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): 927-929

Received: 07-07-2018
Accepted: 09-08-2018

**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

# Ovipositional preference of gram pod borer (*Helicoverpa armigera*, Hubner) to chickpea (*Cicer arietinum* L.) genotypes under free choice test

**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, JG 11, ICCL 86111 (resistant check), ICC 3137 (susceptible check) and JG 14 (local check) were evaluated to study the ovipositional preference of *Helicoverpa armigera* during 2016-17 and 2017-18. The experiment was conducted in completely randomized design in the laboratory, adopting free-choice experiment technique. Twenty eight pairs (males & females) of adults of *H. armigera* were released in the cage containing chickpea genotypes, for mating & oviposition. Preference of adult females for oviposition was determined based on total egg count on different genotypes. Lowest mean oviposition was observed on genotypes NBeG-49 (11.67 eggs/ plant) and ICCL-86111 (13 eggs/ plant). Next better genotypes were CSJ-870 and Phule G-13107 (18 eggs/ plant).

**Keywords:** *Helicoverpa armigera*, *Cicer arietinum*, oviposition, resistance

## Introduction
Chickpea (*Cicer arietinum*) is the third most important grain legume crop of the world [16]. 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 [1]. Chickpea suffers from ravages of several 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 [10, 21]. The yield losses due to *H. armigera* have been reported to the extent of 26.01% - 40.08% [14], 10.53%-39.14% [15] and 80% [12]. In addition to feeding on more than 180 species of plants of about 45 families [9], H. *armigera* has rapidly developed resistance to insecticides [5].
The oviposition preference by the female *H. armigera* moths is influenced by morphological characteristics and chemical cues present on the surface of host plant [19]. The physiological state of an insect is a product of numerous interacting variations like age, feeding status and egg load etc. Egg load is one of several factors that may affect host selection behavior [18, 4, 2] [3]. Chickpea has been reported to be attractive to oviposition of *Helicoverpa* moths from as early as 14 days after planting and throughout the growth period [17]. When moths were drawn to chickpea in all growth stages, there was relatively less oviposition activity and damage in resistant cultivars that secreted high concentrations of malic acid [10]. It has been reported that the preference or non-preference for oviposition on chickpea by female moths may be due to its varying behavioral responses possibly due to different canopy structure of plants. Under natural conditions, the *H. armigera* females prefer to lay eggs on leaves and flowers. The neonates emerging from the eggs feed on the leaves during the initial stages, and the later instars feed on the seeds inside the pod [11]. It is a very serious pest of several crops worldwide because of high mobility, fecundity and overlapping generations [13].
Host plant resistance, as one of the important components of integrated pest management, can play a major role in management of *H. armigera* [16, 14]. Use of resistant or tolerant varieties is economically viable, ecologically safe and compatible with other IPM strategies [8]. Resistant chickpea plants were also reported to show non-preference for oviposition and larval feeding by *H. armigera* [6]. In present experiment 14 promising chickpea genotypes were evaluated against *H. armigera* under free choice conditions.

## Material and methods

The experiment was conducted in laboratory, adopting free-choice experiment technique. A nylon net cage of 12'x 2'x 2' (length, height and width) was erected over an aluminium frame. The net cage contained chain locks and open system on all sides to facilitate observations. Fourteen genotypes were sown in earthen pots of 10cm diameter and 18cm height. Forty two such pots (14 treatments & 3 replications) were used to grow chickpea genotypes. The pots were shifted in the nylon net cage when the plants attained 30 days maturity and arranged randomly inside the cage. Twenty eight pairs of males & females of *H. armigera* adults were released in the cage for mating & oviposition. Ten Petri plates containing glucose solution soaked in sterilized cotton were provided to ensure adult food sufficiency. Count of eggs on different genotypes was taken four days onwards, till the adult mortality. Preference of adult females for oviposition was determined based on total egg count on different genotypes & replications. The data of egg count was subjected to the analysis of variance at 5% level of significance, to work out the ovipositional preference.

## Results and discussion

Mean oviposition (2017 & 2018 pooled, table 1) by *H. armigera* was observed to be between 11.67 eggs/plant (NBeG-49) and 34.67 eggs/ plant (JG-14). Lowest mean oviposition was observed on genotypes NBeG-49 (11.67 eggs/ plant) followed by ICCL-86111 (13.00 eggs/ plant) and both were statistically at par. Next better genotypes having lower oviposition were CSJ-870 and Phule G-13107 (18 eggs/ plant) and were statistically at par (Fig. 1). Golla et al. (2018) also observed significant differences in oviposition by *H. armigera* females among the genotypes tested under multi-choice cage conditions. The lowest number of eggs by the females of *H. armigera* were laid on IG 70012 (555 eggs/genotype), which was not significantly different from PI 599046 (643.5 eggs/genotype), while the highest number of eggs were recorded on ICCW 17148 (1207 eggs/genotype).

Many factors affect host suitability, including nutrient content and secondary substances of the host. The exact cause of differences in larval growth rates, mortality, adult fecundity and survival remains unknown [7]. However, it is reported that the presence of secondary plant substances or poor food quality in wild varieties, malic acid and oxalic acid are the principal components of resistance to *H. armigera* in the cultivated chickpea, which result in oviposition nonpreference and antifeedant effects on *H. armigera* [20].

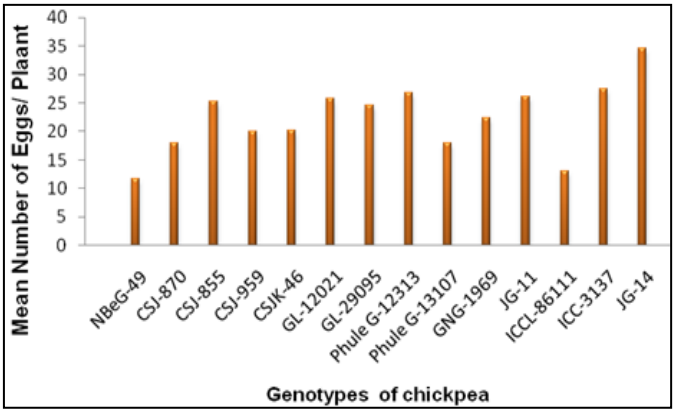


**Fig 1:** Bar diagram indicating oviposition by *H. armigera* females on chickpea genotypes

**Table 1:** Egg laying by *H. armigera* females on chickpea genotypes in free choice experiments, during 2016-17 and 2017-18.

| Name of genotype | *Mean number of eggs laid /plant | | |
|---|---|---|---|
| | 2017 | 2018 | Pooled |
| NBeG-49 | 21.33 (4.66) | 2.00 (1.32) | 11.67 (2.99) |
| CSJ-870 | 36.00 (5.69) | 0.00 (0.71) | 18.00 (3.20) |
| CSJ-855 | 49.33 (7.06) | 1.33 (1.18) | 25.33 (4.12) |
| CSJ-959 | 40.00 (6.35) | 0.00 (0.71) | 20.00 (3.53) |
| CSJK-46 | 39.00 (6.05) | 1.33 (1.18) | 20.17 (3.62) |
| GL-12021 | 51.00 (6.88) | 0.67 (1.00) | 25.83 (3.94) |
| GL-29095 | 45.67 (6.78) | 3.33 (1.94) | 24.50 (4.36) |
| PHULE-G- 12313 | 34.00 (5.70) | 19.67 (4.49) | 26.83 (5.09) |
| PHULE-G- 13107 | 33.33 (5.66) | 2.67 (1.45) | 18.00 (3.55) |
| GNG-1969 | 34.33 (5.85) | 10.33 (3.25) | 22.33 (4.55) |
| JG-11 | 33.00 (5.56) | 19.33 (4.45) | 26.17 (5.00) |
| ICCL-86111 | 25.33 (4.58) | 0.67 (1.00) | 13.00 (2.79) |
| ICC-3137 | 21.00 (4.60) | 34.00 (5.87) | 27.50 (5.24) |
| JG-14 | 49.67 (6.79) | 19.67 (4.47) | 34.67 (5.63) |
| C.D. (5%) | | | 1.51 |
| SEm ± | | | 0.53 |

*Mean of three replications

**Figures in parentheses are √x+0.5 values

## Conclusions

From present study, it may be concluded that the genotypes NBeG-49, ICCL-86111, CSJ-870 and Phule G-13107 observed lowest oviposition of *Helicoverpa armigera*. NBeG-49 (11.67 eggs/ plant) followed by ICCL-86111 (13.00 eggs/ plant). 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.

## References

1. Anonymous. Project Coordinator's Report, All India Coordinated Research Project on Chickpea, Indian Institute of Pulses Research, Kanpur. 2013, 39.
2. Blaney WM, Simmonds MST. The role of chemicals from legumes in mediating host selection by adults and larvae of *Helicoverpa armigera*: A behavioral and electropholic study (in F.) Host selection behaviour of *Helicoverpa armigera*. Summary Proceedings of the First Consultative Group Meeting, ICRISAT Center, Patancheru, Andhra Pradesh, India. 1990; 5-7.
3. Courtney SP, Kibota T. Mother does not know the best: selection of hosts by ovipositing insects. In: Insect Plant Interactions (Ed. E A Bernays). 1990; 61-68.
4. Fitt GP. The influence of shortage of hosts on the specificity of oviposition behaviour in species of *Daucus* (Diptera: Tephritidae). Physiological Entomology. 1986; 11:133-143.
5. Kranthi KR, Jadhav DR, Kranthi S, Wanjari RR, Ali SS, Russel DA. Insecticide resistance in five major insect pests of cotton in India. Crop Protection. 2002; 21:449-460
6. Lateef SS. Gram pod borer (*Heliothis armigera*) (Hub.) resistance in chickpea. Agricultural Ecological Environment. 1985; 14:95-102.
7. Liu Z, Li D, Gong PY, Wu KJ. Life table studies of the cotton bollworm, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) on different host plants. Environmental Entomology. 2004; 33:1570-1576.

8. Nadeem S, Shafique M, Hamed M, Atta BM, Shah TM. Evaluation of advanced chickpea genotypes for resistance to pod borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae). Pakistan Journal of Agricultural Science. 2010; 47:132-135.
9. Pawar VM. Microbial control of *Helicoverpa* sp. on pulse crops. IPM systems in Agriculture (Upadhyaya RK, Mukerji KG and Rajak R L Eds) Aditya Books Private limited New Delhi, India, 1998.
10. Reed W, Cardona C, Sithanantham S, Lateef SS. The chickpea insect pests and their control. Saxena MC and Singh KB (eds). The Chickpea. CAB International, Wallington, UK. 1987; 283-318.
11. Rembold H. Malic acid in chickpea exudates a marker for *Heliothis* resistance. International Chickpea Newsletter. 1981; 4:18-19.
12. Ruttoh EK, Mulwa RMS, Ngode L, Gohole L, Towett, B, Njogu N, *et al*. Screening for host plant resistance to *Helicoverpa armigera* (Lepidoptera: Noctuidae) in selected chickpea (*Cicer arientinum* L.) genotypes in Kenya. Egerton Journal of Science & Technology. 2013; 13:39-55.
13. Sarode SV. Sustainable management of *Helicoverpa armigera* (Hubner). Pestology. 1999; 13(2):279-284.
14. Sarwar M, Sattar M. Varietal variability of winter rapeseed (*Brassica napus* L.) for their susceptibility to green aphid, *Myzus persicae* (Sulzer) (Homoptera: Aphididae). Pakistan Journal of Zoology. 2013; 45:883-888.
15. Sarwar M, Ahmad N, Tofique M. Host plant resistance relationships in chickpea (*Cicer arietinum* L.) against gram pod borer (*Helicoverpa armigera*) (Hubner). Pakistan Journal of Botany. 2009; 41:3047-3052.
16. Sarwar M, Nazir N, Toufiq M. Identification of susceptible and tolerant gram *(Cicer arietinum)* genotypes against gram pod borer (*Helicoverpa armigera* Hubner). Pakistan Journal of Botany. 2011; 43:1265-1270.
17. Sequeira RV, Mc Donald JL, Moore AD, Wright GA, Wright LC. Host plant selection by *Helicoverpa* spp. in chickpea-companion cropping systems. Entomologia Experimentalis et Applicata. 2001-2001; 101:1-7.
18. Singer MC. Quantification of host preference by manipulation of oviposition behaviour in *Euphydryas editha*. Oocologia. 1982; 52:230-235.
19. Udayagiri S, Mason CE. Host plant constituents as oviposition stimulants for a generalist herbivore: European corn borer. Entomol. Exp. Appl. 1995; 76:59-65.
20. Yoshida M, Cowgill SE, Wightman JA. Roles of oxalic and malic acids in chickpea trichome exudate in host-plant resistance to *Helicoverpa armigera*. Journal of Chemical Ecology. 1997; 23(4):1195-1210.
21. Zalucki MPG, Firempong DS, Twine P. The biology and ecology of *Heliothis armigera* (Hübner) (Lepidoptera: Noctuidae) in Australia: what do we know? Australian Ecology. 1986; 34:779-814.