Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(4): 394-396
Received: 14-05-2018
Accepted: 19-06-2018

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Population dynamics of mustard aphid, *Lipaphis erysimi* (Kaltenbach) on mustard in relation to different weather parameters

Rupa Bavisa, GM Parmar, MM Hirapara and MF Acharya

Abstract
A study on population dynamics of aphid, *L. erysimi* (Kalt.) in mustard were carried out during *Rabi*, 2016-17 at Main Oilseeds Research Station, Junagadh Agriculture University, Junagadh. The effect of various abiotic factors on the activity of aphid and correlation coefficient were also worked out. The study on population dynamics and its correlation with abiotic parameters is important for a sound and sustainable integrated pest management module for aphid control. The aphid population was commenced from 1st week of December and continued throughout the crop period which ranged from 0.14 to 4.9 aphid index/plant. The infestation gradually increased and reached to peak during 3rd week of February (4.9 aphid index/plant). Correlation coefficient (r) showed a positive effect with evaporation, minimum temperature, bright sunshine hours, wind speed and maximum temperature while negative relationship with morning relative humidity, evening relative humidity and mean relative humidty.

Keywords: mustard aphid, *Lipaphis erysimi* (kalt.), weather parameters, correlation

Introduction
Rapeseed-mustard crops are cultivated in 53 countries spreading over the 6 continents covering an area of 24.2 million ha with an average yield of 1451 kg/ha ranging from 411 kg/ha (Russian Federation) to 6250 kg/ha (Algeria) and netted the total production of 35.1 million tonnes. Among various biotic factors responsible for reducing the yield of mustard, insect pests are the major one. Thirty eight insect pests are known to be associated with mustard crop in India (Bakhetia and Sekhon, 1989) [1]. Out of which, Mustard aphid, *Lipaphis erysimi* (Kalt.), Mustard sawfly, *Athalia proxima* Klug., Painted bug *Bagrada hilaris* Kirk., Leaf miner, *Chromatomyia horticola* Goureau and Bihar hairy caterpillar, *Spilarctia obliqua* Walker are the pests of major importance. Among all the insect pests, the mustard aphid, *Lipaphis erysimi* (Kalt.) has gained the status of key pest of rapeseed-mustard in India. In nature the distribution and abundance of living organisms determined by combine effect of different components of ecosystem. Abiotic factors influence the most for build-up of the population.Weather conditions play the most favourable role for its rapid multiplication (Sinha *et al*., 1989; Singh and Malik, 1998) [7, 6]. It has become absolutely imperative that a fresh approach to pest control be undertaken by studying its population dynamics in relation to weather parameter. Such study will provide an opportunity to fact the pest challenge by manipulating the manageable ecological parameters in the form of planting or harvesting time adjustment, varietals selection, correct time of pesticide application, etc. Therefore, the present study was formulated to observe the aphid population in relation to the weather parameters.

Materials and Methods
A study on population dynamics of aphid in mustard was carried out on variety Gujarat Mustard-2. The crop was raised after following standard agronomical practices in large plot (20x20 m) and it was divided into 15 quadrates one quadrates as one repetition. The plots were kept free from any insecticidal spray throughout the crop period. To find out the incidence of mustard aphid, five plants were randomly selected from each plot. Observations will be recorded at weekly interval starting from the first week of sowing till the maturity of crop (Appendix 1). Generally, it was observed that mustard aphids sit in overlapping manner and hence, it was difficult to record aphids on numerical basis. Hence, aphid index is given for determining aphid population. The meteorological parameters were also recorded during study period. With a view to study the impact of different weather parameter on pest incidence a simple correlation between pest population and weather parameter worked out by the method suggested by Panse and Sukhatme (1985) [5].

$$rX_1Y_1 = \frac{\sum X_1Y_1 - \frac{(\sum X_1)(\sum Y_1)}{n}}{\left\{\sum X_1^2 - \frac{(\sum X_1)^2}{n}\right\}\left\{\sum Y_1^2 - \frac{(\sum Y_1)^2}{n}\right\}}$$

Where,

$r\mathrm{X}_1\mathrm{Y}_1 =$ simple correlation coefficient
$\mathrm{X}_1 =$ various weather parameter
$\mathrm{Y}_1 =$ weekly pest population
$\mathrm{n} =$ number of observation

Results and Discussion

The data on population of aphid presented in Table 1 indicated that the aphid population was commenced from 4th Week After Sowing (WAS) [1st week of December (49th Standard Meteorological Week- SMW)] and continued throughout the crop period which ranged from 0.14 to 4.9 aphid index/plant. The infestation gradually increased and reached to peak (3.4 aphid index/plant) in the 5th week of January (5th SMW). There after aphid population slightly decline in the 1st week of February (6th SMW). Very next week *i.e.* 2rd week of February (7th SMW), population of aphid increased (4.47 aphid index/plant) and reached to its peak during 3rd week of February (8th SMW) (4.9 aphid index/plant). Thereafter, decreasing trend was observed up to 2nd week of March (11th SMW) as crop reached to its maturity. Relatively higher activity (1 - 4.90 aphid index/plant) was observed during 2nd week of January to 4th week of February (2nd - 9th SMW) *i.e.* 9th to 16th WAS. However, at the maturity of the crop, the negligible population with more number of winged aphids was observed on green stem of mustard. Hugar *et al* (2008) [3] found that the incidence of the mustard aphid, *L. erysimi* commenced (2.60 aphids/plant) in the 1st week of December and reached to peak in the 3rd week of January with 825 aphids/plant. Malik and Sachan (2013) [4] also reported that incidence of mustard aphid started in the third week of December reaching to its peak in the second week of February.

During the present study it was found that aphid population was observed right from flowering to maturity of crop. Though, the initial population was found comparatively law but as the temperature decreased and temperature coincide with flowering, the aphid population multiplied very fast and attained its peak level during flowering stage when temperature was comparatively low.

The correlation coefficient between aphid index and weather parameters are presented in Table-2. The correlation matrix indicated that the aphid population exhibited highly significantly positive correlation with evaporation (r = 0.627**) and significant positive relation with minimum temperature (r = 0.514*). Aphid population had positive correlation with bright sunshine hours, wind speed, maximum temperature (0.405) and mean temperature (0.471) while negative relationship with morning relative humidity (-0.452), evening relative humidity (-0.334) and mean relative humidty (-0.423). Malik and Sachan (2013) [4] reported that aphid population had non-significant positive relation with maximum temperature and non–significant negative correlation was observed with mean relative humidity**.** Chaudhary (2015) [2] found that aphid showed highly significant positive (r =0.652) correlation with evaporation. Aphid population had positive correlation with bright sunshine hours, wind speed, maximum temperature, minimum temperature and mean temperature while negative relationship with morning relative humidity and evening relative humidity.

Conclusion

Aphid population commenced from 4th Week After Sowing (WAS) [1st week of December (49th Standard Meteorological Week- SMW)] with aphid index 0.14 and reached to peak (4.9 aphid index/plant) at 15th week after sowing. Relatively higher activity (1 to 4.90 aphid index/plant) was observed during 2nd week of January to 4th week of February (2nd to 9th SMW) *i.e.* 9th to 16th WAS. The correlation matrix indicated that the aphid population had highly significant positive correlation with evaporation (r = 0.627**) and significant and positive relation with minimum temperature (r = 0.514*). All other weather parameter did not show any significant relation with weather parameter.

Acknowledgement

The authors are grateful to Dr. G. M. Parmar and entire staff of dept. of entomology for their support during research work.

Table 1: Population dynamics of *L. erysimi* on mustard during *rabi* 2016-17

Month/week	SMW	WAS	Aphid index/plant
November IV	48	3	0.0
December I	49	4	0.14
II	50	5	0.25
III	51	6	0.38
IV	52	7	0.87
January I	1	8	0.97
II	2	9	1.0
III	3	10	1.59
IV	4	11	1.95
V	5	12	3.4
February I	6	13	3.1
II	7	14	4.47
III	8	15	4.9
IV	9	16	4.32
March I	10	17	2.12
II	11	18	1.35

Table 2: Correlation between weather parameters and population of aphid on mustard during 2016-17

Weather parameter	Aphid
Evaporation mm	0.627**
Bright Sunshine Hours	0.349
Wind Speed km/hr	0.470
Maximum temperature ºC	0.405
Minimum temperature ºC	0.514*
Mean temperature ºC	0.471
Morning Relative humidity%	-0.452
Evening Relative humidity%	-0.334
Mean RH	-0.423

Note:*correlation significant at 0.05% (0.497); **correlation significant at 0.01% (0.623)

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