



## POD BORER INCIDENCE AND LOSS ESTIMATION IN CHICKPEA

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### ABSTRACT

A field trial was conducted during *rabi*, 2014-15 to study the population dynamics of gram pod borer and to assess the loss to chickpea due to the infestation by the pod borer. The standard paired plot design was employed to estimate the losses. The pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) was the single key pest. The population of *Helicoverpa armigera* (Hubner) on chickpea variety Vijay in the untreated plots of the loss estimation trial indicated that the larval numbers were significant from early December, 2014 (6.28 per 4-m row) that reached a peak on 15<sup>th</sup> December, 2014 (10.51 per 4-m row) and with a seasonal mean of 5.81 larvae per 4-m row. Among the prevailing abiotic factors of the environment, only the mean relative humidity showed a significant negative correlation with the pod borer larval population ( $r = -0.64^*$ ). The pod borer larvae were parasitized in nature by the parasitoid, *Campoletis chloridae* Uchida from 22<sup>nd</sup> December, 2014 with 3.53 per cent parasitisation that increased to a maximum of 12.35 per cent the next week on 29<sup>th</sup> December, 2014. The plant stand was 30 per cent more when the crop was treated with insecticides and kept pest-free. The mean larvae per plant were 6 times more and the mean numbers of damaged pods per plant were 7.7 times more when the crop was untreated and exposed to the pod borer infestation. On the basis of yield, a loss of 26.57 per cent was recorded due to *H. armigera* infestation.

**Key words:** Chickpea, gram pod borer, loss estimation

### INTRODUCTION

Chickpea (*Cicer arietinum* L.), known as Bengal gram, gram or *chana* is an important *rabi* pulse crop of India and has been considered as 'King of Pulses' (Bhatt and Patel, 2001). In Rajasthan chickpea is cultivated in an area of 14.34 lakh hectares with a production of 99 thousand tons and a productivity of 690 kg/ha (Department of Agriculture, Rajasthan, 2011-12). Bengal gram is infested by 57 species of insect pests and other arthropods in India; however, the major insect pest of chickpea is the gram pod borer, *Helicoverpa armigera* (Hubner), which is polyphagous, multivoltine and cosmopolitan, known to feed on 182 species of plants belonging to 47 families in India (Sithanatham, 1987 and Panwar, 1998); *Helicoverpa armigera* has a wide host range, and feeds on more than 250 crop species (Kranthi *et al.* 2002). High polyphagy, mobility, reproductive rate and diapause are major factors contributing to its serious pest status (Fitt, 1989 and Sharma *et al.*, 2005). The gram pod borer begins infestation at the seedling stage and later feeds on the flowers and developing seeds in pods until crop maturity (Reed *et al.*, 1987). The yield loss range in chickpea has been estimated to be from 10 to 60 per cent under normal weather conditions (Vaishmpayam and Veda, 1980); 50 to 100 per cent under favourable weather conditions with frequent cloudy days during the crop season that often

accounts for about 90 to 95 per cent of the total damage caused by insect pests (Sachan and Katti, 1994).

### MATERIALS AND METHODS

The present investigation on loss estimation in chickpea due to the major insect pest, gram pod borer, was carried out during *rabi* 2014-15 at the Instructional Farm, Rajasthan College of Agriculture, Udaipur. Sowing of chickpea variety Vijay was done on 4<sup>th</sup> November, 2014, following all the recommended agronomic practices to raise the crop. The trial was laid out in paired plots as randomized block design (Leclerg, 1971) with two treatments (treated and untreated) replicated 13 times. The plot size for each replicate measured 12 m<sup>2</sup> (4m x 3m) and chickpea cultivation was maintained at a spacing of 30cm x 10cm, row-row and plant-plant, respectively. The treated plots were kept free from insect infestation for which seed treatment with thiomethoxam 30 FS was done followed by weekly spraying of recommended doses of insecticides alternating quinalphos (0.05%) with deltamethrin (0.005%) and cypermethrin (0.01%) beginning from 30 days after germination until pod maturity; whereas, the untreated plots were left free for natural pod borer infestation.

Observations for *Helicoverpa armigera* (Hubner) larvae were taken along the 4-metre-row of chickpea,

selecting 3 rows from each replicate from both the treated and untreated plots during vegetative stage of crop growth, expressed as numbers per 4-m row. Later, after pod initiation, the total numbers of pods, numbers of damaged pods per plant were counted. To estimate the losses caused by the pod borer, the following parameters were recorded in both the treatments: numbers of plants per plot; numbers of pods per plant; yield per plant (g) and yield per plot (g):

$$\text{Loss in yield (\%)} = \frac{X_1 - X_2}{X_1} \times 100$$

Where,  $X_1$  = Yield in treated plot  
 $X_2$  = Yield in untreated plot

The yield data was subjected to statistical analysis and significance tested by "t" test:

$$t = \frac{Y_1 - Y_2}{\text{S. Ed.}}$$

Where

$Y_1$  = Average yield in treated plot

$Y_2$  = Average yield in untreated plot

S. Ed. = Standard error of difference of mean

## RESULTS AND DISCUSSION

The population of gram pod borer, *Helicoverpa armigera* (Hubner) on chickpea variety Vijay, in the untreated plots of the loss estimation trial, as presented in Table (1), shows that the larval numbers were significant from early December, 2014 (6.28 per 4-m

row) that increased gradually reaching the peak on 15<sup>th</sup> December, 2014 (10.51 per 4-m row) and with a seasonal mean of 5.81 larvae per 4-m row. Among the prevailing abiotic factors of the environment, only the mean relative humidity showed a significant negative correlation with the pod borer larval population ( $r = -0.64^*$ ). The pod borer larvae were parasitized in nature by the parasitoid, *Campoletis chloridae* Uchida from 22<sup>nd</sup> December, 2014 with 3.53 per cent parasitisation that increased to a maximum of 12.35 per cent the next week on 29<sup>th</sup> December, 2014; however, the parasite happened to be active from IV week of December, 2014 to the II week of January, 2015. The gram pod borer is usually active from October through March with wide variations for different locations and the associated larval and larval-pupal parasitoids, which are density-dependent and location-specific, also abound in varying degrees during this period. Earlier, Sachan and Bhaumik (1998) observed that the extent of natural parasitization of *Helicoverpa armigera* (Hubner) by *Campoletis chloridae* Uchida on chickpea varied between 12.69 and 56.28 per cent (1995-96) and 3.57 and 80.64 per cent (1996-97) on a standard weekly basis. Parasitization recorded during 1995-96 was 37.17, 46.10, 42.67, 16.16, and 26.19 per cent during November, December, January, February, and March, respectively; while, the corresponding figures during 1996-97 were 51.04, 65.14, 63.39, 21.46 and 5.85 per cent, respectively.

The loss estimation due to infestation of chickpea by *H. armigera* taking into account different parameters of crop growth and the yield attributing traits (Table: 2) indicated that the mean plant stand per plot and the mean numbers of pods per plant were significantly less in the

**Table 1. Population of *H. armigera* on gram in the untreated loss estimation plots**

Dates of Observation	Mean Abiotic Factors of Environment			Mean Pod borer/4m-row
	Atmospheric Temperature (C)	Relative Humidity (%)	Sunshine (hrs)	
01/12/2014	21.62	52.00	8.90	6.28
08/12/2014	18.86	48.60	8.60	10.85
15/12/2014	16.01	54.30	7.10	13.26
22/12/2014	13.59	57.70	7.70	10.51 (3.53)
29/12/2014	14.54	53.00	8.70	3.82 (12.35)
05/01/2015	14.80	72.00	3.90	3.46 (7.87)
12/01/2015	17.20	54.00	8.70	3.46 (9.09)
19/01/2015	14.70	65.00	7.60	0.58
26/01/2015	16.20	73.00	4.02	0.10
Seasonal Mean	16.39	58.84	7.25	5.81
Coefficient of correlation (r) for mean Atm. Temp. & pod borer population				0.15
Coefficient of correlation (r) for mean R. H. & pod borer population				-0.64*
Coefficient of correlation (r) for mean sunshine & pod borer population				0.36

Figures in parentheses are per parasitization values; \* indicates t-value significant at 5%

**Table 2: Loss estimation in chickpea due to *H. armigera***

S.No.	Parameters	Treated	Untreated	Standard Deviation (sd)	Student t-value	Mean Loss (%)
1.	Mean plant stand/ 4m-row	20.31	14.18	0.126	- 21.25**	---
2.	Mean larvae/ 4m-row	8.16	52.24	1.513	105.01**	---
3.	Mean pods/ plant	54.23	45.77	0.108	- 19.78**	---
4.	Mean damaged pods/ 4m-row	2.95	22.69	0.104	62.30**	---
5.	Mean yield (g)/plot	2408.92	1707.85	0.027	20.065**	26.57
6.	Estimated mean yield (Kg/ha)	2007.44	1423.21	---	---	29.10

\*\* The t-value significant at P = 0.05 & 0.01

untreated plots than in those treated. The plant stand under treated conditions was 1.43 times more than under untreated conditions; likewise, the mean numbers of pods per plant were 1.2 times more. The numbers of pod borer larvae (52.24 per 4-m row) and quantum of damaged pods (22.69 pods per 4-m row) were significantly more in the untreated plots, being 6.40 and 7.69 times higher; ultimately, the resultant mean yield (2408.92 g/plot) was significantly more when the crop was kept treated with negligible infestation. The overall mean loss worked out to be 26.57 per cent due to the pod borer infestation alone as there were no other notable pestiferous insects on the crop; however, when the data was converted on a per hectare basis the loss was 29.10 per cent. The available literature indicates that loss estimation varies widely and is location specific. Srivastava and Srivastava (1990) observed the mean pod damage to chickpea (*Cicer arietinum*) by *Helicoverpa armigera* in protected and unprotected plots as 0.9 and 5.9 per cent, respectively during 1984; while, 1.0 and 6.4 per cent, respectively during 1985. The loss in grain yield in the unprotected plot compared to the protected plot was 115 kg/ha (avoidable loss = 16.7%) in 1984 and 128 kg/ha (avoidable loss = 18%) in 1985. Mehta *et al* (2000) recorded yield losses due to the pod borer in two cultivars of chickpea to be 23.35 per cent (cv. C-235) and 20.08 per cent (cv. HPG-17) during 1996-98. Chaturvedi (2004) observed maximum damage during the reproductive phase of the crop with a damage of 36.4 per cent to the pods by *Helicoverpa armigera* (Hubner). Singh *et al* (2008) reported yield loss in chickpea due to *H. armigera* to vary from 36.88 to 50 per cent in different localities of Uttar Pradesh (India). Deshmukh *et al* (2010) opine that chickpea when protected against pod borer, *H. armigera* resulted in avoiding grain yield loss of 41.17 per cent.

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