Journal of Experimental Agriculture International

Volume 45, Issue 11, Page 212-218, 2023; Article no.JEAI.108793
ISSN: 2457-0591
(Past name: American Journal of Experimental Agriculture, Past ISSN: 2231-0606)

Occurrence of Insect-Pest of Cluster Bean [*Cyamopsis tetragonoloba* (Linn.) Taubert] Associated with Meteorological Parameters in Gird Region of Madhya Pradesh, India

Mona Sharma [a], Pradyumn Singh [b], Prince Mahore [a*], Dheerendra Mahor [b] and Suman Choudhary [a]

[a] Department of Entomology, College of Agriculture, Gwalior, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474002, Madhya Pradesh, India.
[b] Department of Entomology, College of Agriculture, Khandwa, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474002, Madhya Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JEAI/2023/v45i112251

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/108793

Original Research Article

Received: 19/09/2023
Accepted: 22/11/2023
Published: 04/12/2023

ABSTRACT

Insects are a big threat in agriculture. To study about insect pests complex of the cluster bean, a field experiment conducted at Research Farm, Rajmata Vijyaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh during *Kharif* season 2022-23. The incidence of insect pests observed on *kharif* cluster bean, namely thrips, *Megleurothrips distalis* (karny), Jassid, *Empoasca kerri* (Pruthi) aphid, *Aphis craccivora* (Koch) and whiteflies, *Acaudaleyrodes rachipora* (Singh). Peak

**Corresponding author: E-mail: princemahore30@gmail.com;*

population of aphid, Jassid and whitefly were observed during 37th SMW (2nd week of September) (4.39, 5.74 and 5.67 individuals/leaf, respectively); while peak population of thrips were observed during 38th SMW (3rd week of September) (4.75 individuals/leaf), thrips peak population was observed 38th SMW (3rd week of August) (3.70 thrips/leaf). Population of aphid and Jassid showed positive significant correlation with rainfall (r= 0.505*) and (r= 0.498*), respectively. Population of aphid, jassid and whitefly showed highly significant positive correlation with minimum temperature (r= 0.684**), (r= 0.745**) and (r= 0.591*), respectively. Population of aphid, jassid, thrips and whitefly showed significant positive correlation with evening relative humidity (r= 0.606*), (r= 0.621*), (r= 0.511*) and (r= 0.498*).

Keywords: Cluster bean; aphid; jassid; thrips; whitfly; correlation.

1. INTRODUCTION

The cluster bean, also known as guar or *Cyamopsis tetragonoloba* (Linn.) Taub. is currently acknowledged as one of the most significant commercial crops of arid and semi-arid countries (Omprakash and Raju 2014). Its young pods of cluster bean are used as vegetables and are a low-cost source of energy, protein, fat, carbohydrate, vitamin A, vitamin C, calcium, and iron for every 100 g of edible portion. Its seed contains gum ranging from 31.4 to 41.23 per cent [1,2]. The cluster bean is reportedly good for several health benefits because it is entirely nutritious and treats anaemia, which is a growing health issue in almost all women. It improves cardiovascular health, strengthens bones, and promotes better blood circulation. It is advised throughout pregnancy since it is beneficial to the. Cluster beans are one of the most widely cultivated crops in the world, with 82% of the total output being produced in India. In India, 3.14 million hectares area with 1.52 million tonnes production of cluster bean seed and 484 kg/ha of productivity of cluster bean. Cluster beans are solely grown on 75280 hectares area in Madhya Pradesh, with a productivity of 750 kg/ha [3]. In the cluster bean crop, sucking pests including whitefly, jassid, and aphid considerably decrease yields by draining the sap from the underside surface of the leaves. About 73.86 per cent yield loss was reported to be caused by pest complex [4]. The diseased areas develop a yellow colour as a result of their feeding, and the leaves finally fall off. In addition to feeding, these insects also produce honeydew, which encourages the development of sooty mould, that prevents photosynthesis and stunts the growth of plants. If the crop is cultivated for fodder, not only is the seed production lowered, but the quality of the fodder also suffers. There are various insect pests infesting the cluster bean crop, *viz*., jassid, *Empoasca kerri* (Pruthi); Aphid, *Aphis craccivora* (Koch); whitefly, *Acaudaleyrodes rachipora* (Singh), thrips, *Megaleurothrips distalis* (Karny) were recorded [5-7].

2. MATERIALS AND METHODS

The experiment was carried out at the research farm, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India. Randomized Block Design (RBD) with 3 replications was deployed during *rabi*, 2021. The row-to-row and plant-to-plant spacing were 45 cm X 10 cm, respectively and the plot size was 5.0 m X 3.6 m. For recording observations of insect-pest, ten plants were randomly selected and tagged in each net plot area. The observations on the insect-pest population were recorded from a marked area in three leaves (upper, middle and lower) of the same selected plants. The observations were recorded at weekly intervals starting from the second week after sowing till to the harvest of the crop. The whole experimental plot was kept free from any acaricides. The data was collected as the mean number of insect/leaf area/plant and were correlated with meteorological parameters. Then experimental data were subjected to statistical analysis using analysis of variance (ANOVA).

3. RESULTS AND DISCUSSION

The results on periodic mean population of insect pests explicated that four important pests and a natural enemy of crop were found colonizing cluster bean crop in Gird region of Madhya Pradesh. In the pests complex of important insect pests of cluster bean four pests *viz*. thrips, *Megaleurothrips distalis* (Karny); aphid, *Aphis craccivora* (Koch); whitefly, *Bemisia tabaci* (Singh) and jassid, *Empoasca kerri* (Pruthi) were sucking insect pests. They first invaded the

crop at early growth stage i.e., second week after sowing (WAS) and remained active till 14th WAS.

3.1 Thrips, *Megalurothrips distalis* (Karny)

The observations on thrips recorded during Kharif, 2022 are presented in Table 2. The population of *M. distalis* was first observed from 13th August to 19th August in 33rd SMW with 1.00 thrips/leaf and continued till 43rd SMW almost harvesting of the crop. Further, its population remained increasing and reaches its peak in 38th SMW with 3.70 thrips/leaf, and later on, the population of *M. distalis* started declining gradually and remained to 0.80 thrips/leaf during 43rd SMW. Among meteorological parameters, the correlation analysis revealed that evening relative humidity had significant positive effect on the population of *M. distalis* with 'r' value (r= 0.511) at 5% level of significance and the effect of the remaining weather parameters was found non-significant. More harmonically, Dawar et al. [7] reported that the various pests attacking the crop *viz., P. vittula*, *M. distalis*, *E. kerri*, *A. craccivora*, *A. rachipora* were recorded on cluster bean crop throughout the crop season and the peak population of thrips was observed during 38th SMW in the third week of September and remained until the crop harvest. Similarly, Pawar et al. [6] reported that five insect pests viz., *E. kerri*, *A. rachipora*, *M. usitatus*, *C. dispar* and *O. obesus* were recorded on cluster bean. Among them, *M. usitatus* appeared little late (5 WAS) and disappeared from the crop from 13 WAS.

3.2 Aphid, *Aphis craccivora* (Koch)

The results on the population of Aphids are presented in Table 2. The results revealed that the population of *A. craccivora* was first observed from 6th August to 12th August in 32nd SMW with 0.70 aphids/leaf. Furthermore, it population remained increasing and reaches its peak in 37th SMW (10th September to 16th September) at 4.39 aphids/leaf, and later on, the population of *A. craccivora* started declining gradually and remained to 0.90 aphids/leaf during 43rd SMW (22nd October to 28th October). The correlation analysis revealed that minimum temperature and evening relative humidity had significant positive effect on the population of *A. craccivora* with 'r' value (r= 0.591 and 0.498) at 5% level of significance and the effect of the remaining weather parameters was found non-significant (Table 3). The present results are completely supported by Kumawat [8] who that various pests attacking the crop *viz., P. vittula, M. distalis*, *E. kerri*, *A. craccivora*, *A. rachipora* were recorded on cluster bean crop throughout the crop season and the peak population of thrips was observed during 38th SMW in the third week of September and remained until the crop harvest. Additionally, it was reported that that aphids, jassid, whitefly, thrips and blister beetle population in black gram field attained peak in the 1st week of September during 2013 and 2nd week of September during 2014 in Udaipur (Rajasthan) [9]. In contrary, the findings of Prasad et al. [10] are partially supporting the present results, who stated that the morning and evening relative humidity were significantly positive, they also stated that minimum temperature showed significant negative correlation with aphid population on groundnut.

3.3 Whitefly, *Acaudaleyrodes rachipora* (Singh)

The data presented in Table 1, revealed that the population of *A. rachipora* started from 3rd WAS i.e. 2nd week of August (32th SMW) with 2.99 whitefly/leaf. The population increased with crop growth and reached to a peak level of 5.67 whiteflies per/leaf during 8th WAS in 2nd week of September (37th SMW). The whitefly population declined thereafter continuously (1.20 whitefly/leaf) during 4th week of October (43th SMW). The correlation analysis revealed that the minimum temperature had significant positive effect on the population of *A. rachipora* with 'r' value (r= 0.684) at 1% level of significance. Besides, the evening relative humidity and rainfall had significant positive effect on the population of *A. rachipora* with 'r' value (r= 0.606 and 0.505) at 5% level of significance and the effect of the remaining weather parameters was found non-significant. Dawar et al. [7] investigated on the population dynamics of cluster bean and observed similar results. In their study, various pests attacking cluster bean *viz., P. vittula*, *M. distalis*, *E. kerri*, *A. craccivora*, *A. rachipora* were recorded on the crop throughout the crop season and the peak population of aphids was observed during 37th SMW in the second week of September and remained until the second week of October. Similarly, Bali et al. [11] also investigated the seasonal incidence against whitefly, in correlation with the weather parameters and revealed that the cluster bean has been attacked by a number of

insect pests, but sucking pests like aphids, jassid and whitefly was seen to cause more damage to the crop in sub-tropic Jammu. Pawar et al. [6] also reported that five insect pests viz., *E. kerri*, *A. rachipora*, *M. usitatus*, *C. dispar* and *O. obesus* were recorded on cluster bean. Among them whitefly was noted on cluster bean up to 14 and 15 WAS, respectively.

3.4 Jassid, *Empoasca kerri* (Pruthi)

The data recorded on Jassid during *Kharif*, 2022 are presented in Table 1. The population of cowpea pod borer initiated from 2nd WAS i.e. 1st week of August (31st SMW) was of 0.89 Jassid /plant. The pest population reached to a peak level (5.74 Jassid /plant) during 8th WAS coincided i.e. 2nd week of September (37th SMW) and thereafter decreased gradually and reached to a low level of 0.90 Jassid per plant during 1st week of November (44th SMW). The correlation analysis revealed that minimum temperature had significant positive effect on the population of *E. kerri* with 'r' value (r= 0.745) at 1% level of significance. Furthermore, the evening relative humidity and rainfall had significant positive effect on the population of *A. rachipora* with 'r' value (r= 0.621 and 0.498) at 5% level of significance and the effect of the remaining weather parameters was found non-significant. This result congruent with Pawar et al. [6] who reported that five insect pests viz., *E. kerri*, *A. rachipora*, *M. usitatus*, *C. dispar* and *O. obesus* were recorded on cluster bean. Among them, *E. kerri* was noted first during 3 weeks after sowing (WAS). Similarly, Kumawat [8] revealed that insect pests such as *P. vittula, M. distalis*, *E. kerri*, *A. craccivora*, *A. rachipora* were also recorded on cluster bean crop throughout the crop season and the peak population of jassid was observed during 38th SMW in the third week of September and remained until the crop harvest. Bali et al. [12] reported that the jassid population was at its peak in the 17th standard week during 2020. The correlation study shows that jassid had positive correlation with temperature whereas it shows negative correlation with relative humidity and rainfall. Also, Panwar et al. [13] observed that the jassid was the first to appear during 3 weeks after sowing (WAS), and whitefly 4 weeks after sowing (WAS) under North Gujarat conditions. Nitharwal and Kumawat [14] reported that the infestation gradually reached at peak 12.40 jassid/three leaves during *Kharif* 2006 and 13.2 jassid/three leaves during *Kharif* (2007) in the first week of September during year. A positive significant correlation of jassid and whitefly with relative humidity (r=0.62 and 0.63 in 2006 and 0.70 and 0. 56 in 2007) was observed.

Table 1. Meteorological data recorded in cluster bean crop growth period during *Kharif 2022* at Gwalior

SMW	Dates	Temperature (°C)		Relative Humidity (%)		Rainfall
		Maximum	Minimum	Morning	Evening	
30	July 23-29	32.20	26.10	91.10	76.20	3.40
31	July 30- Aug 5	33.40	26.60	88.80	58.50	27.00
32	Aug 6- 12	32.80	25.90	90.70	66.40	87.00
33	Aug 13- 19	30.30	21.70	88.40	74.40	64.60
34	Aug 20- 26	32.10	24.30	89.20	73.20	135.00
35	Aug 27- Sept 2	34.20	25.90	86.20	60.50	9.80
36	Sept 3- 9	35.30	26.00	80.40	55.50	0.00
37	Sept 10- 16	32.20	24.90	95.40	72.00	60.00
38	Sept 17- 23	31.00	24.10	92.50	75.00	61.00
39	Sept 24- 30	32.50	23.80	89.10	58.00	13.80
40	Oct 1- 7	33.60	23.30	89.00	61.40	8.40
41	Oct 8- 14	29.90	21.70	94.20	70.20	103.00
42	Oct 15- 21	32.50	17.60	85.40	55.80	0.00
43	Oct 22- 28	32.90	15.30	81.00	47.40	0.00
44	Oct 29- Nov 4	32.90	14.80	89.70	48.70	0.00

Table 2. Population of major insect pests complex in cluster bean crop during *Kharif* 2022

SMW	Dates	Population of major insect pests (no/ 3 leaves)				Temperature (ºC)		Relative Humidity (%)		Rainfall (mm)
		M. distalis	*A. craccivora*	*A. rachipora*	*E. kerri*	Maximum	Minimum	Morning	Evening	
31	July 30- Aug 5	0.00	0.00	0.00	0.89	33.40	26.60	88.80	58.50	27.00
32	Aug 6- 12	0.00	0.70	2.99	3.11	32.80	25.90	90.70	66.40	87.00
33	Aug 13- 19	1.00	1.45	3.72	4.21	30.30	21.70	88.40	74.40	64.60
34	Aug 20- 26	2.90	2.78	4.90	4.93	32.10	24.30	89.20	73.20	135.00
35	Aug 27- Sept 2	2.10	3.29	4.88	4.10	34.20	25.90	86.20	60.50	9.80
36	Sept 3- 9	1.40	4.06	5.26	5.10	35.30	26.00	80.40	55.50	0.00
37	Sept 10- 16	**3.58**	**4.39**	**5.67**	**5.74**	32.20	24.90	95.40	72.00	60.00
38	Sept 17- 23	3.70	3.83	4.45	4.80	31.00	24.10	92.50	75.00	61.00
39	Sept 24- 30	3.44	2.10	3.73	4.62	32.50	23.80	89.10	58.00	13.80
40	Oct 1- 7	2.70	1.10	2.10	3.26	33.60	23.30	89.00	61.40	8.40
41	Oct 8- 14	1.80	2.55	3.70	3.10	29.90	21.70	94.20	70.20	103.00
42	Oct 15- 21	1.10	1.27	2.10	1.33	32.50	17.60	85.40	55.80	0.00
43	Oct 22- 28	0.80	0.90	1.20	1.10	32.90	15.30	81.00	47.40	0.00
44	Oct 29- Nov 4	0.00	0.00	0.00	0.90	32.90	14.80	89.70	48.70	0.00
45	Nov 5- 11	0.00	0.00	0.00	0.00	33.10	16.90	90.40	54.50	0.00
46	Nov 12- 18	0.00	0.00	0.00	0.00	30.40	11.40	87.00	62.10	0.00

SMW= Standard Meteorological Week

Table 3. Correlation coefficients (r) and co-efficient of determination (R^2) between seasonal population of major insect pests complex and weather parameters in cluster bean crop during *Kharif* 2022

Major insect pests complex	Weather parameters									
	Maximum Temperature (ºC)		Minimum Temperature (ºC)		Morning Relative Humidity (%)		Evening Relative Humidity (%)		Rainfall (mm)	
	r	R^2	r	R^2	r	R^2	r	R^2	r	R^2
M. distalis	-0.082^{NS}	-	0.495^{NS}	-	0.325^{NS}	-	0.511*	0.2614	0.329^{NS}	-
A. craccivora	0.069^{NS}	-	0.591*	0.3495	0.125^{NS}	-	0.498*	0.2475	0.344^{NS}	-
A. rachipora	0.024^{NS}	-	0.684**	0.4682	0.142^{NS}	-	0.606*	0.3672	0.505*	0.2551
E. kerri	0.042^{NS}	-	0.745**	0.5546	0.209^{NS}	-	0.621*	0.3851	0.498*	0.2482

*NS= Non significant; *significant at 5% level; **significant at 1% level*

4. CONCLUSION

The incidence of insect pests observed on *kharif* cluster bean, namely thrips, *Megleurothrips distalis* (karny), Jassid, *Empoasca kerri* (Pruthi) aphid, *Aphis craccivora* (Koch) and whiteflies, *Acaudaleyrodes rachipora* (Singh). The results on periodic mean population of insect pests explicated that four important pests and a natural enemy of crop were found colonizing cluster bean crop in Gird region of Madhya Pradesh.

ACKNOWLEDGEMENTS

The authors thank the Head, Department of Entomology, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior for providing facilities to conduct the investigations and also special thanks to the Director, Indian Vegetable Research Institute, Varanasi for providing cluster bean variety for conducting this research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Pathak R, Singh M, Henry A. Genetic divergence in cluster bean (*Cyamopsis tetragonoloba*) for seed yield and gum content under rainfed conditions. Indian Journal of Agricultural Sciences. 2009;79 (7):559-61.
2. Muthuselvi R, Shanthi A, Praneetha S. Mean performance of cluster bean (*Cyamopsis tetragonoloba*) genotypes for yield and quality parameters. International Journal of Chemical Studies. 2018;6(2): 3626-3629.
3. Anonymous. Ministry of agriculture, government of India; 2021.
   Available:https://www.indiastatagri.com/table/agriculture/area-production-yield-guar-seed-india-1997-1998-20/421001
4. Pandey SN, Singh R, Sharma VK, Kanwat PM. Losses due to insect pests in kharif pulses. J Ent. Res. 1991;53(4):629-631.
5. Singh SP. Insect pest management in Forage Crops. Proceeding of advanced training course on insect pest management, Department of Entomology, CCS Haryana Agricultural University, Hisar. 1997;132-135.
6. Pawar ST, Patel PS, Pareek D, Sushm A, Patel BC. Pest succession of important pests and their natural Enemies on Cluster bean, *Cyamopsis tetragonoloba* (L.) Taubert. AGRES –Int. e-Journal. 2017;6 (1):71-79.
7. Dawar P, Dwarka Vishwakarma D, Yadav PS, Rien SP, Singh UC. Seasonal incidence of insect pests and natural enemies of cluster bean associated with meteorological parameters. The Pharma Inn. J. 2022; 11(2):157-161.
8. Kumawat. Studies on pest complex of cluster bean [*Cyamopsis tetragonoloba* (Linn.) Taubert] in Northern M.P. M.Sc. (Ag.) Thesis. RVSKVV, Gwalior, M.P. 2022;62.
9. Jat SK, Lekha, Rana BS. Effect of abiotic factors on the Incidence of major Insect pests of blackgram [*Vigna mungo* L. Hepper]. Int. J. of Agril. Sci. 2017;9 (17):4159-4161.
10. Prasad TV, Nandagopal V, Gedia MV. Effect of abiotic factors on the population dynamics of *Aphis craccivora* Koch in groundnut in Saurashtra region of Gujarat. Indian Journal of Entomology. 2008;70(4):309-313.
11. Bali R, Singh AK, Kumawat PK, Singh M, Hussain T, Sharma RN. Seasonal incidence and bio-efficacy of eco-friendly insecticides of whitefly in cluster bean [*Cyamopsis tetragonoloba* (L.). The Pharma Inn. J. 2021;11(1):1725-1728.
12. Bali R, Singh AK, Kumawat PK, Hussain T, Singh M, Sharma RN, Bajiya S, Kakraliya SS. Seasonal incidence and eco-friendly management of jassids in cluster bean [*Cyamopsis tetragonoloba* (L.) Taub]. Biological Forum – An International Journal. 2022;14(1):1316-1320.
13. Panwar ST, Patel PS. Pest succession, varietal screening and management of important pests of cluster bean. M.Sc. Thesis Submitted to Chimanbhai Patel College of Agriculture, Sardarkrushhinagar Dantiwada Agriculture University, Sardarkrushhinagar, Gujarat; 2011.

14. Nitharwal M, Kumawat KC. Population dynamics of insect pest of green gram, *Vigna radiata* (Linn.) in Semi-Arid region of Rajasthan. Indian Journal of Applied Entomology. 2009;23:90-9.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/108793