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STUDIES ON RELATIVE TOXICITY OF CYPERMETHRIN IN COMBINATION WITH CERTAIN INSECTICIDES TO THE LARVAE OF *Spodoptera litura* Fabricius*

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ABSTRACT

Laboratory evauation of relative toxicity of cypermethrin alone and in combination with certain insecticides endosulfan, monocrotophos and carbaryl at five concentrations for each instar studied against the larvae of *Spodoptera litura* Fabricius in five instars by bio-assay method to determine LC 50 and LC 90 values indicated that cypermethrin alone was the most toxic to the larvae of tobacco caterpillar in all instars followed by cypermethrin + carbaryl, cypermethrin + monocrotophos and cypermethrin + endosulfan.

KEY WORDS: Tobacco caterpillar, Toxicity, Synthetic Pyrethroid, Bioassay.

Spodoptera litura Fab. is a ubiquitous pest found throughout India. The larval stage of this pest is remarkably polyphagous but this is specially a major pest of tobacco both in nursery and in the field and also of castor. In other host plants as recorded by Fletcher (1919) are cabbage, cauliflower, jute, potato leaves, radish leaves, sweet potato, lucerne, groundnut, cotton, tur, rose, celery, poppy leaves, apple, onion, tea and cotton in Egypt.

Synthetic pyrethroids possess the highest knock down effect as compared to the most active orgaannophosphate and carbamate insecticides. Earlier studies on synthetic phrethroids by Bhat and Patel (1980) proved that cypermethrin was particularly active against the second and fourth-instar larvae of *S.littoralis*. Their trials however were restricted to a particular instar. The present investigations were undertaken to test the relative toxicity of cypermethrin alone and in combination with certain insecticides viz., endosulfan, monocrotophos and carbaryl against five instars of *S.litura* which could not be satisfactorily controlled with conventional insecticides.

MATERIALS AND METHODS

Relative toxicity of the cypermethrin alone and in combination with endosulfan, monocrotophos and carbaryl to the larve of *S.litura* was determined by bio-assay method. Required concentrations of the insecticides were prepared in solvent acetone. Each concentration was replicated thrice and the concentration per cent were prepared

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Table1. Relative toxicity of cypermethrin with other insecticides to different instar larvae of *S. litura*

Instar	Insecticide	Regresion equation	LC_{50}	Fiducial Limits	Ratio synergistic/ Antago-nistic	LC_{90}	Financial limits	Ratio synergistic/ antagonistic	Relative toxicity based on LC_{50} values
First	Cypermethrin	1.84+1.74 x	0.00006	0.00005-0.00009		0.00034	0.00019-0.00062		1.00
Second		1.48+1.65 x	0.00013	0.00010-0.00019		0.00081	0.00042-0.00156		2.16
Third		0.80+1.74 x	0.00025	0.00019-0.00034		0.00138	0.00077-0.00247		4.16
Fourth		0.64+1.62 x	0.00048	0.00035-0.00066		0.00293	0.00158-0.00546		8.00
Fifth		0.01+1.65 x	0.00108	0.00079-0.00148		0.00645	0.00334-0.01246		18.00
First	Cypermethrin	1.00+1.61 x	0.00509	0.00368-0.00705	0.0118	0.03125	0.01681-0.01246	0.0109	1.00
Second	endosulfan	1.48+1.61 x	0.01017	0.00731-0.01415	0.0128	0.06287	0.03367-0.11730	0.0129	1.99
Third		1.71+1.53 x	0.02352	0.01691-0.03269	0.0106	0.16030	0.08005-0.32120	0.0086	4.62
Fourth		2.38+1.56 x	0.05164	0.03736-0.07141	0.0093	0.33850	0.16770-0.68310	0.0086	10.14
Fifth		2.65+1.53 x	0.09404	0.06757-0.13080	0.0115	0.63860	0.32030-1.27400	0.0101	18.47
First	Cypermethrin	1.16+1.65 x	0.00541	0.00397-0.00737	0.0111	0.03228	0.01675-0.06220	0.0105	1.00
Second	monocrotophos	1.46+1.62 x	0.00957	0.00692-0.01321	0.0136	0.05873	0.03142-0.10908	0.0138	1.76
Third		2.16+1.65 x	0.02166	0.01593-0.02943	0.0115	0.12880	0.06797-0.24420	0.0107	4.00
Fourth		3.71+1.88 x	0.04142	0.03144-0.05458	0.0116	0.19730	0.11700-0.33280	0.0148	7.65
Fifth		2.94+1.62 x	0.07670	0.05577-0.10540	0.0141	0.46930	0.25210-0.87400	0.0137	14.17
First	Cypermethrin	1.08+1.75 x	0.00306	0.00227-0.00412	0.0196	0.01653	0.00929-0.02952	0.0206	1.00
Second	carbaryl	1.28+1.64 x	0.00651	0.00475-0.00891	0.0200	0.03894	0.02000-0.07582	0.0208	2.12
Third		2.01+1.71 x	0.01219	0.00898-0.01655	0.0205	0.06794	0.03678-0.12550	0.0203	3.98
Fourth		2.10+1.62 x	0.02299	0.01671-0.03163	0.0209	0.14030	0.07437-0.26440	0.0209	7.51
Fifth		2.77+1.64 x	0.05198	0.03815-0.07081	0.0208	0.31100	0.16120-0.60060	0.02074	16.98

for each insecticide from 1 per cent stock solution as follows:

Cypermethrin: 0.0000195, 0.000039, 0.000078, 0.000156, 0.000312, 0.000625, 0.00125, 0.0025, 0.005.

Cypermethrin + endosulfan: 0.000312+ 0.00156, 0.000625+, 00312, 0.00125+0.00625, 0.0025+0.0125, 0.005+0.025, 0.01+0.05, 0.02+0.1, 0.04+0.2, 0.08+0.4.

Cypermethrin + monocrotophos: 0.000312+ 0.00125, 0.000625+0.0025, 0.00125+ 0.005, 0.0025+0.01, 0.005+0.02, 0.01+0.04, 0.02+0.08, 0.04+0.16, 0.08+0.32.

Cypermethrin + carbaryl: 0.000312+0.000625, 0.000625+0.00125, 0.00125+0.0025, 0.0025+0.005, 0.005+0.01, 0.01+0.02, 0.02+0.04, 0.04+0.08, 0.08+0.160

The above concentrations were used from 1 to 5 for first instar, 2 to 6 for second instar, 3 to 7 for third instar, 4 to 8 for fourth instar and 5 to 9 for fifth instar caterpillars of *S. litura* regardless of the treatments.

For carrying out the experiment with the newly hatched larvae, the moths were collected from the field and reared in the laboratory to obtain a standard culture. The eggs laid by them were kept in glass jars for obtaining the first instar larva. To avoid canabolism among larvae, they were reared in separate tubes from second instar onwards. After preparing the required insecticidal concentration, 1 ml of prepared solution was taken into a petri-dish and was allowed to dry as reported by Pradhan (1967). The newly hatched larvae of *S.litura* at the rate of 10 per replication were allowed to crawl on treated petri-dishes in all the three replications for a period of 10 minutes (Jotwani *et al* ., 1961). After crawling for the specific period mentioned above, the larvae were carefully transferred with camel hair-brush to the untreated petri-dishes with tender castor leaves as food. Parellel control treatments were maintained using acetone.

For the assessment of toxic effect, the mortality counts were taken 24 hours after the treatment. The corrected percentage mortality was maintained by Abbot's formula (1925). The mortality data were subjected to probit analysis (Finney,1952). LC $_{50}$ and LC $_{90}$ values were calculated for each insecticide with their fiducial limits.

RESULTS AND DISCUSSION

Based on mortality data, the LC_{50} and LC_{90} values were calculated both by maximum lkelihood method and graphically. It was found that the values obtained in both methods were almost similar (Table 1). The LC $_{50}$ values of 0.00006 to 0.00108 and LC_{90} values of 0.00034 to 0.00645 were recorded for first to fifth instar of *S.litura* with cypermethrin alone. Cypermethrin + endosulfan, Cypermethrin + monocrotophos and cypermethrin + carbaryl registered LC_{50} values of 0.00509 to 0.09404, 0.00541 to 0.07670 and 0.00306 to 0.05198,LC_{90} values of 0.03125 to 0.6386, 0.03228 to 0.4693 and 0.01652 to 0.311 respectively for first to fifth instar larvae of *S.litura*.

When cypermethrin tested in combination with endosulfan, monocrotophos and carbary1, it recorded the antagonistic ratios of 0.0118, 0.0111 and 0.0196 during first instar larvae of *S.litura* for LC_{50} values indicating the antagonistic effect of cypermethrin with other insecticides. Similar trends were observed in other instars as well. It is evident from these results that use of cypermethrin alone was highly toxic to all instars of *S.litura* as compared to use in combination with endosulfan, monocrotophos and carbaryl indicating, presumbly less compatability. The results revealed that the order of toxicity of cypermethrin when tested individually against the larvae of *S.litura* during five instars indicated that LC 50 values second to fifth instar larvae were 2.1, 4.1, 8.0 and 18.0 times respectively more toxic than that of first first instar larvae. These results emphasize that even though lower concentrations were able to give mortality in earlier instars, higher concentrations were required in advanced instars. The results agree with the findings of Salama *et al.*, (1975). A similar trend was observed in all instars when cypermethrin was tested in combination with endosulfan, monocrotophos and carbaryl.

Evaluation of comparative toxicity of the insecticidal treatments based on LC_{50} values against the five instars of *S. litura* revealed that cypermethrin was 78 to 107 times as toxic as cypermethrin + carbaryl ; 1.56 to 2.24 times as toxic as cypermethrin + monocrotophos and 1.06 to 1.24 times as toxic as cypermethrin + endosulfan to all the instars (Table 1). Abdel-Aal and Hussein (1979) reported that permethin, cypermethrin and sumiciden constituted the most toxic group individually. The order of toxicity was cypermethrin cypermethrin + carbaryl cypermethrin + monocrotophos cyper methrin + endosulfan in all the instars. From these findings, it is inferred that cypermethrin alone was highly toxic against *S.litura* larvae as compared to use in combination with endosulfan, monocrotophos and carbaryl respectively indicating presumably incompatability.

Table 2. Comparative toxicities of cypermethrin + endosulfan, cypermethrin + monocrotophos, cypermethrin + carbaryl and cypermethrin at LC_{50} levels against *Spodoptera litura*.

Instar	Cyperpermethrin + endosulfan	Cyperpermethrin + monocrotophos	Cyperpermethrin + carbaryl	Cyperpermethrin +
First	1.00	1.15	1.66	84.83
Second	1.00	1.06	1.56	78.23
Third	1.00	1.08	1.92	94.08
Fourth	1.00	1.24	2.24	107.58
Fifth	1.00	1.22	1.80	87.07

REFERENCES

ABBOT, W.S. 1925. A method of computing the effectivenes of insecticides. J. Econ. Entomol. 28: 265-267.

ABDEL-AAL, Y.A.I. and HUSSEIN, M.H. 1979. The relative toxicity of certain insecticides to **S. littorali** and **C. undecimpunctata**. International Pest Control. 21: 79-80.

BHAT, M.V. and PATIL,. V.T. 1980. Role of Cypermethrin in cotton pest management. Andhra Agric.J. 27 (1&2): 86-87.

FINNEY, D.J. 1952. **Probit Analysis.** 318 pp. Cambridge Universty Press, London.

FLETCHER, T.B. 1919. Annotated list of Indian Crop-pests. Proc. 3rd Ent. Meet. Pusa. 67-68

JOTWANI, M.G., RAI B.K. and PRADHAN, S. 1961. Bio-assay of the comparative toxicity of some insecticides to the larvae of **Prodenia litura** Fabricius (Noctuidae: Lepidoptera) Indian J. Entomol., 23: 50-53.

PRADHAN, S. 1967. strategy of integrated pest control. Indian J. Entomol., 29: 105-122.

SALAMA, A.E., HORNY A.H. and ASHRU, M. 1975. Susceptibility of different larval instars of the cotton leafworm **Spodoptera littoralis** (Lepidoptera:Noctuidae) to insecticides. Bull. Entomol. Soc. Egypt. Econ. Ser. 10: 225-232.