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Efficacy of Different Insecticides Against Larval Population Density of Gram Pod Borer, *Helicoverpa armigera* (Hub.) with Reference to Chickpea in Faisalabad–Pakistan

ZAHID ALI SHAH[1], MUHAMMAD KASHIF SHAHZAD AND MUHAMMAD ASIF SHARAZ
Department of Zoology, Government College University, Faisalabad–Pakistan
[1]Corresponding author E-Mail: mkshzd@hotmail.com

ABSTRACT

Field study was conducted to determine the comparative efficacy of cypermethrin 10 EC, endosulfan 35 EC, lambdacyhalothrin 2.5 EC and chlorpyrifos 40 EC against the larval population of gram pod borer, *Helicoverpa armigera* on chickpea in the experimental research area of Ayub Agricultural Research Institute, Faisalabad, Pakistan during Rabi season 2001-02. The efficacy of the insecticides was ascertained by comparing treated plots with the control plots. All the insecticides resulted in significant reduction in the larval population density of the pest and thereby, increased the biomass and grain yield in comparison with control. However, chlorpyrifos proved to be the best insecticide followed by endosulfan, lambdacyhalothrin and cypermethrin.

Key Words: Gram; Chemical control; Insect pest; Yield; Insecticide resistance

INTRODUCTION

Chickpea, *Cicer arietinum* L., is very important pulse crop in Pakistan (FAO, 1994). It is an excellent source of vegetable protein (Khan, 1980). Its seeds are eaten as green vegetable, fried, roasted; as snack food and ground to obtain flour and dhal (Hulse, 1991). The chickpea has relatively few insect pests but gram pod borer, *Helicoverpa armigera* is the major pest (Patel *et al*., 1971; Reed *et al*., 1980; Lal *et al*., 1985; Naresh & Malik, 1986; Lal, 1996). The pod borers inflicted heavy crop losses from seedling to maturity. But the losses reached at its peak when the pods appeared (Mehto & Singh, 1983; Deka *et al*., 1989). Lal (1996) reported that the seed yield losses due to *H. armigera* were 75-90% and in some places the losses were up to 100%. These losses can be reduced by the application of insecticides (Sinha *et al*., 1983; Singh *et al*., 1987; Rakesh *et al*., 1996; Balasubramanian *et al*., 2001). The present study was planned to determine the comparative efficacy of four different insecticides against *H. armigera* on chickpea.

MATERIALS AND METHODS

The present study was carried out to determine the efficacy of different insecticides against the larval population density of *Helicoverpa armigera* on chickpea in the field of Ayub Agricultural Research Institute, Faisalabad during Rabi season 2001-02. The experiment was laid out in a Randomized Complete Block Design with five treatments including a control and four replications. The plot size was 7.00 X 3.60 m and row to row distance was 45 cm. Four insecticides *viz.*, cypermethrin 10 EC, endosulfan 35 EC, lambdacyhalothrin 2.5 EC and chlorpyrifos 40 EC at the rate of 350, 1000, 250 and 800 mL acre^{-1}, respectively were tested twice *i.e.* eight and nineteen days after the commencement of the pod formation. The insecticides were applied with the help of "Solo Knapsack Hand Sprayer". One pre-treatment and five post-treatment observations were made. The post-treatment observations were recorded on successive odd days after the application of each spray. For the purpose of data collection, the number of live larvae was noted on randomly selected five plants per plot. The data were finally subjected to statistical analysis using single factor analysis of variance and Duncan's multiple range test to compare means of different treatments. At maturity of the crop one row from each plot was harvested and desiccated to determine the biomass and yield per treatment.

RESULTS

Larval population. Pretreatment larval population of *Helicoverpa armigera* was insignificant but larval population differed significantly among the treatments after the application of insecticides (Table I). A sharp decline in the larval population density of *H. armigera* was noted one day after the application of each spray compared to control. Minimum larval population of the gram pod borer was observed on third day after the application of each spray in case of cypermethrin, endosulfan and chlorpyrifos while in case of lambdacyhalothrin, the minimum larval population was observed on one day after the application of first spray and after that the population started to rise again. On the whole, the larval population in treated plots remained lower in all observed days after the application of both sprays in comparison with control (Table I).

Table I. Mean larval population of gram pod borer (*Helicoverpa armigera*) observed one day before and one, three, five, seven and nine days after the application of insecticidal spray on chickpea during Rabi season 2001-02

Treatments	Dose/ acre (mL)	First spray						Second spray					
		Pre-treatment population	Population observed after 1 day	3 days	5 days	7 days	9 days	Pre-treatment population	Population observed after 1 day	3 days	5 days	7 days	9 days
Cypermethrin	350	8.25 $^{N.S}$	7.00 b	6.75 b	7.00 b	9.00 b	9.00 b	8.50 b	7.00 b	6.25 b	11.00 b	11.50 b	16.75 b
Endosulfan	1000	9.75 $^{N.S}$	5.25 b	5.25 b	5.75 b	6.00 bc	6.00 bc	7.50 b	4.50 bc	3.25 cd	4.75 c	8.00 bc	14.75 b
Lambdacyhalothrin	250	9.00 $^{N.S}$	5.25 b	6.50 b	5.00 b	5.75 bc	7.00 bc	8.25 b	5.00 bc	5.00 bc	7.00 c	7.75 bc	13.25 b
Chlorpyrifos	800	10.25 $^{N.S}$	3.75 b	2.25 c	2.75 b	3.50 c	4.25 c	5.50 b	2.50 c	2.25 d	4.25 c	5.75 c	11.25 b
Control		10.25 $^{N.S}$	13.00 a	11.50 a	12.75 a	14.75 a	16.25 a	15.00 a	17.25 a	19.25 a	20.50 a	22.00 a	26.25 a

[1]N.S = Non Significant 2. Treatment means marked by the same letter/letters are non-significant at $\alpha = 0.05$ and vice versa

Biomass. Table II depicts that chlorpyrifos was the most effective treatment with extrapolated biomass of 56.34 kg per treatment followed by endosulfan, lambdacyhalothrin, cypermethrin and control with biomass of 48.44 kg, 46.55 kg, 35.76 kg and 29.71 kg per treatment, respectively.

Grain yield. Chlorpyrifos established itself as the most effective insecticide with respect to grain yield as well, with grain yield of 14.20 kg per treatment (Table II). The grain yield per treatment in case of endosulfan, lambdacyhalothrin, cypermethrin and control was 12.60, 12.14, 10.54 and 7.34 kg, respectively.

Table II. The extrapolated biomass and grain yield of chickpea after the application of different insecticides during Rabi season 2001-02

Treatments	Biomass/treatment (kg)	Grain yield (kg)
Cypermethrin	35.76	10.54
Endosulfan	48.44	12.60
Lambdacyhalothrin	46.55	12.14
Chlorpyrifos	56.34	14.20
Control	29.71	7.34

DISCUSSION

The population of *H. armigera* increased greatly during the pod formation stage (Deka *et al*., 1987; Lal, 1996; Patel & Koshiya, 1999) and caused substantial damage to pods therefore at this stage control measures become necessary. In the present study, four different insecticides were applied to check the population of *H. armigera* on chickpea.

These results can not be compared in absolute terms to any of the studies conducted so far as none of them used this combination of insecticides. However, these findings are in general agreement with those of Srivastava and Singh (1977), Sinha *et al*. (1983), Gohokar *et al*. (1985), Chaudhary and Sachan (1995) and Jadhav and Suryawanshi (1998) because they also reported that the application of insecticides reduced the larval population of *H. armigera* to a considerable extent and hence increased the yield. Moreover, the studies of Balasubramanian *et al*. (2001) are in close conformity with the results of present study that chlorpyrifos was the most effective insecticide.

In past, the best insecticide was reported to be the cypermethrin (Gohokar *et al.*, 1985; Singh *et al.*, 1987; Khan *et al.*, 1993; Jadhav & Suryawanshi, 1998) and endosulfan (Chaudary *et al.*, 1980; Rizvi *et al.*, 1986), but in the present study chlorpyrifos proved to be the best insecticide. Control of this pest was not adequate now probably due in part to the development of insecticide resistance because of frequent use of insecticides. Phokela *et al*. (1990) observed a tendency of increased resistance to cypermethrin in the population of *H. armigera.* Moderate to high levels of resistance to cypermethrin and moderate resistance to endosulfan were recorded in field populations of *H. armigera* in Pakistan (Ahmad *et al*., 1995). Chlorpyrifos was proved to be the best insecticide against the pest. However, other insecticides may also remain fully effective against *H. armigera* if used according to manufacturers' recommendations (Sharma & Chawla, 1992) and insecticides should be applied aimed at preserving insecticide efficacy for future control of this and other pests.

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