

LABORATORY EVALUATION OF TWO ANTICOAGULANTS AGAINST *RATTUS RATTUS WROUGHTONI* HINTON*

S. KESHAHA BHT and A. SUJATHA

Central Plantation Crops Research Institute, Kasaragod 670 124, Kerala.

ABSTRACT

Warfarin and fumarin are the two anticoagulant rodenticides available in India for rodent control operations. The toxicity and relative acceptability of these poisons to the black rat, *Rattus rattus wroughtoni* Hinton, an important rodent pest of coconut and cocoa in South India were evaluated in the laboratory. There was no significant difference in the toxicity between these poisons (LFP₅₀ around 4 days for both the poisons) to *R. r. wroughtoni*, but there was much difference in their acceptance. After consuming the poison baits, the animals started dying from the third day onwards. The peak mortality was on the fifth day for warfarin and the seventh day for fumarin. Cent per cent mortality was achieved within 12 to 14 days feeding. However the baits mixed with fumarin were preferred significantly to those mixed with warfarin and hence recommended to use such poison bait continuously for two weeks in the field.

INTRODUCTION

Warfarin (a phenyl compound) and fumarin (a furyl compound) are the two multiple dose anticoagulant rodenticides available in India for rodent control operations. These poisons being chronic in their actions have several advantages over single dose ones such as zinc phosphide (Dubock, 1978). Considering the effectiveness against rodent pests and safeness on non-target animals, these anticoagulants gained much importance in recent years in both indoor and outdoor rodent control operations.

The black rat, *Rattus rattus wroughtoni* Hinton, is a predominant rodent pest in coconut and cocoa plantations in South India (Bhat, 1978; Abraham and Remamony 1979; Bhat *et al.*, 1981; Advani, 1984). Studies were conducted on the efficacy (Girish *et al.*,

1976; Chaturvedi *et al.*, 1977, Agarwal *et al.*, 1979) and acceptance (Rai *et al.*, 1982) of different anticoagulants against the house rat, *R. rattus* that inhabits residential premises and godowns. But very little work has been done on the toxicity of multiple dose anticoagulants against *R. r. wroughtoni*. Hence attempts were made at CPCRI, Kasaragod to find out the toxicity and relative acceptability of warfarin and fumarin against *R. r. wroughtoni* infesting coconut and cocoa.

MATERIALS AND METHODS

The toxicity and relative acceptability of anticoagulants were studied during 1986 on live rats freshly captured from coconut and cocoa fields around Kasaragod (12°30'N; 75°E). The animals were housed individually in animal cages (45 × 30 × 20 cm) and allowed to acclimatize to laboratory conditions for

*Contribution No. 545, CPCRI, Kasaragod

one week before the commencement of the experiment. Those individuals found apparently healthy after the conditioning period, were used in the test. The toxicity was studied by feeding animals with powdered rice containing 0.025% warfarin or fumarin for restricted periods of 3,4,6,8,10,12 and 14 days. Water was provided *ad libitum*. Each experiment was conducted on 15 fresh individuals of known body weight. The quantity of the bait consumed was recorded daily. Mortality of the individuals was also noted daily and the symptoms of poisoning ascertained. After the bait feeding period, the survived animals were maintained on cereal feeds and observed

for 30 days starting from the first day of poisoning. Delayed mortality, if any, was recorded after ascertaining the cause of death. At the end of each experiment, the consumption of poison (active ingredient) per kg of five body weight of the animal was determined. The lethal feeding period (LEP₅₀ value was calculated by probit analysis.

Relative acceptability was studied by exposing two different baits simultaneously in separate containers. The quantity of each bait consumed was recorded daily and for comparison the absolute value of daily intake was computed to per kg body weight of live animals.

Table I. Toxicity of warfarin and fumarin each at 0.025% concentration to *R. r. wroughtoni*

Particulars		Number of days feeding						
		3	4	6	8	10	12	14
% mortality	W	20.0	46.7	73.3	86.7	93.3	100.0	—
	F	20.0	53.3	73.3	80.0	93.3	93.3	100.0
Days till death	W	4.7± 0.33	7.6± 1.91	5.7± 0.38	5.3± 0.29	6.2± 0.39	6.9± 0.75	—
	F	4.3± 0.67	6.1± 0.40	5.2± 0.35	6.9± 0.36	8.5± 1.30	9.0± 0.92	8.7± 1.05
Lethal dose*	W	6.7± 1.47	7.7± 0.91	11.1± 0.90	6.7± 0.65	8.1± 0.67	8.5± 1.08	—
	F	5.5± 0.73	8.7± 0.67	9.7± 1.18	8.4± 0.92	11.3± 1.63	11.5± 1.47	11.6± 1.70
Survival dose	W	6.6± 0.59	6.3± 0.40	13.0± 1.68	14.1± 1.40	17.9± ‡	—	—
	F	5.3± 0.23	7.9± 0.95	9.6± 1.50	16.3± 1.63	6.7 ‡	21.8 ‡	

*mg/kg body weight of the animal

‡Only one animal survived.

After consuming the poison baits the animals started dying on the third day, but the rate of mortality was the highest on the fifth day for warfarin and seventh day for fumarin. However, it was extended upto 16 and 21 days with warfarin and fumarin, respectively (Fig-1). The mean survival day was slightly less with warfarin (6.14 days) as against 7.16 days with fumarin.

Relative acceptability

The consumption of both warfarin and fumarin was found to be significantly less than plain baits (Table II). However, when compared to plain bait, the consumption of fumarin was slightly more than that of warfarin. When both poison baits were exposed simultaneously the rats consumed significantly more of fumarin than warfarin mixed baits.

RESULTS AND DISCUSSION

Toxicity

The results of the study on the toxicity of warfarin and fumarin on *R. r. wroughtoni* are summarised in Table I. Three days feeding on the poison baits resulted in only 20% mortality. The LFP_{50} value for both the poisons was 4.07 days. However, cent per cent mortality was achieved after feeding for 12 days on warfarin-mixed and 14 days on fumarin-mixed baits.

There was considerable variation in the susceptibility of individuals to these poisons. Some individuals died after consuming 2.25 mg (ai) of warfarin and 2.60 mg (ai) of fumarin per kg body weight, but some others even survived a dose of 17.93 mg of warfarin and 21.80 mg of fumarin.

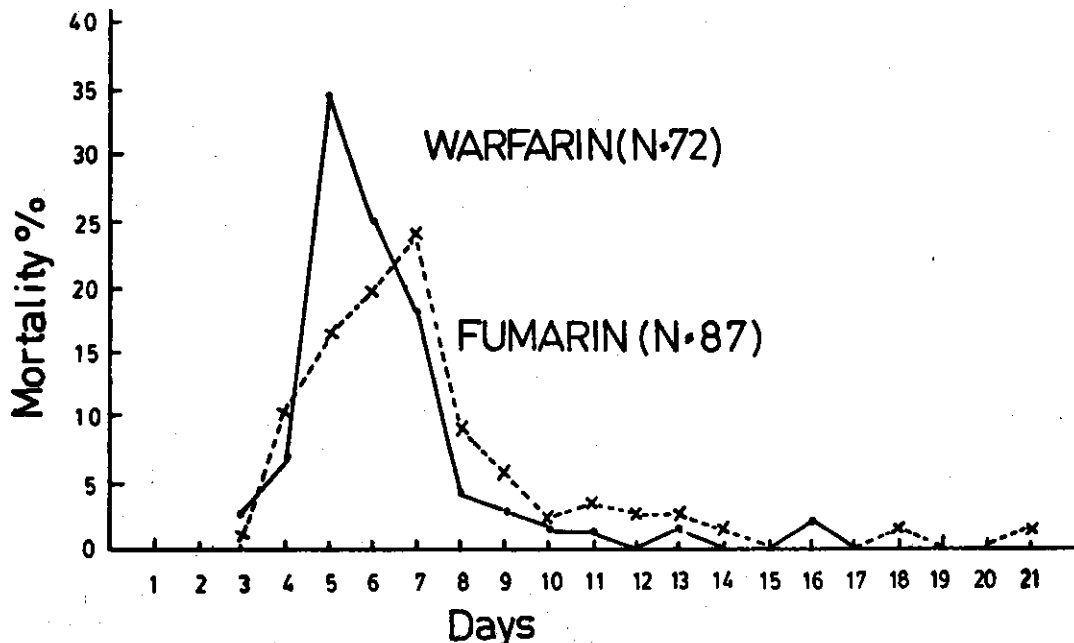


Fig. 1. Percentage of mortality of *R. r. wroughtoni* in different days of the test with anticoagulant - mixed baits.

Table II. *Relative acceptability of poison baits by R. r. wroughtoni*

Treatments	Consumption (g/kg) of baits			t value at P < 0.01
	warfarin	fumarin	plain	
Warfarin vs. fumarin	12.68 ± 2.34 (12.3%)	90.34 ± 5.43 (87.7%)	—	12.55
Warfarin vs. plain	30.83 ± 6.65 (30.0%)	—	71.96 ± 6.45 (70.0%)	4.91
Fumarin vs. plain	—	28.91 ± 3.22 (38.0%)	47.13 ± 3.92 (62.0%)	3.29

The present study thus revealed that both warfarin and fumarin were equally toxic to *R. r. wroughtoni*. Girish *et al.* (1976) also found that warfarin and fumarin were equally toxic, the mean days to death being 6.5(3-10) and 6.9(3-11), respectively. Chaturvedi *et al.* (1977) reported that the average days to death were slightly less with warfarin (5.0 days) than fumarin (5.9 days), but the former took longer periods (13 days) than the latter (11 days) to achieve 100% kill. Agarwal *et al.* (1979) however, obtained 100% mortality when rats were exposed to fumarin-mixed bait for 10 days, but only 75% mortality was noticed when exposed to warfarin-mixed baits even upto 16 days. All these studies revealed that there was high degree of variation in the susceptibility of *Rattus rattus* towards warfarin and fumarin. However the results obtained in the present study on *R. r. wroughtoni* are also in conformity with most of them.

It was further observed that the species *R. r. wroughtoni* significantly preferred fumarin mixed bait to warfarin mixed ones. This is in conformity with the observations of Rai *et al.* (1982) on the

house rat, *R. Rattus*. Other rodents viz. *Funambulus pennanti*, *Tatera indica* and *Meriones hurrianae* also showed an aversion towards warfarin mixed baits, (Mathur and Prakash, 1980; 1982). However, they have further observed that there was no significant reduction in the consumption of fumarin-mixed baits when compared to plain ones. In general, fumarin was found to be more effective than warfarin against field rodents, and hence it is preferred to use such poison bait continuously for about two weeks in the field, to achieve an appreciable reduction in the pest population.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. K.V.A. Bavappa, Director, Central Plantation Crops Research Institute, Kasaragod for encouragement and facilities provided. Thanks are due to Shri GB Pillai, Head, Division of Entomology, CPCRI Regional Station, Kayamkulam for going through the manuscript critically; to Shri AS Sukumaran, Scientist, CPCRI, Kasaragod for giving suggestions, to Sri. K. Vijayakumar, Scientist in the same Institute for statistical analysis of the

data and to Shri Basavarajiah, Technical Assistant, CPCRI, Kasaragod for helping in collection of live rats for experiments.

REFERENCES

- ABRAHAM, C.C. and REMAMONY, K.S. 1979. Pests that damage cocoa plants in Kerala. *Indian Arecanut, Spices, Cocoa J.* 2: 77-81.
- ADVANI, R. 1984. Ecology, status and postnatal development of the black rat infesting coconut and cocoa. pp. 626-632. In *Proc. PLACROSYM V Kasaragod, Kerala.*
- AGARWAL, S.K., SINGH, K.N., SRIVASTAVA, P.K. and GIRISH, G.K. 1979. Relative efficacy of different chemicals against the house rat *Rattus rattus*. *Bull. Grain Tech.* 17: 10-13.
- BHAT, S.K. 1978. Rodent damage to cocoa in south India. *Rodent Newsletter.* 2(3): 1.
- BHAT, S.K., NAIR, C.P.R. and MATHEW, D.N. 1981. Mammalian Pests of cocoa in south India. *Trop. Pest Manage.* 27: 297-302.
- CHATURVEDI, G.C., MADSEN C. and THAKORE, K.M. 1977. Studies on efficacy of different anticoagulant rodenticides on *Rattus rattus* (house rat) pp. 139-141. In *Proc. All India Rodent Seminar.* Sidhapur, India.
- DUBOCK, A.C. 1978. Rodent control in crop stores. *Outlook on Agri.* 9: 220-224.
- GIRISH, G.K., ARORA, K.K. and JAIN, S.K. 1976. Studies on rodents and their control. XIV: Comparative efficacy of different anticoagulants against black rat *Rattus rattus*. *Bull. Grain Tech.* 14: 30-33.
- MATHUR, R.P. and PRAKASH, I. 1980. Acceptability and toxicity of anticoagulants to the palm squirrel, *Funambulus pennanti* Wroughton. *Z. Angew. Zool.* 67(4): 46-48.
- MATHUR, R.P. and PRAKASH, I. 1982. Evaluation of warfarin against *Tatera indica* and *Meriones hurrianæ*. *Proc. Indian Acad. Sci. (Part B)* 91: 463-468.
- RAI, R.S., LAL P. and SRIVASTAVA, P.K. 1982. Acceptance of different poison baits by the black rat *Rattus rattus* L. *Rodent Newsletter* 6: 30.