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Pawan Kumar Raghuwanshi

Dept. of Agriculture

Entomology, COA, RVSKVV,

Gwalior, Madhya Pradesh, India

UC Singh

Dept. of Agriculture

Entomology, COA, RVSKVV,

Gwalior, Madhya Pradesh, India

NS Bhadoria

Dept. of Agriculture

Entomology, COA, RVSKVV,

Gwalior, Madhya Pradesh, India

SPS Tomar

Dept. of Agriculture

Entomology, COA, RVSKVV,

Gwalior, Madhya Pradesh, India

OP Bharti

Krishi Vigyan Kendra, Harda,

Madhya Pradesh, India

Corresponding Author:**Pawan Kumar Raghuwanshi**

Dept. of Agriculture

Entomology, COA, RVSKVV,

Gwalior, Madhya Pradesh, India

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Succession and incidence of insect pests and their natural enemies in okra

Pawan Kumar Raghuwanshi, UC Singh, NS Bhadoria, SPS Tomar and OP Bharti

Abstract

This study was aim to observe and assessment of succession and Incidence of Insect pests and their natural enemies on Okra. The data revealed that insect pests and their natural enemies *viz.*, three orders (Hemiptera, Lepidoptera and Coleoptera) and six families (Cicadellidae, Aphididae, Aleyrodidae, Pyrrhocoridae, Noctuidae and Coccinellidae) were noticed. The seasonal incidence of pests *viz.*, Jassid, whitefly and aphid were notice in 34th (4th) week of August, while, shoot and fruit borer and red cotton bug were observed in 37th (3rd) week of September. However, natural enemies *viz.*, Lady bird beetle and predator mite were noticed in 36th (2nd) and 35th (1st) week of September, respectively, during 2015-16 and 2016-17. The data revealed that maximum activity was recorded in September. The correlation studies were made between the incidence of insect pests and selected weather parameters. The Correlation of meteorological parameters with different insect pests were notice positively and highly significant to maximum temperature, while, minimum temperature, relative humidity and rainfall were found negative and correlation.

Keywords: Okra, seasonal incidence, sucking pest, correlation and *Earias spp.*

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) or bhindi or lady's finger is an important Malvaceous vegetable crop grown in India. Okra is attacked by a number of insect pests are Aphid (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Gennadius) and aphid (*Aphis gossypii* Glover) of which shoot and fruit borer, *Earias spp.* is one of the major constraints in achieving potential yield. The sucking pests usually attack right from early seedling stage to last fruit harvesting. The important pests are Jassid, whitefly and aphid. Jassid attack causes the leaves to curl upward along the tip and margins and develop necrotic areas which extend over entire surface resulting in hopper burn. Heavy infestation of sucking pests in young stage results in stunted growth and gradual death of the plants, Khating, *et al.*, (2016) ^[1]. The infested fruits become unfit for human consumption, thus resulting in 35 to 76% decrease in yield (Hafeez and Rizvi, 1994) ^[3] and caused severe damage to the crop leading to yield losses to an extent of 3.5-90% in Andhra Pradesh (Krishnaiah *et al.*, 1976) and 30.81% at Coochbehar, West Bengal (Ghosh *et al.*, 1999) ^[2]. Keeping this in view, the present studies were undertaken to succession and incidence of insect pest and their natural enemies on okra.

Materials and methods

The research work was carried out at Department of Agriculture Entomology research farm, RVSKVV, Gwalior (M.P.) during *Kharif*, 20116-17 and 2017-18. The experimental was laid out in Randomized Block Design with replicated thrice. The plot size was 3 m x 2.4 m with Spacing was adopted 60 cm x 30 cm. Okra seed of variety VRO-22 was sown by dibbling 2 to 3 seeds/ hill. Insect pest population observations were done at weekly interval on randomly selected ten plants per plot. The insect pests population were recorded on three leaves *i.e.* basal, middle and upper leaves of plant. It were initiated after germination and continued up to the availability of insects or maturity of the crop. The incidence of shoot and fruit borer will be recorded at weekly interval during at fruiting stage, the number of healthy and damaged fruits of ten randomly selected plants was counted at each picking and after each observation damaged fruits were removed. Natural enemies present on the crop, their population were also

recorded. The population was expressed as numbers per plant. The per cent fruit borer infestation was computed as follows:

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

Results and Discussion

Succession of Insect pests and their natural enemies on Okra

The data revealed that about five species of insect pests and two spp. their natural enemies were observed, data are presented in table- 1 which associated with various stages of the okra crop (after germination).

The first major group of sucking insects to attack in the vegetative stage was Jassid (*Amrasca biguttula biguttula* Ishida) (Hemiptera: Cicadellidae), Aphid (*Aphis gossypii* Glover) (Hemiptera: Aphididae) and whitefly (*Bemisia tabaci* Genn.) (Hemiptera: Aleyrodidae) were the most prominent minor pests which caused damage at growth stages of crop, all these were available till maturity of the crop. The second group of insect pests which included *i.e.* okra shoot and fruit borer (*Earias vittella* Fabricius) (Lepidoptera: Noctuidae) and red cotton bug (*Dysdercus cingulatus* Fabricius) (Hemiptera: Pyrrhocoridae) were considered as most important and pre dominant pest of okra. The flower initiation stage (2nd week of September) marked the initiation of both pests and remained active upto the last picking of the fruits. In the group of natural enemies *Viz.*, lady bird beetle (*Coccinella septempunctata* L.) (Coleoptera: Coccinellidae) was observed during the reproductive stage (2nd week of September) and most active during the fruiting stage, while the Predator spider, *Amblyseius longispinosus* (Evans) (Acari, Phytoseiidae) was observed during the vegetative stage (1st week of September) and most active during the fruiting stage. Both of them, the lady bird beetle was noticed pre dating on soft bodies insect pests *i.e.* whitefly, jassid and aphid etc. and remained active from vegetative stage to last picking of the fruits both of the experiment years.

This study confirmed by Patel *et al.*, (2012) [6] Observed that five important insect pests, aphid *Aphis gossypii*, jassid *Amrasca biguttula biguttula*, whitefly *Bemisia tabaci*, shoot and fruit borer *Earias vittella* and mite *Tetranychus macfarlanei* were recorded. The five insects species *viz.*, shoot and fruit borer (*Earias vittella*), aphid (*Aphis gossypii*), jassid (*Amrasca biguttula biguttula*), whitefly (*Bemisia tabaci*) and red cotton bug (*Dysdercus koenigii*) were observed as the major insect pests infesting okra. The majority of the insect pests were showed positive correlation with maximum temperature and minimum temperature, Pandey and Koshta (2017) [7].

Incidence of insect pests on Okra

In the present study, sucking pests *i.e.* Jassid, Whitefly and aphid were first observed when the crop age was about 16-17 days after germination (4th week of August (34th SMW) during 2015-16 and 2016-17 respectively, data presented in Table 2, it is evident that sucking pests were present on the crop during the entire cropping season and remained available upto the crop maturity stage of the crop 29th to 04th November. The lowest (0.85 plant⁻¹), (0.95 plant⁻¹) and (0.71 plant⁻¹) population of Jassid, whitefly and aphid were recorded during the third week of august along with its highest population (12.38 plant⁻¹), (5.05 plant⁻¹) and (6.13 plant⁻¹) during the 5th week of September.

Aphid was present on the crop during the entire cropping season and remained available upto the crop maturity as on 29th to 04th November. The lowest aphid population (0.71 plant⁻¹) was recorded during the third week of august along with its highest population (6.13 plant⁻¹) during the fourth week of September.

The red cotton bug was first observed (4.33) at reproductive stage in third week of September when the crop age was about 44 days old (after germination) and reached to its peak infestation (11.75%) during 29th to 4th week of November during 2015-16 and 2016-17. The data from the Table 2, it is evident that the pest was present on the crop during the fruiting stage and remained available upto the crop maturity stage of the crop *i.e.* 29th to 4th week of November.

The shoot and fruit borer was first observed when the crop age was about 44 days old (after germination). The data from the Table 2, it is evident that it was present on the crop during the fruiting stage and remained available upto the crop maturity stage of the crop *i.e.* 29th to 4th week of November during 2015-16 and 2016-17. Shoot and fruit borer *i.e.* *Earias insulana* and *Earias vittella* were available on okra but *Earias vittella* (Fab.) was found dominant species. Hence observations were recorded on *Earias vittella* only. The initial infestation per cent (33.50) of the pest was noticed during reproductive stage in third week of September and reached to its peak infestation (48.50%) during the first week of November. Accordance with Patel *et al.*, (2012) [6] The incidence of sucking pest like jassid, whitefly and borer like shoot and fruit borer started simultaneously in fourth weeks after sowing *i.e.* the last week of July. Out of these, two sucking pests occurred throughout the season. Among them, whitefly multiplied at comparatively faster rate reaching the peak level 8th weeks after sowing. It was followed by jassid which attained the peak level 11th weeks after sowing conforming positive correlation with whitefly. The third sucking pest *i.e.* aphid multiplied relatively slowly and as such reached to the peak level 13th weeks after sowing *i.e.* first week of October disclosing positive correlation with jassid. The period of maximum activity of shoot and fruit borer (18.36 fruit borers per plant) were noticed during first week of January. The density of aphid (17.94 per three leaves) and jassid (17.12 per three leaves) were observed during first, second week of December respectively whereas whitefly (13.23 per three leaves) were observed during fourth week of November. The density of red cotton bug (3.16, 2.94 and 2.89 per plant) was observed during second and fourth week of December and fourth week of January, Pandey and Koshta (2017) [7].

Natural enemies

Lady bird beetle, *Coccinella septempunctata* L.

The *Coccinella septempunctata*, the seven-spot ladybird is the most common ladybird. Its elytra are of a red colour, but punctuated with three black spots each, with one further spot being spread over the junction of the two, making a total of seven spots. Lady bird beetle first incidence was observed when the crop age was about 37 days old (after germination). The initial population of lady bird beetle (16.33) was noticed during reproductive stage in 2nd to 1st week of November and reached to its peak population (23.17) during the 3rd week of September, the data from the Table 3 and it was present on the crop up to reproductive stage of the crop.

Predatory mite *Amblyseius longispinosus* (Acari: Phytoseiidae), predators responded to stimuli associated with webbing, mite feeding damage and other residues in the

webnests. Predatory mite, is used as a biological control agent of *Eotetranychus cendanaei* Rimando (Acari, Tetranychidae). The data from the Table 3, it is evident that the pest was present on the crop till the maturity stage of the crop 1st week of September during 2015-16 and 2016-17. Similar study was done by Patel *et al.*, (2012) [6] Observed that predators like green lacewing *Chrysoperla scelestes* and lady bird beetle *Coccinella septempunctata* were recorded.

Nature of Damage

Both nymph and adults are the damaging stage which suck the cell sap from the lower surface of leaf, twigs and other tender parts of the plant, causing curling of leaves and leading to stunted growth of the plants and same symptoms shown by both Jassid and whitefly and aphid. Jassid and aphid excrete honey dew which causes the black sooty mould resulted in adverse effect on the photosynthesis of the plants.

The red cotton bug larva is an internal feeder. Brown caterpillars immediately bore into the nearest tender shoot, flower or fruit just after hatching. Soon after boring into shoots or fruits, they plug the entrance hole with excreta. As a result, the affected twigs, flower and fruits dries up and droop off.

Shoot and Fruit borer, the larva is an internal feeder. Brown caterpillars immediately bore into the nearest tender shoot, flower or fruit just after hatching. Soon after boring into shoots or fruits, they plug the entrance hole with excreta. As a result, the affected twigs, flower and fruits dries up and droop off.

Correlation studies with incidence of insect pests of okra

The Correlation of meteorological parameters with different

pests was notice positively and highly significant to maximum temperature, while, minimum temperature was found negative and correlation, Table- 4. The larval population of shoot and fruit borer showed significant positive correlation with maximum temperature ($r = 0.555$ and 0.848), minimum temperature ($r = -0.818$ and -481), morning vapour pressure ($r = -0.174$ and -0.387), evening vapour pressure ($r = -0.738$ and -0.703) and Rinfall ($r = -0.283$ and -0.601). This study supported with Patel *et al.*, (2012) [6] the population of these sucking pests declined at the end of crop season. With continuation of conforming significant positive correlation with aphid ($r = 0.966$). Shoot and fruit borer population started to see in 4th weeks after sowing, conforming significant positive correlation with jassid ($r = 0.940$) and whitefly ($r = 0.579$). Pandey and Koshta (2017) [7] found that aphid, jassid, whitefly and red cotton bug population had significant positive correlation with maximum temperature while shoot and fruit borer had positive correlation with maximum temperature. Mahmood (2002) [8] reported that jassid showed positive and significant correlation with maximum and minimum temperature while relative humidity was negatively and non-significantly correlated with population fluctuation.

Conclusion

The five species of insect pests namely Jassid, Whitefly Aphid shoot and fruit borer and red cotton bug were found on okra. The maximum move of insect and pests was noticed in September during both of years. The association of correlation of insects and pest with Temperature was found positive and highly significant and rest of the parameters made negative correlation, during Kharif 2015-16 and 2016-17.

Table 1: Succession of insects pest and their natural enemy at different growing stages in okra during *kharif* 2015-16 and 2016-17

Date of observation (At SMW)	Common Name	Crop Age (DAS)	Crop Stage
Aug, 20 th - 26 th , 2015-16 and 2016-17	Jassid, Aphid, Whitefly	17-21	VS
Sept, 27 th - 2 nd , 2015-16 and 2016-17	Jassid, Aphid, Whitefly, Predator mite	22-29	VS
Sept, 3 rd - 9 th , 2015-16 and 2016-17	Jassid, Aphid, Whitefly, Lady bird beetle, Predator mite	30-36	VS
Sept, 10 th - 16 th , 2015-16 and 2016-17	Jassid, Aphid, Whitefly, Shoot & fruit borer, Red cotton bug, Lady bird beetle, Predator mite	37-43	RS
Sept, 17 th - 23 rd , 2015-16 and 2016-17		44-51	RS
Sept, 24 th - 30 th , 2015-16 and 2016-17		52-59	MS
Oct, 1 st - 7 th , 2015-16 and 2016-17		60-67	MS
Oct, 8 th - 14 th , 2015-16 and 2016-17		68-74	VS
Oct, 15 th - 21 th , 2015-16 and 2016-17		75-81	VS
Oct, 22 th - 28 th , 2015-16 and 2016-17		82-89	VS
Oct, 29 th - 4 th Nov, 2015-16 and 2016-17		90-96	RS

VS = Vegetative Stage

RS = Reproductive Stage (Flowering / Fruiting Stage)

MS = Maturity Stage

Table 2: Incidence of insect pest complex on okra at Gwalior during Kharif 2015-16 and 2016-17

Month	SMW	Mean Population (nymph + adult per 30 leaf)									No. of red cotton bug per plant			% fruit infestation by shoot and fruit borer			
		Jassid			White Fly			Aphid			2015	2016	Polled mean	2015	2016	Polled mean	
		2015	2016	Polled mean	2015	2016	Polled mean	2015	2016	Polled mean							
August	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	34	10.67	6.33	8.50	7.67	11.33	9.50	5.00	9.33	7.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
September	35	18.67	23.33	21.00	13.33	17.33	15.33	12.33	14.67	13.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	36	43.00	50.33	46.67	22.00	24.33	23.17	15.67	17.67	16.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	37	43.00	66.33	54.67	22.00	28.33	25.17	24.00	28.00	26.00	3.67	5.00	4.33	30.67	36.33	33.50	33.50
	38	57.00	71.67	64.33	26.00	50.33	38.17	35.00	30.67	32.83	4.33	5.33	4.83	40.33	41.67	41.00	41.00
	39	62.00	114.67	88.33	48.00	53.00	50.50	56.33	66.33	61.33	7.00	7.33	7.17	45.00	47.00	46.00	46.00
October	40	111.00	122.33	116.67	45.67	49.33	47.50	55.67	60.33	58.00	11.33	10.67	11.00	42.33	45.00	43.67	43.67
	41	114.00	133.67	123.83	47.00	41.33	44.17	49.33	46.67	48.00	13.33	12.33	12.83	43.67	46.67	45.17	45.17
	42	112.00	117.33	114.67	39.00	33.67	36.33	45.00	48.67	46.83	8.67	10.33	9.50	44.00	44.67	44.33	44.33
	43	96.00	85.33	90.67	28.00	23.33	25.67	12.33	22.67	31.00	7.00	8.67	7.83	42.67	32.33	21.33	21.33
November	44	37.00	43.33	40.17	21.00	24.00	22.50	12.67	18.67	15.67	5.33	4.67	5.00	47.33	49.67	48.50	48.50

Table 3: Movement of natural enemies on okra at Gwalior during Kharif 2015-16 and 2016-17

Month	SMW	No. of lady bird beetle per ten plant			No. of Predator Mite per ten plant		
	2015	2015	2016	Polled mean	2015	2016	Polled mean
August	32	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00
	34	0.00	0.00	0.00	0.00	0.00	0.00
September	35	0.00	0.00	0.00	9.33	14.67	12.00
	36	15.33	17.33	16.33	21.67	31.67	26.67
	37	22.00	24.33	23.17	27.00	38.00	32.50
	38	19.33	21.00	20.17	24.00	36.67	30.33
	39	16.67	18.67	17.67	18.00	34.00	26.00
October	40	16.33	17.33	16.83	17.00	31.67	24.33
	41	16.00	18.33	17.17	13.00	29.00	21.00
	42	13.00	17.00	15.00	8.00	28.00	18.00
	43	10.00	14.33	12.17	2.67	7.67	5.17
November	44	12.33	17.33	14.83	2.67	4.00	3.33

Table 4: Correlation coefficient of insect pest and their Natural enemies with Meteorological parameter

Meteorological parameter	Temperature 0c				Relative Humidity %				Rainfall mm	
	Maximum		Minimum		Morning		Evening		2015	2016
	2015	2016	2015	2016	2015	2016	2015	2016		
Jassid	0.7572	0.872	-0.838	-0.541	-0.382	-0.564	-0.898	-0.798	-0.539	-0.707
White fly	0.7389	0.779	-0.677	-0.201	-0.570	-0.272	-0.895	-0.485	-0.581	-0.721
Aphid	0.69	0.743	-0.534	-0.338	-0.441	-0.282	-0.753	-0.582	-0.426	-0.644
Shoot & Fruit Borer	0.5556	0.848	-0.818	-0.481	-0.174	-0.387	-0.738	-0.703	-0.283	-0.601
Leady bird beetle	0.7458	0.787	-0.386	-0.267	-0.402	-0.548	-0.713	-0.606	-0.158	-0.728
Predator Mite	0.6493	0.743	0.041	-0.008	-0.426	-0.329	-0.460	-0.373	-0.061	-0.718

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