Research Paper

ADVANCE RESEARCH JOURNAL OF
C R P
IMPROVEMENT
Volume 5 | Issue 2 | Dec., 2014 | 149-153
e ISSN-2231-640X

DOI :
10.15740/HAS/ARJCI/5.2/149-153
Visit us: *www.researchjournal.co.in*

Studies on varietal screening and date of sowing of *Helicoverpa armigera* (Hub.) on chickpea [*Cicer arietiinum* (L.)]

■ O.M. CHOUDHARY[1], R. ANWALA AND M.M. SHARMA[1]

AUTHORS' INFO

Associated Co-author :
[1]Department of Entomology, College of Agriculture, BIKANER (RAJASTHAN) INDIA

Author for correspondence:
R. ANWALA
Department of Soil Science, College of Agriculture, BIKANER (RAJASTHAN) INDIA
Email: rajveeranwala@gmail.com

ABSTRACT : Investigations on screening of chickpea varieties/genotypes, dates of sowing of *H. armigera* (Hub.) on chickpea were conducted at Experimental Farm, College of Agriculture during *Rabi* season in 2005-06. Ten varieties/genotypes of chickpea were tested for relative incidence of the pest. Among these varieties RSG-44 and RSG-945 were found to be highly susceptible followed by CSJ-104, RSG-959, RSG-895, RSG-888, RSG-897 and RSG-973 as moderately susceptible while, CSJD-884 and RSG-931 as least susceptible. The maximum yield was obtained in CSJD-884 (14.54 q ha^{-1}) at par with RSG-931 (14.36 q ha^{-1}), while lowest yield was from RSG-44 (11.13 q ha^{-1}).The experiment on dates of sowing revealed that early sown crop (5th October) had the lowest larval population (2.50 larvae/five plants) of gram pod borer, minimum pod damage (14.50%) with relatively better yield (13.04 q ha^{-1}) as compared to late sown (20th November) crop with higher larval population (6.13 larvae/five plants), higher pod damage (28.96%) and lower yield (9.77 q ha^{-1}).

Key **W**ords : Date of sowing, Varietal screening, Gram pod borer, Larvel population, Yield

How to cite this paper : Choudhary, O.M., Anwala, R. and Sharma, M.M. (2014). Studies on varietal screening and date of sowing of *Helicoverpa armigera* (Hub.) on chickpea [*Cicer arietiinum* (L.)]. *Adv. Res. J. Crop Improv.*, **5** (2) : 149-153.

Paper **H**istory : **Received :** 27.07.2013; **Revised :** 05.11.2014; **Accepted :** 18.11.2014

Chickpea or gram [*Cicer arietinum* (L.)] is one of the most important pulse crop grown in about 9 million hectares worldwide out of which about 70 per cent is grown in India (Anonymous, 2001). Although all the pulses occupy a unique position in Indian agriculture as well as throughout the world, chickpea is considered as "king of pulses". It is also known as Bengal gram, "Chana" or gram, originated from South Western Asia. It is a *Rabi* season crop cultivated throughout the India. The main gram growing states are Madhya Pradesh, Uttar Pradesh, Rajasthan, Bihar, Haryana, Maharashtra and Punjab. It occupies 7.28 m ha area and production is 5.77 million tonnes annually with the productivity of 792 kg ha^{-1} (Anonymous, 2004). In Rajasthan, gram occupies 11.18 lac ha area with an annual production of 7.07 metric tonnes (Anonymous, 2003). The major growing districts in Rajasthan are Kota, Sriganganagar, Chittorgarh, Alwar, Tonk, Jalawar, Pali, Jaipur, Sawai Modhopur, Bikaner, Churu, Sikar and Hanumangarh (Anonymous, 2005).Chickpea is a rich source of nutrients *i.e.* protein (17-21%), carbohydrate (61-63%) and fat (4-5%). It also contains calcium, iron, niacin, vitamin B and Vitamin C. It provides the valuable protein supplement to the diet of the predominately vegetarian human population, besides it contributes to the national income. It is also considered to have medicinal value for blood purification and is beneficial for diabetic patients.Amongst the several constraints affecting the yield, insect pests were recognized as most important. Among various insect pests of chickpea, the gram pod borer *Helicoverpa armigera* (Hubner) is the most biotic (Antibiosis) constraint (Srivastava and Srivastava, 1990 and Sharma *et al*., 2005). *H. armigera* is widely distributed species occurring in the middle east Asia, India, Australia and Africa (Fitt, 1989). It assumed major pest status across number of crops because of its high fecundity, migratory behaviour, high adaptation to various climatic conditions and development of resistance to a range of insecticides. Although it attacks chickpea throughout the crop growth, the damage caused during flowering and pod formation stages results in substantial yield loss.*Helicoverpa* (*Heliothis) armigera* commonly called as gram pod borer,

tomato fruit borer, cotton boll worm or American bollworm, is a typical polyphagous pest of sporadic nature, damaging more than 150 plant species, among which are the important crops like pulses, vegetables, cereals, oilseeds, cotton and wild plants (Jayraj, 1982). Chickpea is the most preferred host of *H. armigera*, which suffers losses to the tune of 25 to 75 per cent (Tripathi and Sharma, 1984).

RESEARCH PROCEDURE

The experiment was laid out in a Randomized Block Design (RBD) with 10 varieties/genotypes including RSG-44 with three replications. The plot size was kept 2 x 3 m^2 and row to row and plant to plant distance were maintained as 30 cm and 10 cm, respectively. The crop was sown in third week of October, 2005. Population of *H. armigera* (Hub.) was recorded at weekly intervals on chickpea crop during morning hours between 8.00 A.M. to 10.00 A.M. without disturbing the pest. The observations on the incidence of *H. armigera* (Hub.) infesting chickpea were recorded on five randomly selected tagged plants in each plot by counting the larval population. The varieties/genotypes were allowed to have a natural infestation. The observations of larval population of the gram pod borer were recorded soon after appearance of the pod borer. Weekly observations were recorded till harvesting of the crop. Observation of grain yield was also recorded at harvest.

RESEARCH ANALYSIS AND REASONING

Ten varieties of chickpea *viz*., RSG-888, RSG-895, RSG-897, RSG-931, RSG-945, RSG-959, RSG-973, CSJD-884, CSJ-104 and RSG-44 were screened for their varietal resistance against gram pod borer *H. armigera*. The varietal screening of chickpea was assessed on the basis of number of larvae per five randomly selected plants of each variety in three replications. The observations on larval population were recorded at weekly intervals starting from the appearance of the pest on pods and up to the harvest of the crop. Thus, seven observations were recorded in all. Data presented in Table 2 showed that larval population of *H. armigera* (Hub.) on gram pods were observed during first week of February. Therefore, the first observation was recorded in 5th standard week.

First observation :

The mean larval number of *H. armigera* observed during first week of February ranged from 1.67 to 4.00 per five plants (Table 2). The minimum larval population of 1.67 was recorded on the varieties CSJD-884 and RSG-931. However, both of these varieties were significantly superior over all of the remaining varieties except RSG-959 (2.33) to which those two were at par. Out of the remaining varieties, in CSJ-104, RSG-895, RSG-888 and RSG-897 the *H. armigera* larval population ranged from 2.67 to 3.00 per five plants. All these varieties were significantly at par to each other. The maximum infestation (4.00 larve per five plants) populations was recorded on variety RSG-44 followed by RSG-945 (3.67) and RSG-973 (3.33). These varieties were at par to each other. The order of susceptibility in chickpea varieties/genotypes against gram pod borer was CSJD-884 < RSG-931 < RSG-959 < CSJ-104 < RSG-895 < RSG-888 < RSG-897 < RSG-973 < RSG-945 < RSG-44.

Second observation :

The second observation was taken on 8th of February, 2006. The mean larval population of pod borer ranged between 2.33 to 5.67 per five plants. The minimum infestation of the pod borer was observed on variety CSJD-884 followed by RSG-931. Both the varieties were statistically at par in their degree of infestation. However, these varieties were found to be significantly superior over rest of the varieties/genotypes *i.e.*

Table 1 : Screening of chickpea varieties/genotypes against *H. armigera* (Hub.) during *Rabi* 2005-06

Sr. No.	Varieties /genotypes	Average larval population	Yield (q ha^{-1})
1.	RSG-888	4.00* (2.23)**	13.26
2.	RSG-895	3.81 (2.19)	13.60
3.	RSG-897	4.14 (2.27)	13.19
4.	RSG-931	2.90 (1.97)	14.36
5.	RSG-945	5.05 (2.46)	11.64
6.	RSG-959	3.67 (2.16)	13.70
7.	RSG-973	4.28 (2.30)	13.10
8.	CSJD-884	2.62 (1.90)	14.54
9.	CSJ-104	3.59 (2.14)	13.80
10.	RSG-44	5.81 (2.61)	11.13
	S.E. ±	0.052	0.171
	C.D. (P=05)	0.15	0.51

* Average of three replications, ** Figures in parenthesis are transformed $\sqrt{x + 1}$ values

RSG-959, CSJ-104, RSG-895, RSG-897, RSG-888, RSG-973, RSG-945 and RSG-44. The maximum infestation was recorded on RSG-44 (5.67 larvae/ five plants) followed by RSG-945 (5.33 larvae/ five plants). Both of these varieties were at par. The order of susceptibility in chickpea varieties/genotypes based on observations of 8th February, 2006 was CSJD-884 < RSG-931 < RSG-959 < CSJ-104 < RSG-895 < RSG-897 < RSG-888 < RSG-973 < RSG-945 < RSG-44.

Third observation :

The data recorded on 15th of February, 2006 showed that significant difference existed in the larval population of *H. armigera*. The larval population recorded on RSG-931, RSG-895, CSJD-884, RSG-959, RSG-888 and RSG-897 ranged between 3.67 to 5.0 per five plants. All these varieties were significantly at par. The maximum larval population of 7.33 was recorded on RSG-44 followed by RSG-945, RSG-973 and CSJ-104 with a mean population of 6.00, 5.67 and 5.33 larvae per five plants, respectively. All of these four varieties were comparable to each other. The peak of the larval population was observed in CSJD-884 and CSJ-104 during this week. The variability of susceptibility recorded in chickpea varieties in the third observation was in the order RSG-931 < RSG-895 < CSJD-884 < RSG-959< RSG-888 < RSG-897 < CSJ-104 < RSG-973 < RSG-945 < RSG-44.

Incidence of larval population of *H. armigera* on chickpea :

Weekly observations recorded on the population of gram pod borer during *Rabi* 2005-06 have been presented in Table 3. It was observed that the pest after appearance was present on the gram throughout the growing season of crop irrespective of sowing dates.

The data revealed that the pod borer mature larvae were observed during 05 meteorological week (31st January, 2006) with the initial population of 1.50 larvae/five plants on chickpea crop sown on 5th October. Thereafter, population started increasing continuously and peaked during 08 meteorological week (20th February, 2006) with an average population of 4.0 larvae/five plants on the crop sown on 5th October. Later on its population declined gradually in this crop. There was no mature larval population observed in 05 meteorological week in the crop of remaining dates of sowing. The initial larval population recorded at 06 meteorological week (6th February, 2006) was 3.75, 4.75 and 5.50 larvae/ five plants in the crops sown on 20th October, 5th November and 20th November, respectively and the population started increasing continuously. The pod borer population in these dated crops peaked in 08 meteorological week (20th February, 2006) with an average population of 6.25, 7.25 and 8.25 larvae/five plants, respectively.

When the crop was sown as late as 20th November, it fetched maximum mean larval population of 6.13 larvae/five plants, which was significantly higher than those in 20th October

Table 2 : Weekly mean larval population of gram pod borer, *Helicoverpa armigera* (Hubn.) on different varieties/genotypes of chickpea during *Rabi* 2005-06

Varieties /genotypes	01.02.2006 (05)δ	08.02.2006 (06)	15.02.2006 (07)	22.02.2006 (08)	01.03.2006 (09)	08.03.2006 (10)	16.03.2006 (11)	Mean
RSG-888	3.00† (2.00)*	4.33 (2.31)	5.00 (2.44)	6.00** (2.64)	4.33 (2.31)	3.00 (2.00)	2.33 (1.82)	4.00 (2.23)
RSG-895	2.67 (1.91)	4.00 (2.24)	4.33 (2.31)	5.67** (2.58)	4.67 (2.38)	3.00 (2.00)	2.33 (1.82)	3.81 (2.19)
RSG-897	3.00 (2.00)	4.00 (2.24)	5.00 (2.44)	6.33** (2.71)	5.33 (2.51)	3.33 (2.08)	2.00 (1.73)	4.14 (2.27)
RSG-931	1.67 (1.63)	2.67 (1.91)	3.67 (2.16)	4.67** (2.38)	3.67 (2.16)	2.33 (1.82)	1.67 (1.63)	2.90 (1.97)
RSG-945	3.67 (2.16)	5.33 (2.51)	6.00 (2.65)	6.67** (2.77)	5.67 (2.58)	4.67 (2.38)	3.33 (2.08)	5.05 (2.46)
RSG-959	2.33 (1.82)	3.67 (2.16)	4.67 (2.38)	5.67** (2.58)	4.33 (2.31)	3.00 (2.00)	2.00 (1.73)	3.67 (2.16)
RSG-973	3.33 (2.08)	4.67 (2.38)	5.67 (2.58)	6.33** (2.71)	5.00 (2.44)	3.33 (2.08)	1.67 (1.63)	4.28 (2.30)
CSJD-884	1.67 (1.63)	2.33 (1.82)	4.67** (2.38)	4.00 (2.23)	2.67 (1.91)	2.00 (1.72)	1.00 (1.41)	2.62 (1.90)
CSJ-104	2.67 (1.91)	3.67 (2.16)	5.33** (2.51)	5.00 (2.44)	3.67 (2.16)	3.00 (2.00)	1.67 (1.63)	3.59 (2.14)
RSG-44	4.00 (2.24)	5.67 (2.58)	7.33 (2.88)	8.33** (3.05)	6.00 (2.65)	5.33 (2.51)	4.00 (2.24)	5.81 (2.61)
S.E. ±	0.074	0.066	0.094	0.087	0.077	0.079	0.076	0.052
C.D. (P=0.05)	0.220	0.200	0.280	0.260	0.230	0.230	0.220	0.150

*Figures in parenthesis are $\sqrt{x+1}$ value, ** Peak larval population , † Average of three replications, δ Meteorological week

Table 3 : Effect of sowing dates on the incidence of gram pod borer, *H. armigera* (Hub.) in chickpea during *Rabi* 2005-06

Date of sowing (Meteorological week)	Larval population at weekly intervals per five plants (during meteorological weeks)							
	31.01.06 (05)	06.02.06 (06)	13.02.06 (07)	20.02.06 (08)	27.02.06 (09)	06.03.06 (10)	12.03.06 (11)	Mean
5th October	1.50† (1.57)*	2.25 (1.79)	3.00 (1.98)	4.00** (2.22)	2.50 (1.87)	1.75 (1.65)	-	2.50 (1.87)
20th October	-	3.75 (2.17)	5.25 (2.49)	6.25 (2.69)	5.00 (2.44)	4.00 (2.23)	2.75 (1.93)	4.50 (2.34)
5th November	-	4.75 (2.39)	6.50 (2.73)	7.25 (2.89)	6.25 (2.68)	4.75 (2.39)	3.25 (2.05)	5.46 (2.54)
20th November	-	5.50 (2.54)	6.75 (2.78)	8.25 (3.04)	7.00 (2.83)	5.25 (2.49)	4.00 (2.24)	6.13 (2.67)
S.E. ±	0.045	0.14	0.13	0.12	0.11	0.10	0.073	0.068
C.D. (P=0.05)	0.15	0.43	0.40	0.39	0.35	0.34	0.24	0.22

*Figures in parenthesis are $\sqrt{x+1}$ values, †Data based on four replications, ** Peak larval population during crop season

Table 4 : Effect of sowing dates on mean larval population, pod damage and yield in chickpea against *H. armigera* during *Rabi* 2005-06

Date of sowing	Average larval population	Pod damage (%)	Yield (q ha^{-1})
5th October	2.50† (1.87)*	14.50† (22.35)**	13.04†
20th October	4.50 (2.34)	23.18 (28.76)	11.24
5th November	5.46 (2.54)	26.27 (30.83)	10.12
20th November	6.13 (2.67)	28.96 (32.55)	9.77
S.E. ±	0.068	0.65	0.39
C.D. (P=0.05)	0.22	2.09	1.26

*Figures in parenthesis are $\sqrt{x+1}$ values

(4.50) as well as of 5th October (2.50). Although 20th November crop larval population was at par to that of 5th November(5.46).

Pod damage by gram pod borer, *H. armigera* (Hub.) :

Examination of all the pods of five randomly selected plants from each plot of the four dates of sowing was executed at harvest for damaged and healthy pods. Data are presented in Table 4. The minimum per cent pod damage (14.50) was observed in 5th October sown crop. This sowing date proved significantly better than all the other sowing dates. In the crop sown on 20th October per cent pod damage was 23.18 which has been identified as medium pod damage among the four treatments. The maximum per cent pod damage (28.96%) was recorded in 20th November sown crop followed by 5th November (26.27%) and both the sowing dates were at par to each other. Similar findings are repoted by Srivastava and Srivastava (1989) and Chhabra and Kooner (1980). Results reported by Ali *et al.* (1992) with pod borer damage on chickpea varieties. Our findings are contradictory with Anwar and Shafique (1993) on pod borer.

Yield of chickpea :

The perusal of data (Table 4) indicated that out of all the sowing dates of crop, 5th October sown crop proved significantly superior in comparison to other sown crops in terms of yield. The maximum yield was recorded in the crop sown on 5th October (13.04 q ha^{-1}) as compared to late sown crops. This treatment differed significantly and superior to rest of the treatments. The medium grain yield was recorded in crop sown on 20th October (11.24 q ha^{-1}) and crop sown on 5th November (10.12 q ha^{-1}). The minimum yield was recorded in the crop sown on 20th November (9.77 q ha^{-1}) though it was at par with that of 5th November.

Effect of varieties on yield of chickpea :

The perusal of data presented in Table 1 indicated that all the varieties/genotypes proved significantly superior in comparison to RSG-44 and RSG-945 in terms of yield. The maximum yield was recorded in CSJD-884 (14.54 q ha^{-1}) followed by RSG-931 (14.36 q ha^{-1}). Both the varieties did not differ significantly with each other but were superior to rest of the varieties/genotypes. The minimum yield was recorded in RSG-44 and RSG-945 which were at par and significantly inferior to rest of the varieties. The yield obtained from RSG-973, RSG-897, RSG-888, RSG-895, RSG-959 and CSJ-104 ranged between 13.10 to 13.80 q ha^{-1}. The order of susceptibility of the varieties/ genotypes of chickpea on the basis of yield was CSJD-884 < RSG-931 < CSJ-104 < RSG-959< RSG-895 < RSG-888 < RSG-897 < RSG-973 < RSG-945 < RSG-44.

Conclusion :

Since no variety was completely resistant, the data of peak larval population of gram pod borer *H. armigera* given in Table 4 were converted to $\sqrt{x+1}$ values and then analysed using formula $x \pm \sigma$. Thus, three distinct groups of larval population were obtained *i.e.* below 3.05, between 3.06 to 4.93 and above 4.93 per five plants. Using this parameter the varieties/ genotypes were categorized as least susceptible, moderately susceptible and highly susceptible. Taking into consideration the above parameter, the varieties CSJD-884 and RSG-931 were

categorized as least susceptible with a larval population as below 3.05 per five plants. The varieties CSJ-104, RSG-959, RSG-895, RSG-888, RSG-897, RSG-973 were categorized as moderately susceptible with larval population ranging from 3.06 to 4.93 per five plants.

LITERATURE CITED

Ali, H., Rashid, A. and Iqbal, J. (1992). Pod borer infestation on promising gram varieties. *Pak. Entomol.*, **14**: 81-83.

Anonymous (2001). Agricultural Statistics at Glance 2001. Government of India, Ministry of Agriculture, Krishi Bhavan ; 64-65.

Anonymous (2002-2003). Annual report 2002-2003. All India co-ordinated project on chickpea, IIPR, Kanpur, p114.

Anonymous (2004). Agriculture Statistics at a glance. IFFCD, NEW DELHI (INDIA).

Anonymous (2005). Profuction prospects of *Rabi* 2004-05 and programme for *Kharif* 2005. Agriculture in Rajasthan, Department of Agriculture.

Anwar, M. and Shafique, M. (1993). Integrated control of gram pod borer, Heliothis armigera (Hub.) in Sindh. *Proc. Pak. Cong. Zool.*, **13**: 215-222.

Bhagwat, V.R., Aherkar, S.K., Satpute, U.S. and Thakare, H.S. (1995). Screening of chickpea (*Cicer arietinum* L.) genotypes for resistance to gram pod borer, *Helicoverpa armigera* (Hubner) and its relationship with malic acid in leaf exudates. *J. Entomological Res.*, **19** (3) : 249-253.

Chhabra, K.S. and Kooner, B.S. (1980). Sources of resistance in chickpea to the gram pod borer, *Heliothis armigera* (Hb). *Punjab Agri. Univ. J. Res.*, **17**: 13-16.

Fitt, G.P. (1989). The ecology of Heliothis in relation to agroecosystems. *Annual Rev. Entomol.*, **34**: 17–52.

Jayraj, S. (1982). Biological and ecological studies of Heliothis. Proceedings of the international workshop on Heliothis management ICRIST centre Patancheru, A.P. Indian, November, 15-20, 1981 pp 17-28.

Sharma, H.C., Pampapathy, G., Lanka, S.K. and Smith, T. J. Ridsdill (2005). Antibiosis mechanism of resistance to pod borer, Helicoverpa armigera in wild relative of chickpea. *Euphytica*, **142** (1-2) : 107-117.

Srivastava, C.P. and Srivastava, R. P. (1989). Screening for resistance to gram pod borer, *Heliothis armigera* (Hub.) in chickpea (*Cicer arietinum* L.) genotypes and observations on its mechanism of resistance in India. *Insect Sci. Appl.*, **10**: 255-258.

Srivastava, C.P. and Srivastava, R.P. (1990). Antibiosis in chickpea, *Cicer arietinum* (L.) to gram pod borer, *H. armigera* (Hub.). *Entomon.*, **15** (1-2) : 89-93.

Tripathi, S.R. and Sharma, S.K. (1984). Biology of *Helicoverpa armigera* (Hubner) in Trai belt of eastern Uttar Pradesh, India. (Lepidoptera : Noctuidae). *Giarnale italiana di Entomologia.*, **2**: 215-222.