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Population Dynamics of Pests in Okra Cv. Arka Anamika in Relation to Weather Parameters

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ABSTRACT

A study was exercised to evaluate impact of weather factors on population dynamics of some of major insect pests of okra during kharif season of year 2017-18. The study was conducted on population dynamics of pests in okra Cv Arka Anamika in relation to weather parameters at vegetable research station, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad. The results of the present investigation demonstrated that the incidence of whitefly, jassids and shoot and fruit borer was observed. The correlation between maximum temperature and whitefly incidence indicated a positive non- significant relationship and the maximum relative humidity has a negative significant correlation and minimum relative humidity showed a positive significant correlation on whitefly incidence. The correlation between rainfall, sunshine hours, and whitefly was negative non-significant effect. Both the maximum temperature and minimum temperature were positively correlated with the population buildup of jassids. Rainfall has shown positive influence on the population buildup of jassids whereas sunshine hours has shown negative correlation and non-significant. The correlation between minimum temperature and shoot and fruit borer incidence indicated a negative significant relationship whereas maximum relative humidity exerted a positive significant correlation. The correlation between rainfall, sunshine hours and shoot and fruit borer larval incidence was positively non -significant. The coefficient of determination value indicated that meterological parameters could influence the variation in the population of whitefly, jassids and borers.

Key words: *Okra, Insect pests, Weather parameters.*

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) belongs to the family Malvaceae and it is commonly known as Bhindi in India. It is native to west Africa and most important fruit vegetable crop in India. India is the largest producer of okra in the world. At present, okra cultivated at an extent of 5.11 lakh ha across the country and with an estimated production of 58.48 MT and with a productivity of 11.4 MT ha^{-1} [8]. In Telangana the okra occupies an area of 12.78 thousand ha and with the production of 171.69 MT.

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The major okra growing states are Uttar Pradesh, Bihar and West Bengal.

Okra is a multipurpose crop valued for its tender and delicious pods. Carbohydrates are mainly present in the form of mucilage[5]. The mucilage is highly soluble in water and has an intrinsic viscosity value of about 30 per cent. Okra is a rich source of proteins, carbohydrates and vitamin C[2] and plays a vital role in human diet. It provides a valuable supplementary nutrition in human diet in developing countries where there is often a great alimentary imbalance[4]. It has good medicinal value with its antispasmodic, demulcent, diaphoretic, diuretic, emollient, stimulant and vulnery properties[6].

Okra is attacked by a number of insect pests of which the shoot and fruit borer, *Earias vittella* (Fabricius) is a serious pest of okra crop. As high as 72 species of insects have been recorded on okra[9]. The shoot and fruit borer, *E. vittella* is a serious pest while in among the sucking pests, okra jassids, (*Amrasca biguttula biguttula* (Ishida)), whitefly, (*Bemisia tabaci* (Gennadius)) and aphids (*Aphis gossypii Glover*) are of major sucking pests cause significant damage to the crop and among the diseases yellow vein mosaic virus is a serious problem.

Among sucking pests jassids damages the crop in both nymph and adult phases of life by sucking the cell sap usually from the ventral surface of the leaves. During feeding it injects toxic saliva into plant tissues ultimately curling and turning the leaves in yellowish color. The whitefly (*Bemisia tabaci*) not only damages the crop by sucking the cell sap and secreting the honeydew on leaves, but also it acts as a vector of okra yellow vein clearing mosaic virus disease. Both species of okra spotted borer feeding on shoot and fruit are considered as the most notorious pest of okra; Firstly, it causes direct damage to tender shoots and secondly it infests fruits resulting in both quantitative and qualitative losses upto 71per cent. Caterpillars bore into the top shoot and feeds inside the shoot before fruit formation occurs. Severe infestations cause to collapsing of stem and wilting of the leaves. Later on, caterpillars bore into the fruits and feed inside. As a result of infestation, plant bears smaller and deformed pods, resulting upto loss of 49 per cent pods which leads to 36-90 per cent loss in fruit yield of okra. Moreover, infested fruits remain unfit for human consumption.

The damage of different insect pests varies from year to year depending upon weather conditions and the intensity of insect pests attack. About 145 species of insect pests are recorded on attack of okra plant. In okra the insect pest's infestation causes reduction in plant height, number of effective branches and marketable fruit yield, respectively.

MATERIAL AND METHODS

The experiment was carried out at VRS, Rajendranagar, Hyderabad from August to December 2017. This region falls under VI Agro climatic zone. For present experimentation virgin soils was selected. The experimental site comes under sub-tropical zone and is situated at a latitude of 17^{o} 19^{1} N and longitude of 79^{o} 23^{1} E. The altitude of the place is 542.3 m above the mean sea level. The mean annual precipitation is 852 mm which will be received almost from south-west monsoon during June to October. The average minimum and maximum temperatures recorded during crop growth period were 31.7^{o}C and 19.6^{o}C respectively. The average humidity ranged from 60 to 70 per cent. Hyderabad thus has hot dry summer and moderate cold winter.

Method of observation:

Population of jassid, mites and whitefly (total nymphs + adults) were recorded on six leaves per plant viz., each from 2 upper, 2 middle and 2 lower plant canopy. Shoot and fruit borer (*Earias spp.*) was recorded on the basis of per cent fruit damage. These observations were recorded in untreated plots. Observations of weather data (maximum and minimum temperature, morning and evening relative humidity, wind speed, sun shine hours, total rainfall per week, no. of rainy days per week, morning and evening vapour pressure and evaporation etc.) were recorded on daily basis.

Observations on different insect pests were recorded as detailed below:

A. Sucking Pest Complex:

Jassids, Whitefly and Aphids

A total of six leaves, each two leaves from upper, middle and lower canopy of the plant were carefully examined for the presence of total nymphs and adults of jassid (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemesia tabaci* Genn.), aphids (*Aphis gossipi*) observations were carried out on 5 randomly selected plants, twice in a standard week.

B. Shoot and fruit borer, *Earias vittella* (Fabricius):

Observations on the intensity of fruit infestation by fruit borer (*Earias vittella*) at each picking were recorded as follows:

Fruit infestation by *E. vittella* was judged by weighing the healthy fruits and fruits damaged by *E. vittella*, and the per cent fruit borer infestation was computed as follows:

$$\text{Percent fruit infestation} = \frac{\text{Wt. of damaged fruit}}{\text{Total Wt. of fruits observed}} \times 100$$

After each observation damaged fruits were removed.

RESULTS AND DISCUSSION

Effect of weather parameters on the incidence of pests and diseases

1. Effect of weather parameters on the incidence of okra jassids

The data pertaining to the effect of weather parameters on okra jassids was tabulated as 1,2 and figure 1.

The jassids population was first recorded on the plants of okra, in the 35th standard week, (2.4 jassids plant^{-1}) 20 days after sowing and the infestation continued till the end of the crop in 42nd standard week. The peak infestation was observed during 1st week of October in the 40th standard week. The meteorological parameters which prevailed during the experimental period were correlated with jassids population to understand the relationship between abiotic factors and jassids incidence.

1.1. Effect of temperature on jassids incidence:

Both the maximum temperature and minimum temperature were positively correlated with the population buildup of jassids (r = 0.058 and r = 0.283) respectively. The jassids population reached a peak (12.4 jassids plant^{-1}) when the maximum temperature was 30.1^{o}C and minimum temperature was 21.8 ^{o}C and thereafter decreased with the increase in maximum and decrease in minimum temperature. The results are in concurrence with the findings of several workers who studied the jassids population vs. weather relations in the okra jassids (*Amrasca biguttula biggutula*), a related species occurring during the same time and observed minimum temperature was positively correlated with jassids incidence in okra Aarwe *et al.*[1].

1.2. Effect of relative humidity on jassids incidence:

The jassids incidence was positively correlated with maximum and minimum relative humidity during the study period. The maximum relative humidity ranged from 70 to 97 per cent. Though a positive correlation was observed between maximum relative humidity and jassids incidence, it was not significant. The peak jassids population (12.4 jassids plant^{-1}) was recorded when maximum relative humidity was 98.3 per cent. It was observed that decrease in minimum relative humidity increased jassids population with positively non-significant correlation (r=0.2861). The minimum relative humidity ranged between 39.4 to 97.1 per cent during study period. These findings are in agreement with those of Nath *et al.*[7], who found the relative humidity was positively non-significant correlation with jassids incidence in okra.

1.3. Effect of rainfall on jassids incidence:

Rainfall has shown positive influence on the population buildup of jassids (r= 0.585*). The high rainfall (21.9 mm) recorded during October first week drastically increased jassids population. Later as rainfall decreased the jassids population which decreased gradually and no jassids was observed in the last week of

October 2017. However, rainfall has shown significant correlation to jassid build up during study period.

1.4. Effect of sunshine hours on jassids incidence:

The number of sunshine hours ranged between 2.7 to 9 hours during the period of study. The peak jassids population (12.4 jassids plant^{-1}) was recorded at 2.9 sunshine hours. The results indicated that with a decrease in sunshine hours the jassids population increased. The jassids incidence showed non-significant negative correlation to sunshine hours (r= -0.364).

2. Effect of weather parameters on the incidence of okra whitefly:

The data pertaining to the effect of weather parameters on okra whitefly was tabulated as 1,2 and figure 1.

The whitefly population was first recorded on the plants of okra, in the 35th standard week, 20 days after sowing and the infestation continued till the 39th standard week. The peak whitefly incidence was observed during 2nd week of September in the 37th standard week. The meteorological parameters which prevailed during the experimental period were correlated with whitefly population to understand the relationship between meteorological parameters and whitefly incidence during the period of study.

2.1. Effect of temperature on whitefly incidence:

Whitefly incidence was positively correlated with maximum and minimum temperature (r = 0.114 and r = 0.322) respectively. The maximum temperature ranged between 28.4 to 31.1°C and minimum temperature ranged between 19.6 to 22.6°C during the study period. The peak whitefly population (6.2 whitefly plant^{-1}) was found when maximum temperature was 31.7^{o}C and minimum temperature was 22^{o}C. The correlation between maximum temperature and whitefly incidence indicated a positive non- significant relationship (r=0.114). The whitefly population increased with rise in maximum temperature and decrease in minimum temperature in 37th standard week. The results are in concurrence with the findings of several workers who studied the whitefly population vs. weather relations in the okra whitefly (*Bemisia tabaci*), and observed minimum temperature was positively correlated with whitefly incidence in okra Aarwe *et al*.[1].

2.2. Effect of relative humidity on whitefly incidence:

The maximum relative humidity has a negative significant correlation (r=-0.0081) and minimum relative humidity showed a positive significant correlation (r=0.178) on whitefly incidence. The maximum relative humidity was found to be 93.4 per cent at the time of peak incidence. The minimum relative humidity ranged between 39.4 to 97.1 per cent. The rise in whitefly population with increase in maximum relative humidity and decrease in minimum relative humidity was observed in 37th standard week.

2.3. Effect of rainfall on whitefly incidence:

The rainfall ranged between 7.9 to 11.9 mm during study period after the incidence of whitefly observed on okra plants. The correlation between rainfall and whitefly was negative non-significant effect (r= -0.118). The high rainfall (21.9 mm) recorded during October first week which completely reduced whitefly population.

2.4. Effect of sunshine hours on whitefly incidence:

The number of sunshine hours ranged between 2.7 to 9 hours during the study period. The rise in sun shine hours increased the whitefly population between 35th standard week to 37th standard week. The correlation between sunshine hours and whitefly incidence was found to be negatively non-significant. (r= -0.0454).

3. Effect of weather parameters on the incidence of okra shoot and fruit borer:

The data pertaining to the effect of weather parameters on okra shoot and fruit borer was tabulated as 1,2 and figure 1.

The shoot and fruit borer population was first recorded on the plants of okra, in the 35th standard week, 20 days after sowing and the infestation continued till the end of the crop in 44th standard week. The peak shoot and fruit borer incidence was observed during 3rd week of October in the 42nd standard week. The meteorological parameters which prevailed during the experimental period were correlated with shoot and fruit borer population to understand the relationship between meteorological parameters and shoot and fruit borer incidence during the period of study.

3.1. Effect of temperature on shoot and fruit borer incidence:

The shoot and fruit borer damage percentage was negatively correlated with minimum temperature. The minimum temperature ranged between 15.1- 22.6°C during the study period. The peak shoot and fruit borer damage percentage (12.5 per cent) was recorded when minimum temperature was 19.6°C. The correlation between minimum temperature and shoot and fruit borer incidence indicated a negative significant relationship (r=-0.553*). The shoot and fruit borer population increased with increase in maximum temperature and decrease in minimum temperature between 35th standard week to 42nd standard week. The correlation found between maximum temperature on shoot and fruit borer incidence was positively non-significant (r=0.487). Harinkhere[3] reported a negative significant correlation with larval population of shoot and fruit borer and minimum temperature collaborates the findings of the present study.

3.2. Effect of relative humidity on shoot and fruit borer incidence:

The maximum relative humidity had a positive significant correlation on shoot and fruit borer incidence. The maximum relative humidity was found to range between 90-97 per cent at the time of peak incidence. The minimum relative humidity ranged between 39 to 67 per cent. The rise in shoot and fruit borer population with increase in maximum relative humidity was observed between 38th standard week and 41st standard week. The correlation between minimum relative humidity and shoot and fruit borer was found to be negative non-significant (r=-0.261). Harinkhere[3] reported a negative correlation with larval population of shoot and fruit borer and relative humidity collaborates the findings of the present study.

3.3. Effect of rainfall on shoot and fruit borer incidence:

The rainfall ranged between zero to 21.9 mm during study period after the incidence of shoot and fruit borer observed on okra plants. The correlation between rainfall and shoot and fruit borer larval incidence was positively non - significant (r= 0.436).

3.4. Effect of sunshine hours on shoot and fruit borer incidence:

The number of sunshine hours ranged between 2.7 to 9 hours during the study period. The rise in sunshine hours increased the shoot and fruit borer population between 38th standard week to 42nd standard week. The correlation between sunshine hours and shoot and fruit borer incidence was found to be positively non-significant (r=0.411).

Table 1: Simple correlation on weather parameters on jassids, whitefly and shoot and fruit borer population on okra crop during 2017-18

Weather parameters	Correlation Co-efficient (r)		
	Jassids	Whitefly	Shoot and Fruit Borer
Max. Temperature (°C)	0.058	0.114	0.487
Min. Temperature (°C)	0.283	0.322	-0.553*
RH I (%)	0.521	-0.008	0.668*
RH II (%)	0.286	0.178	-0.261
Rainfall (mm)	0.585*	-0.118	0.436
Sunshine hours	-0.364	-0.045	0.411

*significant at 5% level of significance

Table 2: Population dynamics of pests of okra (jassids, whitefly, shoot and fruit borer) in relation to weather parameters at VRS, Rajendranagar, Hyderabad

Standard week	Temperature		Relative humidity (%)		Sun shine hours (day-1)	Rainfall (mm)	Rainy days	Mean temp °C	Jassids/ plant	White fly/ plant	Shoot and fruit borer (% damage)
	max°C	min°C	I	II							
32	29.9	22.6	88.6	65.1	3.9	6.5	0.3	26.25	0	0	0
33	29.5	22.2	90.1	70.6	3.5	2.2	0.1	25.85	0	0	0
34	28.4	21.5	90.7	70.0	4.2	3.6	0.6	24.95	0	0	0
35	28.9	21.9	92.6	75.4	3.3	11.9	0.7	25.4	2.4	5.5	0.6
36	31.1	22.5	93	65.0	5.8	3.7	0.3	26.8	3.6	4.4	1.2
37	31.7	22.0	93.4	63.0	7.6	4.8	0.1	26.85	5.5	6.2	1.5
38	28.6	21.5	91.3	73.6	2.7	3.0	0.3	24.2	7.8	3.5	2.5
39	30.9	20.9	97.0	71.7	3.8	7.9	0.4	25.9	4.4	4.4	3.2
40	30.1	21.8	98.3	68.6	2.9	21.9	0.4	25.95	12.4	0	8.8
41	30.7	21.4	99.4	97.1	5.2	15.9	0.6	26.05	3.5	0	10.5
42	31.6	19.6	95.4	47.9	6.4	14.3	0.1	25.6	2.2	0	12.5
43	31.0	19.9	95.0	52.9	6.5	1.9	0.1	25.45	0	0	10.2
44	30.1	15.1	91.1	39.4	9	0.0	0.0	22.6	0	0	8.5

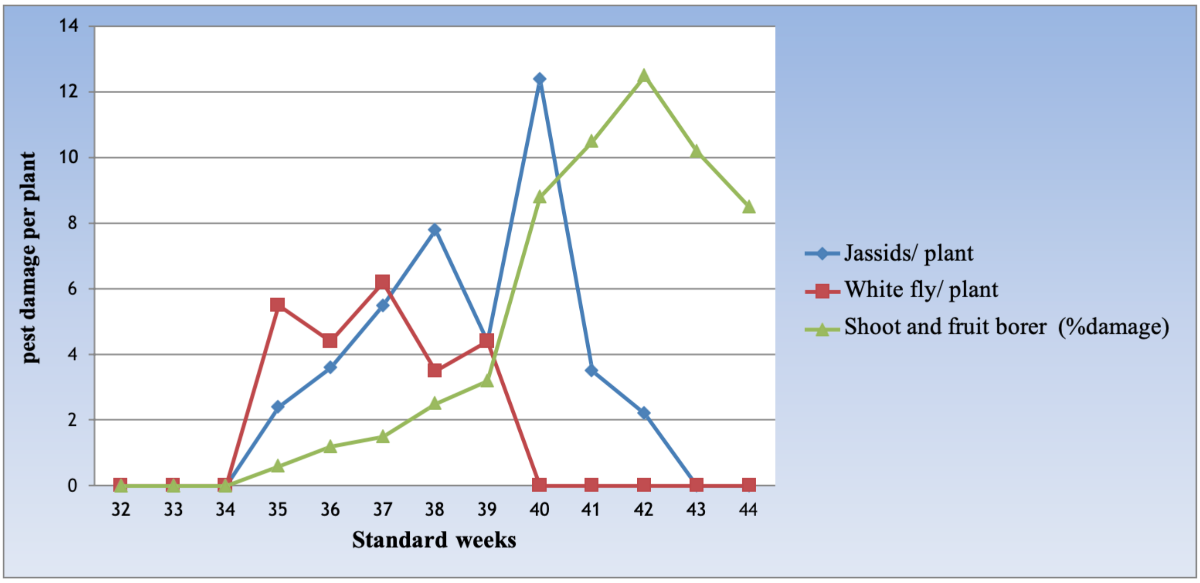

Fig. 1: Incidence of whitefly, jassids, shoot and fruit borer on okra during *kharif* 2017

CONCLUSION

Months of September and October are important for the monitoring of insect pests of okra because maximum populations of jassid, whitefly and fruit borer infestation were recorded during these months. Jassid population was observed maximum in 1st week of October. The highest number of jassids showed positive correlation with maximum rainfall. Infestations by spotted borer on shoot were observed maximum in the 3rd week of October. The higher number of fruit borers showed positive correlations with the minimum temperature and maximum relative humidity. Population of whitefly occurred from 35th to 39th standard week and peak population was observed during 2nd week of September.

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