Original Research Article

Seasonal incidence of sucking pests and their natural enemies in okra *Abelmoschus esculentus* (L.) Moench

Abstract

Okra, *Abelmoschus esculentus* (L.) Moench is a major vegetable crop grown in India. The crop is susceptible to various sucking insects and mite pests throughout the cropping period. The present field experiment was carried out to observe the incidence and correlation between weather parameters and sucking pests along with their natural enemies in okra (variety Arka Anamika) at Central Research Station, Odisha University of Agriculture and Technology, Bhubaneswar, Khordha, Odisha during summer 2021.The maximum population of two major sucking pests i.e., leafhopper and whitefly was observed at 22nd and 19th SMW, respectively where as the peak activity of aphid and two spotted spider mites were recorded at 21st SMW. Among the natural enemies, coccinellid and spiders were recorded and the highest activity was observed at 22nd SMW. The correlation studies revealed a significant positive correlation between minimum temperature (r= 0.577) and afternoon relative humidity (r= 0.618) with leafhopper population. Further, there was significant negative correlation between spider population and maximum temperature (r= -0.788) where as both morning and afternoon relative humidity (r= 0.677 and r= 746) had positive effect. In addition, there was significant positive correlation between the predators (coccinellid and spider) and prey (aphid and leafhopper) population.

Keywords: Arka Anamika, sucking pests, natural enemies, correlation

Introduction

Okra, *Abelmoschus esculentus* (L.) Moench (Family: Malvaceae) is an economically important vegetable crop grown in tropical and sub- tropical parts of the world. Due to tenderness and succulence nature of this crop it harbours many insect pests and diseases which require special attention to combat with at proper time and manner. Sucking pests viz., leafhopper, *Amrasca biguttula biguttula* (Ishida); whitefly, *Bemisia tabaci* (Genn.); Aphid, *Aphis gossypii* Glov. and mite, *Tetranychus cinnabarinus* (Boisd.) play a major role in causing significant yield losses in okra in the process of feeding through sap sucking from the leaves and tender growing tips resulting in removal of sufficient amount of chlorophyll reducing vital function of plants (photosynthesis) (Meena and Kanwat, 2005). Whitefly apart from causing direct damage through sap sucking, also acts as a vector of a viral disease,

Bhendi Yellow Vein Mosaic (BYMV), as a result the plant completely debilitates with losses to the extent of 90 per cent in fruit yield. In the light of above facts this experiment was carried out to determine the impact of weather parameters on the magnitude of infestation by the sucking pests of okra and their associated natural enemies.

Materials and Method

The field experiment was carried out to observe the seasonal incidence and correlation of weather parameters with sucking pests of okra (variety Arka Anamika) at Central Research Station, Odisha University of Agriculture and Technology, Bhubaneswar, Khordha, Odisha during summer 2021. Observations on population of pests and natural enemies were recorded after 15 days of sowing (DAS) at weekly interval from randomly selected 5 plants leaving behind the border rows for up to final harvesting. Lower side of selected leaves were carefully examined for the presence of nymphs and adults of leafhopper, whitefly and aphid. The sampling technique for sucking pests was given by Singh and Kaushik (1990) where the samples were taken from three leaves, one each from the top, middle and bottom canopy, of five randomly selected plants infesting the crops. Similarly, the population of the two spotted spider mite, *Tetranychus urticae* Koch was recorded on three leaves each from the top, middle and bottom canopy of each plant by using 1 cm^2 windows made on the card board and at three places on each leaf and was expressed as number of mites per cm^2 (Nain *et al.*, 2017).

Result and Discussion

Leafhopper, *Amrasca biguttula biguttula* (Ishida)

The studies on incidence of leafhopper, *Amrasca biguttula biguttula* affirmed that it is one of the major sucking pest of okra and prevailing throughout the cropping season (Table 1). Mohanasundaram and Sharma (2011) and Anitha and Nandihalli (2008) also observed the infestation of okra leafhopper throughout the cropping season in their localities.

During the season incidence of leafhopper commenced from first week of April, which rapidly increased and attained its peak at 22^{nd} SMW (fourth week of May) with a mean population density of 14.30 leafhoppers per leaf which was probably because of the higher afternoon relative humidity (63.00 %). However, this pest remained active in high nos. from 20^{th} SMW (11.42/ leaf) to 24^{th} SMW with a population of 10.62 per leaf. Patel *et al.* (2022) also observed the activity of *A. biguttula biguttula* from March to May with peak on fourth week of April with a population of 19 leafhoppers per three leaves. Similarly Jat and Singh (2019) reported the infestation of leafhopper from second week of March and attended a peak population in the first week of May. The slight differences in the incidence might be attributed due to the difference in sowing date of the crop and climatic factors of the region.

The correlation studies showed that population of *A. biguttula biguttula* did not affected by maximum temperature (Table 2). The maximum temperature showed a non significant negative effect on *A. biguttula biguttula* population build up where as the minimum temperature (r= 0.577) exhibited positive significant effect. These findings are in agreement with the observations of Preetha and Nadarajan (2007) and Singh *et al*. (2013) who recorded a non significant negative effect of maximum temperature and mean temperature on *A. biguttula biguttula* population. Patel *et al.,* 2022 observed a significant positive correlation between leafhopper population and minimum temperature in summer season in okra crop. The leafhopper population was significantly and positively correlated with afternoon relative humidity (r= 0.618). This observation is in partial akin with Burade *et al*. (2019) who reported the correlation between leafhopper population and afternoon relative humidity is positive but not significant. Rainfall had positive but non-significant effect on leafhopper population. Here our findings differ with Mohansundaram and Sharma (2011) and Selvaraj *et al*. (2010) who showed that maximum temperature had positive impact where as rainfall and relative humidity had negative effect on leafhopper population. The observed differences may be attributed to different ecological conditions of the study area. The *A. biguttula biguttula* population was negatively and non significantly correlated with bright sunshine hours.

Whitefly

The incidence of whitefly commenced from first week of April (14th SMW) after 15 DAS which rapidly increased and attained the highest population on 19th SMW (first week of May) with a mean population density of 8.46 whitefly per leaf (Table 1). However the population of whitefly remained fully active on the month of May, thereafter it declined. This data is in accordance with the findings of Patel *et al*., 2022 who reported that the whitefly population in okra started from 11th SMW and it gradually increased attending a peak population of 17 whiteflies per three leaves on 17th SMW. However the present finding is not in accordance with the reports of Sapkal *et al*. (2022) who reported that the whitefly population reached the highest population very quickly i.e., only three weeks after the first incidence.

The present findings revealed that the maximum temperature had positive effect on *B tabaci* population (Table 2). Minimum temperature had positive but non-significant effect on population build up of whitefly. Our result is in partial confirmation with the findings of Burade *et al.* (2019) who cited that whitefly had significant positive correlation with both maximum and minimum temperature. Morning relative humidity had negative correlation

with *B tabaci*. Afternoon relative humidity had positive correlation with *B tabaci* population. Rainfall had negative non significant effect on whitefly population. The present findings did not agree with those of Singh *et al.,* 2013 who reported negative correlation with maximum and minimum temperature, morning and afternoon relative humidity while the relation was positive with rainfall. The bright sunshine hours and wind speed exhibited positive effect on whitefly. However, all the weather parameters had non-significant effect on *B. tabaci* population in the present findings.

Aphid

The population of aphid commenced from second week of April (15^{th} SMW) and reached maximum populations of 14.05 and 14.60 aphids per leaf during 20^{th} and 21^{st} SMW (Table 1). Our observations are in partial akin with the findings of Patel *et al.* (2022) who reported the incidence of aphid started from first week of March i.e., at 10^{th} SMW and continued up to the crop termination at last week of May reaching the peak activity in third week of April i.e., 17^{th} SMW with a population of 16.20 per three leaves. The slight difference might be due to change in sowing date and the ecological conditions of the locality.

The maximum temperature had negative but non-significant correlation with aphid population (Table 2). The present findings suggested that there was no significant relation between aphid population and relative humidity.

Two spotted spider mite

The mite population in the okra crop was noticed from 18^{th} SMW (fifth week of April) with population density of 3.52 per cm^2 leaf (Table 1). Thereafter the mite population increased at an accelerated pace in the succeeding weeks to reach peak of 16.28 per cm^2 leaf at 21^{st} SMW. This result is in confirmatory with the findings of Sugeetha, 1998 who reported that mite appeared on summer okra crop much earlier i.e., in mid April on 50 days old crop and reached the peak from end of April to end of May. Similar trend in population fluctuation of mite was reported by Gulati, 2004 who stated that the incidence of mite started from April and reached the peak in the month of May.

Maximum and minimum temperature exerted a negative and positive effect on the population of two spotted spider mite (Table 2). Our observation is in arguement with the results of Gulati (2004) and Mohansundaram and Sharma (2011) who reported negative effect of minimum temperature on population build up of two spotted spider mite. This is due to change in weather conditions of the locality. Morning relative humidity had positive effect on the population of *T. urticae*. Similar effect of afternoon relative humidity was observed by

Gulati (2004). However all the weather parameters had non-significant effect on the mite population throughout the experimental period.

Coccinellids

In the recent studies four species of coccinellids namely *Coccinella transversalis, Cheilomenes sexmaculata, Micraspis discolor* and *Brumoides suturalis* were found associated with sucking pests of okra. Similar result with respect to coccinellid fauna on okra crop were reported by Singh *et al.,* 2013 from Madhya Pradesh and Potai and Chandrakar, 2018 from Raipur, Chhattisgarh. The highest activity of coccinellids (1.08/ plant) synchronized with the peak activity of leafhopper at 22nd SMW (fourth week of May) (Table 1).

The correlation studies indicated that coccinellids were adversely affected by maximum temperature (Table 3). The present findings are in conformity with findings of Meena and Kanwat (2010) as they also observed non significant positive correlation of maximum temperature with coccinellids. Both morning and afternoon relative humidity had positive effect in summer season. These predators have significant positive correlation with the population build up of their prey i.e., aphid and leafhopper. These findings are in line with the results of Khating *et al.,* 2016 and Lal *et al.,* 2020 who stated positive significant correlation between sucking pests and predatory ladybird beetle. This is due to the prey-predator relationship.

Spiders

Spiders are important group of arthropod natural enemies associated with insect pests in okra ecosystem (Singh *et al.,* 2013). The highest activity of spider noticed on fourth week of May (22nd SMW) which coincided with the highest activity of leafhopper (Table 1).

The maximum temperature had significant negative influence on the population build up of predatory spiders (r= -0.788) (Table 3). However, both morning (r= 0.677) and afternoon (r= 0.746) relative humidity had significant positive effect as it was already reported by Sahito (2013). Rest of the weather parameters had no significant effect on the population of these predators. The spiders have significant positive correlation (r= 0.767) with leafhopper population.

Conclusion

Leafhopper, whitefly, aphid and two spotted spider mites are some major pests associated with okra throughout the cropping season. However, their population fluctuated with respect to the prevailing weather conditions. The maximum population of leafhopper and whitefly was recorded at 22nd and 19th SMW, respectively where as the peak activity of aphid and two spotted spider mites were recorded at 21st SMW. Four species of coccinellids

i.e., *Coccinella transversalis, Cheilomenes sexmaculata, Micraspis discolor* and *Brumoides suturalis* and spiders were found associated with aphids and leafhoppers of okra and their highest activity was observed at 22nd SMW. The correlation studies revealed a significant positive correlation between minimum temperature (r= 0.577) and afternoon relative humidity (r= 0.618) with leafhopper population. Further, there was significant negative correlation between spider population and maximum temperature (r= -0.788) where as both morning and afternoon relative humidity (r= 0.677 and r= 746) had positive effect. Aphid showed significant positive association with coccinellid (r= 0.876) population where as leafhopper showed the same association with both coccinellid (r= 0.922) and spider (r= 0.767) population. Hence it can be concluded that the population of sucking pests is greatly influenced by weather parameters and also a strong association was observed between the pests and their natural enemies. Therefore the understanding is essential to study the prey predator relationship from ecological point of view and for taking up timely management practices.

Table 1. Incidence of sucking pests and natural enemies in okra along with the abiotic factors during summer, 2021

Month	SMW	Temperature (°C)		RH (%)		Rainfall	BSH (hours)	Wind velocity	leafhopper/leaf	whitefly/leaf	aphid/leaf	Two spotted spider mite/ cm^2 leaf	coccinellid/plant	spider/ plant
		Max	Min	Morning	Afternoon									
March	12	38.50	23.50	92.00	30.00	0.00	3.70	3.70	0.00	0.00	0.00	0.00	0.00	0.00
	13	39.70	24.60	93.00	55.00	75.00	6.30	5.90	0.00	0.00	0.00	0.00	0.00	0.00
April	14	37.60	25.50	92.00	46.00	3.50	6.80	6.90	0.41	0.20	0.00	0.00	0.00	0.00
	15	37.00	24.80	89.00	50.00	3.70	4.60	6.60	0.83	0.69	0.73	0.00	0.08	0.00
	16	38.80	26.00	90.00	42.00	0.00	8.00	8.20	3.52	3.94	4.13	0.00	0.16	0.00
	17	39.90	26.60	89.00	37.00	0.00	7.30	7.10	5.90	4.94	5.85	0.00	0.28	0.32
	18	37.30	25.00	87.00	47.00	5.60	7.60	7.50	8.14	5.65	8.61	3.52	0.48	0.24
May	19	37.40	25.50	85.00	60.00	58.20	8.10	6.70	8.81	8.46	11.14	5.05	0.80	0.36
	20	37.10	27.30	91.00	51.00	31.20	8.90	7.90	11.42	7.85	14.05	11.57	0.84	0.40
	21	34.90	25.60	89.00	67.00	105.30	4.40	9.40	11.32	5.55	14.60	16.28	1.04	0.56
	22	33.50	27.60	92.00	63.00	28.50	5.60	6.20	14.30	6.33	10.66	13.81	1.08	0.60
June	23	36.60	26.70	92.00	60.00	21.80	7.70	5.40	11.48	4.28	10.09	12.59	0.96	0.48
	24	32.20	25.40	94.00	72.00	113.80	0.50	3.60	10.62	3.28	5.52	12.49	0.60	0.60
	25	32.20	26.20	94.00	78.00	165.80	1.80	3.20	9.76	2.28	5.65	12.26	0.52	0.48

Table 2. Correlation analysis between weather parameters and sucking pest population during summer, 2021

Insect	Summer, 2021						
	T (max)	T (min)	RH (M)	RH (E)	RF	BSH	Wind speed
Leafhopper	-0.568	0.577*	0.201	0.618*	0.473	-0.151	-0.194
Whitefly	0.107	0.435	-0.478	0.026	-0.008	0.460	0.345
Aphid	-0.083	0.434	-0.159	0.220	0.143	0.342	0.396
Two spotted spider mite	-0.580	0.485	0.679	0.571	0.412	-0.456	-0.058

*Significant at 5 % level

Table 3. Correlation analysis between weather parameters, natural enemies and their prey population during summer, 2021

	Summer, 2021								
Natural enemy	T (max)	T (min)	RH (M)	RH (E)	RF	BSH	Wind speed	Aphid	Leafhopper
Coccinellid	-0.422	0.493	0.135	0.528	0.303	0.045	0.039	0.876**	0.922**
Spider	-0.788*	0.268	0.677*	0.746*	0.535	-0.654	-0.328	0.092	0.767*

*Significant at 5 % level

**Significant at 1 % level

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