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ON THE SAFE USE OF PESTICIDES IN CONTROLLING THE TERRESTRIAL MOLLUSC PESTS

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The preferred food items of the slugs Laevicaulis alte *and the snails* Achatina fulica *were used to prepare 'poison baits' by injecting the pesticides 'Rogor' and 'Nuvan' to kill these mollusc pests. The 'poison baits' prepared with* Trichosanthes dioica *and* Lycopersicum esculentum *were accepted by 100% individuals of both the species irrespective of the pesticides used. In all cases the slug and snail individuals died within a considerable length of time following consumption of the bait. The importance of using 'poison bait' lies not only with the sure success in killing the pests but also with the 'safe use' of toxic materials in order to avoid environmental hazards.*

Key words: slugs – snails – poison bait – control – India

Various attempts are being made by different workers to control the slug and snail pests (Mead, 1961, 1979; Godan, 1983; Raut & Ghose, 1984; Henderson, 1989). Since non-chemical control methods are less effective in reducing the pest population density to a desirable level chemical control device is still in practice. Though some molluscicides have been proved much effective in killing the pest slugs and snails the use of these chemicals is not being encouraged now-a-days by the biologists due to environmental pollution. It is sure that on way of controlling pests we are unnecessarily releasing a substantial amount of pesticides in the environment. These toxic materials not only degrading the environmental conditions but also compelling the beneficial organisms to die. To avoid all these problems, to ensure the death of the pests through the use of chemicals we have developed the technique of 'bait preparation' by using two commonly used pesticides. We have conducted experiments both under field and laboratory conditions with a view to kill the pestiferous slugs *Laevicaulis alte* Ferussac and snails *Achatina fulica* Bowdich occurring in West Bengal, India.

MATERIALS AND METHODS

For preparation of baits required amount fresh vegetables viz., pointed gourd (*Trichosanthes dioica*), tomato (*Lycopersicum esculentum*), bean (*Vigna unguiculata*), lady's finger (*Hibiscus esculentus*) and the fruit cucumber (*Cucumis sativa*) were taken as they constitute the natural food of the slugs *L. alte* and the snails *A. fulica* occurring in West Bengal, India. The two commonly used organo phosphorous pesticides viz., Rogor (Rallis India Limited, Bombay) and Nuvan (Hindustan Ciba-Geigy Limited, Bombay) were considered for bait preparation. In all cases 15-20 g sized vegetables or fruit were selected for introduction of pesticides in these foods. Two doses, 0.5 ml and 1.0 ml of these pesticides were injected by a 2 ml syringe into these food matters. These food matters were left as such for a period of 30 minutes. After that, these were considered for experiments.

Two terraria, each 60 x 30 x 30 cm in size were considered for studies. The terraria were provided with loose, moist soil at the bottom. Required number of slug and snail individuals were released into these terraria. They were maintained with the same foods which were considered for bait preparation. Of the two terraria, one was considered for experiments with lugs and the other for the snails. The slug and snail individuals thus, were maintained for a period of 7 days. Then, on the 8th day the baits prepared with only one kind of food were offered to them in the evening. In each terrarium three such baits were supplied to the slugs or snails at a time. Altogether, three trials were made on three successive dates with

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TABLE I

Mortality rate in *Laevicaulis alte* in three different trials due to the application of 'poison bait'

Pesticide	Dose	Bait used	Trial number	Number of individuals			Time taken (in minutes) for death after feeding
				Exposed to baits	Accepted the bait	Died (%)	
Rogor	0.5 ml	*T. dioica*	I	8	8	8 (100)	32-48
			II	8	7	7 (100)	39-53
			III	8	7	7 (100)	36-59
		L. esculentum	I	10	10	10 (100)	46-101
			II	8	8	8 (100)	49-122
			III	11	11	11 (100)	52-109
		V. unguiculata	I	10	0	9 (0)	–
			II	10	0	0 (0)	–
			III	8	0	0 (0)	–
		H. esculentus	I	10	2	2 (100)	42-51
			II	11	2	2 (100)	44-51
			III	10	0	0 (0)	–
		C. sativa	I	10	4	4 (100)	27-50
			II	9	3	3 (100)	29-54
			III	9	2	2 (100)	36-49
		Mixed	I	10	10	10 (100)	38-109
			II	10	10	10 (100)	46-126
			III	10	10	10 (100)	39-119
	1.0 ml	*T. dioica*	I	9	9	9 (100)	41-202
			II	9	9	9 (100)	52-268
			III	9	9	9 (100)	49-244
		L. esculentum	I	10	10	10 (100)	93-101
			II	8	8	8 (100)	98-160
			III	8	8	8 (100)	99-129
		V. unguiculata	I	8	0	0 (0)	–
			II	10	0	0 (0)	–
			III	8	0	0 (0)	–
		H. esculentus	I	10	0	0 (0)	–
			II	8	1	1 (100)	–
			III	10	0	0 (0)	62
		C. sativa	I	10	4	4 (100)	49-96
			II	10	2	2 (100)	54-101
			III	8	0	0 (0)	–
		Mixed	I	8	8	8 (100)	88-160
			II	10	5	5 (100)	99-156
			III	8	4	4 (100)	115-221

TABLE II

Mortality rate in *Laevicaulis alte* in three different trials due to the application of 'poison bait'

Pesticide	Dose	Bait used	Trial number	Number of individuals			Time taken (in minutes) for death after feeding
				Exposed to baits	Accepted the bait	Died (%)	
Nuvan	0.5 ml	*T. dioica*	I	8	8	8 (100)	98-180
			II	7	7	7 (100)	112-176
			III	10	10	10 (100)	156-202
		L. esculentum	I	10	10	10 (100)	107-152
			II	9	9	9 (100)	93-160
			III	11	11	11 (100)	96-151
		V. unguiculata	I	10	0	0 (0)	–
			II	6	0	0 (0)	–
			III	8	0	0 (0)	–
		H. esculentus	I	8	1	1 (100)	72
			II	10	0	0 (0)	–
			III	10	2	2 (100)	49-64
		C. sativa	I	6	1	1 (100)	106
			II	12	3	3 (100)	63-119
			III	8	1	1 (100)	70
		Mixed	I	12	12	12 (100)	116-242
			II	9	9	9 (100)	90-188
			III	10	10	10 (100)	101-229
	1.0 ml	*T. dioica*	I	10	10	10 (100)	88-382
			II	9	9	9 (100)	104-302
			III	9	9	9 (100)	101-292
		L. esculentum	I	10	10	10 (100)	112-364
			II	9	9	9 (100)	106-400
			III	9	9	9 (100)	132-384
		V. unguiculata	I	9	0	0 (0)	–
			II	9	0	0 (0)	–
			III	9	0	0 (0)	–
		H. esculentus	I	10	2	2 (100)	146-302
			II	9	0	0 (0)	–
			III	9	1	1 (100)	261
		C. sativa	I	9	1	1 (100)	138
			II	8	1	1 (100)	108
			III	9	1	1 (100)	309
		Mixed	I	10	8	8 (100)	95-368
			II	9	8	8 (100)	107-449
			III	9	8	8 (100)	146-401

TABLE III

Mortality rate in *Achatina fulica* in three different trials due to the application of 'poison bait'

Pesticide	Dose	Bait used	Trial number	Number of individuals			Time taken (in minutes) for death after feeding
				Exposed to baits	Accepted the bait	Died (%)	
Rogor	0.5 ml	*T. dioica*	I	6	5	5 (100)	18-220
			II	8	7	7 (100)	69-311
			III	10	7	7 (100)	42-256
		L. esculentum	I	8	8	8 (100)	80-325
			II	8	8	8 (100)	95-419
			III	12	12	12 (100)	75-355
		V. unguiculata	I	9	0	0 (0)	–
			II	8	0	0 (0)	–
			III	10	0	0 (0)	–
		H. esculentus	I	10	2	2 (100)	70-370
			II	8	2	2 (100)	107-564
			III	7	1	1 (100)	130
		C. sativa	I	10	4	4 (100)	121-357
			II	10	1	1 (100)	430
			III	7	2	2 (100)	354
		Mixed	I	8	8	8 (100)	45-242
			II	11	11	11 (100)	42-337
			III	9	9	9 (100)	62-240
	1.0 ml	*T. dioica*	I	8	8	8 (100)	39-171
			II	6	5	5 (100)	52-182
			III	9	9	9 (100)	60-226
		L. esculentum	I	7	7	7 (100)	45-158
			II	8	8	8 (100)	67-235
			III	10	10	10 (100)	40-188
		V. unguiculata	I	12	0	0 (0)	–
			II	7	0	0 (0)	–
			III	9	0	0 (0)	–
		H. esculentus	I	10	1	1 (100)	174
			II	8	1	1 (100)	103
			III	8	0	0 (0)	–
		C. sativa	I	10	2	2 (100)	59-247
			II	7	1	1 (100)	174
			III	10	2	2 (100)	75-320
		Mixed	I	8	8	8 (100)	60-325
			II	10	10	10 (100)	49-244
			III	9	9	9 (100)	70-286

TABLE IV

Mortality rate in *Achatina fulica* in three different trials due to the application of 'poison bait'

Pesticide	Dose	Bait used	Trial number	Number of individuals			Time taken (in minutes) for death after feeding
				Exposed to baits	Accepted the bait	Died (%)	
Nuvan	0.5 ml	*T. dioica*	I	6	6	6 (100)	98-385
			II	8	8	8 (100)	79-307
			III	11	11	11 (100)	102-421
		L. esculentum	I	9	9	9 (100)	76-280
			II	8	8	8 (100)	84-345
			III	10	10	10 (100)	103-462
		V. unguiculata	I	7	0	0 (0)	–
			II	10	0	0 (0)	–
			III	9	0	0 (0)	–
		H. esculentus	I	8	0	0 (0)	–
			II	6	1	1 (100)	185
			III	7	3	3 (100)	156-425
		C. sativa	I	6	0	0 (0)	–
			II	9	0	0 (0)	–
			III	7	2	2 (100)	132-505
		Mixed	I	10	10	10 (100)	62-340
			II	10	10	10 (100)	106-385
			III	9	9	9 (100)	92-331
	1.0 ml	*T. dioica*	I	8	8	8 (100)	60-244
			II	10	10	10 (100)	68-270
			III	10	10	10 (100)	71-409
		L. esculentum	I	12	12	12 (100)	75-384
			II	8	8	8 (100)	66-357
			III	9	9	9 (100)	105-362
		V. unguiculata	I	7	0	0 (0)	–
			II	12	0	0 (0)	–
			III	8	0	0 (0)	–
		H. esculentus	I	10	1	1 (100)	572
			II	7	0	0 (0)	–
			III	5	0	0 (0)	–
		C. sativa	I	8	2	2 (100)	164-221
			II	9	1	1 (100)	248
			III	9	1	1 (100)	249
		Mixed	I	7	7	7 (100)	60-210
			II	10	10	10 (100)	67-278
			III	10	10	10 (100)	92-432

different number of animals in each trial. All the five types of baits were offered separately to the slugs and snails in the same way. Also another experiment was made by supplying all types of baits (two examples of each bait) together i.e. mixed bait to both the slugs and snails. Through constant watch, the number of slug or snail individuals accepted the bait, the number of individuals died and the time taken for death after consumption of bait have been recorded in respect to trials and species.

RESULTS

The results of each trial both with the slugs *L. alte* and the snails *A. fulica,* in respect to different baits prepared using pesticides Rogor and Nuvan have been shown in Tables I to IV.

DISCUSSION

From the results it appears that Rogor and Nuvan both 0.5 ml and 1.0 ml doses are effective in killing the slugs *L. alte* and the snails *A. fulica.* However, the acceptance of the poison baits is very much dependent on the type of vegetables or fruits that are used in preparation of same. It is clear that the slugs and snails did not accept the baits while prepared by using *V. unguiculata.* Irrespective of doses of pesticides slugs and snails invariably died when the baits were accepted by them. Of course, there exists a high degree of preference for different types of baits. Almost in all trials *T. dioica* and *L. esculentum* were accepted by all the slug and snail individuals while in cases of *H. esculentus* and *C. sativa* baits only 10.0 – 42.8% and 11.1 – 40.0% individuals respectively accepted the baits. Though 100% individuals accepted the mixed baits it is observed that these baits were prepared mostly with *T. dioica* and *L. esculentum.* The bait accepted individuals though needed a considerable length of time for death, it is evident that all the individuals died during night hours.

Usually pesticides are used either by spraying or by dusting. Sometimes, paticularly in case of mollusc pests these are also used in preparation of pellet baits (Godan, 1983). While unnecessarily a heavy amount of pesticides are released into the nature in course of controlling the pests through spraying and dusting of pesticides the contamination of soil due to the mixing of toxic materials used in pellet baits which are left in the field as such (because all the pellets are not consumed by mollusc pests) can, by no means, be rulled out. Since all these methods of chemical control are inviting environmental pollution and other hazards it would be wise to use the 'toxic bait' as per present findings with a view to avoid these hazards by ensuring the death of target animals. It is clear that the 'poison baits' prepared by *T. dioica* and *L. esculentum* would be effective in controlling the slugs L. alte and the snails *A. fulica* occurring in this part of India. The left over 'poison baits' could easily be collected in the next morning for disposal preferably to bury deep into the ground. If the workers prepare the 'poison baits' by using the preferred vegetable or fruit-foods of the concerned species occurring in different parts of the globe it is expected that the density of slug and snail populations could be reduced to a level so as to protect the crops.

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