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EFFECT OF ABIOTIC FACTORS ON MUSTARD APHID (*LIPAPHIS ERYSIMI* KALT.) ON INDIAN *BRASSICA*

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ABSTRACT

To determine the relative role of weather variables on mustard aphid *Lipaphis erysimi* (Kalt) population, field experiments were conducted. The study revealed that in early sown Indian mustard, the aphid population had a significant negative correlation with minimum and maximum temperature. Similarly, the morning and evening RH, and rainfall showed negative correlation with aphid population. On division of aphid infestation period into three different phases of infestation, it was observed that during the establishment phase, the weather parameters had significant role in governing the aphid population. The temperature, rainfall and sunshine hours were negatively correlated, whereas, morning and evening relative humidity and wind speed showed positive correlation. During the declining phase, wind speed alongwith temperature had negative relationship with aphid population build up.

INTRODUCTION

Abiotic factors *viz.*, temperature, light, moisture etc. have a direct influence on insect distribution and development. Among these parameters, temperature plays most important role in determining the growth rate of insects. Wind and rain are of importance not only for survival but also for disposal of insect population. More than three dozen insect-pests are found associated with rapeseed and mustard crops in India, of which mustard aphid (*Lipaphis erysimi* Kalt.) is the most dreaded, which even after best management reduces the yield and oil content (Singh, 1982 and Bakhetia and Sekhon, 1989). The pest remains active through out the growth period and has been observed feeding on foliage, inflorescence and pods of these crops. The incidence and spread of aphid is largely influenced by weather conditions. Hence, it was felt pertinent to assess the relative importance of weather variables in mustard aphid population dynamics.

MATERIAL AND METHODS

The present investigations were carried out during *rabi* (winter) seasons of 1996-97 and 1997-98 at Research Farm of Department of Agricultural Meteorology CCS Haryana Agricultural University, Hisar (29^0 10' N, 75^0 46' E and 215.2 m a.m.s.l.). The experiment comprised of three sowing dates *viz.*, Oct. 5 (D_1), Oct. 19 (D_2) and Nov. 24 (D_3) in 1996 and Nov. 24, Dec. 4, Dec. 16 in 1997 and four varieties *viz.*, Varuna, Laxmi, RH-30 and BSH-1 replicated thrice in RBD. The observations on population of mustard aphid were recorded on first day of every standard week between 0900 to 1330 hrs throughout the stand of crop in the field. When its appearance was first noticed, 10 plants were selected randomly and tagged to record aphid population in each replication. The population was recorded from a 15cm long top portion of central twig on a plant causing least possible disturbance as suggested by Singh and Singh (1982). The following method was adopted to

Length of inflorescence twig infested with aphid	Number of aphids present
1 mm	10±1
2 mm	20±1
3 mm	30±1
4 mm	40±1
10 mm	100±1

find out number of aphids present on a plant when the count was difficult.

RESULTS AND DISCUSSION

The variation in aphid population with days after sowing as influenced by sowing dates and cultivars were correlated with weather parameters and presented in Table 1. During 1996-97 crop season, maximum temperature showed no relationship with aphid population in first two sowing dates during October and had a significant negative correlation in third date of sowing (1st week of November). This could have been possible because of the crop in early sown condition has already attained pod formation and tender parts for feeding of aphids were available. However, pooled data showed a significant negative correlation of temperature with aphid population. The minimum and mean temperature had a significant negative correlation with D_1 and D_2 sowings. The morning and evening RH showed a negative correlation with aphid population on the basis of pooled data. The morning RH and wind speed had positive correlation with aphid population irrespective of sowing dates. The duration of sunshine hours showed a highly positive significant correlation in D_3 and also for pooled data. The rainfall showed negative correlation with aphid population.

During 1997-98, the crop sowing was delayed by more than 50 days in comparison of 1996-97 because of three wet spells in October, which led to water logging in the experimental field. The correlation of aphid population with the meteorological parameters during 1997-98 showed similar pattern as during 1996-97, however there was slight variation in the 'R^2 values and the possible reason for this could be because of the marked variation in sowing dates and abnormal weather conditions like low day and night temperature, high morning and evening RH and poor sunshine hours during 1997-98. Ahuja (1990) has earlier reported that the aphid population was negatively correlated with maximum and minimum temperature and sunshine hours. However, Singh *et al.* (1986) observed a positive effect of the temperature (maximum and minimum), RH (morning and evening) and sunlight on the population of *L. erysimi*, whereas, wind speed and rainfall had negative effect.

The period of aphid infestation was divided into three phases namely, the initiation phase, establishment phase and declining phase and impact of weather parameters on the population build up during each phase was analysed and the correlation coefficients were worked out (Table 2). During the initiation phase, the minimum and mean temperatures have negative significant correlation with aphid population. Whereas, during establishment phase, the temperature, rainfall and sunshine hours were negatively correlated, however morning, evening and mean RH and wind speed showed positive correlation. The pooled data analysis during establishing phase indicated a negative correlation with aphid population with maximum, minimum and mean temperature, sunshine hours and rainfall whereas, morning and evening RH and wind speed showed positive correlation. During the declining phase, morning RH showed positive correlation whereas, wind speed showed negative correlation with the aphid population builds up.

The regression equations between aphid population and important weather parameters and their partial correlation (R^2) are shown in Table 3. The R^2 value indicated no significant effect of weather parameters during initial phase. However, during establishment phase in 1996-97, sunshine hours and rain had significant contribution in population development of aphid. During 1997-98, the minimum temperature and sunshine hours significantly influenced the aphid population. In the declining phase, wind speed, maximum temperature and rainfall played significant role in governing the aphid

Table 1. Correlation coefficients for mustard aphid population on mustard crop and weather parameter relationship

		Temperature^{0}C			RH %			BSS Hrs	Rain mm
		Max	Min	Mean	M	E	Mean		
1996-97									
	D_1	0.13	-0.76*	-0.39*	0.52*	0.35	0.31	-0.08	-0.25
	D_2	-0.11	-0.59*	-0.38*	0.32	0.49*	0.36	-0.03	-0.34
	D_3	-0.46*	-0.33	-0.16	0.54*	0.62*	0.62*	-0.81*	-0.40*
	Pooled	-0.35	-0.55*	-0.42*	0.52*	0.38*	0.47*	-0.54*	-0.20
1997-98	D_1	-0.68*	-0.24	-0.48*	0.37	0.42*	0.35	-0.50*	-0.34
	D_2	-0.36	-0.74*	-0.48*	0.28	0.42*	0.22	-0.33	-0.39*
	D_3	-0.44*	-0.23	-0.34	0.60*	0.47*	0.50*	-0.36	-0.52*
	Pooled	-0.30	-0.35	-0.20	0.33	0.34	0.36	-0.33	-0.36
Both Years Pooled		-0.38*	-0.35	-0.34	0.47*	0.37*	0.41*	-0.39*	-0.24

Table 2. Correlation Coefficients for aphid population and weather parameter relationship during various phases of aphid infestation (2 years pooled)

	Temperature^{0}C			RH %			WS km/hr	BSS Hrs	Rain mm
	Max	Min	Mean	M	E	Mean			
Initiation phase	0.04	-0.43*	-0.36	0.41*	0.27	0.37*	-0.32	-0.30	-0.03
Establishment phase	-0.35	-0.38*	-0.43*	0.43*	0.47*	0.51*	0.21	-0.46*	-0.24
Declining phase	-0.47*	-0.30	-0.34	0.52*	0.30	0.26	-0.56*	-0.09	-0.32

Table 3. Regression equations for aphid population and weather parameter relationship

		Equation	N	R^2
Initiation phase				
	Pooled	(i) Y = 5.32 - 0.40 Tmin	24	0.38*
		(ii) Y = 5.98 - 0.42 Tmin - 0.08 SS	24	0.49*
Establishment phase				
	Pooled	(i) Y = -806.9 +138.2 SS + 6.9 Tmin	115	0.62*
		(ii) Y = -986.6 + 142.6 SS + 71.5 Rain	115	0.72*
Declining phase				
	Pooled	(i) Y = 0.59 + 0.76 WS	32	0.42*
		(ii) Y = -1.76 + 0.12 Tmax + 0.72 WS - 0.02 Rain	32	0.52*

Where,

Tmin - Minimum Temperature; Rain - Rainfall;
WS - Wind speed and SS - Sun shine hours.

population.

In the light of literature and present findings there is ambiguity regarding concrete effect of meteorological parameters on the mustard aphid population build up. It is mainly because of wide fluctuations of weather parameters, large gap in sowing time and the coverage of the entire period of aphid activity on the crop. The extreme situations at initiation and decline phase such as weather, crop phenology and stage appear to overmasked the total effect.

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