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## Effect of various environmental parameters on population of mustard aphid (*Lipaphis erysimi* Kalt.)

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### Abstract

Pusa Mustard -25 was sown as test crop. Sowing of crop was done on November 30<sup>th</sup> for two experimental years namely: 2017-18 and 2018-19. The incidence of *Lipaphis erysimi* Kalt. on mustard started from fourth standard week in both the years i.e. 2017-18 and 2018-19 at Tirhut College of Agriculture Dholi, Muzaffarpur. The incidence of mustard aphid started from fourth standard week during both the experimental years (2017-18 & 2018-19). Initially *Lipaphis erysimi* Kalt. was less in number (8.2 in 2017-18 and 7.2 in 2018-19) but gradually the insect population started increasing very fast. Mustard aphid population attained its peak (222.4) during tenth standard week in the first year of experiment (2017-18) and became highest (208.8) during ninth standard week in the year 2018-19. The insect started decreasing from twelfth standard week and vanished in the thirteenth standard week. During 2017-18 the relative humidity at 1400 hr was negatively correlated while the maximum temperature and number of rainy days were negatively correlated in the second experimental year (2018-19). The rainfall has not any significant role in incidence of mustard aphid.

**Keywords:** Environmental parameters, mustard aphid, population, mustard

### 1. Introduction

Among the oilseed crops, mustard or *Brassica* sp. is a major one as it constitutes major source of edible oil in India. The crop is partly self-fertile and pollination is done mainly by wind, gravity and insects. It is native to Western Europe, the Mediterranean and temperate regions in Asia. With the demand for oilseed running ahead of supplies, the production trend is unsatisfactory due to the attack of insect-pest. Rai (1976) <sup>[1]</sup>, "Mustard is prone to attack by a number of insect pests". *Lipaphis erysimi* Kalt. (Mustard aphid) attacks the crop right from seedling stage to maturity that ravages crop in reproductive stage and acts as a limiting factor in the yield of crop.

*Lipaphis erysimi* Kalt. Belongs to family Aphididae and is commonly known as mustard aphid or turnip aphid. *Lipaphis erysimi* Kalt. Is exclusively female and wingless. Sometimes during migrating period winged mustard aphid is also seen. Mustard aphid is a pale green or whitish green and produces one hundred young ones during a few weeks' life span. Length of insect varies from 1.4 mm to 2.4 mm. Wingless males are seen occasionally having olive green to brown colour. Singhvi *et.al.* (1973) <sup>[2]</sup>, "the infestation by mustard aphid not only results in reduced yield of seeds but also reduces the oil content up to 66.87%".

Weather acts as a crucial parameter in development of mustard aphid and is also an important factor in aphid management. Mustard aphid secretes honeydew which leads to sooty moulds i.e. blackish appearance of leaves and stem and plant as a whole. Damaging agents are both nymphs and adult. *Lipaphis erysimi* Kalt. Suck the cell sap due to which leaves become curled and discoloured, spots appear on the foliage, as a result plant gradually wilts, turn yellowish or brownish and dies. Due to this mustard aphid is considered as a 'National Pest'.

### 2. Materials and Methods

Pusa Mustard 25 was grown as a test crop. The sowing of crop was done on 30<sup>th</sup> of November in both the year i.e. 2017-18 and 2018-19. The crop was grown in 100 square metre plots as per the recommended agronomic practices without application of insecticides. Observations on population of mustard aphid was recorded at weekly intervals under natural field conditions. The recording was done from the initial appearance of the pest to the final disappearance.

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The counting of aphid was done by removing it from 10-cm top portion of the terminal shoot (i.e. twig) with the help of a camel hair brush on a white paper sheet. No plant protection measure was taken throughout the crop season.

The study was conducted during the *Rabi* season of 2017-18 and 2018-19. Meteorological observations with regards to ambient temperature (0 °) C, relative humidity (%), rainfall (mm), mean number of aphid population and number of rainy

days, prevailing at T.C.A. Dholi, (Muzaffarpur) were recorded daily in both the crop seasons i.e., 2017-18 and 2018-19. The data is presented in Table 1 and Table 2 for year 2017-18 and 2018-19 respectively.

Observations were taken weekly and the number of mustard aphids were counted right from their incidence and till they vanished. The impact of physical parameters was worked out by using regression analysis and coefficient of correlation.

**Table 1:** Population dynamics of mustard aphid on Pusa Mustard -25 (2017-18)

Month	Standard week	Mean No. of aphid per 10cm top twig	Temperature (Maximum)	Temperature (Minimum)	RH (%) 0700 hr	RH (%) 1400 hr	Rainfall(mm)	No. of Rainy days
January	3rd	00	14.9	7.8	100.0	95.1	00	00
	4th	8.2	19.4	7.8	99.4	85.8	00	00
	5th	10.4	21.4	9.2	97.5	73	00	00
February	6th	11.4	25.2	9.7	98.5	83.8	00	00
	7th	56.8	24.2	11	97.8	82.1	00	00
	8th	121.2	27.7	12.8	99.1	79.2	00	00
	9th	152.8	29.2	14.8	100	71.7	00	00
March	10th	222.4	31.4	13.4	99.1	72.8	00	00
	11th	66.4	31.6	15.7	97	65.7	00	00
	12th	18.4	34.4	14.7	90.1	67.7	00	00
	13th	00	33.3	18	92.7	77.7	00	00

**Table 2:** Population dynamics of mustard aphid on Pusa Mustard -25 (2018-19)

Month	Standard week	Mean No. of aphid per 10cm top twig	Temperature (Maximum)	Temperature (Minimum)	RH (%) 0700 hr	RH (%) 1400 hr	Rainfall(mm)	No. of Rainy days
January	3rd	00	22.8	6.2	100.0	88.2	00	00
	4th	7.2	22.8	12.2	99.4	89.7	00	00
	5th	8.8	23.9	7.5	100.0	73.8	00	00
February	6th	9.2	23.2	10.2	98.0	85.7	8.4	1
	7th	45.6	24.0	11.5	98.5	83.1	00	00
	8th	122.6	26.1	11.9	100.0	83.0	00	00
	9th	140.6	24.9	11.5	99.1	90.4	00	00
March	10th	198.8	27.0	12.8	99.7	83.8	00	00
	11th	34.0	31.3	14.5	96.4	73.0	00	00
	12th	10.0	32.1	16.2	97.2	65.2	00	00
	13th	00	31.3	18.2	90.2	67.5	00	00

### 3. Results and Discussion

The data pertaining to mean number of aphids per 10 cm top twig during the crop season 2017-18 is presented in Table 1. The appearance of aphid started from fourth standard week i.e. January 18<sup>th</sup>, 2018 onwards. Initially it was very less in number (8.2 per 10 cm top twig) but gradually it started increasing from fifth standard week (10.4 per 10 cm top twig), in sixth standard week it increased a little (11.4 per 10 cm top twig) while from seventh standard week population of mustard aphid per 10 cm top twig was suddenly increased (56.8) and kept on increasing in successive weeks. In eighth and ninth standard week the insect population was very high (121.2 per 10 cm top twig and 152.8 per 10 cm top twig respectively), while aphid population was recorded at its peak in 10<sup>th</sup> standard week i.e., around March 7<sup>th</sup> onwards (222.4 per 10 cm top twig). After that the population of mustard aphid declined rapidly from eleventh standard week (66.4 per 10 cm top twig) with the lowest in twelfth standard week (18.4 per 10 cm top twig) and later on in thirteenth standard week the crop was completely free from the insect as there was no aphid seen further.

The trend of insect incidence was same for both the experimental year (*Rabi* season of 2017-18 and 2018-19). This year too (i.e. *Rabi* season of 2018-19), the incidence of mustard aphid started from fourth standard week (7.2 per 10 cm top twig). The population of mustard aphid kept on

increasing in successive weeks (8.8 per 10 cm top twig in the 5<sup>th</sup> standard week, 9.2 per 10 cm top twig in the 6<sup>th</sup> standard week, 45.6 per 10 cm top twig in the 7<sup>th</sup> standard week). The trend of aphid population kept on increasing thereafter (122 per 10 cm top twig in the 8<sup>th</sup> standard week, 140.6 per 10 cm top twig in the 9<sup>th</sup> standard week) while the insect was at its peak in the 10<sup>th</sup> standard week (198.8 per 10 cm top twig) and later on it declined in the upcoming weeks (34.0 per 10 cm top twig in the 11<sup>th</sup> standard week, 10.0 per 10 cm top twig in the 12<sup>th</sup> standard week). However, the field was totally free from insect in the 13<sup>th</sup> standard week.

The present findings on incidence and population dynamics was more or less similar with Ahuja (1990) <sup>[3]</sup> and Singh and Malik (1998) <sup>[4]</sup> who reported the appearance of first aphid incidence in late December or early January and attained its peak during last week of January to third week of February. Singh and Lal (1999) <sup>[5]</sup> reported peak population of aphid in February second week. In 2001, Kulkarni and Patel <sup>[6]</sup> reported the aphid population reached its peak during the fourth week of February with a high incidence during first fortnight of February. The similar findings were observed with the population dynamics of year 2014-15, that was 101.50 population per plant. Dhaliwal *et. al.*, (2005) <sup>[7]</sup> found the highest dispersal potential in aphid infestation was noticed at siliqua maturity stage in February second week, which differs from other crop stages significantly. Sahoo (2013) <sup>[8]</sup>

as well as Deepak *et al.* (2002) <sup>[9]</sup> reported that population of aphid started from December last week and disappeared after March first week also support the present findings. In 2005, Vekaria and Patel <sup>[10]</sup> found that the incidence of mustard aphid occurred six weeks after sowing i.e. third week of December and was at its peak intensity (3.94 AI) at 14 weeks after sowing coinciding with February second week during 2003-04, however, during 2004-05 aphid incidence was late, i.e., during last week of December and reached its peak (3.08 AI), thirteen weeks after sowing coinciding with February first week.

Rao *et al.*, 2013<sup>[11]</sup> found the role of temperature was significant in regulating the aphid incidence. Malik and Sachan in the year 2013<sup>[12]</sup> reported the seasonal incidence of mustard aphid from third week of December reaching its peak in second week of February.

Table 3 and 4 explain about the correlation matrix of mustard aphid with the maximum temperature, minimum temperature, relative humidity at 0700 hours, 1400 hours, rainfall and number of rainy days during the year 2017-18 and 2018-19 (*Rabi* season).

**Table 3:** Correlation Matrix among Aphids and Weather Parameters (2017-18)

Variables	Correlation
Maximum Temperature	0.391
Minimum Temperature	0.320
RH 0700 hr	0.376
RH 1400 HR	0.382
Rainfall (mm)	-
No. of rainy days	-

Correlation is significant at 0.01 level and 0.05 level.

**Table 4:** Correlation Matrix among Aphids and Weather Parameters (2018-19)

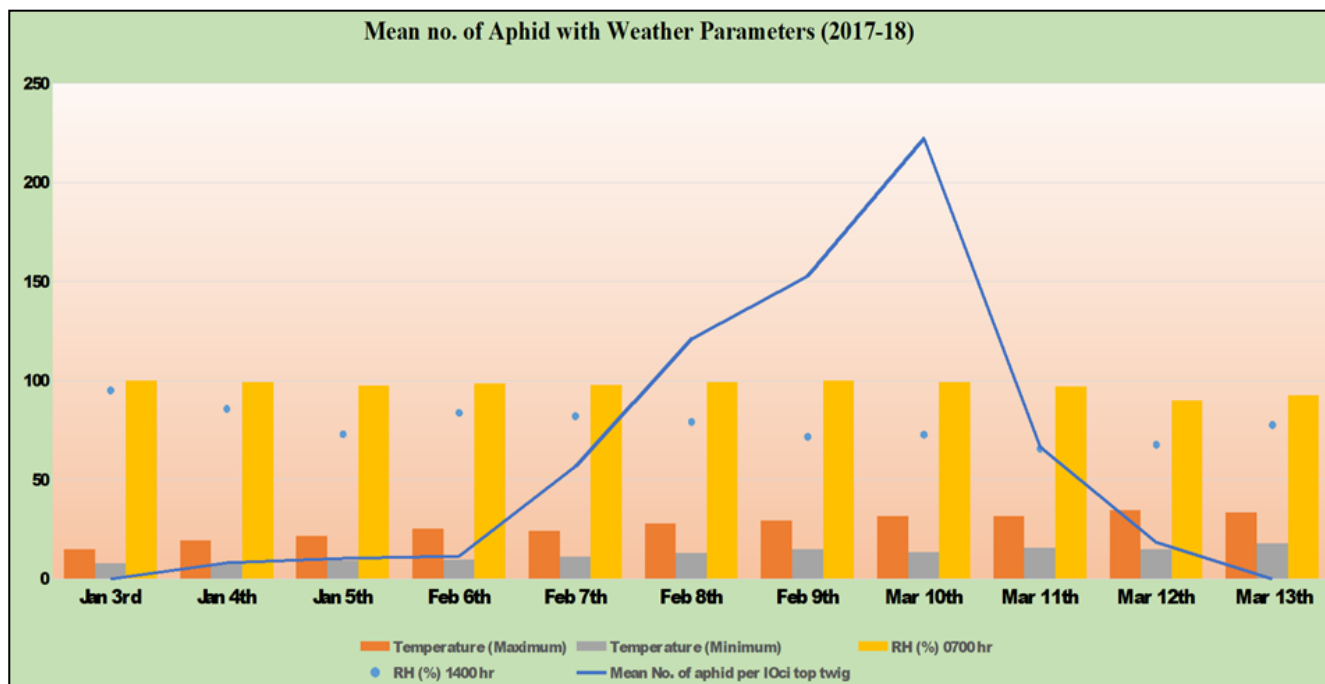
Variables	Correlation
Maximum Temperature	-0.040
Minimum Temperature	0.025
RH 0700 hr	0.350
RH 1400 HR	0.385
Rainfall (mm)	-0.173
No. of rainy days	-0.173

Correlation is significant at 0.01 level and 0.05 level.

The correlation of aphid was found positive with both the maximum temperature and minimum temperature with a value of 0.391 and 0.320 respectively. However, it was found non-significant with the relative humidity at 7 a.m. in the morning with a value of 0.376 while at 2 p.m. it was 0.382. The correlation of insect with rainfall as well as no. of rainy days was also non-significant as there was no rainfall during the season.

The correlation of mustard aphid was found negative in the second experimental year (as in case of previous year it was negative too) with value -0.040 with the maximum temperature and positive (0.025) with the minimum temperature. The value of RH at 0700 hr was 0.350 while it was significant at 1400 hr having a value 0.385. Rainfall as well as number of rainy days were non-significant as there was a single rainy day during the crop season.

Abbas *et al.* 2014 <sup>[13]</sup> reported that the population of mustard aphid was governed positively by temperature while relative humidity was correlated positively. During an experiment in 2012 <sup>[14]</sup> by Achintya and Debjani aphid was having a significant positive correlation with the minimum temperature. The above findings are having similarity with the results given by Choudhary and Pal during 2009 <sup>[15]</sup>, Dogra *et al.* 2001 <sup>[16]</sup>.



**Fig 1:** Mean No. of mustard aphid with weather parameters (2017-18)

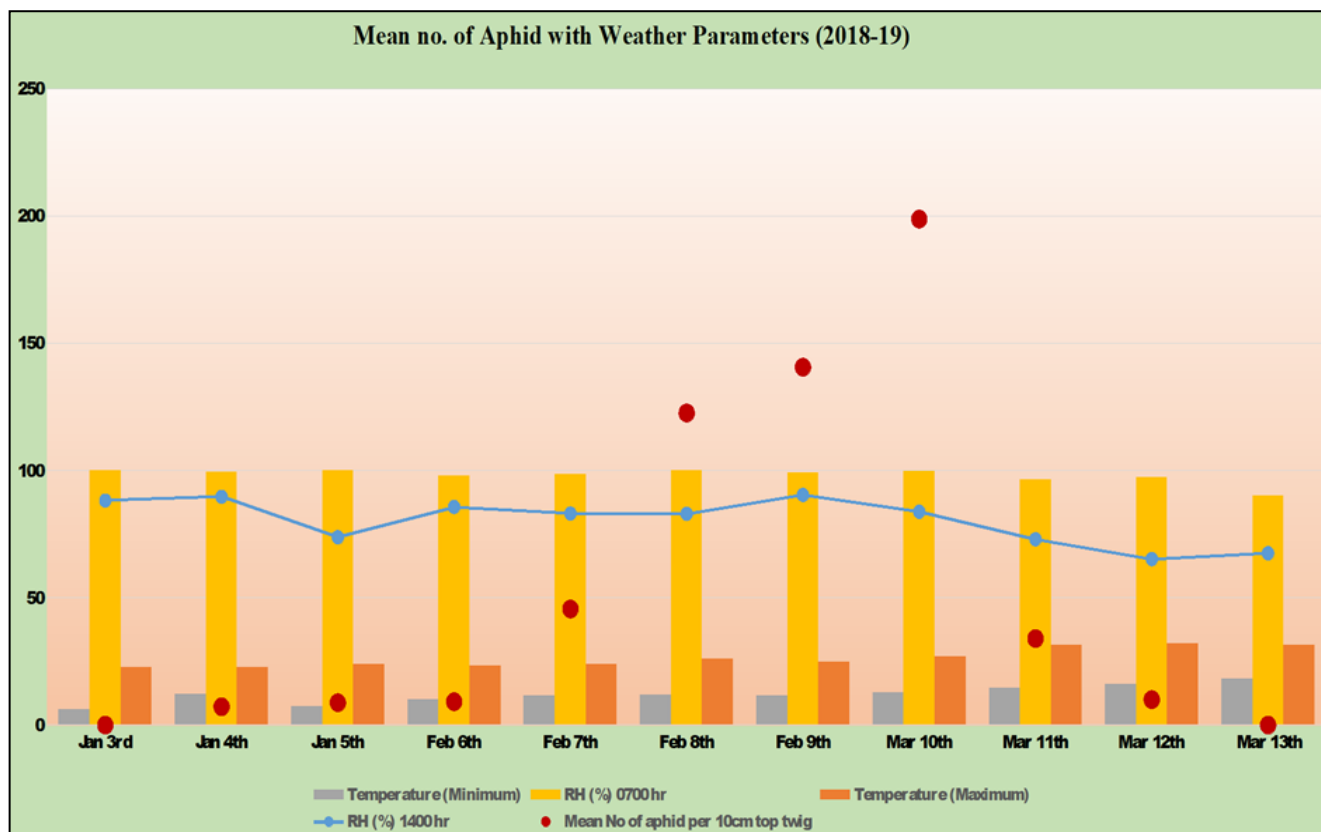


Fig 2: Mean No. of mustard aphid with weather parameters (2018-19)

#### 4. Conclusion

From above findings it may be concluded that the incidence of *Lipaphis erysimi* Kalt. Started from fourth standard week in both the years i.e. 2017-18 and 2018-19.

Mustard aphid population was at its peak during tenth standard week and ninth standard week in the year 2017-18 and 2018-19 respectively. During 2017-18 the relative humidity at 1400 hr was negatively correlated while the maximum temperature, rainfall and number of rainy days were negatively correlated in the second experimental year. All other parameters in both experimental were correlated positively and were non-significant. Graphs in fig. (i) and (ii) shows the incidence as well as disappearance of mustard aphid.

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