International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 590-594

Received: 21-05-2018
Accepted: 22-06-2018

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Screening of chickpea tolerant genotypes against pod borer *Helicoverpa armigera* (Hübner) at hotspot Pantnagar

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Abstract
Screening of chickpea genotypes were carried out against *Helicoverpa armigera* (Hübner) during *Rabi* season 2016-17 and 2017-18. During 2016-17 based on preliminary screening results of percent pod damage and PRSR eleven promising genotypes *viz.*, ICC 07104, ICCV 07108, ICCV 09103, ICCV 14872, ICCV 97105, HC 1, NBeG 1004, GLW 48, GL 25016, JG 11 and ICCV 92944 were categorised in grade three (resistant). During 2017-18, those eleven promising genotypes were further screened against pod borer. Overall mean number of egg population per plant was recorded highest in NBeG 1004 (0.56 eggs/ plant) and lowest in ICCV 07108 (1.22 eggs/ plant). However, the highest larval population was found in JG 11 (3.60 larva/plant) and lowest mean larval population in ICCV 92944 (1.68 larvae/plant). Percent pod damage varied significantly from the highest in ICCV 92944 (19.94 percent) to the lowest in JG 11 (35.67 percent). The minimum grain yield of chickpea was recorded in ICCV 97105 (822.30 kg/ha) and maximum grain yield was obtained from ICCV 92944 (1036.00 kg/ha). On the basis of the percent pod damage of genotypes ICCV 09103, HC 1, NBeG 1004, GLW 48, GL 25016 and ICCV 92944 were found to be least preferred and can be used as source of resistance against *H. armigera*.

Keywords: Chickpea, *Helicoverpa armigera*, Screening, Host plant resistance

Introduction
Pulses are important sources of proteins, vitamins and minerals and are popularly known as “Poor man’s meat”. Currently, we are in the mid-way of self-sustaining in pulses production although we are world leader in production, consumption and import as well. Chickpea is cultivated in an area of 8.19 million hectares with a production of 7.33 million tonnes and a productivity of 895 kg/ha in India (FAOSTAT, 2015) [2]. Chickpea pod borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) is the most notorious insect pest. It causes 10 to 60 percent yield loss in normal weather conditions in chickpea (Srivastava, 2003) [7], while it was 50 to 100 percent during favourable weather conditions (Reheenen *et al*., 1991) [9]. *H. armigera* is a difficult insect pest to tackle due to its wider host range, multiple generations, migratory behaviour, high fecundity and existing insecticidal resistance (Sarwar, 2013) [4]. Evaluation of chickpea genotype against pod borer resistance has given an 1improved motivation to the identification and use of host plant resistance as a fundamental concept of worldwide for the management chickpea pod borer. Antixenosis and antibiosis are the mechanisms of plants may cause reduction in insect size weight, survival, longevity, reproduction and resulting in longer development time (Sharma *et al*., 2003) [6]. Keeping this in view, the present studies has been carried out for screening of chickpea genotypes against pod borer *H. armigera* under natural condition, which influence in the identifying suitable genotype for sustainable production.

Materials and methods
Screening of thirty nine chickpea genotype along with three check varieties and ICC 3137 (susceptible check), ICCL 86111 (resistant check) and PG 186 (local check) was carried out for evaluating resistance against *H. armigera* at G. B. Pant University Agriculture & Technology, Pantnagar. Each genotype was sown in 3 rows plot, 2 m long, with spacing 10 x 45cm. There were three replications in a randomized complete block design. Normal agronomic practices were followed for raising the crop. Intercultural and weeding operations

were carried out as needed. The chickpea crop was raised without any insecticidal treatments so that population of the insect pest and its natural enemies could build up freely.
The observations were recorded on egg and larval population at vegetative stage, 50% flowering stage and 50% maturity stage, percent pod damage and grain yield on five randomly selected plants. Percent pod damage was calculated with the help of following formula:

$$\text{Percent pod damage} = \frac{\text{Number of damaged pod}}{\text{Total number of pods}} \times 100$$

The percentage of pod damage at maturity of genotypes was compared with that of the check varieties. The test genotypes were then graded by using the following formula.

$$\text{Pest Resistance (\%)} = \frac{\text{Percent PD in check} - \text{Percent PD in test genotype}}{\text{Percent PD in check}} \times 100$$

Where, PD = Pod damage.

The pest resistance percentage was converted to 1-9 scale as follows:

Pest Resistance	Pest Resistance Susceptible Rating (PRSR)	
100%	1	Immune
75 to 99%	2	Highly resistant
50 to75%	3	Resistant
25 to 50%	4	Moderately Resistant
10 to 25%	5	Intermediate
-10 to 10%	6	Equal to susceptible check
-25 to-10%	7	Moderately susceptible
-50 to-25%	8	Susceptible
<-50% or less	9	Highly susceptible

Statistical analysis: Tukey's HSD was used to compare differences among treatment means (P<0.05) using Statistical Package for Social Sciences (SPSS) software.

Results and discussion

Preliminary screening of chickpea genotypes under field condition during 2016-17

Thirty nine genotypes were screened in random block design along with three checks ICC 3137 (susceptible check), ICCL 86111 (resistant check) and PG 186 (local check). The data on number of eggs and larvae count recorded at vegetative stage, 50% flowering stage and 50% maturity stage along with percent pod damage and yield of genotypes have been represented in the Table 1.

Table 1: Preliminary screening of chickpea genotypes against *H. armigera* during 2016-17

Sl. no	Genotypes	Vegetative*		50% Flowering*		50% Pod maturity*		Mean egg population*	Mean larval population*	Pod damage (%)*	PRSR	Yield (Kg/ha)*
		Egg/ plant	Larvae/ plant	Egg/ plant	Larvae/ plant	Egg/ plant	Larvae/ plant					
1	5034	0.70^{abcde}	1.00^{abc}	2.10^{abc}	1.70^{bcdefg}	1.15^{abcde}	2.35^{abcd}	1.32^{abcde}	1.69^{a}	77.34^{defghi}	5	933.87^{opq}
2	ICC 14364	0.90^{abcdef}	0.60^{ab}	1.10^{abc}	3.20^{ijkl}	0.70^{abcde}	5.10^{efghi}	0.90^{ab}	2.97^{abcdef}	87.07^{hi}	6	866.67^{lmno}
3	ICC 14872	0.50^{abcd}	2.35^{abc}	1.80^{abc}	2.75^{hij}	0.45^{ab}	$3.55^{abcdefgh}$	0.92^{ab}	2.89^{abcdef}	40.35^{abcde}	3	918.84^{nopq}
4	ICCV 15996	1.10^{abcdef}	2.10^{abc}	0.90^{abc}	2.35^{ghi}	0.45^{ab}	2.30^{abc}	0.82^{ab}	2.25^{abcd}	89.97^{hi}	6	784.27^{jkl}
5	ICCV 07104	0.80^{abcdef}	2.50^{abc}	0.70^{abc}	2.80^{hij}	0.60^{abcd}	$3.20^{abcdefg}$	0.70^{a}	2.83^{abcdef}	43.81^{abcde}	3	921.05^{nopq}
6	ICCV 07108	1.10^{abcdef}	2.15^{abc}	0.75^{abc}	2.15^{fgh}	1.05^{abcde}	2.25^{abc}	0.97^{ab}	2.19^{abcd}	42.86^{abcde}	3	916.03^{nopq}
7	ICCV 07112	0.70^{abcde}	3.30^{abc}	1.35^{abc}	3.45^{jklmn}	0.65^{abcd}	$4.25^{bcdefghi}$	0.90^{ab}	3.67^{bcdefg}	91.40^{hi}	6	618.33^{g}
8	ICCV 07113	$2.05^{abcdefg}$	0.90^{abc}	2.15^{abc}	4.35^{op}	0.45^{ab}	1.75^{ab}	1.55^{abcde}	2.34^{abcd}	93.59^{j}	6	481.67^{f}
9	ICCV 08108	2.15^{bcdefg}	1.25^{abc}	0.90^{abc}	1.95^{defgh}	0.55^{abc}	$3.65^{abcdefghi}$	1.20^{abc}	2.29^{abcd}	$61.31^{abcdefghi}$	4	818.33^{jklm}
10	ICCV 09103	0.15^{ab}	2.20^{abc}	1.50^{abc}	4.20^{nop}	0.55^{abc}	2.75^{abcdef}	0.74^{a}	3.05^{abcdef}	40.22^{abcde}	3	901.00^{mnopq}
11	ICCV 09115	1.00^{abcdef}	3.10^{abc}	2.15^{abc}	5.25^{q}	0.90^{abcde}	5.70^{ghi}	1.35^{abcde}	4.69^{fg}	83.09^{ghi}	6	965.00^{pq}
12	ICCV 09118	0.70^{abcde}	2.20^{abc}	2.20^{abc}	3.55^{jklmno}	0.95^{abcde}	$3.70^{abcdefghi}$	1.29^{abcd}	3.15^{abcdef}	91.40^{hi}	6	916.68^{nopq}
13	ICCV 10	0.90^{abcdef}	2.30^{abc}	1.20^{abc}	4.15^{mno}	1.10^{abcde}	2.80^{abcdef}	1.07^{ab}	3.69^{bcdefg}	32.68^{ab}	6	928.00^{opq}
14	ICCV 92944	0.60^{abcde}	0.85^{abc}	1.00^{abc}	$1.50^{abcdefg}$	0.30^{a}	2.44^{abcde}	0.64^{a}	1.60^{a}	29.91^{a}	3	992.33^{q}
15	ICCV 95334	$1.30^{abcdefg}$	3.05^{abc}	0.80^{abc}	3.15^{ijk}	0.65^{abcd}	$3.80^{bcdefghi}$	0.92^{ab}	3.33^{abcdef}	$54.80^{abcdefghi}$	4	818.33^{jklm}
16	ICCV 97105	1.05^{abcdef}	0.95^{abc}	1.30^{abc}	2.80^{hij}	0.85^{abcde}	$3.65^{abcdefghi}$	1.07^{ab}	2.47^{abcd}	39.96^{abcde}	3	921.50^{nopq}
17	ICCL 86105	2.60^{defg}	4.50^{abc}	1.20^{abc}	5.70^{q}	0.90^{abcde}	6.22^{hi}	1.57^{abcde}	5.48^{g}	94.14^{j}	6	178.17^{ab}
18	JG 11	1.10^{abcdef}	2.60^{abc}	1.90^{abc}	4.05^{lmno}	0.80^{abcde}	$4.60^{cdefghi}$	1.27^{abc}	3.15^{abcdef}	43.79^{abcd}	3	905.00^{mnop}
19	GL 12021	0.80^{abcdef}	1.90^{abc}	0.30^{ab}	1.20^{abcde}	1.65^{bcde}	$3.75^{abcdefghi}$	0.92^{ab}	2.28^{abcd}	$70.42^{bcdefghi}$	5	439.61^{ef}
20	GL 29095	0.00^{a}	4.10^{abc}	1.40^{abc}	1.10^{abcd}	1.60^{bcde}	$4.70^{cdefghi}$	1.00^{ab}	3.30^{abcdef}	85.98^{hi}	6	488.06^{f}
21	GL25016	0.80^{abcdef}	1.15^{abc}	0.30^{ab}	1.40^{abcdef}	0.90^{abcde}	2.85^{abcdef}	0.67^{a}	1.80^{ab}	31.50^{a}	3	985.00^{q}
22	CSJK 46	0.50^{abcd}	2.50^{abc}	0.10^{a}	1.70^{bcdefg}	1.60^{bcde}	2.80^{abcdef}	0.73^{a}	2.34^{abcd}	36.96^{abc}	6	333.34^{cd}
23	HC 1	0.40^{abc}	4.20^{abc}	0.80^{abc}	1.10^{abcd}	0.90^{abcde}	1.65^{ab}	0.70^{a}	2.32^{abcd}	91.96^{hi}	3	877.34^{lmnop}
24	NBeG 49	0.80^{abcdef}	2.40^{abc}	0.70^{abc}	1.10^{abcd}	1.90^{e}	$4.90^{cdefghi}$	1.13^{ab}	2.80^{abcdef}	85.84^{hi}	6	333.72^{cd}
25	HK 1	$1.40^{abcdefg}$	3.45^{abc}	0.50^{abc}	1.05^{abc}	1.30^{abcde}	2.61^{abcdef}	1.07^{ab}	2.37^{abcd}	89.58^{hi}	6	467.73^{f}
26	CSJ 859	0.90^{abcdef}	4.70^{abc}	1.10^{abc}	1.10^{abcd}	1.70^{cde}	2.72^{abcdef}	1.24^{abc}	2.84^{abcdef}	75.77^{defghi}	5	647.34^{g}
27	NBeG 740	0.50^{abcd}	4.80^{bc}	0.50^{abc}	0.90^{ab}	1.80^{de}	2.51^{abcde}	0.94^{ab}	2.74^{abcde}	$73.55^{cdefghi}$	5	436.11^{ef}
28	NBeG 806	2.30^{cdefg}	4.10^{abc}	1.15^{abc}	0.70^{a}	1.10^{abcde}	$3.60^{abcdefghi}$	1.52^{abcde}	2.80^{abcdef}	76.15^{defghi}	5	629.04^{g}
29	NBeG 1004	0.00^{a}	2.90^{abc}	1.10^{abc}	1.00^{abc}	1.20^{abcde}	$3.96^{bcdefghi}$	0.77^{a}	2.62^{abcde}	33.74^{ab}	3	854.31^{klmno}
30	BG 3043	0.40^{abc}	2.50^{abc}	1.10^{abc}	1.00^{abc}	1.70^{cde}	1.87^{ab}	1.07^{ab}	1.79^{ab}	$75.54^{cdefghi}$	5	349.67^{de}
31	ICC 506 EB	$1.80^{abcdefg}$	1.00^{abc}	2.80^{abc}	1.45^{abcdef}	0.80^{abcde}	2.80^{abcdef}	1.80^{abcde}	1.75^{a}	$45.66^{abcdefg}$	4	766.82^{ijk}
32	GLW 48	0.60^{abcde}	1.20^{abc}	1.40^{abc}	1.35^{abcdef}	0.80^{abcde}	$3.77^{abcdefghi}$	0.94^{ab}	2.11^{abc}	32.13^{ab}	3	936.06^{opq}
33	CSJ 855	2.70^{efg}	3.45^{abc}	2.72^{abc}	1.65^{bcdefg}	0.70^{abcde}	$3.60^{abcdefghi}$	2.04^{bcdef}	2.90^{abcdef}	$58.02^{abcdefghi}$	4	746.16^{hij}
34	PAO-14-1130	2.85^{fg}	0.50^{ab}	3.30^{c}	3.70^{klmno}	1.50^{abcde}	5.05^{defghi}	2.55^{def}	3.09^{abcdef}	85.92^{hi}	6	245.88^{bc}
35	GLW 63	0.20^{abc}	0.50^{ab}	1.05^{abc}	$1.50^{abcdefg}$	1.00^{abcde}	5.30^{fghi}	0.75^{a}	2.43^{abcd}	$53.72^{abcdefgh}$	4	437.89^{ef}

36	GLW 131	2.70^{efg}	0.60^{ab}	1.90^{abc}	1.30^{abcdef}	0.90^{abcde}	3.60^{abcdefghi}	1.84^{abcde}	1.84^{ab}	73.34^{cdefghi}	5	668.34^{gh}
37	GLW 22	2.10^{abcdefg}	0.90^{abc}	1.20^{abc}	1.20^{abcde}	1.30^{abcde}	3.75^{abcdefghi}	1.54^{abcde}	1.95^{ab}	82.47^{fghi}	6	678.34^{ghi}
38	CSJ 870	3.40^{g}	5.20^{c}	3.40^{c}	1.80^{cdefg}	0.50^{abc}	4.80^{cdefghi}	2.43^{cdef}	3.93^{cdefg}	90.56^{hi}	6	447.11^{f}
39	GLW 57	2.00^{abcdefg}	0.40^{a}	2.80^{abc}	3.30^{jklm}	0.70^{abcde}	4.62^{cdefghi}	1.84^{abcde}	2.78^{abcde}	53.45^{abcdefgh}	4	479.11^{f}
40	ICC 3137	3.45^{g}	0.70^{ab}	4.52^{d}	5.55^{q}	1.60^{bcde}	7.30^{i}	3.19^{f}	4.52^{efg}	90.00^{hi}	-	400.56^{def}
41	ICCL 86111	1.10^{abcdef}	2.45^{abc}	1.40^{abc}	2.05^{efgh}	0.90^{abcde}	4.30^{bcdefghi}	1.14^{ab}	2.93^{abcdef}	39.10^{abcd}	3	830.55^{jklmn}
42	PG 186	0.40^{abc}	1.40^{abc}	0.40^{abc}	1.50^{abcdefg}	1.30^{abcde}	4.20^{bcdefghi}	0.70^{a}	2.37^{abcd}	43.98^{abcdef}	3	985.00^{q}

*Means in a column followed by the same letter(s) do not differ significantly at the 5% level by Tukey's HSD: PRSR- Pest Resistance Susceptible Rating

Number of eggs and larvae per plant: During the vegetative stage the mean egg population per plant varied significantly from nill egg population on NBeG 1004 and GL 29095 to the highest of 3.40 on CSJ 870 as compared to the susceptible check ICC 3137 (3.45), resistant check ICCL 86111(1.10) and local check PG 186 (0.40). Larval population per plant also varied significantly from the lowest on GLW 57 (0.40) to the highest of on CSJ 870 (5.20) as compared to susceptible check ICC 3137(0.70), resistant check ICCL 86111 (2.45) and local check PG 186 (1.40). The *Helicoverpa* population started to increase steadily at 50 percent flowering stage with mean egg and larval population varied significantly from 0.10 to 3.40 eggs/plant and 0.70 to 5.70 larvae/plant per plant, respectively. The maximum egg population on CSJ 870 (3.40 eggs/plant) and maximum larval population on ICCV 86105 (5.70 larvae/plant) were recorded. At the 50 percent pod maturity stage, the larval population was at its peak, whereas the egg population reduced and varied from lowest on ICCV 92944 (0.30) to highest on genotype NBeG 49 (1.90) as against the susceptible check ICC 3137 (1.60), resistant check ICCL 86111 (0.90) and local check PG 186 (1.30). Larval population per plant varied significantly from lowest of on HC 1 (1.65) to highest on ICCV 86105 (6.22) as compared to susceptible check ICC 3137 (7.30), resistant check ICCL 86111 (4.30) and PG 186 (4.20) respectively. When overall mean of the eggs laid by *H. armigera* per plant were considered together, there were significant differences among test genotypes. The minimum number of eggs (0.64) was observed on ICCV 92944 and the maximum number of eggs was recorded on PAO-14-1130 (2.55). Similarly when overall mean of the larvae of *H. armigera* per plant were considered together, there were significant differences among test genotypes. The minimum number of larvae observed on ICCV 92944 (1.60) and the maximum number of larvae were recorded ICCL 86105 (5.48) which was at par with susceptible check ICC 3137 (4.52) as compared to resistant check ICCL86112 (2.93) and local check PG 186 (2.37).

Percent pod damage: Percent pod damage ranged at par in most of the genotypes due to severe incidence of *H. armigera*. Pod borer damage varied from the lowest in ICCV 92944 (29.91 percent) followed by GL 25016 (31.50 percent) which are significantly at par with resistant check ICCL 86111 (39.10 percent) and local check (43.98 percent). However, highest pod damage was observed in ICCL 86105 (94.14 percent), followed by ICCV 07113 (93.59 percent) as compared to susceptible check ICC 3137 (90.00 percent).

Pest Resistance Susceptible Rating: PRSR was calculated on the basis of genotype pod damage as compared to the susceptible check ICC3137. The PRSR ranged 3 to 6 among the genotype. Out of thirty nine genotypes eleven genotype *viz.* ICC 07104, ICCV 07108, ICCV 09103, ICCV 14872, ICCV 97105, HC 1, NBeG 1004, GLW 48, GL 25016, JG-11 and ICCV 92944 showed PRSR rating of 3 as against the susceptible check PRSR rating 6, resistant check ICCL 86111 and local check PG 186 recorded PRSR rating 3.

Grain yield: The yield ranged from 178.17 kg/ha to 992.33 kg/ha. The minimum grain yield was recorded in ICCL 86105 (178.17 kg/ha) followed by PAO-14-1130 (245.88 kg/ha) due to heavy infestation of *H. armigera* and maximum grain yield was obtained from ICCV 92944 (992.33 kg/ha) followed by GL 25016 (985.00 kg/ha), as compared to checks ICC 3137, ICCL 86111 and PG 186 with 400.56, 835.55, 985.00 kg/ha respectively.

The promising genotypes *viz.*, ICC 07104, ICCV 07108, ICCV 09103, ICCV 14872, ICCV 97105, HC 1, NBeG 1004, GLW 48, GL 25016, JG 11 and ICCV 92944 were selected for confirmatory screening under pesticide free field conditions during 2017-18.

Confirmation of resistance in eleven promising chickpea genotypes against *H. armigera* under field conditions during 2017-18:

Eleven promising chickpea genotypes selected from preliminary screening of thirty nine genotypes were sown in random block design with three checks ICC 3137 (susceptible check), ICCL 86111 (resistant check) and PG 186 (local check), for confirmation of resistance. The observations recorded were presented in Table 2.

Table 2: Confirmation of resistance in promising chickpea genotypes against *H. armigera* during 2017-18

Sl.no	Genotypes	Vegetative*		50% Flowering*		50% Pod maturity*		Over all mean egg population*	Over all mean larval population*	Pod damage (%)*	PRSR	Yield (Kg/ha)*
		Egg/ plant	Larvae/ plant	Egg/ plant	Larvae/ plant	Egg/ plant	Larvae/ plant					
1	ICC 07104	0.47^{abc}	1.23^{a}	0.97^{abcde}	2.33^{b}	0.90^{abc}	2.93^{abc}	0.78^{abcd}	2.17^{abc}	32.44^{bcd}	3	1019.00^{fg}
2	ICCV 07108	1.20^{ef}	1.77^{a}	0.93^{abcd}	1.50^{ab}	1.53^{c}	3.20^{abc}	1.22^{fg}	2.16^{abc}	35.26^{d}	4	1021.00^{fg}
3	ICCV 09103	0.14^{a}	1.27^{a}	1.30^{cde}	1.37^{a}	0.77^{ab}	2.70^{ab}	0.74^{abc}	1.78^{a}	30.18^{abcd}	3	1016.00^{efg}
4	ICCV 14872	0.50^{abc}	0.97^{a}	1.53^{e}	2.43^{cd}	0.63^{a}	3.23^{abc}	0.89^{bcde}	2.21^{abc}	32.00^{bcd}	3	968.50^{cde}
5	ICCV 97105	1.10^{ef}	2.03^{a}	1.13^{bcde}	2.37^{bcd}	0.60^{a}	1.73^{a}	0.95^{cdef}	2.04^{ab}	34.25^{cd}	4	822.30^{b}
6	HC 1	0.13^{a}	2.03^{a}	0.77^{abc}	3.20^{def}	1.13^{abc}	4.50^{bc}	0.68^{abc}	3.25^{bcd}	27.99^{abcd}	3	1022.00^{fg}
7	NBeG 1004	0.63^{bcd}	1.27^{a}	0.40^{a}	1.70^{abc}	0.67^{a}	3.57^{abc}	0.56^{a}	2.18^{abc}	23.49^{abc}	3	1028.00^{g}
8	GLW 48	0.60^{bcd}	1.20^{a}	1.47^{de}	1.60^{abc}	1.10^{abc}	3.63^{abc}	1.06^{def}	2.14^{abc}	27.74^{abcd}	3	977.30^{cdef}
9	GL 25016	0.26^{ab}	1.87^{a}	0.83^{abc}	4.03^{fg}	0.87^{ab}	3.33^{abc}	0.66^{ab}	3.08^{bcd}	22.00^{ab}	3	1001.00^{defg}
10	JG-11	1.03^{def}	2.04^{a}	1.23^{bcde}	5.17^{h}	1.20^{abc}	3.60^{abc}	1.16^{efg}	3.60 ^{d}	35.67^{d}	4	954.30^{cd}

11	ICCV 92944	0.63^{bcd}	1.20^{a}	0.97^{abcde}	1.40^{a}	0.87^{ab}	2.43^{ab}	0.82^{abcd}	1.68^{a}	19.94^{a}	3	1036.00^{g}
12	ICC 3137	1.27^{f}	0.70^{a}	1.53^{e}	4.10^{g}	1.37^{bc}	5.33^{c}	1.39^{g}	3.38^{cd}	67.33^{e}	-	730.00^{a}
13	ICCL 86111	0.80^{cde}	1.17^{a}	1.13^{bcde}	3.37^{efg}	0.60^{a}	3.73^{abc}	0.84^{abcd}	2.75^{abcd}	19.78^{a}	3	1132.00^{h}
14	PG 186	0.63^{bcd}	1.73^{a}	0.67^{ab}	3.07^{de}	1.20^{abc}	3.87^{abc}	0.83^{abcd}	2.89^{abcd}	29.07^{abcd}	3	949.50^{c}

*Means in a column followed by the same letter(s) do not differ significantly at the 5% level by Tukey's HSD: PRSR- Pest Resistance Susceptible Rating

Number of eggs and larvae per plant: During vegetative stage mean egg population per plant recorded significantly lowest on HC 1 (1.20) which was statistically at par with genotype ICCV 09103, GL 25016, ICC 07104 and ICCV 14872 having 0.14, 0.26, 0.47and 0.50 eggs per plant respectively. However, the number of eggs recorded in susceptible check were ICC 3137 (1.27), resistant check (0.80) and local check PG 186 (0.63). Larval population per plant during vegetative stage varied non-significantly from lowest of 0.97 on ICCV 14872 to highest of 2.04 on JG 11 as compared to 0.70 and 1.17 on susceptible check ICC 3137 and resistant check ICCL 86111 respectively. At 50% flowering stage egg population per plant significantly varied from lowest of 0.40 on NBeG 1004 which were statistically at par with HC 1, GL 25016, ICCV 07108, ICCV 92944 and ICC07104 having 0.77, 0.83, 0.93, 0.97 and 0.97 eggs per plant respectively. The highest 1.53 were observed on genotype ICCV 14872 as against statistically at par with the susceptible check ICC 3137 (1.53), resistant check ICCL 86111 (1.13) and local check PG 186 (0.67). Whereas, Larval population per plant varied significantly from the lowest of 1.37 on ICCV 09103 which was statistically at par with ICCV 92944, ICCV 07108, GLW 48 and NBeG 1004 having 1.40, 1.50, 1.60 and 1.70 larval population per plant respectively to the highest of 5.17 on JG 11 as compared to susceptible check ICC 3137 (4.10), resistant check ICCL 86111 (3.37) and local check PG 186 (3.07). During 50% pod maturity stage mean egg population per plant varied non-significantly from the lowest on ICCV 97105 (0.60) to the highest ICCV 08108 (1.53) as against the susceptible check ICC 3137 (1.37), resistant check ICCL 86111 (0.60) and local check PG 186 (1.20). Larval population increased in all the genotypes at this stage and varied significantly from the lowest of 1.73 larvae per plant on ICCV 97105 which was statistically at par with all other genotypes except the highest of 4.50 larvae per plant on HC 1 as compared to 5.33, 3.73 and 3.87 on checks susceptible check ICC 3137, resistant check and local check PG 186 respectively. When overall mean number of the eggs laid by *H. armigera* per plant were considered together, there were significant differences among test genotypes. The minimum number of eggs (0.56) was observed on NBeG 1004 which was statistically at par with ICCV 92944, GL 25016, ICCV 09103, ICC 07104 and HC 1 having 0.66, 0.68, 0.74, 0.78 and 0.82 eggs per plant respectively and the maximum number of eggs was recorded on ICCV 07108 (1.22) which was significantly at par with susceptible check ICC 3137 (1.39). Similarly when overall mean number of the larvae per plant were considered together, there were significant differences among test genotypes. The minimum number of larvae was observed on ICCV 92944 (1.68) followed by ICCV 09103 (1.78) and the maximum numbers of larvae were recorded on JG 11 (3.60) as compared to susceptible check ICC 3137 (3.38), resistant check (2.75) and local check PG 186 (2.89). Similar work was also reported by Wakil *et al.*, (2005) [10] who conducted field trial to investigate 27 different genotypes of chickpea against *H. armigera* and recorded 1.27 (Paider-91) to 5.40 (C-44) larvae per plant. Above findings were also supported by Ujagir and Khare (1988) [8], the number of eggs varied from 1.8 (ICC) to 9.8 (ICC 873). While in the present study the mean egg population per plant varied from 0.56 to 1.22 it due to divergence in genotypes.

Pod damage: Percent pod damage ranged significantly from 19.94 percent to 35.67 percent. Minimum pod damage was observed in ICCV 92944 (19.94 percent), followed by GL 25016 (22.00 percent) which are statistically at par with NBeG 1004, GLW 48, HC 1 and ICCV 09103 having 23.49, 27.74, 27.99 and 30.18 pod damage respectively. However, maximum pod damage was observed in JG 11 (35.67 percent), followed by ICCV 08108 (35.26 percent) as compared to susceptible check ICC 3137 (67.33 percent), resistant check ICCL 86111 (19.78 percent) and local check PG 186 (29.07 percent). Above finding were supported by Sehgal and Ujagir (1990) [5] who reported 42.6 to 90% percent pod damage in chickpea by *H. armigera* at Pantnagar during *Rabi* season 1979-80 and 1987-88. Similar findings were also observed by Jaba *et al*., (2017) [3] who reported percent mean pod damage ranged from 68.49 to 100.

Pest Resistance Susceptible Rating: PRSR obtained between 3 and 4 by comparing pod damage of test genotypes with susceptible check ICC3137. Out of eleven test genotypes, eight genotypes *viz.* ICC 07104, ICCV 09103, ICCV 14872, HC 1, NBeG 1004, GLW 48, GL 25016 and ICCV 92944 recorded PRSR rating of 3 resistant which were at par with resistant check ICCL 86111 and local check PG 186. Whereas, ICCV 07108 and JG 11 have recorded PRSR rating 4 as compared with susceptible check ICC 3137 recorded PRSR rating 6.

Grain yield: The grain yield ranged from 822.30 kg/ha to 1036.00 kg/ha. The highest grain yield was recorded in ICCV 92944 (1036.00 kg/ha) which was at par with ICC 07104, ICCV 07108, ICCV 09103, HC 1, NBeG 1004, GL 25016 recorded 1019.00 kg/ha, 1021.00 kg/ha, 1016.00 kg/ha, 1022.00 kg/ha, 1028.00 kg/ha and 1001.00 kg/ha respectively. Lowest yield was recorded in ICCV 97105 (822.30 kg/ha) followed by JG 11 (954.30 kg/ha) as compared susceptible check ICC 3137 (730.00 kg/ha), resistant check ICCL86111 (1132 kg/ha) and local check PG 186 (949.50 kg/ha). The findings was supported by Ali and Mohammad (2014) [1] also reported cultivar Hawata which gave the highest seed yield 1482 kg/ha followed by Atmore 1276 kg/ha and Shandi 1246 kg/ha.

Conclusion: From the above study concluded that none of the tested genotypes were free from *H. armigera* infestation. However, based on the, lower egg laying, larval population percent pod damage and PRSR values the genotype ICCV 09103, HC 1, NBeG 1004, GLW 48, GL25016 and ICCV 92944 were found to be least preferred as compared to ICCV 07104, ICCV 07108, ICCL 14872, GL 97105 and JG 11. The genotypes which are least preferred could be exploited as a source of resistance for the varietal development of chickpea germplasm against *H. armigera*. Further study is needed to explore the influence of biophysical, biochemical plant characters and influence of climate change on tested genotypes in relation to resistance against *H. armigera*.

Acknowledgement
The authors are grateful to Norman E. Borlaug Crop Research Centre (NEB-CRC), G. B. Pant University of Agriculture & Technology for providing required facilities to carry out the work.

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