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## Varietal response of chickpea against the gram pod borer, *Helicoverpa armigera* (Hubner) under natural field conditions

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#### Abstract

Comparison of susceptibility response among ten chickpea varieties against gram pod borer showed that none was completely resistant against this pest. Variety Vijay recorded lowest (19.73 and 23.33%) pod damage followed by RSG 888 (20.46 and 27.67%); whereas, Samrat recorded pod damage of (30.40 and 34.33%) per cent followed by Kabuli with highest (31.26 and 37.04%) pod damage. Percent pod damage was recorded from varieties GNG 1581, Dahod Yellow, BGM 564, RSG 963, BGM 564 and local gram ranged between (23.66 to 28.26%) and (28.67 to 33.33%). However varieties Vijay and RSG 888 were found to be least susceptibility while GNG 1581, Dahod Yellow, Samrat, BGM 547, RSG 963, RSG 564 and Kabuli were moderate susceptibility. The maximum yield was recorded for Vijay (2.12 and 2.02 kg/plot) followed by RSG 888 (1.90 and 1.80 kg/plot). The minimum yield was recorded for Samrat (1.45 and 1.41 kg/plot) and Kabuli (1.18 and 1.08 kg/plot), respectively during 2013-14 and 2014-15.

**Keywords:** Chickpea varieties, gram pod borer, *Helicoverpa armigera*

#### 1. Introduction

Chickpea, *Cicer arietinum* L., is a very important legume crop that belongs to family Fabaceae, extensively grown throughout the country [27]. Chickpea is considered to be the third most important grain legume in the world being extensively grown in almost 45 countries of the world [22]. Chickpea is a crop of sandy soils but for the last few years it is being grown on irrigated lands after the harvesting of rice as cereal-legume rotation for reducing the exhaustion of rare soil nutrients [1]. Chickpea comprises 17.2% protein, 5.4% fat and 3.0% minerals wherein the nutrition vitality is about 1507 kJ. The dependable values for de-husked splitting chickpea are 21.8%, 5.8% and 2.9% respectively. They are also a source of high-quality protein, so known as "a poor man's meat" [28]. Production constraints in chickpea primarily include insect pests and diseases [17]. Among the insect pests, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) is the major constraint in the production of crop worldwide [23]. *H. armigera* is highly polyphagous, cosmopolitan, devastating and worldwide distributed pest [24, 21, 15]. It is most serious pest of important agricultural crops and causes yield losses in like tomato, cotton, okra, chickpea, pigeonpea and besides cereals, oil seeds and vegetable crops etc, but it mainly attacks chickpea [10]. The pest feeds voraciously and causes about 50 to 60 per cent damage to the chickpea pods [11], appearing throughout the year on different crops, and is reported to complete 7 overlapping generations [20]. Environmental conditions during the late vegetative and reproductive period for chickpea (February to mid-March) are particularly conducive to pod borer development. The pod borers inflicted heavy crop losses from seedling to maturity, but the losses reached at its peak when the pods appeared [16]. Lal (1996) reported that the seed yield losses due to *H. armigera* were 75-90% and in some places the losses were up to 100% [12]. The yield loss in chickpea due to pod borer was reported as 10 to 60 per cent in normal weather conditions, while it was 50 to 100 per cent in favorable weather conditions, particularly in the state where frequent rain and cloudy weather is prevailing during the crop season [19]. This pest can be controlled by using different integrated methods but Host plant resistance bids a real implement in integrated pest management [2] for control of pest as compared to many other control methods [26]. Host plant resistance (HPR) as one of the important component of integrated pest management, can play major role in management of *H. armigera* [7, 8]. It is economically reliable, ecologically safe and compatible with other IPM strategies [25, 14, 18].

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Considering the above factors, the present study was conducted to determine resistance/susceptibility of chickpea varieties against *Helicoverpa armigera* under field conditions.

## 2. Materials and Methods

The study was carried out at Instructional Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur during Rabi 2013-14 and 2014-15. The seeds of chickpea varieties: GNG 1581, Dahod Yellow, Samrat, RSG 888, BGM 547, RSG 963, RSG 564, Vijay, Kabuli and Local gram were sown in the plots measuring 3.6 X 3.6 m<sup>2</sup> having row to row and plant to plant distance of 30 cm and 10 cm, respectively. The experiment was laid out in Randomized Block Design (RBD), each replicated thrice. To record the pod damage expressed in percentage, five plants were selected randomly and tagged from each replicate. Total number of pods and number of damaged pods per plant infested by pod borer were counted and the percent infestation pod damage was calculated by using the equation:

$$\text{Pod damage (\%)} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$$

Resistance/susceptibility of each test variety were determined by using the pest susceptibility ratings (PSR) per cent as suggested by Lateef and Reed (1985)<sup>[13]</sup>:

Insect pest susceptibility rating

$$= \frac{\text{Pod damage (\%)} \text{ in check variety} - \text{Pod damage (\%)} \text{ in test variety}}{\text{Pod damage (\%)} \text{ in check variety}} \times 100$$

The grain yield per plot was recorded replication wise and the data was subjected to ANOVA.

### 2.1 Pest susceptibility ratings

Resistance (%)	Relative resistance/ susceptibility rating
100	1
75 to 99	2
50 to 75	3 Increasing resistance
25 to 50	4
10 to 25	5
-10 to 10	6 equal to check
-25 to -10	7
-50 to 10	8 Increasing susceptibility
- 50 to less	9

## 3. Results and discussion

Performance of chickpea varieties against the pod borer, *H. armigera* on the basis of mean percent pod damage and yield kg/plot was studied. [Table 1 and 2; Fig.1 and 2] indicates that variety Vijay recorded lowest (19.73 and 23.33%) pod damage followed by RSG 888 (20.46 and 27.67%); whereas, Samrat recorded pod damage of (30.40 and 34.33%) per cent followed by Kabuli with highest (31.26 and 37.04%) pod damage. Percent pod damage was recorded from varieties GNG 1581, Dahod Yellow, BGM 564, RSG 963, BGM 564 and local gram ranged between (23.66 to 28.26%) and (28.67 to 33.33%). Comparison of resistance among the recombinants against CPB showed that none was completely resistant against this pest. However varieties Vijay and RSG 888 were found to be least susceptibility while GNG 1581, Dahod Yellow, Samrat, BGM 547, RSG 963, RSG 564 and Kabuli were moderate susceptibility during 2013-14 and 2014-15. Deshmukh *et al* (2010) reported chickpea varieties BG-372, HC-1, SAKI-9516, Vijay and Avrodhi to be comparatively less susceptible as they harboured lower larval population (1.07 to 1.32 larvae/ plant) and had lower damage to pods (11.41 to 14.16%)<sup>[6]</sup>. Chandra *et al* (2013) reported mean larval population was lowest (<4.75 larvae/5 plants) on RSG-931 and GNG-1488, which were categorized as least susceptible to the gram pod borer under hyper arid, partial irrigated western plain zone of Rajasthan<sup>[3]</sup>. The genotypes Phule G-06302 and Local Kabuli recorded maximum percent pod damage of 30.40 and 33.04<sup>[9]</sup>. Choudhary *et al* (2015) reported that varieties RSG-44 and RSG-945 were rated as 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 were registered as least susceptible<sup>[4]</sup>. In the present investigation data indicated that all the varieties showed significant superiority over Kabuli and Samrat. The maximum yield was recorded for Vijay (2.12 and 2.02 kg/plot) followed by RSG 888 (1.90 and 1.80 kg/plot). The minimum yield was recorded for Samrat (1.45 and 1.41 kg/plot) and Kabuli (1.18 and 1.08 kg/plot). The yield obtained from GNG 1581, Dahod Yellow, BGM 564, RSG 963, BGM 564 and local gram ranged between (1.53 to 1.80 and 1.43 to 1.71 kg/plot), respectively during 2013-14 and 2014-15. Deshmukh *et al* (2010) reported that genotype BG-372 recorded significantly the highest grain yield (1375 kg/ha), which was at par with HC-1, Dahod Yellow, SAKI-9516, BG-256, Vijay and Avrodhi<sup>[6]</sup>. Jadhav *et al* (2012) reported that the genotype Phule G-7104 registered highest yield of 41.39 q/ha and Kabuli recorded lowest yield of 12.08q/ha<sup>[9]</sup>. Chaudhary *et al* (2015) reported that variety CSJD-884 recorded maximum yield (14.54 q/ha) though was at par with RSG-931 (14.36 q /ha), while lowest yield was recorded from variety RSG-44 (11.13 q/ ha)<sup>[4]</sup>.

**Table 1:** Response of chickpea varieties to *H. armigera* infestation during 2013-14

Varieties	Mean pod damage (%)	Insect pest resistance/susceptibility percent	Pest susceptibility rating	Pest resistance/ susceptibility	Yield (Kg/plot)	Yield (q/ha)
GNG 1581	29.10 (23.66)	7.79	6	Moderately Susceptible	1.80	13.89
D.YELLOW	30.10 (25.20)	1.79	6	Moderately Susceptible	1.73	13.35
SAMRAT	33.43 (30.40)	-18.47	7	Moderately Susceptible	1.45	11.19
RSG 888	26.85 (20.46)	20.26	5	Least Susceptible	1.90	14.66
BGM 547	30.70 (26.13)	-1.83	7	Moderately Susceptible	1.70	13.12

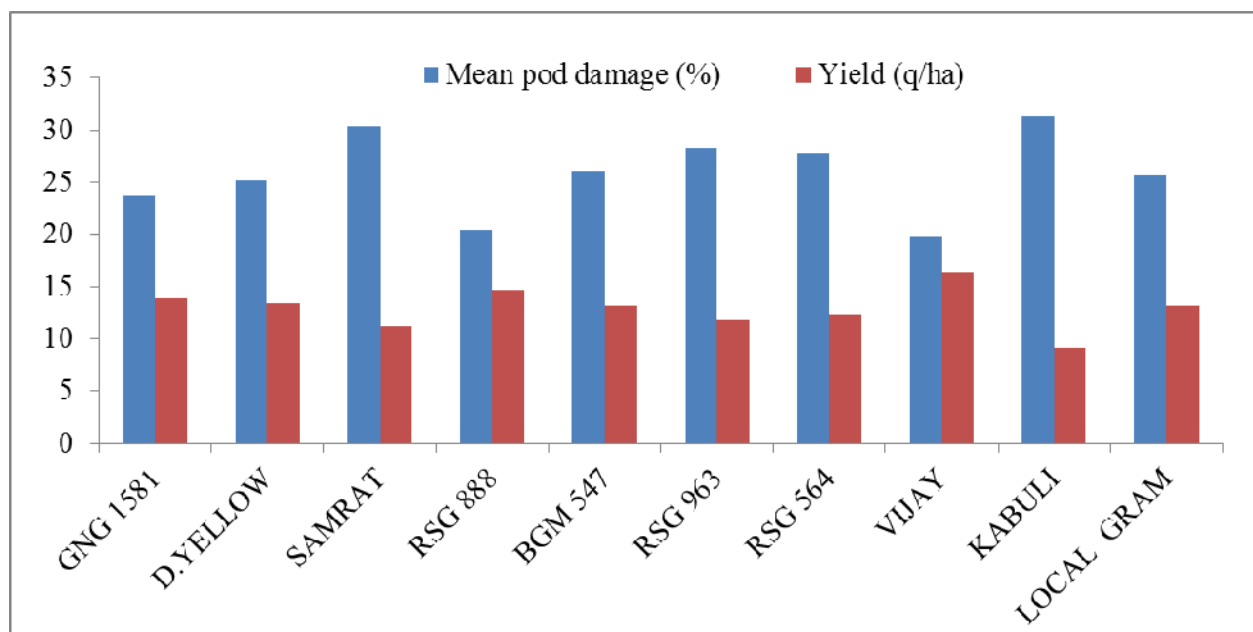
RSG 963	32.10 (28.26)	-10.52	7	Moderately Susceptible	1.53	11.81
RSG 564	31.72 (27.73)	-8.06	7	Moderately Susceptible	1.61	12.42
VIJAY	26.33 (19.73)	23.10	5	Least Susceptible	2.12	16.36
KABULI	33.98 (31.26)	-21.82	7	Moderately Susceptible	1.18	9.10
LOCAL GRAM	30.36 (25.66)	--	---	--	1.71	13.20
S. EM. +	0.98				0.11	
C.D. (p=0.05)	2.92				0.33	
CV (%)	33.45				67.56	

Figures in parentheses are retransformed per cent values

**Table 2:** Response of chickpea varieties to *H. armigera* infestation during 2014-15

Varieties	Mean pod damage (%)	Insect pest resistance/susceptibility percent	Pest susceptibility rating	Pest resistance/susceptibility	Yield (Kg/plot)	Yield (q/ha)
GNG 1581	32.37 (28.67)	8.49	6	Moderately Susceptible	1.71	13.20
D.YELLOW	32.90 (29.53)	5.74	6	Moderately Susceptible	1.62	12.50
SAMRAT	35.85 (34.33)	-9.57	7	Moderately Susceptible	1.41	10.88
RSG 888	31.68 (27.67)	11.59	5	Least Susceptible	1.80	13.89
BGM 547	34.78 (32.67)	-4.27	7	Moderately Susceptible	1.56	12.04
RSG 963	35.26 (33.33)	-6.38	7	Moderately Susceptible	1.43	11.03
RSG 564	35.17 (33.27)	-6.19	7	Moderately Susceptible	1.53	11.81
VIJAY	28.81 (23.33)	25.53	4	Least Susceptible	2.02	15.59
KABULI	37.47 (37.04)	-18.22	7	Moderately Susceptible	1.07	8.26
LOCAL GRAM	34.01 (31.33)	--	--	--	1.57	12.11
S. EM. +	0.75				0.09	
C.D. (p=0.05)	2.24				0.27	
CV (%)	22.57				58.84	

Figures in parentheses are retransformed per cent values



**Fig 1:** Response of chickpea varieties to *H. armigera* damage/infestation during 2013-14

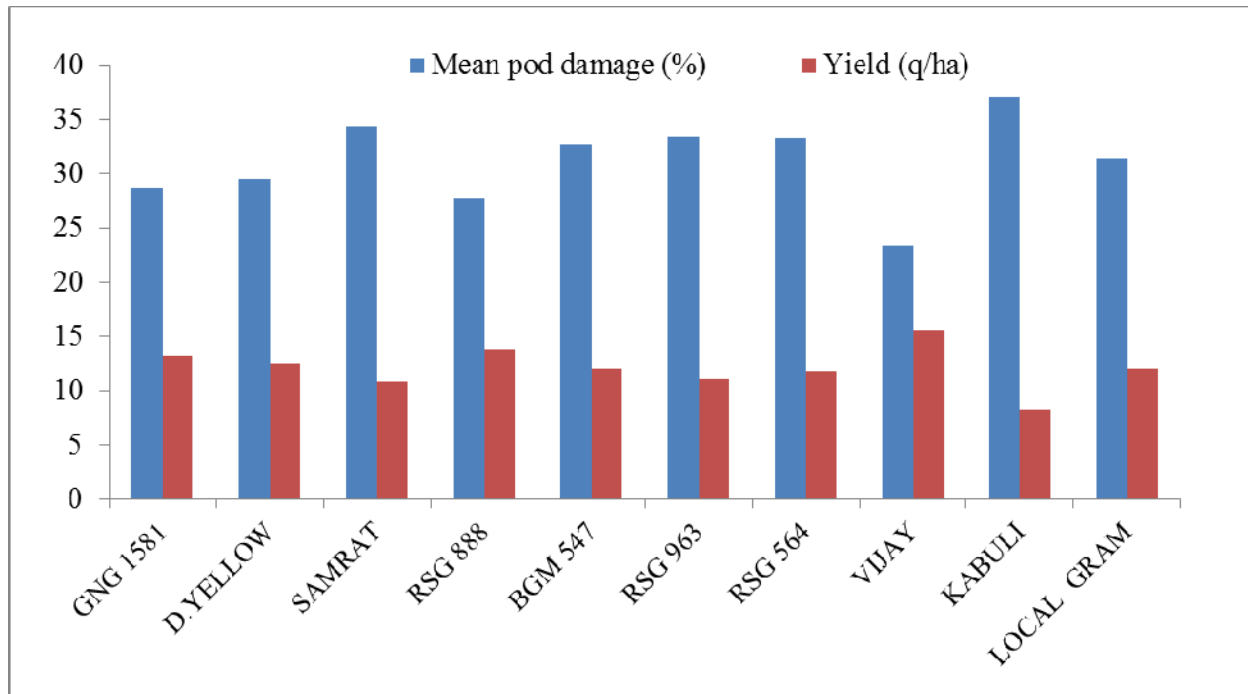


Fig 2: Response of chickpea varieties to *H. armigera* damage/infestation during 2014-15

#### 4. Conclusion

It can be concluded that out of 10 varieties of chickpea screened against *H. armigera*, none was found completely free from infestation of the gram pod borer. However varieties Vijay and RSG 888 were found to be least susceptible and also had lower damage to pods and higher grain yield than remaining cultivars.

#### 5. Acknowledge

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