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Population dynamics of mustard aphid *Lipaphis erysimi* (Kalt.) In relation to weather parameters

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Abstract
Mustard aphid *Lipaphis erysimi* (Kalt.) is a most serious pest, considered as a limiting factor in the cultivation of mustard crop causing 35-96% reduction in yield depending upon weather conditions. Studies were conducted on the population dynamics of mustard aphid on mustard (*Brassica juncea* L.) variety Varuna in relation to weather parameters (Temperature and Relative humidity) in rabi cropping season during 2015-16 at experimental field of Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh (Uttar Pradesh). The natural appearance of mustard aphid was observed from 3rd standard week and lasted up to 11th standard week. The study revealed that population of mustard aphid reaches its peak in 7th standard week showing significant positive correlation with maximum temperature and negative correlation with relative humidity.

Keywords: mustard aphid, population dynamics, correlation, weather parameters

1. Introduction
Mustard crop is of multifarious use providing oil, leafy vegetables, oil cake and also used for various purpose and have immense nutritive value. India is the fourth leading producer of mustard contributing around 11% of world's total production. Rajasthan and Uttar Pradesh have emerged as the major mustard growing state in India. In India during 2017-18 total oilseed production was approximately 31.31million tones as per the Fourth Advance Estimates by Ministry of Agriculture, Government of India. This crop is highly vulnerable to a large number of insect pests. Among all the insect pests, mustard aphid, *L. erysimi* is the most serious pest and considered as a limiting factor in the cultivation of this crop, causing 35-90% reduction in yield [1, 2]. Both nymphs and adults suck the sap from leaves, buds and pods leading to the stunted growth of the plants. Curling may further occur in infested leaves and at advanced stage plants may wither and die. Plants remain stunted and sooty molds grow on the honey dew excreted by the insects [3]. Further due to feeding of insect, plant becomes weak and this pest also acts as a vector of number of plant viruses. Host plant, microclimate and natural enemies are the important factor that affects the growth rate of the crop and migration of pest [4]. Environmental parameters such as temperature, relative humidity, and rainfall plays an important role in population build-up and disappearance of *L. erysimi* [5]. It has been experienced in the recent past that due to the climate change, the life cycle of *L. erysimi* greatly altered in various ways and also affect the insect-plant interaction. Very often, it has resulted in increasing herbivore pressure on plants [5-7]. Results of modeling studies carried by Whittaker & Tribe [9] concluded that the temperature is linked with the density of sucking pest. Whereas, in other study it was reported that the lifecycle and population build up of aphids depends upon the thermal requirement and host specificity [9]. It is therefore, essentially required to gather information on population trends of, *L.erysimi vis a vis* weather parameters i.e., temperature and relative humidity particularly.

2. Materials and Methods
To study the incidence of mustard aphid an experiment was conducted during rabi season of 2015-16 for which mustard variety Varuna was sown in the experimental field of Faculty of Agricultural Sciences, AMU, Aligarh with plot size of 4×3m^2 and the spacing of 30×10 cm between row to row and plant to plant in randomized block design (RBD) with 6 replications. All agronomic practices were followed to raise the crop except the plant protection measures.

Weekly observations were recorded on the population of aphids on mustard throughout the cropping season. The crop was monitored regularly from 3rd standard week till the maturation of crop. For recording population of mustard aphid, 10 plants were randomly selected from each replication and the population of mustard aphid was recorded at weekly interval. For counting the number of aphid samples were taken by selecting top 10 cm apical twigs which were cut and brought to the laboratory by placing them in a polythene bags separately for each plant removed with the help of camel hair brush on white paper sheet and counting was done. To determine the correlation analysis of aphid population with abiotic factors, weekly meteorological data (Maximum, Minimum, Temperature and Relative Humidity) was collected from meteorological stations, Department of Physics, Aligarh Muslim University, Aligarh, India and analysis was done using SPSS 16 software.

3. Result and Discussion

Population dynamics of *L. erysimi* was determined on mustard from 14th January 2016 to 10th march 2016. The population was first recorded as 72 aphids per 10 cm shoots on 14th January i.e., 3rd Standard week. During this period the temperature fluctuated from 18.40 to 22.37 °C and relative humidity was between 67.14 and 98 per cent. Subsequently, population of aphids gradually increased upto 28th January 2016 and afterward abruptly increased and reached the peak at 7th standard week i.e., 11th February 2016, with an average population of 153 aphids per terminal shoot. During this period the temperature fluctuated from 9.5 to 23.42 °C and relative humidity was between 52.14 and 85.42 per cent. Thereafter, population of aphids declined gradually upto 11th standard week i.e., 10th March 2016 and then completely disappeared.

Table 1: Population dynamics of mustard aphid, *Lipaphis erysimi* in relation to weather parameters during Rabi season.

Standard weeks	Temperature(Cº)		Humidity(RH) Per cent		No. of aphids/plant
	Maximum	Minimum	Maximum	Minimum	
3	22.37	18.40	98.00	67.14	72.00
4	15.67	7.51	95.00	82.00	82.00
5	18.31	6.22	96.28	74.28	88.00
6	23.31	10.71	83.00	56.42	144.80
7	23.42	9.50	85.42	52.14	153.00
8	24.51	11.77	74.28	52.57	149.00
9	26.85	13.51	77.71	49.85	133.40
10	29.48	15.05	76.85	45.57	124.00
11	29.74	16.51	74.14	44.57	108.00

This sudden increase in population may be attributed to the favorable prevailing temperature and relative humidity during this period for the population buildup and development of aphids. The incidence, growth and multiplication of *L. erysimi* are largely influenced by meteorological parameters like temperature, relative humidity, rainfall [10]. The report of present study is in conformity with the findings of Davis *et al*. [11] and is also explained that survivorship of *Myzus persicae* increased to maximum at 25 °C and then decreased as temperature increased. However, maximum survivorship at 25 °C in case of *Aphis gossypi* [12].

Similar observations were taken by Kumar *et al*. [5] who reported that aphid appeared in the 3rd standard week during end of January then increase and reached its peak in 7th standard week. These results are also at par with the results of Singh and Lal [2] who reported that appearance of mustard aphid population started from 2nd week of January and reached its peak in 8th standard week.

Table 2: Correlation of population of mustard aphid with weather parameters.

Avg. Popu. on Mustard vr. Varuna	Max. Temp.	Min. Temp.	Max. RH	Min. RH
Varuna	0.431	-0.122	-0.718	0.664

Max.= Maximum, Min.=Minimum *Significant at 0.05% level, **Significant at 0.01%.

The seasonal abundance of *L. erysimi* was subjected to Pearson's correlation test that showed a significant correlation with environmental conditions. The data presented in table 2 indicated that the population of aphids exhibited significant negative correlation with maximum humidity (- 0.718) and positive correlation with minimum humidity (0.664). Whereas, positive significant correlation (0.431) with maximum temperature and negative significant correlation (-0.122) with minimum temperature. Thus, it could be concluded that increasing temperature and decreasing humidity are responsible for escalation of aphids population. These results are in accordance with the results of Kumar *et al*. [5]; Hasan *et al*. [13]; Singh and Lal [2] and Abbas *et al*. [14], who reported that the aphid population was noticed to be positively governed by temperature. Whereas, relative humidity had shown negative effect. Further, sunshine, wind velocity and evaporation too play an important role in population build up of mustard aphid [15]. Moreover, peak population of aphid is synchronized with flowering stage of the crop.

4. References

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