



Population dynamics of insect pest with their natural enemies in cabbage crop

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Abstract

The insect pest occurred in cabbage were aphid (*Lipaphis erysimi*), Diamond backmoth, cabbage butterfly and natural enemies like *Cotesia plutella*, Stryphid fly, Coccinellid beetle. The population of aphids showed non-significant positive correlation with minimum and maximum temperature, morning and evening relative humidity. The population of Diamond back moth showed non-significant positive correlation with minimum and maximum temperature, non-significant negative correlation with relative humidity. The population of cabbage butterfly showed non-significant positive correlation with maximum and minimum temperature but non-significant negative correlation with morning and evening relative humidity. The population of *Cotesia plutella* showed non-significant negative correlation with maximum temperature and non-significant positive correlation with minimum temperature, significant negative correlation with morning relative humidity and non-significant negative correlation with evening relative humidity. The population of Coccinellid beetle showed non-significant positive correlation with maximum temperature, significant positive correlation with minimum temperature, significant negative correlation with morning and evening relative humidity. The population of Stryphid fly showed significant positive correlation with maximum temperature, non-significant positive correlation with minimum temperature, non-significant negative correlation with relative humidity.

Key words: Aphids, Diamond backmoth, Cabbage butterfly, Stryphid fly, Coccinellid beetle

1.Introduction

Cabbage (*Brassica oleracea* var. *capitata* L.) is a cole crop belongs to family cruciferae, grown throughout India as a leafy vegetable. The colour of cabbage varies from pale or light green to dark green (Ingram, 2000). It consists of carbohydrates (4%), crude protein (2%), fat (0.3%), minerals such as sodium, potassium, calcium, magnesium, phosphorous, copper, iron, zinc, vitamins such as vitamin A, vitamin C and folate (Ogbede *et al.*, 2015; Mochiah *et al.*, 2011). Among total vegetables grown in India cabbage cover an area of 4.3 % (Vanitha *et al.*, 2013). China ranks first in cabbage production 47% of world production, followed by India 12 % (Sharma *et al.*, 2017).

The insect pest cause damage to cabbage is butterfly (*Pieris brassicae* Linnaeus), diamond back moth (*Plutella xylostella* Linnaeus), cabbage semilooper (*Trichopusia ni* Hubner), aphid (*Brevicoryne brassicae* Linnaeus), cabbage leaf webber (*Crociodolomia binotalis* Zeller), painted bug (*Bagrada cruciferarum* Kirkaldy), cabbage head borer (*Hellula undalis* Fabricius), bihar hairy caterpillar (*Spilosoma obliqua* Walk), cabbage flea beetle (*Phyllotreta cruciferae* Goeze), tobacco caterpillar (*Spodoptera litura* Fabricius) (Aiswarya *et al.*, 2018; Patra *et al.*, 2013; Bhavani and Punnaiah, 2004; Sharma and Rao, 2012).

The yield loss of cabbage due to diamond back moth is 52% in India (Krishnamoorthy 2004). The yield loss due to cabbage aphid up to 50 to 80%. The aphids that attack cabbage are cabbage aphid (*Brevicoryne brassicae* Linnaeus), Green peach aphid (*Myzus persicae* Sulzer) and Turnip aphid (*Lipaphis erysimi* Kaltenbach) (Aslam *et al.*, 2011). The major aphid that infest under southern Punjab is cabbage aphid (Aslam *et al.*, 2007).

So the present research focuses on population dynamics of insect pest and natural enemies of cabbage in relation to abiotic factors.

2. Material and Method

The studies were conducted at Entomological Research Farm, Lovely Professional University, Phagwara, Punjab in the year 2021. The variety grown was Barkha f1 hybrid, spacing - 60×45 cm, size of each treatment plot is 6×3.5m, Randomised block design. The land was prepared by using disc plough and cultivator, recommended dosage of fertilizers was applied and other agronomic practices were followed. The 45 days old seedlings were transplanted. The insect population of cabbage were counted from 10 randomly selected plants in each treatment at weekly intervals. The meteorological data were collected from agro meteorological department, Lovely professional university 2021.

Table-1 Population dynamics of insect pest and natural enemies of cabbage in relation with abiotic factors

SW	Insect pest/10plants			Natural enemies / 10plants			Temperature (°C)		Relative humidity (%)	
	Aphids	DBM	CBF	CP	CCB	SF	Min.	Max.	Mor.	Even
5	8.40	0.00	0.00	0.00	0.00	0.00	8.7	17	62.2	49.5
6	25.50	0.00	0.00	0.00	0.00	0.00	10.7	21	66.5	36.7
7	81.75	0.00	0.00	0.00	0.00	0.00	11.4	20.8	83.8	71.4
8	296.62	0.00	0.00	0.00	0.00	0.00	11.7	23.4	83.1	75.4
9	590.37	0.04	0.00	0.00	0.24	0.29	16.5	28.4	68.5	50.5
10	102.83	0.08	4.10	0.00	0.27	0.28	16.5	29.1	62.5	43.4
11	138.08	0.91	1.20	0.00	0.08	0.70	19.7	30.4	59.2	40.7
12	235.08	4.67	0.00	0.00	0.37	0.70	17.8	29.2	63	42.7
13	220.33	15.00	0.00	0.00	0.45	0.12	15.7	30.4	58.8	31.7
14	177.33	10.33	1.30	0.02	0.52	0.04	12.5	31.7	40.5	30

DBM-Diamond backmoth CBF-Cabbage butterfly CP-Cotesia plutella CCB-Coccinellid beetle SF-Stryphid fly

Table-2 Correlation of population dynamics of insect pest and natural enemies of cabbage in relation with abiotic factors

	Aphid	DBM	CBF	CP	CCB	SF
Min.temp	0.418	0.171	0.338	-0.159	0.440	0.883*
Min.temp	0.438	0.566	0.403	0.381	0.810*	0.569
Mor.RH	0.112	-0.593	-0.325	-0.688*	-0.712*	-0.207
Even.RH	0.139	-0.591	-0.252	-0.394	-0.651*	-0.268

At 5% level of significance

Results and Discussion

The insect pest population of aphid in cabbage appeared during 5th SW (8.40 aphids/10 plants) when the minimum temperature 8.7°C, maximum temperature 17°C, morning relative humidity 62.2%, evening relative humidity 49.5% and reached peak during 9th SW (590.37 aphids/10 plants) when the minimum temperature 16.5°C, maximum temperature 28.4°C, morning relative humidity 68.5%, evening relative humidity 50.5%. The population of aphids with maximum temperature ($r = 0.418$), minimum temperature ($r = 0.438$), morning relative humidity ($r = 0.112$), evening relative humidity ($r = 0.139$) showed non-significant positive correlation. Patra *et al.*, (2013) also noticed that population of aphid with maximum non-significant positive correlation. Varmora *et al.*, (2009) also observed non-significant positive correlation with maximum and minimum relative humidity.

The insect pest population of diamond backmoth in cabbage appeared during 9th SW (0.04 larva/10plants) when the minimum temperature 16.5°C, maximum temperature 28.4°C, morning relative humidity 68.5%, evening relative humidity 50.5% and reached peak during 13th SW (15 larva/10plants) when the minimum temperature 15.7°C, maximum temperature 30.4°C, morning relative humidity 58.8%, evening relative humidity 31.7%. The population of diamond backmoth with maximum temperature (0.171) and minimum temperature (0.566) showed non-significant positive correlation while the morning relative humidity (-0.593) and evening relative humidity (-0.591) showed non-significant negative correlation. Mane and Singh, (2021) also observed that maximum temperature showed non-significant correlation with diamond backmoth. Anjali and Pandya, (2019) also noticed non-significant negative correlation with maximum and minimum relative humidity. Bhagat *et al.*, (2018) also showed non-significant positive correlation with temperature and non-significant negative correlation with relative humidity.

The insect pest population of cabbage butterfly in cabbage appeared during 11th SW (1.20 larva/10 plants) when the minimum temperature 19.7°C, maximum temperature 30.4°C, morning relative humidity 59.2%, evening relative humidity 40.7% and maximum during 10th SW (4.10larva/10plants) when the minimum temperature 16.5°C, maximum temperature 29.1°C, morning relative humidity 62.5%, evening relative humidity 43.4% The population of cabbage butterfly with maximum temperature (0.338) and minimum temperature (0.403) showed non-significant positive correlation while morning relative humidity (-0.325) and evening relative humidity (-0.252) showed non-significant negative correlation. Ahmad *et al.*, (2018) also noticed that non-significant positive correlation with maximum and minimum temperature. Khan and Talukder, (2017) also noticed negative correlation with minimum and maximum relative humidity.

The natural enemies population of *Cotesia plutella* in cabbage appeared during 14th SW (0.02 parasitoid larva/10 plants) when the minimum temperature 12.5°C, maximum temperature 31.7°C, morning relative humidity 40.5%, evening relative humidity 30%. The of *Cotesia plutella* showed non-significant negative correlation with minimum temperature (-0.159) and non-significant positive correlation maximum temperature (0.381). The population of *Cotesia plutella* showed significant negative correlation with morning relative humidity (-0.688) and non-significant negative correlation with evening relative humidity (-0.394). Patra et al., (2017) also showed non-significant negative correlation with evening relative humidity.

The natural enemies of Coccinellid beetle in cabbage appeared during 9th SW (0.24larva/10plants) when the minimum temperature 16.5°C, maximum temperature 28.4°C, morning relative humidity 68.5%, evening relative humidity 50.5% and reached peak during 14th SW (0.52 larva/10plants) when the minimum temperature 12.5°C, maximum temperature 31.7°C, morning relative humidity 40.5%, evening relative humidity 30%. The population of Coccinellid beetle showed non-significant positive correlation (0.440) with minimum temperature and significant positive correlation (0.810) with maximum temperature. The morning relative humidity (-0.712) and evening relative humidity showed significant negative correlation. Patra et al., (2017) also observed maximum temperature showed positive effect on Coccinellid beetle and also morning and evening relative humidity showed negative effect of population of *Coccinellid* beetle.

The population of Syrphid fly appeared during 9th SW (0.29larva/10plants) when the minimum temperature 16.5°C, maximum temperature 28.4°C, morning relative humidity 68.5%, evening relative humidity 50.5%. and reached peak during 12th SW (0.70larva/10plant) when the minimum temperature 17.8°C, maximum temperature 29.2°C, morning relative humidity 63%, evening relative humidity 42.7%. The population of Coccinellid beetle showed significant positive correlation with maximum temperature (0.883) and non-significant positive correlation with minimum temperature (0.569). The population of Syrphid fly showed non-significant negative correlation with maximum relative humidity (-0.207) and minimum relative humidity (-0.268). Borad et al., (2020) also showed significant positive correlation with temperature and maximum relative humidity and minimum relative humidity showed non-significant negative correlation.

Conclusion

The population of aphid showed non-significant positive correlation with temperature and relative humidity, diamond back moth showed non-significant positive correlation with temperature and non-significant negative correlation with relative humidity. Cabbage butterfly showed non-significant positive correlation with temperature, non-significant negative correlation with relative humidity. The population of Coccinellid beetle showed non-significant positive correlation with maximum temperature, significant positive correlation with minimum temperature, significant negative correlation with relative humidity.

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