Research Paper :

A study on organophosphate resistance frequencies in *Helicoverpa armigera*

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International Journal of Plant Protection, **Vol. 4 No. 1 (April, 2011) : 27-29**

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SUMMARY

An experimental result showed that organophosphate resistance frequencies were unexpected despite meagre use of organophosphate compounds for management of *H. armigera*. The resistance studies revealed that profenofos 0.1ug did not show any resistance level throughout the season, while quinalphos 0.75ug and Chlorpyriphos 1.0ug per larvae showed low to moderate resistance. Monocrotophos 1.0ug per larvae showed constant moderate to high resistance throughout the season.

Jadhav, Y.T., Kanase, R.V., Thaware, D.S. and Shinde, B.A. (2011). A study on Organophosphate resistance frequencies in *Helicoverpa armigera*. *Internat. J. Pl. Protec.*, **4**(1): 27-29.

Key words : *Helicoverpa armigera*, Organophosphate, Resistance

Received : ***August, 2010***
Accepted : ***October, 2010***

Helicoverpa armigera Hubner, a polyphagous and cosmopolitan pest has been reported to damage more than 200 plant species, causing an estimated annual crop loss to around Rs.2,000 crores despite the use of insecticide chemicals worth about Rs.500 crores (Pawar, 1998).

In recent years, *H. armigera* has developed resistance to certain molecules in all the established chemical groups of insecticides available to Indian farmer's. (Armes *et al.*, 1992). The important mechanisms of organophosphate resistance may be due to target-site resistance involving decreased sensitivity to acetyl-cholinesterase to inhibition (Brown *et al.*, 1996;Harold and Ottea,1997).

Hence, realizing the need to understand the levels of resistance and to develop comprehensive strategies for organophosphate resistance management in important pest such as *H. armigera*, an experimental study was conducted during the cropping season of 2005-06.

MATERIALS AND METHODS

An experimental research work was conducted in the laboratory of Department of Entomology, during 2005-06 in Randomized Block Design comprising of four main treatments of quinalphos 0.75ug, profenofos 0.1ug, monocrotophos 1.0ug and chlorpyriphos 1.0ug on *H. armigera* larvae. Initially nearly 10,000 eggs and 6,000 larvae of H. *armigera* were collected from various host plants like cotton, red gram, chickpea, *Lagascea mollis* from nearby farmer's field. The collected eggs were disinfected with 0.02% sodium hypochlorite and then transferred into multicellular trays containing chickpea based semi synthetic diet (Armes *et al.*, 1992). The second instar larvae were later transferred individually into multicellular trays to avoid cannibalism. When the larvae attained age of third instar weighing 30-40mg body weight, they were applied the dose of 1ul on dorsal prothorax by using Hamilton micro-applicator. Control was taken by applying larvae with acetone only. All the rearing procedures were carried out at temperature of 27 ± 2^0C, relative humidity of 78 ± 2 per cent and photo period of approximately 13:11 Light: Dark hours regime. Larval mortality was observed after every 24 hours upto 7 days.

Table 1 : Organophosphate resistance frequencies in *H. armigera*

Month	Per cent Resistant to			
	Quinalphos 0.75ug/larvae	Profenofos 0.1ug/larvae	Monocrotophos 1.0ug/larvae	Chlopyriphos 1.0ug/larvae
Aug.2005	14.01 (21.97)	0.0 (0.0)	41.66 (40.22)	26.24 (30.72)
Sep. 2005	2.96 (8.72)	0.0 (0.0)	44.16 (41.67)	22.12 (27.30)
Oct. 2005	13.81 (21.81)	0.0 (0.0)	28.75 (32.46)	19.23 (25.99)
Nov. 2005	1.04 (5.74)	0.0 (0.0)	30.83 (33.71)	16.27 (23.81)
Dec. 2005	13.58 (21.64)	0.0 (0.0)	26.03 (30.66)	24.48 (29.67)
Jan. 2006	14.77 (22.63)	0.0 (0.0)	24.16 (29.47)	23.95 (29.33)
Feb. 2006	10.41 (18.81)	0.0 (0.0)	32.19 (34.57)	29.93 (33.10)
Mar.2006	6.73 (15.00)	0.0 (0.0)	36.26 (37.00)	30.42 (33.46)

Figures in parenthesis are arc sin values

Corrected larval mortality was calculated by using Abbots formula (1925) and later by using per cent resistance formula organophosphate resistance, per cent in *H. armigera* larvae was calculated. Log dose probit (LDP) bioassays were carried out to workout the median lethal dose. The mortality data were subjected to probit analysis as per procedure of Finney (1971) and by using "Indostat" entomological software.

RESULTS AND DISCUSSION

The organophosphate resistance frequencies during 2005-06 season in *H.armigera* presented in Table 1 revealed that quinalphos 0.75ug showed continuous fluctuation in resistance frequencies from August to December month whereas in January the highest resistance frequency of 14.77 per cent was obtained followed by February (10.41%) and March (6.73%). Similar studies were conducted by Jadhav and Armes (1996) wherein they reported moderate to high level of resistance to quinalphos. In another study Lal *et al.* (1998) found 12.79, 2.73 and 2.70 fold resistance to quinalphos in Hissar region of Haryana.

Profenofos 0.1ug showed cent per cent mortality and exhibited no resistance throughout the season, whereas monocrotophos 1.0ug had regular rise and fall in resistance frequencies from August to December with 41.66 per cent to 26.03 per cent. However, January (24.16%) there was continuous increase in the resistance frequencies till March(36.26%).Manikanand (1998) exhibited similar results showing moderate level of resistance in monocrotophos on *H.armigera* from Theni district of Tamilnadu. Armes *et al.* (1996) reported low evidence of monocrotophos resistance (0.4-3 fold) while moderate quinalphos resistance (4-5 fold) in Nepal. Resistance frequencies to chlorpyriphos 1.0ug was constantly reducing from August (24.24%) to November (16.27%) showing rise and fall in December (24.48%) and January (23.95%) while consequently increased in February (29.93%) and March (30.42%).

Thus, the present investigation clearly indicates that *H.armigera* had developed no organophosphate resistance to profenofos while quinalphos developed some organophosphate resistance under controlled conditions. However, resistance level in chlorpyriphos and monocrotophos indicated significantly alarming results.

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