Seasonal Incidence of Major Insect Pests in Relation to Abiotic Factors in Mustard

ABSTRACT

Aim: The present study was under taken to the know the incidence of major insect- pests of mustard and their correlation with abiotic factors.
Study design: Randomized Block Design (one factor anova).
Place and Duration of Study: Regional Agricultural Research Station (RARS), Palem, Nagarkurnool district, Telangana state during *rabi*, 2023-24 between November to March.
Methodology: The field experiment was conducted at RARS, Palem using the variety DRMRIJ 31 with spacing of 45cm× 15 cm. Observations were taken timely from the start of the pest incidence to till harvest of the crop at weekly intervals (Standard Meteorological Week). The incidence of insect pests and their natural enemies were individually correlated with the weather parameters.
Results: The highest population of mustard aphids at 6th SMW (9.65 aphids/10cm apical shoot), leaf webber at 3rd SMW (5.70 larvae/plant), flea beetle at 52nd SMW (1.78beetles/plant) painted bug at 3rd SMW (1.20 bugs/plant) mustard sawfly at 52nd SMW (0.22 grubs/plant), predatory ladybird beetle peak at 4th SMW (0.22 beetle/plant). The correlation studies of the pests with weather parameters revealed that maximum temperature positive non-significant correlation with leaf webber, painted bugs and coccinellids, non-significant negative with sawfly, significant positive with aphid and negative with flea beetle. Minimum temperature was non-significant negative with leaf webber, aphids, painted bugs, flea beetle, sawfly and coccinellids. Morning relative humidity was positive correlated with painted bug and flea beetle, negative non-significant with leaf webber, sawfly and coccinellids and negative significant with aphid. Evening relative humidity was positive non-significant with leaf webber and sawfly, negative non-significant with painted bug and coccinellids, positive significant with flea beetle and negative significant with aphid. Sunshine hours positive correlated with leaf webber, aphids, painted bugs, sawfly and coccinellids and negative non-significant with flea beetle.
Conclusion: Seasonal incidence of insect pests in crops is closely linked to weather parameters such as temperature, humidity and sunshine hours. Understanding these relationships is crucial for effective pest management and crop protection.

Keywords: Correlation, Incidence, Insect pests, Mustard, Weather parameters.

1. INTRODUCTION

Mustard *Brassica juncea* (L.) is an important oilseed crop and a valuable source of edible oil in India with a production of 11.9 million metric tons and an average productivity of 1497 kg ha-1, it is grown across 7.9 million hectares in India [1,2,3]. The lower yield of mustard was caused by a number of factors, the main one being insect infestations. In India, rapeseed and mustard crops have been reported to be infested by over 43 various types of insect pests *viz*., mustard aphid, *Lipaphis erysmi* (Kalt), mustard sawfly, *Athalia lugens proxima* (Klug), leaf webber, *Crocidolomia binotalis* (Zeller), painted bug, *Bagrada hilaris* (Burmeister) and the leaf miner, *Phytomyza horticola* (Goureau) [4]. Among these, leaf webber is a relatively recent pest that damages mustard and can cut output losses by as much as 81.8% to 13.2% [5]. *L. erysimi* considerably lowers oil content by 5–15% and decreases mustard yields by 35.4–96.0% [6]. Adult flea beetles are busy leaf-feeders that, when present in big enough quantities, can destroy and defoliate plants that have small, uneven holes in them [7][8]. Painted bug damage

is most severe at the seedling stage of mustard, causing yield losses between 26.8% and 70.8%. At pod formation and maturity, losses are 30.1% in yield and 3.4% in oil content [9]. Crop varieties differ in the frequency of insect pests, which affects timing and peak activity as well as yield differential effects. Gaining insight into these processes increases yields by improving the efficacy of insect control. Relationships between insect populations and abiotic factors are revealed by correlation studies using meteorological measurements. Thus, this investigation examined the seasonal occurrence of the main pest insects of mustard in connection to meteorological variables such as maximum and minimum temperature, relative humidity in the morning and evening, and sunshine hours.

2. MATERIAL AND METHODS

To study the seasonal incidence of insect pests of mustard, the field experiment was conducted at Regional Agricultural Research Station (RARS), Palem using the variety DRMRIJ 31. The crop was sown (8th of November) in a plot of size 5m×4m laid in a randomized block design with spacing of 45cm× 15 cm during *rabi*, 2023-24. All the agronomical practices were followed except for the plant protection measures in order to assess the incidence of pests and natural enemies. Observations of insect pests *i.e,*number of leaf webber larvae, sawfly grubs, painted bug nymphs and adults, aphids (top 10 cm apical shoot) per plant, flea beetle larvae per plant, and coccinellid grubs/adults per plant were counted from randomly selected 10 plants from the start of the pest incidence to till harvest of the crop at weekly intervals (Standard Meteorological Week). In addition, meteorological data was gathered for the correlation studies from RARS, Palem's meteorological observatory. The incidence of insect pests and their natural enemies were individually correlated with the weather parameters viz., maximum and minimum temperature, maximum and minimum relative humidity and sunshine hours, from RARS, Palem's meteorological observatory. The data were statistically analysed in OP STAT.

3. RESULTS AND DISCUSSION

3.1 Mustard Aphid

Aphid incidence peaked at the 6th SMW with a population of 9.65 aphids per 10 cm apical shoot, having been seen during the 2nd SMW at a population level of 0.92 aphids per 10 cm apical shoot (Table 1). The aphid population exhibits a non-significant negative (r= -0.082) and positive relationship with temperature minimum and sunshine hours, respectively. It also exhibits a significant positive association (r= 0.802) with temperature maximum and a significant negative correlation (r= -0.784) with RH I and RH II (Table 2). The outcome is consistent with the observations made by [10], who also noted the peak incidence during the sixth SMW and [11] Significant positive relation between aphids and temperature maximum and non-significantly with sunshine hours (r= 0.230). [12] A non-significant negative association of aphids with temperature minimum (0.067), [13] significant negative association with RH I (r= -0.814**), [14] significant negative correlation with RH II (r= -0.720**).

3.2 Leaf Webber

Leaf webber was first observed in the 49th SMW, when its population level was 0.88 larvae per plant, as shown in table 1. Their average population of 5.70 larvae per plant peaked during the third SMW, and it continued to grow until the sixth SMW, when it stood at 2.08 larvae per plant. Table 2 exhibits the data from the correlation study of leaf webbers. The population of leaf webbers was found to be non-significantly positively correlated with temperature maximum (r = 0.515), sunshine hours (r = 0.604) and RH II (r = -0.385), on-significantly negatively correlated with temperature minimum (r = -0.263) and RH I (r = -0.010). The results are in line with [15] Leaf webber had non-significant positive correlation with the maximum temperature (r=0.361), [1] non-significantly negative correlated with temperature minimum (r= -0.397), RH I (r=-0.658) and RH II (R= -0.282) and non-significantly positive correlated with the sunshine hours (r= 0.280) [16].

3.3 Mustard Sawfly

Sawflies were first observed in the 51st SMW, when there were 0.02 grubs per plant. The population peaked during the 52nd SMW at a population of 0.22 grubs per plant, however the population was only observed up until the first SMW, when rising temperatures caused it to disappear (Table 1). Sawfly incidence was non-significantly negatively correlated with temperature maximum as represented in the table 2 (r= -0.384), temperature minimum (r= -0.475), while non-significantly positively correrlated with the RH I (r=0.321), RH II (r=0.0.287) and sunshine hours (r= 0.452). It was found in accordance with [1], who reported peak

incidence of sawfly at 52nd SMW in mustard and a non-significant negative association with temperature maximum (r= -0.57) [17], sunshine hours (r= 0.170), non-significantly negative correlated with temperature minimum (r= -0.625) [18].

3.4 Painted Bugs

First recorded in the 49th SMW at 0.08 bugs per plant, painted bug incidence peaked in the 3rd SMW at 1.20 bugs per plant. The population of painted bugs showed no significant negative correlation with temperature minimum (r= -0.112), RH II (r= -0.112) and non-significant positive correlation with temperature maximum (r=0.119), RH I (r= 0.052), and sunshine hours (r= 0.309) (Table 1&2). The above results were similar with the findings of [19], who stated that painted bugs had a non-significant positive association with temperature maximum (r= 0.444), [20] non-significant negative association with temperature minimum (r= -0.358) and [21] non-significant negative association with RH II (r= - 0.055), non-significant positive correlation with sunshine hours (r= 0.154) [16].

3.5 Flea Beetle

The incidence of flea beetles began in the 49th SMW with a population of 1.08 beetles per plant, and it peaked in the 52nd SMW with a population of 1.78 beetles per plant (Table 1&2). The flea beetle population was significantly negatively correlated with temperature maximum (r = -0.755**), non-significantly negatively correlated

Table 1. Incidence of major insect pests in mustard in relation to weather parameters during *rabi*, 2023-24

SMW	Temperature (oC)		Relative Humidity (%)		Sunshine Hours	Mean population of insect pests per plant					
	Tmax	Tmin	RH I	RH II		Aphids/10 cm twig	Leaf webber/plant	Flea beetle/ plant	Painted bug/plant	Sawfly/plant	Coccinellids/ plant
49	29.60	20.70	76.90	58.30	3.10	0.00	0.88	1.08	0.08	0.00	0.00
50	30.80	19.30	81.60	60.10	6.60	0.00	3.84	0.74	0.18	0.00	0.00
51	28.50	18.20	81.40	60.00	4.60	0.00	0.30	0.98	0.00	0.02	0.00
52	29.30	15.80	81.00	57.60	7.50	0.00	2.26	1.78	0.20	0.22	0.02
1	29.86	15.60	79.29	53.00	7.56	0.42	2.96	0.90	0.06	0.06	0.02
2	29.49	16.06	78.00	54.00	4.40	0.94	2.30	0.78	0.10	0.00	0.01
3	30.83	17.03	76.29	49.71	7.03	2.02	5.70	0.10	1.20	0.00	0.06
4	30.69	17.37	76.57	50.57	6.50	3.96	3.66	0.14	0.02	0.00	0.22
5	31.10	17.67	76.57	48.43	5.43	8.85	3.54	0.01	0.00	0.00	0.16
6	32.44	17.26	62.71	42.71	6.49	9.65	2.08	0.00	0.00	0.00	0.00

Table 2. Correlation of insect pests in mustard with weather parameters during *rabi*, 2023-24.

Insect pests	Correlation coefficient (r)				
	Temperature (°C)		Relative Humidity (%)		Sunshine Hours
	Max.	Min.	RH (M)	RH (E)	
Aphid, *L.erysimi*	0.802^{**}	-0.082^{NS}	-0.784^{**}	-0.871^{**}	0.099^{NS}
Leaf webber,*C.binotalis*	0.515^{NS}	-0.263^{NS}	-0.010^{NS}	-0.385^{NS}	0.604^{NS}
Flea beetle, *P.cruciferae*	-0.775^{**}	-0.053^{NS}	-0.602^{NS}	0.779^{**}	-0.071^{NS}
Painted bug, *B. cruciferarum*	0.119^{NS}	-0.112^{NS}	0.052^{NS}	-0.112^{NS}	0.309^{NS}
Sawfly, *A. lugens proxima*	-0.384^{NS}	-0.475^{NS}	0.321^{NS}	0.287^{NS}	0.452^{NS}
Lady bird beetle, *C. septumpunctata*	0.288^{NS}	-0.103^{NS}	-0.023^{NS}	-0.396^{NS}	0.158^{NS}

with temperature minimum (r = -0.053), sunshine hours (r = -0.071), non-significantly positively correlated with RH I (r = 0.602), and significantly positively correlated with RH II (r = 0.799**), in line with the correlation data displayed in Table 2. The aforementioned findings were at contrast with those of [16], who also noted that the flea beetle peak occurrence occurred in the fourth SMW and negative significant association between flea beetle and temperature maximum (r= -0.539*) on mid late-sown, non-significant negatively with temperature minimum (r= -0.500), non-significant positively with RH I (0.777), significant positively with RH II (0.723**) on late sown mustard [22] and [16] non-significant negative correlation with sunshine hours (r= -0.114).

3.6 Coccinellids

Coccinellid incidence was recorded at 0.02 per plant during the 52nd SMW, and the maximum population was recorded at 0.22 during the 4th SMW (Table 1&2). The population was non-significantly positively correlated with the temperature maximum (r= 0.288), sunshine hours (r= 0.158) and non-significant negatively with temperature minimium (r = -0.103), RH-I (r = -0.023) and RH-II (r = -0.396), which was found in line with the [23], coccinellid incidence attained its peak in 4th SMW and non-significantly positively correlated with the temperature maximum (r =0.385) [24], non-significantly negatively associated with temperature minimum (r= -0.12) [25], non-significantly negatively correlated with RH-I (r= -0.221), RH-II (r = 0.448) and non-significantly positively correlated with sunshine hours (r= 0.275) [1].

4. CONCLUSION

The investigation's findings, taken together, indicate that the highest temperature has a positive but non-significant correlation with leaf webber, painted bugs, and coccinellids, a negative correlation with sawflies, a significant positive correlation with aphids and a negative correlation with flea beetles. The minimum temperature was non-significantly negative with leaf webber, aphids, painted bugs, flea beetles, sawflies and coccinellids. Morning relative humidity has a negative non-significant correlation with leaf webber, sawfly, and coccinellids and significant correlation with aphids, and a positive correlation with painted bug and flea beetles. Evening relative humidity was positive non-significant with leaf webber and sawfly, negative non-significant with painted bug and coccinellids, positive significant with flea beetle and negative significant with aphid. Leaf webber, aphids, painted bugs, sawflies, and coccinellids have positive correlations with sunshine hours, but flea beetles have non-significant negative correlations.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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