

## DETERIORATION OF INSECTICIDES ON GLASS AND ON LEAF SURFACE\*

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A detailed knowledge of persistent toxicity of insecticides is of vital importance in evolving integrated pest control programmes. Further the frequency of insecticidal application in pest control schedules can be judiciously fixed if the persistence of insecticides under field conditions is fully understood. Very few studies have been conducted in this line in Kerala (Asaf ali *et al.* 1969, Abdulla Koya 1969.. This paper embodies the results of investigations on the persistent toxicity of some of the common insecticides, carried out at the Agricultural College, Vellayani.

### Materials and methods

Pesticides used in these trials were formulated from either pure or technical grades taking the active ingredient alone into account. DDT (supplied by the Mysore Insecticides, Mysore, lindans and fenitrothion (supplied by M/s. Tata Fison, Bombay), endrin (supplied by Shell Chemical Corporation, Bombay), ethyl parathion (supplied by Chika Ltd., Bombay), malathion (supplied by Cynamid India Pvt., Ltd., Bombay carbaryl (supplied by Union Carbide India Ltd, Bombay, endosulfan (supplied by Hochsted Pharmaceuticals, Bombay), and triehlorfon (supplied by Bayer and Co., Bombay) were used in the experiments. Sweet potato plants of 'Bhadrakali chovala' variety raised in 30 X 30 cm flower post were used for assessing the persistence of insecticides on leaf surface. *Bracon brevicornis*. the test insect, was bred on the larvae of *Corcyra cephalonica* reared in the laboratory on wheat flour media.

Different concentrations of insecticide solutions (vide Table 1) were prepared by dissolving the required quantities of toxicants in benzene. In the case of carbaryl, chloroform was used as solvent. 1 ml, of the insecticide solution was pipetted out into a petridish and it was allowed to evaporate by gentle rotation, thus ensuring the formation of a uniform deposit of the toxicant in the dish. The dishes were air dried for 5 to 10 minutes and then closed with the other half and exposed to sun. 18 such dishes were prepared for each insecticide and three of them were taken for each observation at intervals of 1, 2, 4, 8, 16 and 32 days of

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exposure. Dishes similarly treated with solvent alone served as control. The dishes with insecticide residues were then inverted over chimneys darkened with black paint. Fifteen freshly emerged male *B. brevicornis* collected in a specimen tube were introduced into each chimney and all the chimneys were placed on a black surface. Because of the brightness, the parasites usually settled on the inner side of the dishes and this ensured a proper pick up of the insecticide by the insects. Results were assessed by counting the dead insects 24 hours after exposure.

Sweet potato leaves were treated with insecticide emulsions prepared from pure or technical materials using benzene or chloroform as solvent and triton X100 as emulsifier. The concentrations of solvent and emulsifier in the final spray materials were maintained at 5% and 0.6 per cent respectively. Each insecticide solution was sprayed on one potted plant to run off level by means of a hand atomizer. The sprayed plants were exposed to sunlight but protected from rains. Plants similarly treated with solvent and emulsifier alone in water served as control.

Leaves from treated as well as untreated (control) plants were collected at intervals of 1, 2, 4, 8, 16 and 32 days after spraying. Each leaf was placed over a darkened chimney with the upper surface of the leaf facing downwards. A clean petridish was placed over the leaf and it was well pressed so that no space was left between the leaf and chimney. Fifteen male braconids were introduced into the chimney from beneath. Electric lights were provided from above so that the leaves were brightened sufficiently to attract the parasites to the treated leaf surface. Mortality counts were taken at the end of 24 hours after exposure, counting the moribund ones also as dead. P. T. value, taken as an index of persistent toxicity, was calculated following the method of Pradhan (1967) with a suitable modification. T is the average residual toxicity and P the period for which the toxicity persisted to give 50 percent kill (estimated by suitable choice of transformation to linearise the relationship and by fitting an unweighted regression model).

### Results and Discussion

Persistence of various insecticides on glass surface and on sweet potato leaf are presented in Tables 1 and 2 respectively. It is seen that all the insecticides suffered a more rapid and drastic reduction on leaf surface than on glass. The persistence of malathion on glass surface was exceptionally high even much higher than that of DDT which is known as a stable insecticide. This peculiar behaviour of malathion has been observed earlier also (Metcalf 1961). Taking into consideration the P. T. values the descending order of persistence of the remaining insecticides was endrin > trichlorfon > parathion > carbaryl > lindane > DDT > endosulfan > fenitrothion.

Table 1

Persistence of various insecticides on second pottridish s exposed to 0

Insecticide	Concentration	Area of application (sq. m)	Area of exposure (sq. m)	Area of treatment (sq. m)	Area of exposure (sq. m)	Area of treatment (sq. m)	OT (g)	CR (%)
DDT	0.2%	84.4	88.88	80.00	0.70	88.88	25.00	844.80
Lindane	0.05%	25.54	88.88	89.38	15.88	38.88	1.28	1.12
Endrin	0.08%	25.54	91.82	38.88	88.00	88.00	55.55	8.57
Parathion	0.1%	100.00	100.00	21.88	75.80	70.85	0.00	1.27
Malathion	0.1%	100.00	88.88	2.82	22.58	85.20	77.77	88.08
Penitrothioa.	0.05%	100.00	100.00	88.88	28.00	1.88	0.00	0.25
Carbaryl	0.2%	82.22	88.88	55.55	48.20	88.84	28.00	1.48
Endosulfan	0.05%	88.88	82.22	75.54	48.20	58.80	1.27	0.28
Trichlorion	0.05%	98.00	88.88	84.44	82.98	82.98	48.20	4.87

Temperature during the experiment: 28.7 to 31.8°C. Humidity 62 to 86%

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Personnel vicinity of previous insecticide sprayed on [redacted] [redacted] [redacted] mod  
\* Xposed to Sun, to [redacted] breeze 0:15

DDI	0.2%	75.54	62.29	68.00	44.44	8.80	0.80	1.04	1.80
0.03%	86.68	-4.44	0.80	0.02	0.00	8.00	0.80	0.89	0.82
8.88%	69.92	60.00	55.54	0.00	0.00	0.00	0.00	7.86	8.6
8.03%	75.54	69.29	31.10	8.00	0.80	0.00	0.80	0.81	8.54
0.1%	80.88	60.00	26.66	0.88	0.00	0.00	0.00	8.83	8.68
0.08%	66.66	58.80	90.80	0.00	8.00	0.00	0.00	6.75	0.42
0.2%	44.44	40.00	26.66	0.02	8.08	0.89	5.10	8.42	
0.03%	48.80	15.35	0.00	0.00	0.00	0.00	0.00	1.04	8.02
8.85%	68.88	61.18	8.00	8.88	8.08	8.00	54.88	8.45	

P = Period for which toxicity persisted to give 50% kill. T = A enzoon side to toxicity  
 ORP = Order of relative toxicity. The higher the number the higher the toxicity.  
 Humidity: 75 - 89% All insecticides \* used 0.00% Ze frooco mial B ruan = 0.00%

Malathion which had a high degree of persistence on glass surface showed a drastic reduction on leaf and ranked along with endrin, parathion, fenitrothion and lindane. DDT was most persistent on leaf surface. But endrin, inspite of its inherent stable nature, suffered rapid loss on leaf surface and its P. T. index was on par with that of parathion which is a known nonpersistent insecticide. The persistent toxicity of trichlorfon and sevin on leaf was low and that of endosulfan was exceptionally poor, its P. T. index being 2.04 only. The results indicate that even stable insecticides like endrin, carbaryl. etc. when applied at recommended doses may not persist long enough to pose serious problems of residue hazards under conditions in Kerala.

### Summary

Persistent toxicity of DDT 0.2%, lindane 0.03%, endrin 0.03%, parathion 0.03%, malathion 0.1%, fenitrothion 0.03%, carbaryl 0.2%, endosulfan 0.03% and trichlorfon 0.05% on glass and leaf surfaces, when exposed to sunlight, was determined using *B. brevicornis* as test insect and adopting a criterion elaborated by Pradhan (1967) with some modification. The descending order of persistence on glass surface was malathion > endrin > trichlorfon > parathion > carbaryl > lindane > DDT > endosulfan > fenitrothion and on leaf surface it was DDT > malathion > endrin > parathion > fenitrothion > lindane > trichlorfon > carbaryl > endosulfan.

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