

SEASONAL INCIDENCE OF MAJOR INSECT PESTS IN RELATION TO ABIOTIC FACTORS IN MUSTARD

ABSTRACT

AIM: The present study was under taken to the know correlation between populations of major insect-pests with abiotic factors.

Study design: Randomized Block Design

Place and Duration of Study: AICRP on Groundnut, Main Agricultural Research Station and Department of Agricultural Entomology, Dharwad during *khariif* 2021 between July to October.

Methodology: The field experiment was conducted at Regional Agricultural Research Station (RARS), Palem using the variety DRMR IJ 31 in a randomized block design with spacing of 45cmx 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 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 (0.02 larvae/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 nonsignificant correlation with leaf webber, painted bugs and coccinellids, nonsignificant negative with sawfly, significant positive with aphid and negative with flea beetle. Minimum temperature was nonsignificant 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 nonsignificant 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 nonsignificant 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. India's mustard yields were lower than those of the world average of 1849 kg/ha as well as those of Germany (3811 kg/ha), China (1834 kg/ha), and Canada (1769 kg/ha) [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. Major pests include mustard aphid, *Lipaphis erysmi* (Kalt), mustard sawfly, *Athalia*

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lugens proxima (Klug), leaf webber, *Crociodolomia 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] (Kalasariya, 2016). *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.

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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 DRMR IJ 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 were taken timely from the start of the pest incidence to till harvest of the crop at weekly intervals (Standard Meteorological Week). The number of leaves webber larvae, sawfly larvae, 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 ten randomly chosen plants. 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, using the correlation analysis in OP STAT.

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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 outcome is consistent with the observations made by [10], who also noted the peak incidence during the sixth SMW. 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 above results were agreed with [11], who reported the 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 ($r = -0.720^{**}$).

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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].

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3.3 Mustard Sawfly

Sawflies were first observed in the 52nd SMW, when there were 0.02 larvae per plant. The population peaked during this same SMW, however the population was only observed up until the first SMW, when rising temperatures caused it to disappear (Table 1). It was found in accordance with [1], who reported peak incidence of sawfly at 52nd SMW in mustard. 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 correlated with the RH I ($r = 0.321$), RH II ($r = 0.0287$) and sunshine hours ($r = 0.452$). the findings were similar with [17], reported that sawfly incidence had a non significant negative association with temperature maximum ($r = -0.57$), while positively with 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 aforementioned findings were at contrast with those of [16], who also noted that the flea beetle peak occurrence occurred in the fourth SMW. The flea beetle population was significantly negatively correlated with temperature maximum ($r = -0.755^{**}$), non-significantly negatively correlated 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. These results were in line with [22], recorded the 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 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), which was found in line with the [23], coccinellid incidence attained its peak in 4th SMW. Coccinellids population was non significantly positively correlated with the temperature maximum ($r = 0.288$), sunshine hours ($r = 0.158$) and non-significant negatively with temperature minimum ($r = -0.103$), RH-I ($r = -0.023$) and RH-II ($r = -0.396$), 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].

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

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, <i>L.erysimi</i>	0.802**	-0.082 ^{NS}	-0.784**	-0.871**	0.099 ^{NS}
Leaf webber, <i>C.binotalis</i>	0.515 ^{NS}	-0.263 ^{NS}	-0.010 ^{NS}	-0.385 ^{NS}	0.604 ^{NS}
Flea beetle, <i>P.cruciferae</i>	-0.775**	-0.053 ^{NS}	-0.602 ^{NS}	0.779**	-0.071 ^{NS}
Painted bug, <i>B. cruciferarum</i>	0.119 ^{NS}	-0.112 ^{NS}	0.052 ^{NS}	-0.112 ^{NS}	0.309 ^{NS}
Sawfly, <i>A. lugens proxima</i>	-0.384 ^{NS}	-0.475 ^{NS}	0.321 ^{NS}	0.287 ^{NS}	0.452 ^{NS}
Lady bird beetle, <i>C. septumpunctata</i>	0.288 ^{NS}	-0.103 ^{NS}	-0.023 ^{NS}	-0.396 ^{NS}	0.158 ^{NS}

4. CONCLUSION

The investigation's findings, taken together, indicate that the highest temperature has a positive but nonsignificant 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. Along with leaf webber, aphids, painted bugs, flea beetles, sawflies and coccinellids, the minimum temperature was non-significantly negative. 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.

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REFERENCES

- [1]. Shaila O, Ramesh S, Reddy SS, Laxmi KV, Sujatha M, Raju CD.. Seasonal incidence of various insect pests in mustard crop and their relation with weather factors. *Pharma innov*, 2022;11(3): 612-616.
- [2]. Agricultural Statistics at a Glance. Government of India, Ministry of Agriculture and Farmers Welfare Department of Agriculture and Farmers Welfare, Economics and Statistics Division. 2022; pp.262.
- [3]. Kaur A, Grover DK. Trends in area, yield and production of major oilseeds in Punjab: District wise analysis. *Agril. Sit. India*, 2020;76(10):26-36.
- [4]. Sharma P, Singh Y P. Directorate of rapeseed and mustard, Indian Council of Agriculture Research, Sewar, Bharatpur (Rajasthan). *Ann Nat Lang Jrl*, 2020;1: 47-51.
- [5]. Kalasariya RL. Management of aphid, *Lipaphis erysimi* in mustard with different spray schedules. *IJPP*, 2016;44(1): 16-23.
- [6]. Rana JS. Performance of *Lipaphis erysimi* (Kalt.) (Homoptera: Aphididae) on different Brassica species in a tropical environment. *J Pestic Sci.*, 2005;78: 155-160.
- [7]. Furth DG. Survey and quantitative assessment of flea beetle diversity in a Costa Rican rainforest (Coleoptera: Chrysomelidae: Alticinae). *Special topics in leaf beetle biology*. Pensoft. 2003;1-24.
- [8]. Knodel JJ, Olson DL. Crucifer flea beetle biology and integrated pest management in canola. North Dakota State University, Fargo, Dakota. *Ext SerPub*, 2002;E-1234: p. 8.
- [9]. Singh HY, Gupta DS, Yadav TP, Dhawan K. Postharvest losses caused by painted bug (*Bagrada cruciferarum* Kirk.) to mustard. *HAU. J. Sci*, 1980;10(3): 407-409.
- [10]. Chand A, Khinchi SK, Kumawat KC, Hussain A, Sharma SL. Quantitative and qualitative status of insect pests of mustard, *Brassica juncea* (L.) Czern and Coss and their natural enemies. *Pharma innov*, 2021;11(1): 412-415.

- [11]. Sarkate RS. Varietal screening and population dynamics of major insect pests of mustard. Ph.D (Agri) Thesis Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India. 2014
- [12]. Pal S, Debnath P. Seasonal incidence of major insect pests and predators of mustard in lower gangetic plains of West Bengal. J. entomol. zool. Stud 2020;8(6): 1424-143.
- [13]. Dash L, onarand A. Population dynamics and efficacy of some insecticides against mustard Sawfly, *Athalia lugens proxima* (Klug.) on mustard. Int. j. curr. microbiol. appl. sci., 2019;8(8): 2998-3004.
- [14]. Patel PK, Singh SK, Chandra U, Kumar V, Omar V. Succession of insect pest complex in rapeseed mustard. j exp zool, 2022; 25(2): 1987-1991.
- [15]. Pawar VR, Bapodra JG, Joshi MD, Ghadge SM, Dalve SK. Incidence of leaf webber, *Crociodolomia binotalis* (Zeller) on mustard. Int. J. Plant Prot, 2010; 3(1): 130-131.
- [16]. Pratihari AKS, Sundria MM, Pandey S. Seasonal Incidence of Insect Pests of Mustard (*Brassica juncea* L.) and their Correlation with Weather Parameters: Mustard Insect Pest Incidence and Weather Parameters. Ann Arid Zon, 2024; 63(1): 73-77.
- [17]. Vinyas SN. Varietal screening and management of major insect pests of mustard (*Brassica juncea* L.). M.Sc (Agri) Thesis Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India. 2021.
- [18]. Pandey A, Kumar P, Singh S, Kumar A, Kumar M.. Seasonal incidence of different insect pests and natural enemy with relation to weather factors in mustard crop. Pharma innov, 2023;11(3): 612-616.
- [19]. Kashyap N, Painkra GP, Painkra KL and Bhagat PK. Insect-pests succession, natural enemies and their correlation with weather parameters in mustard crop. J. plant dev. Sci, 2018;10(10): 563-568.
- [20]. Singh G, Singh AK, Yadav SK, Giri SK, Verma K. Studies on correlation between populations of major insect-pests with abiotic factors. J. entomol. zool. Stud, 2018;6(4):1679-1681.
- [21]. Divya C, Kalasariya RL, Kanara HG. Seasonal incidence of mustard painted bug, *Bagrada hilaris* (Burmeister) and their correlation with abiotic factors on mustard. J. Insect Sci. 2015;28(1): 92-95.
- [22]. Kumar A, Mishra MK, Pandey R, Singh BK. Seasonal incidence of insect-pests complex of rapeseed at different sowing dates. J. Entomol. Res. 2023;47: 901-904.

[23]. Mishra SK, Kanwat PM. Seasonal incidence of mustard aphid, *Lipaphis erysimi* (Kalt) and its major predator on mustard and their correlation with abiotic factors. J. entomol. zool. stud. 2018;6(3): 831-836.

[24]. Patel RM, Chaudhari SJ, Rabari PH, Patel BC, Dodia DA. Incidence of aphid (*Lipaphis erysimi* Kalt) in mustard and their fluctuation with biotic and abiotic factors. J. entomol. zool. stud. 2019;7(5): 946-950.

[25]. Hugar PG, Anandhi P, Varma S, Sarvanan L. Seasonal incidence of important insect pests of mustard and their natural enemies in relation to weather parameters, in Allahabad region. J. Entomol. Res 2008;32(2): 109-112.

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