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Effect of Some Herbicides on Egg Parasitism and Development of *Trichogramma chilonis* Ishii (Trichogrammatidae : Hymenoptera)

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ABSTRACT

Herbicides may affect natural enemy activity either by destroying their food and host resources or by killing them directly or by repelling them from the treated area. Laboratory study was conducted to work out the effect of six herbicides namely, pretilachlor, paraquat, sulfosulfuron, 2, 4 - DEE, Sumisoya and imazosulfuron, each at three dosages, on the pupal mortality, egg parasitism and subsequent development of *Trichogramma chilonis* Ishii, an egg parasitoid of lepidopteran crop pests. The herbicides caused 0 – 10.65% mortality of the treated pupae and all the herbicides were considered to be safe to pupal stage of the parasitoid. 2, 4 - DEE caused considerable reduction to the parasitism of treated eggs by the parasitoid, whereas, others had little to moderate levels of adverse effect on egg parasitism. The herbicides had no marked adverse effect on adult longevity. None of the herbicides affected the subsequent emergence of the adults from treated host eggs. Reduction of egg parasitism in some herbicides may be either due to the repellent action of these chemicals themselves or due to adjuvants used in formulation.

Key Words : *Trichogramma chilonis*, Non-target toxicity, Herbicides

Pesticides may affect natural enemy effectiveness either by causing direct mortality or by influencing their reproduction, behaviour, foraging or movement (Jepson, 1989; Croft, 1990). Insecticides and acaricides are directly damaging to arthropod natural enemies whereas, the effect of fungicides and herbicides on them may not always be direct. Herbicides may affect natural enemy activity either by destroying their food and host resources or by killing them directly or repelling them from treated area. Herbicides have been reported to kill entomopathogenic nematode, *Steinernema feltiae* (Forschler *et al.*, 1990). Paraquat and diquat make treated soils in vineyards repellent to the predaceous mite, *Typhlodromus pyri* (Scheuten) (Boller *et al.*, 1984). Hassan *et al.* (1988) while studying the non-target toxicity of glyphosate on arthropod natural enemies, found it moderately harmful to the predatory carabid beetle, *Bembidion lampros*. Hence, assessment of potential effect of herbicides on beneficial arthropods is of immense importance for the establishment of effective pest management programme. In this background, the present programme was undertaken to study the effect of six herbicides on the pupal mortality, egg parasitism and subsequent development of *Trichogramma chilonis* Ishii, an egg parasitoid of lepidopteran crop pests.

MATERIALS AND METHODS

Laboratory experiment was conducted with six herbicides namely, pretilachlor 50 EC, paraquat dichloride 24 SL, sulfosulfuron 75 WP, 2, 4 - DEE 38 EC, Sumisoya 50 WG (a new molecule) and imazosulfuron 10 SC, each at 3 dosages (recommended field dosages and above and below it) diluted in 500 l of water (Table 1) at 30± 1°C temperature and 60± 5% R.H.

To study the effect of these herbicides on the pupal stages of *T. chilonis*, egg cards containing the eggs of *Corcyra cephalonica* Staint. were offered to the adult parasitoids for parasitisation. After 4 days, when the parasitoid larvae inside the host eggs entered pupation, the cards were made into pieces, each piece containing about 75 parasitized eggs. The cards were then dipped into herbicide solutions, removed immediately and were dried under fan. These were then kept inside small glass phials for emergence of adult parasitoids. Pupal mortality was recorded after adult emergence.

To study the effect of herbicides on egg parasitism by adult parasitoids and their subsequent development, small egg cards were prepared with about 150 sterilized *Corcyra* eggs. These cards were then dipped in herbicidal solutions, removed

immediately and dried under fan. Treated egg cards were placed in small glass phials and single pair of *T. chilonis* adults was released inside it for oviposition. The longevity of adult females was recorded after each 24 hr. The number of eggs parasitized by each female was recorded after blackening of parasitised host eggs and percentage of adult emergence was recorded subsequently after the emergence of adults. Data obtained were statistically analyzed for test of significance following Completely Randomized Design.

RESULTS AND DISCUSSION

Effect of herbicides on pupal mortality:

Amongst the herbicides tested, relatively higher mortality was observed in Sumisoya at 20 – 40 g a.i. /ha (8.57 – 10.65%), imazosulfuron at 30 and 40 g a.i. / ha (7.21 and 8.57%), paraquat dichloride at 900 g a.i. / ha (8.89%) and pretilachlor at 750 g a.i. / ha (7.78%) (Table 1). Sulfosulfuron @ 25 and 20 g a.i. / ha, 2, 4 – DEE at 450 and 300 g a.i. /ha produced no mortality to the treated pupae and these treatments were statistically superior to imazosulfuron at 40 and 30 g a.i. / ha, Sumisoya at 20 – 40 g a.i. / ha, pretilachlor at 750 g a.i. / ha and paraquat dichloride at 900 g a.i. / ha. However, on the basis of percent mortality, all the herbicides, even at dosages higher than the recommended ones, were considered to be safe to *T. chilonis* pupae.

Table 1 Percent corrected mortality of *T. chilonis* pupae after treatment with different herbicides

Herbicides	Dosage (g a.i. / ha)	% mortality
Pretilachlor 50 EC	750	7.78 (16.37)*
	500	5.56 (12.37)
	300	1.11 (6.46)
Paraquat dichloride 24 SL	900	8.89 (17.78)
	600	2.22 (7.88)
	360	2.22 (7.88)
Sulfosulfuron 75 WP	30	2.22 (7.88)
	25	0.0 (4.05)
	20	0.0 (4.05)
2,4 - DEE 38 EC	600	3.33 (10.29)
	450	0.0 (4.05)
	300	0.0 (4.05)
Sumisoya 50 WG	40	10.65 (19.27)
	30	9.47 (16.54)
	20	8.57 (15.60)
Imazosulfuron 10 SC	40	8.57 (15.60)
	30	7.21 (14.46)
	20	3.61 (9.25)
CD at p = 0.05	-	10.27

* Data in parentheses denote angular transformed values.

Effect of herbicides on egg parasitism and subsequent development :

Amongst the herbicidal treatments, 2, 4-DEE at 300-600 g a.i. / ha produced lowest numbers of parasitized eggs (39.40-22.40 eggs / female) resulting in 41.54-66.77% reduction in egg parasitization over control (67.40 eggs / female)(Table 2). However, only the two higher dosages of the herbicide (600 and 450 g a.i. / ha) differed significantly from control and other herbicidal treatments. All other treatments were at par with control though, Sumisoya and pretilachlor also considerably reduced egg parasitism (14.58-24.63% and 18.29-20.77%, respectively).

The herbicidal treatments did not affect the longevity of the adult females.

Table 2 Egg parasitization and percent emergence of *T. chilonis* from herbicide treated host eggs

Herbicides	Dosage	No. of eggs parasitized/ female	% reduction over control	% adult emergence
Pretilachlor	750	53.40(7.22)*	20.77	93.33(76.73)**
50 EC	500	54.60(7.30)	18.99	89.33(71.22)
	300	53.60(7.25)	20.47	89.33(73.37)
Paraquat	900	60.20 (7.54)	10.68	89.33 (72.82)
dichloride	600	64.40 (7.94)	4.45	91.33 (74.70)
24 SL	360	66.60 (8.13)	1.19	90.67 (74.51)
Sulfosulfuron	30	66.20 (8.05)	1.78	92.00 (74.49)
75 WP	25	65.60 (8.06)	2.67	93.34 (75.73)
	20	64.20 (8.01)	4.75	90.67 (74.51)
2,4 DEE	600	22.40 (4.55)	66.77	93.51 (76.90)
38 EC	450	26.80 (5.16)	60.24	95.06 (78.55)
	300	39.40 (6.07)	41.54	95.33 (79.12)
Sumisoya	40	50.80 (7.09)	24.63	89.33 (71.42)
50 WG	30	51.20 (7.08)	24.04	92.60 (76.35)
	20	54.20 (7.31)	19.58	92.00 (73.85)
Imazosulfuron	40	57.20 (7.55)	15.13	94.00 (79.16)
10 SC	30	58.20 (7.58)	13.65	95.33 (79.00)
	20	62.60 (7.82)	6.26	95.33 (80.39)
Control		67.40 (8.15)		95.33 (79.00)
CD at p = 0.05		1.46		N. S.

* Square root transformed values.
** Angular transformed values.

Adult emergence from herbicide treated host eggs ranged from 89.33-95.33% as compared to 95.33% in control. This clearly shows that, herbicidal treatments did not affect the subsequent emergence of *T. chilonis* adults.

Pesticides cause harm to natural enemies not only through their acute and persistent toxicity leading to mortality, but commercial formulations of pesticides usually posses characteristic odour which may cause anti-directional movement of natural enemies from the site of odour. During the present investigation, the herbicides were found to be safe to the pupal stages of *T. chilonis*. When herbicide treated host eggs were offered to the adult trichogrammatids for parasitization, 2, 4 – DEE caused significant reduction in the rate of parasitisation. Similar effects, though at non-significant levels, were observed in Sumisoya and pretilachlor. The results of the present investigation are in clear conformity with earlier findings as reduction in fecundity has been reported in beneficial insects when exposed to 2, 4 – D. More over, 2, 4 – DB dimethyl-amine salt has low toxicity to bees (EPA). The reduction in egg parasitism in 2, 4 – DEE, a phenoxy acetic herbicide, and a few others may be due to direct toxicity or repellent action of the chemicals or the adjuvant used in formulations. Another alarming aspect of using 2, 4 – DEE is that, it may affect the adult parasitoids by depleting their nectar sources, as it is known to inhibit nectar secretion even at concentrations that cause no visible injury to plants (Anon. 1981).

REFERENCES

Anonymous 1981. Pesticide – pollinator interactions. Rep. Natl. Res. Coun. Canada. (Canada NRC Associate Committee on Scientific Criteria for Environmental Quality). No. 18471: 190pp.

Boller, E. F.; Janser, E. and Potter, C. 1984. Testing of the side-effects of herbicides used in viticulture on the common spider mite *Tetranychus urticae* and the predaceous mite *Typhlodromus pyri* under laboratory and semi-field conditions. *Zeitschrift fur pflanzenkranKheiten und pflanzenchutz*, **91**: 561 – 568.

Croft, B. A. 1990. Arthropod biological control agents and pesticides. John Willey and Sons, New York.

EPA Pesticide Fact Sheet. pmep. cce. Cornell. Edu / profiles / herb – growth reg / 2, 4 – d – butylate /2,4 – db / herb – prof – 2, 4 db.

Forschler, B.T.; All, J.N. and Gardner, W. A. 1990. *Steinernema feltiae* activity and infectivity in response to herbicide exposure in aqueous and soil environments. *J. Invert. Pathol.* **55** : 375 - 379.

Hassan, S.A.; Bigler, F.; Bogenschutz, H.; Boller, E.; Brun, J.; Chiverton, P.; Edwards, P.; Mansour, F.; Naton, E.; Oomen, P.A.; Overmeer, W.P.J.; Polgar, L.; Rieckman, W.; Samsoe-Petersen, L.; Staubli, A.; Sterk, G.; Tavares, K.; Tuset, J.J.; Viggiani, G. and Vivas, A.G. 1988. Results of the fourth joint pesticide testing programme carried out by the IOBC/WPRS-Working Group.

Jepson, P. C. (ed.) 1989. Pesticides and non – target Invertebrates. Intercept. Wimborne. Dorset, U. K.