

Studies on the Residual Effect of Some Insecticides in Soil to Maggots of the Melon fly *Dacus cucurbitae* Coquillett

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The melon fly *Dacus cucurbitae* is the most destructive pest of cucurbitaceous vegetables in India. The control of this pest is a very serious problem, since the destructive larval stages which feed inside infested fruits are safe from external application of insecticides. One of the vulnerable stages of the insect is the full-grown maggot which falls to ground to pupate in soil and this is a stage at which it can be attacked by insecticides.

Application of Carbon bisulphide in soil killed the pupae of the Mediterranean fruit fly (Borg, 1933). Adults of *Dacus tryoni* emerging from soil treated with BHC at 0.13 to 2.08 lb Y-BHC per acre died soon after emergence (Ryan, 1950). Application of 6% heptachlor at 1 oz per sq. yard gave effective kill of the larvae and pupae of *Ceratitis capitata* (Constantino, 1957). Dieldrin, aldrin, parathion and lindane applied at 5-10 lb per acre gave good supplementary control of the pest (Steiner, 1957). The relative toxicity of the insecticides to the third instar maggots of *Dacus cucurbitae* was in the order, parathion > endrin > aldrin > heptachlor > dieldrin > lindane > malathion > chlordane (Bhatia and Kaul, 1965).

It is, however, not known as to how long the insecticides applied to soil will remain toxic to the maggots. This information is important to ensure maximum advantage of soil application of insecticides in the control of fruit flies. The present study was therefore undertaken to assess the residual toxicity of some soil insecticides to maggots of *Dacus cucurbitae*.

The experiment was conducted twice, once during summer season (April and May, 1966) and the next during rainy season (June and July, 1966).

Materials and Methods

Commercial dust formulations of DDT, BHC, aldrin, heptachlor and sevin were used in the experiments. Each insecticide was tried at three doses, viz., 1 lb, 2 lb and 4 lb of actual toxicant per acre. They were applied in exposed plots of 4' x 4'. The required quantity of the insecticide for each plot was thoroughly mixed with some fine sand, then uniformly distributed in the plot and raked to a depth of 4 inches. One plot was prepared for each dose of an insecticide and a raised border of 3' was left untreated around each. An untreated plot of the same dimensions served as control.

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Soil samples were collected from each of the above plots separately at the end of 24 hours after application and then at weekly intervals for a period of six weeks. The marginal portions of the plots were avoided in the collection of soil samples. One hundred and fifty gram of the soil was weighed into a 10 cm petri dish. Full-grown maggots of *Dacus cucurbitae*, which had just come out of the infested fruits for pupation, were put into the soil in the dish. The dish was then covered with a wire-gauze cylinder (10 cm high),

the upper end of which was closed with another petri dish. Three replications were prepared for each treatment and for the control. The percentage of maggots surviving and completing the life cycle was recorded.

Results and Discussion

Results of the two experiments are given in Tables I and II. It will be observed that all the insecticides under test gradually lose their toxicity to the fly maggots after application in soil. Out of the three doses tried, the highest dose of 4 lb of active

TABLE I

Survival of maggots of *Dacus cucurbitae* exposed to soil treated with different insecticides at different intervals after application
(Period : April-May, 1966)

Insecticide	Dose lb/acre	Per cent survival of maggots at various intervals						
		24 hrs	7 days	14 days	21 days	28 days	36 days	42 days
DDT	1	10.0	50.0	70.0	80.0	80.0	93.3	100.0
	2	16.6	60.0	70.0	76.6	80.0	93.3	100.0
	4	26.6	56.5	63.3	73.3	76.6	90.0	100.0
BHC	1	5.0	56.6	66.6	73.3	86.6	96.6	100.0
	2	5.0	53.3	63.3	73.3	80.0	96.6	100.0
	4	Nil	23.3	53.3	73.3	73.3	90.0	100.0
Aldrin	1	Nil	23.3	23.3	30.0	40.0	66.6	86.6
	2	Nil	10.0	13.3	26.6	26.6	56.6	70.0
	4	Nil	Nil	Nil	13.3	13.3	26.6	66.6
Heptachlor	1	Nil	40.0	50.0	53.3	60.0	63.3	80.0
	2	Nil	33.3	50.0	53.3	53.3	60.0	63.3
	4	Nil	16.6	20.0	26.6	40.0	43.3	70.0
Sevin	1	36.6	63.3	56.6	63.3	70.0	90.0	100.0
	2	26.6	63.3	63.3	80.0	86.6	93.3	100.0
	4	20.0	53.3	53.3	66.6	66.6	86.6	100.0
Control	..	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Total Rainfall = 69.0 mm.

TABLE II

Survival of maggots of *Dacus cucurbitae* exposed to soil treated with different insecticides at different intervals after application
(Period: June-July, 1966)

Insecticide	Dose lb/acre	Per cent survival of maggots at various intervals						
		24 hrs	7 days	14 days	21 days	28 days	36 days	42 days
DDT	1	10.0	63.3	70.0	73.3	83.3	100.0	100.0
	2	10.0	60.0	63.3	66.6	76.6	90.0	100.0
	4	26.6	53.6	56.6	80.0	83.3	86.6	100.0
BHC	1	40.0	60.0	63.3	66.6	83.3	96.6	100.0
	2	40.0	70.0	70.0	73.3	83.3	100.0	100.0
	4	30.0	53.3	56.6	56.6	70.0	86.6	100.0
Aldrin	1	Nil	26.6	33.3	56.6	60.0	70.0	80.0
	2	Nil	20.0	33.3	53.3	53.3	60.0	73.3
	4	Nil	6.6	10.0	13.3	16.6	36.6	60.0
Heptachlor	1	Nil	43.3	53.3	53.3	53.3	66.6	76.6
	2	Nil	43.3	53.3	46.6	46.6	60.0	76.6
	4	Nil	16.6	16.6	33.3	46.6	46.6	70.0
Sevin	1	40.0	56.6	53.3	70.0	70.0	93.3	100.0
	2	26.6	53.3	70.0	80.0	63.3	86.6	100.0
	4	16.6	50.0	50.0	70.0	70.0	83.3	100.0
Control	..	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Total Rainfall = 1507.0 mm.

ingredient per acre has been found to be far more effective than the other doses in all the insecticides. A comparison of the effectiveness of the five insecticides when used at 4 lb per acre is represented in Fig. 1 and 2. It will be observed that both in initial toxicity and in residual toxicity, aldrin and heptachlor are superior to DDT, BHC and sevin.

Change in climatic conditions from summer to rainy season does not appear to affect the toxicity of these materials in the soil to the maggots. Aldrin gives the best

result with very high residual action. The survival of maggots in soil treated with aldrin at 4 lb per acre is only 26.6 % and 36.6 % respectively in rainy and summer months when exposed 36 days after the date of application. In the case of heptachlor, these values are 43.3% and 46.6 % respectively.

These results thus indicate that aldrin and heptachlor can be used with advantage by applying in soil to give supplementary control of the fruit fly. These insecticides

when applied at 4 lb per acre have remained effective for 5 weeks in killing the maggots which fall into soil for pupation. An increase of the dose to 6 lb or 8 lb per acre may ensure a more long-standing effect.

Summary and Conclusions

Aldrin and heptachlor when applied to soil are highly effective in killing the maggots of *Dacus cucurbitae* which drop into soil for pupation and are far superior to DDT, BHC and sevin. When applied at 4 lb per acre aldrin and heptachlor remain very effective against the maggot upto 36 days giving less than 50 per cent survival of the maggots.

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