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Research Note

Effect of insecticides on immature stages of *Cotesia plutellae* Kurdj. (Hymenoptera; Braconidae), an endo-larval parasitoid of diamondback moth

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ABSTRACT : **Thirteen insecticides were assayed for their toxicity to the immature stages of *Cotesia plutellae* Kurdj. (Hymenoptera: Braconidae), when sprayed on parasitized diamondback moth larvae at various developmental stages of the parasitoid. With the advancement of age from 0 to 6 days after parasitization, the toxicity of insecticides was lower. NSKE, neemark, methomyl and acephate were fairly safe while fenvalerate, fipronil, spinosad, quinalphos and endosulfan were detrimental to all the stages of development showing zero per cent survival. In decreasing order, monocrotophos, cartap hydrochloride, lufenuron and thiodicarb were moderately toxic.**

KEY WORDS: Diamondback moth, *Cotesia plutellae*, insecticides, toxicity

Cotesia plutellae Kurdj., is an important endo-larval parasitoid of diamondback moth, *Plutella xylostella* (L.) and has been reported from different parts of India (Yadava *et al.*, 1975; Jayarathnan, 1977; Nagarkatti and Jayanth, 1982). Conservation of natural enemies forms a vital component of integrated pest management in order to reduce the pesticide load in the environment. Hence, selection and use of pesticides that are less toxic to the immature stages of the parasitoid residing inside the host body is essential. Therefore, a study was taken up to ascertain the toxicity of some commonly used insecticides against the immature stages of *C. plutellae* at different periods of their development.

MATERIAL AND METHODS

The experiment was carried out at UAS, Dharwad, in 1999. Both DBM and *C. pluttelae* were maintained in the laboratory following standard procedures (Anon., 1994). A batch of about 300 one-day-old second instar DBM larvae was kept for parasitization by 20 pairs of *C. plutellae* in the rearing cage for 24 h. Out of this, 200 parasitized larvae were exposed to insecticidal treatments, while the rest 100 larvae were kept as control to record the per cent parasitism in each batch. Likewise for each insecticide, batches of 300 DBM larvae were parasitized.

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The time of removal of parasitized larvae was taken as zero day of parasitization. The parasitized larvae were reared separately in rearing tubs on cabbage leaves. Ten parasitized larvae each with different developmental stages of parasitoids (0, 2, 4 and 6 days) were taken in petri plates and sprayed with one ml of each insecticidal solution separately (Table 1) using chromatographic sprayer. The test was replicated five times with ten parasitized larvae containing immature parasitoids in each replication. The treated DBM larvae were reared till pupation or formation of the parasitoid cocoons.

$$\text{Per cent survival of } C.\ plutellae = \frac{\text{Actual \% survival of } C.\ plutellae}{\text{\% parasitism in control}} \times 100$$

In some cases, DBM larvae died after treatment before the emergence of parasitoid and hence further observations could not be made. However, in other cases, the number of DBM pupae or the parasitoid cocoons was recorded and the percentage values were worked out. The data were later subjected to two-factor analysis in completely randomized design after arc-sine transformation and the means were separated by Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The per cent survival of *C. plutellae* following insecticidal sprays to parasitized larvae, after 0, 2, 4 and 6 days of parasitization, showed significant differences (Table 1). NSKE, neemark, methomyl and acephate were fairly safe to the immature stages while fenvalerate, fipronil, spinosad, quinalphos and endosufan were detrimental showing zero per cent survival at all stages of development. The parasitized host larvae after 0 days of parasitization were more susceptible as evidenced from decreased survival. With the advancement in age from zero to 6 days after parasitization, the toxicity of insecticides decreased. The reason may be that late *C. plutellae* larval stages have greater glycogen and fat resources as opined by Hamilton and Kiechefer (1969). Hence, though the DBM larvae may become more vulnerable to insecticides with the advancement of parasitization, the larvae of *C. plutellae* survived. In the decreasing order, monocrotophos, cartap hydrochloride, lufenuron and thiodicarb were moderately toxic.

It was observed that the insecticides which were toxic to the host larvae were also detrimental to the immature stages of the parasitoid. Similar conclusions have been made by Furlong and Wright (1993), Idris and Grafius (1993) and Chilcutt and Tabashnik (1997). However, when fenvalerate, fipronil and spinosad were sprayed after 6 days of parasitization, when the parasitoid larvae were in the mature larval stage, the parasitoid larvae emerged out of the host but died without forming cocoons. Similar effects were noticed in quinalphos and endosulfan treated larvae, after 4 and 6 days of parasitization. The selection of insecticides is, therefore, very crucial in managing the DBM population and conserving its natural enemy, *C. plutellae*.

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Table 1: Per cent survival of *C. plutellae* per ten parasitized DBM larvae treated

Sl. No.	Treatments Conc (%)	Days after parasitism				Mean	% parasitism in control
		Zero	Two	Four	Six		
1.	Fenvalerate (0.01)	0.00^{n}	0.00^{n}	0.00^{n}	0.00^{n}	0.00	87.50
2.	Fipronil (0.01)	0.00^{n}	0.00^{n}	0.00^{n}	0.00^{n}	0.00	86.54
3.	Spinosad (0.048)	0.00^{n}	0.00^{n}	0.00^{n}	0.00^{n}	0.00	92.73
4.	Qunialphos (0.05)	0.00^{n}	0.00^{n}	0.00^{n}	0.00^{n}	0.00	85.71
5.	Endosulfan (0.07)	0.00^{n}	0.00^{n}	0.00^{n}	0.00^{n}	0.00	86.95
6.	Thiodicarb (0.15)	0.00^{n}	68.00 (55.55)^{ij}	68.00 (55.55)^{ij}	80.00 (63.43)^{fghi}	54.00 (47.29)	91.48
7.	Lufenuron (0.0005)	0.00^{n}	50.00 (45.00)^{kl}	68.00 (55.55)^{ij}	82.00 (64.89)^{fgh}	50.00 (45.00)	90.19
8.	Neemark (0.00015)	78.00 (62.08)^{ghi}	80.00 (63.44)^{fghi}	86.00 (68.03)^{efg}	98.00 (81.87)^{ab}	85.50 (67.62)	86.79
9.	NSKE (5.0)	88.00 (69.73)^{de}	90.00 (71.56)^{cde}	98.00 (81.87)^{ab}	100.00 (90.00)^{a}	94.00 (75.82)	89.36
10.	Acephate (0.075)	44.00 (41.55)^{kl}	56.00 (48.45)^{jk}	88.00 (69.73)^{def}	92.00 (73.57)^{cd}	70.00 (56.79)	88.88
11.	Methomyl (0.0125)	54.00 (47.29)^{jkl}	72.20 (58.05)^{hi}	94.00 (75.82)^{bcd}	96.00 (78.46)^{abc}	79.00 (62.73)	88.23
12.	Cartap hydro-chloride (0.05)	0.00^{n}	54.00 (47.29)^{jkl}	56.00 (48.45)^{jk}	78.00 (62.08)^{ghi}	47.00 (43.28)	90.38
13.	Monocroto-phos (0.072)	0.00^{n}	24.00 (29.33)^{m}	24.00 (29.33)^{m}	40.00 (39.23)^{l}	22.00 (27.97)	85.41
	Mean	20.31 (26.79)	38.00 (38.06)	44.77 (41.99)	51.23 (45.70)		

Figures in parentheses are arc-sine transformed values.
Means followed by the same letters do not differ significantly by DMRT (P=0.01)

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