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## Seasonal abundance of *brevicoryne brassicae* L. and their predators under different field of cabbage in relation to weather parameters

**Neelam Yadav and Neerja Agrawal**

### Abstract

The present study was carried out on persuade of abiotic factors on abundance of cabbage aphid (*Brevicoryne brassicae*) and their predators on organic and Integrated Pest management (IPM) cabbage fields during *rabi* season of 2017-18 at Insectary, department of Entomology CSAUAT, Kanpur. The infestation of *Brevicoryne brassicae* first appeared in the 51<sup>st</sup> standard week (0.3 per cent) in IPM field whereas in the organic field it commenced in 1<sup>st</sup> standard week i.e. 1.34 per cent and increased gradually and reached its peak 67.00 per cent in the 9<sup>th</sup> standard week. Predator *Coccinella septempunctata* was most common during all the period of observation in both the fields. Moreover, weather may become more favourable for pests and sometimes for the predator to develop. Data calculated on correlation coefficient to estimate the relationship between the number of cabbage aphids and intensity of predators associated with weather parameters.

**Keywords:** Pest, *Brevicoryne brassicae*, IPM field, Organic cabbage field, predators, weather parameters

### Introduction

Vegetables are grown in every part of our country under varied agro-climatic conditions. More than 40 kinds of vegetables belonging to different groups, namely, solanaceous, cucurbitaceous, leguminous, cruciferous (Cole crops), root crops and leafy vegetables are grown in India. India is the second largest producer of vegetables in the world next only to China. Vegetables play an important role in balanced nutrition as these are valuable source of carbohydrates, proteins, vitamins and minerals (Srivastava and Bhutani, 2009) [12]. With the advent of modern technologies such as improved varieties, hybrid production, integrated pest management, protected cultivation. Sometimes cause complete failure of the crop. Among the crucifers, cabbage (*Brassica oleracea* L. var. capitata) is the most popular winter vegetables grown throughout India. In India, cabbage crop occupies an area of 433.9 ha with a production of 8573.3 MT and this is one of the most ravaged cruciferous vegetables by insect pests. The insect pests namely, aphid (*Brevicoryne brassicae* Linn. and *Lipaphis erysimi* Kalt.), diamondback moth (*Plutella xylostella* Linn.), cabbage borer (*Hellula undalis* Fab.), cabbage looper, (*Trichoplusia* Hub.), leaf webber (*Crociodolomia binotalis* Zell.), painted bug (*Bagrada cruciferarum* Kirk.), cabbage butterfly (*Pieris brassicae* Linn.) and tobacco caterpillar (*Spodoptera litura* Fab.) are of more significance on cabbage which affect their yield and quality throughout the country (Yadav and Malik, 2014) [15]. Cabbage aphid, *Brevicoryne brassicae* is one of the serious pests of cruciferous crops. Adults and nymphs feed by sucking plant juices, causing yellowing and curling of leaves, and wilting and stunting of plants. In case of severe infestation yield may decrease up to 80% (Atwal, 1976) [2]. When large colonies develop, the leaves become bleached and distorted and the plants are unable to develop a marketable head. Aphids may have up to forty-five generations per year. Due to high reproductive capacity of aphids and as a result of extensive insecticide application, it has developed resistance against certain insecticides (Ahmad and Akhtar, 2013; Garg *et al.*, 1987; Sweeden and McLeod 1997) [1, 7, 15] which forced the researchers to find out new and effective insecticides. As weather influences the population of pests and predators, the present investigations were undertaken to study the association of climatic parameters with the population build-up of cabbage aphid and predators, in order to understand the pest and predator ecology better. Local weather patterns have a significant impact on the abundance of insect pests in our crops Components of weather, mainly temperature and moisture, can either

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promote insect population growth or cause populations to decline. There is no doubt that weather plays a major role in determining the survival and growth rates of insect populations because of its direct impact on them and on their food supply.

## 2. Materials and Methods

The present study was based on the infestation of cabbage aphid and their predators on cabbage crop in IPM and organic fields. The pests and predators of cabbage were recorded by direct visual counting method, ten plants were selected randomly and the population of pests and natural enemies were recorded from 3 leaves i.e. top, middle and bottom at weekly interval on standard meteorological week basis. Finally, average population of pest and natural enemies per ten plants was worked out. Meteorological data were collected from Department of Agronomy CSAUAT, Kanpur to correlate pest and predators' incidence in cabbage. The observations of pests and predators population were recorded starting from the first week after transplanting till harvest of the crop. With a view to study the impact of weather parameters on the pest, a simple correlation between pest population and weather parameters was worked out. Weekly data of the pests and predators were correlated with the prevailing climatic factors such as maximum temperature, minimum temperature and relative humidity prevailing in the field by computing correlation coefficient (r) with a view to study the combined qualitative impact of different weather parameters on the pests and predators population on IPM and organic cabbage crop during rabi season, 2017-2018.

## 3. Result and Discussion

### 3.1 Abundance of cabbage aphid and their predators on IPM cabbage field

The data recorded on seasonal abundance of Cabbage aphid (*Brevicoryne brassicae*) during rabi season of 2017-18 are presented in Table 1 and Table 2. It is evident from the Table -1 that population of cabbage aphid first appeared in the 51<sup>st</sup> Standard week and reached its peak (69.67) in the 8<sup>th</sup> SW when the maximum and minimum temperature were 30.3 °C and 12.1 °C, respectively with 63.3 per cent relative humidity and 5.6 hours of sunshine. Thereafter, the population showed a decreasing trend in IPM field of cabbage. (Table1).

Coccinellids beetles viz., *Coccinella septempunctata*, *Coccinella transversalis*, *Menochilus sexmaculata* and Syrphid were recorded in the IPM cabbage field. The data presented in Table 1, revealed that the population of coccinellid beetles ranged from 0.34 to 16.67 mean per ten plants. The *Coccinella septempunctata* started from 52<sup>nd</sup> Standard Week and increased gradually to peak on 11<sup>th</sup> Standard Week (Chandra and Kushwaha, 1987; Bhaskar and Virakatanath, 2002; Badjena and Mandal, 2005) [6, 5, 3]. The population dynamics of coccinellid beetles indicates that its population increased gradually with the increase of aphid population and decreased gradually with the decrease in aphid population. Second in order of population was *Coccinella transversalis* followed by *Menochilus sexmaculata* and Syrphid were also recorded in small numbers in 51<sup>st</sup> and 52<sup>nd</sup> Standard Week respectively. Similar results were observed by the (Shah *et al.* 2013) and (Mandal & Patnik, 2008) [11, 8].

### 3.2 Abundance of cabbage aphid and their predators on organic cabbage field

The Cabbage aphid (*Brevicoryne brassicae*) was recorded during the period of study. It is evident from the Table -2 that population of cabbage aphid first appeared in the 1<sup>st</sup> SW and reached its peak (67.00) in the 9<sup>th</sup> SW when the maximum and minimum temperature were 30.3 °C and 12.1 °C respectively with 63.3 per cent relative humidity and 5.6 hours of sunshine. The population showed a decreasing trend thereafter (Table 2). Different Coccinellid beetles viz., *Coccinella septempunctata*, *Coccinella transversalis*, *Menochilus sexmaculata* and Syrphid were recorded. The data presented in Table 4, revealed that the population of coccinellid beetles ranged from mean 0.34 to 10.67 per plant. The *Coccinella septempunctata* started from 50<sup>th</sup> Standard week and increased gradually to peak on 9<sup>th</sup> Standard Week. The population dynamics of coccinellid beetles indicates that its population increased gradually with the increase of aphid population and decreased gradually with the decrease in aphid population. Second in order of population was *Coccinella transversalis* followed by *Menochilus sexmaculata* 4<sup>th</sup> and 9<sup>nd</sup> Standard Week respectively (Wagle *et al.*, 2005 and Bana *et al.*, 2012) [14, 4].

**Table 1:** Abundance Cabbage aphid and their predators on cabbage crop in IPM field during Rabi season, 2017-2018 (Mean of 10 plants)

Sr. No.	Standard Meteorological Week	Pest <i>Brevicoryne brassicae</i>	Predators				Temperature		Relative humidity		Sun Shine (hrs/ day)
			<i>Coccinella septempunctata</i>	<i>Coccinella transversalis</i>	<i>Menochilus Sexmaculatus</i>	Syrphid	Max. Temp. (°C)	Min. Temp (°C)	Max. Rh (%)	Min. Rh (%)	
1	46	0.0	0.0	0.0	0.0	0.0	29.5	13.2	86	43	2.5
2	47	0.0	0.0	0.0	0.0	0.0	26.3	9.8	68	39	2.7
3	48	0.0	0.0	0.0	0.0	0.0	26.7	7.6	87	38	2.8
4	49	0.0	0.0	0.0	0.0	0.0	25.2	10.5	81	45	4.8
5	50	0.0	0.0	0.0	0.0	0.0	24.6	10.5	92	45	2.5
6	51	0.3	0.0	0.0	0.0	0.0	23.2	8.2	89	53	2.3
7	52	2.0	1.34	0.0	0.0	0.0	21	6.8	97	66	3
8	1	4.7	2.0	0.67	0.3	0.34	17.1	5.6	98	69	2.2
9	2	11.3	2.34	1.34	0.0	0.0	20.3	5.3	97	61	1.4
10	3	0.7	1.34	0.34	0.0	0.0	22.4	6.5	93	53	5.4
11	4	1.3	3.0	0.34	1.3	0.0	21.6	5.7	92	62	7.5
12	5	1.0	3.67	1.34	0.0	0.0	25.4	9.8	88	50	6.5
13	6	12.0	3.34	2.0	0.7	0.0	23.2	8.4	83	47	8.7
14	7	13.3	9.34	2.67	0.3	0.0	24.3	11.2	87	56	6.5
15	8	69.7	10.0	1.34	0.3	0.34	30.3	12.1	84	42	5.6
16	9	35.0	12.0	2.0	1.0	0.0	30.7	14.6	85	45	8
17	10	15.0	15.3	0.67	0.7	0.0	30.5	13.9	72	36	8.5
18	11	4.0	16.7	1.34	0.0	0.0	33.2	15.7	61	30	8.9

**Table 2:** Abundance Cabbage aphid and their predators on cabbage crop in organic field during Rabi season, 2017-2018 (Mean of 10 plants)

Sr. No.	Standard Meteorological Week	Pest <i>Brevicoryne brassicae</i>	Predators				Temperature		Relative humidity		Sun Shine (hrs/day)
			<i>Coccinella septempunctata</i>	<i>Coccinella transversalis</i>	<i>Menochilus Sexmaculatus</i>	Syrphid	Max. Temp. (°C)	Min. Temp (°C)	Max. Rh (%)	Min. Rh (%)	
1	46	0.0	0.0	0.0	0.0	0.0	29.5	13.2	86	43	2.5
2	47	0.0	0.0	0.0	0.0	0.0	26.3	9.8	68	39	2.7
3	48	0.0	0.0	0.0	0.0	0.0	26.7	7.6	87	38	2.8
4	49	0.0	0.0	0.0	0.0	0.0	25.2	10.5	81	45	4.8
5	50	0.0	0.0	0.34	0.67	0.0	24.6	10.5	92	45	2.5
6	51	0.0	1.34	0.34	1.34	0.0	23.2	8.2	89	53	2.3
7	52	0.0	2.67	0.0	0.0	0.0	21	6.8	97	66	3
8	1	1.34	3.0	0.0	0.0	0.0	17.1	5.6	98	69	2.2
9	2	6.0	3.0	0.0	1.0	0.0	20.3	5.3	97	61	1.4
10	3	4.0	3.0	0.0	0.67	0.0	22.4	6.5	93	53	5.4
11	4	5.34	3.67	0.0	0.0	0.34	21.6	5.7	92	62	7.5
12	5	8.34	6.0	0.0	0.0	0.34	25.4	9.8	88	50	6.5
13	6	20.67	4.67	0.0	0.34	0.0	23.2	8.4	83	47	8.7
14	7	22.67	4.67	0.0	0.0	0.0	24.3	11.2	87	56	6.5
15	8	56.0	10.0	0.0	0.0	0.0	30.3	12.1	84	42	5.6
16	9	67.0	10.67	0.0	0.0	0.0	30.7	14.6	85	45	8
17	10	1.34	10	0.0	0.0	0.0	30.5	13.9	72	36	8.5
18	11	0.0	3.67	0.0	0.0	0.0	33.2	15.7	61	30	8.9

### Correlation studies between cabbage pest - predator populations and weather parameters in IPM field:

The correlation coefficient between pests population and abiotic factors i.e. temperature, Relative humidity and sunshine are presented in Table-3. The correlation studies clearly revealed that the abundance of *Brevicoryne brassicae* population exhibited non-significant positive correlation with maximum and minimum temperature ( $r= 0.393$  &  $r= 0.353$ ) respectively and sunshine hours ( $r= 0.293$ ), It was observed that aphid was independent of the effect of abiotic factors.

The correlation coefficient between predators population and abiotic factors i.e. temperature, Relative humidity and sunshine are presented in Table-3. The correlation studies show the population of *Coccinella septempunctata* was highly affected by maximum and minimum temperature ( $r= 0.6452$

and  $r= 0.6980$ ). The sunshine also had a positive correlation ( $r=0.744$ ) for building up of its population. It was observed that relative humidity had a negative correlation with maximum & minimum Relative humidity ( $r= - 0.5560$  &  $r= - 0.4184$ ). However *Coccinella transversalis* and *Menochilus sexmaculatus* had a positive correlation with sunshine only ( $r= 0.607$  &  $r=0.6078$ ) respectively.

### Correlation studies between cabbage pest - predator populations and weather parameters in Organic field:

It is evident from Table 4 that Predator, *Coccinella septempunctata* had shown significant positive correlation ( $r=0.6604$ ) with sunshine rest of the Coccinellids did not respond to weather parameters and were non-significant.

**Table 3:** Simple Correlation coefficient (r) between pest and predator populations on cabbage crop in IPM field with weather parameters during Rabi season 2017-18.

S.No	Pest/ Predator (Scientific name)	Temperature (°C)		Relative Humidity (%)		Sunshine Hrs./day
		Max. temp	Min. temp	Max. RH	Min. RH	
1	<i>Brevicoryne brassicae</i>	0.393	0.353	-0.072	-0.164	0.293
2	<i>Coccinella septempunctata</i>	0.646**	0.698**	-0.556*	-0.418	0.744***
3	<i>Coccinella transversalis</i>	0.167	0.290	-0.101	0.009	0.584*
4	<i>Menochilus sexmaculata</i>	0.036	0.053	0.022	0.144	0.607*
5	<i>Syrphid</i>	-0.228	-0.084	0.234	0.409	-0.034

**Table 4:** Simple Correlation coefficient(r) between pest and predator populations on cabbage organic field with weather parameters during Rabi season 2017-18.

S.No	Pest / Predator (Scientific name)	Temperature (°C)		Relative Humidity (%)		Sunshine Hrs./day
		Max. temp	Min. temp	Max. RH	Min. RH	
1	<i>Brevicoryne brassicae</i>	0.3567	0.3686	0.0021	-0.0955	0.4027
2	<i>Coccinella septempunctata</i>	0.3849	0.4084	-0.1414	-0.1071	0.6604**
3	<i>Coccinella transversalis</i>	-0.1203	-0.0443	0.1797	0.0037	-0.3603
4	<i>Menochilus sexmaculata</i>	-0.3665	-0.3791	-0.3479	0.2260	-0.3981

\*, \*\*and \*\*\* denote significant at 5%, 1% and 0.1% level of significance, respectively

(Raja *et al.* 2014) [9] revealed that the population of *B. brassicae* was positively influenced by temperature (maximum and minimum) and relative humidity and negatively influenced by rainfall, wind speed in Theni. Maximum and minimum temperature and wind speed were positively influenced in *B. brassicae* populations in Hosur. The population was positively influenced by maximum temperature and minimum temperature, rainfall and wind

speed in Ooty. Whereas (Shalini *et al.*, 2016) [10] reported that the maximum population of *Brevicoryne brassicae* was recorded 348 aphids / plant in 47th SW of year 2013-14 when the temperature range were 10.7-25.1°C and RH 38-78% and 332 aphids / plant in 9th SW in year 2014-15 when the temperature ranged and RH observed 10.1-25.8 °C and RH 40- 80%, respectively. The population of *B. brassicae* had significant positive influence of maximum temperature,

minimum temperature and wind speed while RH morning and RH evening showed negative influence on them. The literature on IPM and organic field cabbage infestation by cabbage aphid is very scanty.

### Conclusion

From above studies it describes that the population of predators increased with the increase of cabbage aphid pest population specially *Coccinella septempunctata* in both the fields. However the organic field showed good cabbage heads which were shining and solid. The correlation coefficient of pests and predators was worked in IPM and organic and it was found that in IPM field minimum relative humidity had a positive correlation with building up of population of cabbage aphid while *Coccinella septempunctata* had a positive correlation with maximum, minimum temperature and sunshine.

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