Annals of Arid Zone 63(1): 73-77, 2024

Seasonal Incidence of Insect Pests of Mustard (*Brassica juncea* L.) and their Correlation with Weather Parameters

Akshay Kumar Singh Pratihar, M.M. Sundria, Shalini Pandey* and Rahul Bhardwaj

Agriculture University, Jodhpur, Mandor 342 304, India

Received: April 29, 2023 Accepted: May 31, 2023

Abstract: Seasonal incidence of mustard insect pests and their correlation with weather parameters during Rabi, 2021-22 revealed that aphid [*Lipaphis erysimi* (Kalt.)], infestation began from 51st standard meteorological week (SMW) and reached at peak (126.20 aphid 10 cm^{-1} terminal shoot) on 4th SMW while the painted bug, *Bagrada hilaris* (Kirk.) infestation was observed twice during the cropping season. First infestation was recorded in 45th SMW (0.60 bugs $plant^{-1}$) and second infestation occurred from 8th SMW to 10th SMW (5.13 bugs $plant^{-1}$). The peak activity of the flea beetle, *Phyllotreta cruciferae* (Goeze) was noticed on 4th SMW (0.93 beetles $plant^{-1}$) whereas the leaf webber, *Crocidolomia binotalis* Zell. infestation reached to peak (2.87 larvae $plant^{-1}$) on 6th SMW. The mustard aphid exhibited a noteworthy negative correlation with minimum temperature, whereas it demonstrated a distinctly positive correlation with morning relative humidity (RH). Flea beetle and leaf webber were significantly negative correlated with minimum temperature. Painted bug was significantly positive with maximum temperature while significantly negative correlated with evening RH.

Key words: Mustard, seasonal incidence, correlation, weather parameters, insect pests.

Correspondence
Shalini Pandey
pandeyshalini80@gmail.com

Citation
Pratihar, A.K.S., Sundria, M.M., Pandey, S. and Bhardwaj, R. 2024. Seasonal incidence of insect pests of mustard (Brassica juncea) and their correlation with weather parameters. Annals of Arid Zone 63(1): 73-77

doi: 10.59512/aaz.2024.63.1.9

https://epubs.icar.org.in/index.php/AAZ/article/view/135752

In India, seven primary oilseed crops are cultivated, with rapeseed and mustard collectively contributing to approximately one-third of the total oilseed production in the country (Singh and Bansal, 2020). This places them in the second position, following groundnut, in terms of oilseed production. India covers acreage of 6.69 mha contributing 10.11 mt of production with the productivity of 1511 kg ha^{-1} (Anonymous, 2022a). The major mustard growing states in India are Rajasthan, Haryana, Madhya Pradesh, Uttar Pradesh, and West Bengal. Rajasthan occupies first position in area 3.59 mha and production 6.19 mt with the productivity of (1724 kg ha^{-1}) (Anonymous, 2022b). Rajasthan stands at fourth position in productivity after Haryana, Madhya Pradesh and Gujarat (Anonymous, 2022a). Several factors are responsible for lower production and productivity of mustard among which insect pests are the major constraints. More than three dozens of insect pests are known to be associated with rapeseed and mustard. Among them, aphid, *Lipaphis erysimi* (Kalt.); sawfly,

Athalia lugens proxima (Klug.); painted bug, *Bagrada hilaris* (Kirk.), leaf webber, *Crocidolomia binotalis* Zell., flea beetle, *Phyllotreta cruciferae* (Goeze) and leaf miner, *Phytomyza horticola* (Goureau) are insect pests of rapeseed and mustard (Sharma and Singh, 2010). In terms of economic importance, *L. erysimi* is regarded as a national pest, considered to be a major limiting factor in successful cultivation of the crop; reducing yield to the tune of 35.4-96.0% and oil content of 5-15% (Bakhetia and Arora, 1986; Bakhetia and Sekhon 1989; Rana 2005). Painted bug damage is more serious at seedling stage on mustard and causes losses at seedling stage varied from 26.8 to 70.8% whereas at the pod formation and maturity stages 30.1% losses in yield and 3.4% in oil content (Singh *et al*., 1980). Leaf webber is a serious pest causing yield losses of 13.2 to 81.8% (Ameta *et al*., 2005; Chauhan and Yadav, 2007). Patel *et al*. (2017) reported the damage caused by flea beetle.

However, with increase in cropping intensity and the changing patterns under different agro-climatic conditions, the pest complex of the crops has also been changed to a great deal. Seasonal abundance of insect pest provides not only information of initiation of the pest but also provides peak activity of particular pest. Biotic and abiotic parameters play a vital role in population build-up of insect pests. Singh *et al*. (2000) recorded the Coccinellid predators viz., *Coccinella septempunctata, C. transversalius, C. sexmaculata and Brumus suturalis* associated with mustard aphid infesting mustard crop. Among these, *C. septempunctata* and *C. transversalis* were important aphidiphagous predators of the mustard aphid. Correlation study helps in to provide either positive or negative association of pest population with biotic or abiotic factors. It allows growers to take timely action against insect pests in an efficient manner. Therefore, the present investigation was planned to identify the insect pests population fluctuations in relation to the weather parameters.

Materials and Methods

Experimental details

To study the seasonal incidence of insect pests of mustard, the field experiment was carried out on variety NRCHB – 101. The crop was sown in 3 m × 10 m plot size at spacing of 30 cm × 10 cm at Research Farm, Agricultural Research Station, Mandor during rabi 2021-22. The crop was grown as per the standard agronomic practices without using any control operations.

Observations recorded

The observations for painted bug, flea beetle, leaf webber and ladybird beetle were recorded from five randomly selected plants in each plot at weekly interval from their appearance to harvesting of the crop. At flowering stage, aphids were removed from 10 cm of the terminal shoot of 5 plants with the help of camel hair brush on a white paper sheet and total number of aphids were counted (Pal *et al*., 2018).

Statistical analysis

The simple correlation was computed between the population of aphid, painted bug, flea beetle, and leaf webber with weather parameters i.e., maximum, and minimum temperature (°C), average temperature (°C), morning relative humidity (%), evening relative humidity (%), average relative humidity (%), rainfall (mm) and bright sunshine (Hrs.).

Results and Discussion

In the present study, various insect pests viz., aphid, painted bug, leaf webber and flea beetle were observed (Table 1).

Population of aphid and its correlation with weather parameters

The aphid infestation initiated from 51st standard meteorological week (SMW) with the mean population of 23.67 aphids 10 cm^{-1} terminal shoot and remained till 9th SMW. The peak activity of aphid (126.20 aphids 10 cm^{-1}) was observed in 4th SMW. Similarly, Hasan and Singh (2011) reported that the incidence of *L. erysimi* initiated from 2nd SMW (0.44 aphids 10 cm^{-1} twig, 1.11 aphids 10 cm^{-1} cm twig) and reached to peak (207.22 aphids 10 cm^{-1} cm twig, 360.56 aphids 10 cm^{-1} cm twig) in 5th SMW during 2007-2008 and 2008-2009 crop seasons, respectively. Significant negative correlation of aphid was observed with minimum temperature (r = -0.573) while the correlation between aphid and morning RH was significant and positive (r = 0.593) (Table 2). These findings corroborate with the observations recorded by several workers who reported that aphid population was positively

Table 1. Seasonal incidence of mustard insect pests and weather parameters during incidence period

SMW*	Date of observation	Mean number of insect pests				Temp. (°C)		RH (%)		Rainfall (mm)	Bright Sunshine (Hrs.)
		Aphid	Painted bug	Flea beetle	Leaf webber	Min.	Max.	Morning	Evening		
		Per 10 cm of central shoot	Per plant								
45	Nov. 05, 2021	0.00	0.60	0.00	0.00	20.90	28.80	62.80	51.80	0.00	7.86
46	Nov. 12, 2021	0.00	1.07	0.00	0.00	16.90	26.30	70.80	68.10	0.00	7.32
47	Nov. 19, 2021	0.00	1.67	0.00	0.00	18.60	28.20	66.30	56.80	0.00	4.87
48	Nov. 26, 2021	0.00	3.60	0.00	0.20	17.90	25.40	75.60	55.80	0.00	9.02
49	Dec. 03, 2021	0.00	3.67	0.00	0.47	15.90	25.40	73.00	53.90	0.00	4.07
50	Dec. 10, 2021	0.00	3.93	0.00	0.87	13.40	23.00	80.60	55.90	0.00	8.51
51	Dec. 17, 2021	23.67	2.93	0.00	1.40	11.90	22.90	72.10	43.30	0.00	7.82
52	Dec. 24, 2021	40.47	2.00	0.00	1.00	13.40	20.60	82.70	77.60	3.40	4.56
1	Jan. 01, 2022	84.40	1.00	0.33	1.13	12.90	20.20	82.90	57.00	10.00	5.18
2	Jan. 08, 2022	78.67	0.00	0.47	1.40	10.90	16.10	88.10	69.70	0.00	6.00
3	Jan. 15, 2022	106.53	0.00	0.73	1.60	12.80	22.20	78.70	47.80	0.00	6.38
4	Jan. 22, 2022	126.20	0.00	0.93	2.00	11.70	19.80	84.80	56.10	6.00	7.04
5	Jan. 29, 2022	111.53	0.00	0.67	2.53	11.70	24.20	80.90	51.90	0.00	8.07
6	Feb. 05, 2022	98.13	0.00	0.47	2.87	14.40	23.80	78.60	53.40	0.50	8.84
7	Feb. 12, 2022	72.00	0.00	0.27	2.27	16.90	26.60	75.70	70.50	0.00	9.31
8	Feb. 19, 2022	36.33	2.20	0.13	1.27	17.70	28.90	59.70	46.40	0.00	9.20
9	Feb. 26, 2022	19.93	3.27	0.00	0.00	18.60	29.40	70.90	44.40	0.00	9.35
10	Mar. 05, 2022	0.00	5.13	0.00	0.00	21.60	33.60	58.90	27.10	0.00	9.18

*SMW = Standard Meteorological Week; Min: Minimum; Max: Maximum; Hrs: Hours; Temp: Temperature; RH: Relative humidity

correlated with morning and evening relative humidity while negatively correlated with minimum temperature (Lal *et al*., 2018; Pawar *et al*., 2010). The maximum temperature and bright sunshine were negatively non-significant correlated (r = -0.500) and (r = -0.343), respectively.

Population of Painted bug and its correlation with weather parameters

The bug infestation was initiated early on the crop when crop was 5-7 days old i.e., 45th SMW. Two peaks of bug infestations were observed, firstly it increased till 50th SMW i.e., 3.93 bugs plant^{-1} and then it was decreased and no bugs were seen on plants during 2nd SMW to 7th SMW. No bug infestation occurred on crop during flowering and pod emerging stage, when the crop reached to maturity, then bugs infestation occurred again and reached to the second peak level at harvesting i.e., 5.13 bugs plant^{-1} during 10th SMW. Similarly, Pal *et al*. (2018) reported that the activity of painted bug appeared two times i.e. 45th - 52nd SMW and 6th - 12th SMW. Painted bug population significantly positive correlated with maximum temperature (r = 0.491) while it was significantly negative correlated with evening relative humidity (r = -0.485). Similarly, Lal *et al*. (2018) reported significantly positive correlation of painted bug with maximum temperature (r = 0.48).

Population of Flea beetle and its correlation with weather parameters

The flea beetle infestation was initiated in 1st SMW and continued till 8th SMW. The peak activity of flea beetle was observed in 4th SMW and reached to the level of 0.93 beetles plant^{-1}. Lal *et al*. (2018) reported that seasonal incidence of flea beetle was started on 47th SMW and attained its peak during 52nd SMW. Kashyap *et al*. (2018) also reported that the flea beetle population commenced at initial stage of the mustard crop from 1st week of December with 2.4 beetle plant^{-1} and peak infestation was 15.8 beetle plant^{-1} in 1st week of February (6th SMW).

Table 2. Correlation coefficient of the mustard insect pests with weather parameters

Particulars	Correlation coefficient (r)			
	Insect pests			
	Aphid	Painted bug	Flea beetle	Leaf webber
Minimum temperature (°C)	-0.573*	0.445	-0.692*	-0.552*
Maximum temperature (°C)	-0.534	0.491*	-0.460	-0.332
Average temperature (°C)	-0.561*	0.482*	-0.564	-0.439
Morning RH (%)	0.593*	-0.460	0.486	0.383
Evening RH (%)	0.327	-0.485*	-0.201	0.101
Average RH (%)	0.467	-0.532*	0.097	0.255
Rainfall (In mm)	0.346	-0.226	0.123	0.081
Bright Sunshine (Hrs.)	-0.343	0.154	-0.114	0.280

*Significant at 5% level

The flea beetle population was significantly negative correlated with minimum temperature (r = -0.692).

Population of leaf webber and its correlation with weather parameters

The leaf webber infestation initiated in 48th SMW (0.20 per plant) and the peak activity of larvae (2.87 larvae plant^{-1}) was observed in 6th SMW. Shaila *et al*. (2022) reported that the pest was present during the entire crop period and attained its peak (3.76 webs/plant) at 52nd SMW. Sarkate (2014) also reported mustard leaf webber infestation at 2nd SMW and increased till 10th SMW. The significant but negative correlation between leaf webber and minimum temperature (r = -0.552) was observed. Similarly, Shaila *et al*. (2022) reported that the leaf webber incidence was negatively correlated with temperature and morning RH.

Conclusion

Conclusively, the results of present investigation suggested that aphid population increased with minimum temperature while it raised with increased morning RH. Likewise, painted bug population build up occurred with increased maximum temperature while it reduced with increased evening RH. Further, the population of leaf webber and flea beetle was higher when minimum temperature dropped.

References

Ameta, O.P., Srivastava, A.K. and Sharma, K.C. 2005. Efficacy of seed treatment against sawfly *Athalia lugens proxima* (Klug.) and painted bug, *Bagrada cruciferarum* Kirk. in mustard *Brassica campestris* (L.). *Pestology* 29(1): 9-13.

Anonymous 2022a. Agriculture statistics at a glance 2021. Ministry of agriculture and farmer welfare, Department of Agriculture Cooperation, Government of India, New Delhi pp.1-430.

Anonymous 2022b. *Rajasthan Agriculture Statistics At A Glance 2020-21*. Commissionerate of Agriculture, Rajasthan, Jaipur pp.1-105.

Bakhetia, D.R.C. and Arora, R. 1986. Control of insect pests of toria, sarson and rai. *Indian Farming* 36: 41-44.

Bakhetia, D.R.C. and Sekhon, B.S. 1989. Insect pests and their management in rapeseed-mustard. *Journal of Oilseeds Research* 6: 269-273.

Chauhan, R. and Yadav, J.L. 2007. Bio efficacy and persistence of some insecticides against painted bug, *Bagrada hilaris* (Burm.). *Agricultural Science Digest* 27(1): 71-72.

Hasan, W. and Singh, C.P. 2011. Field assessment of mustard aphid, *Lipaphis erysimi* (Kalt.) on cultivars of Indian mustard (*Brassica juncea* L.). *Annals of Plant Protection Sciences* 19(1): 51-54.

Kashyap, N., Painkara, G.P., Painkara, K.L. and Bhagat, P.K. 2018. Insect-pests succession, natural enemies and their weather parameters in mustard crop. *Journal of Plant Development Science* 10(10): 563-568.

Lal, B., Nayak, M.K., Srivastava, A.K. and Tomar, D.S. 2018. Seasonal incidence of major insect pests of mustard and their natural enemies. *International Journal of Chemical Studies* 6(3): 3658-3661.

Pal, S., Singh, D.K. and Umrao, R.S. 2018. Population dynamics of insect pests in mustard and eco-friendly management of *L. erysimi* (Kalt.) in Uttrakhand. *International Journal of Current Microbiology and Applied Sciences* 7(7): 324-331.

Patel, S., Singh, C.P. and Yadav, S.K. 2017. Seasonal incidence of mustard flea beetle, Phyllotreta cruciferae on *Brassica* species in relation to weather parameters at different dates of sowing.

Journal of Entomology and Zoology Studies 5: 673-677.

Pawar, V.R., Bapodra, J.G., Joshi, M.D. and Ghadge, S.M. 2010. Population dynamics of aphid *Lipaphis erysimi* (Kalt.) on mustard. *Agricultural Science Digest* 30(3): 221-223.

Rana, J.S. 2005. Performance of *Lipaphis erysimi* (Kalt.) (Homoptera Aphididae) on different *Brassica* species in a tropical environment. *Journal of Pesticide Science* 78: 155-160.

Sarkate, R.S. 2014. Varietal screening and population dynamics of major insect pests of mustard. *Master's Thesis, submitted to Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani*. India 431402 pp. 1-57.

Shaila, O., Ramesh, S., Reddy, S.S., Vijaya Laxmi, K., Sujatha, M. and Raju, C.D. 2022. Seasonal incidence of various insect pests in mustard crop and their relation with weather factors. *The Pharma Innovation Journal* 11(3): 612-616.

Sharma, P. and Singh, Y.P. 2010. Directorate of rapeseed and mustard, Indian Council of Agriculture Research, Sewar, Bharatpur (Rajasthan). *Annual National Language Journal* 1: 47-51.

Singh, H.Y., Gupta, D.S., Yadav, T.P. and Dhawan, K. 1980. Postharvest losses caused by painted bug (*Bagrada cruciferarum* Kirk.) to mustard. *HAU Journal of Research* 10: 407-409.

Singh, L. and Bansal, S. 2020. Status of rapeseed and mustard crop in India: Trend and decomposition analysis. *Journal Krishi Vigyan* 8(2): 279-284.

Singh, N.N., Rai, S. and Rai, S. 2000. Relative abundance of different coccinellids in mustard ecosystems. *Indian Journal of Entomology* 62: 422-426.

Printed in March 2024