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Effect of weather parameters on incidence of insect pests of cucumber in eastern Bihar

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ABSTRACT

The insect-pests infestation in cucumber leads to severe injury to its' vegetative parts and fruits by epilachna beetle, red pumpkin beetle, whitefly, pumpkin caterpillar, leaf minerand fruit fly. The present investigation was taken upduring 2014 and 2015 to study the population dynamics of prevailing six insect-pests of cucumber and its natural enemies inrelation to weather parameters.The correlation studies between insect pests and weather parameters revealed that the melon fruit fly (*Bactrocera cucurbitae* Coquillett), epilachna beetle (*Epilachna vigintioctopunctata Fabricius),* red pumpkin beetle *(Aulacophora foveicollis*Lucas*),* whitefly *(Bemisia tabaci* Gennadius*),* pumpkin caterpillar *(Diaphania indica* Saunders*)* and leaf miner *(Liriomyza trifolii* Burgess*)* showed significant positive correlation with maximum and minimum temperature,whereas negative and nonsignificant correlation with relative humidity and rainfall. The natural enemies such ascoccinellids and spiders showed significant positive correlation with maximum and minimum temperature, and non significant negative correlation with relative humidity and rainfall. Sunshine hour showed positive correlation with all the insect pests and natural enemies except epilachna beetle.

Key words : Insect pests, population dynamics, cucumber, climatic factors

Cucumber (*Cucumis sativus* L.) is an important vegetable crop and one of the most popular members of the Cucurbitaceae family. Like other cucurbits, cucumber is also being subjected to damage by wide array of insect pests' right from the initial stages of the crop toharvest of the products in India.The extent of loss caused by these dipteran flies is varying from 20 to 100 per cent depending upon cucurbit species and environmental conditions (Rai *et al*., 2014). The melon fruit fly, red pumpkin beetle (*Aulacophora foveicollis* Lucas) and epilachna beetle (*Henosepilachna septima* Dieke), leaf roller, green semilooper and white fly etc. are the most destructive pest of cucurbits (Barma and Jha, 2013;Khan *et al*., 2012; Krisha Kumar *et al*., 2006).

Keeping this in view, the present investigation was carried out on occurrence of melon fruit fly, epilachna beetle, red pumpkin beetle, leaf roller, leaf miner, whitefly, natural enemies (coccinellids and spiders) with abiotic factors to develop economical strategies of pest management.

MATERIALS AND METHODS

The present investigation was carried out during the summer season of 2014-15 and 2015-16 at Vegetable Research Farm of Bihar Agricultural University, Sabour, Bhagalpur, Bihar (latitude 87 º 2´ 54"E, longitude 25º 14´ 24"N, altitude 30 m a.s.l.).

The local variety of cucumber 'Varsha' was grown in a plot size 25m^2 (5m×5m) with a plant spacing 100cm × 130cm. All agronomical practices were done to raise the crop excluding plant protection measures. Observations on pest incidence were taken at an interval of seven days at morning hours during the whole period of crop growing season.Direct count of all the developmental stages of the pests like epilachna beetle (grub and adult) and redpumpkin beetle (adult) were taken from randomly selected seven plants from each plot. For fruit fly, three bottle traps were installed at a distance of 50 m between the traps to avoid trap interference effect. These traps were charged with 0.4 ml of cuelure and 1 ml of dichlorovos at monthly and fortnightly intervals respectively. The fruit flies were collected at weekly intervals and identified to species level and recorded. For observation of pumpkin caterpillar and leaf miner, randomly tagged five vines per plot were selected and number of larvae per vine and no. of mines per vine were counted at weekly interval. The *Bemisiatabaci* (Gennadius) population was recorded

Table 1: Enumeration of insect pests and natural enemies in cucumber

Sl. no.	Scientific Name	Common Name	Family	Order	Remarks
1.	*Epilachna vigintioctopunctata* (Fabricius)	Hadda beetle	Coccinellidae	Coleoptera	Foliage feeder
2.	*Aulacophora foveicollis* (Lucas)	Red pumpkin beetle	Chrysomelidae	Coleoptera	Foliage and flower feeder
3.	*Diaphania indica* (Saunders)	Pumpkin caterpillar	Pyralidae	Lepidoptera	Foliage tender fruit feeder
4.	*Bactrocera cucurbitae* (Coquillet)	Fruit fly	Tephritidae	Diptera	Damaging fruits
5.	*Bemisia tabaci* (Genn.)	Whitefly	Aleyrodidae	Hemiptera	Foliage feeder
6.	*Liriomyza trifolii* (Burgess)	Leaf miner	Agromyzidae	Diptera	Mining leaves
			Natural enemies		
1.	i. *Coccinella septempunctata* ii. *Menochilus sexmaculata*	Coccinellids	Coccinellidae	Coleoptera	Predator
2.	i. *Neoscona* spp ii. *Oxyopes* spp	Spiders	Araneidae	Araneae	Generalist Predator

by counting it at weekly interval on five tagged randomly selected plants by observing three compound leaves selected from different positions, *i.e.*, bottom, middle and top of the plant in each replication. Regarding natural enemy (coccinellids *Coccinella septempunctata* L. and *Menochilus sexmaculata* Fabricius and spiders) is concerned, five vines per plot were selected and number of natural enemy was counted (Table 1).

Meteorological data *viz.*, maximum and minimum temperature(°C), rainfall (mm), maximum and minimum relative humidity (%) and sunshine hours were collected from the Department of Agronomy (Meteorology), Bihar Agricultural University, Sabour, Bhagalpur, Bihar. Correlation and regression were made between insect pests, trap catches and mean weather parameters.

RESULTS AND DISCUSSION

Melon fruit fly (Bactrocera cucurbitae,* Coq.*)

The pooled data of two years shows that the fruit fly (*Bactrocera cucurbitae,* Coq.) occurred from third week of April to second and third week of June (Table 2). The peak (50 to 66 fruit fly/trap/week) population of fruit fly was recorded during May. Banerji *et al*. (2005) also reported that peak population of fruit fly was recorded on bitter gourd in West Bengal during summer followed by winter season. The melon fruit fly had significant positive correlation with both maximum (r =+0.623) and minimum (r = +0.632) temperature (Table 3) and non significant correlations with other parameters. Barma and Jha (2013) had also reported significant positive correlation with maximum and minimum temperature alongwith negatively significance with relative humidity.

Red pumpkin beetle (Aulacophora foveicollis,Lucas)

Red pumpkin beetle infestation was observed throughout the cropping period with highest population (2.80 to 3.40 adults/plant) during first week of May to first week of June (Table 2). Rathod and Borad (2010) also recorded highest incidence of red pumpkin beetle during

Table 2: Seasonal incidence of insect pests and natural enemies of cucumber (Mean data of two years, 2014 and 2015)

Dates	Standard Week	Insect pests						Natural enemies	
		Red pumpkin beetle/ plant	Fruit fly/ trap/ week	Epilachna beetle/ plant	Whitefly/ 3 leaves/ vine	Leaf roller/ vine	Leaf miner/ vine	Coccinellids/ vine	Spiders/ vine
26 Mar-01 Apr	13th	0.80	-	0.30	1.40	0.20	0.60	0.33	0.50
02 Apr-08 Apr	14th	0.75	-	0.40	1.70	0.42	0.65	0.35	0.80
09 Apr-15 Apr	15th	1.40	-	0.40	2.90	0.42	1.20	0.54	1.10
16 Apr-22 Apr	16th	2.00	40.00	0.50	3.25	0.48	1.70	0.55	1.35
23 Apr-29 Apr	17th	2.10	40.50	0.75	4.00	0.65	3.30	0.54	1.60
30 Apr-06 May	18th	2.95	50.00	0.90	4.40	0.80	3.70	0.75	2.20
07 May-13 May	19th	3.40	56.00	0.78	4.55	0.78	4.20	0.71	2.55
14 May-20 May	20th	3.20	63.00	0.70	5.00	0.76	4.20	0.85	2.40
21 May-27 May	21st	3.30	66.00	0.50	5.40	0.70	4.10	1.10	2.04
28 May-03 Jun	22nd	2.80	57.00	0.46	5.30	0.53	3.34	0.71	1.70
04 Jun-10 Jun	23rd	1.90	54.00	0.40	4.10	0.37	3.00	0.55	1.35
11 Jun-17 Jun	24th	1.00	42.00	0.32	3.40	0.20	3.50	0.50	1.33

Table 3: Correlation studies between insect pests and natural enemies of cucumber with weather parameters (Pooled value of two years)

Insect pests	Maximum temperature	Minimum temperature	Maximum R.H.	Minimum R.H.	Rainfall	Sunshine hours
Melon fruit fly	0.623*	0.632*	-0.380	-0.124	-0.303	0.309
Red pumpkin beetle	0.550*	0.657*	-0.298	0.015	-0.452	0.262
Epilachna beetle	0.399	0.540*	-0.332	0.176	-0.228	-0.050
Whitefly	0.554*	0.671*	-0.380	-0.080	-0.448	0.392
Pumpkin Caterpillar	0.279	0.353	-0.141	-0.014	-0.263	0.219
Leaf miner	0.727*	0.843*	-0.513	-0.159	-0.534	0.340
Natural enemies						
Coccinellids	0.576*	0.630*	-0.297	-0.137	-0.476	0.452
Spiders	0.590*	0.701*	-0.311	-0.0340	-0.499	0.292

* Correlation is significant at the 0.05 level of significance

summer season.A. foveicollis population had positive significant correlation with maximum (r = +0.550) and minimum (r= +0.657) temperature (Table 3), while maximum RH (r= -0.298) and rainy days (r =-0.452) had non significant negative correlation with pumpkin beetle population.

Epilachna beetle (Epilachna vigintioctopunctata, Fabricius)

Epilachna beetle was initiated from last week of March to second week of June (Table 2). The population was highest in last week of April to third week of May with the population of 0.70 to 0.90 beetles/plant. Significant positive correlations was obtained only with minimum temperature (r = +0.540) while the positive correlations with maximum temperature (r = +0.399) and negative correlation with maximum relative humidity (r= -0.332) and rainfall (r = -0.228) were non significant(Table 3).

The results are in conformity with the findings of Barma and Jha (2013), about the incidence of epilachna beetle on pointed gourd which revealed that the significant

Table 4: Correlation studies between spider and pest's

Pests	Spider
Melon fruit fly	0.865*
Red pumpkin beetle	0.951*
Epilachna beetle	0.805*
Whitefly	0.885*
Pumpkin caterpillar	0.867*
Leaf miner	0.788*

* Correlation is significant at the 0.05

positive correlation with maximum temperature and negative correlation to other remaining factors.

Whitefly (Bemisia tabaci, Genn.)

The peak incidence of whitefly was recorded during last week of May to second week of June (4.00 to 5.40/ 3 leaves/ vine) (Table 2). The correlation study showed that B. tabaci population had significant and positive correlation with maximum and minimum temperatures, whereas, it had negative correlation with relative humidity, rainfall (Table 3).The present findings are in agreement with Manoj and Anil (2016) who found that the correlation coefficient of B. tabaci population with different weather variables showed that Tmax and Tmin were significantly and positively correlated with B. tabaci population in all the varieties at 5 per cent level. Evening relative humidity (RHe) has significant but negative correlation with B. tabaci population. RHm,WS, SS and rainfall had non significant correlation with B. tabaci population.

***Pumpkin Caterpillar (Diaphania indica*, Saunders)**

Pumpkin Caterpillar, Diaphania indica (Saunders) was recorded throughout the crop season in both the two years of study.Population was very low 0.20 to 0.80 per vine (Table 2) with the peak incidence during last week of April to last week of May (0.65 to 0.80 larvae/ vine).The maximum and minimum temperatures exerted positive correlations, whereas max. and min. relative humidity, rainfall had negative correlation with the pest population but all were non significant.Halder *et al.* (2017) found that the maximum, minimum and mean temperature, growing degree day and evaporation rate showed significant positive correlations with D. indica, whereas a negative correlation was established with relative humidity, rainfall and wind velocity.

Leaf miner (Liriomyza trifolii, Burgess)

The leaf damage by L. trifolii was maximum (3.30 to 4.20 mines/ vine) during last week of April to third week of May (Table 2). Aawathanarayana Reddy andAshok Kumar (2004) found that the peak infestation of leafminer was noticed during March - April.The highly significant positive correlations with maximum and minimum temperature (r = +0.727 and r= +0.843) and non significant correlation with other weather parameters were obtained (Table 3).

Coccinellids

The population of coccinellids (Coccinella septempunctata L. and Menochilus sexmaculata Fabricius) ranged from 0.33 to 1.10 coccinellid/ vine with the peak incidence of coccinellids (0.71 to 1.10 coccinellids/ vine) during first week of May to first week of June (Table 2). The coccinellids also showed significant positive correlation with maximum (r = +0.576) and minimum (r = -0.630) temperature (Table 3). Meena and Shashi (2014) also found that maximum and minimum temperature and relative humidity showed significant positive correlation with coccinellids population.

Spiders

Analysis of pooled data on spider incidence for both the two years revealed that the predator was active throughout the growing season of cucumber. The important species of spider found dominated in the cucumber field are Neoscona spp and Oxyopes spp. Peak spider activity (1.60 to 2.55 spiders/ vine) was recorded during third week of April to last week of May (Table 2).Spider incidence had asignificant positive correlation with maximum (r = +0.590) and minimum temperature (r = +0.701) and non significant with other paramters. The present findings are accorded with Sunil (2013) who found that spiders incidence showed negative correlation with weekly total rainfall. This correlation indicated better activity of spider fauna at higher average temperature associated with relative humidity and low rainfall.

Correlation between spider and pest's

Spider had significant impact on the population of all insects viz: melon fruit fly, red pumpkin beetle, epilachna beetle, pumpkin caterpillar, whitefly and leaf miner (Table 4).

CONCLUSION

It is concluded that the population of fruit fly, B. cucurbitae, epilachna beetle, E. vigintiopunctata, red pumpkin beetle, A. foveicollis**,** pumpkin caterpillar, D. indica, whitefly, B. tabaci and leaf miner, L. trifolii of cucurbitaceous vegetables, were positively significantly influenced by

maximum and minimum temperatures. Other weather parameters had non significant.

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