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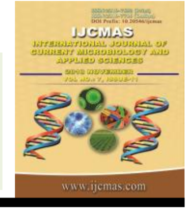

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Seasonal Incidence of Sucking Pest of Okra and its Relationship with Weather Parameters in Summer Season

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Investigation on seasonal incidence of sucking pest of okra and its relationship with weather parameters was carried out at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat during summer 2016 and 2017. The data revealed that peak population of jassid (16.1 jassid/3leaves) and whitefly (15.7 whitefly/3 leaves) was observed at 17th and 16th standard meteorological week of summer 2016, respectively. Whereas, in summer 2017 the peak population of aphid (17.8 aphid/3 leaves) was observed at 16th standard meteorological week. There was positive correlation between pest population with maximum temperature, minimum temperature, morning relative humidity and bright sunshine. Only evening relative humidity was negatively correlated.

Introduction

Okra, *Abelmoschus esculentus* (L.) Moench, commonly known as ladys finger is an important vegetable crop and belongs to Malvaceae family.

The crop is grown in the several states of India including Gujarat. In India, it is cultivated in the area of about 492.7 thousand hectares with the production of 5552.3 thousand tonne.

In Gujarat, it is mainly cultivated in spring-summer and rainy seasons, which occupies the area of 76.02 thousand hectares with 908.6 thousand tonne annual production. In Junagadh district, it is cultivated in 0.81 thousand hectares with annual production of 1.4 thousand tonne (Anonymous, 2016). A major constraint in vegetable production is poor and inadequate control of pests and diseases, which cause high yield losses (Tindall, 1983). Many of pests occurring on cotton are found to ravage the okra crop.

Among the various pests of okra, Aphid, jassid, whitefly, shoot and fruit borer and mite are the major pests infesting okra under Junagadh conditions of Gujarat State. Among insect pests of okra, jassid, *Amrasca biguttula biguttula* Ishida, whitefly, *Bemisia tabaci* Gennadius and shoot and fruit borer, *Earias vittella* Fabricius are the notorious insect pests (Singh *et al.*, 1993).

Chaudhary and Dadheech (1989) reported 54.04 per cent losses in yield of okra due to jassid, aphid, whitefly and shoot and fruit borer in Rajasthan. The sucking pest complex consisting of aphids, leaf hoppers, whiteflies, thrips and mites are major pests and cause 17.46 per cent yield loss in okra (Sarkar *et al.*, 1996)

Jassid, *A. biguttula biguttula* (Ishida) is an important sucking pest of okra that feeds mostly on lower surface of okra leaves, leading to hopper burn (Bindra and Mahal, 1979) causing considerable yield losses upto 40 to 56 per cent (Rawat and Sahu, 1973; Krishnaiah, 1980 and Hormchan *et al.,* 2001).

Whitefly, *B. tabaci* has become a serious pest on vegetables, field crops and ornamental plant and fruits world-wide and attacks 176 plant species (Ren *et al.,* 2001) with considerable damage (Oliviera *et al.,* 2001). The pest is also known to transmit the serious disease namely yellow vein mosaic, affecting the quality of the produce.

To avoid yield losses caused by the sucking pest complex and encourage cultivation of okra crop on large area and to increase the production and productivity of okra in Gujarat as well as in India, all efforts are needed to tackle these major sucking pests by knowing their peak period of infestation through studies on seasonal abundance as well as according to mode of action of insecticides, bio-pesticidesand botanicals.

Seasonal abundance of the insect pest provides not only the information of initiation of the pest but also provides the peak activity of the particular pest. Biotic and abiotic parameters play a vital role in population build-up of insect pest. Correlation study helps in to provide either positive or negative association of pest population with biotic or abiotic factors. It gives direct influence of particular parameter on pest population build-up as well as its indirect effect through other parameters. In the present study the efforts have been made to study the seasonal incidence, its correlation with biotic and abiotic parameters on population build-up of major insect pest of okra.

Materials and Methods

The field experiment on seasonal incidence of pestson okraand its relation with weather parameters was carried out at Instructional Farm, College of Agriculture, JAU, Junagadh. The Okra (GJO-3) was sown in a block size of 20 m x 20 m keeping the spacing of 60 X 30 cm. All the recommended agronomic practices *viz.* weeding, harrowing, application of fertilizer dose and irrigation were carried out timely and properly to raise good crop. The crop area kept free from any insecticidal application throughout the season. The crop area was divided into ten quadrates (1.2 x 1.2 m each).

Observation recorded

Observation on population of sucking pests was taken at the appearance of the pest on five randomly selected and tagged plants from ten different quadrates of crop area. Jassid, whitefly and aphids counts was recorded early in the morning at weekly interval on three leaves i.e. upper leaves, middle leaves and bottom leaves from each randomly selected plant. With a view to study the impact of different weather factors on pest abundance, a multiple regression of pest population with different weather parameters was worked out. The meteorological data on temperature (maximum and minimum), relative humidity (morning and evening) and mean bright sunshine hours in different standard weeks was obtained from the Meteorological Observatory, Department of Agricultural Meteorology, JAU, Junagadh.

Results and Discussion

Jassid, *Amrasca biguttula biguttula* (Ishida)

A study was carried out to know the occurrence and abundance of jassid on GJO-3 variety of okra during summer 2016 and summer 2017. The data obtained are summarized in Table 1 and depicted in Figure 1 and 2.

The result presented in Table 1 and Figure 1 and 2 revealed that the population of jassid was ranging from 0.7 to 16.1 jassid per three leaves) during summer 2016. Whereas during summer 2017 it was ranging from 0.7 to 15.3 jassid per three leaves. In both the season the jassid incidence noticed from third week after germination (i.e. 11 standard meteorological week). During both the year of experiment, the population of this pest showed two peaks on okra crop. In summer 2016 first peak of jassid was observed at 17th standard meteorological week with 16.1 jassid/3 leaves (i.e. 9th WAG) and second peak was observed at 19th standard meteorological week with15.2 jassid/3 leaves (i.e. 11th WAG). Whereas in summer 2017 the first peak of jassid was observed at 15th standard meteorological week with 15.3 jassid/3 leaves (i.e. 7th WAG) and second peak was observed at 17th standard meteorological week with 14.4 jassid/ 3 leaves (i.e. 10th WAG). In both the years after second peak the population declined gradually during the successive weeks. However, the jassid population remained active throughout the crop period.

Anitha and Nandihalli (2008) recorded that the 4.33 jassid per 3 leaves from first week of April and peak jassid incidence (18.44 jassid per 3 leaves) was noticed during the last week of June. Kumari *et al.,* (2009) concluded that infestation of jassid was started (3.53 jassid per leaf) at 21 days old okra crop and reached its peak (17.33 jassid per leaf) when the crop was about 63 days old and thereafter its population followed declining trend. Das *et al.,* (2011) observed that the jassid first appeared in 3rd WAS and maximum population reached during 5 to 7 WAS.

Study on effect of various weather parameters on the fluctuation of jassid population on okra during summer 2016 (Table 3) indicated that the pest population showed significant positive correlation with maximum temperature(r=0.545). While, minimum temperature (r=370) and morning relative humidity (r= 0.277) and bright sunshine (r= 0.392) were non significantly positively correlated. Only evening relative humidity (r=-0.219) was negatively correlated with pest population among studied parameters. The same trend was observed in the year 2017. The highly significant correlation was observed with maximum temperature (r= 0.826). Minimum temperature (r= 0.4378), morning relative humidity (r= 0.147) and bright sunshine (r= 0.232) were positively correlated. Whereas, evening relative humidity was negatively correlated with the pest population.

Kumawat *et al.,* (2000) concluded that correlation study of the jassid with abiotic factors indicated the significantly positive correlation between jassid population and maximum temperature. Mandal (2002) reported that jassid population exhibited significant positive correlation with maximum and minimum temperature. Iqbal *et al.,* (2010) reported that the jassid population and minimum temperature had significant positive correlation and the other factors were found non-significant.

Singh *et al.,* (2013) reported that the jassid population showed negative correlation with maximum, minimum and mean temperature and maximum and minimum relative humidity.

Whitefly, *Bemisia tabaci* (Gennadius)

The result presented in Table 1 and Figure 3 and 4 revealed that the population of whitefly was ranging from 1.8 to 16.2 whitefly per three leaves during summer 2016. Whereas during summer 2017 it was ranging from 3.2 to 15.7 whitefly per three leaves per plant. In 2016 the whitefly incidence noticed from third week after germination (i.e. 11 standard meteorological week) while during 2017 it was noticed from second week after germination.

During both the year of experiment, the population of this pest showed two peaks on okra crop. In summer 2016 first peak (16.2 whitefly/3 leaves) was observed at 16th standard meteorological week and second peak (12.8 whitefly/3 leaves) was observed at 20th standard meteorological week. Whereas in summer 2017 the first peak (15.7 whitefly/3 leaves) of whitefly was observed at 16th standard meteorological week and second peak 13.2 whitefly/ 3 leaves) was observed at 20^{h} standard meteorological week. In both the years after second peak the population declined gradually during the successive weeks. However, the whitefly population remained throughout the crop period.

Solanki (2005) found that the incidence of whitefly initiated from the 4th week after sowing and highest population peak (10.45 whitefly per leaf) was observed after the 10th week of sowing. Dabhi (2007) revealed that the incidence of whitefly was noticed during 9th to 11th week after sowing during summer. Anitha and Nandihalli (2008) recorded that 9.16 whitefly per 3 leaves, from first week of April. Peak whitefly incidence was noticed during last week of April (14.91 whitefly per 3 leaves). Sahito *et al.,* (2012) recorded whitefly population (5.00 ± 0.75 per leaf). First record (6.04 ± 0.62 whitefly per leaf) in 4th week of March and 2nd peak (7.72 ± 1.08 per leaf) in 3rd week of April. Pal *et al.,* (2013) recorded that the incidence of whitefly started in the 2nd week of April. The population of the whitefly increased sharply and reached at peak within a month of its appearance in the field.

Study on effect of various weather parameters on the fluctuation of whitefly population on okra during summer 2016 (Table 3) indicated that the significant positive correlation between pest population and maximum temperature (r=0.523) while minimum temperature (r=252) and morning relative humidity (r= 0.025) and bright sunshine (r= 0.451) were positively correlated.

Only evening relative humidity (r=-0.378) was negatively correlated with pest population among studied parameters. The same trend was observed in year 2017, highly significant correlation observed with maximum temperature (r= 0.708). Minimum temperature (r= 0.255), morning relative humidity (r= 0.025) and bright sunshine (r= 0.431) were positively correlated. Whereas, evening relative humidity (r= -0.082) was negatively correlated with the pest population.

Kumawat *et al.,* (2000) showed that the maximum temperature was significantly positively correlated with whitefly density. Pun *et al.,* (2005) revealed that there was positive correlation between whitefly population and maximum and minimum temperature and sunshine hours, whereas morning relative humidity, wind velocity and total rainfall had negative correlation on whitefly population. Solanki (2005) found that whitefly population had significant positive correlation with maximum temperature and significant negative correlation with minimum temperature as well as morning relative humidity. Dabhi (2007) revealed that the physical factors bright sunshine hours and temperature (maximum and minimum) showed negative effect during summer.

Table.1 Seasonal incidence of sucking pests on okra during years 2016 and 2017

WAG	Std. Met. week	Number of jassid/3 leaves		Number of whitefly/3 leaves		Number of aphid/3 leaves	
		2016	2017	2016	2017	2016	2017
1	9	0.0	0.0	0.0	0.0	0.0	0.0
2	10	0.0	0.0	0.0	3.2	1.6	1.3
3	11	0.7	0.7	3.9	5.1	2.3	2.7
4	12	1.7	2.1	5.2	6.2	6.2	6.8
5	13	4.7	5.4	9.8	10.3	8.4	10.4
6	14	9.3	9.6	10.7	11.4	10.2	13.7
7	15	13.2	15.3	13.4	13.3	11.3	15.3
8	16	15.4	11.2	16.2	15.7	13.7	17.8
9	17	16.1	9.2	13.8	14.2	14.1	14.1
10	18	14.3	14.4	11.2	12.3	12.9	11.9
11	19	15.2	11.7	8.3	11.8	9.3	9.6
12	20	12.8	9.7	12.8	13.2	5.8	6.4
13	21	9.7	7.2	8.3	10.3	5.1	5.3
14	22	6.2	7.2	5.1	7.2	3.8	4.7
15	23	3.4	5.3	3.7	4.3	2.9	3.2
16	24	1.9	3.1	1.8	3.2	1.3	1.7

Table.2 Correlations of weather parameters with pest complex of Okra during year 2017 and 2017

Parameter	Year	Temp.		R.H.		BSS
		Max.	Min.	Morn.	Even.	
Jassid	2016	0.5454*	0.3700	0.2774	-0.2119	0.3929
	2017	0.8265**	0.4378	0.1477	-0.0459	0.2323
Whitefly	2016	0.5238*	0.2521	0.0254	-0.3781	0.4510
	2017	0.7087**	0.2553	0.2284	-0.0827	0.4316
Aphid	2016	0.3436	0.0581	-0.0269	-0.4755	0.5531*
	2017	0.6105*	0.1011	0.0613	-0.2336	0.4259

* Significant at 5% (r=0.497) ** Significant at 1% (r=0.623)

Singh *et al.*, (2013) reported that the whitefly population showed negative correlation with maximum, minimum and mean temperature and maximum and minimum relative humidity showed positive correlation.

Aphid, *Aphis gossypii* (Glover)

The result presented in Table 1and Figure 5 and 6 revealed that the population of aphid was ranging from 1.3 to 14.1 aphid per three leaves during summer 2016. Whereas during summer 2017 it was ranging from 1.3 to 17.8 whitefly per three leaves per plant. In both the year the aphid incidence noticed from second week after germination (i.e. 10th standard meteorological week). During both the years of experimentation, the population of this pest showed only one peak on okra crop. In summer 2016 peak population (14.1 aphid/3 leaves) was observed at 17th standard meteorological week (i.e. 9th WAG). Whereas, in summer 2017 the peak population of aphid (17.8 aphid/3 leaves) was observed at 16th standard meteorological week (i.e. 8th WAG). In both the years after peak level the population declined gradually during the successive weeks. However, the aphid population was appeared during the crop growth throughout the crop period.

Earlier, Saha (2015) reported that, the incidence was highest in the second week of February with 15.29 aphids/3 leaves. Thereafter gradual decrease was observed in the population up to the last week of April and reached to the lowest (6.52 aphids/3 leaves) due to hot weather. In the month of May the population again started increased up to the end of the season (10.64 aphids/3 leaves)

Study on effect of various weather parameters on the fluctuation of aphid population on okra during summer 2016 (Table 3) indicated that the positive correlation between pest population and maximum temperature (r=0.343), minimum temperature (r=0.058) and significantly positive correlation with bright sunshine (r= 0.451). Whereas, morning relative humidity (r=-0.026) and evening relative humidity (r= -0.475) were negatively correlated with pest population among studied parameters. The slightly different trend was observed in year 2017, significant positive correlation observed with maximum temperature (r= 0.610). Minimum temperature (r= 0.101), morning relative humidity (r= 0.061) and bright sunshine (r= 0.425) were positively correlated. Whereas, evening relative humidity (r= -0.233) was negatively correlated with the pest population.

Shukla (2014) revealed that the aphid population was reached to its peak level (27.17 aphids / 3 leaves) during 14th weeks after sowing (first week of July). Whereas, the correlation study showed that aphid population had positive correlation with rainfall (r = 0.261) and negative correlation with both maximum and minimum temperature.

From the overall results of the present investigation it can be concluded that, first peak of jassid was observed at 17th standard meteorological week with 16.1 jassid/3 leaves (i.e. 9th WAG). In case of whitefly in summer 2016 first peak (16.2 whitefly/3 leaves) was observed at 16th standard meteorological week. Whereas, in summer 2017 the peak population of aphid (17.8 aphid/3 leaves) was observed at 16th standard meteorological week (i.e. 8th WAG). There was positive correlation between pest population with maximum temperature, minimum temperature, morning relative humidity and bright sunshine.

Research category: Entomology

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