**Field screening of chickpea varieties/germplasm against gram pod borer, *Helicoverpa* *armigera* (Hubner) in Kanpur region of Uttar Pradesh, India**

**ABSTRACT**

Student's Instructional Farm (SIF) of Chandra Shekhar Azad University of Agriculture and Technology in Kanpur (U.P.), India was the location where the field tests were carried out in order to screen several chickpea varieties/germplasm for their resistance against *H. armigera* (Hubner). Twenty different chickpea varieties/germplasm were tested for the presence of *H. armigera* (Hubner). These varieties/germplasm included Radhey, Avrodhi, K-850, KWR-108, IPC-1370, IPC-1374, GNG-2391, GNG-2392, Pusa-391, Pusa-397, KGD-1918, KGD-1145, KGD-1316, KGD-1320, KGD-2018, KGD-2019, JG-174, and JG-176. Additionally, two check varieties/germplasm, KGD-2020 (Resistant check) and KGD-1168 (Susceptible check), were also used. The variety/germplasm of Radhey had the lowest overall mean population of *H. armigera* larvae per plant, which was recorded as 0.43 larvae per plant. Radhey also had the lowest pod damage per percent, which was recorded as 9.86 percent. KGD-1320 had the highest grain yield across all the chickpea varieties/germplasm, with 16.08 q/ha.

**Keywords:** *H. armigera*, germplasm, Resistant check, Susceptible check

**1. INTRODUCTION**

Chickpea, *Cicer arietinum* Linn. is considered as “King of Pulses” and commonly known as Gram, Chana, Bengal gram (India), Chickpea (English), Hamaz, Hommes (Arab world), Nohud, Lablabi (Turkey), Shimbra (Ethiopia) and Garbanzo (Latin America), in different countries. It belongs to the family Fabaceae, sub-family Faboideae. “The genus *Cicer* originated in South-eastern Turkey and spread to other parts of the world. It is adapted to relatively cooler climates. In India, it is sometimes called as “poor man’s meat and rich man’s vegetable”” **(Bahadur *et al.,* 2018)**. The largest area of adaption is in the Indian sub-continent. Chickpea is cultivated in many countries of the world and comprises of 20 per cent of the world legumes production. It is the most important crop with high acceptability and wider use. It provides a high-quality protein to the people in developing countries. Green leaves/twigs of chickpea are used in preparing nutritious vegetables in countries of South Asia. These are also used as high protein fodder mixed with cereal leaves. “There are two types of chickpea *i.e., Desi* and *Kabuli* types. *Desi* type has small seeds with angular, sharp edges and the seed coat can vary from black to cream or yellow. The flowers of *Desi* type are generally pink and almost 80-90 per cent of the world’s chickpea crop is grown is *Desi* type. The splits (*dal*) and flour (*besan*) are invariably made from *desi* type. The *kabuli* type have large rounded seeds shaped like a ram’s head with cream beige or white seed coats, estimated at 10 per cent production area of the chickpea growing regions” **(Pandey *et* *al.*, 2011)**. Chickpea stover is fed to the cattle/goats as a nutrient rich supplement as their major cereal fodder in the lean season. Its ability to enrich the soil fertility by fixing large quantities of atmospheric nitrogen with the help of symbiotic bacteria mainly *Rhizobium* species is economically sound and environmentally acceptable. It has high nutritive value and is enriched with vegetable protein, carbohydrate, cholesterol lowering fiber, oil, ash, calcium, and phosphorus.

 In India, chickpea had total pulses area of 10.91 million hectare with production of 13.75 million tonnes and productivity 1260 kg/ha in 2024. It is grown in six major states *viz*., Maharashtra, Madhya Pradesh, Rajasthan, Gujrat, Uttar Pradesh, Andhra Pradesh, Karnataka and Chhattisgarh altogether contributing 97.15 per cent of the total production and 96.95 per cent of the total area of chickpea production in India. In U.P. chickpea is grown in an area of 0.62 million hectare with production of 0.77 million tonnes and productivity of 1250 kg/ha in 2023-24. Maharashtra is the single largest producer in the country accounting for over 23.82 per cent of total production while Madhya Pradesh, Rajasthan and Uttar Pradesh contribute about 22.05 per cent, 19.28 per cent and 5.59 per cent, respectively **(ANGRAU 2023-24)**.

 “It is a rich source of nutritional values in the diet of Indian people because of containing 21.5 per cent protein, 64.5 per cent carbohydrates and 4.5 per cent fat which is comparatively deficient in the cereals and oilseeds. Its green leaves and pods are used as green vegetables and germinated grains for breakfast and other delicious dishes by the people in their daily meals” **(Parmar *et al.,* 2015)**.

 “Gram is important pulse crop cultivated globally. Chickpea play an important role in the vegetarian diet as a major source of protein. It is consumed as a green vegetable, dal, chhole, germinated breakfast food and powder to prepare sweets and many other relishing dishes. Its leaves are consumed both raw and cooked to take advantage of malic acid, citric acid, mineral matter and fiber, which have medicinal properties. Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujrat, Andhra Pradesh and Karnataka are the major chickpea producing states sharing over 95 per cent area of chickpea production. Various factors responsible for low production and productivity of chickpea are poor genetic base, weeds, diseases and insect pests. Major insect pests of chickpea are Gram Pod Borer, *Helicoverpa* *armigera* (Hubner), cutworm, *Agrotis* *ipsilon* (Hufnagel), Gram semilooper, *Autographa* *nigrisigna* (Walker), Aphid, *Aphis* *craccivora* (Koch) and Tur pod bug, *Clavigralla* *gibbosa* (Spinola**)” (Sithanantham *et al.,* 1984)**.

 Gram pod borer, *Helicoverpa* *armigera* (Hubner) is a noxious and polyphagous pest of global importance damaging more than 200 cultivated and wild hosts **(Yadav *et al.,* 2011)**. Among cultivated hosts, chickpea, *Cicer* *arietinum* (Linnaeus), which is one of the most valuable pulse crop, reports heavy incidence of *H. armigera* damaging foliage and pods of the crop to the extent of up to 80 per cent in India ranging from region to region and depending upon climate and crop intensity **(Srivastava and Sehgal, 2002)**. Its outbreak has been witnessed due to its polyphagous nature, multivoltine, migratory, overwintering and diapause under adverse conditions. The most damaging stage of the pest is larvae, which feed on both foliage and pods.

 “The incidence of *H. armigera* begins from early vegetative to maturity stage of the crop. At early stage, the young larvae start feeding on leaflets, buds, flowers and finally the green pods of chickpea. Owing to this, reduction in yield ranged from 40-50 per cent has been recorded and may cause even complete loss of the crop” **(Rai *et al.,* 2003; Mandal and Roy, 2012)**. “The annual losses due to insect-pests have been estimated up to 15% in chickpea” **(Chandrashekhar *et al.,* 2014)**. A single larva can consume up to 30-40 pods in its life time **(Taggar and Singh, 2012)**. Reduction of chickpea production due to this pest may range from 70 to 95 per cent. “Crop pest surveillance and its monitoring aids in successful pest management strategies. The gram pod damage due to *Helicoverpa* *armigera* (Hubner) on chickpea crop could increase up to 100 per cent in India” **(Singh and Yadav, 2007)**. The immature stage of *H. armigera* consumed on foliage but they occurred highly dangerous at flowering and pod formation stage causing significant damage done by insect pests which could be minimized and kept under economic threshold level.

 Host plant resistance remains the most effective tool in integrated pest management which is compatible with other methods of management without any additional cost to the growers. Hence, the present research was undertaken to screen the chickpea varieties/germplasm against the Gram pod borer. Growing of resistant varieties/germplasm is an important component of integrated pest management because of environmental safety and compatibility with other methods. Keeping this in view all these facts chickpea varieties/germplasm were screened for their relative susceptibility in chickpea.

 This study is important because it proposes the search for chickpea varieties/germplasm resistant to *Helicoverpa* *armigera*, which is a polyphagous pest of economic importance due to its devastating effects on different crops.

**2. MATERIALS AND METHODS**

 The twenty varieties/germplasm of chickpea were screened against gram pod borer under unprotected natural field conditions. The chickpea varieties/germplasm were obtained from Legume Section, C.S.A. University of Agriculture and Technology, Kanpur, U.P., India.

**Table 1. Details of experiment on varietal/germplasm screening**

|  |  |
| --- | --- |
| Design | RBD |
| Plot size | Two rows of 4.0 m |
| Replications | 3 |
| Treatments | 20 |
| Number of rows per plot | 02 |
| Row length | 4 m per row |
| Spacing row to row | 30 cm |
| Spacing plant to plant | 10 cm |

**Table 2. List of varieties/germplasm for screening against gram pod borer during Winter, 2023-24 and 2024-25**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment No.** | **Varieties/germplasm** | **Treatment No.** | **Varieties/germplasm** |
| **T1** | Radhey | **T11** | KGD-1918 |
| **T2** | Avrodhi | **T12** | KGD-1145 |
| **T3** | K-850 | **T13** | KGD-1316 |
| **T4** | KWR-108 | **T14** | KGD-1320 |
| **T5** | IPC-1370 | **T15** | KGD-2018 |
| **T6** | IPC-1374 | **T16** | KGD-2019 |
| **T7** | GNG-2391 | **T17** | KGD-2020 (RC) |
| **T8** | GNG-2392 | **T18** | JG-174 |
| **T9** | Pusa-391 | **T19** | JG-176 |
| **T10** | Pusa-397 | **T20** | KGD-1168 (SC) |

RC- Resistant Check

SC- Susceptible Check

**2.1 Observations recorded on insect infestation in chickpea varieties/germplasm**

 Each variety/germplasm was grown in a plot with two rows of 4.0 m length with 30 cm × 10 cm spacing in Randomised Block Design (RBD) with three replications. All the recommended agronomic practices were adopted for raising the crop. The experimental site was kept free from insect-pest management practices. The observation on population of gram pod borer was recorded from five randomly selected plants from each variety/germplasm and each unit of plot. The insect-pest population data was recorded from 30 DAS (Days after sowing) to till the harvesting of the crop at weekly interval. Their mean value of population data (larvae/plant) was used to determine resistance/susceptible levels.

**2.2 Calculations on per cent pod damage caused by *Helicoverpa* *armigera* in chickpea**

 The per cent pod damage caused by gram pod borer, *Helicoverpa* *armigera* was estimated from data collected at the time of harvesting in each variety/germplasm. Collected pods were critically examined for the damage caused by gram pod borer, *H. armigera* in the laboratory on the basis of nature of damage. Pods damaged by *H. armigera* have big circular holes without larval exuviae on the pods. Number of healthy and damaged pods due to pod borer were recorded separately from each variety/germplasm and converted into percentage pod damage with the help of following formula:

$$Pod damage (\%)=\frac{Total number of damaged pods}{Total number of examined pods}×100$$

**2.3 Calculation of grain yield of each variety/germplasm**

 Grain yield per plot for each variety/germplasm was recorded after harvesting of the crop and then converted into kg/ha.

**2.4 Calculation of Pest Susceptibility Rating (%) (1-9 Scale) for screening of chickpea varieties/germplasm against *H. armigera***

 The per cent of pod damage at maturity of test entry was compared with that of the check cultivar in the trial. The test entries were then graded using a formula:

$$Pest Susceptibility Rating \left(\%\right)=\frac{P.D. of check-P.D. of test cultivar}{P.D. of check}×100$$

Where:

P.D. = Mean of % pods damaged

The insect pest resistance/susceptibility rating was calculated and rated on 1-9 scale as per the method given by **Lateef and Sachan (1990)**.

**Table 3. Details of Pest Resistance/Susceptibility Rating Scale**

|  |  |  |
| --- | --- | --- |
| **Pest resistance rating (%)** | **Relative resistance/ susceptibility rating** | **Category** |
| 100% | 1 | Highly resistant |
| 75 to 99% | 2 | Highly resistant |
| 50 to 75% | 3 | Least susceptible |
| 25 to 50% | 4 | Least susceptible |
| 10 to 25% | 5 | Least susceptible |
| -10 to 10% | 6 | Moderately susceptible |
| -25 to -10% | 7 | Moderately susceptible |
| -50 to -25% | 8 | Highly susceptible |
| Less than -50% | 9 | Highly susceptible |

**3. RESULTS AND DISCUSSION**

 **During winter season, 2023-24**, the overall mean population of *H. armigera* larvae/plant were recorded during crop period in the range of 0.46 – 1.23 (Radhey and Pusa-391).The lowestnumber ofoverall mean population of *H. armigera* larvae/plant was recorded in varieties/germplasm Radhey (0.46), KGD-1320 (0.49), GNG-2392 (0.52), K-850 (0.57) and the highest larvae/plant was recorded in Pusa-391 (1.23), KGD-1918 (1.22), KGD-2018 (1.13), IPC-1374 (1.01), JG-174 (0.91), IPC-1370 (0.86), GNG-2391 (0.86), Avrodhi (0.81), JG-176 (0.79), KGD-1316 (0.78), KWR-108 (0.78), KGD-1145 (0.76), KGD-2019 (0.72), Pusa-397 (0.69) as compared with Resistant check KGD-2020 (0.60) and Susceptible check KGD-1168 (1.18). (Table 4)

 The mean per cent of pod damage caused by *H. armigera* was recorded during harvest of the crop ranges from 10.84 to 22.36 per cent. A significant difference among the pod per cent damage was recorded from different varieties/germplasm. The maximum pod damage per cent was recorded in Pusa-391 (22.36) followed by IPC-1374 (21.60), KGD-2018 (20.56), GNG-2391 (18.24), KGD-2019 (17.23), IPC-1370 (16.73), KGD-1316 (16.71), JG-174 (16.50), Avrodhi (16.43), KWR-108 (16.28), GNG-2392 (15.79), KGD-1145 (15.41), Pusa-397 (15.30), JG-176 (14.92) while the minimum pod damage per cent was recorded in Radhey (10.84) followed by KGD-1320 (13.60), K-850 (13.90) compared to resistant check KGD-2020 (14.90) and KGD-1168 (Susceptible check) (21.45). (Table 4)

The pest susceptibility rating (PSR) was obtained against each variety/germplasm screened against *H. armigera* in chickpea crop based on the per cent pod damage.The varieties/germplasm Radhey, K-850, GNG-2392, Pusa-397, KGD-1145, KGD-1320, KGD-2020, JG-176 was found least susceptible against *H. armigera* in chickpea with Pest Susceptibility Rating 4 followed by Avrodhi, KWR-108, IPC-1370, GNG-2391, KGD-1316, KGD-2019, JG-174 with Pest Susceptibility Rating 5 showed least susceptible, varieties of IPC-1374, Pusa-391, KGD-1918, KGD-2018 found moderate susceptible against major insect of chickpea with Pest Susceptibility Rating 6. (Table 4)

The grain yield was estimated at the time of harvest of the crop in different varieties/germplasm of chickpea in q/ha. Among all the varieties/germplasm of chickpea, the highest grain yield (15.49) was obtained in KGD-1320 followed by Radhey (14.51), GNG-2391 (14.31), KWR-108 (14.07), KGD-2020 (14.02), KGD-2018 (13.94), KGD-1145 (13.62), Pusa 397 (13.37), GNG-2392 (13.15), K-850 (13.02), JG-174 (13.01), KGD-2019 (12.80), JG-176 (12.62), IPC-1370 (12.36), IPC-1374 (11.39), Pusa-391 (11.08) while the significant lowest grain yield was recorded in varieties/germplasm KGD-1918 (9.45), Avrodhi (10.33), KGD-1316 (10.49) compared with Susceptible check KGD-1168 (10.65). (Table 4)

 **During winter season, 2024-25**, the overall mean population of *H. armigera* larvae/plant were recorded during crop period in the range of 0.40 – 1.06 (Radhey and Pusa-391).The lowestnumber ofoverall mean population of *H. armigera* larvae/plant was recorded in varieties/germplasm Radhey (0.40), KGD-1320 (0.44), GNG-2392 (0.48), K-850 (0.48) and the highest larvae/plant was recorded in Pusa-391 (1.06), KGD-1918 (1.04), KGD-2018 (0.99), IPC-1374 (0.88), JG-174 (0.80), KGD-1316 (0.77), IPC-1370 (0.74), Avrodhi (0.69), GNG-2391 (0.67), KWR-108 (0.67), KGD-2019 (0.67), KGD-1145 (0.66), Pusa-397 (0.62), JG-176 (0.61) as compared with Resistant check KGD-2020 (0.55) and Susceptible check KGD-1168 (1.03). (Table 5)

The mean per cent of pod damage caused by *H. armigera* was recorded during harvest of the crop ranges from 8.89 to 21.80 per cent. A significant difference among the pod per cent damage was recorded from different varieties/germplasm. The maximum pod damage per cent was recorded in Pusa-391 (21.80) followed by IPC-1374 (21.55), KGD-1918 (19.90), KGD-2018 (19.39), GNG-2391 (19.10), KGD-1316 (17.90), JG-174 (17.17), IPC-1370 (16.17), KGD-2019 (16.13), Avrodhi (15.63), JG-176 (15.54), KWR-108 (14.55), GNG-2392 (14.46), KGD-1145 (14.32), Pusa-397 (13.83), while the minimum pod damage per cent was recorded in Radhey (8.89) followed by KGD-1320 (10.84), K-850 (12.66) compared to resistant check KGD-2020 (14.05) and KGD-1168 (Susceptible check) (19.37). (Table 5)

The pest susceptibility rating (PSR) was obtained against each variety/germplasm screened against *H. armigera* in chickpea crop based on the per cent pod damage. The varieties/germplasm Radhey was found least susceptible against *H. armigera* of chickpea with Pest Susceptibility Rating 3 followed by K-850, GNG-2392, Pusa-397, KGD-1145, KGD-1320, KGD-2020 was found least susceptible against *H. armigera* in chickpea with Pest Susceptibility Rating 4 followed by Avrodhi, KWR-108, IPC-1370, KGD-2019, JG-174, JG-176 with Pest Susceptibility Rating 5 showed least susceptible and varieties/germplasm GNG-2391, KGD-1918, KGD-1316, KGD-2018 found moderate susceptible against *H. armigera* of chickpea with Pest Susceptibility Rating 6, the varieties/germplasm IPC-1374, Pusa-391 was found moderate susceptible against *H. armigera* of chickpea with Pest Susceptibility Rating 7, respectively. (Table 5)

The grain yield was estimated at the time of harvest of the crop in different varieties/germplasm of chickpea in q/ha. Among all the varieties/germplasm of chickpea, the highest grain yield (16.67) was obtained in KGD-1320 followed by Radhey (15.04), KGD-2020 (14.96), KWR-108 (14.81), KGD-2018 (14.72) GNG-2391 (14.55), K-850 (14.23), Pusa 397 (14.11), JG-176 (14.07), GNG-2392 (13.86), IPC-1370 (13.74), Avrodhi (13.50), KGD-2019 (13.17), Pusa-391 (12.44), KGD-1145 (12.28), JG-174 (12.07) while the significant lowest grain yield was recorded in varieties/germplasm KGD-1918 (10.73), IPC-1374 (11.43), KGD-1316 (11.54) compared with Susceptible check KGD-1168 (11.79). (Table 5)

 **Pooled data,** the overall mean population of *H. armigera* larvae/plant were recorded during crop period in the range of 0.43 – 1.14 (Radhey and Pusa-391). The lowest number of overall mean population of *H. armigera* larvae/plant was recorded in varieties/germplasm Radhey (0.43), KGD-1320 (0.46), GNG-2392 (0.50), K-850 (0.52) while the highest larvae/plant was recorded in Pusa-391 (1.14), KGD-1918 (1.13), KGD-2018 (1.06), IPC-1374 (0.94), JG-174 (0.85), IPC-1370 (0.80), KGD-1316 (0.77), GNG-2391 (0.76), Avrodhi (0.75), KWR-108 (0.72), KGD-1145 (0.71), JG-176 (0.70), KGD-2019 (0.69), Pusa-397 (0.65) as compared with Resistant Check KGD-2020 (0.57) and Susceptible Check KGD-1168 (1.10). (Table 6)

The mean per cent of pod damage caused by *H. armigera* was recorded during harvest of the crop ranges from 9.86 to 22.08 per cent. A distinct significant difference among the pod per cent damage was recorded from different varieties/germplasm. The maximum pod damage per cent was recorded in Pusa-391 (22.08) followed by IPC-1374 (21.57), KGD-1918 (20.08), KGD-2018 (19.97), GNG-2391 (18.67), KGD-1316 (17.30), JG-174 (16.83), KGD-2019 (16.68), IPC-1370 (16.45), Avrodhi (16.03), KWR-108 (15.41), JG-176 (15.23), GNG-2392 (15.12), KGD-1145 (14.86), Pusa-397 (14.56) while the minimum pod damage per cent was recorded in Radhey (9.86) followed by KGD-1320 (12.22), K-850 (13.28), compared to resistant check KGD-2020 (14.47) and Susceptible check KGD-1168 (20.41). (Table 6)

The Pest Susceptibility Rating (PSR) was obtained against each variety/germplasm screened against *H. armigera* in chickpea crop based on per cent pod damage. The varieties/germplasm Radhey were found least susceptible against *H. armigera* in chickpea with Pest Susceptibility Rating 3.5 followed by K-850, GNG-2392, Pusa-397, KGD-1145, KGD-1320, KGD-2020 were found least susceptible against *H. armigera* in chickpea with Pest Susceptibility Rating 4, JG-176 variety/germplasm of chickpea was found least susceptible against *H. armigera* in chickpea with Pest Susceptibility Rating 4.5 followed by Avrodhi, KWR-108, IPC-1370, KGD-2019, JG-174 with Pest Susceptibility Rating 5 showed least susceptible, GNG-2391, KGD-1316 varieties/germplasm was found least susceptible against *H. armigera* with Pest Susceptibility Rating 5.5, varieties/germplasm of KGD-1918, KGD-2018 were found moderate susceptible against *H. armigera* in chickpea with Pest Susceptibility Rating 6, the varieties/germplasm IPC-1374, Pusa-391 were found moderate susceptible against *H. armigera* in chickpea with Pest Susceptibility Rating 6.5. (Table 6)

The grain yield was estimated at the time of harvest in different varieties/germplasm of chickpea in q/ha. Among all the varieties/germplasm of chickpea the highest grain yield (16.08) was obtained in KGD-1320 followed by Radhey (14.77), KGD-2020 (14.49), KWR-108 (14.44), GNG-2391 (14.43), KGD-2018 (14.33), Pusa-397 (13.74), K-850 (13.62), GNG-2392 (13.50), JG-176 (13.34), IPC-1370 (13.05), KGD-2019 (12.98), KGD-1145 (12.95), JG-174 (12.54), Avrodhi (11.91), Pusa-391 (11.76), IPC-1374 (11.41), while the significant lowest grain yield was recorded in variety/germplasm KGD-1918 (10.09), KGD-1316 (11.01) compared with susceptible check KGD-1168 (11.22). (Table 6). The present findings are supported by **Kumar *et al.* (2013)** who screened fifty different genotypes of chickpea with susceptible (H82-2) and resistant (C 235) against gram pod borer and reported on the basis of pod damage, nine genotypes which showed tolerance with 5.50 – 8.50 per cent pod damage, the genotypes in this range were DGP 15, GIG 0312, ICL 87315, ICCV 7, RIL 115, ICC 29, ICC 12470, ICCV 10 and PG 23. Seven genotypes (DGP 15, GIG 0312, ICCL 87315, ICCV 7, RIL 115, ICC 29, ICC 12470, ICCV 10 and PG 23) showed pod damage variation from 20.00 – 23.00 per cent with a susceptible grade and remaining 34 genotypes showed pod damage variation from 10.50 – 19.00 per cent rating with moderately resistant grade. **Sarnaik *et al.* (2017)** observed twenty “chickpea genotypes, a wide range of variation was observed against *Helicoverpa* *armigera* with the larval population (0.99 to 2.02 larvae per plant), pod damage (4.37 to 10.50 per cent) and grain yield (12.21 to 24.48 q/ha), respectively. The lowest larval population (0.99 larvae per plant), pod damage (4.37 per cent) and grain yield (24.48 q/ha) were observed in JG-11 these results indicated that it is resistant against *H. armigera* compared to resistant check *i.e.,* ICCL-86111. While the maximum larval population (2.02 larvae per plant), pod damage (10.50 per cent) was observed in the variety ICCV-95334, respectively; and lowest yield was recorded from the genotype, ICC-3137 (Susceptible check) *i.e.*, 12.21 q/ha”. **Choudhary *et al.* (2014)** reported that “the genotype CSJD-884 as having maximum yield which was at par with RSG-931 which were least susceptible to *H. armigera*.” **Brar and Singh (2015)** worked with nine chickpea genotypes and evaluated them against *Helicoverpa* *armigera*, in different genotypes larval population varied from 0.27 to 3.56 larvae per five plants, respectively. Lowest pod damage of 11.02 per cent and PSR score of 3 was observed in genotype 5282. Significantly, highest grain yield of 1388 kg/ha was recorded in genotype GL 25016. **Kumar *et al.* (2017)** reported that “susceptibility response among ten chickpea varieties against gram pod borer showed that no variety taken under study was completely resistant against the pest. However, varieties Vijay and RSG 888 were found to be least susceptible while GNG 1581, Dahod Yellow, Samrat, BGM 547, RSG 963, RSG 564 and Kabuli were moderately susceptible. 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”. **Vikrant *et al.* (2017)** screened fifty genotypes/ cultivars of chickpea against *H. armigera*. Among all the genotypes/cultivars the lowest (4.50 per cent in 1st year and 4.00 per cent in 2nd year) pod damage was recorded in Avrodhi variety, whereas HC-3 genotype recorded the highest (24.00 % in 1st year and 23.00 % in 2nd year) pod damage in chickpea. **Deepak *et al.* (2018)** conducted studies with “ twenty chickpea genotypes along with susceptible and resistant check, Annageri-1 and C-235 was screened against pod borer *Helicoverpa* *armigera*. The mean larval population of *H. armigera* on different genotypes was ranged from 1.54 larvae/m to 6.54 larvae/m. the lowest larval population density was recorded in variety BG-372 with 1.54 larvae/m. BG 256 recorded significantly highest number of larval population 6.53 larvae/m. On the basis of percent pod damage, the genotype KPG 59 recorded significantly lower percentage pod damage (6.87%) and significantly highest per cent pod damage (26.66 %) was recorded in genotype RSG 888 (16.37 q/ha), CSG 8962 (14.73 q/ha), VISHWAS (14.55 q/ha) and GNG 2144 (13.64 q/ha) produced highest grain yield”. **Galav *et al.* (2018)** screened “different genotypes of chickpea against *Helicoverpa* *armigera* from 15 different genotypes of *desi* chickpea and reported that lowest pod damage (9.73%) among all the *desi* genotypes, followed by ICCV 07117 (11.23%), on the other hand highest pod damage percentage was noted in the genotypes JG 130 × ICC 11551 (23.91%), followed by JG 9605” (23.73%). **Kumar *et al.* (2019)** evaluated fifteen chickpea varieties/genotypes and screened them for resistance to gram pod borer, *Helicoverpa* *armigera*. The overall lowest mean larval population was recorded on Pusa 391 closely followed by RSG 888 during crop season Winter, 2017-18. The overall highest mean larval population (4.46) was recorded in genotype JGK 1. The maximum per cent pod damage (15.52%) was also observed in JKG 1 genotype and minimum per cent damage (2.77%) in Pusa 391. **Singla *et al.* (2022)** worked with seven chickpea genotypes *viz.,* GL 12021, GL 29095, GL 13001, GL 13042 along with ICCL 86111 (resistant check), L 550 (susceptible check) were screened for resistance against *Helicoverpa* *armigera*. The larval population varied from 2.58-6.95 larvae/5 plants. The lowest larval population (2.58) was recorded in GL 12021 as compared 6.95 larvae per five plants in the susceptible genotype, L 550. The minimum per cent pod damage (10.03%) and maximum yield (1857 kg/ha) was also recorded in GL 12021, while maximum per cent pod damage (44.79%) and minimum grain yield (998 kg/ha) was recorded in variety L 550. **Kumar *et al.* (2022)** worked with sixteen chickpea genotypes including susceptible check BG 362 and screened them against gram pod borer, *Helicoverpa* *armigera*. The mean larval population of *H. armigera* ranged from 0.69 to 3.22 larvae per five plants in different genotypes. The lowest larval population was recorded in genotype KPG 59 (0.69 larvae/five plants) and highest in genotype L 550 (3.22 larvae/five plants). The genotype RVG 203 recorded significantly lowest per cent pod damage (5.33%) followed by KPG 59 (6.03%) and BG 212 (9.66%). The genotype L 550 recorded significantly highest per cent pod damage (31.33%) followed by BG 362 (24.33%) and GG 2 (23.33%). The genotypes RVG 203 (1840 kg/ha), KPG 59 (1822 kg/ha) produced highest grain yield. The genotype L550 (8 PSR) recorded significantly highest pest susceptibility rating (PSR) and the lowest pest susceptibility rating was recorded in genotype KPG 59 and RVG 203 *i.e.,* 2 PSR. **Udavant *et al.* (2022)** screened chickpea genotypes against gram pod borer, *Helicoverpa* *armigera* and recorded the least larval population on genotypes ICCL 86111 (0.51 larvae/plant). The genotype ICCL 86111 had the least pod damage, 3.36 per cent and maximum pod damage with 9.85 per cent recorded in ICC 3137 genotype. **Patel *et al.* (2015)** screened “different chickpea genotypes against gram pod borer, *Helicoverpa* *armigera* (Hubner) on chickpea and revealed that the genotypes/cultivars, 9423-5, BJD 72, Chaffa, Dahod yellow, GG-3, GG-4, ICCC-4 and Phule-G-5 were found tolerant, whereas genotype/cultivars 9423-5 and GJG-0737 showed lesser susceptibility reactions against gram pod borer, *H. armigera*. The cultivar PKV-2 and Vishal showed moderate susceptibility. However, genotype/cultivars 8802-2, GG-1 and GG-2 exhibited highly susceptible reactions against gram pod borer based on larval population and pod damage. The two years pooled data revealed lower (4.67%) pod damage in variety BJD-72 and highest (23.00%) pod damage was found in genotype 8802-2”.

**Table 4. Screening of chickpea varieties/germplasm against *H. armigera* during Winter, 2023-24**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Varieties/Germplasm** | **Overall mean population of *H. armigera* (larvae/plant)** | **Pod damage (%)** | **PSR** | **Pest Resistance/ Susceptibility** | **Yield (q/ha)** |
| 1 | Radhey | 0.46 (0.97)\* | 10.84 (19.22)\*\* | 4 | Least Susceptible | 14.51 |
| 2 | Avrodhi | 0.81 (1.14 | 16.43 (23.91) | 5 | Least Susceptible | 10.33 |
| 3 | K-850 | 0.57 (1.03) | 13.90 (18.24) | 4 | Least Susceptible | 13.02 |
| 4 | KWR-108 | 0.78 (1.13) | 16.28 (23.79) | 5 | Least Susceptible | 14.07 |
| 5 | IPC-1370 | 0.86 (1.16) | 16.73 (24.14) | 5 | Least Susceptible | 12.36 |
| 6 | IPC-1374 | 1.01 (1.22) | 21.60 (27.69) | 6 | Moderate Susceptible | 11.39 |
| 7 | GNG-2391 | 0.86 (1.16) | 18.24 (25.28) | 5 | Least Susceptible | 14.31 |
| 8 | GNG-2392 | 0.52 (1.00) | 15.79 (23.41) | 4 | Least Susceptible | 13.15 |
| 9 | Pusa-391 | 1.23 (1.31) | 22.36 (28.22) | 6 | Moderate Susceptible | 11.08 |
| 10 | Pusa-397 | 0.69 (1.09) | 15.30 (23.02) | 4 | Least Susceptible | 13.37 |
| 11 | KGD-1918 | 1.22 (1.31) | 20.26 (26.75) | 6 | Moderate Susceptible | 9.45 |
| 12 | KGD-1145 | 0.76 (1.12) | 15.41 (23.11) | 4 | Least Susceptible | 13.62 |
| 13 | KGD-1316 | 0.78 (1.13) | 16.71 (24.12) | 5 | Least Susceptible | 10.49 |
| 14 | KGD-1320 | 0.49 (0.99) | 13.60 (21.64) | 4 | Least Susceptible | 15.49 |
| 15 | KGD-2018 | 1.13 (1.27) | 20.56 (26.96) | 6 | Moderate Susceptible | 13.94 |
| 16 | KGD-2019 | 0.72 (1.10) | 17.23 (24.52) | 5 | Least Susceptible | 12.80 |
| 17 | KGD-2020 | 0.60 (1.04) | 14.90 (22.70) | 4 | Least Susceptible | 14.02 |
| 18 | JG-174 | 0.91 (1.18) | 16.50 (23.96) | 5 | Least Susceptible | 13.01 |
| 19 | JG-176 | 0.79 (1.13) | 14.92 (22.72) | 4 | Least Susceptible | 12.62 |
| 20 | KGD-1168 | 1.18 (1.29) | 21.45 (27.59) | Susceptible Check |  | 10.65 |
|  | **SE (±m)** | 0.02 | 0.94 |  |  |  |
|  | **CD @ 5%** | 0.07 | 2.71 |  |  |  |

\*Figure in parenthesis are square root transformed values

\*\*Figure in parenthesis are arc sin transformed values

**Table 5. Screening of chickpea varieties/germplasm against *H. armigera* during Winter, 2024-25**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Varieties/Germplasm** | **Overall mean population of *H. armigera* (larvae/plant)** | **Pod damage (%)** | **PSR** | **Pest Resistance/ Susceptibility** | **Yield (q/ha)** |
| 1 | Radhey | 0.40 (0.94)\* | 8.89 (17.34)\*\* | 3 | Least Susceptible | 15.04 |
| 2 | Avrodhi | 0.69 (1.09) | 15.63 (23.28) | 5 | Least Susceptible | 13.50 |
| 3 | K-850 | 0.48 (0.98) | 12.66 (20.84) | 4 | Least Susceptible | 14.23 |
| 4 | KWR-108 | 0.67 (1.08) | 14.55 (22.42) | 5 | Least Susceptible | 14.81 |
| 5 | IPC-1370 | 0.74 (1.11) | 16.17 (23.71) | 5 | Least Susceptible | 13.74 |
| 6 | IPC-1374 | 0.88 (1.17) | 21.55 (27.65) | 7 | Moderate Susceptible | 11.43 |
| 7 | GNG-2391 | 0.67 (1.08) | 19.10 (25.91) | 6 | Moderate Susceptible | 14.55 |
| 8 | GNG-2392 | 0.48 (0.98) | 14.46 (22.35) | 4 | Least Susceptible | 13.86 |
| 9 | Pusa-391 | 1.06 (1.24) | 21.80 (27.83) | 7 | Moderate Susceptible | 12.44 |
| 10 | Pusa-397 | 0.62 (1.05) | 13.83 (21.83) | 4 | Least Susceptible | 14.11 |
| 11 | KGD-1918 | 1.04 (1.24) | 19.90 (26.49) | 6 | Moderate Susceptible | 10.73 |
| 12 | KGD-1145 | 0.66 (1.07) | 14.32 (22.23) | 4 | Least Susceptible | 12.28 |
| 13 | KGD-1316 | 0.77 (1.12) | 17.90 (25.02) | 6 | Moderate Susceptible | 11.54 |
| 14 | KGD-1320 | 0.44 (0.96) | 10.84 (19.22) | 4 | Least Susceptible | 16.67 |
| 15 | KGD-2018 | 0.99 (1.22) | 19.39 (26.12) | 6 | Moderate Susceptible | 14.72 |
| 16 | KGD-2019 | 0.67 (1.08) | 16.13 (23.67) | 5 | Least Susceptible | 13.17 |
| 17 | KGD-2020 | 0.55 (1.02) | 14.05 (22.01) | 4 | Least Susceptible | 14.96 |
| 18 | JG-174 | 0.80 (1.14) | 17.17 (24.47) | 5 | Least Susceptible | 12.07 |
| 19 | JG-176 | 0.61 (1.05) | 15.54 (23.21) | 5 | Least Susceptible | 14.07 |
| 20 | KGD-1168 | 1.03 (1.23) | 19.37 (26.11) | Susceptible Check |  | 11.79 |
|  | **SE (±m)** | 0.02 | 1.06 |  |  |  |
|  | **CD @ 5%** | 0.08 | 3.05 |  |  |  |

\*Figure in parenthesis are square root transformed values

\*\*Figure in parenthesis are arc sin transformed values

**Table 6. Pooled screening of chickpea varieties/germplasm against *H. armigera* during Winter, 2023-24 & 2024-25**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Varieties/Germplasm** | **Overall mean population of *H. armigera* (larvae/plant)** | **Pod damage (%)** | **PSR** | **Pest Resistance/ Susceptibility** | **Yield (q/ha)** |
| 1 | Radhey | 0.43 (0.96)\* | 9.86 (18.30)\*\* | 3.5 | Least Susceptible | 14.77 |
| 2 | Avrodhi | 0.75 (1.11) | 16.03 (23.60) | 5 | Least Susceptible | 11.91 |
| 3 | K-850 | 0.52 (1.00) | 13.28 (21.37) | 4 | Least Susceptible | 13.62 |
| 4 | KWR-108 | 0.72 (1.10) | 15.41 (23.11) | 5 | Least Susceptible | 14.44 |
| 5 | IPC-1370 | 0.80 (1.14) | 16.45 (23.92) | 5 | Least Susceptible | 13.05 |
| 6 | IPC-1374 | 0.94 (1.20) | 21.57 (27.67) | 6.5 | Moderate Susceptible | 11.41 |
| 7 | GNG-2391 | 0.76 (1.12) | 18.67 (25.60) | 5.5 | Least Susceptible | 14.43 |
| 8 | GNG-2392 | 0.50 (1.00) | 15.12 (22.88) | 4 | Least Susceptible | 13.50 |
| 9 | Pusa-391 | 1.14 (1.28) | 22.08 (28.02) | 6.5 | Moderate Susceptible | 11.76 |
| 10 | Pusa-397 | 0.65 (1.07) | 14.56 (22.43) | 4 | Least Susceptible | 13.74 |
| 11 | KGD-1918 | 1.13 (1.27) | 20.08 (26.62) | 6 | Moderate Susceptible | 10.09 |
| 12 | KGD-1145 | 0.71 (1.10) | 14.86 (22.67) | 4 | Least Susceptible | 12.95 |
| 13 | KGD-1316 | 0.77 (1.12) | 17.30 (24.57) | 5.5 | Least Susceptible | 11.01 |
| 14 | KGD-1320 | 0.46 (0.97) | 12.22 (20.46) | 4 | Least Susceptible | 16.08 |
| 15 | KGD-2018 | 1.06 (1.24) | 19.97 (26.54) | 6 | Moderate Susceptible | 14.33 |
| 16 | KGD-2019 | 0.69 (1.09) | 16.68 (24.10) | 5 | Least Susceptible | 12.98 |
| 17 | KGD-2020 | 0.57 (1.03) | 14.47 (22.35) | 4 | Least Susceptible | 14.49 |
| 18 | JG-174 | 0.85 (1.16) | 16.83 (24.22) | 5 | Least Susceptible | 12.54 |
| 19 | JG-176 | 0.70 (1.09) | 15.23 (22.97) | 4.5 | Least Susceptible | 13.34 |
| 20 | KGD-1168 | 1.10 (1.26) | 20.41 (26.85) | Susceptible Check |  | 11.22 |
|  | **SE (±m)** | 0.02 | 1.00 |  |  |  |
|  | **CD @ 5%** | 0.07 | 2.88 |  |  |  |

\*Figure in parenthesis are square root transformed values

\*\*Figure in parenthesis are arc sin transformed values

**4. CONCLUSION**

The study analyzed the mean population of *H. armigera* larvae/plant in various chickpea varieties/germplasm during Winter 2023-24 and 2024-25. The lowest population of larvae/plant was found in Radhey, KGD-1320, GNG-2392, and K-850, while the highest larvae/plant was found in Pusa-391, KGD-1918, KGD-2018, IPC-1374, JG-174, IPC-1370, KGD-1316, Avrodhi, KWR-108, KGD-1145, JG-176, KGD-2019, and Pusa-397. The pod damage caused by *H. armigera* ranged from 9.86 to 22.08% during harvesting, with significant differences among germplasm/varieties. The pest susceptibility rating (PSR) was calculated for each variety/germplasm screened against *H. armigera*. Radhey was found to be the least susceptible, followed by K-850, GNG-2392, Pusa-397, KGD-1145, KGD-1320, KGD-2020, JG-176, Avrodhi, KWR-108, IPC-1370, KGD-2019, and JG-174. The highest grain yield was obtained in KGD-1320, followed by Radhey, KGD-2020, KWR-108, GNG-2391, KGD-2018, Pusa-397, K-850, GNG-2392, JG-176, IPC-1370, KGD-2019, KGD-1145, JG-174, Avrodhi, Pusa-391, and IPC-1374.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**REFERENCES**

**ANGRAU. (2023-2024).** Crop outlook reports of Andhra Pradesh.

**Bahadur, D. G. M., Keval, R., Verma, S. and Bisht, K. (2018).** Seasonal occurrence of Gram pod borer, *Helicoverpa* *armigera* (Hubner) on chickpea in Varanasi. *Journal of Entomology and Zoology Studies*, **6** (6): 786-790.

**Brar, H. S. and Singh, R. (2015).** Host plant resistance in chickpea against gram pod borer, *Helicoverpa* *armigera* (Hubner) under field and laboratory conditions. *Journal of Food Legumes*, **28** (1): 69-72.

**Chandrashekhar, K., Gupta, O., Yeishetty, S., Sharma, O. P., Bhagat, S., Chattopadhyay, C., Sehgal, M., Kumari, A., Amarsen, N., Sushil, S. N., Sinha, A. K., Asre, R., Kapoor, K. S., Satyagopal, K. and Jeyakumar, P. (2014).** Integrated Pest Management for Chickpea. NCIPM, LBS Building, IARI Campus, New Delhi, 43.

**Choudhary, O. M., Anwala, R. and Sharma, M. M. (2014).** Studies on varietal screening and effect of date of sowing on *Helicoverpa* *armigera* (Hubner) in chickpea, *Cicer* *arietinum* (Linn.). *Advance Research Journal of Crop Improvement*, **5** (2): 149-153.

**Deepak, V., Singh, P. S. and Singh, S. K. (2018).** Screening of chickpea genotypes against gram pod borer, *Helicoverpa* *armigera* (Hubner). *Journal of Food Legumes*, **31** (2): 101-105.

**Galav, A., Bhowmick, A. K., Joshi, N., Singh, K. K., Mehta, V., & Sharma, S. (2018).** Impact of weather parameters on population fluctuation of *Helicoverpa* *armigera* (Hubner) on chickpea. *Int. J. Adv. Sci. Res. Manage*, **1**: 121-123.

**Kumar, D., Singh R. B. and Singh, A. (2017).** Varietal response of chickpea against the gram pod borer, *Helicoverpa* *armigera* (Hubner) under natural field conditions. *Journal of Entomology and Zoology Studies*, **5** (2): 938-942.

**Kumar, J., Singh, D. C., Singh, A. P. and Verma, S. K. (2013).** Screening of chickpea genotypes for resistance against pod borer *Helicoverpa* *armigera* (Hub.). *Trends in Biosciences*, **6** (1): 101-103.

**Kumar, P., Ahmad, M. A., Kumar, R. and Moses, S. (2019).** Varietal screening of chickpea, *Cicer* *arietinum* (Linn.) against gram pod borer, *Helicoverpa* *armigera* (Hubner). *Journal of Entomology and Zoology Studies*, **7** (1): 33-35.

**Kumar, P., Singh, P. S. and Kumar, R. (2022).** Field screening of certain chickpea genotypes against gram pod borer, *Helicoverpa* *armigera* (Hubner). *Journal of Entom. Research*, **56**: 958-964.

**Lateef, S. S. and Sachan, J. N. (1990).** Host-plant resistance to *H. armigera* in different agroecological contexts. In chickpea in the nineties: *proceedings of the second international workshop on chickpea improvement, ICRISAT Center, India*. 181-189.

**Mandal, S. K. and Roy, S. P. (2012).** Impact of environmental factors on certain pulse crops of north-eastern Bihar (India) with reference to resource management. *The Ecoscan*, **1** (Special Issue): 35-40.

**Pandey, S., Sharma, M., Ghosh, R., Rameshwar, T. and Reddy, D. R. (2011).** Chickpea diseases and insect-pest management. *Legume* *pathology*, pp. 1-14.

**Parmar, S. K., Thakur, A. S. and Mawinter, R. S. (2015).** Effect of sowing dates and weather parameters on the incidence of *Helicoverpa* *armigera* in chickpea. *The Bioscan*. **10** (1): 93-96.

**Patel, S. R., Patel, K. G. and Ghetiya, L. V. (2015).** Susceptibility of chickpea genotypes against gram pod borer, *Helicoverpa* *armigera* (Hubner). *Journal of Applied Bioscience*, **41** (2): 144-147.

**Rai, D., Ujagir, R. and Singh, R. K. (2003).** The larval parasitization by *Campoletis* *chloridae* Uchida (Hymenoptera: Ichneumonidae) of *Helicoverpa* *armigera* (Hubner) in pure chickpea crop at Pantnagar. *Journal of Biological Control*, **17** (1): 81-83.

**Sarnaik, S. V. and Chiranjeevi, B. (2017**). Field screening of some chickpea genotypes for their resistance against gram pod borer, *Helicoverpa* *armigera* (Hubner). *The Bioscan and International Journal of Life Sciences*, **12** (1): 399-403.

**Singh, S. S. and Yadav S. K. (2007).** Comparative efficacy of insecticides, biopesticides and neem formulations against *H. armigera* on chickpea. *Annals of Plant Protection Science*, **15** (2): 299-302.

**Singla, A., Singh, R., Taggar, G. K., Sujayanand, G. K. and Singh, S. (2022).** Role of host plant resistance in chickpea against *Helicoverpa* *armigera* (Hubner). *Journal of Entomological Research*, **46** (2): 238-243.

**Sithanantham (1984).** Insect-pests of pigeon pea and chickpea and their management in: Plant protection in field crops Hyderabad, Andhra Pradesh, India: *Plant Protection Association of India*, pp: 159-173.

**Srivastava, R. M. and Sehgal, V. K. (2002).** Bio efficacy of various insecticides against *H. armigera* in chickpea. *Indian Journal of Entomology*, **64** (1): 17-20.

**Taggar, G. K. and Singh, R. (2012).** Integrated management of insect pests of *Winter* pulses. In: Arora R, Singh B and Dhawan A. K. (ed.) Theory and practice of Integrated pest management. *Scientific* *Publishers*, India; 454-72.

**Udavant, R. N., Bantewad, S. D. and Tupe, A. P. (2022).** Evaluating response of chickpea genotypes for resisting *Helicoverpa* *armigera* (Hubner) throughout growing season and correlating with yield parameter. *Scientist*, **2** (2): 576-585.

**Vikrant, S. D. R., Kumar A., Singh, S. and Yadav, G. P. S. (2017).** Screening of different germplasm/varieties against *H. armigera* in chickpea. *Journal of Entomology and Zoology Studies*, **5** (4): 1671-1675.

**Yadav, D. K., Singh, S. K. and Chakravarti, S. (2011).** Age specific survival and fecundity table of Capitulum borer (*Helicoverpa* *armigera*) in sunflower. *Journal of Eco-friendly Agriculture*, **6** (2): 144-147.