Forage Res., **41** (4) : pp. 237-241 (2016) **http://forageresearch.in**

EVALUATION OF CHICKPEA (*CICER ARIETINUM* L.) GENOTYPES FOR YIELD AND THEIR SUSCEPTIBILITY REACTION AGAINST *HELICOVERPA ARMIGERA* (HUB.)

KRISHAN KUMAR, ROSHAN LAL* AND B. L. JAT

Pulses Section, Department of Genetics and Plant Breeding,
CCS Haryana Agricultural University,
Hisar-125 004 (Haryana), India
**(e-mail : roshanhau@Yahoo.co.in)*

(Received : 31 December 2016; Accepted : 25 March 2016)

SUMMARY

Eighteen chickpea (*Cicer arietinum* L.) genotypes were evaluated for yield and their susceptibility reaction against gram pod borer, *Helicoverpa armigera* Hub. for three consecutive years under natural field conditions during **rabi** 2010-11, 2011-12 and 2012-13 at Hisar. Among these, maximum grain yield was realized from the genotype H 04-28 (13.00 q/ha) during the season **rabi** 2010-11 and it was statistically at par with RSG 931 (12.45 q/ha), H 03-56 (11.73 q/ha) and RSG 963 (10.82 q/ha) during **rabi** 2011-12 and it was statistically at par with GNG 1488 (10.01 q/ha), CSJ 140 (9.07 q/ha) and H 03-56 (8.95 q/ha) during **Rabi** 2012-13 and it was statistically at par with RSG 888 (8.80 q/ha) and GNG 1591 (7.79 q/ha). However, on the basis of average of three years (2010-11 to 2012-13), the maximum yield was exhibited by the genotype GNG 1488 (9.36 q/ha) followed by RSG 931 (8.95 q/ha), H 04-28 (8.32 q/ha) and H 03-56 (8.20 q/ha). The genotype H 03-56 flowered earliest in 68-71 days and proved the best donor against gram pod borer with PSR 4.7. Minimum larval population was recorded in BG 256 (15.8 l/mrl) and it was followed by GL 25016 (17.5 l/mrl) and H 04-28 (18.5 l/mrl). Minimum per cent pod infestation by *H. armigera* was recorded in genotype H 01-27 (27.8%) and it was superior over all other genotypes. It was followed by H 03-56 (29.5%), CSJ 140 (30.9%) and GNG 1488 (31.3%). H 01-27 proved least susceptible genotype under natural field condition. The genotype H 03-56 flowered earliest and seemed to be the best as potential donor for pod borer's tolerance under late sown condition. GNG 1488, RSG 931, H 04-28, H 03-56 and RSG 963 proved promising genotypes for yield and against *H. armigera*. These genotypes may further be utilized in breeding programmes to develop the high yielding and tolerant cultivars against gram pod borer.

Key words : Chickpea, yield, gram pod borer, pest susceptibility rating

Chickpea (*Cicer arietinum* L.) is the most important pulse crop in the Indian sub-continent (Sharma *et al.,* 2014). It is used for human as well as for animal nutrition purposes. It is the main source of protein for vegetarian people. It is produced primarily for human consumption but can also be utilized as a feed ingradient for animals. Chickpea straw, the main by-product produced after chickpea grain threshing, is used for animal feeding by the farmers due to its more nutritive value and palatability than cereal straws (Kafilzadeh and Maleki, 2011).

Among various biotic factors responsible for reducing the yield of chickpea, insect-pests are the major ones. Among them, gram pod borer, *Helicoverpa armigera* is the key insect-pest in all the chickpea growing areas and causes 40 to 80 per cent damage (Sharma, 2001). Not only it feeds on leaves of the plant but feeds on the reproductive portion of the plant also. For the management of this key insect, growers generally rely on the use of insecticides which create undesirable problems such as residue hazards, resurgence in insect population, environmental pollution and toxic effect on natural enemies. To combat these adverse effects, the identification and use of resistant/tolerant genotypes is considered as the best alternative for integrated management of the key pest. In view of this, the present investigation was undertaken to evaluate the chickpea genotypes for relative susceptibility against gram pod borer.

MATERIALS AND METHODS

The experiment was conducted to evaluate the 18 chickpea (*Cicer arietinum* L.) genotypes for yield

and their susceptibility reaction against gram pod borer, *H. armigera* (Hub.) under natural field conditions for three years during **rabi** seasons of 2010-11, 2011-12 and 2012-13 at Pulses Research Area, Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar. All the genotypes were grown in a randomized block design with three replications in plot size of 5 rows x 4.0 m length with 30 x 10 cm spacing each. All the recommended agronomic package practices were followed to raise the crop. No insecticide was sprayed in the experimental field. The data were recorded for days to 50 per cent flowering, larval population per meter row length, per cent pod damage, yield in q /ha and pest susceptibility rating. Data were compiled and analyzed statistically as per the procedure of Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

During **rabi** 2010-11, maximum grain yield was recorded for the genotype H 04-28 (13.00 q/ha) and it was statistically at par with RSG 931 (12.45 q/ha) and H 03-56 (11.73 q/ha) (Table 1). The genotype H 03-56 flowered earliest in 68 days and proved the best donor against gram pod borer with PSR 6. Minimum larval population was recorded in GNG 1591 (25.5 l/mrl) and it was statistically at par with GNG 1488 (25.8 l/mrl) followed by C-235 (26.7 l/mrl), BG 256 (27.3 l/mrl) and H 03-45 (29.2 l/mrl). Minimum per cent pod infestation by *H. armigera* was recorded in genotype H 01-27 (58.5%) and it was superior over all other genotypes. It was followed by H 04-28 (67.7%) and statistically at par with CSJ 140 (71.3%).

The data recorded during the season **rabi** 2011-12 presented in Table 2 reveal that the genotype RSG 963 (10.82 q/ha) showed the maximum grain yield and it was statistically at par with GNG 1488 (10.01 q/ha) and CSJ 140 (9.07 q/ha). The genotype H 03-56 flowered earliest in 68 days and proved the best donor against gram pod borer with PSR 4. Minimum larval population (3.4 l/mrl) was recorded in GNG 1591 and HC 5 and it was statistically at par with RSG 931 (3.5 l/mrl), H 04-29 (3.6 l/mrl) and RSG 888 (3.7 l/mrl). Minimum per cent pod infestation by *H. armigera* was recorded in genotype GNG 1488 (3.5%) and it was superior over all other genotypes. It was followed by H 03-56 (4.6%), RSG 963 (4.7%) and H 04-29 (5.0%).

TABLE 1
Evaluation of chickpea genotypes against gram pod borer, *Helicoverpa armigera* during 2010-11

S. No.	Genotypes	Days to 50% flowering	Larval population/mrl*	Per cent pod damage**	Yield (q/ha)	PSR
1.	RSG 963	80	30.1 (5.58)	76.0 (59.68)	9.51	6
2.	H 01-27	86	29.3 (5.51)	58.5 (49.92)	8.67	5
3.	GNG 1488	86	25.8 (5.16)	75.4 (60.30)	10.67	6
4.	HC 5	86	35.9 (6.07)	74.8 (59.85)	10.03	6
5.	RSG 931	80	32.1 (5.75)	76.4 (60.99)	12.45	6
6.	CSJ 140	86	30.8 (5.64)	71.3 (57.69)	7.27	6
7.	GNG 1591	75	25.5 (5.15)	79.1 (62.90)	10.59	6
8.	RSG 888	80	29.0 (5.48)	81.6 (64.83)	8.04	6
9.	BG 256	86	27.3 (5.16)	77.2 (61.52)	6.58	6
10.	H 03-45	89	29.2 (5.50)	79.2 (62.18)	6.62	6
11.	GL 25016	75	30.6 (5.62)	76.2 (60.81)	8.74	6
12.	H 03-56	68	34.0 (5.91)	71.5 (57.86)	11.73	6
13.	C 235	89	26.7 (5.26)	83.5 (66.10)	7.22	6
14.	H 82-2	86	33.8 (5.90)	76.7 (61.20)	7.11	-
15.	L 550	86	30.2 (5.59)	73.8 (59.25)	4.08	6
16.	HK 2	86	29.6 (5.53)	74.5 (59.74)	3.39	6
17.	H 04-29	75	41.3 (6.51)	81.7 (64.69)	8.43	6
18.	H 04-28	86	33.1 (5.83)	67.7 (55.40)	13.00	5
	S. Em±	-	(0.17)	(1.74)	0.73	-
	C. D. (P=0.05)	-	(0.35)	(3.54)	1.49	-

*Figures in parentheses are $\sqrt{n+1}$.
**Figures in parentheses are angular transformed values.

TABLE 2
Evaluation of chickpea genotypes against gram pod borer, *Helicoverpa armigera* during 2011-12

S. No.	Genotypes	Days to 50% flowering	Larval population/mrl*	Per cent pod damage**	Yield (q/ha)	PSR
1.	RSG 963	84	5.1 (2.47)	4.7 (12.43)	10.82	4
2.	H 01-27	86	3.9 (2.19)	8.8 (17.21)	7.76	6
3.	GNG 1488	87	4.8 (2.40)	3.5 (10.73)	10.01	2
4.	HC 5	86	3.4 (2.10)	5.0 (12.85)	4·29	4
5.	RSG 931	86	3.5 (2.13)	5.3 (13.34)	7.11	4
6.	CSJ 140	88	5.7 (2.58)	4.8 (12.64)	9.07	4
7.	GNG 1591	80	3.4 (2.10)	6.5 (14.80)	3.69	4
8.	RSG 888	87	3.7 (2.17)	14.5 (22.31)	2.72	9
9.	BG 256	88	4.3 (2.23)	10.5 (18.91)	1.96	7
10.	H 03-45	87	4.1 (2.26)	11.4 (19.74)	4.46	8
11.	GL 25016	80	4.4 (2.33)	7.9 (16.34)	4.10	5
12.	H 03-56	68	6.1 (2.65)	4.6 (12.30)	3.92	4
13.	C 235	86	4.2 (2.29)	5.2 (13.17)	7.45	4
14.	H 82-2	87	3.8 (2.17)	8.9 (17.26)	8.97	-
15.	L 550	86	3.9 (2.21)	5.6 (13.56)	3.18	4
16.	HK 2	86	4.7 (2.38)	8.5 (16.97)	6.88	6
17.	H 04-29	75	3.6 (2.15)	5.0 (12.85)	3.36	4
18.	H 04-28	86	3.8 (2.17)	7.0 (15.30)	3.64	5
	S. Em±	-	(0.19)	(0.97)	0.85	-
	C. D. (P=0.05)	-	(0.36)	(1.85)	1.73	-

*Figures in parentheses are $\sqrt{n+1}$.
**Figures in parentheses are angular transformed values.

During **Rabi** 2012-13, the genotype H 03-56 (8.95 q/ha) exhibited highest yield and it was statistically at par with RSG 888 (8.80 q/ha) and GNG 1591 (7.79 q/ha). Minimum pod damage was recorded in genotype H 03-56 (12.4%) and it was at par with H 04-29 (12.5%), GNG 1591(13.2%) and H 03-45 (13.6%) (Table 3). In this season, the minimum days to 50 per cent flowering were recorded for the genotypes H 03-56 (71days) and H 04-29 (71days) and proved the best donor against gram pod borer with PSR 4. Observations recorded on per cent pod damage revealed that minimum damage was observed in genotype H 03-56 (12.4%) and H 04-29 (12.5%) and these were superior over all other genotypes. These were followed by GNG 1591 (13.2%), H 03-45 (13.6%) and RSG 931 (13.9%).

However, on the basis of average of three years (2010-11 to 2012-13), the maximum yield was exhibited by the genotype GNG 1488 (9.36 q/ha) followed by RSG 931 (8.95 q/ha), H 04-28 (8.32 q/ha) and H 03-56 (8.20 q/ha). The genotype H 03-56 flowered earliest in 68-71 days and proved the best donor against gram pod borer with PSR 4.7. Minimum larval population was recorded in BG 256 (15.8 l/mrl) and it was followed by GL 25016 (17.5 l/mrl) and H 04-28 (18.5 l/mrl). Minimum per cent pod infestation by *H. armigera* was recorded in genotype H 01-27 (27.8%) and it was superior over all other genotypes. It was followed by H 03-56 (29.5%), CSJ 140 (30.9%) and GNG 1488 (31.3%). Similar investigations were also carried out by Rai and Ramujage (2005), Hossain (2009), Singh *et al.* (2009), Nadeem *et al.* (2011), Kumar *et. al.* (2013), Kumar *et al.* (2013a) and Singh and Singh (2015).

On the basis of three years data (Table 4), it was concluded that H 01-27 proved least susceptible genotype under natural field condition. The genotype H 03-56 flowered earliest and seemed to be best as potential donor for pod borer's tolerance under late sown condition. There was no direct correlation with larval population for pod damage. GNG 1488, RSG 931, H 04-28, H 03-56 and RSG 963 proved promising genotypes for yield and against *H. armigera.* These genotypes may further be utilized in breeding programmes to develop the high yielding and tolerant cultivars against gram pod borer.

TABLE 3
Evaluation of chickpea genotypes against gram pod borer, *Helicoverpa armigera* during 2012-13

S. No.	Genotypes	Days to 50% flowering	Larval population/mrl*	Per cent pod damage*	Yield (q/ha)	PSR
1.	RSG 963	83	45.0 (6.78)	27.8 (31.80)	3.86	9
2.	H 01-27	87	61.3 (7.78)	16.0 (23.57)	4.45	6
3.	GNG 1488	83	78.4 (8:90)	15.0 (22.73)	7.40	6
4.	HC 5	83	41.2 (6.49)	17.2 (24.51)	5.26	6
5.	RSG 931	83	55.7 (7.53)	13.9 (21.86)	7.28	5
6.	CSJ 140	83	55.8 (7.53)	16.6 (24.04)	7.46	6
7.	GNG 1591	81	60.7 (7.85)	13.2 (21.33)	7.79	5
8.	RSG 888	77	61.0 (7.87)	16.6 (24.04)	8.80	6
9.	BG 256	-	-	-	-	-
10.	H 03-45	84	47.4 (6.96)	13.6 (21.60)	6.27	6
11.	GL 25016	-	-	-	-	-
12.	H 03-56	71	79.3 (8.96)	12.4 (20.55)	8.95	4
13.	C 235	87	43.9 (6.70)	17.0 (24.36)	4.37	6
14.	H 82-2	83	25.1 (5.10)	16.6 (24.04)	5.52	-
15.	L 550	87	46.7 (6.88)	18.5 (25.45)	1.71	7
16.	HK 2	87	41.4 (6.51)	17.2 (24.49)	1.21	6
17.	H 04-29	71	38.2 (6.26)	12.5 (20.70)	4.82	4
18.	H 04-28	-	-	-	-	-
	S. Em±	-	(0.30)	(0.95)	0.56	-
	C. D. (P=0.05)	-	(0.59)	(1.36)	1.10	-

*Figures in parenthesis are √n+1
**Figures in parenthesis are angular transformed values.

TABLE 4
Evaluation of chickpea genotypes against gram pod borer, *Helicoverpa armigera* [Pooled mean over three years (2010-11, 2011-12 and 2012-13)]

S. No.	Genotypes	Days to 50% flowering	Larval population/mrl*	Per cent pod damage**	Yield (q/ha)	PSR
1.	RSG 963	82	26.7 (4.9)	36.2 (34.64)	8.06	6.3
2.	H 01-27	86	31.5 (5.2)	27.8 (30.23)	6.96	5.7
3.	GNG 1488	85	36.3 (5.5)	31.3 (31.25)	9.36	4.7
4.	HC 5	85	27.0 (4.9)	32.3 (32.40)	6.53	5.3
5.	RSG 931	83	30.4 (5.1)	31.9 (32.06)	8.95	5.0
6.	CSJ 140	86	30.8 (5.3)	30.9 (31.46)	7.93	5.3
7.	GNG 1591	79	29.9 (5.0)	32.9 (33.01)	7.36	5.0
8.	RSG 888	81	31.2 (5.2)	37.6 (37.06)	6.52	7.0
9.	BG 256	87	15.8 (3.7)	43.9 (40.22)	4.27	6.5
10.	H 03-45	87	26.9 (4.9)	34.7 (34.51)	6.78	6.7
11.	GL 25016	78	17.5 (4.0)	42.1 (38.58)	6.42	5.5
12.	H 03-56	69	39.8 (5.8)	29.5 (30.24)	8.20	4.7
13.	C 235	87	24.9 (4.8)	35.2 (34.54)	6.35	5.3
14.	H 82-2	85	20.9 (4.4)	33.9 (33.99)	7.20	-
15.	L 550	86	26.9 (4.9)	32.6 (32.75)	2.99	5.7
16,	HK 2	86	25.2 (4.8)	33.4 (33.73)	3.83	6.0
17.	H 04-29	74	27.7 (5.0)	33.1 (32.75)	5.54	5.7
18.	H 04-28	86	18.5 (4.0)	37.4 (35.35)	8.32	4.5
	S. Em±	-	(0.2)	(1.22)	0.71	-
	C. D. (P=0.05	-	(0.4)	(2.42)	1.44	-

*Figures in parenthesis are √n+1
** Figures in parentheses are angular transformed values.

REFERENCES

Hossain, M. A. 2009 : Field screening of chickpea genotypes against pod borer. *Bangladesh J. Agril. Res.,* **34** : 517-521

Kafilzadeh, F., and E. Maleki. 2011 : Chemical composition, *in vitro* digestibility and gas production of straws from different varieties and accessions of chickpea. *J. Anim. Physiol. Anim. Nutr*., **96** : 111-118.

Kumar, S. V., Sunil, J. Chandraprakash, B. Arunkumar, and Kapil Patil. 2013 : Screening and clustering of chickpea (*Cicer arietinum* L.) germplasm to pod borer (*Helicoverpa armigera* Hubner). *Bioinfolet.*, **10** : 513-520

Kumar, J., D. C. Singh, A. P. Singh, and S. K. Verma. 2013a : Screening of chickpea genotypes for resistant against pod borer, *Helicoverpa armigera* Hubn. *Trends in Biosciences,* **6** : 101-103.

Nadeem, S., M. Hamed, M. Shafique, B. M. Atta, and T. M. Shah, 2011: Evaluation of resistance in Kabuli chickpea genotypes against chickpea pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera : Noctuidae) under field conditions. *Songklanakarin J. Sci. Technol*., **33** : 291-294

Panse, V. G., and P. V. Sukhatme. 1967 : *Statistical Methods for Agricultural Workers*. ICAR, New Delhi.

Rai, D. and Ramujage. 2005 : Screening of chickpea *(Cicer arietinum)* genotypes for resistance to gram pod borer *(Helicoverpa armigera). Indian J. Agric. Sci.,* **75** : 120-122.

Sharma, H. C. 2001 : *Compendium of Chickpea and Lentil : Diseases and Pests.*

Sharma, K. D., A. Kumar, Karmal Singh, and Krishan Kumar, 2014 : Biomass partitioning and yield of chickpea (*Cicer arietinum* L.) genotypes under soil moisture stress. *Haryana J. Agron.* **30** : 125-128.

Singh A. K.., C. P., Srivastava, and N. Joshi. 2009 : Evaluation of integrated pest management modules against gram pod borer in chickpea. *Indian J. Agric. Sci*., **79** : 49-52.

Singh, B. H., and Ravinder Singh 2015 : Host plant resistance in chickpea against gram pod borer, *Helicoverpa armigera* (Hübner) under field and laboratory conditions. *J. Food Legumes*, **28** : 69-72.