



## MANAGEMENT OF CHICKPEA POD BORER, *HELICOVERPA ARMIGERA* (HUBNER) USING NEEM SEED EXTRACT AND LAMBDA-CYHALOTHRIN IN HIGH BARIND TRACT

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### Abstract

**Context:** Lambda cyhalothrin and neem seed extract can protect chickpea by controlling pod borer *Helicoverpa armigera* (Hubner).

**Objective:** To find out the effect of neem seed extract and lambda-cyhalothrin application schedule for the effective and economic management of pod borer attacking chickpea.

**Materials and Methods:** The experiments were conducted in High Barind Tract of northern Bangladesh with the application of neem seed extract @ 50 g<sup>l</sup> (two and three spraying) and lambda-cyhalothrin. (Karate 2.5 EC) @ 2 ml<sup>l</sup> (two and three spraying) and untreated control. The seeds of BARI-Chola 5 chickpea were sown in rows with the spacing of 40 cm. At maturity, all the pods were collected from 10 randomly selected plants from middle rows of each plot. The damaged (bored) and total numbers of pod were counted. The grain yield loss (kg<sup>ha</sup>) and percent pod damage were determined. The seed yield of each treatment was converted to kg<sup>ha</sup>.

**Results:** The lowest pod damage (2.55%) as well as grain yield loss (34.90 kg<sup>ha</sup>) were observed in the treatment where lambda cyhalothrin applied three times at 7 days interval from flowering stage. Chickpea seed yield was maximum (1338 kg<sup>ha</sup>) with lambda cyhalothrin sprayed thrice which was identical to sprayed twice (1280 kg<sup>ha</sup>). Neem seed extract showed a marginal performance to control chickpea pod borer. The highest marginal benefit cost ratio (3.19) was recorded from lambda cyhalothrin sprayed twice.

**Conclusion:** Lambda cyhalothrin double sprayed with 7 days interval from pod formation stage is the best package in managing pod borer in chickpea considering efficacy and profitability.

**Keywords:** Chickpea, pod borer, pod damage, pesticides, yield.

### Introduction

In Bangladesh chickpea is generally grown under rain fed or residual soil moisture conditions in rabi season after harvest of rice during October-March. Among the major pulses grown chickpea ranks fifth in area and production but second in consumption priority. It is a popular pulse crop in High Barind Tract (HBT) in the north-west of Bangladesh (within 24°20'-25°15'N, 88°15'-88°55'E). Chickpea is estimated to be grown on about 10,000 hectares of land in the HBT and is an important source of income and nutrition for resource-poor farm families (Musa *et al.* 2002). The area sown to chickpea in Bangladesh has reduced from >100,000 ha during 1980s to around 15,000 ha in recent years (FAOSTAT 2007). This reduction is primarily attributed to the yield instability caused by pod borer (Rahman *et al.* 2000). Environmental conditions during the late vegetative and reproductive period for chickpea (February to mid-March) are particularly conducive to pod borer development.

The chickpea has relatively few insect pests but gram pod borer, *Helicoverpa armigera* (Hubner) Hardwick is the major pest (Lal *et al.* 1985, Naresh and Malik 1986, Lal 1996). The pod borers inflicted heavy crop losses

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from seedling to maturity. But the losses reached at its peak when the pods appeared (Mehto and 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%. The yield loss in chickpea due to pod borer was reported as 10 to 60 per cent in normal weather conditions, while it was 50 to 100 per cent in favorable weather conditions, particularly in the state where frequent rain and cloudy weather is prevailing during the crop season (Patel 1979). 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).

In favourable conditions pod borer may cause 90-95 per cent pod damage (Sachan and Katti 1994). The young caterpillar of pod borer skeletonizes the leaves, while grown up caterpillar bores into the pods and feeds on the seeds. Chemical insecticides are generally used in pod borer control due to their effectiveness and easy availability. Recently, *H. armigera* is reported to have developed resistance to many commonly used insecticides (Lande 1992). In past, the best insecticide was reported to be the cypermethrin (Gohokar *et al.* 1985, Singh *et al.* 1987, Khan *et al.* 1993, Jadhav and Suryawanshi 1998) and endosulfan (Chaudary *et al.* 1980, Rizvi *et al.* 1986). 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* (Ahmad *et al.* 1995).

In many trials lambda cyhalothrin performed well to control pod borer. Farmers generally sprayed insecticides at full podding or pod maturing stage when full-grown pod borer are visible on the plant with boring pods. As a result the grown up pod borers are not killed instead it creates environmental pollution. These led to the present experiments.

### Materials and Methods

The experiments were conducted in the farmer's field at Farming System Research and Development (FSRD) site, Bangladesh Agricultural Research Institute (BARI), Kadamshahar, Godagari, Rajshahi during Rabi season of 2008-2009 in the HBT. Application of neem seed extract and lambda-cyhalothrin considered as treatments of the experiments which were: T<sub>1</sub> = spraying of neem seed extract @ 50 g<sup>l</sup> (two sprayings at 7 days interval starting from pod formation stage), T<sub>2</sub> = spraying of lambda cyhalothrin (Karate 2.5 EC @ 2 ml<sup>l</sup>) (two sprayings at 7 days interval starting from pod formation stage), T<sub>3</sub> = spraying of neem seed extract 50 g<sup>l</sup> (three spraying at 7 days interval from flowering stage), T<sub>4</sub> = spraying of lambda cyhalothrin (Karate 2.5 EC @ 2 ml<sup>l</sup>) (three sprayings at 7 days interval starting from flowering stage), T<sub>5</sub> = untreated control. It was laid out in randomized complete block design with six dispersed replications. The land was fertilized with 12-20-17-10-1 N-P-K-S-B kg/ha (BARC 2005) in the form of urea, triple super phosphate, muriate of potash, gypsum and boric acid, respectively. All fertilizers were applied as basal at the final land preparation. The seeds of BARI-Chola 5 chickpea were sown in rows with the spacing of 40 cm @ 50 kg<sup>ha</sup> ranging from 23-25 October 2008. The unit plot size was 3m x 4m with a distance of 100 cm between the plots and 150 cm between the replications. The spraying was done by Knapsack hand sprayer as per treatments. At maturity, all the pods were collected from 10 randomly selected plants from middle rows of each plot and examined. The damaged (bored) and total numbers of pods were counted and the percent pod damage was determined.

The grain yield loss (kg<sup>ha</sup>) due to pod borer damage of each treatment was calculated according to Hossain *et al.* (1999). Plants of middle four rows avoiding border rows of each plot comprising 4.8 m<sup>2</sup> (1.6 m x 3 m) area was harvested. The pods were then threshed; grains were cleaned and dried in the bright sunshine. The seed yield of selected area was converted to kg<sup>ha</sup>. The experimental data were analyzed by MSTAT-C software. The percent data were subjected to square root transformation for statistical analysis. Mean comparisons for treatment parameters were compared using Duncan's Multiple Range Test (Steel and Torrie

1960) at 5% level of significance. The economic analysis was done for gross return, gross margin and marginal benefit cost ratio (MBCR) for different treatments following the method suggested by CIMMYT (1988). For calculating income and benefit the following market prices were used: Karate 2.5 EC = Tk.100.00<sup>-100ml</sup>, Neem seed = Tk. 50.00<sup>-kg</sup> and Chickpea = Tk. 40.00<sup>-kg</sup>, Labour wage for spraying pesticides = Tk.150/day/labour (work 8 h/day).

## Results

*Effect on pod damage and yield loss:* Neem seed extract and lambda-cyhalothrin reduced pod borer damage significantly (Table 1). Significantly the lowest pod damage (2.55%) and grain yield loss (34.90 kg<sup>-ha</sup>) were observed in the treatment where lambda-cyhalothrin was applied thrice at 7 days interval from flowering stage. The next highest pod damage (4.23%) and yield loss (56.39 kg<sup>-ha</sup>) were found in lambda-cyhalothrin sprayed double at 7 days interval from pod formation stage. The highest pod damage (10.66%) and seed yield loss (124.71 kg<sup>-ha</sup>) were recorded in untreated crop. The highest number of pods/plant (43.20) was found in the lambda-cyhalothrin sprayed three times which was statistically identical to two applications (41.32) and the lowest was in untreated control (32.40). This might be due to its high toxicity with fast acting activities that produced quick knock down action to pod borer resulted in the lowest pod damage and also produced highest number of pods/plant. Due to highest pod borer infestation, some twigs, flowers and pods might completely damaged in untreated control resulted highest pod damage and lowest number of pod/plant.

*Yield, gross return, gross margin and marginal benefit cost ratio:* Yield of chickpea varied significantly with the level of pod borer damage depending on efficacy of neem seed extract and lambda-cyhalothrin (Table 1). Significantly the highest yield (1338 kg<sup>-ha</sup>) was obtained from lambda-cyhalothrin applied three times which was statistically identical to sprayed two times (1280 kg<sup>-ha</sup>) and the lowest (1049 kg<sup>-ha</sup>) was in untreated control. Spraying neem seed extract provided statistically identical yield to untreated control. Yield increased was 27.58% and 22.03% over untreated control in lambda-cyhalothrin sprayed thrice and twice, respectively (Table 1). Neem seed extract was found moderately effective for controlling the pod borer. Lower pod borer damage and higher number of pod/plant were found in lambda-cyhalothrin spraying contributed to higher yield of chickpea.

**Table 1.** Effect of neem seed extract and lambda-cyhalothrin on pod damage and yield loss of chickpea

Treatments	No. of spray	Pods/ plant	Pod damage (%)	Yield loss (kg <sup>-ha</sup> )	Yield (kg/ha)	Yield increase over control (%)	Gross return (Tk./ha)	Variable cost* (Tk./ha)	Gross margin (Tk./ha)	Marginal benefit cost ratio (MBCR)
T <sub>1</sub> : Neem seed extract	2	38.05 b	7.19 b (2.68)	84.15 b	1087 c	3.67	43490	3400	40090	0.45
T <sub>2</sub> : Karate 2.5 EC	2	41.32 ab	4.23 d (2.06)	56.39 c	1280 ab	22.03	51190	2900	48290	3.19
T <sub>3</sub> : Neem seed extract	3	38.82 b	5.53 c (2.35)	66.99 c	1146 bc	9.23	45820	5000	40820	0.77
T <sub>4</sub> : Karate 2.5 EC	3	43.20 a	2.55 e (1.60)	34.90 d	1338 a	27.58	53520	4350	49170	2.66
T <sub>5</sub> : Untreated control	-	32.40 c	10.66 a (3.27)	124.71 a	1049 c	-	41950	-	41950	-
LSD (0.05)		3.93	0.22	15.82	141.00	-	-	-	-	-
CV (%)		4.70	4.18	11.99	5.53	-	-	-	-	-

NB: Value in parenthesis is square root transformed mean values. \* Variable cost means pesticide cost and labour cost for spraying pesticide

The gross return, gross MBCR cost ratio varied depending on cost of pesticide application (Table 1). The highest gross return (Tk.53,520<sup>-ha</sup>) was recorded from lambda-cyhalothrin sprayed three times followed by sprayed two times (Tk.51,190<sup>-ha</sup>) and the lowest (Tk.41,950<sup>-ha</sup>) was in untreated control. On the other hand maximum variable cost (Tk.5,000<sup>-ha</sup>) was calculated from neem seed extract sprayed thrice. The MBCR of pesticide application revealed the highest monetary benefit from lambda-cyhalothrin two applications whose

MBCR was 3.19. The lowest MBCR (0.45) was found when the crop sprayed three applications with neem seed extract. This variation was attributed due to the variation of seed yield of chickpea along with low cost involvement in lambda-cyhalothrin application.

### Discussion

A field trial was conducted in India during the summer to evaluate the efficacy of lambda-cyhalothrin against the pod borers *H. armigera* of red gram (*Cajanus cajan*). Lambda-cyhalothrin was sprayed 3 times at 15-day intervals at 10, 20 or 40g a.i.<sup>-ha</sup>. Percentage pod damage by pod borer was 5.1 in the 40 g a.i.<sup>-ha</sup> treatment. The highest yield (1506 kg<sup>-ha</sup>) was recorded in this treatment (Mathirajan *et al.* 2000). Singh *et al.* (1985) observed that percentage pod damage due to *H. armigera* was much less in pigeon pea plot treated with ethanolic extract neem seed kernel (2%). Visalakshimi *et al.* (2005) reported that application of neem effectively reduced the oviposition of *H. armigera* throughout the crop period. Reddy *et al.* (2010) studied the efficacy of common insecticides viz., neem seed kernel extract (NSKE), HaNPV, Endosulfan were tested alone and in combination against gram pod borer, *H. armigera* in chickpea. Result showed that larval reduction was highest with NSKE 1.66% + HaNPV 250LE/ha + Endosulfan 0.023% followed by NSKE 1.66%+ Endosulfan 0.023%, NSKE 2.5% + HaNPV 250LE sprayed twice at 15 days interval, respectively.

### Conclusion

Lambda-cyhalothrin 2.5 EC @ 2 ml<sup>l</sup> sprayed two times at 7 days intervals from pod formation stage determined to be the best package in managing pod borer in chickpea considering efficacy and profitability in HBT.

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