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Population dynamics of mustard aphid, *Lipaphis erysimi* Kaltenbach infesting radish under middle Gujarat condition

AT Raval and AH Barad

Abstract
An experiment was conducted under field conditions at Anand Agricultural University, Anand during *Rabi*, 2020-21 to study the effect of different weather parameters on occurrence and abundance of mustard aphid infesting radish. The incidence of aphids on radish crop was observed from December, 2020 to January, 2021. The incidence was initiated during the second week of December (49th SMW) in *Rabi*, 2020. Initially, its population was low (8.2 aphids per 3 leaves), which was gradually increased in its numbers and attained peak level (71.6 aphids per 3 leaves) during second week of January (2nd SMW). Then after, population was gradually decreased toward the maturity of the crop. Aphid population showed positive correlation with morning relative humidity, evening relative humidity and wind speed. It showed significantly negative correlation with the maximum temperature. Whereas, negative correlation with minimum temperature, morning vapour pressure, evening vapour pressure and bright sunshine hours.

Keywords: Radish, aphid, *Lipaphis erysimi*, population dynamics, Gujarat

Introduction
India is blessed with diverse agro-climatic zones with distinct seasons, making it possible to grow a wide range of vegetables. Vegetables occupy an important place in the food basket of Indian consumers, a majority of whom are vegetarian by either choice or lack of access. India is the largest producer of vegetables in the world after China (Rai and Pandey, 2007) [10]. In India, it is grown in an area of 10.25 million hectares with the productivity of 17.97 MT/ha which contributes 14% of the total world production of vegetables. Vegetable production in India is 184 million tonnes during 2018 (Anonymous, 2018) [1]. Crucifers are well known all over the world as important vegetable crops of daily necessity to rich and poor alike. Cruciferous vegetables *viz*., Radish (*Raphanus sativus* L.), Cabbage (*Brassica oleracea* var. capitata), Cauliflower (*Brassica oleracea* var. botrytis), Turnip (*Brassica rapa*), Knol-khol (*Brassica oleracea* var. *caulorapa*) and Mustard (*Brassica juncea*) are rich sources of vitamins, minerals and proteins (Mhaske, 2008) [8]. Among them, radish is one of the most popular cruciferous vegetables. Radish (*Raphanus sativus* L.) is an anciently cultivated vegetable originated in the area between the Mediterranean and the Caspian Sea (Crisp, 1995) [6]. The radish is mainly grown for its enlarged roots and green leaves and eaten raw as salad or sometimes cooked as vegetable. In India, total area under radish production is 0.209 m ha with total production of 3.06 million tonnes and productivity 14.65 tonnes/ha. State wise West Bengal is highest in area (40,960 ha) and production (5,39,000 tonnes) of radish throughout country followed by Haryana, Punjab, Bihar, Chhattisgarh, Assam, Uttar Pradesh and Odisha. Whereas, Punjab recorded with highest productivity (21.92 tonnes/ha) of radish in India. It grown in both *Kharif* and *Rabi* seasons in fields as well as kitchen gardens (Anon., 2018) [1]. The low yield of radish can be attributed to a wide variety of pests and diseases. Major insect pests of radish in India are aphids *i.e*., *Brevicoryne brassicae* (L.), *Lipaphis erysimi* (Kalt.), *Myzus persicae* (Sulz.) and *Toxoptera aurantii* (Fon.); flea-beetles, *Phyllotreta cruciferae* (Goeze) and *Monolepta signata* (Olivier) and mustard sawfly *Athalia lugens proxima* (Klug). While, minor pests are *Thrips tabaci* (Lind.), *Crocidolomia pavonana* (F.), *Hellula undalis* (Fab.), *Spilosoma obliqua* (Walk.) and *Spodoptera litura* (Fab.) (Butani and Juneja, 1994) [4]. The insect pests inflict crop losses to the tune of 40 per cent in vegetable production (Bhati *et al.*, 2015) [2]. Among that mustard aphid, *Lipaphis erysimi* Kaltenbach (Homoptera: Aphididae) is the most notorious, cosmopolitan louse-like and obligate insect-pest, which causes a bulk of

the qualitative and quantitative loss of radish crop. Knowledge about the activity period and influence of weather leads to ecologically sound, timely and efficient utilization of resources for strategic management of aphids. Moreover, decision making for the time and method of control strategy to be adopted, can be very well framed if, population dynamics and weather association is well understood.

Materials and Methods

The investigations on population dynamics of aphid, *L. erysimi* on radish were carried out at Horticulture Research Farm, College of Horticulture, AAU, Anand during *Rabi*, 2020-21. For this purpose, radish variety vikas gold was sown at spacing of 45 x 15 cm. All standard agronomical practices were followed to grow the crop only except insecticidal application. The plot was divided into six equal quadrates of 1.0 m^2. From each quadrate, five plants were selected randomly to count the aphid population. Again, within each plant, three leaves were selected randomly for counting aphid population. As well as population of natural enemies were also recorded from randomly selected five plants. The data thus obtained were correlated with minimum and maximum temperature, morning and evening relative humidity, morning and evening vapour pressure, bright sunshine hours and wind speed. The data obtained during the investigation were used to work out correlation coefficient with help of SPSS software. The periodical data on population of mustard aphid recorded from radish leaves were also correlated with various natural enemies' population to determine their relationship.

Results and Discussion

In the nature, populations of organisms are never truly stable. The rise and fall of population density depend on weather conditions. The periodical week-wise data of aphid population and various weather parameters are presented in Table 1 and depicted in Figure 1.

Incidence of Mustard aphid, *L. erysimi* on Radish

The data on population of aphid, *L. erysimi* recorded on radish plant are presented in Table 1. Incidence of the pest on radish plant was observed from December to January. The incidence of aphid started during second week of December (49th SMW) during, 2020. Initially, its population was low (8.2 aphids per 3 leaves), which was gradually increased in its numbers and attained peak level (71.6 aphids per 3 leaves) during second week of January (2nd SMW). Then after, population was gradually decreased toward the maturity of the crop upto last week of January (4th SMW). The higher incidence of aphid population was observed during last week of December to 3rd week of January (52nd SMW to 3rd SMW). Overall maximum population of aphids on radish reached during the month of January, 2021. Thus, maximum population of aphid recorded during the harvesting stage of crop.

Ghosh and Mitra (1983) [7] reported that mustard aphid infestation on seed crop of radish began in early December and reached its peak in January. Vermora *et al*. (2009) [11] revealed that the aphid population first appeared in cabbage started from the first week of December (10.60 aphids per plant) and reached to peak level coinciding with the second week of February. Patel (2015) [9] observed that population buildup of aphid started from 2nd week of December on cauliflower. Bhojeshwari *et al*. (2020) [3] reported that aphid population appeared on cabbage from 4th week of November and reached to peak during 1st week of February. Thus, the above reports are more or less in corroboration with the present findings.

Table 1: Population dynamics of aphid, *L. erysimi* and natural enemies on radish in relation to different weather parameters during *Rabi*, 2020-21

Month	Week	SMW	No. of aphid(s)/ 3 leaves	No. of natural enemies/plant		Temperature (°C)			Relative humidity (%)			Wind speed (Km/hr)	BSS (hrs/ day)	Vapour Pressure (Mm of Hg)	
				Coccinellids (grubs and adults)	Syrphid fly larva (e)	Max.	Min.	Mean	RH_1	RH_2	Mean			VP_1	VP_2
Dec., 2020	I	48	0	0	0	30.43	17.57	24.00	76.57	41.57	59.07	4.27	8.39	12.21	12.99
	II	49	8.2	0.4	0.2	32.71	15.14	23.93	87.86	36.14	62.00	1.46	9.49	11.94	12.81
	III	50	18.6	0.6	0.4	27.43	17.93	22.68	94.14	62.43	78.29	2.29	4.76	14.62	15.06
	IV	51	35.8	1.2	0.8	26.57	12.64	19.61	82.00	44.29	63.14	3.74	8.81	9.33	11.16
	V	52	49.6	1.4	1.0	26.81	12.25	19.53	73.63	36.50	55.06	3.73	9.24	8.33	9.28
Jan., 2021	I	1	60.2	1.6	1.4	25.70	14.90	20.30	77.00	48.00	62.50	3.40	4.10	10.10	11.50
	II	2	71.6	2.2	1.6	27.50	16.10	21.80	89.00	59.00	74.10	3.90	5.60	12.60	16.00
	III	3	65.4	1.6	1.2	29.20	13.60	21.40	91.00	44.00	67.80	1.80	8.60	11.10	12.90
	IV	4	52.6	1.2	0.8	26.90	11.10	19.00	81.00	38.00	59.30	3.10	9.40	8.80	9.40

Note: SMW: Standard Meteorological Week, RH_1: Morning Relative Humidity, RH_2: Evening Relative Humidity BSS: Bright Sunshine Hours, VP_1: Morning Vapour Pressure, VP_2: Evening Vapour Pressure

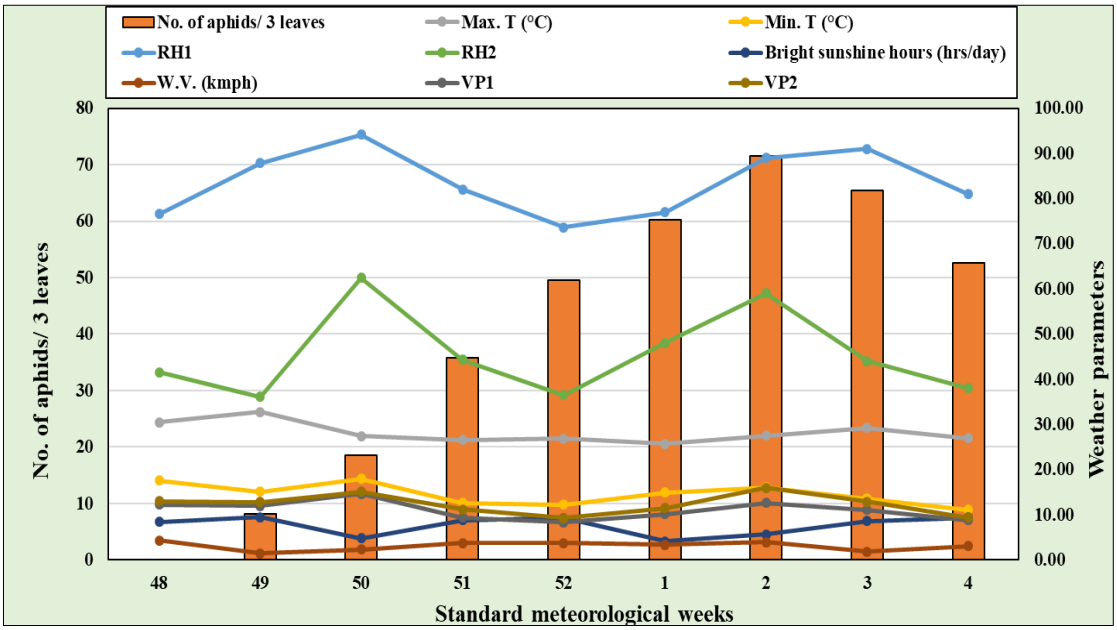

Fig 1: Population dynamics of aphid and its correlation with weather parameters

Table 2: Correlation coefficient (r) between weather parameters and population of aphid, *L. erysimi* on radish during *Rabi*, 2020-21

Weather Parameters	Correlation co-efficient (r)
Bright Sunshine Hours, hrsday^{-1} (BSS)	-0.237
Maximum Temperature, °C (MaxT)	-0.616*
Minimum Temperature, °C (MinT)	-0.481
Morning Relative Humidity, % (RH_1)	0.015
Evening Relative Humidity, % (RH_2)	0.180
Morning Vapour Pressure, mm of Hg (VP_1)	-0.393
Evening Vapour Pressure, mm of Hg (VP_2)	-0.100
Wind Speed, kmhr^{-1} (WS)	0.104

*Significant at 0.05% level of significant

Table 3: Correlation coefficient (r) between population of natural enemies and aphid, *L. erysimi* on radish during *Rabi*, 2020-21

Natural enemies	Correlation co-efficient (r)
Coccinellids	0.970**
Syrphid fly larvae	0.968**

**Significant at 0.01% level of significant

Effect of Weather Parameters on Aphid Population

The investigations were carried out to understand the effect of various weather parameters on population fluctuations of aphid, L. *erysimi*, and the data on correlation among them are presented in Table 2. The correlation coefficient data indicated that morning relative humidity (r = 0.015), evening relative humidity (r = 0.180) and wind speed (r = 0.104) had non-significant positive correlation with aphid population. Whereas, correlation of aphid with the maximum temperature (r = -0.616*) found significantly negative. Activity of aphid had non-significant negative correlation with minimum temperature (r = -0.481), morning vapour pressure (r = -0.393), evening vapour pressure (r = -0.100) and bright sunshine hour (r = -0.237) on radish.

Chavada (2020) [5] found that cabbage aphid showed negative correlation with minimum and maximum temperature. Patel (2015) [9] also found that aphid on cauliflower showed negative correlation with morning and evening vapour pressure. Bhojeshwari *et al.* (2020) [3] reveled that average temperature exerted significant negative relationship with aphid population on cabbage. thus, present findings are in agreement with the earlier reports.

Incidence of Natural Enemies on Radish

The periodical week-wise data of natural enemies' population are presented in Table 1 and its correlation with aphid presented in Table 3.

Coccinellids

The activity of coccinellids (grubs and adults) on radish crop observed during 49th standard meteorological week (2nd week of December) to 4th standard meteorological week (4th week of January (Table 1). The highest population (2.20 coccinellids/plant) of coccinellids was observed during 2nd standard meteorological week (2nd week of January). Thus, population of coccinellids during the entire period ranged from 0.40 to 2.20 with an average of 1.24 coccinellids/plant. There was a highly significant positive correlation (r = 0.970**) between coccinellids and aphid population (Table 3).

Syrphid fly

The activity of larvae of syrphid fly on radish was observed during 49th standard meteorological week (2nd week of December) to 4th standard meteorological week (4th week of January) as mentioned in Table 1. The population gradually increased and reached to peak (1.60 larvae/plant) during 2nd standard meteorological week (2nd week of January). Thereafter, larval population slowly decreased at time of harvesting (0.80 larvae/plant) during last week of January (4th standard meteorological week). The activity of syrphid fly was found till the harvesting of the crop. There was a highly significant positive correlation (r = 0.968**) between syrphid fly larvae and aphid population (Table 3).

Conclusion

From the above results, it can be concluded that the activity of mustard aphid, *L. erysimi* was observed from December, 2020 to the maturity of the radish plants in January, 2021. The incidence of aphids started during second week of December (49th SMW) during *Rabi*, 2020. The peak population level

(71.6 aphids per 3 leaves) was recorded during second week of January (2nd SMW). Then after, population was gradually decreased toward the maturity of the crop upto last week of January (4th SMW). Overall maximum population of aphids on radish reached during the month of January, 2021.

The fluctuation of population density of any organism during crop season depends on many abiotic factors. The correlation coefficient data indicated that morning relative humidity, evening relative humidity and wind speed had non-significant positive correlation with aphid population. Whereas, aphids' population had significantly negative correlation with the maximum temperature. Activity of aphid had non-significant negative correlation with minimum temperature, morning vapour pressure, evening vapour pressure and bright sunshine hours on radish. Activity of natural enemies showed highly significant positive correlation with the fluctuating aphid population.

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References

1. Anonymous. Indian Horticulture Database, National Horticulture Board, 2018.
2. Bhati R, Sharma RC, Singh R. Studies on occurrence of insect-pests of different Brassica species. International Journal of Current Science. 2015;14:125-132.
3. Bhojeshwari S, Pachori R, Navya RN, Patidar S. Population dynamics of Cabbage aphid, *Lipaphis erysimi* on cabbage crop (*Brassica oleracea* var. *capitata* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(3):950-952.
4. Butani DK, Juneja SS. Pests of radish in India and their control. Pesticides. 1994;18(5):10-12.
5. Chavada KM. Comparative biology, population dynamics and management of cabbage aphid, *Lipaphis erysimi* (Kalt.), (Master's thesis, Anand Agricultural University, Anand), 2020.
6. Crisp P. Radish: *Raphanus sativus* (Cruciferae), In: Smartt J: Simmonds N - W: editors. Evolution of crop plants. 2nd Edition, Longman Scientific & Technical, 1995, 86-89.
7. Ghosh MR, Mitra A. Incidence pattern and population composition of *Lipaphis erysimi* (Kaltenbach) on mustard and radish. Pranikee. 1983;4:43-51.
8. Mhaske SN. Studies on seasonal incidence and management of pests infesting radish, *Raphanus sativus* Linn., (Master's thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India), 2008.
9. Patel NM. Bionomics, population dynamics and management of aphid, *Lipaphis erysimi* (Kaltenbach) on cauliflower, (Master's thesis, Anand Agricultural University, Anand, Gujarat, India), 2015.
10. Rai M, Pandey AK. Towards a rainbow revolution. The Hindu Survey Indian Agriculture, 2007, 112-120.
11. Vermora JM, Raghvani KL, Joshi MD, Makadia RR, Dalwadi NG, Boricha HV. Population dynamics of aphid, *Lipaphis erysimi* (Kalt.) and predators on cabbage. Asian Sciences. 2009;4(2):56-58.