepas diberi makanan yang beracun. Ini menandakan bahawa tikus tersebut dapat menjadi peka terhadap racun tersebut dan tikus-tikus lain akan menjadi peka jika kajian ini berterusan. Kesimpulannya, tempoh pemberian makanan yang berkesan yang membawa maut (LFP 99) ialah 11.0 hari untuk menjadi peka kepada racun, coumatetralyl tersebut.

INTRODUCTION

Coumatetralyl was developed as an anticoagulant rodenticide during the early fifties. In Europe it has been found to perform better than warfarin (LUND, 1972) and is equally effective against warfarin-susceptible and warfarin-resistant rats (GREAVES and AYRES, 1969). In Malaysia, studies have shown it to be highly effective against the rice-field rat, *Rattus argentiventer* (LAM, 1984). Studies against *Rattus tiomanicus*, the predominant rodent pest in oil palm and cocoa-coconut plantings have shown coumatetralyl to be equally effective as warfarin (WOOD and LIAU, 1977). It has been widely used for rat control in these plantation tree crops.

Studies have shown that most rodent species differ in their susceptibilities to different rodenticides (DUBOCK and KAUKAINEN, 1978). As such each species' susceptibility level to the rodenticide has to be ascertained first to enable the determination and/or monitoring of its resistance (DRUMMOND, 1971). This has been done for *R. argentiventer* against coumatetralyl (LAM,

1984). The susceptibility level of *R. tiomanicus* to coumatetralyl is unavailable and there is a need for such an information (HO and LAM, 1983). This paper reports on the susceptibility of *R. tiomanicus* to coumatetralyl based on the duration of feeding. The findings could serve as a baseline data for the detection of resistance in this species.

MATERIALS AND METHODS

Rattus tiomanicus were live-trapped from cocoa-coconut fields in Hilir Perak that have never been baited with any type of rodenticides. The rats were caged individually in cages measuring 45 x 45 x 30 cm and conditioned in the laboratory for two weeks prior to testing. The test methodology was similar to that reported by LEE and MUSTAFA (1983).

The animals were subjected to no-choice feeding test. The poison baits used were commercially prepared coumatetralyl at 0.0375% concentration in wax cube maize-base. Five groups of animals (ten males and ten females in each group) were first pre-baited for two days with unpoisoned wax

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cube maize-based baits before they were allowed unrestricted feeding upon the poison baits for two, four, six, eight and ten days respectively.

At the end of the prescribed feeding period for each animal group; the animals were fed with laboratory pellets, fresh copra and ripe bananas. The groups of animals were kept for a further observation of 30 days beginning from the last day of the test. Bait consumption was measured to the nearest 0.1 g daily and any mortality was recorded. Dead rats were autopsied for symptoms of anticoagulant poisoning. The data obtained in the feeding tests were used to determine the lethal feeding period (LFP 50, LFP 99) by probit analysis.

RESULTS AND DISCUSSION

The differences between the uptake of poisoned and unpoisoned baits in all the feeding tests was statistically insignificant (Table 1). The lowest amount of bait taken was 4.3 g while the highest was 10.4 grammes. There were differences in susceptibility to coumatetralyl poisoning. The lowest fatal dose was 26.7 mg/kg while the highest survived dose was 162.8 mg/kg. Such variation in susceptibility have also been shown with warfarin (LEE and MUSTAFA, 1983; WOOD and LIAU, 1977).

The mortality rate increased with the duration of feeding and 100% death of the treated animals were obtained in the 10-day feeding period. Sixty per cent of the animals succumbed to the poison after five to eight days feeding, with the shortest time recorded being two days and the longest was 14 days. The nature of death was typical of anti-coagulants where death of the animals occurred after a lethal dose has been consumed. With continuous feeding, animals could have died of an overdose as feeding does not stop after a lethal dose has been taken. Under such circumstances the calculation of the lethal dose only provides an indication as to the amount of poison taken and not to the amount that caused death. A more accurate method then would be to know the feeding duration which determine the lethal feeding period (LFP).

The lethal feeding period corresponding to 50% and 95% mortality within the 95% fiducial limits (LFP 50; LFP 95) by probit analysis were 3.2 (1.9–4.2) days and 9.0 (6.4–21.2) days for males, and it was 2.9 (2.0–3.7) days and 6.1 (4.7–11.4) days for females. Although the females were more susceptible to the poison than males, it was statistically insignificant ($P > 0.05$). Earlier studies by WOOD and LIAU (1977) with coumatetralyl at 0.01% over a four-day feeding period also gave higher female mortality as compared with the male. LAM (1984) also reported similar findings with *R.*

Table 1. Results of the no-choice feeding tests on *R. tiomanicus* given 0.0375% coumatetralyl in maize-based paraffin baits at different number of days

Number of feeding days	Sex	Mean body weight (g)	Mortality (dead/treated)	Mean bait intake		Lethal dose of coumatetralyl (mg/kg) mean (range)	Survived dose of coumatetralyl (mg/kg) mean (range)	Days to death mean (range)
				Last day plain (g)	1st day poison (g)			
2	M	95.8	3/10	7.8	6.5	30.4(26.7 – 48.4)	19.6(12.4–40.5)	6.7(4–11)
	F	94.9	2/10	8.0	6.1	32.6(28.5– 51.2)	20.5(11.8–36.4)	3.5(3– 4)
4	M	101.1	5/10	9.3	8.9	39.6(30.4– 49.8)	25.2(16.9–42.5)	5.6(3– 7)
	F	93.2	8/10	8.4	7.9	48.2(28.4– 60.5)	27.4(17.9–37.8)	4.4(2– 7)
6	M	103.5	9/10	6.3	6.1	70.4(42.5– 104.8)	77.5	6.2(3– 10)
	F	96.8	9/10	7.2	6.9	67.3(37.2– 114.7)	79.5	5.3(3– 10)
8	M	95.0	9/10	7.8	6.8	113.7(64.1– 191.6)	162.8	6.1(4– 11)
	F	77.9	10/10	6.2	5.6	117.5(31.9– 137.9)	–	6.8(4– 12)
10	M	94.4	10/10	7.8	7.7	147.6(34.3– 251.6)	–	8.3(4– 13)
	F	100.5	10/10	8.0	7.9	152.6(48.3– 264.8)	–	8.7(4– 14)

M – Male
F – Female

argentiventer when the LFP 50 of females was 1.49 days as compared with 2.34 days for males using baits with 0.002% coumatetralyl concentration. This also indicates that *R. tiomanicus* is more tolerant to coumatetralyl as compared with *R. argentiventer*.

For the pooled data, the LFP 50 was 3.0 (2.3–3.6) days and the LFP 99 was 11.0 (8.0–19.7) days. Three individuals (two males and one female) that survived the six- and eight-day feeding period is possible in view of the high variation in susceptibility. With field application of the poison bait in the long term, this could lead to the

occurrence of resistant rats. Thus the LFP 99 value of 11.0 days could be suitable for screening of coumatetralyl resistance.

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SUMMARY

Laboratory feeding tests with commercial wax maize baits were conducted to determine the susceptibility of *Rattus tiomanicus* Miller to coumatetralyl. No-choice feeding on 0.0375% coumatetralyl baits for the periods of two, four, six, eight and ten days gave mortalities of 25%, 65%, 90%, 95% and 100% respectively. Marked variation in susceptibility to coumatetralyl among the individuals was seen in the feeding tests. Sixty per cent of the animals succumbed to the poison between five and eight days showing symptoms of chronic poisoning. The lethal feeding period (LFP 50) was 2.9 (2.0–3.7) days for females and 3.2 (1.9–4.2) days for males. No significant difference ($P > 0.05$) was found between the mean of the two sexes. The marked variation in susceptibility of the animals with two males and one female surviving the six- and eight-day feeding period indicates the possible occurrence of resistant rats if field application of the poison was undertaken in the long term. Thus the LFP 99 level of 11.0 days would be a suitable test for detecting coumatetralyl resistance.

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