www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(10): 968-971

www.thepharmajournal.com
Received: 13-08-2021
Accepted: 18-09-2021

Sushila Bhathesar
Department of Entomology, Sri Karan Narendra College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

SK Khinchi
Department of Entomology, Sri Karan Narendra College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

KC Kumawat
Department of Entomology, Sri Karan Narendra College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

Suresh Choudhary
Department of Entomology, Sri Karan Narendra College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

Corresponding Author
Sushila Bhathesar
Department of Entomology, Sri Karan Narendra College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

Seasonal abundance of major sucking insect pests on moth bean, *Vigna aconitifolia* (Jacq.) Marechal

Sushila Bhathesar, SK Khinchi, KC Kumawat and Suresh Choudhary

Abstract
A field experiment was conducted to seasonal abundance of major sucking insect pests of leafhopper, *Empoasca motti* (Pruthi.), whitefly, *Bemisia tabaci* (Genn.) and thrips, *Caliothrips indicus* (Bagnall) on moth bean, *Vigna aconitifolia* (Jacq.) Marechal. The incidence of leafhopper reached peak population of 7.84 leafhopper/ three leaves. The incidence of whitefly commenced in the first week of August of 32nd standard meteorological week of which gradually increased and reached its peak of 11.40 whitefly/ three leaves of moth bean in the first week of September of 36th standard meteorological week. The incidence of thrips reached peak population of 9.48 thrips/ three leaves in the first week of September of 36th standard meteorological week, thereafter, the population of thrips declined on moth bean crop. The relative humidity showed positive significant correlation with leafhopper (r= 0.69), whitefly (r= 0.66) and thrips (r= 0.67) population whereas, maximum temperature, minimum temperature and rainfall showed non-significant correlation with leafhopper population.

Keywords: Moth bean, leafhopper, whitefly, thrips and seasonal abundance

Introduction
Moth bean, *Vigna aconitifolia* (Jacq.) Marechal is an important pulse crop in arid and semi-arid regions of India and some other countries of Asia. Use of resistant crop variety is economically, ecologically, and environmentally advantageous. The moth bean, *V. aconitifolia* seeds contain about 10.30 per cent moisture, 25.66 per cent protein, 2.78 per cent fat, 0.41 per cent mineral matter, 3.90 per cent fibre, 61.76 per cent carbohydrate and lysine, the essential amino acid (Brown and Gaur, 1960; Pant and Tulsiani, 1963) [4, 15]. The original palace of moth ban is considered in India. India has the largest area under moth bean. *V. aconitifolia* in the world. It is also grown in Sri Lanka, China, Pakistan and United States of America. In India, during 2017-18 moth bean have been grown on about 1.11 M ha area with 0.31 metric tones production and 277 kg/ ha productivity (Anonymous 2018) [1]. The major growing states are Rajasthan, Gujarat, Maharashtra, Jammu & Kashmir and Punjab. Rajasthan holds a key position with an area of 9.53 Lakh hectares and with annual production of 2.91 lakh tonnes and average productivity of 382 kg/ hectare. In Rajasthan, Bikaner, Churu, Barmer, Jodhpur, Nagour, and Hanumangarh are major growing districts (Anonymous, 2019) [2]. The moth bean, *V. aconitifolia* crop is damaged at various stages of growth by a number of insect pests like whitegrub, *Holotrichia consanguinea* (Blanchard), termite, *Odontotermes obesus* (Rambur), Leafhopper, *Empoasca motti* (Pruthi), whitefly, *Bemisia tabaci* (Genn.), galerucid beetle, *Madurasia obscurella* (Jacoby), thrips, *Caliothrip sindicus* (Bagnall), stemfly, *Ophiomyia phaseoli* (Tryon). The major sucking insect pests leafhopper, whiteflies and thrips cause moderate to severe damage right from germination to maturity of the crop and leads to considerable decrease in yield (Puttaswami *et al.*, 1977) [17]. The study aimed in order to find out the correlation of *E. motti*, whitefly, *B. tabaci* and thrips, *C. indicus* in moth bean, *V. aconitifolia* ecosystem with the weather parameters. Suitable understanding of the seasonal abundance of major sucking insect pests is important due to variation in weather conditions and changing sucking insect pests scenario on the moth bean crop.

Materials and Methods
In order to study the seasonal abundance of major sucking insect pests of moth bean, five separate plots of 3.0 x 2.4 m^2 size keeping row to row and plant to plant distance of 30 x 10 cm, respectively were maintained. The variety RMO-257 was sown on third week of July, 2019 at Agronomy farm, Sri Karan Narendra College of Agriculture, Jobner, Rajasthan. The population of major sucking insect pests of leafhopper, *E. motti*; whitefly, *B. tabaci* and thrips, *C. indicus* on moth bean, *V. aconitifolia* were recorded at weekly interval right from germination to harvesting of crop.

The pest populations were recorded on five randomly selected and tagged plants per plot in morning hours. The population of leafhopper, *E. motti* was recorded by counting both nymphs and adults as per method described by Rawat and Sahu (1973) [18]. The population was recorded on three leaves, *i.e*. top, middle and bottom canopy of each tagged plant. The population of whitefly, *B. tabaci* was counted visually on three leaves from upper, middle and lower canopy of five selected and tagged plant of each plot. For counting both nymphs and adults of whitefly population, the leaf was held at the petiole by thumb and fore fingers and twisted until the entire underside of leaf became clearly visible (Butter and Vir, 1990) [5]. The observations of thrips, *C. indicus* was recorded at weekly interval. Its population was counted at fully opened leaves from five randomly selected and tagged plants of each plot with the help of magnifying lens on three leaves from upper, middle and lower canopy of each tagged plant. The flower bud and flowers were also considered for taking population when it appeared on the plant. The population was counted early in the morning when thrips was not very active.

Interpretation of data

The meteorological data was obtained from meteorological observatory of Agronomy Farm, S.K.N. College of Agriculture, Jobner. The simple correlation was computed between the mean population of leafhopper, whitefly and thrips with weather parameters, *viz*., maximum and minimum temperature, average relative humidity and rainfall. The following formula was used for calculating correlation coefficient (Gupta, 1996) [6].

$$r = \frac{N \Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{N\Sigma x2 - (\Sigma x)2 \,.N\, \Sigma y2 - (\Sigma y)2}}$$

Where

r = Simple correlation coefficient
x = Independent variables *i.e.* abiotic components
y = Dependent variables *i.e.* pests
N = Number of observations

Results

A study on seasonal abundance of sucking insect pests of moth bean in relation to meteorological parameters, *viz*., maximum and minimum temperature, relative humidity and rainfall was carried out on variety RMO-257. During the study a leafhopper, *E. motti*, whitefly, *B. tabaci* and thrips, *C. indicus* were recorded as the major sucking insect pests infesting moth bean, *V. aconitifolia* crop. The population of insect pests except leafhopper, whitefly and thrips were negligible hence; the population of leafhopper, whitefly and thrips were recorded.

Leafhopper, *Empoasca motti* (Pruthi.)

The data presented in the table- 1 and Fig-1 showed that infestation of the leafhopper commenced in the first week of August (32nd SMW) and the first observation was recorded on 6th August 2019. Initially, the population of leafhopper was low (2.60 leafhopper/ three leaves). The population increased gradually and reached to peak (7.84 leafhopper/ three leaves) in the last week of August (35th SMW) at 33.9 ^{0}C maximum temperature, 19.5 ^{0}C minimum temperature, 83.0 per cent relative humidity and 44.2 mm rainfall and there after the population started declining. The population was 0.60 leafhopper/ three leaves in the 40th SMW and observed in traces thereafter. The maximum temperature (r= -0.03), minimum temperature (r= -0.47) and rainfall (r= 0.25) showed a non-significant correlation with leafhopper population whereas, relative humidity showed positive significant correlation (r= 0.69) with leafhopper population at 5 per cent level of significance.

Whitefly, *Bemisia tabaci* (Genn.)

The incidence of whitefly, *B. tabaci* commenced in the first week of August (32nd SMW) and the first observation was recorded on 6th August, 2019. Initially, population of whitefly was low (4.36 whitefies/ three leaves) which gradually increased and reached to its peak (11.40 whiteflies/ three leaves) in the first week of September (36th SMW) at 33.8 ^{0}C maximum temperature, 22.9 ^{0}C minimum temperatures, 83.0 per cent relative humidity and 06.6 mm rainfall, thereafter, the population of whitefly declined. The population was 1.76 whiteflies/ three leaves in the 40th SMW. The maximum temperature (r= 0.05), minimum temperature (r= -0.31) and rainfall (r= 0.07) showed non-significant correlation with whitefly population whereas, relative humidity (r= 0.66) showed a significant positive correlation with whitefly population at 5 per cent level of significance.

Table 1: Seasonal abundance of major sucking insect pests on moth bean, *Vigna aconitifolia* (Jacq.) Marechal

S. No.	Standard Meteorological weeks (SMW)*	Date of observation	Temperature (^{0}C)		Relative Humidity (%)	Rainfall (mm)	Population per three leaves		
			Max.	Mini.			Leafhopper	Whitefly	Thrips
1	32	06.08.2019	32.0	20.0	82	95.6	2.60	4.36	3.56
2	33	13.08.2019	30.5	19.8	87	43.0	4.60	6.00	5.80
3	34	20.08.2019	34.0	20.0	75	00.8	3.24	6.80	6.44
4	35	27.08.2019	33.9	19.5	83	44.2	7.84	9.56	7.20
5	36	03.09.2019	33.8	22.9	83	06.6	5.48	11.40	9.48
6	37	10.09.2019	36.3	24.9	70	00.0	3.40	5.84	4.24
7	38	17.09.2019	35.2	23.3	63	00.0	2.00	2.44	3.00
8	39	24.09.2019	32.8	24.3	75	12.2	1.80	3.20	3.20
9	40	01.10.2019	33.3	22.7	67	00.6	0.60	1.76	1.40
	Correlation coefficient with maximum temperature						-0.03^{NS}	0.05^{NS}	-0.02^{NS}
	Correlation coefficient with minimum temperature						-0.47^{NS}	-0.31^{NS}	-0.35^{NS}
	Correlation coefficient with relative humidity						0.69^{*}	0.66^{*}	0.67^{*}
	Correlation coefficient with rainfall						0.25^{NS}	0.07^{NS}	0.02^{NS}

*Standard Meteorological Week

Thrips, *Caliothrips indicus* (Bagnall)

Similarly, the incidence of thrips, *C. indicus* commenced in the first week of August (32th SMW) and the first observation was recorded on 6th August, 2019. Initially, population of thrips was (3.56 thrips/ three leaves) which gradually increased and reached to its peak (9.48 thrips/ three leaves) in the first week of September (36th SMW) at 33.8 ^{0}C maximum temperature, 22.9 ^{0}C minimum temperatures, 83 per cent relative humidity and 06.6 mm rainfall, thereafter, the population of thrips declined. The lowest population was 1.40 thrips/ three leaves in the 40th SMW. The maximum temperature (r= -0.02), minimum temperature (r= -0.35) and rainfall (r= 0.02) showed a non-significant correlation with thrips population, whereas, relative humidity showed positive significant correlation (r= 0.67) with thrips population at 5 per cent level of significance.

Discussion

The data on seasonal abundance of major sucking insect pests of moth bean, *V. aconitifolia* deliver information on the initiation and population buildup of sucking insect pests in relation to abiotic factors of environment like temperature, relative humidity and rainfall under the prevailing agroclimatic conditions. The insects which were found to have extreme impact on growth, development and yield of the moth bean crop in the present investigation, were the leafhopper, *E. motti*, whitefly, *B. tabaci* and thrips, *C. indicus*.

Leafhopper, *Empoasca motti* (Pruthi.)

The leafhopper population increased gradually and the population was registered at peak level during 35th SMW (7.84 leafhopper/ three leaves) in last week of August, after this, it was decreased. Similar trend of leafhopper population was also recorded by Vikrant *et al.* (2013) [22] who reported the population dynamics of major sap sucking pests of blackgram of jassid began infesting the crop from the first week of August, increased gradually and reached to its peak during September. Among the abiotic factors, only relative humidity showed a significant positive correlation with jassid population. The population of this pest was started to persist, after the peak infestation and then declined and reached at a population level of 0.60 leafhopper/ three leaves in 40th SMW. Leafhopper population and meteorological parameters, *viz*., maximum temperature, minimum temperature, relative humidity and rainfall were studied by calculating the correlation coefficient between them. The correlation coefficient worked out presented that the leafhopper population was significant positively correlated with relative humidity (r = 0.69) and non-significant correlated with maximum temperature (r = -0.03), minimum temperature (r= -0.47) and rainfall (r= 0.25) which supported by Vikrant *et al.* (2013) [22] Babu and Meghwal (2014) [3] observed the population of leafhopper showed positive correlation with rainfall.

Whitefly, *Bemisia tabaci* (Genn.)

The whitefly incidence on moth bean was started in the first week of August (32th SMW). The whitefly population increased gradually and the population was registered at peak level during 36th SMW (11.40 whitefly/ three leaves) in first week of September, after this, it was started to decline. Similar trend of whitefly population was also recorded by Yadav and Singh (2013) [23], Nitharwal *et al.* (2013) [13], Suman *et al.* (2018) [21] Kumar *et al.* (2019) [10], Singh *et al.* (2019) [20] and Sharma *et al.* (2019) [19] who investigated the whitefly incidence in the arid pulses in the month of August and in the first week of September the peak activity was noticed. The data of meteorological parameters, *viz.*, maximum temperature, minimum temperature, relative humidity and rainfall that recorded during the peak were found 33.8 ^{0}C, 22.9 ^{0}C, 83 per cent and 06.6 mm respectively. The population of this pest was started to persist, after the peak infestation and then declined and reached at a population level of 1.76 whitefly/ three leaves was recorded in 40th SMW. Whitefly population and meteorological parameters, *viz.*, maximum temperature, minimum temperature, relative humidity and rainfall were studied by calculating the correlation coefficient between them. The correlation coefficient worked out presented that the whitefly had showed significant positive correlation with relative humidity (r= 0.66) and its population was non-significant correlated with maximum temperature (r= 0.05), minimum temperature (r= -0.31) and rainfall (r= 0.25). The results are in resemblance with Moanaro and Choudhary (2018) [12] who also observed the significant positive correlation between relative humidity and whitefly population.

Thrips, *Caliothrips indicus* (Bagnall)

The thrips incidence on moth bean was started in the first week of August (32th SMW). The thrips population increased gradually and the population was registered at peak level during 36th SMW (9.48 thrips/ three leaves) in first week of September, after this, it was started to decline. Similar trend of thrips population was also recorded by Nitharwal *et al.* (2013) [13], Babu and Meghwal (2014) [3], Harde *et al.* (2018) [7], Suman *et al.* (2018) [21] and Singh *et al.* (2019) [20] who investigated that the thrips population were started to appear from first week of August and reached to its peak level in the first week of September. The data of meteorological parameters, *viz*., maximum temperature, minimum temperature, relative humidity and rainfall recorded that during the peak were found 33.8 ^{0}C, 22.9 ^{0}C, 83 per cent and 06.6 mm respectively. The population of thrips was started to persist after the peak infestation and then declined and reached at a population level of 1.40 thrips/ three leaves was recorded in 40th SMW. Thrips population and meteorological parameters *viz*., maximum temperature, minimum temperature, relative humidity and rainfall were studied by calculating the correlation coefficient between them. The correlation coefficient worked out showed that the thrips had showed significant positive correlation with relative humidity (r = 0.67) and non-significant correlation with maximum temperature (r = -0.02), minimum temperature (r= -0.35) and rainfall (r = 0.02). These results are in conformity with those of Janu and Dahiya (2017) [9], Suman *et al.* (2018) [21], Meghana *et al.* (2018) [11], Nigude *et al.* (2018) [14], Patel *et al.* (2020) [16] who found that the thrips population showed significantly positive correlation with morning and evening relative humidity. Jakhar and Choudhary (2013) [13] who found the the negative correlation between population of thrips and maximum and minimum temperature. Babu and Meghwal (2014) [3] who found that the thrips population was positively correlated with rainfall.

Conclusion

The leafhopper, *E. motti*, whitefly, *B. tabaci* and thrips, *C. indicus* were the major sucking insect pests of moth bean. The peak population of leafhopper was recorded in the last week

of August, whereas, the peak of whitefly and thrips were recorded in the first week of September. The correlation coefficient worked out revealed that the relative humidity showed positive significant correlation with leafhopper, whitefly and thrips population on moth bean crop while, maximum temperature minimum temperature and rainfall had a non-significant correlation with population of leafhopper, whitefly and thrips.

Acknowledgement
The authors are highly thankful to Dean, Sri Karan Narendra College of Agriculture, Jobner, Rajasthan for providing the facilities.

References

1. Anonymous. Annual Report. National Network Research Project on Arid Legumes. Indian institute of Pulses Research, Kanpur (U.P.) 2018, 2-3.
2. Anonymous. DES, Ministry of agriculture and farmer welfare (DAC$FW), Govt. of India 2019. https://farmer.gov.in.
3. Babu SR, Meghwal ML. Population dynamics and monitoring of sucking pests and bollworms on Bt. cotton in humid zone of Southern Rajasthan. The Bioscan 2014;9:629-632.
4. Brown AS, Gaur IC. Physico-chemical study of *Phasealus acontifolius* (moth), Indian Journal of Applied Chemistry 1960;23:157.
5. Butter NS, Vir BK. Sampling of whitefly, *Bemisia tabaci* (Genn.) in cotton. Journal of Research, Punjab Agricultural University 1990;27:615-619.
6. Gupta SC. Correlation, Fundamentals of Statistics. Himalaya Publishing House, Mumbai 1996, 510-587.
7. Harde SN, Mitkari AG, Sonune SV, Shinde LV. Seasonal incidence of major sucking insect pest in Bt. cotton and its correlation with weather factors. International Journal of Agriculture and Enviromental Science 2018;5:59-65.
8. Jakhar BL, Chaudhary FK. Influence of abiotic factors on incidence of sucking pest in frenchbean. An international e-journal 2013;2:68-71.
9. Janu A, Dahiya KK. Influence of weather parameters on population of whitefly, *Bemisia tabaci* in American cotton (*Gossypium hirsutum*). Journal of Entomology and Zoology Studies 2017;5:649-654.
10. Kumar P, Naqvi AR, Meena RS, Mahendra. Seasonal incidence of whitefly, *Bemisia tabaci* (Gennadius) in tomato (*Solanum lycopersicum* Mill). International Journal of Chemical Studies 2019;7:185-188.
11. Meghana H, Jagginavar SB, Sunitha ND. Population dynamics of sucking insect pest complex on intra-specific and inter-specific Bt cotton under rainfed situation. Journal of Entomology and Zoology Studies 2018;6:466-471.
12. Moanaro, Choudhary JS. Seasonal incidence of major sucking pests complex of *Capsicum* in relation to weather parameters in Eastern Plateau and Hill region of India. Journal of Entomology and Zoology Studies 2018;6:270-273.
13. Nitharwal M, Kumawat KC, Choudhary M. Population dynamics of insect pests of greengram, *Vigna radiata* in semi-arid region of Rajasthan. Journal of Insect Science 2013;26:90-92.
14. Nigude VK, Patil SA, Bagade AS. Seasonal incidance of sucking pests of groundnut *Arachis hypogaea* L. International Journal of Current Microbiology and Applied Sciences 2018;7:558-561.
15. Pant R, Tulsiani DRP. Total soluble carbohydrates and reduction substances of some leguminous seeds. Current Science 1963;37:74-75.
16. Patel KR, Shah KD, Ghelani YH, Kaneria PB, Patel MM. Effect of abiotic factors on population dynamics of *Thrips tabaci* Lindeman infesting Bt. Cotton. Journal of Entomology and Zoology Studies 2020;8:100-102.
17. Puttaswami GBLV, Ali TMM. Record of pests infesting moth bean, *Phaseolus aconitifolia* (Jacq.) a potential pulse crop. Current Research 1977;6:69-71.
18. Rawat RR, Sahu HN. Estimation of losses in growth and yield of okra due to *Empoasca devastans* Dist. and *Erias sp*. Indian Journal of Entomology 1973;35:252-254.
19. Sharma P, Rana BS, Azad M, Kumawat K. Seasonal incidence of sucking insect pests of cowpea, *Vigna unguiculata* [Linn] Walpers in relation to abiotic factors. Journal of Entomology and Zoology Studies 2019;7:1242-1244.
20. Singh M, Bairwa DK, Jat BL. Seasonal incidence of sucking insect pests of greengram. Journal of Entomology and Zoology Studies 2019;7:654-658.
21. Suman Acharya VS, Mehra K, Singh V. Seasonal incidence of sucking pests on moth bean *Vigna aconitifolia* (Jacq.) Marechal. Indian Journal of Entomology 2018;80:1207-1210.
22. Vikrant Swaminathan R, Bajapai NK. Population dynamics of major insect pests of blackgram. Indian Journal of applied Entomology 2013;27:16-20.
23. Yadav NK, Singh PS. Seasonal abundance of insect pests on mungbean and its correlation with abiotic factors. Journal of Entomology Research 2013;37:297-299.