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Efficacy of different insecticides against lentil pod borer (*Helicoverpa* spp)

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Abstract: A field experiment was conducted to evaluate comparative efficacy of four different insecticides viz. Lorsban (Chlorpyrifos), Thiodan (Endosulfan), Curacron (Profenophos) and Tracer (Spinosad) along with untreated check against pod borer (*Helicoverpa* spp), on lentil crop. The crop was sprayed with insecticides at pod formation stage. Highly significant differences were observed amongst insecticides, which had a varying degree of control in respect of decreased larval pest population and pod damage, whereas seed yield increased. Tracer was the most effective insecticide in reducing the population of pod borer and decreasing maximum pod damage, followed by Lorsban and Thiodan. Curacron was found to be the least effective insecticide under this study. The maximum increase seed yield per hectare was obtained with Tracer, whereas Thiodan resulted minimum increase seed yield over control. It has also been indicated that lentil pod borer can causes about 30.7 to 49.6% losses to yield.

Key words: Lentil, pod borer, insecticide, pod damage, seed yield

INTRODUCTION

Lentil *(Lens culinaris* Medik.), locally known as Masoor, is an important Rabi season pulse crop. It is mainly cultivated in South Asia, West Asia, North Africa, the Nile Valley Region, North America, South America and Eastern Europe. Lentils probably originated in the Near East and spread to Egypt, Central and Southern Europe, the Mediterranean basin, Ethiopia, Afghanistan, India and Pakistan, China and also to the New World including Latin America[5-7]. India is a major producer of lentil crop in the world with 30 % production of the total yield during 2001-2003, followed by Turkey and Canada with 18% and 16 % respectively[2].

In Pakistan it is cultivated either as "bosi" crop after floods in kacha area (both sides of the River Indus) or as a "dubari" crop after rice. Its seed mostly eaten as dal (split seed). Bahl *et al* [4]reported that lentil is probably the oldest of grain legumes to be domesticated. The crop has primary product which is the seed with a relatively higher content of protein, carbohydrate and a calorie compared to other legumes and is the most desired crop because of its high average protein content and fast cooking characteristics in many lentil producing regions[9]. Under food legume crops, lentil is affected by many biotic and abiotic factors. Among the biotic factors, insect pests play a significant role for reducing the yield per acre. Some of these are economically important. Pod borer (*Helicoverpa* spp) is a highly polyphagous and also a serious insect pest of lentil crop. Pod borer, *Helicoverpa armigera* (Hb.) and *Heliothis* spp. infest many host plants, especially lentil in West Asia and the Indian subcontinent[3]. Similarly, Van Emdren *et al* [11] have also reported that *Heliothis armigera* is an important pest of lentil crop. Patanker *et al* [10] reported that *Helicoverpa armigera* is the most serious pest of chickpea and other crop plants all over the world. In severe cases it causes about 75-90% losses in seed yield[8], he pointed out that gram pod borer damaged leaves tender shoots, apical tips, floral buds and pods.

Keeping in view the importance of the subject, an experiment was conducted to evaluate the response of insecticides against lentil pod borer.

MATERIALS AND METHODS

An experiment was conducted to test the comparative efficacy of four different insecticides (Table 1) for management of pod borer (*Helicoverpa* spp) on lentil crop during Rabi season 2003-2004 at farmers fields, on the left bank of River Indus, village Kot Almoon, district Thatta, Sindh, Pakistan.

The experiment was laid out in randomized complete block design with three replications using five treatments including check. A lentil variety Masoor-85 was planted on 14th October 2003 with row to row distance of 0.15 meter. The plot size was 4.5 m^2 (1.5 m x 3.0 m). The first spray was applied with hand sprayer at pod formation

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Table 1: Insecticides and their doses used in the experiment

S. No.	Insecticides used		Group	Formulation	Doseml/ha
	Common name	Local name			
1.	Endosulfan	Thiodan	Chlorinated	35 EC	2500
2.	Chlorpyrifos	Lorsban	Organophosphate	40 EC	2500
3.	Profenophos	Curacron	Organophosphate	250 EC	2500
4.	Spinosad	Tracer	Naturalyte	240 SC	200
5.	Check (no spray)	--	--	--	--

Table 2: Average larval population of pod borer (*Helicoverpa* spp) on lentil crop before and after first spray of insecticides

Insecticides	Larval population/plant					Reduction percentage over check
	Before spray	After spray				
	24 hours	24 hours	3 days	7 days	mean	
Thiodan (Endosulfan)	3.80	1.27	1.93	2.67	1.96	52.88
Lorsban (Chlorpyrifos)	3.67	1.07	2.13	2.47	1.89	54.57
Curacron (Profenophos)	3.87	1.13	2.33	2.67	2.04	50.96
Tracer (Spinosad)	3.93	0.87	1.80	2.13	1.60	61.54
Check (no spray)	3.73	4.07	4.13	4.27	4.16	

Table 3: Average larval population of pod borer (*Helicoverpa* spp) on lentil crop before and after second spray of insecticides.

Insecticides	Larval population/plant					Reduction percentage over check
	Before spray	After spray				
	24 hours	24 hours	3 days	7 days	mean	
Thiodan (Endosulfan)	3.93	1.07	1.60	2.47	1.71	58.80
Lorsban (Chlorpyrifos)	3.73	1.00	1.33	2.40	1.58	61.93
Curacron (Profenophos)	4.07	1.20	1.87	2.60	1.89	54.46
Tracer (Spinosad)	3.87	0.73	1.27	1.93	1.31	68.43
Check (no spray)	4.13	4.27	4.00	4.20	4.15	

stage to each treatment and the second spray was applied after 15 days of intervals.

Five plants were randomly selected from each treatment and observations were recorded 24 hours before spray and after 24 hours, 3 and 7 days of each spray. The reduction percentage of larvae was recorded by counting total number of live larvae before and after spray, and pod damage percentage was recorded by counting the total number of pods and number of pods damaged by the pest. The observation was calculated according to Henderson and Tilton[1] formula, in order to determine the efficacy of insecticides. The pod yield data were recorded at the time of harvest. The data obtained were analyzed statistically, and means were compared by using Duncan's Multiple Range Test[16].

RESULTS AND DISCUSSIONS

Data collected on the comparative efficacy of four different insecticides tested for management of pod borer in lentil crop was highly significant and is presented in Table 2-4, whereas the yield data is presented in Table 5.

Reduction percentage of larval population:

First spray: The results presented in Table 2 revealed that the Tracer (Spinosad) is the most effective insecticide among all the insecticides tested at 24 hours, 3 and 7 days after application of first spray in controlling the pod borer on lentil crop, followed by Lorsban (Chlorpyrifos), and Thiodan (Endosulfan). Curacron (Profenophos) was found to be the least effective. The reduction percentage of larval population over check was high recorded with Tracer (61.54), followed by Lorsban (54.57) and Thiodan (52.88), where as Curacron (50.96) resulted the minimum reduction percentage over check.

Second spray: The results of second spray (Table 3) showed that the Tracer (Spinosad) was also more effective in respect of reducing the larval population of pod borer when compared with other insecticides tested at 24 hours, 3 and 7 days, followed by Lorsban (Chlorpyrifos), Thiodan (Endosulfan) and Curacron (Profenophos). The reduction percent of larval population over check was also high recorded with Tracer (68.43), followed by Lorsban (61.93), Thiodan (58.80) and Curacron (54.46).

Reduction percentage of pod damage: The results of reduction percentage of pod damage are presented (Table 4) showed that the application of Tracer (Spinosad) was more effective in damage reduction percentage of pods with 82.6%, followed by Thiodan (Endosulfan) (80.2%),

Table 4: Average reduction percentage of pod damage at different intervals on lentil crop, sprayed with different insecticides.

Insecticides	Pod damage percentage					
	during 1st spray		during 2nd spray		mean of both sprays	
	Mean	Reduction % age over check	Mean	Reduction % age over check	Mean	Reduction % age over check
Thiodan (Endosulfan)	2.4	80.2	2.8	78.6	2.6	79.4
Lorsban (Chlorpyrifos)	2.7	78.0	2.3	82.4	2.5	80.2
Curacron (Profenophos)	2.5	79.3	4.2	67.9	3.4	73.6
Tracer (Spinosad)	2.1	82.6	1.9	85.5	2.0	84.1
Check (no spray)	12.1		13.1		12.6	

Table 5: Seed yield data of lentil crop.

Insecticides	Yield data		% increased over check
	Mean kg/plot	Mean Kg/ha	
Thiodan (Endosulfan)	3.37 d	748.2	+ 30.7
Lorsban (Chlorpyrifos)	3.98 b	885.2	+ 41.4
Curacron (Profenophos)	3.55 c	788.9	+ 34.3
Tracer (Spinosad)	4.63 a	1029.6	+ 49.6
Check (no spray)	2.33 e	518.5	

Curacron (Profenophos) (79.3 %), and Lorsban (Chlorpyrifos) (78.0 %), during the first spray. Similarly, during the second spray of insecticide, Tracer (Spinosad) also remained the top most effective and showed the maximum pod damage reduction percentage with 85.5%, whereas the minimum reduction percentage of pod damage was achieved (67.9%) with Curacron (Profenophos). At the average results of both sprays (Table 4) revealed that application of Tracer (Spinosad) resulted in the maximum reduction percentage of pod damage with 84.1%, followed by Lorsban (Chlorpyrifos) 80.2%, Thiodan (Endosulfan) 79.4%, whereas the Curacron (Profenophos) resulted in the minimum reduction percentage of pod damage with (73.6%).

Seed yields of lentil crop: The data of seed yields (kg/plot, kg/ha) and increased percent over check is presented in Table 5. The results showed highly significant differences among one an other. Tracer (Spinosad) resulted maximum seed yield 4.63 kg/plot, followed by Lorsban (Chlorpyrifos) 3.98 kg/plot, Curacron (Profenophos) 3.55 kg/plot, and whereas the minimum seed yield 3.37 kg/plot over check was obtained with Thiodan (Endosulfan). Similarly, the maximum percent of seed yield was increased over check by Tracer (Spinosad) with 49.6% followed by Lorsban (Chlorpyrifos) with 41.4% and Curacron (Profenophos) with 34.3%, whereas the lowest increase percent was obtained by Thiodan (Endosulfan) with 44.3%.

It has been indicated from the present studies that insecticide Tracer remained the most effective against the pest activity and resulted in the maximum reduction percentage of larval population of pod borer and the pods damage percentage was also decreased as comparison to other insecticides in lentil crop. Similarly the seed yield in kg per hectare was also increased with Tracer over check and further more it was also indicated from the yield data that in normal conditions pod borer can causes about 30.7% to 49.6% losses to lentil yield. The present results are in agreement with findings of Salgado *et al* [13] and Ruberson and Tillman[14], who reported that the insecticide Tracer has a high efficacy on target insects, including *Heliothine* species, while maintaining little effect on beneficial insects. Tracer is a biologically based insect control product with many favorable characteristics. The organism *Saccharopolyspora spinosa*, a bacterium, produces the secondary metabolite Spinosad, which is the active ingredient in Tracer[12]. Johnson *et al* [15] reported that the Tracer has been effective in controlling pyrethroid-resistant tobacco budworm.

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