Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(5): 597-602

Received: 05-07-2018
Accepted: 06-08-2018

Hariom Sharma
Department of Entomology, JNKVV, Jabalpur, Madhya Pradesh, India

Abhishek Shukla
Department of Entomology, JNKVV, Jabalpur, Madhya Pradesh, India

AK Bhowmick
Department of Entomology, JNKVV, Jabalpur, Madhya Pradesh, India

AK Sharma
Department of Entomology, JNKVV, Jabalpur, Madhya Pradesh, India

Correspondence
Hariom Sharma
Department of Entomology, JNKVV, Jabalpur, Madhya Pradesh, India

Evaluation of chickpea (*Cicer arietinum* L.) genotypes against gram pod borer (*Helicoverpa armigera*, Hubner) under field conditions

Hariom Sharma, Abhishek Shukla, AK Bhowmick and AK Sharma

Abstract
Fourteen genotypes of chickpea (*Cicer arietinum* L.) namely CSJ 859, CSJ 870, CSJ 855, CSJK 46, Phule G 13107, Phule G 12313, GL 12021, GL 29095, GNG 1969, NBeG 49 and JG 11 including resistant check (ICCL 86111), susceptible check (ICC 3137) and local check (JG 14) were evaluated against *Helicoverpa armigera* through field screening trials during the years 2016-17 and 2017-18. The trials were conducted in Randomized Block Design with three replications. Larval density of *Helicoverpa armigera* was recorded on different genotypes at regular intervals during vegetatve, flowering and maturity stages of the crop. Pooled data analysis indicated lowest seasonal mean population density of *H armigera* on genotypes CSJ-870 and CSJ-855 (0.41 and 0.48 larva / 0.5 m^2, respectively).

Keywords: *Helicoverpa armigera, Cicer arietinum,* larval density, resistance, field screening

Introduction
Chickpea (*Cicer arietinum*) is the third most important grain legume crop of the world [1]. It is a premier pulse crop of India both in terms of area and production. In India, chickpea was grown on 9.21 m ha area with a production and productivity of 8.88 mt and 995 kg ha^{-1}, respectively, and the highest production of chickpea (3551 thousand tones) was recorded in Madhya Pradesh [2]. Chickpea seed is recognized as a valuable source of dietary proteins (18 to 22%), carbohydrate (52 to 70%), fat (4 to 10%), minerals (calcium, phosphorus, iron) and vitamins. Its straw has a good forage value [3]. Chickpea suffers from an averages of about 60 insect-pests, and among these half a dozen species are considered as of economic importance, but gram pod borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) is known to be the key pest [4,5]. Larvae of *H. armigera* cause damage to flowers during early stage of the crop and feed on developing pods of chickpea by inserting their anterior portion into pods [6]. This is directly reflected in lower yield. The yield losses due to *H. armigera* have been reported to the extent of 26.01% - 40.08% [7], 10.53%- 39.14% [8] and 80% [9]. In addition to feeding on more than 180 species of plants of about 45 families [10]. *H. armigera* has rapidly developed resistance to insecticides [11]. Host plant resistance (HPR) as one of the important components of integrated pest management, can play a major role in management of *H. armigera* [1, 12]. Use of resistant or tolerant varieties is economically viable, ecologically safe and compatible with other IPM strategies [13]. Resistant chickpea plants were also reported to show non-preference for oviposition and larval feeding by *H. armigera* [14]. In present experiment 14 promising chickpea genotypes were screened against *H. armigera* under field conditions.

Material and Methods
The experiment was laid out in Randomized Block Design with 14 treatments and three replications, at Livestock Farm, JNKVV, Jabalpur. Fourteen genotypes namely CSJ 859, CSJ 870, CSJ 855, CSJK 46, Phule G 13107, Phule G 12313, GL 12021, GL 29095, GNG 1969, NBeG 49 and JG 11 including resistant check (ICCL 86111), susceptible check (ICC 3137) and local check (JG 14) were evaluated against *H. armigera*. Larval density of *Helicoverpa armigera* on different genotypes was recorded weekly throughout the growing season of the crop. Varietal preference was determined considering the mean larval density of all observations during each crop stage. Larval density in different genotypes were subjected to analysis of variance at 5 percent level of significance for describing their relative susceptibility.

Results and Discussion

Mean larval population of *Helicoverpa armigera* recorded on 14 genotypes of chickpea at vegetative, flowering and maturity stages are presented in table 1.

Larval density at vegetative stage

Pooled mean population (2017 and 2018 pooled in table no 1) of *Helicoverpa armigera* varied from 0.27 (CSJ-870) to 1.15 (ICC-3137) larva/ 0.5 m^2 during the vegetative stage of crop. Pooled data indicated lowest mean larval population in genotypes CSJ-870, CSJ-855, ICCL-86111, CSJK-46 and GL-29095 (0.27, 0.31, 0.30, 0.39 and 0.39, larva / 0.5 m^2, respectively) which were statistically at par. Next better treatments were genotypes CSJ-959, GNG-1969, GL-12021 and Phule-G-12313 (0.43, 0.46, 0.48 and 0.48 larva / 0.5 m^2, respectively) which were statistically at par.

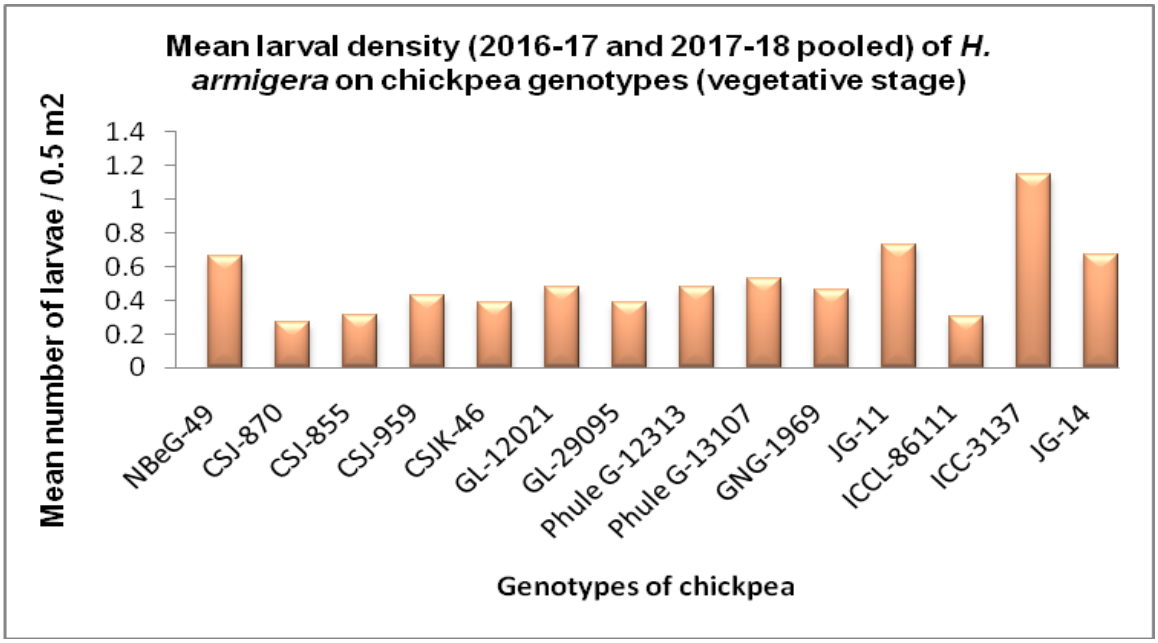

Fig 1

Larval density at flowering stage

Pooled mean population of *Helicoverpa armigera* ranged between 0.78 (GL-12021) and 2.24 (ICC-3137) larvae/ 0.5 m^2 during flowering stage of the crop. Genotypes GL-12021, CSJ-870, ICCL-86111, CSJ-855, CSJK-46 and GL-29095 recorded lowest mean larval density of 0.78, 0.81, 0.81, 0.96, 0.99 and 1.00 larva / 0.5 m^2, respectively and were statistically at par.

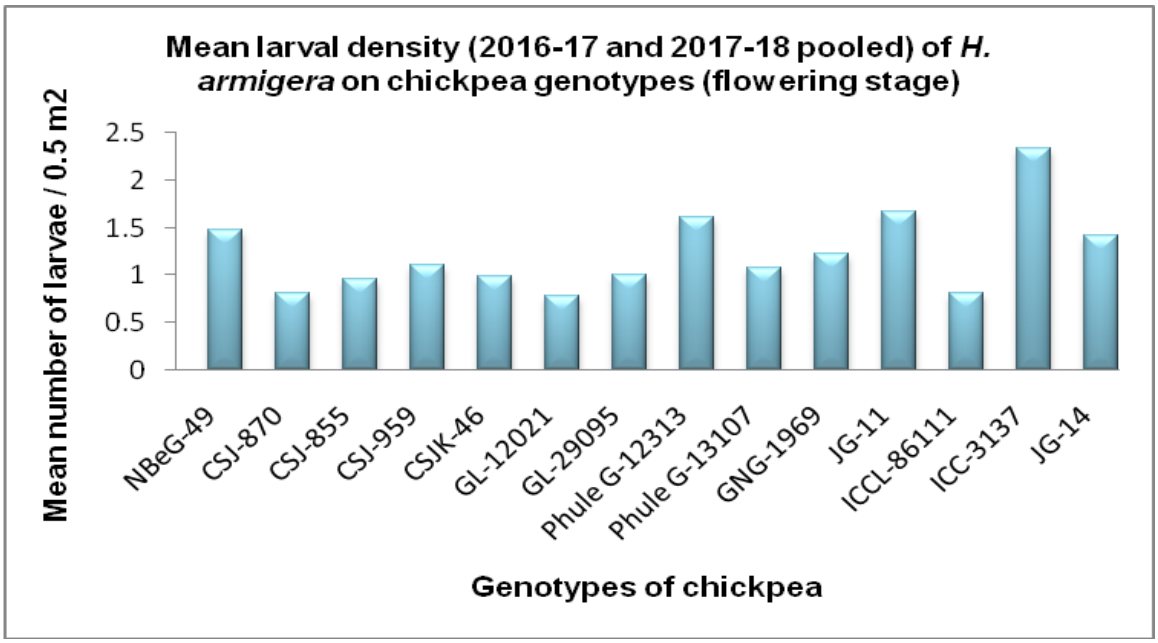

Fig 2

Larval density at maturity stage

Pooled mean larval population of *Helicoverpa armigera* was observed between 0.00 (NBeG-49) and 5.53 (ICC-3137) larvae/ 0.5 m^2 at maturity stage of the crop. Genotype NBeG-49 followed by CSJ-855 and CSJ-870 indicated lowest number of larva (0.0, 0.0 and 0.02 larva / 0.5 m^2, respectively) and were statistically at par.

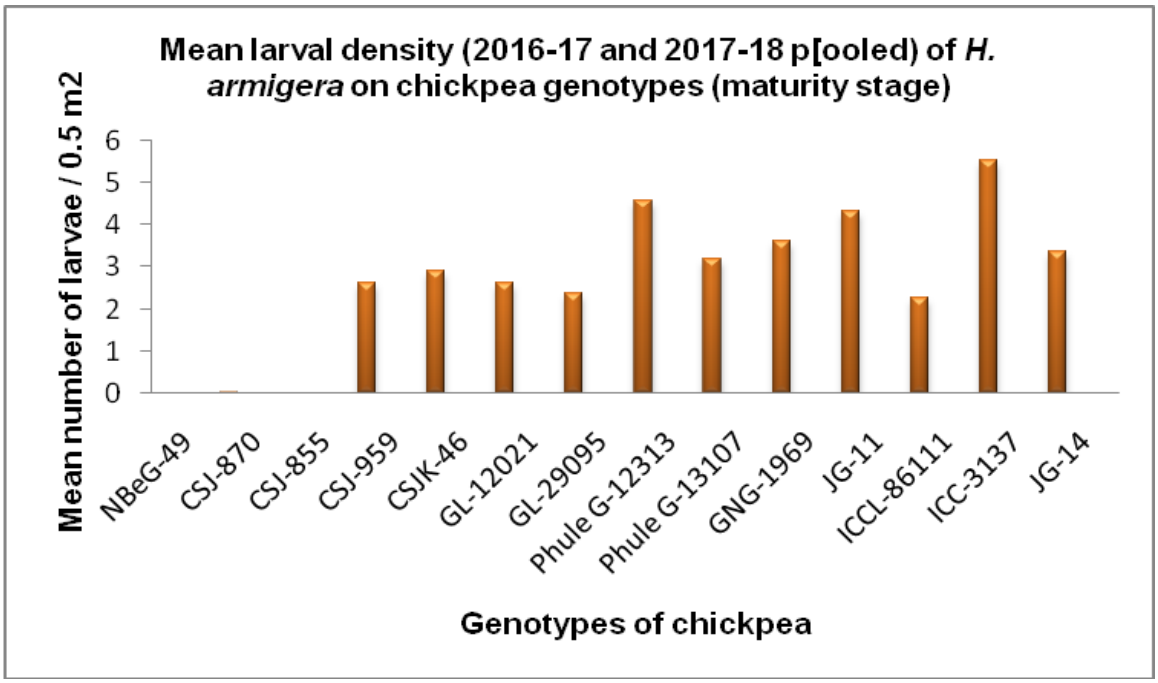

Fig 3

Overall mean larval density of *Helicoverpa armigera* throughout crop season

Pooled seasonal mean population of *Helicoverpa armigera* ranged between 0.41 (CSJ-870) and 2.70 (ICC-3137) larvae/ 0.5 m^2. Pooled data analysis indicated lowest seasonal mean population density in genotypes CSJ-870 and CSJ-855 (0.41 and 0.48 larva / 0.5 m^2, respectively) which were statistically at par. Next better genotypes were NBeG-49 and ICCL-86111 with seasonal mean population density of 0.80 and 0.99 larva, respectively and were at par.

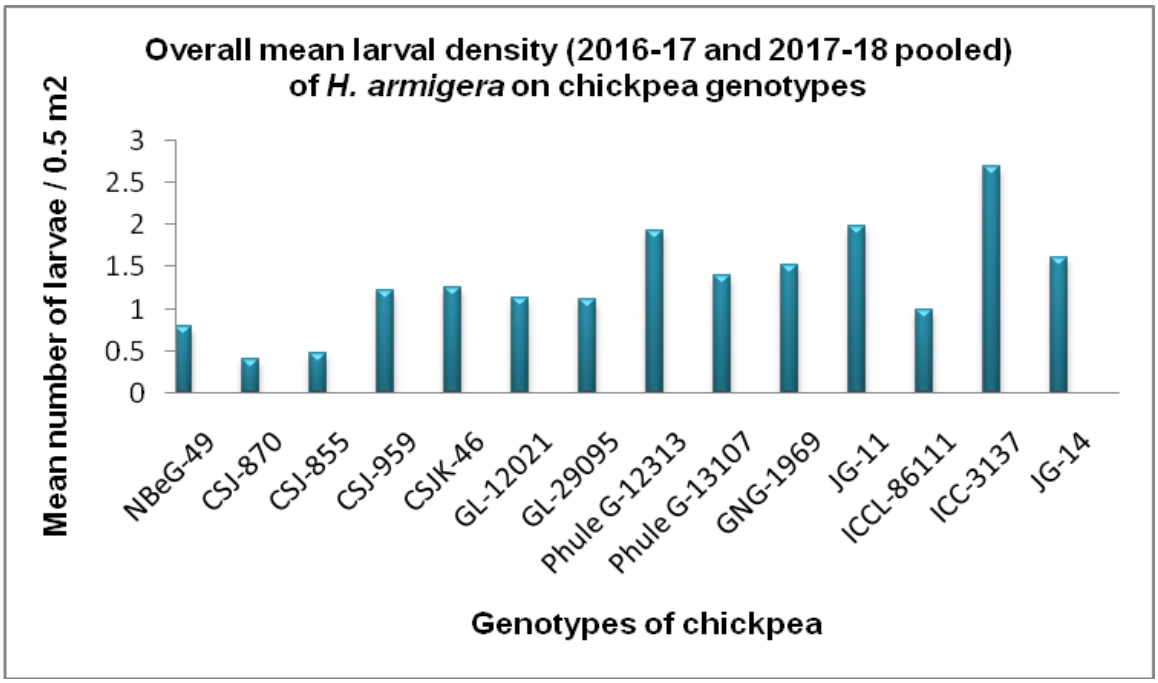

Fig 4

Per cent pod damage

Pooled mean percentage pod damage of *Helicoverpa armigera* was observed between 6.29% and 31.72% in genotype ICCL86111 and ICC-3137. Genotype ICCL-86111 and JG 11 had lowest pod damage (6.29% and 7.40% respectively) and were statistically at par. Next better treatments were genotypes JG 14 and Phule-G-12313 with pod damage of 7.91% and 8.68%, respectively and were statistically at par.

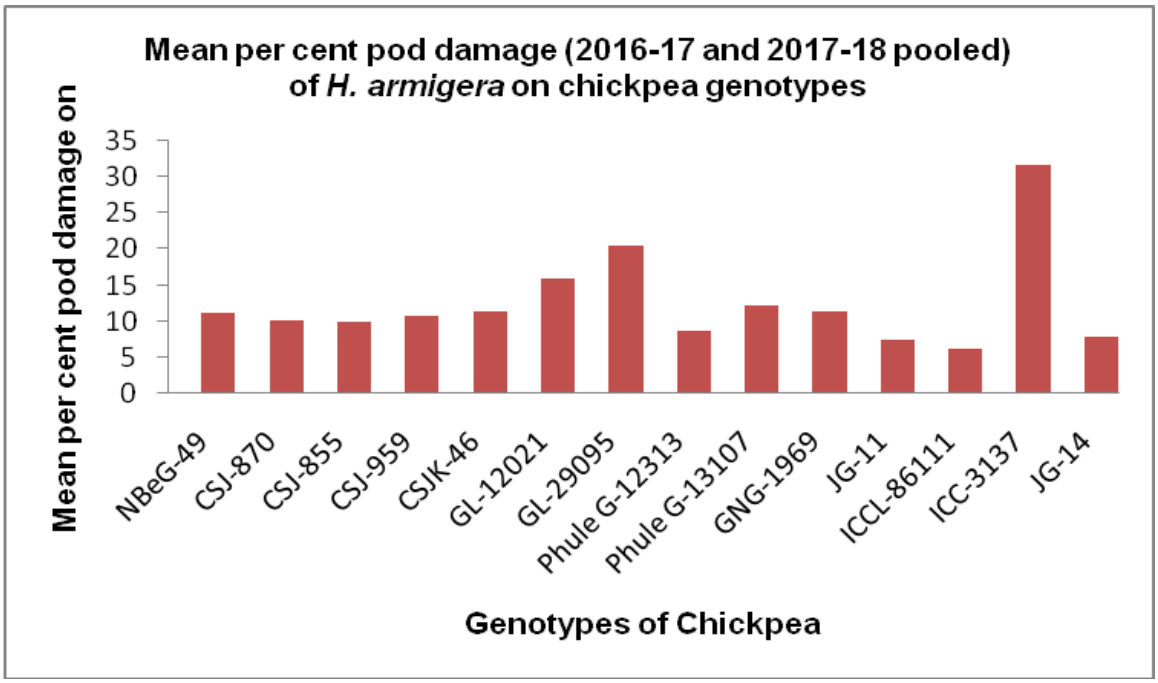

Fig 5

Yield

Pooled mean seed yield of chickpea genotypes ranged from 16.39 to 34.28 q/ha (in genotypes GL-12021 and Phule-G-12313, respectively). Genotype Phule-G-12313 recorded highest seed yield (34.28 q/ha.) followed by genotype Phule - G-13107 (31.11 q/ha.)

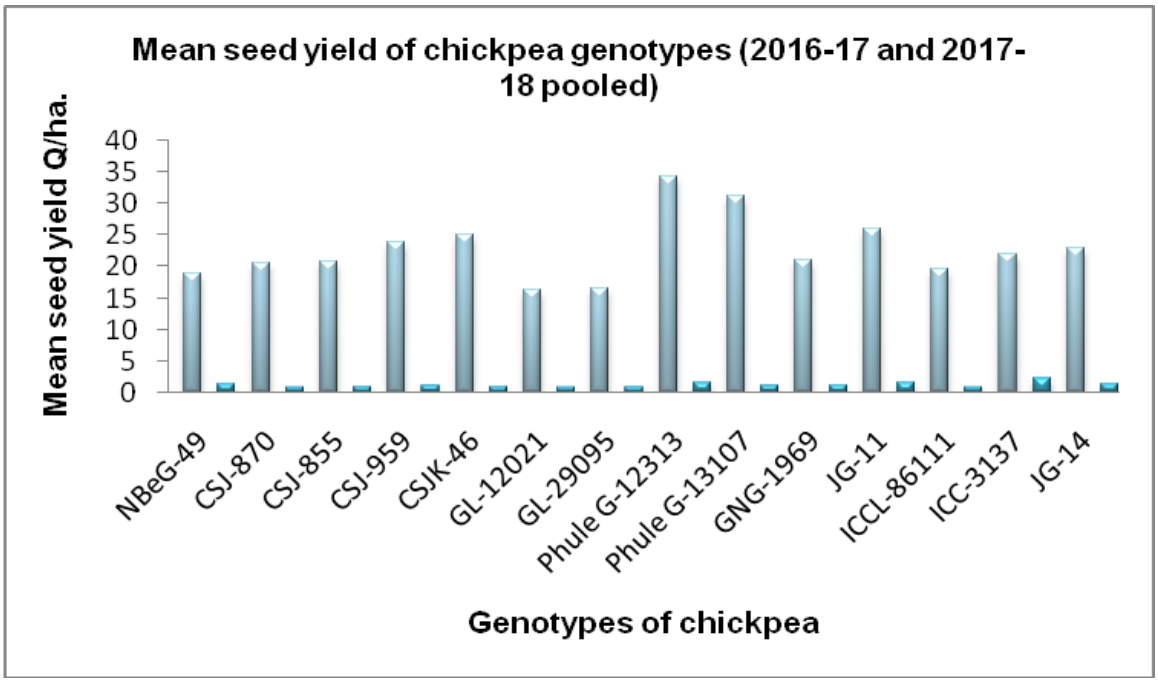

Fig 6

Several scientists have evaluated chickpea genotypes in the past which do not resemble to present genotypes, hence their findings are not comparable to the present work. [15]. reported genotypes ICC 1964, ICC 14, ICC 729 and ICC 515 as least susceptible to *H. armigera*. [16]. reported genotype C 235 to be tolerant to *H. armigera* with lowest (5.5%) pod damage. In present work the pod damage (%) has not been considered as the criteria for comparing the performance of genotypes against *H. armigera* incidence due to the fact that different genotypes vary in their inherent pod bearing capacity.

Ruttoh *et al*. (2013) reported significant variation in larval densities among genotypes and observed genotypes EC 58318, ICC 10, ICC 14831, EC 583260, EC 583264 and EC 583250 to have high resistance against *H. armigera*. [9]. Dialoke *et al*. (2014) reported cultivar ICCV 16903 to be resistant to *H. armigera*. [17]. Patange *et al*. (2015) reported variety Virat to be resistant against *H. armigera*. [18]. In present experiment genotypes CSJ-870 and CSJ-855 recorded lowest seasonal mean larval population of *H. armigera* and proved to be least preferred genotypes.

Table 1: Mean larval density of *Helicoverpa armigera* on chickpea genotypes during different crop stages, pod damage and yield (*Rabi* 2016-17 and 2017-18 pooled)

Sr. No.	Genotypes	Mean larval density/0.5 m^2 (pooled)				Pod damage (%)	Yield q/ha.
		Vegetative stage	Flowering stage	Maturity stage	Over all larval density		
1	NBeG-49	0.66 (1.08)	1.47 (1.40)	0.00 (0.71)	0.80 (1.14)	11.14 (19.46)	18.89
2	CSJ-870	0.27 (0.87)	0.81 (1.14)	0.02 (0.72)	0.41 (0.95)	10.18 (18.51)	20.58
3	CSJ-855	0.31 (0.90)	0.96 (1.20)	0.00 (0.71)	0.48 (0.99)	9.84 (17.98)	20.75
4	CSJ-959	0.43 (0.97)	1.10 (1.26)	2.62 (1.73)	1.23 (1.31)	10.85 (19.20)	23.83
5	CSJK-46	0.39 (0.94)	0.99 (1.22)	2.92 (1.82)	1.25 (1.31)	11.35 (19.59)	25.14
6	GL-12021	0.48 (0.99)	0.78 (1.13)	2.63 (1.75)	1.13 (1.27)	16.01 (23.25)	16.39
7	GL-29095	0.39 (0.94)	1.00 (1.22)	2.37 (1.69)	1.12 (1.27)	20.53 (26.88)	16.47
8	Phule-G-12313	0.48 (0.99)	1.61 (1.45)	4.57 (2.20)	1.93 (1.55)	8.68 (16.83)	34.28
9	Phule -G-13107	0.53 (1.02)	1.07 (1.25)	3.18 (1.90)	1.40 (1.37)	12.13 (19.46)	31.11
10	GNG-1969	0.46 (0.98)	1.22 (1.31)	3.60 (1.99)	1.53 (1.41)	11.35 (19.38)	21.03
11	JG 11	0.73 (1.11)	1.67 (1.47)	4.32 (2.15)	1.98 (1.56)	7.40 (15.72)	26.06
12	ICCL-86111	0.30 (0.90)	0.81 (1.14)	2.27 (1.64)	0.99 (1.21)	6.29 (14.51)	19.50
13	ICC-3137	1.15 (1.28)	2.34 (1.68)	5.53 (2.39)	2.70 (1.77)	31.72 (34.22)	21.89
14	JG 14	0.67 (1.08)	1.41 (1.38)	3.35 (1.93)	1.62 (1.44)	7.91 (16.19)	22.95
SEm±		0.02	0.03	0.06	0.03	4.00	6.29
CD (5%)		0.07	0.09	0.16	0.08	1.41	2.21

**Figures in parentheses are √x+0.5 values

Conclusions

- From present study, it may be concluded that the genotypes CSJ-870, CSJ-855, NBeG-49 and ICCL-86111 observed lowest seasonal mean population density of *Helicoverpa armigera*. The genotype ICCL-86111 and JG 11 had lowest pod damage (6.29% and 7.40% respectively). The host plant resistance play important role in pest management in chickpea.

Acknowledgements

- Authors are thankful to the department of entomology JNKVV, Jabalpur, Madhya Pradesh for providing necessary facilities and for requisite funding towards this research study.

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