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Effect of weather parameters on natural enemies of mustard aphid

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Abstract
Among the natural enemies of mustard aphid, *Coccinella septempunctata* and *Syrphid* flies are dominating. During the experimental year 2017-18, it was observed that the appearance of ladybird beetle that is *Coccinella septempunctata* was 0.30 as seen in the fourth standard week of observation when the aphid population was growing high and it was equal in comparison with the *Syrphid* fly (0.30). The correlation of ladybird beetle was -0.012 with the maximum temperature while with the minimum temperature it was -0.162 and *Syrphid* fly was found -0.180 with the maximum temperature and -0.176 with the minimum temperature (negative and non- significant). There was not any correlation with the rainfall as there was no rain during that period. The correlation of relative humidity in ladybird beetle was 0.251 at 0700 hours and 0.207 at 1400 hours. In case of *Syrphid* fly, the relative humidity was -0.633 and non-significant at 0700 hours while at 1400 hours it was 0.453 and non-significant. In the second experimental year, 2018-19, the trend of population of both the natural enemies was of same pattern. The population of ladybird beetle was found 0.20 in the fourth standard week and its peak was 1.00 in the eighth standard week. The population of *Coccinella septempunctata* was found 0.10 upto the tenth standard week and it became 0.00 after that. In case of *Syrphid* fly, the population initially was 0.20 in the fourth standard week. It was maximum 1.10 in seventh standard week and gradually it declined to 0.40 in the ninth standard week and became 0.20 in the tenth standard week.. In case of ladybird beetle it was -0.012 with the maximum temperature and -0.087 with the minimum temperatuire. The correlation with the relative humidity of ladybird beetle was found -0.515 that is non- significant at 0700 hours and at 1400 hours it was -0.081 that is non -significant too. In case of *Syrphid* fly the correlation with the maximum temperature was non-significant and negatively correlated that is -0.142 while with the minimum temperature it was -0.083 and non-significant. The rainfall was found non-significant in both the cases. The relative humidity at 0700 hr was -0.529 and at 1400 hr it was 0.453 in case of *Syrphid* fly and was found non -significant.

Keywords: Weather parameters, natural enemies, mustard aphid, mustard

1. Introduction
Mustard aphid is a serious Key pest of mustard crop and is responsible for heavy losses in the production of mustard. *Lipaphis erysimi* Kaltenbach (mustard aphid) infests the crop right from seedling stage to maturity that ravages the crop during the reproductive phase and acts as a limiting factor in the production. It is commonly known as mustard aphid or turnip aphid. Role of weather on the incidence and development of mustard aphid is crucial and important factor in aphid management. This noxious pest causes 27 to 96% yield losses in mustard in India (Bakhetia and Sidhu, 1983) [1]. The crop needs repeated application of insecticides for successful cultivation which has serious residual effects. Various methods are available these days to reduce or manage the population of mustard aphid. Generally biological control are preferred due to their eco-friendly nature. Among the natural enemies of mustard aphid, *Coccinella septempunctata* and *Syrphid* flies are dominating. About 90% of the known 4200 *Coccinellid* species are predaceous by nature (Iperti and Paoletti, 1999) [2] and in India, *Coccinellid* diversity includes 119 predaceous species (Omkar and Parvez, 2000c) [3].
There were two natural enemies found namely *Coccinella septempunctata* and *Syrphid* fly. Natural enemies appear at a later stage of crop when most of the damage has been caused by aphids in mustard. Moreover, population of these two natural enemies are too low to reduce the population of mustard aphid (Aslam *et al.*, 2007) [4]. Joshi and Sharma (2008) [5] have reported 31 species of Ladybeetles with 14 new records from district Dehradun, India. The natural enemies are self-powered, self-sufficient and self-regulating requiring no further investments in control (Pimental, 1991) [6].

The biological control method is highly effective and long lasting. The natural enemies reduce the population of mustard aphid by eating them and maintain a balance in nature and hence are safe for the environment.

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 square metre plot as per the recommended agronomic practices without the application of insecticides. Observations on population of natural enemies in mustard crop was recorded at weekly intervals under natural field conditions. The recording was done from the initial appearance of the pest as well as its natural enemies to the final disappearance. No plant protection measure was taken throughout the crop season. The data are presented in table 1 and table 2.

The study was conducted during winters of 2018 and 2019. 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 that is, 2017-18 and 2018-19. The counting of natural enemies found in the field was counted on five randomly selected plants. The data is presented in table 1 and table 2 of the year 2017-18 and 2018-19 respectively.

The impact of abiotic factors on population build-up of natural enemies 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.

Table 1: Population dynamics of Natural Enemies on Pusa Mustard -25 (2017-18)

Month	Standard Week	Mean No. of *Syrphid* fly	Mean No. of *Coccinella septempunctata*	Maximum Temperature	Minimum Temperature	RH 0700 hr	RH 1400hr
January	4th	0.30	0.30	19.4	7.8	100	85.8
	5th	0.60	0.50	21.4	9.2	97.5	73
February	6th	1.00	0.60	25.2	9.7	98.5	83.8
	7th	1.20	0.80	24.2	11	97.8	82.1
	8th	0.80	1.00	27.7	12.8	99.1	79.2
	9th	0.40	0.60	29.2	14.8	100	71.7
March	10th	0.20	0.10	31.4	13.4	99.1	72.8

Table 2: Population dynamics of Natural Enemies on Pusa Mustard -25 (2018-19)

Month	Standard Week	Mean No. of *Syrphid* fly	Mean No. of *Coccinella septempunctata*	Maximum Temperature	Minimum Temperature	RH 0700 hr	RH 1400hr
January	4th	0.20	0.20	22.8	12.2	99.4	89.7
	5th	0.40	0.50	23.9	7.5	100	73.8
February	6th	0.80	0.60	23.2	10.2	98	85.7
	7th	1.10	0.80	24	11.5	98.5	83.8
	8th	0.80	1.00	26.1	11.9	100	83
	9th	0.40	0.60	24.9	11.5	99.1	90.4
March	10th	0.20	0.10	27	12.8	99.7	83.8

3. Results and Discussion

During the experimental year 2017-18, it was observed that the appearance of ladybird beetle that is *Coccinella septempunctata* was 0.30 as seen in the fourth standard week of observation when the aphid population was growing high and it was equal in comparison with the *Syrphid* fly (0.30). The counting was done on five randomly selected mustard plants. As the population of mustard aphid increased, simultaneously the population of ladybird beetle also increased. The population of ladybird beetle was recorded maximum 1.00 in the eighth standard week after that it decreased to 0.10 in the tenth standard week and became 0.00 after that. While in case of *Syrphid* fly, the population initially was 0.30 in the fourth standard week. And it attained its peak 1.20 in the seventh standard week and after that it declined to 0.20 in the tenth standard week in the year 2017-18. The correlation of ladybird beetle was -0.012 with the maximum temperature while with the minimum temperature it was -0.162 and *Syrphid* fly was found -0.180 with the maximum temperature and -0.176 with the minimum temperature (negative and non- significant). There was not any correlation with the rainfall as there was no rain during that period. The correlation of relative humidity in ladybird beetle was 0.251 at 0700 hours and 0.207 at 1400 hours. In case of *Syrphid* fly, the relative humidity was -0.633 and non-significant at 0700 hours while at 1400 hours it was 0.453 and non-significant.

In the second experimental year, 2018-19, the trend of population of both the natural enemies was of same pattern. The population of ladybird beetle was found 0.20 in the fourth standard week and its peak was 1.00 in the eighth standard week. The population of *Coccinella septempunctata* was found 0.10 upto the tenth standard week and it became 0.00 after that. In case of *Syrphid* fly, the population initially was 0.20 in the fourth standard week. It was maximum 1.10 in seventh standard week and gradually it declined to 0.40 in the ninth standard week and became 0.20 in the tenth standard week. The temperature in both the natural enemies was found negatively correlated. In case of ladybird beetle it was -0.012 with the maximum temperature and -0.087 with the minimum temperature. The correlation with the relative humidity of ladybird beetle was found -0.515 that is non- significant at 0700 hours and at 1400 hours it was -0.081 that is non - significant too. In case of *Syrphid* fly the correlation with the maximum temperature was non-significant and negatively correlated that is -0.142 while with the minimum temperature it was -0.083 and non-significant. The rainfall was found non-significant in both the cases. The relative humidity at 0700 hr was -0.529 and at 1400 hr it was 0.453 in case of *Syrphid* fly and was found non -significant. The data of both the years are shown in table 3 and table 4.

Arshad Ali and Rizvi (2012) [7], Kulkarni and Patel (2001) [8] also support the multiplication of Coccinellids was positively correlated with rainfall and relative humidity. Atwal (1971) [9] also observed that *Coccinella* multiplied to reach its maximum population inspite of decline in aphid population. Vkaria and Patel (1999) [10] also suggested that the population of *Syrphid* fly appeared in second week of January and attain its peak in fourth week of February. Yellow sarson attracted predators including *C. septempunctata* and *C. cerana* which were maximum when the mustard aphid was in abundance Singh *et al.* (2011) [11]. *Syrphid* fly was observed later that is in the second standard week and gained its peak population (7 in number) in the 7th standard week as reported by Singh and Singh (2013) [12].

Table 3: Correlation of Weather Parameters with the Natural Enemies on Pusa Mustard-25 (2017-18)

Weather Parameters	*Syrphid* fly	*Coccinella septempunctata*
Maximum Temperature	-0.180	-0.012
Minimum Temperature	-0.176	0.162
Relative Humidity(0700hr)	-0.633	-0.251
Relative Humidity(1400hr)	0.453	0.207
Rainfall(mm)	NS	NS
No. of Rainy Days	NS	NS

Correlation is significant at 0.01 level and 0.05 level.

Table 4: Correlation of Weather Parameters with the Natural Enemies on Pusa Mustard-25 (2018-19)

Weather Parameters	*Syrphid* fly	*Coccinella septempunctata*
Maximum Temperature	-0.142	-0.012
Minimum Temperature	-0.083	-0.087
Relative Humidity(0700hr)	-0.529	-0.515
Relative Humidity(1400hr)	-0.115	-0.081
Rainfall(mm)	NS	NS
No. of Rainy Days	NS	NS

Correlation is significant at 0.01 level and 0.05 level.

4. Conclusion

It can be concluded from the above observations that the natural enemies found were only the *Syrphid* fly and ladybird beetle that is *Coccinella septempunctata.* Both the natural enemies appeared from the fourth standard week. Initially, the population was low and attained its peak in eighth standard week in ladybird beetle and seventh week in case of *Syrphid* fly. Population was nil after the tenth standard week in both the natural enemies. Temperature was negatively correlated in both the years with the *Syrphid* fly and ladybird beetle. The relative humidity was positive in correlation with both the natural enemies. There was no effect of rainfall in both the years.

5. References

1. Bakhetia DRC, Sidhu SS. Effect of rainfall and temperature on mustard aphid, *Lipaphis erysimi* Kalt. Indian Journal of Entomology. 1983; 45(2):202-205.
2. Iperti G, Paoletti MG. Biodiversity of predaceous Coccinellidae in relation to bio indication and economic importance Special issue. Invertebrate biodiversity as bioindicators of sustainable landscapes. Practical use of invertebrates to assess sustainable land use. Agriculture Ecosystem Environment. 1999; 74:323-342.
3. Omkar Pervez A. Biodiversity of predaceous coccinellids (Coleoptera: Coccinellidae) in India: A review Journal of Aphidology. 2000c; 14:41-66.
4. Aslam M, Razaq M. Arthropod fauna of *Brassica napus* and *Brassica juncea* from Southern Punjab (Pakistan). Journal of Agricultural Urban Entomology. 2007; 24:49-50.
5. Joshi PC, Sharma Pushpendra K. First records of coccinellid beetles (Coccinellidae: Coleoptera) from district Haridwar (Uttarakhand), India. Natural History Journal of Chulalongkorn Uni. 2008; 8(2):157-167.
6. Pimental D. Diversification of Biological Control strategies in agriculture. Crop Protection 1991; 10:243-253.
7. Ali Arshad, Parvez Qamar Rizvi. Influence of abiotic and biotic factors on Population Dynamics of Mustard Aphid, *Lipaphis erysimi* (Kalt.). On Indian Mustard *Brassica juncea* with Respect to Sowing Dates. Academic Journal of Plant Sciences. 2012; 5(4):123-127.
8. Kulkarni AK, Patel IS. Seasonal abundance of mustard aphid *Lipaphis erysimi* Kalt. And associated bio-agents in Indian Mustard *Brassica juncea* crop. Indian Journal of Agricultural Sciences. 2001; 71(10):681-682.
9. Atwal AS, Chaudhary JP, Ramrazan M. Mortality factor in natural population of cabbage aphid *Lipaphis erysimi* Kalt. (Aphididae: Homoptera) in relation to parasite, Predators and Weather conditions. Indian journal of Agricultural Sciences. 1971; 41(4):507-510.
10. Vekaria MN, Patel GM. Succession of important pests of mustard in North Gujarat. Indian Journal of Entomology. 1999; 61(4): 356-361.
11. Singh A, Lal MN. Ecofriendly Approaches for management of mustard aphid, *Lipaphis erysimi* (Kalt.) M.Sc. (Ag.) Thesis, NDUA & T, Faizabad, India, 2011.
12. Singh K, Singh NN. Preying Capacity of Different Established Predators of the Aphid *Lipaphis erysimi* (Kalt.). Infestating Rapeseed -Mustard Crop in Laboratory Conditions. Plant Protection Science. 2013; 49(2):84-88.