



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2019; 7(6): 857-860

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Received: 22-09-2019

Accepted: 24-10-2019

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Population dynamics of mustard aphid (*Lipaphis erysimi* Kalt.) under different environmental conditions

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Abstract

A mustard variety Pusa Mustard -25 was grown as test crop. The sowing of crop was done on 30th of November in both the years namely 2017-18 and 2018-19. The crop was grown in 100 square metre plot as per the recommended agronomic practices without the application of insecticides. at T.C.A., Dholi (Muzaffarpur). The observations were recorded daily in both the crop seasons that is, 2017-18 and 2018-19. In the year 2017-18, it was found that the population of mean number of mustard aphid population initially, was 12.9, in the fourth standard week. It gradually increased from 18.2 to 30.4 in the fifth standard week to sixth standard week respectively. The population attained its peak in the ninth standard week that was 69.8 and after that it declined gradually and in the thirteenth standard week it was only 4.2. In the year 2018-19, the mean population of mustard aphid was 3.7 initially in the fourth standard week. It increased gradually from 8 to 46.6 from the fifth standard week to eighth standard week respectively. The peak of mean aphid population was 46.6 in the eighth standard week and after that the population started declining from 34.8 to 21.4 and lasted to 2.2 in the sixth, seventh and thirteenth standard week respectively. The correlation table shows that in both the years that is in 2017-18 and 2018-19, there was a negative correlation of aphid population with the aphid maximum and minimum temperature and it was non-significant. The relative humidity (RH) was also found non-significant. There was not any correlation of aphid population with the rainfall.

Keywords: Mustard, *Lipaphis erysimi* Kalt., weather parameters, oilseed

1. Introduction

Mustard (*Brassica* sp.) is generally considered as oilseed crop due to its consumption as the edible oil in India. Due to the attack of several insect-pest the production of mustard is very low. "Mustard (yellow sarson) is attacked by a number of insect-pests", Rai (1976) [1].

Mustard aphid (*Lipaphis erysimi* Kalt.) is one of the serious pest of mustard crop. It is supposed to attack the crop from the seedling stage till maturity. Due to this nature of attack by the insect, it is considered as an enemy to the crop and hence the production is hampered very badly. The insect belongs to the aphididae family and sometimes is also called as turnip aphid. The attacking insect is generally female, which are wingless. It can produce one hundred eggs during its life span of only a few weeks (generally 8 weeks after maturity). The female is pale green or whitish green in colour. It has two rows of dark bands on the thorax as well as abdomen. Length generally remains in between 1.4 mm to 2.4 mm. Males are occasionally seen in this insect which are wingless and colours brown. According to Singhvi *et al.* (1973) [2] "The infestation by mustard aphid not only results in yield of seed but it reduces the oil content also."

Role of weather on the incidence and development of mustard aphid is crucial and important factor in aphid management. Besides, mustard aphid also secretes honeydew which encourages the growth of sooty moulds, giving the stem and leaves black appearance and interfering in the photosynthesis. Both nymphs and adult cause damage to the plants by sucking the sap from their host plants. Due to sap sucking, leaves become curled and discoloured, spots appear on the foliage and plant may gradually wilt and turn yellowish or brownish and die. In terms of economic importance, mustard aphid is regarded as a national pest.

2. Materials and Methods

A mustard variety Pusa Mustard 25 was grown as test crop. The sowing of crop was done on 30th of November in both the year namely 2017-18 and 2018-19. The crop was grown in 100

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square metre plot as per the recommended agronomic practices without the 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. The counting of aphid was done by removing it from 10-cm top portion of the terminal shoot with the help of camel hair brush on a white paper sheet. No plant protection measure was taken throughout the crop season.

The study was conducted during winters of 2018 and 2019. Meteorological observations with regards to ambient temperature ($^{\circ}\text{C}$), 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 that is, 2017-18 and 2018-19. The data is presented in table 1 and table 2 of the year 2017-18 and 2018-19 respectively.

Weekly observations of the number of mustard aphids were recorded right from the appearance till the disappearance of the pest. The impact of abiotic factors on population build up of mustard aphid was worked out by using regression analysis and correlation coefficients. Simultaneously, data on different weather parameters were taken during the period of experimentation.

3. Results and Discussion

As per the observations recorded in the year 2017-18, it was found that the population of mean number of mustard aphid population initially, was 12.1, in the fourth standard week. It gradually increased from 18.2 to 30.4 in the fifth standard week to sixth standard week respectively. The population attained its peak in the ninth standard week that was 69.8 and after that it declined gradually and in the thirteenth standard week it was only 4.2. There was a certain trend in the population pattern that is during the sixth, seventh, eighth, ninth standard week, the population was 30.4, 46.2, 62.7, 69.8 respectively and after that decline in the population of mustard aphid was observed. This happened when the minimum temperature range was between 9.7°C to 14.8°C which means the population of mustard aphid increased at a specific minimum temperature range and after that there was no increase in the aphid population and the maximum temperature at that duration ranged from 25.2°C to 29.2°C . The maximum number of mean aphid population was found when the relative humidity was 100 at 0700 hr and 71.7 at 1400 hr. There was no rainfall during that period of time in 2017-18. The data is presented in table 1.

In the year 2018-19, the mean population of mustard aphid was 3.7 initially in the fourth standard week. It increased gradually from 8 to 46.6 from the fifth standard week to eighth standard week respectively. The peak of mean aphid population was 46.6 in the eighth standard week and after that the population started declining from 34.8 to 21.4 and lasted to 2.2 in the sixth, seventh and thirteenth standard week respectively. This was observed when the minimum temperature range was 11.5°C to 18.2°C and the maximum

temperature ranged from 24.9°C to 31.3°C . The maximum number of mean aphid population was found when the relative humidity was 99.1 at 0700 hr and 90.4 at 1400 hr. There was no rainfall during that period that is in 2018-19. A rainfall of 8.4 mm was also recorded in the sixth standard week. Table 2 shows the observations.

In table 3, the correlation of aphid population with the weather parameters is mentioned. The correlation table shows that in both the years that is in 2017-18 and 2018-19, there was a negative correlation of aphid population with the aphid maximum and minimum temperature and it was non-significant. The relative humidity (RH) was also found non significant. There was not any correlation of aphid population with the rainfall. These observations are similar with the findings of Choudhury and Pal (2009) ^[3], Singh and Lal (1999) ^[4] and Dogra *et al.* (2001) ^[5] who reported the temperature is negatively correlated with the population of mustard aphid. The influence of abiotic factors on mustard aphids was observed by a lot of workers from different areas. Singh and Verma (1990) ^[6] observed that minimum and maximum relative humidity of preceding three days of observation were the most important factors to increase aphid population and out of these two, the minimum relative humidity played an important role in increasing the aphid population. Rohilla *et al.* (1996) ^[7] observed from the field studies conducted in Haryana that the pest incidence increased with an average temperature of about 13.7°C and a relative humidity of 65%. It decreased with temperature above 35°C , relative humidity less than 60% and rainfall more than 10mm per day. Kumar *et al.* (1997) ^[8] reported that average temperature of 18.06°C (Maximum 22.81°C and Minimum 13.31°C) under the influence of high relative humidity with the range from 80.71% to 86.5% provided conducive conditions for aphid incidence. A similar observation was also made by Hasen *et al.* (2009) ^[9]. Appearance of aphids on mustard seems to be largely controlled by temperature and in warm humid locations aphid attained peak populations earlier as compared to relatively cool climate (Bapuji Rao *et al.* 2013) ^[10]. Ekbohm (1995) ^[11] reported that aphids are present throughout the year in the field and its population reaches to peak during December to February, which is the main period of the mustard. Bishnoi *et al.* (1992) ^[12] found that either mean temperature or saturation deficit contributes significantly to the build up of aphid population. Samdur *et al.* (1997) ^[13] from Delhi observed that average maximum and minimum relative humidity had positive relationship with mean aphid infestation index. Gami *et al.* (2002) ^[14] recorded significant negative correlation with maximum and minimum temperature. Ahuja (1990) ^[15] observed a negative association with maximum and minimum temperatures and sunshine hours. Desh *et al.* (2002) ^[16] observed that Aphid population registered significantly negative correlation with maximum and minimum temperature while with rainfall showed positive correlation. Moreover, the population reached its peak as the flowering stage enhanced.

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	4th	12.9	19.4	7.8	99.4	85.8	00	00
	5th	18.2	21.4	9.2	97.5	73	00	00
February	6th	30.4	25.2	9.7	98.5	83.8	00	00
	7th	46.2	24.2	11	97.8	82.1	00	00
	8th	62.7	27.7	12.8	99.1	79.2	00	00
	9th	69.8	29.2	14.8	100	71.7	00	00
March	10th	43.8	31.4	13.4	99.1	72.8	00	00
	11th	20.2	31.6	15.7	97	65.7	00	00
	12th	10.2	34.4	14.7	90.1	67.7	00	00
	13th	4.2	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	4th	3.7	22.8	12.2	99.4	89.7	00	00
	5th	8.0	23.9	7.5	100.0	73.8	00	00
February	6th	20.5	23.2	10.2	98.0	85.7	8.4	1
	7th	32.2	24.0	11.5	98.5	83.1	00	00
	8th	46.6	26.1	11.9	100.0	83.0	00	00
	9th	34.8	24.9	11.5	99.1	90.4	00	00
March	10th	21.4	27.0	12.8	99.7	83.8	00	00
	11th	18.0	31.3	14.5	96.4	73.0	00	00
	12th	6.0	32.1	16.2	97.2	65.2	00	00
	13th	2.2	31.3	18.2	90.2	67.5	00	00

Table 3: Correlation coefficients of mustard aphid in the year 2017-18 and 2018-19

Weather Parameters	2017-18	2018-19
Maximum Temperature	-0.170	-0.302
Minimum Temperature	-0.589	-0.332
Relative Humidity (0700 hr)	0.201	0.464
Relative Humidity(1400 hr)	-0.456	0.533
Rainfall (mm)	NS	NS
No. of rainy days	NS	NS

11 Degrees of freedom; 0.535 @ 5% significant level; 0.721 @ 1% significant level.

4. Conclusion

From the observations it can be concluded that the population of mustard aphid was observed from the fourth standard week in both the year that is in the year 2017-18 (12.9) and 2018-19 (3.7). The population was maximum in the ninth week in the year 2017-18, 69.8 while minimum in the 13th standard week that is 4.2 and in the year 2018-19 it was maximum in the eighth standard week that was 46.6 and minimum in the thirteenth week that is 2.2. In both the years, the correlation of aphid population was found negative and was non-significant.

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