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Relative Toxicity of Different Pesticides to *Campoletis chlorideae* Uchida (Hym., Ichneumonidae)*

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ABSTRACT

The ichneumonid *Campoletis cholrideae* Uchida is a common parasitoid of *Helicoverpa armigera* (Hubn.) and *Spodoptera litura* (Fab.) on many crops in India. The toxicity of 30 pesticides (19 insecticides, 9 fungicides, neem seed kernel extract (NSKE) and nuclear polyhedrosis virus (NPV) to the adults of *C.chlorideae* was studied. The data on the initial toxicity revealed that acephate, NSKE, NPV and the fungicides appeared to be safe to the parasitoids. The insecticides found to be toxic were tested further for their residual toxicity to *C. chlorideae*. Endosulfan, carbaryl, dichlorvos, phosalone and methyl demeton were less persistent than the other insecticides. Residual toxicity of synthetic pyrethroids especially cypermethrin persisted for a longer time (42 days) against *C. chlorideae*.

KEY WORDS : *Campoletis chlorideae,* pesticides, toxicity

Campoletis chlorideae Uchida (Hymenoptera, Ichneumonidae) had been reported as a dominant parasitoid of the two destructive and polyphagous pests *viz., Helicoverpa armigera* (Hubn.) and *Spodoptera litura* (Fab.). Parasitism by *C.chlorideae* went up to 60% in the fields (Sathe, 1987; Nikam and Gaikwad, 1989). Pesticides selectively effective against the pest without adversely affecting its important natural enemies are to be identified for incorporation in integrated pest managment programme (Hassan *et al.,* 1991). Little information in this regard is available in India and elsewhere on *C.chlorideae*. The purpose of the present research was to determine the toxicity of commonly used pesticides to *C.chlorideae* for selecting the ones best suited for use in integrated control programme.

MATERIALS AND METHODS

Rearing *C.chlorideae* was done on *S.litura* in the laboratory as suggested by Krishnamoorthly (1987). One to two day-old adult parasitoids were used as test insects. The insecticides tested, with their concentrations are listed in Table 1. The fungicides/acaricides *viz.,* dicofol 0.05%, chlorothalonil 0.20%, metalaxyl + mancozeb 0.20%, copper oxychloride 0.20%, dinocop 0.10%, zineb 0.20%, mancozeb 0.20%, carbendazim 0.10% and sulphur 0.20% were also included in the present study. They were tested as formulated materials, except neem seed kernel extract (NSKE) and nuclear polyhedrosis virus (NPV), (6×10^9 polyhedral bodies/ml) at field-recommended concentration. They were diluted with water to get the desired concentration.

The dry film technique adopted by Mani and Thontadarya (1988) was used to test the texicity of pesticides against *C.chlorideae*. Potted tomato plants were sprayed with different pesticides and the treated leaves were exposed in glass vials (20 x 3 cm). Plants treated with water served as untreated check. Mortality was recorded at 1,3,6 and 24 h of exposure in the study on the initial toxicity.

The pesticides which proved detrimental to *C.chlorideae* were further tested for their toxic residual activity by exposing the adults to the

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Table 1. Effect of pesticides on the adults of *C. chlorideae*

Treatment	Mortality of adults (arc-sine x $\sqrt{\%}$) Hours after application				Mean
	1	3	6	24	
Endosulfan 0.07%	26.97	90.00	90.00	90.00	74.24
Carbaryl 0.10%	0.57	0.57	46.90	83.20	32.81
Phosalone 0.07%	0.57	23.84	44.98	90.00	39.85
Monocrotophos 0.05%	0.57	0.57	44.98	90.00	34.03
Methomyl	0.57	0.57	23.84	90.00	28.74
Fenvalerate 0.01%	90.00	90.00	90.00	90.00	90.00
Cypermethrin 0.005%	90.00	90.00	90.00	90.00	90.00
Deltamethrin 0.01%	61.20	90.00	90.00	90.00	85.30
Methyldemeton 0.05%	41.13	90.00	90.00	90.00	77.73
Dimethoate 0.05%	0.57	0.57	43.06	90.00	33.80
Malathion 0.10%	90.00	90.00	90.00	90.00	90.00
Quinalphos 0.05%	90.00	90.00	90.00	90.00	90.00
Chlorpyriphos 0.05%	0.57	28.77	90.00	90.00	45.28
Methylparathion 0.05%	90.00	90.00	90.00	90.00	90.00
Fenthion 0.10%	90.00	90.00	90.00	90.00	90.00
Dichlorvos 0.10%	90.00	90.00	90.00	90.00	90.00
Acephate 0.10%	0.57	0.57	0.57	0.57	0.57
Phosphamidon 0.10%	0.57	90.00	90.00	90.00	90.00
Fluvalinate 0.01%	90.00	90.00	90.00	90.00	90.00
Neem seed kernel extract 2%	0.57	0.57	0.57	0.57	0.57
Nuclear polyhedrosis virus 6 x 10^9 PIB/ml	0.57	0.57	0.57	0.57	0.57
Mean	40.71	54.15	65.49	76.90	–

	SEM	Level of Significance	C.D. (P=0.05)
Treatments (A)	0.56	0.01	2.09
Hours after application (B)	0.25	0.01	0.91
Interaction (AxB)	0.13	0.01	4.17

Data on the fungicide/acaricide not given in the Table since they did not cause any mortality.

treated leaves at regular time intervals as suggested by Mani and Thontadarya (1988). Adult mortality was observed after 24 h of exposure. All tests were replicated 3 times, and in each replicate 10 adult parasitoids were tested. Zero mortality values were converted to 0.01 and the data were transformed into corresponding angles (arcsin $\sqrt{percentage}$) for statistical analysis. 'F' test was employed to analyse the differences in the mortality of the parasitoids due to different pesticides and time intervals.

RESULTS AND DISCUSSION

The data on the initial toxicity of 30 pesticides to the adults of *C.chlorideae* is presented in Table 1. All the nine fungicides/acaricides tested, and three insecticides namely acephate, NSKE and NPV appeared to be safe to the adult parasitoids. There was no mortality of the parasitoid even at 24 h of exposure with the above pesticides. The remaining 18 insecticides proved detrimental to *C.chlorideae*. Among them, fenvalerate, cypermethrin, malathion, methyl parathion and fenthion were extremely toxic inflicting 100% mortality of the parasitoids within an hour of exposure. The other insecticides caused less mortality of *C.chlorideae* in the initial hours of exposure and there was 100% mortality at 24 h of exposure.

Table 2. Residual effect of insecticides to *C. chlorideae*

Treatment	Mortality of adults (arc-sine %)							Mean
	Days after application							
	1	7	14	21	28	35	42	
Endosulfan	90.00	0.57	0.57	0.57	0.57	0.57	0.57	13.35
Carbaryl	90.00	0.57	0.57	0.57	0.57	0.57	0.57	13.35
Phosalone	90.00	0.57	0.57	0.57	0.57	0.57	0.57	13.35
Monocrotophos	90.00	90.00	90.00	0.90	90.00	0.57	0.57	70.25
Methomyl	90.00	90.00	90.00	48.83	23.85	0.57	0.57	49.14
Fenvalerate	90.00	90.00	90.00	61.20	48.83	0.57	0.57	54.39
Cypermethrin	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
Deltamethrin	90.00	90.00	66.18	54.76	0.57	0.57	0.57	43.67
Methyldemeton	90.00	0.57	0.57	0.57	0.57	0.57	0.57	13.35
Dimethoate	90.00	66.18	40.95	0.57	0.57	0.57	0.57	28.49
Malathion	90.00	90.00	90.00	0.90	0.57	0.57	0.57	51.68
Quinalphos	90.00	90.00	90.00	54.76	0.57	0.57	0.57	46.64
Chlorpyriphos	90.00	90.00	90.00	74.97	0.57	0.57	0.57	49.53
Methylparathion	90.00	90.00	90.00	68.83	0.57	0.57	0.57	48.65
Fenthion	90.00	90.00	90.00	90.00	44.98	0.57	0.57	45.16
Dichlorvos	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Phosphamidon	90.00	90.00	66.12	23.85	0.57	0.57	0.57	40.24
Fluvalinate	90.00	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Mean	90.00	60.19	54.81	42.01	16.95	7.80	5.00	-

	SEM	Level of Significance	C.D. (P=0.05)
Treatments (A)	1.17	0.01	3.29
Hours after application (B)	0.73	0.01	2.70
Interaction (AxB)	3.12	0.01	11.49

There were significant differences in the mortality of parasitoids due to different pesticides on different days after treatment. Six insecticides namely endosulfan, carbaryl, phosalone, methyl demeton, dichlorvos and fluvalinate caused 100% mortality on day 1 but the residual effect declined sharply causing no mortality 7 days post spray (Table 2). Cypermethrin was the most persistent and toxic insecticide inflicting 100% mortality of parasitoids even six weeks (42 days) after treatment. Monocrotophos was equally toxic to *C.chlorideae*. The other insecticides lost the residual toxicity to the parasitoid 21-28 days post treatment.

Not much information on the effect of pesticides on *C.chlorideae* is available except that of Prasad *et al.* (1987) who reported the influence of some pesticides, applied as seed treatment, on the parasitoid population in the chickpea fields. However, considerable information is available on a closely related species *C.sonorensis*(Carlson). Plapp and Vinson (1977) found adults to be highly susceptible to many insecticides, and acephate was less toxic to *C.sonorensis*. This conforms to the present observation of low toxicity of acephate to *C.chlorideae*. The low toxicity of acephate to the parasitoids *Cotesia plutellae* (Kurdj) has been reported earlier by Kao and Tzeng (1992). The effect of fungicides on *C.chlorideae* had not been studied so far. However, similar results on the non-toxicity of chlorothalonil, metalaxyl + mancozeb, copper oxychloride, dinocop, zineb, mancozeb, carbendazim and sulphur to other benefical organisms had been reported earlier.

Carbaryl, endosulfan, phosalone, dichlorvos, fluvalinate and methyl demeton showed high initial toxicity to *C.chlorideae*. But their residues disappeared more rapidly than the other insecticides. According to Plapp and Vinson (1977), carbaryl was moderately toxic to *C.sonorensis*. Endosulfan showed high initial toxicity to *C.sonorensis* (Plapp and Bull, 1978). Phosalone and methyl demeton were also found initially toxic to yet another ichneumonid *Phygadeuon trichops* Thoms. (Hassan *et al.*, 1987). The high initial toxicity and subsequent low residual toxicity of endosulfan, phosalone and dichlorvos to the encyrtid parasitoid *Aenasius advena* Comp. (Mani, 1992a) and fluvalinate to *C.plutellae* (Mani, 1992b) had been reported earlier. Besides the selective insecticides, the less persistent chemicals can also be incorporated in the integrated control programme (Meyerdirk *et al.*, 1982).

The remaining insecticides were moderate to highly persistent against *C.chlorideae*. The high toxicity of methomyl (Plapp and Bull, 1978) and methyl parathion and malathion (Lingren *et al.*, 1972) to *C.sonorensis* and chlorphriphos, dimethoate and phosphamidon to *P. trichops* (Hassan *et al.*, 1998) had been reported earlier. Besides these insecticides, synthetic pyrethroids namely fenvalerate, cypermethrin and deltamethrin had shown high initial and residual toxicity to *C.chlorideae* in the present study. According to Dai (1990), *C.chlorideae* was sensitive to pyrethroids. Plapp and Vinson (1977) also reported synthetic pyrethroids like permethrin and NRDC 61 to be highly toxic to *C.sonorensis*. In India, these pyrethroids were found very effective initially against *H.armigera* and *S.litura*.But later, repeated applications of these chemicals had resulted in the outbreak of many insect pests due to disruption of important local parasitoids and predators. According to Meyerdirk *et al* (1982), the use of persistent chemicals should be avoided in the pest mangement programme. Thus the information provided here would contribute to the planning of pest management programme.

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