__Original Research Article__

Seasonal iIncidence of Ssucking pPests and tTheir Nnatural Eenemies Oon Mmoth bBean [*Vigna aconitifolia* (Jacq.) Marechal]

ABSTRACT

A field experiment was conducted at College of Agriculture, NAU, Bharuch (Gujarat) to study the seasonal incidence of sucking pests and their natural enemies and their correlation with weather parameters on moth bean during *kharif* -2023. The studies on seasonal incidence indicated that the incidence of jassid was commenced from 1st week of August (31st SMW) and achieved its peak during 1st week of September (35th SMW). Whitefly infestation commenced from 1st week of August (31st SMW) achieved its peak during 2nd week of September (36th SMW). The population of thrips commenced from 1st week of August (31st SMW) achieved its peak ~~during 2nd~~during 2nd week of September (36th SMW). The population of ladybird beetle was appeared from 2nd week of August (32th SMW) and achieved its peak during 2nd week of September (36th SMW). The population of chrysoperla was appeared from 2nd week of August (32nd SMW) ~~and achieved~~and achieved peak population during 2nd week of September (36th SMW). Among the different environmental factors, morning relative humidity showed significant positive influence on jassid and whitefly population. Bright sunshine hours showed positive significant influence on thrips and whitefly population. However no significant correlation was found between natural enemies and weather parameters.

Keywords: Moth Bbean, Sseasonal iIncidence, sSucking pPests, Lladybird Bbeetle, cChrysoperla

1. INTRODUCTION

Moth bean, *Vigna aconitifolia* (Jacq.) Marechal commonly known as "moth" is one of the important pulse crop and well suited for arid and semi-arid regions of the country. Among *kharif* pulses, it has the maximum drought tolerance capacity. Plants cover large area on the surface, conserve moisture and protect soil from erosion. Moth bean belongs to family

Leguminosae, sub-family *Papilionaceae*. Moth bean is an annual plant. Its tap roots go deeper in soil which can extract moisture from lower horizons in the soil. Stem is branched with plant height of about 30 to 35 cm. Leaves are trifoliate and leaflets are lobed and divided in 3 to 5 parts. Flowers are papilionaceous and mostly self-pollinated (Kukvaya *et al.*, 2018). In India, moth bean occupies an area of 9.68 lakh ha with production of 3.21 lakh tonnes and productivity of 332 kg/ha whereas in Gujarat, it occupies an area of 0.12 lakh ha with production of 0.05 lakh tonnes and productivity of 462 kg/ha during year 2019 – 2020 (Anon., 2021). Jassids and whiteflies also act as vector of yellow mosaic virus apart from causing direct damage by desaping (Satyavir *et al*., 1984). Termites, galerucid beetles, mites and surface grass hoppers are minor pests, while jassid, whitefly, thrips, black weevil, pulse beetle and white grubs are major pests of moth bean (Bhathesar *et al.,* 2021).

2. MATERIAL AND METHODS

A field experiment was conducted at College of Agriculture, NAU, Bharuch (Gujarat) to study the seasonal incidence of sucking pests and their natural enemies and their coorelation with weather parameters on moth bean during *kharif* -2023. For this, moth bean var. GMO-2 was sown at a distance of 45 cm x 10 cm in a plot of 20 m x 20 m and the crop was raised successfully by adopting recommended agronomical practices. The crop was kept free from the insecticidal application throughout the season. Whole plot was divided into five sectors and five plants were selected randomly from each sector. Populations of sucking pests were recorded from the 5 tagged plants at weekly intervals from germination of crop till harvesting of the crop. The population of adults and nymphs of jassid [*Empoasca motti* (Pruthi.)], whitefly [*Bemisia tabaci* (Genn.)] and thrips [*Caliothrips indicus* (Bagnall)] were recorded from three leaves (upper, middle and lower) of each randomly selected plants and mean pest population was worked out.Population of natural enemies such as lady bird beetle and chrysoperla were also recorded from selected plants and mean value was calculated.

3. RESULTS AND DISCUSSION

1. Jassid, *E. motti*

The data represented in the Table-1 shows that jassid population commenced from the 2^{nd} week after sowing (31^{st} SMW) with 2.12 jassid/3 leaves. The population shows an increasing trend from the 3^{rd} WAS (32^{th} SMW) and achieved its peak during 6^{th} WAS (35^{th} SMW) with 8.72 jassid/3 leaves. Thereafter, the population declined from the 7^{th} to 12^{th} week after sowing (36^{th} to 41^{th} SMW) in the range from 0.52 to 5.36 jassid/3 leaves.

Patel *et al*. (2021) reported jassid population started during 31^{st} SMW and peak population found during 36^{th} SMW in green gram. Thus, present findings are more or less in confirmation with earlier findings.

Correlation

The data presented in Table-2 indicated that jassid population had positive significant correlation with morning relative humidity (r = 0.589). Minimum temperature (r = 0.142), evening relative humidity (r = 0.050), bright sunshine hours (r = 0.204), wind speed (r= 0.142) and evaporation (r= 0.150) had positive non significant correlation with the jassid population. However, maximum temperature (r = -0.172), rainfall (r = -0.353) and rainy days (r = -0.242) had negative non significant correlation with the jassid population.

Vikrant and Bajapai (2013) reported that jassid population had positive significant correlation with morning relative humidity. Bhathesar *et al.* (2021) found that jassid population ~~non~~none significantly and negatively correlated with maximum temperature. Thus, present findings are in confirmation with earlier work.

Table 1: Incidence of sucking pests and their natural enemies in moth bean

WAS	SMW	Mean P~~p~~opulation per ~~t~~Three L~~l~~eaves			Mean ~~n~~Number~~o~~. of P~~p~~redators per plant	
		Jassid	Whitefly	Thrips	Ladybird beetle	Chrysoperla
1	**30**	0.00	0.00	0.00	0.00	0.00
2	**31**	2.12	2.48	2.40	0.00	0.00
3	**32**	2.52	4.88	3.16	0.56	2.04
4	**33**	3.36	5.48	5.56	1.20	2.36
5	**34**	4.44	6.28	6.40	1.32	3.56
6	**35**	8.72	7.84	6.04	1.60	4.00
7	**36**	5.36	9.04	8.48	2.40	4.76
8	**37**	3.52	5.64	4.24	2.08	3.28
9	**38**	2.28	3.52	3.24	1.44	2.00
10	**39**	1.52	2.56	3.04	1.16	1.24
11	**40**	0.64	1.72	1.52	0.76	0.92
12	**41**	0.52	1.24	1.16	0.52	0.68

SMW: Standard Meteorological Week, **WAS**: Weeks After Sowing

Table 2: Correlation (r) ~~b~~Between W~~w~~eather ~~p~~Parameters and S~~s~~ucking P~~p~~ests as well as N~~n~~atural E~~e~~nemies in M~~m~~oth ~~b~~Bean

Weather parameters	Jassid	Whitefly	Thrips	Ladybird beetle	Chrysoperla
Maximum temperature (^{0}C)	-0.172	0.582*	0.007	-0.003	0.046
Minimum temperature (^{0}C)	0.543	0.567	0.551	0.110	0.428
Morning relative humidity (%)	0.589*	0.642*	0.281	0.415	0.201
Evening relative humidity (%)	0.050	0.042	0.038	-0.110	-0.018
Bright Sunshine hours (h/day)	0.204	0.620*	0.636*	0.334	0.247
Rainfall (mm)	-0.353	-0.363	-0.286	-0.148	-0.277

Rainy days	-0.242	-0.146	-0.155	0.019	-0.128
Wind speed (km/hr)	0.142	0.101	0.049	-0.296	-0.090
Evaporation mm/day)	0.150	0.084	0.058	0.005	0.092
Note: *Significant at 0.05 level					

2. Whitefly, *B.tabaci*

The data represented in the Table-1 shows that whitefly population commenced from the 2nd week after sowing (31st SMW) with 2.48 whitefly/3 leaves. The population shows an increasing trend from the 3rd WAS (32th SMW) and achieved its peak during 7th WAS (36th SMW) with 9.04 whitefly/3 leaves. Thereafter, the population declined from the 8th to 12th week after sowing (37th to 41th SMW) in the range from 1.24 to 5.64 whitefly/3 leaves.

Bhathesar *et al.*(2021) also recorded highest population of whitefly at 36th SMW after sowing in moth bean which is in complete agreement with present findings.

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Correlation

The data presented in Table -2 indicated that whitefly population had positive significant correlation with maximum temperature (r = 0.582), morning relative humidity (r = 0.642) and bright sunshine hours (r = 0.620). Minimum temperature (r = 0.567), evening relative humidity (r = 0.042), wind speed (r = 0.101) and evaporation (r = 0.084) had positive non significant correlation with the whitefly population. However, evening rainfall (r = - 0.363) and wind rainy days (r = -0.146) had negative non significant correlation with the whitefly population.

Biswas and Banerjee (2019) reported that whitefly population had positive significant correlation with maximum temperature and positive non significant correlation with wind speed. Ojha et al. (2022) found that whitefly population significantly and positively correlated with maximum temperature. Thus, present findings are more or less similar to the earlier findings.

3. Thrips, *C. indicus*

The data represented in the Table -1 shows that thrips population commenced from the 2nd week after sowing (31st SMW) with 2.40 thrips/3 leaves. The population shows an increasing trend from the 3rd WAS (32th SMW) and achieved its peak during 7th WAS (36th SMW) with 8.48 thrips/3 leaves. Thereafter, the population declined from the 8th to 12th week after sowing (37th to 41th SMW) in the range from 1.16 to 4.24 thrips/3 leaves.

Ojha et al.(2022) reported highest population of thrips at 35th SMW in green gram which is more or less in agreement with present findings.

Correlation

The data presented in Table-2 indicated that thrips population had positive significant correlation with bright sunshine hours (r = 0.636). Maximum temperature (r = 0.007), minimum temperature (r = 0.551), morning relative humidity (r = 0.281), evening relative humidity (r = 0.038), wind speed (r = 0.049) and evaporation (r = 0.005) had positive non significant correlation with the thrips population. However, rainfall (r = - 0.286) and rainy days (r = -0.155) had negative non significant correlation with the thrips population.

Soratur *et al*. (2017) reported that among various weather parameters morning relative humidity and evening relative humidity had positive non significant correlation with the thrips population. Ojha *et al*. (2022) found that thrips population had negative non significant correlation with rainfall. So above report is more or less confirmative with result of present findings.

4. Ladybird beetle

The data presented in Table-1 showed ladybird beetle was appeared from 3^{rd} WAS (32^{th} SMW) and persisted till the 12^{th} WAS (41^{th} SMW) in the range between 0.52 to 0.56 ladybird beetle/plant. The ladybird beetle population achieved peak during 7^{th} (36^{th} SMW) with 2.40 ladybird beetle/plant.

The present finding is in agreement with Singh et al. (2019) who reported peak population of ladybird beetle during 37^{th} SMW while, Choudhary et al. (2023) reported maximum population of ladybird beetles in 36^{th} SMW. The variation in present finding may be due to different date of sowing and prevailing weather parameters.

Correlation

The data presented in Table-2 indicated that ladybird beetle population had positive non significant correlation with minimum temperature (r = 0.110), morning relative humidity (r = 0.415), bright sunshine hours (r = 0.334), rainy days (r = 0.019) and evaporation (r = 0.005) had positive non significant correlation with the ladybird beetle population. However, maximum temperature (r = -0.003), evening relative humidity (r = -0.110), rainfall (r = -0.148) and wind speed (r = -0.296) had negative non significant correlation with ladybird beetle population.

Choudhary *et al*. (2023) reported that among various weather parameters minimum temperature, morning relative humidity and bright sunshine hours had positive non significant correlation with the ladybird beetle population which is in agreement with present findings.

5. Chrysoperla

The data represented in the Table-1 showed that chrysoperla was appeared from 3^{rd} WAS (32^{th} SMW) and persisted till the 12^{th} WAS (41^{th} SMW) in the range between 0.68 to 2.04 chrysoperla/plant. The chrysoperla population achieved peak during 7^{th} (36^{th} SMW) with 4.76 chrysoperla/plant.

The present finding is in complete agreement with choudhary *et al*. (2023) who also reported peak population of chrysoperla during 36^{th} SMW.

Correlation

The data presented in Table-2 indicated that chrysoperla population had positive non significant correlation with maximum temperature (r = 0.046), minimum temperature (r = 0.428), morning relative humidity (r = 0.201), bright sunshine hours (r = 0.247) and evaporation (r = 0.092) had positive non significant correlation with the chrysoperla population. However, evening relative humidity (r = -0.018), rainfall (r = - 0.277), rainy days (r = -0.128) and wind speed (r = -0.090) had negative non significant correlation with chrysoperla population.

Choudhary *et al*. (2023) reported that among various weather parameters maximum temperature, minimum temperature and morning relative humidity had positive non significant correlation with the chrysoperla population which is more or less similar to present findings.

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4. CONCLUSION

Jassid was commenced from 1^{st} week of August (31^{st} SMW) and achieved its peak during 1^{st} week of September (35^{th} SMW). Whitefly infestation commenced from 1^{st} week of August (31^{st} SMW) achieved its peak during 2^{nd} week of September (36^{th} SMW). The population of thrips commenced from 1^{st} week of August (31^{st} SMW) achieved its peak ~~during 2^{nd}~~ during 2nd week of September (36^{th} SMW). The population of ladybird beetle was appeared from 2^{nd} week of August (32^{th} SMW) and achieved its peak during 2nd week of September (36^{th} SMW). The population of chrysoperla was appeared from 2^{nd} week of ~~August(~~August (32^{nd} SMW) ~~and achieved~~and achieved peak population during 2^{nd} week of September (36^{th} SMW). Among the different environmental factors, morning relative humidity showed significant positive influence on jassid and whitefly population. Bright sunshine hours showed positive significant influence on thrips and whitefly population. However no significant correlation was found between natural enemies and weather parameters.

COMPETING INTERESTS: NIL

REFERENCES

Kukvaya~~, D~~, D, Jakhar~~, B~~, B. L., Chaudhari~~, S~~, S. J. ~~& Patel~~& Patel, B. C. (2018). Bio-efficacy of insecticides against sucking insect pests of moth bean, *Vigna aconitifolia* (Jacq.) Marechal. *Journal of Entomology and Zoology Studies*, 6(5)~~, 2227~~, 2227-2230.

Anonymous (2021). Crop wise area, production and productivity of pulses from 2010-11 to 2020-21. Report published by Directorate of Pulses Development, Gov. of India, Bhopal~~, P~~, P. 32.

Satyavir, H., Jindal~~, S~~, S. K. & Lodha~~, S~~, S. (1984). Screening of moth bean cultivars against jassid, white fly and yellow mosaic virus. Annals ~~of Arid~~of Arid Zone, 23~~, 99~~, 99-103.

Bhathesar, S., Khinchi, S. K., Kumawat, K. C. & Choudhary, S. (2021). Seasonal abundance of major sucking insect pests on moth bean, *Vigna aconitifolia* (Jacq.) Marechal. *Journal ~~of Pharma~~of Pharma Innovation*, 10(10)~~, 968~~, 968-971.

Patel, R., Marabi, R. S., Nayak, M. K., Tomar, D. S. & Srivastava, A. K. (2021). Population dynamics of major sucking insect pests of mung bean [*Vigna radiata* (L.) Wilczek] in relation to weather parameters. *Journal of Entomology and Zoology Studies,* 9(2), 324-328.

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Vikrant, S. R. &Bajapai, N. K. (2013). Population dynamics of major insect pests of black gram. Journal of Applied Entomology*,* 27(1), 16-20.

Bhathesar, S.~~, Khinchi~~, Khinchi, S. K., Kumawat, K. C. & Choudhary, S. (2021). Seasonal abundance of major sucking insect pests on moth bean, *Vigna aconitifolia* (Jacq.) Marechal. *Journal of Pharma Innovation*~~, 10~~, 10(10)~~, 968~~, 968-971.

Biswas, S. & Banerjee, A. (2019). Seasonal variation in incidence of insect pests occurring on green gram [*Vigna radiata* (Linn.) Wilczek] in lower gangetic plains of West Bengal. ~~International *Journal*~~*International Journal* ~~*of Chemical*~~*of* ~~*Studies*~~*Chemical Studies*, 7(6), 1583-1588.

Ojha, A. K., Tomar, S. P. S., Naveen, N. K., Suman, S. & Saxena, S. (2022). Population dynamics of major insect pests complex of green gram [*Vigna radiata* (Linn.)] and their correlation. *Journal* ~~*of Pharma*~~*of Pharma* ~~*Innovation ,*~~*Innovation,* 11(4), 145-148.

Soratur, M., Rani, D. & Naik, S. M. (2017). Population dynamics of major insect pests of cowpea [*Vigna unguiculata* L. Walp] and their natural enemies. *Journal of Entomology and Zoology* ~~*Studies ,*~~*Studies,* 5(5), 1196-1200

Singh, M., Bairwa, D. K. &Jat, B. L. (2019). Seasonal incidence of sucking insect pests of green gram. *Journal of Entomology and Zoology* ~~*Studies ,*~~*Studies*, 7(2)~~, 654~~, 654-658.

Choudhary, S., Kumawat, K. C., Hussain, A., Sharma, S. L. &Piploda, S. (2023). Effect of biotic and abiotic factors on the incidence of major sucking insect pests of moth bean. *Journal* ~~*of Pharma*~~*of Pharma* ~~*Innovation ,*~~*Innovation,* 12(3)~~, 3976~~, 3976-3980.

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