

Seasonal incidence of stem fly, *Melanagromyza sojae* (Zehntner) infesting black gram (*Vigna mungo* L.) in kharif

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Summary

A field experiment on the seasonal incidence of stem fly, *Melanagromyza sojae* (Zehntner) infesting black gram was carried out in variety GU 1 (Gujarat Urd 1) during kharif 2017 and 2021 at Entomology farm, B. A. College of Agriculture, AAU, Anand. Infestation of *M. sojae* was observed from 1st WAS i.e., 34th SMW. Later on, infestation increased gradually and its highest infestation was observed during the 39th SMW i.e., 68.33 and 73.33% of kharif, 2017 and 2021, respectively. Stem fly infestation exhibited a highly significant positive association ($r = 0.519^{**}$ and 0.655^{**} , respectively) with bright sunshine hours (BSS) and maximum temperature (MaxT), respectively. Abiotic factors viz., rainfall (RF) exhibited a significant negative association (-0.458^{*}), while evaporation (EP) showed a significant positive association (0.466^{*}).

JAЕ 2023, Vol 15

Received: 13 March 2023

Accepted: 30 May 2023

Published: 30 June 2023

<https://doi.org/10.58628/JAE-2315-116>

Associated Editor: Dr. SM Haldhar

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Keywords: Black gram, *Melanagromyza sojae*, Maximum temperature and Bright sunshine hours

Introduction

Black gram or urd is one of the important pulse crop in India. Black gram (*Vigna mungo* L.) is reported to be originated in India. Quantitatively black gram is very good source of protein. It is mainly cultivated in Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal, Punjab, Haryana, Tamil Nadu, Karnataka and Gujarat. In Gujarat, the production of black gram is 73560 tons with 669 kg/ha productivity from an area of 1,09,960 hectares in 2018-19. The major black gram-producing districts in Gujarat are Sabarkantha, Panchmahal, Dahod, Vadodara, Mehsana and Bharuch. It is also somewhat cultivated in Rajkot, Surendranagar and Junagadh districts (Anonymous 2019; Sachin et al. 2019). In India, 60 insect pest species are known to attack black gram at different crop growth stages (Lal & Sachan 1987; Haldhar et al. 2013). Yield loss due to stem fly varies between locations and according to the plant growth stage. It is reported to cause 100% infestation and 33.84% stem tunnelling caused by *M. sojae* in soybean at Pantnagar in Uttarakhand (Gaur et al. 2015).

Materials and Methods

A study on population dynamics of stem fly in black gram was carried out in variety GU 1 (Gujarat Urd 1). To study the population dynamics, the crop was raised in 20 x 10 m plot size with a spacing 45 x 10 cm during kharif 2017 and 2021 at Entomology farm, B. A. College of

Agriculture, AAU, Anand. The plot was kept free from any plant protection measures. The plot was divided into six equal sectors. The size of each sector was 10 x 20 m. From each sector, 10 plants were observed. Ten randomly selected plants were uprooted from each plot for stem fly infestation and brought to the laboratory. The roots of uprooted plants were gently washed in tap water to remove adhered soil. The number of stem fly-infested plants out of 10 plants were recorded. The observations were recorded at every three days interval, started from one week after germination till harvest. The data thus obtained were analysed by following standard statistical technique (Steel & Torrie 1980).

In order to study the instantaneous effect of weather parameters on population fluctuation of stem fly, the data of abiotic parameters viz., bright sunshine (BSS), rainfall (RF), wind speed (WS), maximum (MaxT) and minimum (MinT) temperature, morning (RH₁), evening (RH₂) relative humidity, Morning Vapour Pressure (MoVP), Evening Vapour Pressure (EvVP) and Evaporation were correlated. Week-wise data on various parameters recorded at the Department of Agril. Meteorology, B. A. College of Agriculture, Anand Agricultural University, Anand during 2017 and 2021 were utilized.

Result and Discussion

The population dynamics of stem fly, *M. sojae* was carried out during kharif 2017 and 2021 and data on the infestation of *M. sojae* were presented in Table 1 and 2, respectively.

The activity of *M. sojae* during kharif, 2017

The data on infestation caused by *M. sojae* during kharif, 2017 are presented in Table 1. It can be seen clearly from the data that the infestation of *M. sojae* started from 1st WAS i.e., 34th SMW (13.33%). Then the infestation of *M.*

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sojae increased gradually and its peak was observed during 28th September to 1st October 2017 i.e., 39th SMW to 40th SMW (68.33%). During the latter stage of the crop,

infestation caused by *M. Sojae* declined, but it remained throughout the crop period. Overall, infestation caused by *M. Sojae* ranged from 13.33 to 68.33 per cent.

Table 1. Seasonal incidence of stem fly, *M. sojae* infesting black gram (Kharif, 2017)

Months	SMW	Date of observation	Infestation (%)
August	34 th	26/08/2017	13.33
	35 th	29/08/2017	23.33
September	36 th	01/09/2017	26.67
		04/09/2017	28.33
	37 th	07/09/2017	31.67
		10/09/2017	33.33
		13/09/2017	36.67
	38 th	16/09/2017	51.66
		19/09/2017	56.67
		22/09/2017	61.67
	39 th	25/09/2017	63.33
		28/09/2017	68.33
October	40 th	01/10/2017	68.33
		04/10/2017	66.67
		07/10/2017	65.00
	41 st	10/10/2017	63.33
		13/10/2017	61.67
	42 nd	16/10/2017	60.00
		19/10/2017	58.33
	43 rd	22/10/2017	56.67
		25/10/2017	55.00
		28/10/2017	53.33
	44 th	31/10/2017	51.67
		03/11/2017	50.00
November	45 th	06/11/2017	48.33
		09/11/2017	46.67
	46 th	12/11/2017	45.00
		15/11/2017	43.33
		18/11/2017	41.67

SMW = Standard Meteorological Week

Activity of *M. sojae* during kharif, 2021

The data on infestation caused by *M. sojae* during kharif, 2021 are presented in Table 2. The data indicated that the activity of *M. sojae* started from 1st WAS i.e., 34th SMW (11.67%). Thereafter, the incidence increased

gradually and its peak was observed on 25th September i.e., 39th SMW (73.33%). During the later stage of the crop, infestation caused by *M. sojae* declined and reached 40.00 per cent. Overall, infestation caused by *M. Sojae* ranged from 11.67 to 73.33 per cent.

Table 2. Seasonal incidence of stem fly, *M. sojae* infesting black gram (Kharif, 2021)

Months	SMW	Date of observation	Infestation (%)
August	34 th	23/08/2021	11.67

September		26/08/2021	16.67
	35 th	29/08/2021	21.67
		01/09/2021	26.67
	36 th	04/09/2021	30.00
		07/09/2021	35.00
	37 th	10/09/2021	38.33
		13/09/2021	53.33
		16/09/2021	58.33
	38 th	19/09/2021	63.33
		22/09/2021	65.00
October	39 th	25/09/2021	73.33
		28/09/2021	71.67
	40 th	01/10/2021	70.00
		04/10/2021	66.67
		07/10/2021	65.00
	41 st	10/10/2021	63.33
		13/10/2021	61.67
	42 nd	16/10/2021	60.00
		19/10/2021	58.33
	43 ^d	22/10/2021	56.67
November		25/10/2021	55.00
		28/10/2021	53.33
	44 th	31/10/2021	51.67
		03/11/2021	50.00
	45 th	06/11/2021	46.67
		09/11/2021	46.67
	46 th	12/11/2021	43.33
		15/11/2021	40.00
SMW = Standard Meteorological Week			

From available literature sources revealed that very few workers have attempted to study the seasonal occurrence of stem fly, *M. sojae* on the black gram. Yadav et al. (2020) from Uttar Pradesh found that the maggots of stem fly found to attack on black gram stem from the seedling stage and continue up to the end of the vegetative stage. The damage was more severe on seedlings as compared to mature plants. This is in accordance with the present finding. The report of Manohar & Balasubramanian (1980) from Tamil Nadu deviated from the finding of the present study, which stated that the infestation of stem fly, *O. phaseoli* in black gram was lowest in crops sown in September, October and November and highest in those sown in March, July and August. This discrepancy might be due to variations in locality, ecological conditions, cropping pattern, variety

and cropping systems. Pathan et al. (2022) from Gujarat found that *M. sojae* infesting black gram started from 1st WAS i.e., 13th SMW (16.67%) during the summer, 2017. The infestation increased gradually and its highest infestation was observed on 7th May 2017 i.e., 19th SMW (78.33%).

Correlation matrix of the relationship between weather parameters and infestation of *M. sojae*

In nature, the population of insect-pests is only somewhat stable. The rise and fall of the population density of any organism depend on many abiotic factors like temperature, rainfall, humidity etc. To know the effect of various weather parameters on the infestation caused by (*M. sojae*) infesting black gram, a simple correlation was worked out between three days of mean infestation

(%) and three days of the mean value of different weather parameters.

The data on the correlation between weather parameters and infestation caused by *M. sojae* during *kharif*, 2017 are presented in Table 3. The results of the analysis on the correlation between infestation and weather parameters revealed that bright sunshine hours (BSS) and maximum temperature (MinT) showed highly significant positive correlation (with 'r' values 0.519** and 0.655**, respectively). Abiotic factors viz., rainfall (RF) showed a significant negative association (-0.458*), while evaporation (EP) had a significant positive association (0.466*). The abiotic factors viz., wind Speed (WS), minimum temperature (MinT), morning relative humidity (MoRH), evening relative humidity (EvRH) and morning vapour pressure (MoVP) exhibited negative correlation, while evening vapour pressure (EvVP) showed a positive association.

Table 3. Correlation coefficient (r) between weather parameters and infestation of *M. sojae* in black gram during *kharif* (n = 29)

Weather Parameters	Correlation co-efficient (r)	
	<i>Kharif</i> , 2017	<i>Kharif</i> , 2021
Bright Sunshine Hours (BSS), hr/day	0.519**	0.085
Rainfall (RF), mm	-0.458*	0.169
Wind Speed (WS), km/hr	-0.329	-0.430*
Maximum Temperature (MaxT), °C	0.655**	0.050
Minimum Temperature (MinT), °C	-0.075	0.038
Morning Relative Humidity (MoRH), %	-0.448	0.151
Evening Relative Humidity (EvRH), %	-0.358	0.006
Morning Vapour Pressure (MoVP), mm of Hg	-0.129	0.086
Evening Vapour Pressure (EvVP), mm of Hg	0.001	0.055
Evaporation (EP), mm	0.466*	-0.017

* Significant at 5% level

** Significant at 1% level

Sunshine hours and maximum temperature showed a highly significant correlation, whereas wind speed and rainfall exhibited a significant negative correlation with the infestation of stem fly during *kharif*. Infestation of stem fly, *M. sojae* and evaporation showed a significant positive association during *kharif* 2017, while it was non-significant negative association during 2021. Similarly, rainfall had a significant negative correlation with infestation during *kharif*, 2017, but showed a positive correlation during 2021. Both morning and evening relative humidity did not affect field infestation as it evident from the results of both years of study.

Sharma et al. (1997) also reported that temperature had significant and positive correlation with stem fly, *O. phaseoli* infestation in soybean crop. According to Mangang et al. (2017), the stem fly infestation on soybean and minimum temperature correlated

The data on the correlation worked out between the infestation of *M. sojae* during *kharif*, 2021 and weather parameters are presented in Table 3. The correlation coefficient values worked out between infestation and abiotic factors clearly highlighted that wind speed (WS) had significant negative association with pest infestation (-0.430*). The results of the analysis on the correlation between stem fly infestation and weather parameters revealed that there was no any linear relationship between stem fly infestation and other weather parameters. Bright sunshine hours (BSS), rainfall (RF), maximum temperature (MaxT), minimum temperature (MinT), morning relative humidity (MoRH), evening relative humidity (EvRH), morning vapour pressure (MoVP) and evening vapour pressure (EvVP) showed positive association while, Evaporation (EP) indicated negative association.

significantly and favoured the development of stem fly. These reports conform with the present findings wherein bright sunshine hours had a significant positive association with stem fly infestation in black gram.

Minimum temperature had a significant negative correlation with stem fly incidence in green gram (Irulandi & Balasubramanian 1999), black gram (Nayak et al. 2004), khejri (Haldhar 2012) and soybean (Yadav et al. 2015 and Panwar et al. 2021) has also been reported by a few earlier workers in past which is more or less similar to the present report.

The present study showed A significant positive correlation between stem fly infestation and maximum temperature. This is in accordance with the findings of Nayak et al. (2004), Manjula et al. (2019) and Panwar et al. (2021). Nayak et al. (2004) reported that high ambient temperature favoured pest population build-up on black

gram. According to Manjula et al. (2019), the most influencing factor for stem fly, *O. phaseoli* in black gram was the maximum temperature (36 to 38 °C). This range of temperature was most congenial for the pest. The stem fly, *M. sojae* population in soybean was significantly positively correlated with maximum temperature, as Panwar et al. (2021) reported.

Wind speed significantly negatively correlated with stem fly infestation in black gram. This finding corroborates with the report of Irulandi & Balasubramanian (1999) and Ahirwar et al. (2014), who reported a negative association between these two variables on green gram and soybean crops, respectively. In the present investigation, no clear relationship was established between infestations of stem fly and relative humidity. This is in concurrence with the report of Fand et al. (2019), who concluded the study and reported that both morning and evening relative humidity did not affect the field incidence of *M. sojae* in soybean. A positive correlation was established between infestation of stem fly and vapour pressure.

There was a positive and significant association between stem fly infestation in black gram and evaporation recorded during *kharif*, 2017. This is in agreement with the report of Panwar et al. (2021) who opined that the stem fly, *M. sojae* infesting in soybean had significantly positive correlation with evaporation. From the available sources of literature, it revealed that none of the worker in past has attempted to establish correlation between stem fly infestation and vapour pressure and hence the present finding could not be compared and discussed.

Conclusion

The infestation of *M. sojae* was observed from 1st WAS i.e., 34th SMW (13.33%). Thereafter, the infestation increased gradually and its peak was observed during 39th to 40th SMW of *kharif*, 2017 (68.33%). Bright sunshine hours (BSS) and maximum temperature (MaxT) exhibited highly significant positive association with 'r' value 0.519** and 0.655**, respectively. Abiotic factors viz., rainfall (RF) showed a significant negative association (-0.458*), while evaporation (EP) showed a significant positive association (0.466*). During *kharif*, 2021; infestation was recorded from 1st WAS i.e., 34th SMW (11.67%). Later on, infestation increased gradually and its peak activity was observed on 39th SMW (73.33%). Among the various weather parameters under study, wind speed (WS) showed significant negative association (-0.430*) with stem fly infestation.

Declarations of interests

All authors of this manuscript declare that they have no conflict of interest.

Data sharing

All relevant data are within the manuscript.

References

- Ahirwar KC, Marabi RS & Bhowmick AK. 2014. Population dynamics of major insect pests and seed yield of soybean. *Annals of Plant Protection Sciences*, 22 (1): 56-59.
- Anonymous. 2019. State-wise area, production and productivity of Urad in Gujarat. India stat. <http://www.indiastat.com>.
- Fand BB, Gaikwad MB, Sul NT & Bal SK. 2019. Effect of seasonal weather on incidence of stem fly, *Melanagromyza sojae* (Zehntner) in soybean. *Journal of Agrometeorology*, 21 (4), 520-523.
- Gaur N, Sharma P & Nautiyal A. 2015. Seasonal incidence of major insect pests of soybean and their correlation with abiotic factors. *Journal of Hill Agriculture*, 6 (1), 75-78.
- Haldhar SM, Sharma SK, Choudhary BR, Bhargava R, Samadia DK & Meena SR. 2013. Insect Pests of Arid Vegetable Crops: Practical Manual for Field Identification and Damage Symptoms. *CIAH/ Tech./ Pub. No. 43 pp 1-54*.
- Haldhar SM. 2012. Report of *Homoeocerus variabilis* (Hemiptera: Coreidae) on khejri (*Prosopis cineraria*) in Rajasthan, India: incidence and morphometric analysis. *Florida Entomologist*, 95 (4): 848-853.
- Irulandi S & Balasubramanian G. 1999. Effect of weather parameters on Galerucid beetle, *Madurasia obscurella* (Jacoby) (Galerucidae: Coleoptera) and stem fly, *Ophiomyia phaseoli* (Tryon) (Agromyzidae: Diptera) on green gram. *Insect Environment*, 5 (1), 8-9.
- LalSS & Sachan JN. 1987. Recent advances in pest management in pulses. *Indian Farm*, 37: 29-32.
- Mangang CNJS, Devi KN, Singh L & Singh AD. 2017. Seasonal incidence of insect pests on soybean in relation to weather parameters. *Legume Research*, 40 (6): 1139-1140.
- Manjula K, Prasanthi L & John sudheer M. 2019. Occurrence of stem fly, *Ophiomyia phaseoli* in major pest status in black gram in Southern zone of Andhra Pradesh, India. *Asian Journal of Science and Technology*, 10 (12): 10522-10525.
- Manohar S & Balasubramanian M. 1980. Study on the seasonal incidence of agromyzid stem fly *Ophiomyia phaseoli* Tryon (Diptera: Agromyzidae) in blackgram. *Madras Agricultural Journal*, 67 (8): 534-537.
- Nayak SK, Ujagir R & Chhibber RC. 2004. Effect of abiotic factors on the insect population build up on black gram, *Vigna mungo* L. crop. *Shashpa*, 11 (1): 31-36.
- Panwar A, Nayak MK & Tomar DS. 2021. Population dynamics of major insect pests of soybean and their correlation with abiotic factors in Bundelkhand agroclimate zone of M. P. *Journal of Entomology and Zoology Studies*, 9 (1): 1824-1827.
- Pathan NP, Sisodiya DB & Mohapatra AR. 2022. Population dynamics of stem fly, *Melanagromyza sojae* (Zehntner) infesting black gram (*Vigna mungo* L.) in summer season. *The Pharma Innovation Journal*, 11 (8): 2118-2121.
- Sachin AS, Sivakumar T, Krishna Surendar K & Senthivelu M. 2019. Influence of plant growth regulators and nutrients on biometric, growth and yield attributes in Blackgram (*Vigna mungo* L.). *Journal of Agriculture and Ecology*, 7: 55-63.

- Retrieved from <https://journals.saaer.org.in/index.php/jae/article/view/203>.
16. Sharma D, Bagmare A & Gupta A. 1997. Effect of weather parameters on population build-up of key pests of soybean. *Journal of Insect Science*, 10(2): 120-124.
 17. Steel RGD & Torrie JH. 1980. Principles and procedures of statistics. Publ. McGraw Hill Book Company, New York, USA, p. 137.
 18. Yadav A, Singh G, Singh H, Singh DV, Khilari K & Vivek. 2020. Succession of insect-pests complex associated with black gram in Western Uttar Pradesh. *Journal of Entomology and Zoology Studies*, 8 (5): 28-31.
 19. Yadav P, Banerjee MP, Gupta MP & Yadav VK. 2015. Effect of weather factors on seasonal incidence of insect pests of soybean. *TECHNOFAME- A Journal of Multidisciplinary Advance Research*, 4 (1): 46-51.