Entomology

Population dynamics of mustard aphid, *Lipaphis* erysimi on *Brassica* crop in relation to abiotic factors and sowing date

Dilbag Singh Ahlawat[1*], Dalip Kumar[2] and Rakesh Punia[3]

[1] Assistant Scientist, CCS HAU, Regional Research Station, Rohtak, Haryana, India

[2] Assistant Scientist, Department of Entomology, CCS HAU, Hisar, Haryana, India

[3] Junior Plant Pathologist, Department of Plant Pathology, CCS Haryana Agricultural University, Hisar, Haryana, India

Correspondence Author: Dilbag Singh Ahlawat

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Abstract

Population dynamics of mustard aphid, *Lipaphis erisimi* on Brassica was carried out during *Rabi* season of 2018-19 at Research farm of CCS HAU Regional Research Station, Rohtak (India). Mustard variety RH 30 and RH 0749 were sown on two different dates *i.e.*, 15th October (Timely) and 25th October (Late) in randomized block design with five replications in plot size of 4.2 x 3.0 m^2. The population of mustard aphid, *Lipaphis erisimi* (nymphs + adults) per plant (10 cm long central mother axis) were recorded at weekly intervals starting from the month of January till harvesting of the crop. In mustard crop sown on 15th October, the peak of aphid population was 15.08 and 11.44 aphids/plant on variety RH 30 and RH 0749, respectively. Whereas, in case of crop seeded on 25th October, the peak of aphid population was recorded 18.46 and 12.74 aphids/plant on variety RH 30 and RH 0749, respectively. The average aphid population remained higher in 25th October seeded crop as compared to 15th October. Relative humidity of morning hours found directly associated with *L. erysimi* population on mustard crop in both dates of sowing and both varieties. Weather parameters especially relative humidity of evening hours and rainfall were impacted aphid population positively in both timely as well as late sown mustard crop. The degree of infestation and the rates of population change of the aphids also seemed to be governed by varietal character and flowering stage of the crop.

Keywords: abiotic factors, correlation, *Lipaphis erisimi*, mustard, population dynamics

Introduction

The edible oilseed crops play an important role in Indian economy. In India, rapeseed-mustard crops are next to ground in the area and production. These crops occupied an area of 6.07 million hectares and produced 7.92 million tonnes of oil rich seeds during 2016-17 with average productivity of 1304 kg/ha in India. During 2016-17, in Haryana, the area under these crops was 0.51 million hectares with average production of 0.95 million tonnes and average p roductivity of 1853 kg/ha (Anonymous, 2019) [1]. The average productivity of these crops in India is very low than other countries like Sweden, Canada, Germany and United Kingdom. Out of several constraints responsible for low productivity, the yield losses by insect-pests are most significant. Three and a half dozen insect-pests attack rapeseed-mustard crops, of which mustard aphid, *Lipaphis erysimi* (Kalt.) is a major pest causing 35 to 73 per cent reduction in yield (Rohilla *et al.*, 1987) and 6 per cent reduction in oil content (Singh *et al*., 1987) [2].

The abiotic factors (Temperature, Relative humidity, rainfall and sunshine) play an important role in the multiplication of the aphids. With the occurrence of favourable weather conditions for a longer period of time, a severe outbreak of aphid could be apprehended (Singh, 1982) [3].

Many management methods to control insect-pests in rapeseed-mustard as alternative to insecticides viz., biological control (Kalra, 1988) [4, 5], use of resistant varieties (Agarwal *et al*., 1996) [6] and cultural control (Singh *et al*., 1984) [7] have been tried in the past. Looking into the present concept of cultural management of insect pest which takes care of environmental pollution, safety to natural enemies and ensures minimum health hazards, present studies were conducted.

Material and Methods

A field experiment was carried out during *Rabi* season of 2018-19 at Research Farm of CCS HAU Regional Research Station, Rohtak (India). Mustard variety RH-30 and RH 0749 were sown on two different dates 15th October (Timely) and 25th October (Late) during *Rabi* season 2018-19 following the recommended agronomic practices except the insecticidal sprays in randomized block design with five replications in plot size of 4.2 x 3.0 m^2. The population of mustard aphid, *Lipaphis erisimi* (nymphs+adults) per plant (10 cm long central twig) were recorded at weekly intervals starting from the month of January till harvesting of the crop.

Statistical Analysis

The data collected during studies in the above experiments were subjected to statistical analysis and significant differences were set at $P \leq 0.05$ and $P \leq 0.01$ to work out simple correlation between the population of mustard aphid and weather parameters *viz.*, Temperature (maximum and minimum), Relative Humidity (morning and evening) and rainfall as per procedures of Sheoran *et al*., 1998 [8] for the statistical analysis of the data.

Results and Discussion

The population of mustard aphid, *Lipaphis erisimi* (nymphs+adults) per plant (10 cm length of central mother

axis) were recorded on popular mustard varieties *i.e.*, RH 30 and RH 0749 at weekly intervals starting from the month of January till harvesting of the crop.

Table 1: Population dynamics of mustard aphid on *Brassica juncea* and its relation with weather parameters

Standard Meteorological Week (SMW)	Temperature (0C)		Relative Humidity (%)		Rainfall (mm)	Mean population of aphids/10 cm central shoot			
	Max.	Mini.	Morning	Evening		RH 30 Timely (15.10.18)	RH 30 Late (25.10.18)	RH 0749 Timely (15.10.18)	RH 0749 Late (25.10.18)
1	19.0	7.1	93.4	59.6	3	0.44	0.00	0.30	0.00
2	19.5	7.8	88.6	53.4	0	1.78	3.80	1.04	1.70
3	19.8	5.1	86.0	54.4	0	3.30	6.00	2.08	2.52
4	17.2	7.3	90.2	61.2	5	8.62	12.62	7.38	8.60
5	18.4	8.2	86.6	59.4	0	11.88	15.60	10.40	9.70
6	20.6	9.1	93.3	60.3	8	15.08	18.46	11.44	12.74
7	21.1	11.4	94.3	65.3	0	9.12	12.80	6.42	8.28
8	23.1	11.9	85.9	63.7	3	8.92	10.44	5.60	6.08
9	21.0	9.9	91.7	65.7	4	3.72	4.58	2.58	2.76
10	23.7	11.3	83.1	50.0	0	0.00	0.02	0.00	0.00
Mean	20.34	8.91	89.31	59.3	2.3	6.29	8.43	4.72	5.24

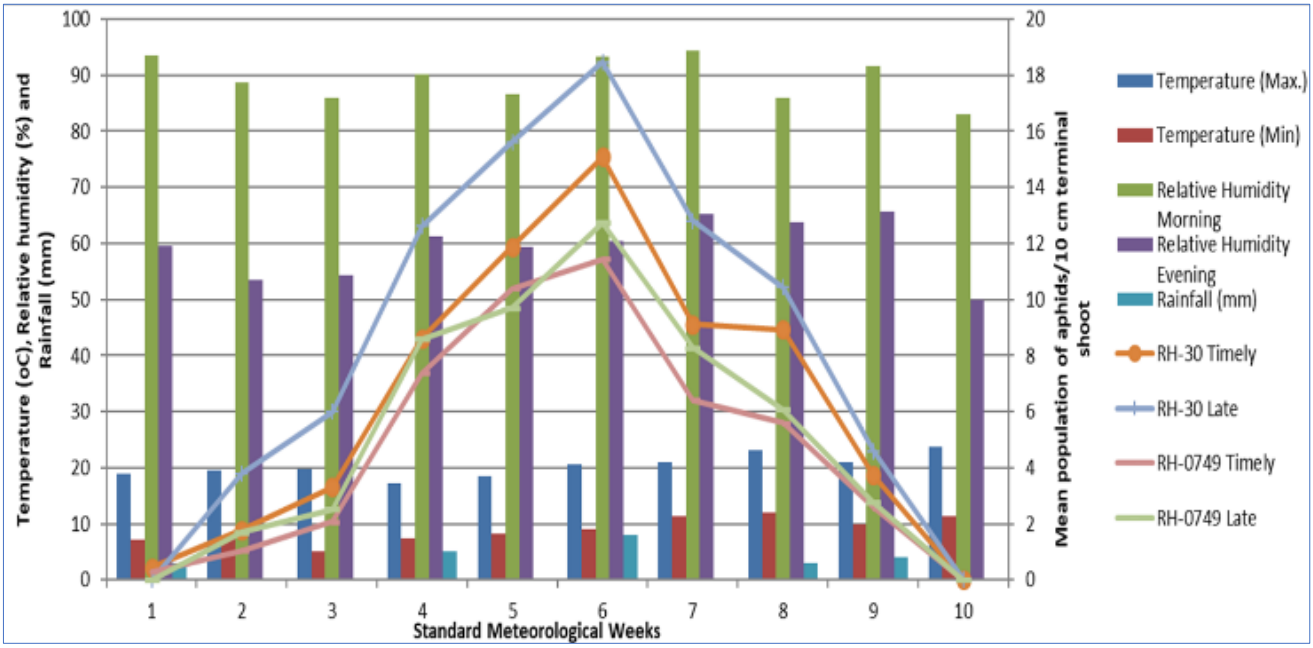

Fig 1

Table 2: Correlation coefficient between mustard aphid population and weather parameter during *Rabi*, 2018-19

Variety	Temperature (º C)		Relative Humidity (%)		Rainfall (mm)
	Maximum	Minimum	Morning	Evening	
RH 30					
Timely sown	-0.172^{NS}	0.178^{NS}	0.276*	0.511**	0.480**
Late sown	-0.255^{NS}	0.099^{NS}	0.265*	0.473**	0.409**
RH 0749					
Timely sown	-0.276*	0.104^{NS}	0.256^{NS}	0.460**	0.458**
Late sown	-0.253^{NS}	0.132^{NS}	0.323*	0.485**	0.480**

*Significant at 5% (p = 0.05), **Significant at 1% (p = 0.01), ^{NS}Non-significant

RES Mustard aphid appeared in first Standatrd Meteorological Week (SMW), as the data exhibited in Table 1, in year 2019 in both varieties *i.e.*, RH 30 and RH 0749 cropped on dated 15th October, whereas, aphid appeared in the 2nd SMW, 2019 on both varieties *i.e.*, RH 30 and RH 0749 that were seeded on 25th October. The aphid population started increasing gradually and reached to its peak on 6th SMW simultaneously in both of the varieties in both dates of sowing *i.e.*, early and late sown crop. The aphid population differed between varieties and dates of sowing. In 15th October of sowing, the peak of aphid population was 15.08 and 11.44 aphids/plant in variety RH 30 and RH 0749, respectively (Table 1). Whereas, in 25th October sowing, the peak of aphid population was 18.46 and 12.74 aphids/plant in variety RH 30 and RH 0749, respectively. The average aphid population remained higher (8.43 and 5.24 aphids/10 cm central shoot in RH 30 and RH 0749) in 25th October sowing as compared to 15th October sown mustard crop *i.e.*, RH 30 and RH 0749,

respectively having 6.29 and 4.72 aphids/10 cm central shoot (Graph 1). It was low on variety RH-0749 as compared with RH-30 in both dates of sowing. Bakhetia (1986) [9], Rohilla *et al.* (1988) [10] and Rohilla (1990) [11] reported that Brassica genotypes, *i.e., B. juncea*, *B. campestris* var. yellow 'sarson' and *B. campestris* var. brown 'sarson' sown early, *i.e.,* towards the end of September or middle of October escaped the incidence of mustard aphid.

Weather parameters *viz.*, average temperature (Max.) 20.34 ^{0}C, (Min.) 8.91^{0}C and average relative humidity 89.31 per cent (Morning) and 59.3 per cent (Evening) proved conducive including rainy days for mustard aphid development (Table 2). Maximum temperature presented negative and non-significant correlation with *L. erysimi* population on mustard crop in both dates of sowing and both varieties with exception in timely sown RH 0749 (r=-0.276), but same influence did not exist at too low temperature as non-significant positive correlation was apparent between aphid population and minimum temperature. Relative humidity of morning and evening hours were found directly associated with aphid population in timely as well as in late sown mustard crop except in timely sown RH 0749 variety in morning relative humidity. Weather parameters especially relative humidity of evening hours and rainfall impacted a lot on mustard aphid, *L. erysimi* population positively in condition of both timely as well as in late sown mustard crop that may be due to agro-climatic condition of the area as well as habitat of planted crop. It is quite conspicuous that the degree of infestation and the rates of population change of the aphids also seemed to be governed by varietal character and flowering stage of the crop (Table 2).

Kalra, 1979 reported that average temperature presented negative and significant correlation with *L. erysimi*population on mustard crop but same influence did not exist at too low temperature. He also observed a negative correlation between relative humidity and mustard aphid population; but when the relative humidity was much below the optimum (60-65 %), the correlation was negative. While, Mehta (1984) [12] did not find any correlation between abiotic factors (temperature, relative humidity and rainfall) and mustard aphid population on various *Brassica* genotypes during January to March. Singh *et al.* (1986) [13] were of the opinion that the temperature (maximum and minimum), relative humidity (morning and evening) and sunlight during peak activities of *L. erysimi*had positive effect on its population, whereas, rainfall showed inverse association. On the other hand, no response of humidity was observed on the population dynamics of *L. erysimi*as as per opinion of Roy (1975) [14] and Jaglan *et al.* (1988) [15]. Rana *et al.* (1993) [16] reported that temperature (minimum), relative humidity (evening) and rainfall were negatively and significantly correlated with the mustard aphid population host *B. juncea* cv. RH 30 during January and February.

Conclusion

It is inferred from the present study that the average aphid population remained higher in 25th October seeded crop as compared to 15th October. Relative humidity of morning hours was found directly associated with *L. erysimi* population on mustard crop in both dates of sowing and both varieties. Weather parameters especially relative humidity of evening hours and rainfall impacted aphid population positively in timely as well as late sown mustard crop. The degree of infestation and rate of population change of the aphids also seemed to be governed by varietal character and flowering stage of the crop.

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