Journal of Advanced Zoology
ISSN: 0253-7214
Volume 45 Issue S1 Year 2024 Page 342-347

Impact of Biotic And Abiotic Factors on *Lipaphis Erysimi* (Kalt.) on Organic Mustard Crop of Terai Region, Kumaun, Uttrakhand.

Meera Rawat[1*], Prof. S. N. Rao[2], Champa Negi[3], Dr. Pawan Kumar[4]

[1]Department of Zoology, Bio-control Laboratory, Radhe Hari Post Graduate Collage, Kashipur, Uttarakhand (India) -244713.ORCID ID-0009-0001-7383-3041*
[2]Department of Zoology, Bio-control Laboratory, Radhe Hari Post Graduate College, Kashipur, Uttrakhand (India) - 244713.Email: mrawatzoology@gmail.com
[3]Department of Economics, S. S. J. Campus/University Almora, Uttrakhand (India) - 263601. Email:chp.negi94@gmail.com
[4]Department of Sociology, S.S.S.T.S.R Government Degree College, Nainidanda, Uttrakhand (India)- 246277. pawankumar.kumar235@gmail.com

***Corresponding Author:** Meera Rawat*
**Email: meerarwt657@gmail.com*

Abstract

The current study was conducted in the organic crop field Mustard is an economically significant crop for farmers in three different blocks in terai region, Kumaun, Uttrakhand. Sowing was done on the first week of November in 2020 and first aphid infestation was seen after one month of sowing. The maximum number of aphid reaches in 2nd week of January 2021. *Lipaphis erysimi* (aphid) population shows a negative correlation with temperature while humidity is non-significant in all three sites. *Coccinella septempuncata* (natural enemy) is positively associated with aphid numbers and was first seen after 2 week of aphid infestation.

Keywords: Organic, Economy, Agriculture, Pest, and Natual enemy.

Introducton-

Mustard is an essential crop of Kumaun as it is significant to farmers' livelihoods. It is acknowledged for its pungent oil which is extracted from its seeds. It is the 2nd most edible oilseed in India after groundnut and accounts for 30% of total oilseed produced in country (Dwivedi *et al.* 2018). It is sometimes also used as vegetable, medicine and fodder (Chandrashekhra *et al.* 2024). It plays an important role in national farming economy as it share about 13% of the country's gross cropped area, contribute about 5% of the gross national product and 11% of value of agricultural products (Singh and Sinhal, 2011).Organic farming is the form of cultivation in which using only organic fertilizers and minimizing the use of pesticide. This type of farming benefits for environment, ecology, soil and human health also. Uttrakhand is the first state of India which introduced an organic agriculture act, 2019 to promote the organic farming in the state and to regulate the sale of chemical and synthetic fertilizers, and pesticide etc. The major problem in organic farming is to control the pest population since pesticides are not used to protect crops from pests, controlling the

population of pests is the main challenges in organic farming. It is very important to know the population dynamics so that farmers could apply best IPM for pest management. *Lipaphis erysimi* (Kalt.) is a destructive pest of Mustard, feeding voraciously on it, which impacts on almost every aerial part of the plant, result in financial loss to the farmers. It is responsible for 35.4-96% yield loss of mustard depending upon the weather condition (Kalasariya and Parmar, 2018). There are numerous abiotic factors which influence aphid population such as- temperature, humidity, and rainfall (Sinha *et al.* 1989; Singh *et al.* 2000; Malik and Sachan, 2013) and its natural predator such as *C. septempunctata*. Das *et al.* (2019) observed that weather parameter plays 72-87 variation in aphid population. Abiotic factor plays an important factor affecting insect development, survival and reproduction (Kumar *et al.* 1999; Vekaria and Patel, 2000).Studying the *Lipaphis erysimi* (Kalt.) population and how it relates to biotic and abiotic factors is crucial to minimize the economic loss.

MATERIAL AND METHOD-

Population of *Lipaphis erysimi*(Kalt.) on mustard plant was recorded form terai region of Kumaun in 2020-2021 from organic farmers fields from three villages of three different block including- Ramnagar (Shankarpur), Kashipur (Neejhra), and Bazpur (Chakarpur) at 15 days of interval. 1 hectare area was selected from three distinct villages and 5 quadrat of 1 square meter was set randomly in the field. 10 plants were chosen at random from each quadrat and 3 leaves were chosen from top, middle and bottom. The Average quantity of aphids and their natural enemy was counted. Meteorological data was collected from the nearest meteorological station of the collection date and average was calculated. Correlation and regression analysis was done for statistical analysis.

RESULT AND DISCUSSION-

Data show that aphid population was first appeared on the crop after 3rd week of sowing about 1 aphid per leaf for site 1st (Ramnagar) and 3rd (Bazpur) while site 2nd (Kashipur) have good number of aphid about 17 aphid per leaf. Peak aphid population on mustard reaches after 10 week of sowing average about 79, 72, and 80 per leaf on site 1, site 2 and site 3 respectively while Das *et al.* (2019) found that the aphid population was reached at peak after 15 week of sowing. The average number of *C. septempunctata* reaches at peak with aphid population about 23, 19, and 21 for site 1, site 2 and site 3 respectively. The correlation matrix for aphid and *C. septempunctata* show strong positive correlation for all the three sites. Thus the population of aphid as increases the number of *C. septempunctata* also increases as the availability of food for survival. As the number of aphid decreases the number of *C. septumpunctata* also decreases as the scarcity of food. The correlation matrix(pearson) indicates that temperature have highly negative correlation with aphid number in three different sites (-8.37**) for site 1 (Ramnagar) table 1, -0.921** for site 2 (Kashipur) table 2, and -0.711* for site 3 (Bazpur) table 3. As the temperature increases the number of aphid decreases in all three sites while humidity show non-significant but positive correlation with aphid number (0.659^{NS}) for site 1 (Ramnagar) table 1., (0.260^{NS}) for site 2 (Kashipur) table 2, and 0.647^{NS} for site 3 (Bazpur) table 3. *Conccinella septempunctata* was significantly positive correlation with aphid number 0.943** for site 1 (table 1), 0.934** for site 2 (table 2), and 0.932** for site 3 (table 3). Similar results were found by Shukla and Kumar (2024) that the infestation of *Lipaphis* was first recorded last week of December to first week of March and the peak pest population was reached in the second week of February. Dostara *et al.* (2022), Das *et al.* (2019) and Ali and Rizvi (2012) found the negative correlation between aphid and temperature while strong and positive correlation between aphid and *C. septempunctata* and mustard aphid *L. erysimi*. Similar result was also observed by Singh *et al.* (2000) Kulkarni *et al.* (2001) and Kumar *et al*. (2024). Samantray *et al.* (2024) found negative correlation of *Lipaphis erysimi* population with all the weather parameters like temperature and humidity. Thus the result indicates strong impact of abiotic and biotic component on aphid (*Lipaphis erysimi*) population in terai region of Kumaun.

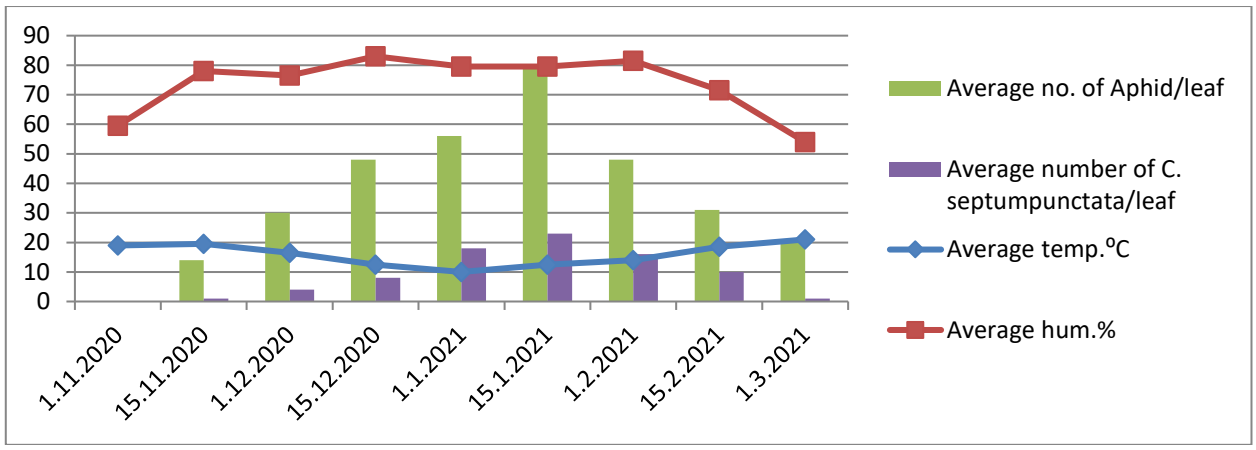


Fig. 1. Population dynamics of Aphid (*Lipaphis erysimi*) and *C. septumpunctata* on Mustard crop (Site 1).

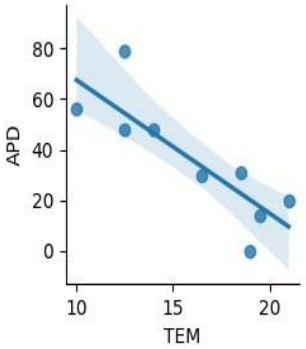


Fig.2

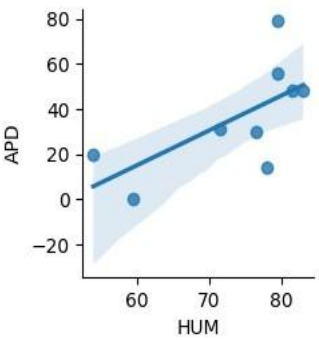


Fig. 3

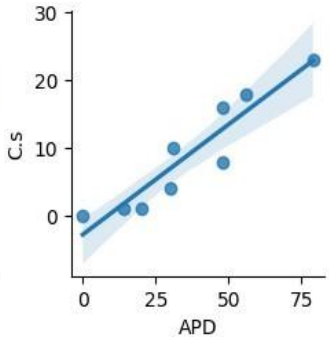


Fig. 4

Fig. 2 Scatter plot between aphid (APD) and temperature (TEM) for site 1 (Ramnagar).
Fig. 3 Scatter plot between aphid (APD) and humidity (HUM) for site 1 (Ramnagar).
Fig. 4 Scatter plot between *C. septumpunctata* (C.s) and Aphid (APD) for site 1 (Ramnagar).

Variables	Correlation Matrix (pearson) with aphid
TEM	-0.837^{**}
HUM	0.659^{NS}
C.s.	0.934^{**}

(*=significant at5%, **=significantat1%and ^{NS}=non-significant).

Table 1. Correlation metrix between meteorological parameters and Aphid population (site 1).

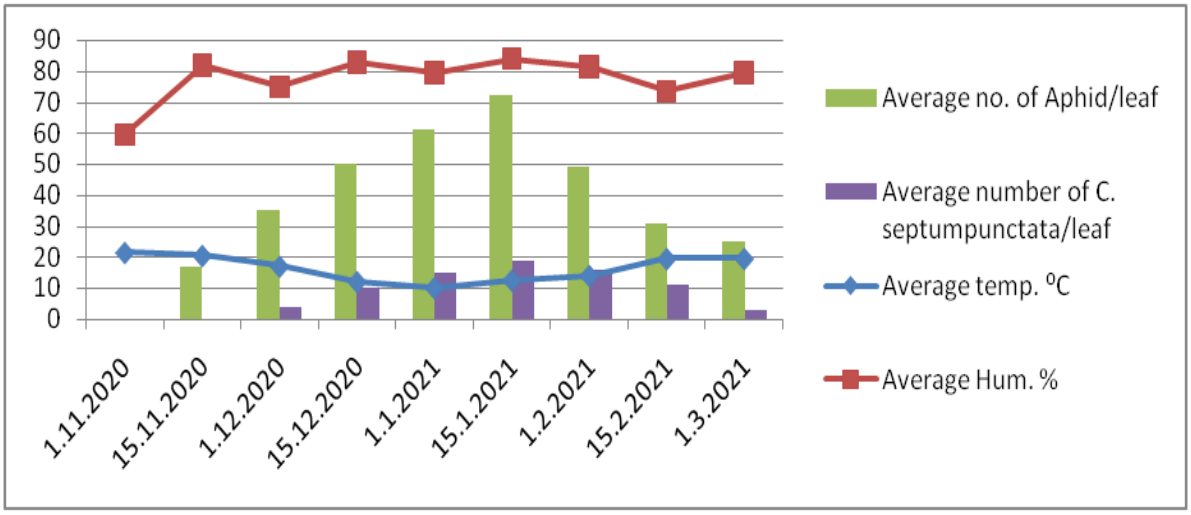
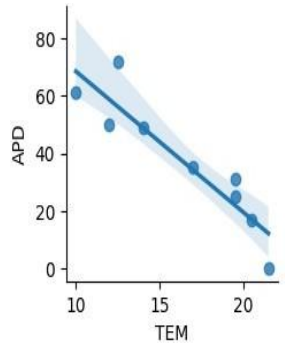
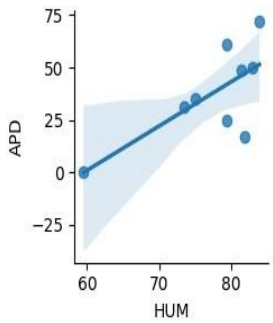


Fig. 5 Population dynamics of Aphid (*Lipaphis erysimi*) and *C. septumpunctata* on Mustard crop (Site 2).





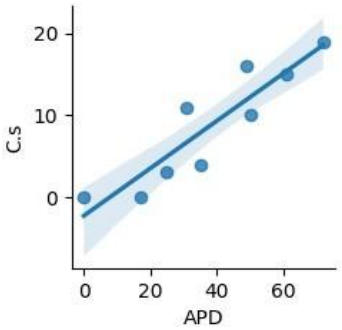


Fig. 6 Fig. 7 Fig. 8

Fig. 6 Scatter plot for aphid (APD) and temperature (TEM) for site 2 (Kashipur).
Fig. 7 Scatter plot for aphid (APD) and humidity (HUM) for site 2 (Kashipur).
Fig. 8 Scatter plot for *C. septumpunctata* (C.s) and aphid (APD) for site 2 (Kashipur).

Variables	Correlation Matrix (pearson) with aphid
TEM	-0.921^{**}
HUM	0.260^{NS}
C.s	0.909^{**}

*=significant at 5%, **=significantat1%and ^{NS}=non-significant

Table 2. Correlation metrix between meteorological parameters and Aphid population (site 2).

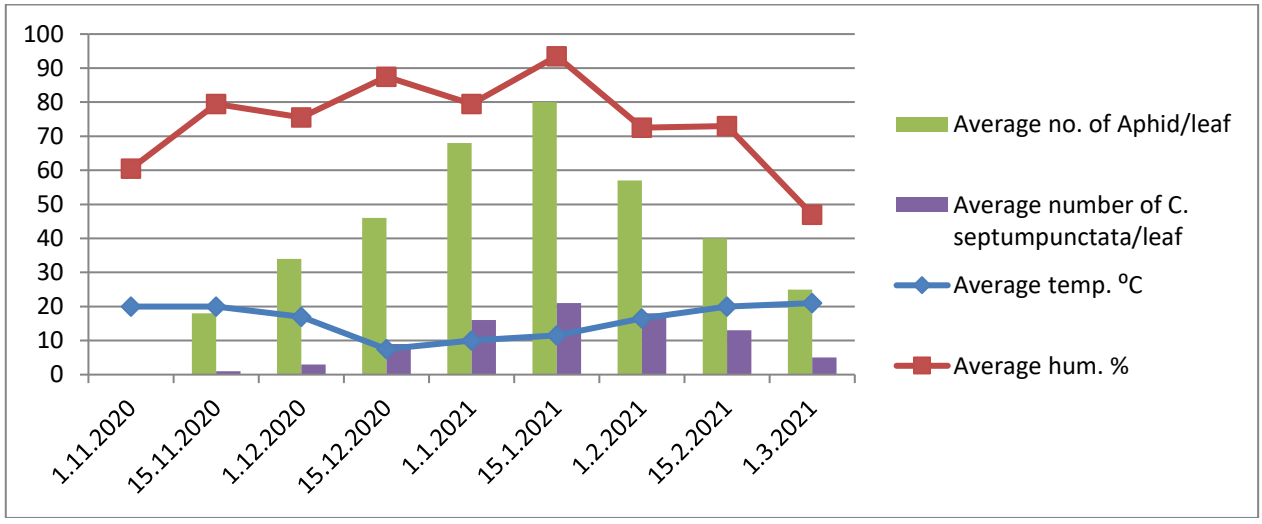
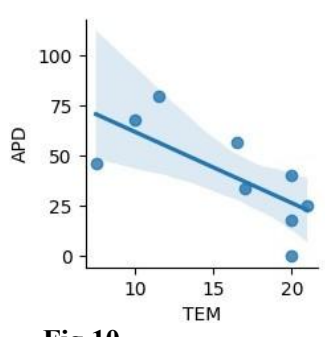
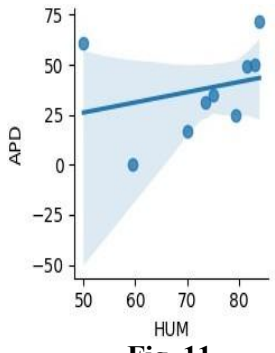


Fig. 9 Population dynamics of Aphid (*Lipaphis erysimi*) and *C. septumpunctata* on Mustard crop (Site 3).





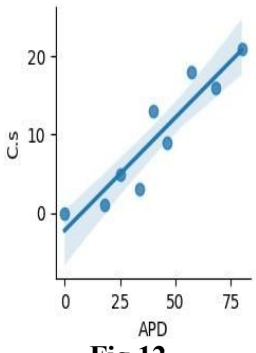


Fig.10 **Fig. 11** **Fig.12**

Fig. 10 Scatter plot between aphid (APD) and temperature (TEM) for site 3 (Bazpur).
Fig. 11 Scatter plot between aphid (APD) and humidity (HUM) for site 3 (Bazpur).
Fig. 12 scatter plot between *C. septumpunctata* (C.s) and aphid (APD) for site 3 (Bazpur).

Variables	Correlation Matrix (pearson) with aphid
TEM	-0.711^{*}
HUM	0.647^{NS}
C.s	0.932^{**}

*=significant at5%, **=significantat1%and ^{NS}=non-significant

Table 3. Correlation metrix between meteorological parameters and Aphid population (site 3).

REFERENCES-

1. Chandrashekara, K. M., Suroshe, S. S., Singh, P. K., Chander, S., & Kumar, P. V. (2024). Life table and demographic parameters of mustard aphid, *Lipaphis erysimi* (Kaltenbach)(Hemiptera: Aphididae) on five brassicaceous host crops. *Current - Science*, *126*(1), 77-84. doi: 10.18520/cs/v126/i1/77-84.
2. Das S, Tejani D. N., Patel J. C., Desai A. G., Desai A. I. and Gangwar G. P.(2019). Effect of weather parameters on population dynamics of mustard aphid. *International Journal of Current Microbiology and Applied Science 8*(4), 1648-1653.https://doi.org/10.20546/ijcmas.2019.804.192.
3. Dotasara S. K., Kumawat K. C., and Swami D. (2022). Population Dynamics of Mustard Aphid *Lipaphis erysimi* (Kaltenbach) and its Natural Enemies. *Indian Journal of Entomology*, *84*(4), 979–980. https://doi.org/10.55446/IJE.2021.10
4. Dwivedi S. A., Singh R. S., and Gharde S. K. (2018). Populations build up of mustard aphid and their natural enemies in relation to biotic and abiotic factors.*Plant Archives, 18*(2), 2495-2500.
5. Kalasariya, R. L., and Parmar, K. D. (2018). Impact of weather parameters on population dynamics of mustard aphid, *Lipaphis erysimi* (Kaltenbach) under south saurashtra zone. *Journal of Insect Science*, *31*(1-2), 51-56.
6. Kulkarni A., andPatel, I.S. (2001). Seasonal abundance o of mustard aphid (*Lipaphis erysimi*) and associated bioagents in Indian mustard (*Brassica juncea*) crop. *Indian Journal of Agriculture Science, 71*, 681-682.https://epubs.icar.org.in/index.php/IJAgS/article/view/40406.
7. Kumar J., Malik Y.P. and Singh S.V. (1999). Forecasting models for outbreak of *Lipaphis erysimi* on some cultivars of mustard, Brassica juncea. *Indian Journal of Entomology, 61,* 59-64.
8. Kumar A., Mishra M.K., Pandey R., Singh A.K., Singh, B.K., and Singh S.K. (2024). Population Dynamics of Mustard Aphid in Relation to Weather Parameters and Effect of Predators on Aphid Population. *Indian Journal of Ecology*, *51*(2), 397-400.https://doi.org/10.55362/IJE/2024/4249.
9. Malik R., and Sachan S. K. (2013). Popualtion build up of mustard, *Lipaphis erysimi* (Kalt.) on Indian mustard in relation to some abiotic factors. *Progressive Agriculture,13*(1), 153-157.https://www.banglajol.info/index.php/PA.
10. Samantaray, P., and Singh, R. N. (2024). Population dynamics of mustard aphid (*Lipaphis erysimi*) Kalt. and ladybird beetle (*Coccinella septempunctata* l.) and their correlations with weather parameters. *Journal of Experimental Zoology India, 27*(1), 969.
11. Singh S.V., Kumar J., Malik Y.P., and Bisen R.S. (2000). Determination of economic threshold of *Lipaphis erysimi* (Kaltenbach) in relation to weather parameters. *Indian Journal of Entomology, 62*, 196-202.https://www.cabidigitallibrary.org/doi/full/10.5555/20013021305.
12. Sinha R P, Yazdani S. S., and Verma G. D. (1989). Population dynamics of mustard aphid *Lipaphis erysimi* (Kalt) in relation to ecological parameters. *Indian Journal of Entomology,51*(3), 334-339.https://www.cabidigitallibrary.org/doi/full/10.5555/19901149624.

13. Singh P, and Sinha V. K. (2011). Effect of Aphid infestation on the Biochemical Constituents of Mustard (*Brassica juncea*) plant. *Journal of Phytology,3*(8), 28-33.http://www.scholarjournals.org/.
14. Shukla A., and Kumar A. (2024). Population Dynamics of Mustard Aphid *Lipaphis erysimi*(Kalt) and its Coccinellid Predators. *Indian Journal of Entomology*, *86*(3), 909-911. https://doi.org/10. 55446/ IJE.2024.1553.
15. Vekaria M.V. and Patel G.M. (2000). Screening of promising Brassica and allied genotypes for resistance against mustard aphid (*Lipaphis erysimi* Kalt.) (Homoptera: Aphididae). *Applied Biological Research, 4*, 75-77.