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Population dynamics of sucking pests and their predators on okra agroecosystem

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Abstract
The present investigation was conducted to study the population dynamics of sucking pests and their predators on okra agroecosystem during the *kharif*, 2016. The major sucking pests recorded in the experimental field were whitefly (*Bemisia tabaci* Gennadius), leaf hopper (*Amrasca bigutulla bigutulla* Ishida) and aphids (*Aphis gossypii* Glover). Ladybird beetle *(Coccinella* spp.*)*, green lacewing *(Chrysoperla carnea)*, *Eocanthecona spp.*, spiders, syrphid fly and ants were some of the predators observed in the bhindi ecosystem. Among them *Coccinella* spp. and spiders were most commonly occurring predators in the field. The peak densities of insect pests and their predators were attained in September-October. *A. bigutulla bigutulla* and *Bemisia tabaci* attained the peak (11.13 leafhopper/3 leaves and 12.11 whitefly/3 leaves) in the 40th standard meteorological week (SMW) while *Aphis gossypii* attained its highest density (23.08 aphids/3 leaves) in 39th SMW. The predator population attained its peak (3.16 spiders/ plant and 3.01 coccinellids/ plant) in the 39th SMW.

Keywords: Dynamics, sucking pests, predators, okra

1. Introduction

Okra, *Abelmoschus esculentus* (L) Moench commonly known as bhindi in India belongs to the family Malvaceae [5]. It is a commercially important crop grown in tropical and subtropical regions of the world. Okra is an export-oriented crop and usually accounts for about 60% of the total fresh vegetables export [15].

India ranks second in terms of vegetable production in the world with the production of about 162897 thousand MT [2] while it occupies the first position in okra production which is about 67% of the total world's production. The area, production and productivity of okra crop in India is 530.8 thousand hectare area, 6350.3 thousand MT and 12 MT/ha, respectively [2].

Okra has high nutritional, industrial and medicinal values [14, 6]. Okra fruit is very rich in fats, vitamins A & B, carbohydrates and minerals such as calcium, iron, magnesium and potassium. Presence of Fe, Mn, Zn, Ni in traces have also been reported [13]. Although okra is a rich source of nutrients but in addition to this, it also serves as the house of pest and diseases. Insect-pests infestation is the prime and the most limiting factor in the successful cultivation of okra [19].

The crop is attacked by several insect-pests like shoot and fruit borer (*Earias vittella* Fabricus), american bollworm or fruit borer (*Helicoverpa armigera* Hubner), whitefly (*Bemisia tabaci* Gennadius), leaf hopper (*Amrasca bigutulla bigutulla* Ishida), aphids (*Aphis gossypii* Glover), leaf roller (*Sylepta derogata)*, blister beetle (*Mylabris pustulatus)*, dusky cotton bug (*Oxycarenus hyalinipennis)* and red spider mite (*Tetranychus urticae)* [4]. However, the key insect-pests causing the economic losses in okra include leaf hopper, whitefly, thrips, fruit borer, and shoot and fruit borer [18]. Shoot & Fruit borer and leafhopper causes 23-54% and 54-66% yield loss while american bollworm and whitefly leads to 22% and 54% reduction in yield respectively [16]. The sucking pests suck the cell sap from the ventral surface of the leaves and in addition inject the toxic saliva into the plant tissues leading to yellowing and curling of leaves [17].

Some of the predator population that contributed to the reduction of sucking pests in okra ecosystem are *Encarsia* sp., *Chrysoperla* spp., ants and Coccinellids [18].

The present study deals with the study of population dynamics of sucking pests and their predators which will help in formulating the proper pest management strategy in okra agro-ecosystem.

2. Material and Methods

The present investigation was carried out at the Vegetable Research Centre, GBPUAT, Pantnagar, Udham Singh Nagar (Uttarakhand) during the *kharif* season, 2016. Arka Anamika variety of okra was sown on 30th July, 2016. The experiment was laid out in a Randomized Block Design (RBD) in four replications. The plot size was 5 × 4 m^2. The row to row and plant to plant spacing was 60cm and 40cm respectively. Each plot consisted of six rows with eleven plants in each row. All the agronomic practices recommended to raise the okra crop were followed uniformly in each experimental plot.

The surveillance of okra crop for the population dynamics of insect pests and their predators was done throughout the growing season of the crop. It was initiated at the seedling emergence of the crop and was continued till the final harvesting of the crop. The data was recorded at the morning hours (7-10 am) since the winged insects at that time were sluggish hence, were easily countable. The observations were taken at the weekly intervals. The sucking pest complex were visually recorded by *Insitu* counts on three randomly selected leaves *viz.* each from upper, middle, and lower portion of plant randomly on five plants excluding the border rows from each plot till the final harvesting. To study predator population five plants were randomly selected and the number of predator *viz.* coccinellids and spiders per plant were recorded weekly. In order to identify the sucking pests and their predators sweep nets (32 cm dia and70 cm long) were used to trap them. Five sweeps was done and weekly data on the number of individual of each species obtained by net sweeping was recorded. For the correct identification the collected insects were brought to the laboratory and killed by placing a small cotton swab dipped in ethyl acetate or chloroform inside the polythene bags. The killed insects were stretched, pinned, labelled, preserved in the wooden collection boxes and identified by renowned scientists [7] of our institute. The data recorded was subjected to mean values of individuals per three leaves per week. The weekly data of pest population collected from the experimental field was analyzed by ANOVA under randomized block design.

3. Results and Discussion

The results obtained during the course of study of population dynamics of insect pests and their predators are as follows:

3.1 Population dynamics of sucking pest complex: The first incidence of leafhopper (1.31 leafhopper/ 3 leaves) and whitefly (1.20 whitefly/ 3 leaves) was marked in the month of August (3rd week of August) when the crop was three weeks old. The incidence was observed from 34th standard meteorological week (SMW) and it lasted upto 43rd SMW. The population of leafhopper and whitefly showed a gradual increase and attained its peak population (11.13 leafhopper/ 3 leaves and 12.11 whitefly/ 3 leaves) at 70DAS in the 40th SMW (1st week of October). While the occurrence of aphids (5.14 aphids/ 3 leaves) was marked from 35th SMW (30 days after the sowing of crop) to 43rd SMW. Its density was highest (23.08 aphids/ 3 leaves) in 39th SMW (Table 1).

Similar findings have been recorded by earlier researchers [11]. They also recorded the first incidence of whitefly and leafhopper 21 DAS (3 weeks old crop), followed by the gradual increase in its population attaining the peak in ninth and tenth week after sowing. The first incidence of sucking pests was seen in the month of July and the peak activity was in the month of September [9] which is similar to the results obtained in our study. In the present study the population of aphids peaked in month of September which is similar to the findings of some prior researchers [12]. They also reported higher population of aphids in the month of May and September. Aphids were the major pests throughout the crop growing season in the present study with their peak activity in the month of September. This is in collaboration to the findings that the mean population of aphids recorded was 39.28 aphids/3 leaf in the month of September during *kharif* season [10]. In the present study the population of whitefly and leafhopper attained the maximum size during the first week of October which was similar to the findings of some prior researchers [3, 1].

3.2 Population dynamics of Predators (Spiders and Coccinellids): The first incidence of spiders (0.33 spiders/ plant) was observed on 33rd SMW and the coccinellids (1.38 coccinellid/ plant) were first observed on 34th SMW. Both the predators attained their highest densities (3.16 spider/ plant and 3.01 coccinellid/ plant) in the fourth week of September in the 39th SMW (Table 1).

The present result of spider is in accordance to the work of some earlier researchers [8] who also observed the maximum population of spiders during April-May and August-September (12-21 and 31-39 SMW, respectively) in the *summer* and *kharif* grown okra crop. The coccinellids results of our present study are comparable to that of some prior researchers [17]. They also found that the population of aphidophagous coccinellid predators appeared simultaneously with the population of soft bodied insects mainly aphids on okra.

Table 1: Population Dynamics of pests and their Predators on okra at VRC, Pantnagar during, *kharif*, 2016

Month	Date	Population fluctuation of Pests (Untreated Plot)				Population fluctuation of Predators/ Plant (Untreated Plot)	
		SMW	Leafhopper/ 3 leaf	Whitefly/3 leaf	Aphids/3 leaf	Spiders	Coccinellids
July-Aug	30-05	31	0	0	0	0	0
Aug	06-12	32	0	0	0	0	0
Aug	13-19	33	0	0	0	0.33	0
Aug	20-26	34	1.31	1.20	0	0.52	0.22
Aug-Sep	27-02	35	4.9	2.23	5.14	0.98	0.47
Sep	03-09	36	7.89	4.81	10.96	1.34	0.89
Sep	10-16	37	8.4	7.63	19.75	1.50	1.29
Sep	17-23	38	9.6	8.9	21.31	2.49	1.68
Sep	24-30	39	10.21	10.42	23.08	3.16	3.01
Oct	01-07	40	11.13	12.11	20.17	3.00	2.97
Oct	08-14	41	8.86	9.62	11.69	2.07	1.71
Oct	15-21	42	8.01	6.54	5.82	1.25	0.28
Oct	22-28	43	6.93	4.38	3.96	0.36	0
Sem	-	-	1.45	2.08	1.18	0.58	0.44
Cd at 5%			4.18	5.96	3.40	1.69	1.67
Cv	-	-	49.06	80.01	25.33	74.10	75.97

4. Conclusion

The overall results of the present study revealed the fluctuation in the population of both insect pests and their predators in each month with the maximum population being recorded in the last week of September and first week of October. This may be probably due to the favourable weather conditions prevailing for the pests and their predators during these months. Thus, this knowledge of population dynamics of the pests and their predators will the help the farmers in devising the sustainable pest management strategy.

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