Indian Journal of Ecology (2022) 49(5) (SI): 1996-1999
DOI: https://doi.org/10.55362/IJE/2022/3773

Manuscript Number: 3773
NAAS Rating: 5.79

Relative Abundance of Mustard Aphid *Brevicoryne brassicae* (Homoptera: Aphididae) on Mustard, *Brassica juncea* (L.)

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***Abstract*:** Field experiment was conducted during the years 2018-19 and 2019-20 at Entomology Farm of Faculty of Agriculture, Wadura campus, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Jammu & Kashmir, India to ascertain the aphid incidence in mustard, *Brassica juncea*. The incidence of aphid started from the 12th standard week (6.37 aphids/20 plant) and reached its peak in 16th standard week *viz*., 127.36 aphids/20 plantsand declined in 22nd standard week (8.54 aphids/20 plants). Negative correlation was found between aphid population and maximum and minimum temperatures. Positive correlation was found between aphid population and rainfall and significantly positive correlation was observed between aphid population and morning relative humidity and evening relative humidity. Two species of predators, *Coccinella septumpunctata* and *Hippodamia variegata*, were observed feeding on mustard aphid. *C. septumpunctata* appeared in 12th standard week (0.05 population/20 plants)and *H. variegata* in 13th standard week (0.15 population/20 plants) and the population reached its peak at 16th standard week viz., 4.05 and 2.35 population/ 20 plants for *C. septumpunctata* and *H. variegata*, respectively that coincided with the peak population of aphids. *B. brassicae* population exhibited significantly positive correlation with *C. septumpunctata* and *H. variegata.*

Keywords: Population dynamics, *Brevicoryne brassicae*, *Coccinella septumpunctata, Hippodamia variegata*

Mustard, *Brassica juncea* (L.) Czern and Coss is an important oilseed crop of Cruciferae family and constitute major source of edible oil for human consumption and cakes for animals. Every effort is being made to raise yield of this crop by adopting modern agricultural practices, such as the use of high yielding varieties, heavy manuring and assured irrigation in order to meet the growing demands of oils. These composite efforts are, however, nullified if crop is not protected from the ravages of insect-pests. The crop is damaged at various stages of plant growth by more than a dozen of insect pests *viz*; mustard sawfly (*Athalia lugens proxima* Kulg.), painted bug (*Bagrada cruciferarum* Kirk.), mustard aphid (*Brevicoryne brassicae*.), cabbage leaf webber (*Crocidolomia binotalis* Zeller), flea beetle (*Phyllotreta cruciferae* Geoze) and leaf miner (*Phytomyza horticola* Meign). The mustard aphid (*Brevicoryne brassicae*) (Homoptera: Aphididae) is the most serious and destructive pest and major limiting factor for mustard cultivation (Biswas and Das 2000). The infestation of this pest varies with place and also depends upon the environmental factors. This pest caused substantial losses in many crops and causes about 35-75 % reduction in the yield of mustard (Singh and Sharma 2012). The infestation also led to 6% reduction in oil contents (Singh et al 2007). The loss caused by aphids is due to direct feeding on leaves, inflorescence and stems as well as indirectly by transmitting diseases (Liu and Yue 2001). The ecological approach to the pest management suggests using pesticides only when and where necessary. Therefore, for ensuring an effective and economical management of this serious pest, the present studies were undertaken to study population fluctuations in relation to weather parameter. These studies will provide an opportunity to face the pest challenge by manipulating sowing time, varietals selection; correct timing of pesticidal application besides other management practices.

MATERIAL AND METHODS

The field experiment was conducted at Entomology Farm of College of Agriculture, Wadura Campus, SKUAST-K, India during 2018-19 and 2019-20. The mustard crop variety, KS 101 "Gulcheen" was sown manually on 2nd week of October in 2018 and 2019, in lines@ 5kg /ha on a plot of 10×12 m^2 about 3 cm deep in furrows, keeping the row to row and plant to plant distances as 30 and 10cm, respectively. Half of the recommended dose of nitrogenous fertilizer (60 Kg N/ha) and full dose of phosphatic fertilizer (60 Kg P_2O_5/ha) and potasic fertilizer (40 Kg K_2O/ha) were applied at the time of ploughing and rest of the nitrogenous fertilizers were applied through

top dressing at the time of flowering. The meteorological data prevailed during the infestation of aphids, *Rabi* 2018-19 and *Rabi* 2019-20 was procured from the meteorological observatory located at Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Jammu & Kashmir.

Observation on aphid population was recorded soon after the appearance of the aphids on mustard and continued till the maturity of the crop. The population of the aphids was recorded on twenty randomly tagged plants at weekly interval. Initially at pre-bloom stage, the population of aphid was recorded on whole plant as a one single unit. At flowering/bloom stage, the aphids were counted from the upper 10 cm twig. At the post-bloom stage the aphids were recorded on the upper, middle and lower pods of plants on five randomly selected plants. The population of coccinellids was also recorded at pre-bloom, bloom, and post-bloom stages on whole plant at weekly interval. The data generated on the population of aphids was correlated with the weather parameters like maximum and minimum temperature, relative humidity and rainfall and with the population of coccinellids. Regression coefficient (R^2) and regression equation (Y = a+ bx) were computed by standard statistical methods.

RESULTS AND DISCUSSION

The commencement of mustard aphid population was from 12th standard week with average number 5.42 aphids/plant in 2018-19 and 3.67 aphids/plant in 2019-20 (Table 1 and 2). The pest reached to its peak population *viz*., 110.27 aphids/plant (2018-19) and 144.45 aphids/plant (2019-20) in the 16th standard week from where started declining and reached the population, 6.23and 10.85aphids/plant in 22nd standard week for 2018-19 and 2019-20 respectively. In *Rabi* 2018-19the population per plant ranged from 0.0 to 12.0, 78.0 to 124 and 5.0 to 20.0 aphids/plant in 12th, 16th and 22nd standard week, respectively. In *Rabi* 2019-20 the population per plant ranged from 0.0 to16.0, 95.0 to 165.0 and 8.0 to 23.0 in 12th, 16th and 22nd standard week respectively. The maximum and minimum temperature does not favour the aphid population however; rainfall, morning and evening relative humidity favoured the aphid population (Table 3). Thus negative correlation was observed between aphid population and maximum temperature and minimum temperature. Positive correlation was found between aphid population and rainfall. Significantly positive correlation was observed with morning relative humidity and evening relative humidity. Mishra and Kanwat (2018) also reported that aphid population is negatively correlated with maximum temperature and positively correlated with relative humidity. Dharavat et al (2016) observed negative correlation of aphids with maximum and minimum temperature and significantly positive correlation with humidity. Sahu et al (2017) reported that pest population drastically decreased after 3rd week of March due to gradual increase in high temperature. Kumar and Paul (2017) observed that the maximum temperature exhibited a negative effect RH with a significant positive effect. Earlier researchers also observed that aphid population exhibit negative correlation with maximum temperature and positive correlation with rainfall, morning and evening relative humidity (Pawar et al 2010, Hassan and

Table 1. Incidence of mustard aphid, *Lipaphis erysimi* and subsequent appearance of its predators during *Rabi* 2018-2019

SMW	No. of aphids/plant	*No. of predators/plant		Max. temp (°C)	Min. temp (°C)	Rainfall (mm)	Morning relative humidity (%)	Evening relative humidity (%)
		Coccinella septumpunctata	*Hippodamia variegata*					
12	5.42	0.03	0.00	13.57	1.76	30.60	82.42	57.14
13	19.32	0.37	0.02	19.36	4.36	2.20	69.57	48.43
14	25.54	0.63	0.25	23.07	4.79	1.40	64.71	36.14
15	50.34	1.15	0.56	21.93	7.57	5.40	77.14	51.14
16	110.27	3.21	1.73	19.5	7.57	13.40	84.71	62.29
17	75.54	2.43	1.16	22.36	8.19	30.20	77.72	59.14
18	70.23	1.79	0.73	20.29	7.33	10.80	80.57	57.29
19	21.59	1.52	0.54	23.57	6.51	22.80	65.42	43.71
20	17.52	1.16	0.37	22.14	8.51	15.60	76.00	59.00
21	8.67	0.43	0.13	22.50	9.57	34.80	80.14	67.29
22	6.23	0.00	0.00	28.14	9.00	6.20	67.71	45.86

SMW = Standard meteorological week
* Mean of population on 20 plants

Table 2. Incidence of mustard aphid, *Lipaphis erysimi* and subsequent appearance of its predators during *Rabi* 2019-20

SMW	No. of aphids/plant	*No. of predators/plant		Max. temp (°C)	Min. temp (°C)	Rainfall (mm)	Morning relative humidity (%)	Evening relative humidity (%)
		Coccinella septumpunctata	*Hippodamia variegata*					
12	7.30	0.07	0.00	16.71	4.64	21.30	74.29	56.57
13	23.73	0.59	0.28	13.57	4.27	68.39	85.71	75.71
14	31.56	0.87	0.64	17.79	3.24	53.20	76.85	60.71
15	64.32	1.48	0.99	21.29	6.34	18.20	74.00	58.29
16	144.45	4.80	2.96	16.71	6.71	29.19	86.28	74.14
17	91.90	3.74	2.01	25.14	8.42	2.03	71.43	65.00
18	83.27	2.85	1.75	23.07	9.50	64.61	73.29	71.00
19	29.07	2.01	1.36	25.29	8.73	6.58	75.29	75.00
20	27.40	1.59	0.80	23.36	8.66	15.61	73.14	65.86
21	12.89	0.67	0.28	28.86	9.01	0.00	70.71	44.57
22	10.58	0.20	0.06	23.21	11.05	42.98	85.57	76.14
23	0	0	0	27.64	12.06	15.80	74.57	68.14

SMW = Standard meteorological week
* Mean of population on 20 plants

Singh 2010, Nayak 2010, Varmora et al 2009). Ahlawat et al (2021) also observed the positive correlation of aphid population with relative humidity and rainfall. The variation in the month of incidence of aphids may be due to different climatic conditions of the Kashmir valley.

The predator population *viz*; *Coccinella septumpunctata* and *Hippodamia variegata* on the mustard aphid appeared simultaneously with the aphid population. *C. septumpunctata* appeared during the 12th standard week as0.03 beetles per plant (2018-19) and 0.07 beetles per plant (2019-20), and *H. variegate* occurrence was observed during the 13th standard week as 0.02 per plant (2018-19) and 0.28 beetles per plant (2019-20). Both the predator populations reached its peak during 16th standard week being 3.21 and 1.73 (2018-19) and 4.80 and 2.96 beetles per plant during 2018-19 and 2019-20 coinciding the peak population of aphids and then again decreased with the decline of aphid population to 0.43 and 0.13 beetles per plant in 2018-19 and 0.20 and 0.06 beetles per plant in 2019-20, respectively (Table 1 and 2). *Brevicoryne brassicae* exhibited positive correlation with coccinellid predators *viz*; *C. septumpunctata* and *H. variegate* (Table 3). Ali et al (2012) also reported that population of coccinellids increased along with the increased population of aphids and thus revealed positive correlation between *B. brassicae* population and coccinellid predators.Mishra & Kanwat (2018) observed that the population of *C. septumpunctata* was influenced by the host insect and both were at peak the same time(17 beetles/404.25 aphids). Similarly Pal et al(2018) reported that the population of predator fluctuated according to its prey population in the season and population of predator was positively correlated with prey population. Bilashini and Singh (2011) reported that numerical density of the predator was observed to increase with increase in density of aphid prey in the field and correlation analysis showed highly positive significant correlation between predator and aphid species.

Table 3. Correlation and regression analysis between abiotic as well as biotic factors and *Lipaphis erysimi* population on *Brassica juncea* (Pooled 2018-19 and 2019-20)

Parameters	Regression equation	Correlation coefficient (r)
Abiotic factors	Aphid population/plant	
Maximum temperature	y = -0.025x+22.92 R^2 = 0.066	-0.26
Minimum temperature	y = -0.002x+7.570 R^2 = 0.001	-0.05
Rainfall	y = 0.012x+21.36 R^2 = 0.003	0.06
Morning RH	y = 0.067x+72.81 R^2 = 0.360	0.60*
Evening RH	y = 0.077x+56.16 R^2 = 0.334	0.58*
Biotic factors		
C. septumpunctata	y = 0.031x+0.105 R^2 = 0.894	0.95**
H. variegata	y = 0.018x-0.011 R^2 = 0.922	0.96**

CONCLUSION

The incidence of mustard aphid, *Brevicoryne brassicae*on mustard was observed from last week of

March i.e. 12th and later reached to peak at 16th standard week. So by manipulating the calendar of sowing of mustard, can protect crop from the peak aphid population infestation. Similarly the population of coccinellid predators also reached peak at 16th standard week, thus coinciding with the peak population of aphids. Aphids exhibit negative correlation with maximum temperature and positive correlation with minimum temperature, rainfall, morning relative humidity, evening relative humidity and positive correlation was between mustard aphid and its predators: *Coccinella septumpunctata* and *Hippodamia variegata*.

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Received 19 July, 2022; Accepted 15 September, 2022