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Original Research Article

Population Dynamics of Major Insects of Okra in relation to Weather Parameters in Jabalpur District of Madhya Pradesh

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Keywords

Abiotic factors, Okra, Population dynamics, Insect pests

A B S T R A C T

A field experiment was conducted on *Rabi* season in 2019-20 to study the effect of abiotic factors on major insect pests on okra cultivator of Kashi Kranti.The period of maximum activity of jassid (23.00/ 6 leaves) and aphid (36.5/ 6 leaves) were observed on 3rd week of November (47 SW) whereas whitefly (15.5/ plant) and fruit borer (40.66 % fruit infestation) were observed highest on 2nd week of October (44 SW) and 1st week of January (2 SW) respectively. White flies had significant positive correlation with maximum and minimum temperature, morning and evening vapour pressure whereas, aphids had significant negative correlation with rainfall. Jassid had no correlation with weather parameters. Shoot and fruit borer had significant negative correlation with maximum temperature, morning vapour pressure while significant positive correlation with wind velocity.

Introduction

Okra *Abelmoschus esculentus* (*L.*) Monech is commonly known as Bhindi or lady's finger etc, which belongs to family Malvaceae. Okra is an export-oriented crop and usually contributes 61.9% of the total fresh vegetables export. India ranks second in terms of vegetable production in the world 185.88 million ton and first in okra production which is about 62% of the world. The India's area, production and productivity of okra crop is 5.13 lakh ha, 6.710 million MT and 10.6 MT/ha respectively. In Madhya Pradesh, the crop is grown in an area of 43.76 thousand ha with production of 638 thousand MT of okra fruits and productivity is 14.3 MT/ha (Anonymous, 2018). The demand and supply are un-matching due to lower productivity. Critical analysis for such low productivity revealed that Okra crop is attacked by a number of insect pests, during their different growth stages, which are major constraints, in getting higher yields. As high as, 112 species of insects have been recorded on okra, under 106 genera, 56 families and 10 orders in bhindi (Chakraborthy *et al.*, 2014).

Among the sucking pests, *B. tabaci* causing direct damage by injecting Okra yellow vein

mosaic virus (OYVMV) resulting in significant loss of 54.04% especially when it occurs in the early stages of crop growth. Jassid, *A. biguttula* both nymphs and adults suck the cell sap and injects toxic saliva which makes affected leaves turn yellowish, curled and reported losses ranging from 40 to 88% (Dhandapani *et al.,* 2003).

Aphids, *Aphis gossypii*, the nymph and adult sucks sap from leaves which turns yellow, get deformed, curled and dried up causing serious reduction in fruit yield (Butani and Verma, 1976) and 22–91.6% losses due to the attack of fruit borer *E. vittella* (Kanwar and Ameta, 2007). Some of the aphidophagous predators like *Encarsia* sp., *Chrysoperla* spp., ants and Coccinellids like *Coccinella septum punctata and Menochilus sexmaculata* which are recognised as one of the important regulating factors in controlling aphid population. They also feed on whiteflies, mites, small insects, eggs of insects. (Sreelatha *et al.*,2019**).**

The management strategies will become more difficult when more than one insect pests from different category occurred. In order to lessen the losses caused by pests and to produce quality crop, it is essential to manage the pest population at appropriate time with suitable measures. The multiplication of these pests has been found to be favoured by environmental factors. Therefore, knowledge on the population fluctuation of insect-pests throughout the growing season of okra can become sound and economical.

Materials and Methods

The experiment was laid out in randomized block design (RBD) with eight treatments and three replications were conducted during *Rabi* season of 2019-20, in the field of Vegetable science farm, Jawaharlal Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh. Seed was sown of variety Kashi Kranti with plant to plant and row to row spacing with 0.60 m x 0.30 m and total plot size of 4.2 m x 3.0 m (12.6 sq. m.) with 0.5 metre pathway between plots. The observation for succession and population dynamics of aphid, jassid (total nymphs + adults) were recorded from each upper, middle and lower (2) leaves twice in a standard week and for whitefly, cage was placed over the plant and counted from the transparent glass surface over the slit. Shoot and fruit borer (*Earias vittella*) recorded on the basis of percent of fruit damage.

$$\text{Percentage fruit borer infestation} = \frac{\text{Weight of infested fruits}}{\text{Weight of the total number of fruits}} \times 100$$

The data on infestation of various insect pests were correlated with prevailing abiotic factors and statistically analyzed as per the method given by Snedecor G.W. and Cochran W.G. (1967) (Fig. 1, Fig. 1 and 2).

Results and Discussion

Whitefly, *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae)

First appearance of whitefly was observed a count of 10.00 whiteflies/ 6 leaves / plant in two weeks of sowing *i.e.,* on 28thOctober (43rd SW). The population of the whitefly gradually increased and reached the peak level of 23.00 per 6 leaves during 44thSW (29th- 04thNov) and present till 46thSW.During this period maximum (30.3°C) and minimum (17.7°C) temperature, morning and evening relative humidity were 92 and 52 percent respectively, wind velocity (1.1 km/hr). Further, sunshine hrs, morning &evening vapour pressure and evaporation were 5.3 per hr, 17.3mm and16.5 mm and 2.3

mm respectively and no rainfall in this period. The findings are more or less in relevance with the Siddhartha (2015), who found whitefly population from 40thSW but found peak level on 43rdSW.Correlation analysis revealed that maximum and minimum temperature (r = 0.51*, 0.80*), morning vapour pressure (r = 0.85*) and evening vapour pressure (r = 0.75*) showed a significant positive correlation with whitefly population. Non-significant positive correlation with rainfall (r = 0.15), morning relative humidity (r = 0.33), evening relative humidity (r = 0.45) and evaporation (r = 0.34) and negative non-significant correlation with sunshine hrs and wind velocity correlation (r = -0.40 and -0.16 respectively). The present findings are in alignment with Siddhartha (2015) who found that significant positive correlation with maximum temperature and minimum temperature and negative correlation with wind velocity. Whereas, Sharma *et al.,* (2010), Pandey and Khosta (2017) showed significant negative correlation with rainfall and significant positive correlation with maximum temperature and positive non-significant correlation with minimum temperature respectively.

Aphid *Aphis gossypii* (Glover) (Hemiptera: Aphididae)

First appearance of aphid was observed a count of 5.00 aphid / 6 leaves in three weeks after sowing i.e., 4th November (44st SW). The population of the aphid gradually increased and reached the peak level of36.50 per 6 leaves during (47th SW) *i.e.* (12th -18th Nov).The aphid population gradually increased and reached the peak level of 36.5 aphids per 6 leaves during 47 SW *i.e.* (19th Nov-25thNov.) During this period maximum (28.2°C) and minimum (10.5°C) temperature, morning and evening relative humidity were 91 and 48 percent respectively, wind velocity (1.4 Km/hr). Further, sunshine, morning & evening vapour pressure and evaporation were 6.8 per hrs, 11.3 mm and 13.2 mm and 2.0 mm respectively and no rainfall in this period. Singh *et al.,* (2013) results found that population started from 36th SW and found peak level of incidence on second week of October 41st SW. This activity might be correlated with the crop growth stage irrespective of sowing time. In contrary, Potai and Chandrakar (2018) observed 33rd SMW and reached peak during 40th SMW i.e., observed peak after 7 weeks after occurrenceAphid population had significant negative rainfall correlation with rainfall (r = -0.51*). Non-significant positive correlation with maximum temperature (r = 0.46), sunshine (r = 0.41), morning and evening vapour pressure (r = 0.14, 0.47), no. of rainy days (r = 0.01), morning relative humidity (r = 0.36) and evaporation (r = 0.39) while, negative correlation with minimum temperature (r = -0.11), evening relative humidity (r = -0.34) and wind velocity (r = -0.34). The present findings are in alignment with Sharma *et al.,* (2020) found negative significant correlation with rainfall and non-significant correlation with minimum temperature and significant positive correlation with maximum temperature and negative relation with minimum temperature and rainfall. While, Siddhartha (2015) showed significant positive correlation with maximum temperature and positive relation with minimum temperature, morning relative humidity and sunshine. Pandey *et al.,* (2017) revealed that aphid has significant positive correlation with maximum temperature.

Jassid, *Amrascabiguttula biguttula* (Ishida) (Hemiptera: Cicadellidae)

First attack of jassid was noticed with a count of 3.50 jassids / 6 leaves third week after

sowing *i.e.,* 4th November (44th SW). The pest reached its peak with 23.00 jassids / 6 leaves during 19th– 25th Nov (47th SW).During this period maximum (28.2°c) and minimum (10.5°c) temperature, morning and evening relative humidity were 91 and 48 percent respectively, wind velocity (1.4 km/hr). Further, sunshine, morning & evening vapour pressure and evaporation were 6.8 per hrs, 11.3 mm and 13.2 mm and 2.0 mm respectively and no rainfall were recorded in this period. Akhila (2019) reported that leafhopper incidence was observed in *Kharif* sown okra during 35thSW and its peak during 40th SW. The activity of the pest might be related to the crop growth stage irrespective of the sowing time. While, Kumar *et al.,* (2017) recorded incidence of jassid from third week of sowing (27thSW) but the peak population appeared at tenth week after sowing (34th SW) the difference may be due to seasonal variation in cropping season. Correlation analysis revealed that jassid population showed non-significant positive correlation with maximum temperature (r = 0.49), rainfall (r = 0.07), morning relative humidity (r = 0.42), sunshine (r = 0.27) and evaporation (r = 0.28) evening vapour pressure (r =0.38) while, minimum temperature (r =-0.03), evening RH (r = -0.24), wind velocity (r = -0.47), morning vapour pressure (r = -0.25) no. of rainy days (r = -0.33) showed negative non-significant correlation. Patta *et al.,* (2019) found that all the weather parameters were non-significant with jassid. However, Siddhartha (2015), Aarwe *et al.,* (2016) found positive significant correlation with maximum temperature. The results are in alignment with that of Akhila (2019), who found maximum temperature and morning humidity found non- significant positive correlation. Patta *et al.,* (2019) found that all the weather parameters were non-significant with jassid. However, Siddhartha (2015), Aarwe *et al.,* (2016) found positive significant correlation with maximum temperature.

Shoot and fruit borer, *Eariasvittella* (Fab.) (Lepidoptera: Noctuidae)

The incidence of fruit infestation had commenced from five weeks after sowing that is, 49 SW (03rdDec –9thDec) with an average percentage of 5.00 of fruit damage. The infestation gradually increased and reached the peak level of 40.66 percent during (1 SW) (1stJan-14thJan).The incidence of shoot and fruit borer also somewhat in alignment with Aarwe *et al.,* (2016) who found attack was from 47 DAG. In contrary, Siddhartha (2015) found infestation from 45thSW.During this period maximum (20.3°c) and minimum (10.3°c) temperature, morning and evening relative humidity were 91 and 62 percent respectively, wind velocity (2.0 km/hr).

Further, sunshine, morning & evening vapour pressure, rainfall and evaporation were 3.5 per hrs,6.9 mm, 8.2 mm,17.9 and 1.4 mm respectively in this period.Correlation studies of shoot and fruit borer revealed that wind velocity showed a significant positive correlation (r = 0.60*) while maximum temperature, morning vapour pressure showed a significant negative correlation (r = -0.89*, -0.59*) respectively. Non-significant positive correlation was observed with morning relative humidity (0.29) and no. of rainy days (0.21) whereas, minimum temperature (r = -0.19), sunshine (r = -0.26), evening relative humidity (r = -0.17), rainfall (r = -0.32) and evaporation (r = -0.36) showed a negative non significant correlation. Similarly, Sharma *et al.,* (2010) found negative correlation with relative humidity and negative significant correlation with mean temperature.

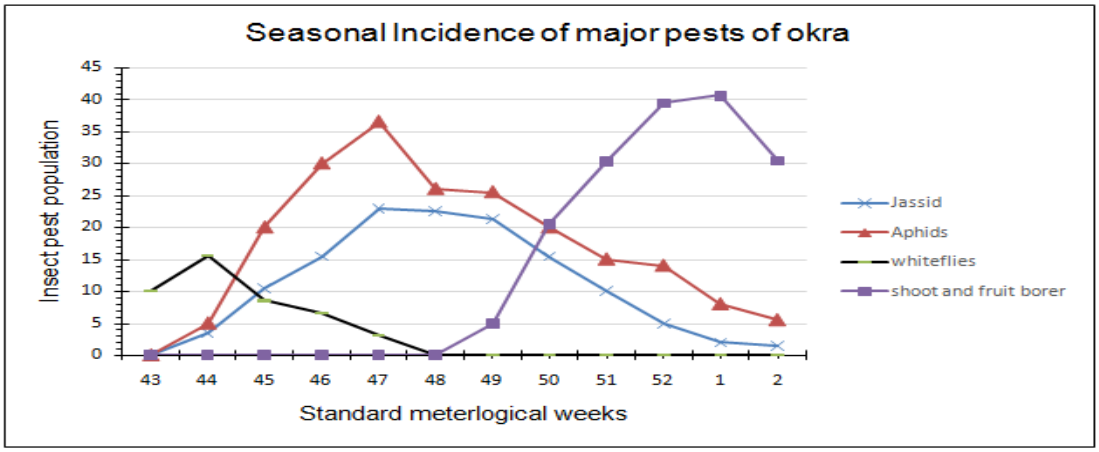
Table.1 Mean population of insect pest complex of okra during *Rabi*2019-2020.

Month	Standard Week	Mean population (nymph & adult) per 6 leaves		Mean population (nymph & adult) per plant	% fruit infestation
		Jassid	Aphid	Whitefly	Shoot & fruit borer
October	43	0	0	10.0	0
	44	3.5	5.0	15.5	0
November	45	10.5	20.0	8.5	0
	46	15.50	30.0	6.5	0
	47	23.00	36.5	3.0	0
	48	22.5	26	0	0
December	49	21.33	25.5	0	5.00
	50	15.5	20.0	0	20.5
	51	10.00	15.0	0	30.33
	52	5.00	14.0	0	39.50
January	1	2.00	8.0	0	40.66
	2	1.50	5.5	0	30.50

Table.2 Correlation (r) and regression coefficient (byx) of abiotic factors on insect pest complex of okra crop during Rabi 2019-2020.

Weather factors	Name of the Insect							
	Jassid		Aphid		Whitefly		Shoot and fruit borer	
	r	byx	r	byx	r	byx	r	byx
Maximum temperature (°C)	0.49 NS		0.46 NS		0.51*	**0.13**	-0.89*	**-0.14**
Minimum temperature (°C)	-0.03 NS	-	-0.11 NS	-	0.80* NS	**0.70**	-0.19 NS	
Sunshine(hrs)	0.27 NS	-	0.41 NS	-	-0.40 NS	-	-0.26 NS	-
Rainfall (mm)	0.07 NS	-	-0.51*	**- 0.72**	0.15 NS	-	-0.32 NS	-
Morning Relative Humidity (RH) (%)	0.42 NS	-	0.36 NS	-	0.33 NS	-	0.29 NS	-
Evening Relative Humidity (RH)(%)	-0.24 NS	-	-0.34 NS	-	0.45 NS	-	-0.17 NS	
Wind velocity (Km/hr)	-0.47 NS	-	-0.34 NS	-	-0.16 NS	-	0.60*	**0.02**
Morning Vapour Pressure (VP)(mm)	-0.25 NS	-	0.14 NS	-	0.85*	**0.56**	-0.59*	**-0.10**
Evening Vapour Pressure (VP) (mm)	0.38 NS	-	0.47 NS	-	0.75*	**0.33**	-0.51	0.00
Evaporation (mm)	0.28 NS	-	0.39 NS		0.34 NS		-0.36 NS	-
No. of rainy days	-0.33 NS	-	0.01 NS	-	-	-	0.21 NS	-

Fig.1 Seasonal incidence of jassid, aphid, whitefly and shoot and fruit borer on okra at weekly intervals, during the crop growth period



In contrary, Patta *et al.*, (2018) who revealed that minimum temperature, morning & evening temperature, evening relative humidity and evaporation has significant negative correlation. Dhandge *et al.*, (2018) found maximum and minimum had significant positive correlation and sunshine had negative correlation.

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