Middle East Journal of Agriculture Research
Volume: 14 | Issue: 04| Oct. – Dec.| 2025

EISSN: 2706-7955 ISSN: 2077-4605
DOI: 10.36632/mejar/2025.14.4.32
Journal homepage: www.curresweb.com
Pages: 469-475

Evaluation of Chickpea, *Cicer arietinum* (L.) Varieties for Resistance to Pod Borer, *Helicoverpa armigers* (Hub.) (Lepidoptera: Noctuidae) in Gezira State, Sudan

Ashraf A.E. Hussein[1], Louai A.M. Abdalla[1] and Yasmin A.A. Abdalla[2]

[1]Department of Crop Protection, Faculty of Agricultural Sciences, University of Gezira, Sudan.
[2]Plant Protection Directorate, Gezira State, Sudan.

Received: 25 August 2025 **Accepted:** 30 Oct. 2025 **Published:** 15 Nov. 2025

ABSTRACT

Pod borer (H*elicoverpa armigera*- Hubner) is considered as one of the major chickpea pests causing damage from seedling to maturity. Two experiments were conducted at Elmadina Arab, Gezira State during two seasons 2017/2018 and 2018/2019 to investigate the infestation level of seven chickpea varieties (Burgeg, Hawatta, Atmour, Baladi, Shandi, Gabel Marra and Wad Hamid) by the pod borer. The experiments were laid out in Complete Randomized Block Design (CRBD) with four replicates. The blocks were divided into seven subplots (2 mustabs 5m x 2m) (mustabs is a wide , flat topped ridge created by pilling soil) and each variety was sown two seeds per hole having 10 cm spacing between holes. Cultural practices were carried out as recommended by the Agriculture Research Corporation. Tested varieties showed a considerable difference in infestation levels in the two seasons witha significance difference in infestation between varieties on 75 days after planting. Jabel Marra variety showed the lowest infestation by pod borer on leaves and pod in both seasons followed by Shandi whereas, Hawata and Atmore recorded high seed yield despite the high infestation of pod borer. Therefore they may be considered as tolerant varieties and could be used in breeding programs for the development of pod borer-resistant chickpea varieties.

Keywords: Podborer, *Helicoverpaarmigera*, chickpea, Resistance Varieties

1. Introduction

Chickpea (*Cicer arietinum* L.) is grown in tropical, sub-tropical and temperate regions. Kabuli type is grown in temperate regions while the Desi type chickpea is grown in the semi- arid tropics. The major chickpea growing countries are India, Pakistan, and Turkey in Asia, Ethiopia in Africa, California and Washington State in the U.S., Mexico and Australia (FAO, 2025). Globally, 12.1 million tons of chickpea is produced annually and 64% of which is produced in (India7.8 million tons); the main countries include Myanmar 0.6, Pakistan0.5, Turkey 0.5, Ethiopia 0.4, Russia 0.3in million tons (FAO, 1994). Chickpea is valued for its nutritive seeds, with high protein content, provides rich fodder to the cattle and serves the purpose of adding nitrogen and organic matter to the soil. It is one of the major cold season food legumes grown in Sudan, the main production area is the Northern region, although, an expansion towards Central regions (Gezira) has been taking place for the last few years and reached 25.210 ha in season 2005/06 and 317.370 ha in season 2021/2022, (FAO, 2025). Being rich in protein, the chickpea plant is susceptible to several biotic and a biotic stresses witch attack roots, foliage and pods (Kumar *et al*., 2019) More than 20 insect pests attack during various growth stages of chickpea including plant pod borer (*Helicoverpa armigers Hubner*), cutworms (Agrotis *ipsilon Agrotis segetum*), lesser armyworms (*Spodoptera exigua*), leaf minor (*Liriomyza cicerina)*, Groundnut aphid (*Aphis craccivora*), pea aphid (*Acyrthsosiphon pisum)*, Semilooper: (*Autographa nigrisigna*), cowpea bean seed beetle (*Callosobruchus maculatus*), and Adzuki bean seed beetle (*C. chinensis*), *Brachia* sp. The main fungi that affect chickpea are (*Fusarium oxysporum*) causing wilt, Ascochyta blight caused by (*Ascochyta rabiei),* leaf spot (*Alternaria* sp., *Ascochytapisi*), rust (*Uromyces ciceris-arientini),* gray mould (*Botrytis ciner*), powdery mildew (*Leviellula taurica*), dry root rot (*Rhizoctonia bataticola),* foot

Corresponding Author: Ashraf A.E. Hussein, Department of Crop Protection, Faculty of Agricultural Sciences, University of Gezira, Sudan. E-mail: aburetaj22@yahoo.com

rot (*Sclerotium rolfsii, Sclerotinia sclerotiorum*) and wilt (*Verticillium albo-atrum*). Viruses isolated from chickpeas include alfalfa mosaic, pea enation mosaic, pea leafroll, pea streak, bean yellow mosaic, and cucumber mosaic. However, In Sudan Pod borer (*Helicoverpa armigera*_Hubner) is a key pest of chickpea (*Cicer arietinum* L.) causing 90-95% total damage from seedling to maturity. The pod borer (PB) is reported as the main insect pest attacking chickpeas in the Sudan. Adults usually feed on nectar, fruit juices and similar liquid, hence they are never pests, only it is larvae or caterpillar that damage the crop, (Akbar *et al.,* 2003). A single larvae of pod borer, can destroyed up to 40 pods through the larval stage on chickpea crop (El Fakhouri *et al*., 2022). The estimate of yield losses by individual insect pests, diseases or weeds in tropical regions ranges between 50 and 100%. Economics losses from direct yield reduction, cost of chemical application and scouting required for a decision to control this pest are considerable, the losses reached their peak when the pods appeared (Mohamed *et al.,* 2015). Pod borer has developed resistance to several pesticides, especially synthetic Pyrethroide, organophosphates, carbamates and organochlorine insecticide (Sardar *et al*., 2017). Environmental conditions during the late vegetative and reproductive period for chickpeas are particularly conducive to PB development. Chemical insecticides are generally used in control due to their effectiveness and easy availability.

PB has developed resistance against conventional insecticides as a result of their heavy use (Mansour and Mohamed, 2014). The development of resistance cultivars to this pest could provide an effective approach in IPM to minimize yield losses. Recently, *H. armigera*is reported to have developed resistance to many commonly used insecticides. Farmers generally sprayed insecticides at full podding or pod maturing stage when full-grown pod borer is visible on the plant with boring pods. As a result, the grown-up pod 3 borers are not killed moreover it creates environmental pollution, left residual toxicants, kills natural enemies, causes resurgence, etc.

This work aims to study the infestation intensity of chickpea PB among seven chickpeas (*Cicer arietinum* L.) varieties (Burgeg, Hawatta, Atmour, Baladi, Shendi, Gebel Marra and Wad Hamid) under field condition.

2. Materials and Methods

2.1. Study area

The experiments were carried out in two seasons in 2017-2018 and 2018/2019 at Elmadina Arab group, South Gezira Locality Gezira Scheme (Latitude15° 20′north word 13°35′south word and Longitude33°44- east word 32°34-west word).

The area is an irrigated part of Gezira Scheme and is characterized by heavy soil (clay 60%) with pH 8-8.5, low organic matter and nitrogen, adequate potassium and low available phosphorus. The average annual rains don't exceed 400 mm.

2.2. Plant Material

The Varieties were Burgeg, Hawatta, Atmour, Baladi, Shandi, Gabel Marra and Wad Hamid. Chickpea seeds were collected from Agricultural Research Corporation, Wad Medani, Sudan and no resistant check variety is available over there.

2.3. Experimental layout

The experiments were laid out in Complete Randomized Block Design (CRBD) with four replicates. The blocks are divided into seven subplots (2 mustabs 5m x 2m).

The experimental area was prepared and divided into seven blocks each block was divided into four subplots (5 m x2 m), and the plot was divided into 5m "mustabs". Weeding and other cultural practices were carried out timely as recommended by the Agricultural Research Corporation.

Chickpea seeds were sown two seeds per hole and the distance between the holes was 10 cm. The sown date was 15 November in both Seasons 2017/2018 and season 2018/2019.The irrigation was taken six times throughout the growth period. The irrigated interval every 15 days. Treatments were arranged in randomized complete block design with 4 replications.

2.4. Data collection

The data was collected at 7-day intervals from the field and recorded depending on the treatments and replicates. The data collection was started 45 days after planting and the flowering initiation stage

of the chickpea plant in the field and continued up to maturity of the crop (pods). Weekly observation on leaves and pod borer on selected ten plants were made randomly.

The total number of leaves per ten selected plants /plots; the number of borer infested leaves were noted down. Pods of chickpea 10 plants were taken randomly from each plot, carefully examined for infestation by the pod borer and the percentage infestation pod in each plot was calculated. Damage caused by the chickpea pod borer was calculated and converted into percent damage.

The crop was harvested; threshed and seed yield was measured for plot and then calculated as kg/ha.

2.5. Data analysis

The collected data on different parameters were statistically analyzed using the MSTAT-C computer package program developed by Russell (1986). Statistical significance was assessed by Least Significant Difference (LSD) at 5% significant level.

3. Results and Discussion

The tested varieties of chickpea differed significantly according to (Least Significant Difference (LSD) at 5%) in the percentage of leaves infestation, percentage of pod infestation by pod borer and seed yield (Tables1, 2, 3 and 4; Figure 1). All varieties were infested with pod borer in leaves and pods in all seasons. Here it clear that None of the tested varieties were completely resistant to pod borer infestation. Some varieties tolerated high infestation exhibited less damage and produced high yields. In other varieties, damage due to infestation was heavy and decreased yield. The young caterpillar of pod borer skeletonized the leaves, while the grown-up caterpillar bored into the pods and faddan the seeds. The larval preference for feeding on plant parts rich in nitrogen such as reproductive structures and growing tips results in extensive crop losses.

3.1. Leave Infestation

3.1.1. Season 2017/2018

The data on the percentage of leaf infestation by PB in Season2017/2018 was presented in Table 1 there was no significant difference between the tested varieties in terms of leaf infestation by PB on the second and third counts. While in the fourth count (75 days after sowing) the tested varieties showed significant differences. Which was the percentage leaf infestation ranged from (14.75–22.44%) recorded from varieties Jabel Marra and Atmore.

Table 1: Percentage of leave Infestation of some chickpea varieties by pod borer, *Helicoverpa armigera*, in Elmadina Arab during Season 2017-2018.

Variety	Percentage Infestation			
	Count1	**Count11**	**Count 111**	**Count 1V**
Burgiag	27.00ab (5.24)	29.27a (5.40)	21.38a (4.67)	15.68bc (4.02)
Hawata	27.00ab (5.24)	28.00a (5.31)	21.01a (4.62)	20.63ab (4.60)
Atmore	29.00a (5.43)	34.90a (5.94)	23.82a (4.88)	22.44a (4.78)
Baladi	21.25abc (4.66)	24.75a (4.89)	20.73a (4.54)	17.63abc (4.24)
Shandi	14.38c (3.81)	26.38a (5.17)	17.92a (4.26)	15.01c (3.94)
Jabel Marra	17.75bc (4.27)	33.15a (5.79)	20.88a (4.57)	14.75c (3.90)
Wad Hamid	22.13abc (4.75)	30.58a (5.55)	20.00a (4.43)	16.75bc (4.14)
SE±	0.32	0.35	0.39	0.17
C.V%	9.46	9.12	12.01	5.69

Data between two Parenthesis areTransformed√x+0.5
Means followed by the same letter(s) are not significantly different at 1 % level.

3.1.2 Season 2018/2019

The percentage leaf infestation by PB in Season 2018/2019 was presented in Table 2. There was no significant difference between the tested varieties in terms of leaf infestation by PB on the first, second, and third counts. While in the fourth count (75day after sowing) the tested varieties showed significant differences where percentage leave infestation ranged from 13.75 to 21.44% recorded from varieties Jabel Marra and Atmore. There was no significant difference between varieties Jabel Marra and Shandi in terms of the percentage of leaf infestation which recorded 13.75% and 14.06%, respectively. Atom rerecorded the highest infestation (21.44) % followed by variety Hawata, whereas Jabel Marra recorded the lowest infestation followed by variety Shandi.

Table 2: Mean percentage of leaves Infestation of some chickpea varieties by pod borer, *Helicoverpa armigera*, in Elmadina Arab during Season2018/019.

Variety	Percentage Infestation			
	Count 1	Count 11	Count 111	Count 1V
Burgiag	28.34a (5.12)	30.42a (5.50)	22.50a (4.80)	14.68bc (3.89)
Hawata	30.42a (5.36)	32.50a (5.68)	22.10a (4.73)	19.63ab (4.49)
Atmore	30.00a (5.48)	38.33a (6.21)	29.11a (5.44)	21.44a (4.67)
Baladi	21.67a (4.66)	25.83a (5.00)	22.83a (4.79)	16.63abc (4.12)
Shandi	12.72a (3.57)	27.92a (5.32)	22.34a (4.77)	14.06c (3.82)
Jabel Marra	19.80a (4.41)	34.17a 5.88	25.00a (5.04)	13.75c (3.77)
Wad Hamid	20.00a (4.46)	31.67a (5.65)	26.67a (5.20)	15.75bc (4.01)
SE±	0.68	0.37	0.27	0.18
C.V%	20.25	9.42	7.69	6.03

Data between two Parenthesis areTransformed √ x+ 0.5
Means followed by the same letter(s) are notsignificantlydifferentat1%level.

3.2 Pod infestation

3.2.1 Season 2017/2018

The percentage of pod infestation by PB in Season2017/2018 was presented in Table 3. There was no significant difference between the tested varieties in terms of pod infestation by PB on the first, second, and third counts, in the fourth count the tested varieties showed significant differences. Which was the mean percentage of pod infestation ranged from (26.43-33.95) % recorded from varieties Jabel Marra and Atmore. There was no significant difference between varieties Jabel Marra, Wad Hamid, Baladi, Sandilands Hawata. Jabel Marra recorded the lowest infestation flowed by variety Wad Hamid. The highest infestation of pods was recorded on Atmore (33.95% flowed by Burgeig 30.00%. Whereas the lowest infestation was recorded on Jabel Marra 26.43%.

3.2.2 Season 2018/2019

The percentage of pod infestation by PB in Season 2018/2019 was presented in Table 4. Statistically, there was no significant difference between the tested varieties in terms of pod infestation by PB on the first, second, and third counts. While in the fourth count (75 days after sowing) the tested varieties showed significant differences. Which was the % pods infestation ranged from (25.43-32.70) % recorded from varieties Jabel Marra and Atmore. There was no significant difference between varieties Jabel Marra, Wad Hamid, Baladi and Shandi. Jabel Marra recorded the lowest infestation flowed by variety Wad Hamid. Atmore recorded the highest infestationof32.70% followed by Hawata and Burgiag28.70%and28.28, respectively. During season 2018/2019 indicated that the highest infestation was recorded on Atmore (32.70) %, followed by Hawata (28,70) % and Burgiag (28.28) %.

Whereas the lowest infestation recorded on Jabel Marra (25.43) % flowed by Wad Hamid (25.75) %, Baladi (25.88) % and Shandi (26.81) %.

Table 3: Mean percentage of pods infestation of some chickpea varieties by pod borer, *Helicoverpa armigera*, in Elmadina Arab during Season 2017/2018.

Variety	Percentage Infestation			
	Count 1	Count 11	Count 111	Count 1V
Burgiag	0.75a (1.00)	17.84a (4.27)	13.78a (3.73)	30.00ab (5.53)
Hawata	0.50a (0.93)	14.10a (3.80)	11.83a (3.49)	29.70b (5.49)
Atmore	0.25a (0.84)	14.73a (3.89)	12.49a (3.54)	33.95a (5.87)
Baladi	0.25a (0.84)	12.12a (3.55)	12.48a (3.57)	27.88b (5.33)
Shandi	0.50a (0.93)	16.51a (4.12)	13.10a (3.67)	28.31b (5.36)
Jabel Marra	0.00a (0.71)	11.49a (3.44)	11.19a (3.39)	26.43b (5.19)
Wad Hamid	0.75a (0.95)	18.19a (4.22)	15.73a (4.01)	27.25b (5.27)
SE±	0.14	0.40	0.31	0.10
C.V%	21.83	14.47	12.20	2.52

Data between two Parenthesis areTransformed√x+0.5
Means followed by the same letter(s) are not significantly different at 1 % level.

Table 4: Mean percentage of pods infestation of some chickpea varieties by pod borer, *Helicoverpa armigera*, in Elmadina Arab during Season 2018/2019.

Variety	Percentage Infestation			
	Count 1	Count 11	Count 111	Count 1V
Burgiag	0.00a (0.71)	20.97a (4.63)	8.39a (2.94)	28.28ab (5.36)
Hawata	0.00a (0.71)	17.18a (4.19)	6.27a (2.42)	28.70ab (5.40)
Atmore	0.00a (0.71)	17.75a (4.26)	7.28a (2.63)	32.70a (5.76)
Baladi	0.21a (0.82)	15.14a (3.95)	7.24a (2.60)	25.88b (5.14)
Shandi	0.00a (0.71)	20.53a (4.58)	8.72a (2.79)	26.81b (5.22)
Jabel Marra	0.00a (0.71)	14.49a (3.85)	10.63a (3.25)	25.43b (5.10)
Wad Hamid	0.26a (0.84)	21.32a (4.59)	14.19a (3.62)	25.75b (5.12)
SE±	0.08	0.37	0.78	0.12
C.V%	15.99	12.17	38.38	3.07

Data between two Parenthesis areTransformed√x+0.5
Means followed by the same letter(s) are not significantly different at 1 % level.

3.3. Yield of chickpea in the two Seasons

The data of seed yielding both Seasons, 2017/2018and 2018/2019 was presented in figure (1). Statistically, there was no significant difference between the tested varieties in terms of yield, whereas Hwata variety recorded the highest seed yield of (1.413 kg/ha) Season, 2017/2018and (3.066 kg/ha) season 2018/2019. The yield potential of the variety Hawata explains based on the high values for full pods number and late maturity. The variety was land races introduced from ICISAT. Early maturity

when combined with high seed yield is a desirable trait that could help to avoid terminal heat and drought and increase its adaptation in the sub-tropics (Singh *et al*., 1993 and Gaur *et al.,* 2010).

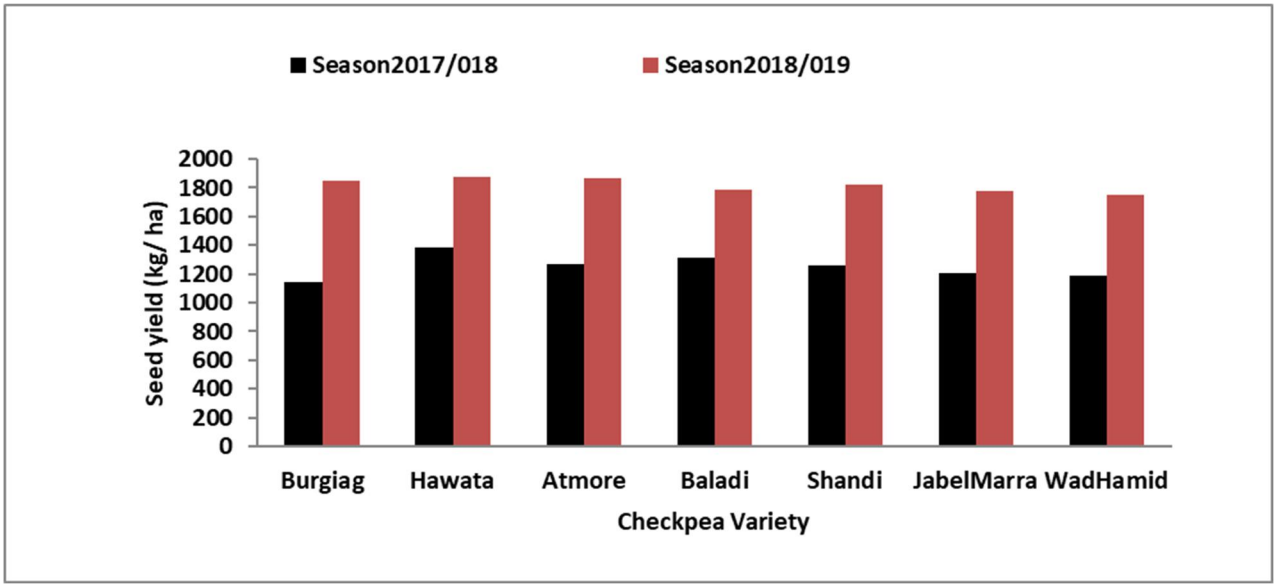

Fig. 1: Yield of chickpea varieties infested by pod borer, *Helicoverpa armigera* (Hub.)

The tested varieties differed infestation levels in all studies indicating their genetic variability as shown from their diverse origin. Infestation levels of varieties in two seasons all varieties were infested by the pod borer in leaves. The chickpea varieties (Atmore and Hawata) had shown high infestation levels of leaves.

In two seasons all varieties were infested with pod borer in leaves and pods. Here it clear that none of the tested varieties was completely resistant to pod borer infestation. Some varieties were tolerated, reduced the damage and produced high yield. But in other varieties infestation damage high and the yield decreased. Symptoms of damage Skeletinzation of leaves feeding chlorophyll only leaving veins by young larvae defoliation, feeds flower and green pods, in green pods make circular holes and feed the grains and make empty. The young caterpillar of pod borer skeletonizes the leaves, while grown up caterpillar bores into the pods and feeds on the seeds effected. The larval preference for feeding on plant parts rich in nitrogen such as reproductive structures and growing tips results in extensive crop losses. Pod borer, *H. armiger*one of the widest distribution of any agricultural pests (except desert and very humid regions), polyphagous and wide range host crop plant, serious pest of chickpea attacked early severe maturity stage account 90 – 95% on total damage. Its serious pest attributed to the high fecundity, extensive polyphagia, and strong dispersal ability and facultative diapause. The larval preference for feeding on plant parts rich in nitrogen (reproductive structures and growing tips) result in extensive crop losses. The young caterpillar of PB skeletonizes the leaves while, grown up caterpillar bores into the pods and feeds on the seeds.

Burgeig and Hwata were adapted to favorable conditions. Both genotypes were late in flowering, maturity, high number of seeds resulted in tolerate the pod borer infestation. The variety Atmore was intermediate seed yield, late maturity, high infestation on leaves and pods and most preferred to farmers. Baladi is early maturity, small seeds and low infestation in leaves and pods. Shandi was low infestation, not prefer to pod borer because susceptible to wilt, late maturity and moderate yield. JebalMarra variety was early flowering, low infestation and low yield. Wad Hamid early flowering, l ow infestation on leaves moderate infestation ofpods andlow yield. Pod borer *H. armigera*(Hubner) wasencountered in most surveyed leaves infestation by pod borer on some chickpea varieties at Elmadina Arab, Gezira state during season 2017/2018 and 2018/2019.

Conclusion

All varieties were infested on leaves and pods. Atmore was the highest infestation on leaves and pods in both seasons flowed by Hawata. The lowest infestation on Jabel Marra on leaves and pods in

both seasons flowed by Shandi. Hawata considered as tolerant Variety which is produced yield in spite of the damage and that reduce low selection pressure to pod borer to develop resistance.

References

Akbar, A., M. Sarwar, N. Ahmed, Q.H. Siddiqui and M. Toufig, 2003. Evaluation for Resistance in Some Local and Exotic Chickpea Genotypes Against *Helicoverpa armigera* (Hubner). Pakistan Journal of Biological Sciences, 6(18):1612-1615.

Mohamed, A.A., I.S.A. Tahir and A. M. A. Elhashimi, (2015). Assessment of genetic variability and yield stability in chickpea (*Cicer arietinum* L.) cultivars in River Nile State, Sudan. Journal of Plant Breeding and Crop, 7(7): 219-224.

Mansour, A. E. A. and A. A. Mohamed, 2014. Evaluation of Different Chickpea Genotypes for Resistance against Pod Borer, *Helicoverpa armiger* (Hub.) (Lepdoptera: Noctuidae) under Field Conditions, Sudan. International Journal of Agriculture Innovations and Research, 2(6):1147-1149.

FAO, 1994. Food and Agriculture Organization of the United Nations. Production Yearbook, Rome, Italy.

FAO, 2025. Food and Agriculture Organization of the United Nations. Production Yearbook, Rome, Italy.

Gaur, P.M., S. Tripathi C.L.L. Gowda, G.V. Ranga Rao, H.C. Sharma, S. Pande and M. Sharma, 2010. Chickpea Seed Production Manual. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 28 pp.

El Fakhouri, K., R. Boulamtat, A. Sabraoui and M. El Bouhssini, 2022, The chickpea pod borer (*Helicoverpa armiger*) (Hub.) yield losses estimation and bioratonal insecticide assessment in Morocco. Agronomy2022, 12(12), 3017.

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

Singh, K.B., Malhotra, R.S., Halila, M.H. et al., 1993. Current status and future strategy in breeding chickpea for resistance to biotic and abiotic stresses. Euphytica 73, 137–149.

Sardar, S. R., S. D. Bantewad and N. E. Jayewar, 2017. Seasonal Incidence of Helicoverpaarmigera Influenced by Desi and Kabuli Genotype of Chickpea. Int. J. Curr. Microbiol. App. Sci. Special Issue-5:536-541