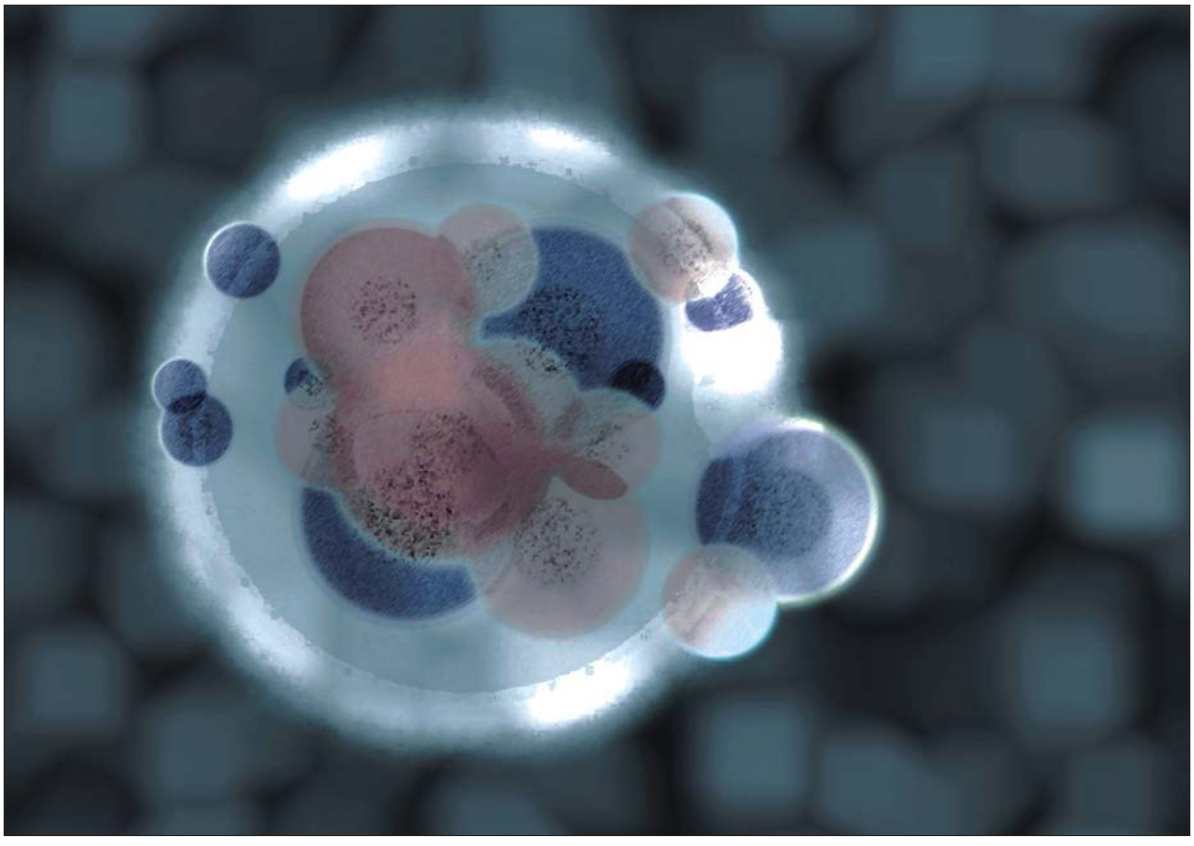

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Influence of Abiotic Environment on the Population Dynamics of Mustard Aphid, Lipaphis Erysimi (Kalt.) On *Brassica* Germplasm

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Abstract: The natural appearance of mustard aphid on *Brassica* germplasm was observed on 11th January (60 DAS) and disappeared after 2nd March (110 DAS). The peak aphid population was found at a maximum, minimum and average temperature of 23.37°, 6.87° and 15.76°C, respectively and mean relative humidity of 54.75% on 10th February at 90 DAS. Then, decline in aphid population and simultaneously increase of *Coccinella* was at 100 and 110 DAS, respectively. Maximum and average temperature showed as positively non-significant effect while minimum temperature caused negatively non-significant on the population of aphid. However, relative humidity had a negative effect. Late appearance of *Coccinella* too could not have any regulatory effect on the incidence of this pest.

Key words: *Brassica*, mustard aphid, germplasm

INTRODUCTION

Rapeseed and mustard are one of the most important oilseed crops in Jammu and Kashmir as they rank second to cereals. Mustard aphid, *Lipaphis erysimi* (Kalt.) has been found to be great hindrance and cause severe reduction to rapeseed and mustard. The losses in yield by mustard aphid were 66-96% (Singh and Sachan, 1997). Weather conditions play the most favorable role for its rapid multiplication (Sinha *et al*., 1989; Rana *et al*., 1993; Singh and Malik, 1998). Therefore, the present research was undertaken to study the population dynamics of mustard aphid in relation to weather conditions with the following objective to study the population build-up of mustard aphid in relation environmental fluctuations on *Brassica* sp. So, that a pest management module may be devised with minimum input and maximum benefit to farmers.

MATERIALS AND METHODS

Seeds of 25 *Brassica* germplasm were obtained from NRCRM, Sewar, Bharatpur and sown in RBD as a rabi crop during 2000-2001 at the R.A.K Institute of Agricultural Sciences, A.M.U. Aligarh in the plot size of 3×3 m^2 and replicated thrice. In each plot the row to row distance was 40 cm and plant to plant 15 cm which was maintained by thinning. For all test germplasms, 10 plants were tagged randomly from each plot and the population count of mustard aphid/10 cm twig was measured at 10 days interval from initial stage of appearance to final disappearance by method adopted by Bakhetia and Sandhu (1973). Further, population of *Coccinella*/plant (immature and adult) was also monitored from tagged plants. The crop was not protected by any insecticide during the course of experiment.

Meteorological records: The data on weather parameters viz., maximum, minimum and average temperature and also mean relative humidity were collected from the Department of Physics, A.M.U. Aligarh. Ten days mean data were collected from daily data record and daily data taken into account 10 days ahead of infestation because this data was correlated and regressed against aphid numbers.

RESULTS AND DISCUSSION

Initial level of infestation of mustard aphid was observed on 11th of January at 60 DAS at maximum, minimum and average temperature of 15.78, 6.96 and 11.37°C and also mean relative humidity of 79.70% (Table 1) with the aphid population varies from 0-17.25 aphids/10 cm twig on different germplasms (Table 2). The

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Table 1: Meteorological data during the period of infestation at 10 days interval at Aligarh

Observation data	Crop age (DAS)*	Mean temperature (°C) Maximum	Minimum	Average	Mean relative humidity (%)
11.1.2001	60	15.78	6.96	11.37	79.70
21.1.2001	70	20.49	4.24	12.36	71.65
31.1.2001	80	23.29	8.06	15.67	59.90
10.2.2001	90	23.37	6.87	15.12	54.75
20.2.2001	100	26.19	10.20	18.19	63.00
2.3.2001	110	26.87	12.42	19.64	62.85

*DAS-Days After Sowing

Table 2: Mean aphid and *Coccinella* population on *Brassica* germplasm

Date of observation	11.01.2001		21.01.2001		31.01.2001		10.02.2001		20.02.2001		02.03.2001	
Days after sowing	60 DAS		70 DAS		80 DAS		90 DAS		100 DAS		110 DAS	
Germplasm	Aphid	*Coccinella*	Aphid	*Coccinella*	Aphid	*Coccinella*	Aphid	*Coccinella*	Aphid	*Coccinella*	Aphid	*Coccinella*
Bio-902	7.50	-	18.25	-	200.12	-	270.12	-	83.20	2.66	35.50	3.00
Alankar	7.30	-	15.25	-	200.12	-	260.32	-	85.10	2.73	35.60	3.05
Pusa Agrani	10.50	-	26.90	-	290.35	-	340.45	-	120.25	2.60	63.40	3.13
BS-2	11.20	-	22.30	-	230.05	-	300.15	-	100.00	2.53	64.80	3.20
RS-30	15.20	-	28.17	-	221.72	-	290.12	-	104.20	2.80	47.10	3.26
DIRA-343	9.20	-	30.13	-	300.12	-	350.40	-	130.50	2.86	59.50	3.33
RH-30	8.90	-	20.15	-	221.06	-	290.11	-	87.20	3.00	39.00	3.06
Krishna	10.20	-	27.20	-	302.12	-	351.07	-	110.50	2.73	70.10	3.00
Vardan	13.10	-	26.30	-	275.75	-	325.28	-	135.25	2.66	67.20	3.26
PR-43	12.20	-	29.50	-	315.11	-	385.19	-	139.00	2.60	55.10	3.33
Laxmi	7.20	-	19.75	-	221.72	-	300.00	-	115.00	2.600	49.20	3.40
Pusa Jaikisan	12.50	-	30.24	-	322.13	-	272.12	-	125.35	2.66	52.30	3.13
Pusa Bold	0.00	-	13.25	-	195.25	-	345.57	-	85.70	2.53	33.20	3.13
KM-999	8.90	-	17.25	-	210.35	-	345.12	-	86.50	2.46	42.10	3.06
T-59	7.50	-	15.25	-	210.35	-	270.19	-	90.30	2.60	43.70	3.13
RLM-198	12.50	-	16.30	-	213.45	-	372.52	-	94.50	2.93	50.00	3.20
Laha-101	9.70	-	18.00	-	240.55	-	300.55	-	92.50	2.85	45.30	3.25
Kranti	10.00	-	19.23	-	241.56	-	250.16	-	115.60	3.00	45.70	3.33
NDR-8501	13.50	-	35.20	-	210.40	-	375.45	-	97.80	2.73	59.50	3.40
Rahini	11.00	-	31.72	-	317.50	-	325.55	-	116.00	2.80	79.80	3.33
RLM-571	12.30	-	29.50	-	270.61	-	262.75	-	160.70	2.45	42.30	3.46
PCR-7	13.50	-	30.15	-	322.19	-	372.51	-	140.50	2.53	66.20	3.33
PSR-30	10.35	-	28.16	-	304.58	-	361.10	-	135.20	2.60	53.20	3.13
Varuna	0.00	-	14.50	-	175.56	-	245.20	-	79.90	2.60	25.40	
BSH-1	17.25	-	45.00	-	340.50	-	425.25	-	180.30	3.73	90.00	

Mean aphid population/10 cm twig, -Mean *Coccinella* population/plant

present findings is in confirmation of Sinha *et al.* (1989) and Jitendra *et al.* (2000) who reported that during end of January if it appeared with its intial intensity of 2.8 aphids/plant on 66 days old crop and increase upto the seventh standard week in February with 403.00 and 264.33 aphids/plant and then decrease and elimination of aphid by the end of March. While Varuna and Pusa Bold escaped from the colonization of mustard aphid. On 21st January at 70 DAS all germplasms even Varuna and Pusa Bold were infested by the aphid and its population varies from 13.25- 45 aphids/10 cm twig on different germplasms in relation to weather conditions.

At 80 DAS on 31st of January population increases rapidly between 175.56-340.50 aphids/10 cm twig on all germplasms with the increase of 3°C in maximum, minimum and average temperature and also 11% reduction in mean relative humidity as compared to 70 DAS. The present findings are in agreement with the reports of Singh and Malik (1998) that the increase in temperature was significantly conducive for aphid multiplication but relative humidity has shown negative response on its intensity. On 10th of February at 90 DAS the peak was obtained ranging from 245.20-425.25 aphids/10 cm twig at maximum, minimum and average temperature at 23.37, 6.87 and 15.12°C, respectively and mean relative humidity of 54.75%. At this stage *Coccinella* appeared in the field but its population was almost negligible.

On 20th of February at 100 DAS aphid population declines many fold irrespective of germplasms due to increase of 3°C temperature and 8% mean relative humidity as compared to 90 DAS. Population of *Coccinella* was ranged from 2.53-3.73 individuals/plant because of increase was obtained in temperature and relative humidity. Further decrease in population was obtained ranging from 79.90-180.30 aphids/10 cm twig at 110 DAS with maximum, minimum and average

Table 3: Analyzed data showing correlation co-efficient (r), regression co-efficient (b) and co-efficient of determination (R^2)

	Maximum temperature		Minimum temperature		Average temperature		Mean relative humidity*		
Germplasm	r	b	r	b	r	b	r	b	Coefficient of determination R^2
Bio-902	0.302	0.011	-0.068	-1.817	0.163	0.004	-0.824	-0.068	0.801
Alankar	0.313	0.012	-0.050	-0.001	0.176	0.005	-0.828	-0.070	0.813
Pusa Agrani	0.342	0.000	0.048	0.009	0.208	0.004	-0.840	-0.053	0.868
BS-2	0.355	0.012	-0.002	-0.000	0.225	0.006	-0.854	-0.064	0.973
RS-30	0.321	0.011	-0.053	-0.001	0.180	0.005	-0.833	-0.065	0.832
DIRA-343	0.343	0.009	-0.028	-0.000	0.205	0.005	-0.839	-0.051	0.862
RH-30	0.296	0.010	-0.070	-0.001	0.157	0.004	-0.821	-0.062	0.821
Krishna	0.333	0.009	-0.022	-0.000	0.202	0.004	-0.837	-0.051	0.853
Vardan	0.376	0.011	0.013	0.000	0.245	0.005	-0.855	-0.057	0.932
PR-43	0.375	0.013	-0.047	0.000	0.184	0.003	-0.830	-0.046	0.865
Laxmi	0.359	0.012	-0.015	-0.000	0.221	0.005	-0.852	-0.064	0.904
Pusa Jaikisan	0.305	0.007	-0.060	-0.001	0.167	0.003	-0.817	-0.046	0.792
Pusa Bold	0.339	0.013	-0.035	-0.000	0.200	0.006	-0.840	-0.073	0.862
KM-999	0.330	0.013	-0.026	-0.000	0.198	0.006	-0.833	-0.073	0.843
T-59	0.331	0.012	-0.029	-0.000	0.197	0.005	-0.836	-0.068	0.849
RLM-198	0.336	0.012	-0.015	-0.000	0.207	0.006	-0.840	-0.068	0.862
Laha-101	0.307	0.010	-0.049	-0.001	0.173	0.004	-0.824	-0.059	0.805
Kranti	0.367	0.013	0.012	0.000	0.239	0.007	-0.834	-0.068	0.887
NDR-8501	0.291	0.008	-0.090	-0.001	0.145	0.003	-0.819	-0.053	0.784
Rahini	0.359	0.010	0.009	0.000	0.233	0.005	-0.841	-0.054	0.890
RLM-571	0.345	0.009	-0.041	-0.000	0.201	0.004	-0.834	-0.052	0.856
PCR-7	0.343	0.009	-0.020	-0.000	0.209	0.004	-0.838	-0.048	0.903
PSR-30	0.331	0.009	-0.390	-0.000	0.193	0.004	-0.832	-0.049	0.840
Varuna	0.315	0.012	-0.070	0.002	0.169	0.005	-0.831	-0.074	0.822
BSH-1	0.385	0.009	0.004	0.000	0.247	0.004	-0.865	-0.046	0.957

*Significant at 5% level

temperature of 26.87, 12.42 and 19.64°C and mean relative humidity of 62.85% and peak period of *Coccinella* was obtained which is ranged between 3.00-3.40 individuals/plant. After that neither aphids nor *Coccinella* were present in the field. In the present findings, the aphids disappeared after 110 DAS on the first week of March. It is due to the maturation of crop and onset of summer season. Identical reports are obtained by Singh and Malik (1998). It was further explained by Singh and Singh (1994) that maturation of crop has created net deficit in water content in plant tissues leading to food scarcity and alate formation in aphid colonies.

The appearance of *Coccinella* in the later half of February might have played an important role but it was too late to fetch potential importance as the harm to the crop has already been done (Hodek, 1967).

Correlation (r) and regression coefficient (b) showed a positive effect with maximum temperature and average temperature (Table 3). However, minimum temperature caused negative effect on the population of mustard aphid. Whereas mean relative humidity showed significantly negative effect. While, the combined effect of all the environmental factors expressed as the coefficient of determination (R^2) ranged between 78.4-97.3%. This showed much variability among the test *Brassica* germplasm but Lal *et al.* (1997) concluded that different germplasm different significantly in relation to infestation. The same results are obtained to the present study and none of the germplasm was found immune or escaped by mustard aphid but differed significantly in their level of infestation.

Infestation of mustard aphid on different germplasm is largely governed by the average temperature and negatively by mean relative humidity. Whereas, minimum temperature influenced negatively on the infestation of aphid. The same reports have been reported by Sing and Singh (1994). It is in confirmation of earlier reports of Atwal *et al.* (1971) and Sinha *et al.* (1989). Contrary results have been found by Chandra and Kushwaha (1986) that temperature had negative effect whereas relative humidity is positively correlated with the abundance of aphid. Devi *et al.* (1995) suggested that due to increase in mean relative humidity during third week of February favoured the multiplication or mustard aphid. Moreover, Sing and Singh (1994) concluded that abiotic factors Shares 77.69% impact on aphid population.

Therefore, it was finally concluded that germplasms differed significantly in the rate of infestation and age of crop as well but weather factors play an important role in the abundance of mustard aphid. So, the weather factors are an important tool in forecasting the aphid multiplication and the farmers are forewarned for the management of mustard aphid by various pest management strategies at proper time or mustard crop.

REFERENCES

Atwal, A.S., J.P. Chaudhary and M. Ramzan, 1971. Mortality factor on the natural population of cabbage aphid, *Lipaphis erysimi* (Kalt.) (Aphididae: Homoptera:Hemiptera) in relation to parasites, predators and weather conditions. Ind. J. Agric. Sci., 41: 507-510.

Bakhetia, D.R.C. and R.S. Sandhu, 1973. Differential response of *Brassia* species to aphid *Lipaphis erysimi* (Kalt.) infestation. J. Punjab Agric. Univ., 10: 272-279.

Chandra, S. and K.S. Kushwaha, 1986. Impact of environmental resistance on aphid complex of cruciferous crops under the agroclimatic conditions of Udaipur 1. Abiotic Components. Ind. J. Ent., 48: 495-514.

Devi, N., Desh Raj and Y.S. Chandel, 1995. Population dynamics of *Lipaphis erysimi* (Kalt.) on rapeseed in mild hill zone of Himachal Pradesh (India). J. Ent. Res., 49: 367-371.

Hodek, I., 1967. Bionomics and ecology of predacious Coccinellid. Ann. Rev. Ent., 12: 79-104.

Jitendra, K., S.V. Singh and Y.P. Malik, 2000. Population dynamics and economic status of *Lipaphis erysimi* on mustard *Brassica juncea*. Ind. J. Ent., 62: 253-259.

Lal, M.N., S.S. Singh and V.P. Singh, 1997. Relative susceptibility of *Brassica* germplasms to mustard aphid *Lipaphis erysimi*. Ind. J. Ent., 59: 369-373.

Rana, J.S., K.S. Khokar, H. Singh and Sucheta, 1993. Influence of abiotic environment on the population dynamics of mustard aphid. *Lipaphis erysimi* (Kalt.) Crop. Res., 6: 116-119.

Singh, C.P. and G.C. Sachan, 1997. Economic injury levels and economics of control of the mustard aphid. *Lipaphis erysimi* (Kalt.) on mustard in Tarai, India. Insect. Sci. Applic., 17: 293-296.

Singh, D. and H. Singh, 1994. Correlation coefficient between abiotic biotic factors (Predator and parasitoid) and mustard aphid, *Lipaphis erysimi* (Kalt.) population on rapeseed-mustard. J. Aphidol., 8: 102-104.

Singh, S.V. and Y.P. Malik, 1998. Population dynamics and economic threshold of *Lipaphis erysimi* (Kaltenbach) on mustard. Ind. J. Ent., 60: 43-49.

Sinha, R.P., S.S. Yazdani and G.D. Verma, 1989. Population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) in relation to ecological parameters. Ind. J. Ent., 51: 334-339.