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Population Dynamics of Mustard Sawfly, *Athalia proxima* (Klug) in Radish

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ABSTRACT: An experiment on the population dynamics of mustard sawfly, *Athalia proxima* (Klug) (Hymenoptera: Tenthredinidae) in radish was conducted at Anand Agricultural University, Anand, Gujarat during *Rabi*, 2022-2023. The infestation of *A. proxima* in radish crop commenced in the second week of December (50th SMW) and it persisted up to the harvest of crop (4th SMW). The population of mustard sawfly fluctuated from 0.55 to 1.95 larvae/plant and attained a peak (1.95 larvae/plant) during the fourth week of December (52nd SMW). Thereafter, the population gradually declined and it was recorded up to harvest of the crop in the fourth week of January (4th SMW). The population of *A. proxima* exhibited non-significant negative correlation with all the weather parameters such as maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, bright sunshine hours, wind speed, morning as well as evening vapour pressure and vapour pressure deficit. *A. proxima* causes significant damage to the radish crop at the seedling stage but information pertaining to its incidence and correlation with different weather parameters on radish is scarce. Hence, the study on population dynamics of *A. proxima* in radish was conducted.

Keywords: Population dynamics, *Athalia proxima*, Radish, Mustard sawfly.

INTRODUCTION

Vegetables are recognized to be extremely essential for food and nutrition security. They are a key component of farm diversification strategies. Vegetables are rich sources of vitamins and minerals, which are needed for the good health of mankind (Schreinemachers *et al*., 2018). Root vegetables are the crops that are grown for their enlarged, edible storage roots. The important commercial crops grown under this group are radish, carrot, turnip and beetroot. In India, the total area under radish cultivation during the year 2019-20 was 2,04,000 ha and the total production was 31,07,000 tonnes (Anonymous, 2020a). The major radish growing states in India are West Bengal, Uttar Pradesh and Madhya Pradesh (Anonymous, 2020a). Vegetables are more prone to insect pests and diseases mainly due to their tenderness and softness as compared to other crops (Sharma, 2011). The cruciferous crops are attacked by a broad complex of pests. Among them, mustard sawfly, *Athalia proxima* (Klug) is a major pest of cruciferous crops (Gharde & Mal 2019). The mustard sawfly is widely distributed in Indonesia, Taiwan, Myanmar and the Indian subcontinent. The pest has also been recorded from almost all the states of India. The mustard sawfly, *Athalia proxima* (Klug) [=*Athalia lugens proxima* (Klug)] (Hymenoptera: Tenthredinidae) is a polyphagous insect and is considered a devastating pest of vegetables in India. It feeds on various cruciferous plants like mustard, cabbage, cauliflower, knoll-khol, turnip *etc* (Sahu *et al*., 2018). The incidence of mustard sawfly on radish crop can be as high as 85 per cent (Srivastava *et al*., 1972). The population of insect-pests, including the mustard sawfly are frequently influenced by weather conditions. Considering the above facts, the present investigation on population dynamics of mustard sawfly, *A. proxima* in radish was carried out.

MATERIAL AND METHODS

In order to study the population dynamics of mustard sawfly in radish, a field experiment was conducted at Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during *Rabi* season, 2022-2023. All recommended agronomical practices were followed to raise the radish crop. The variety of radish crop used for the study was Pusa himani. The crop was sown on November 21, 2022 at a spacing of 15 cm between two rows. The spacing between two plants within the row was approximately 10 cm. The experimental plot was kept free from the application of any insecticides.

The size of the experimental plot was 6.00 × 5.00 m. The entire plot was divided into four equal (3.00 × 2.50 m) sectors. To record observations on larval population, 10 plants were randomly selected from each sector. From each selected plant, the number of larva(e) per

plant was counted. The observations were recorded at weekly intervals starting from one week after germination and continued till the removal of the crop. Finally, the mean larval population of mustard sawfly per plant at a weekly interval was worked out.

A simple correlation was worked out between larval population of *A. proxima* and weather parameters *viz.*, bright sunshine (BSS), rainfall (RF), wind speed (WS), maximum (MaxT) and minimum (Min T) temperature, morning (RH_1) and evening (RH_2) relative humidity, morning (VP_1) and evening (VP_2) vapour pressure, vapour pressure deficit (VPD). The data on weather parameters were obtained from the meteorological observatory located at Anand Agricultural University, Anand, Gujarat.

RESULTS AND DISCUSSION

Population dynamics of *A. proxima*. The data on the weekly larval population of *A. proxima* are given in Table 1. The incidence of mustard sawfly in radish crop commenced in the second week after germination *i.e.* second week of December (50th SMW) and it persisted up to the harvest of crop (4th SMW). The population of mustard sawfly fluctuated from 0.55 to 1.95 larvae/plant. Initially, the population was moderate (1.00 larva/plant), which gradually increased and attained a peak (1.95 larvae/plant) during the fourth week of December *i.e.* 4 weeks after germination (52nd SMW). Thereafter, the population gradually declined and it was recorded up to harvest of the crop in the fourth week of January (4th SMW).

These results are in conformity with the findings of those reported earlier by several workers. The infestation of mustard sawfly commenced in the third week after sowing *i.e.* in December with a population ranging from 0.70 to 1.40 larvae per plant (Bhatt & Bapodra 2004). According to Yadav (2012), the infestation of mustard sawfly on mustard commenced during third week of November (Std. week 46) with average larval population of 1.40 larvae per plant and recorded a peak population of 2.30 larvae per plant during the last week of November (Std. week 47). The larval population of mustard sawfly, *A. proxima* was observed from third week of December (51st SMW) to third week of February (7th SMW) in the range of 0.12 to 1.96 larvae per plant. The peak larval population (1.96 larvae per plant) was observed in the second week of February (Kashyap *et al*., 2018).

Correlation between weather parameters and population of *A. proxima*. The value of the correlation between weather parameters and larval population of *A. proxima* are given in Table 2, which indicated that maximum temperature (r = -0.290), minimum temperature (r = -0.230), morning relative humidity (r = -0.128), evening relative humidity (r = -0.215), wind speed (r = -0.144), bright sunshine hours (r = -0.288), morning (r = -0.194) as well as evening (r = -0.186) vapour pressure and vapor pressure deficit (r = -0.088) showed non-significant negative correlation with sawfly population.

Kalasariya and Parmar (2019) reported that the maximum and minimum temperature influenced the sawfly larval population negatively, while relative humidity in the morning and evening influenced positively and negatively, respectively. Thus, the present findings validate the results of the earlier findings for some weather parameters.

Table 1: Population dynamics of mustard sawfly *A. proxima* in radish.

Month	Week	SMW	WAG	No. of larva(e)/plant
December, 2022	I	49	1	0.00
	II	50	2	1.00
	III	51	3	1.63
	IV	52	4	1.95
January, 2023	I	1	5	1.48
	II	2	6	1.23
	III	3	7	0.95
	IV	4	8	0.55

SMW: Standard Meteorological Week, WAG: Week after germination

Table 2: Correlation coefficient (r) between weather parameters and population of mustard sawfly in radish (n=8).

Weather Parameters	Correlation coefficient (r)
Maximum Temperature, °C (Max. T)	-0.290
Minimum Temperature, °C (Min. T)	-0.230
Morning Relative Humidity, % (RH_1)	-0.128
Evening Relative Humidity, % (RH_2)	-0.215
Bright Sunshine Hours, hrs/day (BSS)	-0.288
Morning Vapour Pressure, mm of Hg (VP_1)	-0.194
Evening Vapour Pressure, mm of Hg (VP_2)	-0.186
Wind Speed, kmph (WS)	-0.144
Vapour pressure deficit, mm of Hg (VPD)	-0.088

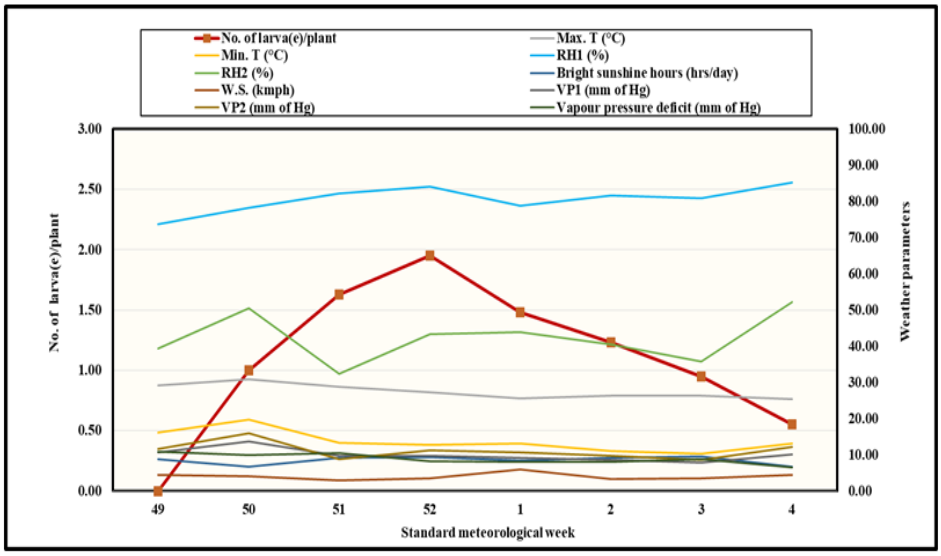

Fig. 1. Population dynamics of *A. proxima* in relation to weather parameters in radish.

CONCLUSIONS

From the present study, it can be concluded that the infestation of *A. proxima* in radish during *Rabi* commenced during the second week after germination *i.e.* second week of December (50th SMW) and it persisted up to the harvest of crop (4th SMW). The population attained a peak (1.95 larvae/plant) during the fourth week of December *i.e.* fourth week after germination (52nd SMW). Correlation analysis indicated that the larval population of *A. proxima* exhibited a non-significant negative correlation with all the weather parameters.

FUTURE SCOPE

The population of insect-pests is largely influenced by the prevailing weather conditions of the place where the crop is grown and therefore effective pest management strategies can rely on forecasting the peak population of the insect-pests. In the present investigation, the results of the correlation studies demonstrated the significance of weather conditions in the prevalence of *A. proxima*. Thus, data from such studies can be utilized to establish a population dynamics model for mustard sawfly on its host crops.

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Conflict of interest. None.

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