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Thara KT
Department of Agricultural Entomology. College of Agriculture, UAHS Shivamogga, Karnataka, India

Sharanabasappa
Department of Agricultural Entomology. College of Agriculture, UAHS Shivamogga, Karnataka, India

Narasa Reddy G
Department of Agricultural Entomology. College of Agriculture, UAHS Shivamogga, Karnataka, India

Girish BR
Department of Agricultural Entomology. College of Agriculture, UAHS Shivamogga, Karnataka, India

Correspondence
Thara KT
Department of Agricultural Entomology. College of Agriculture, UAHS Shivamogga, Karnataka, India

Seasonal incidence of sucking insect pests on okra agro-ecosystem

Thara KT, Sharanabasappa, Narasa Reddy G and Girish BR

Abstract
As many as 10 species of insect pests have been recorded in all stages of the okra. Among them, The blister beetle, *Mylabris pustulata* (Thunberg); grasshopper, *Poecilocerus pictus* (Fab.); grey weevil, *Myllocerus viridanus* (Fab.); flea beetle, *Nisotra apicefulva* (Bryant); aphid, *Aphis gossypii* (Koch.); leafhopper, *Amrasca biguttula biguttula* (Ishida); mites, *Tetranychus urticae* (Koch.); red cotton bug, *Dysdercus koenigii* (Fab.) were considered as serious defoliators and sucking pests. The fruit borers include *Helicoverpa armigera* (Hub.) *Earias vittella* (Fab.) and *Earias insulana*. The population of all insect pests was more abundant on the crop during August to November. A thorough knowledge of seasonal activity of different insect pests determines the predisposing climatic factors affecting their population dynamics. The study was carried out in the Zonal Agricultural and Horticultural Research Station Navile, Shivamogga. The observations on aphid, whitefly and leafhopper and natural enemy incidence was carried out simultaneously on 5 randomly selected plants per plot, from upper, middle and lower strata. Aphid population showed negative correlation with maximum and minimum temperature, rainfall and maximum and minimum relative humidity whereas, positive correlation with minimum temperature. Aphidophagous predators like coccinellids appeared more or less with aphid population. The coccinellids showed negative correlation with maximum, minimum and mean temperature, rainfall and maximum and minimum relative humidity. Leafhopper population showed negative correlation with maximum, minimum temperature and maximum and minimum relative humidity whereas positive correlation with rainfall.

Keywords: Okra, sucking insect pests, population dynamics, natural enemies

Introduction
Among the vegetable crops grown in India, okra (*Abelmoschus esculentus* L. Moench), also known as lady's finger or bhendi, belongs to family Malvaceae and is an important crop grown throughout the year. Besides India, it is grown in many tropical and subtropical parts of the world. Tender fruits are used as vegetables or in culinary preparations as sliced and dried pieces. It is also used for thickening gravies and soups, because of its high mucilage content. The roots and stems of okra are used for cleaning cane juice (Chauhan, 1972) [4]. Matured fruits and stems containing crude fibre are. Used in paper industry. It has good nutritional value, particularly the high content of Vitamin C (30 mg/100 g), Calcium (90 mg/100 g), Iron (1.5 mg/100 g) and other minerals like magnesium and potassium, Vitamin A and B, fats and carbohydrates (Aykroud, 1963) [2].

One of the important limiting factors in the cultivation of okra is insect pests. of which, the sucking pests comprising of Aphids, *Aphis gossypii* (Glover), leafhopper, A*mrasca biguttula biguttu* (Ishida), whitefly, *Bemisia tabaci* (Gennadius) and mite, *Tetranychus cinnabarinus* (Boisduval) causes significant damage to the crop. Krishnaiah (1980) reported about 40 to 56% losses in okra due to leafhopper. There is a reduction of 49.8 and 45.1% in height and number of leaves, respectively due to attack of leafhopper (Rawat and Sadu, 1973) [9]. Aphids and leafhoppers are important pests in the early stage of the crop which desap the plants, make them weak and reduce the yield. Failure to control them in the initial stages was reported to cause a yield loss to the tune of 54.04% (Chaudhary and Dadeech, 1989) [3]. The spider mite, *T. cinnabarinus* has assumed the status of major pest and caused 17.46% yield loss in okra (Sarkar *et al*., 1996). Aphidophagous predators like *Coccinella transversalis* and *Menochilus sexmaculata* are recognized as one of the important regulating factors in managing the aphid population. They also feed on mites, whiteflies, small insects eggs of insects etc. In order to prevent the losses caused by insects and to produce quality crop, it is essential to manage the pest population at appropriate time with suitable measures. The multiplication of these pests has been found to be favoured by environmental factors.

Materials and Methods

The study was carried out c during *kharif* 2015 at Zonal Agricultural and Horticultural Research Station Navile, Shivamogga, Karnataka, India to know the seasonal incidence of sucking pests of okra. Grown as per the recommended package of practices except the plant protection measures. Observations were recorded on 20 randomly selected and tagged plants; further, detailed observations were made at weekly intervals on the incidence of major pests, by following standard protocols, at different crop growth stages. The population of aphids, leaf hoppers mites were recorded from three leaves one each from the upper, middle and lower position on 20 selected plants during kharif and rabi season

Results and Discussion

Aphid population

The results (Figure 1) showed that, the incidence of aphid population has no infestation in the month of August and September. The incidence of aphid commenced from fourth week after sowing that is, second week of September with an average population level of 1.42 aphid population per leaf. An average maximum, minimum and mean temperature (34.57, 30.52 and 34.50°C), relative humidity (66 to 71%), rainfall (0.0 mm) was observed during this period (Figure 1 and Plate 1). The aphid population gradually increased and reached the peak level of 25.87 aphids per leaf during the second week of October. An average maximum, minimum and mean temperature (31.2°, 23.8° and 27.5°C), relative humidity (64 and 50%), rainfall (0.0 mm) were observed during the peak period. Thereafter declined trend was observed and population of aphid reached its lowest level of being average of 1.00 aphids per plant in 47th standard week that is, November which is the third week. An average maximum, minimum and mean temperature (32.3, 16.3, and 24.3°C), relative humidity (57 and 30%), rainfall (0.0 mm) were observed during this period.

Aphid showed negative correlation with minimum (r = -0.2930), and mean temperature (r = -0.2120), rainfall (r = -0.3802), maximum (r = -0.5378) and minimum (r = -0.5109) relative humidity whereas, positive correlation with maximum (r = -0.0384) and coccinellids (r = 0.7438). The aphid appeared in the second week of September with an average population of 1.42 mean aphid/leaf. The aphid population peaked is in the second week of October (25.87 mean aphid/leaf). Aphid showed negative correlation with minimum and mean temperature, rainfall and maximum and minimum relative humidity whereas showed positive correlation with maximum temperature and coccinellids.

Present findings are in line with the findings of Slosser *et al*. (1998) [12] who reported that, population of *A. gossypii* increased during the months of August and October. Patel and Rote (1995) [7] reported that, Aphid population was peak in the second fortnight of October followed by first and second fortnight of November. Similar finding were reported by Preetha and Nadarajan (2007) [8], Hegde *et al*. (2004), Gulati (2004) [5] and Anita and Nandihalli (2008) [1]

Leafhopper

The incidence of leafhopper commenced from 2nd week after sowing that is, the fourth week of August (35st standard week) with an average population level of 1.2 leafhopper/plant. An average maximum, minimum and mean temperature (34.2, 29.8, and 32.0 °C), relative humidity (80 and 75%), rainfall (32.4 mm) were observed during this period (Figure 1) Then the pest population went to peak during the fourth week of September (39th standard week) with 18.43 leafhopper/plant. An average maximum and minimum temperature (29.7, 26.4, and 28.0 °C), relative humidity (80 and 77%) and rainfall (144.36 mm) were observed during this peak period. Thereafter population of leafhopper remained constant, ranging between 7.26 to 9.67 leafhopper/plant from the first fortnight of October (40th standard week) to the third week of November (47th standard week).

Leafhopper showed negative correlation with maximum (r = -0.6023), minimum (r = -0.3988), and mean (r = -0.5215) temperature, and maximum (r = -0.2184), and minimum (r = -0.2340) relative humidity whereas positive correlation with rainfall (r = 0.2359). The leafhopper appeared in the fourth week of August with an average population of 1.2 leafhopper/leaf. The leafhopper population reached the peaked in the fourth week of October (18.43 leafhopper/leaf). Leafhopper showed negative correlation with maximum, minimum and mean temperature, and maximum and minimum relative humidity whereas showed positive correlation with rainfall.

Table 1: Seasonal incidence of sucking pests on okra during *Kharif, and rabi* 2015

Month	WAS	SMW	Number of sucking pests / 3 leaves during kharif		Number of sucking pests / 3 leaves during rabi			
			Aphis gossypii	*Amrasca biguttula biguttula*	Month	SMW	*Aphis gossypii*	*Amrasca biguttula biguttula*
July	3	28	0.00	0.99	October	42	4.53	0.48
	4	29	4.50	5.19		43	11.31	3.90
	5	30	11.04	3.69		44	14.79	3.48
	6	31	25.32	12.93		45	24.54	6.66
August	7	32	34.68	16.77	November	46	37.32	7.94
	8	33	44.79	19.23		47	46.83	26.67
	9	34	27.18	32.49		48	57.60	35.92
	10	35	46.80	24.69		49	67.50	36.18
September	11	36	52.50	35.55	December	50	36.36	16.44
	12	37	45.27	23.55		51	29.01	5.85
	13	38	28.41	14.88		52	24.84	4.50
	14	39	15.45	2.28		53	9.40	3.00
October	15	40	6.60	2.94	Janaury	1	3.84	2.70
	16	41	3.90	0.60		2	2.49	1.50
Mean		-	24.74	13.98	Mean		26.45	12.60
SD		-	18.09	11.90	SD		20.60	11.08

SMW- Standard meteorological week, WAS-weaks after sowing, S.D- Standard deviation,

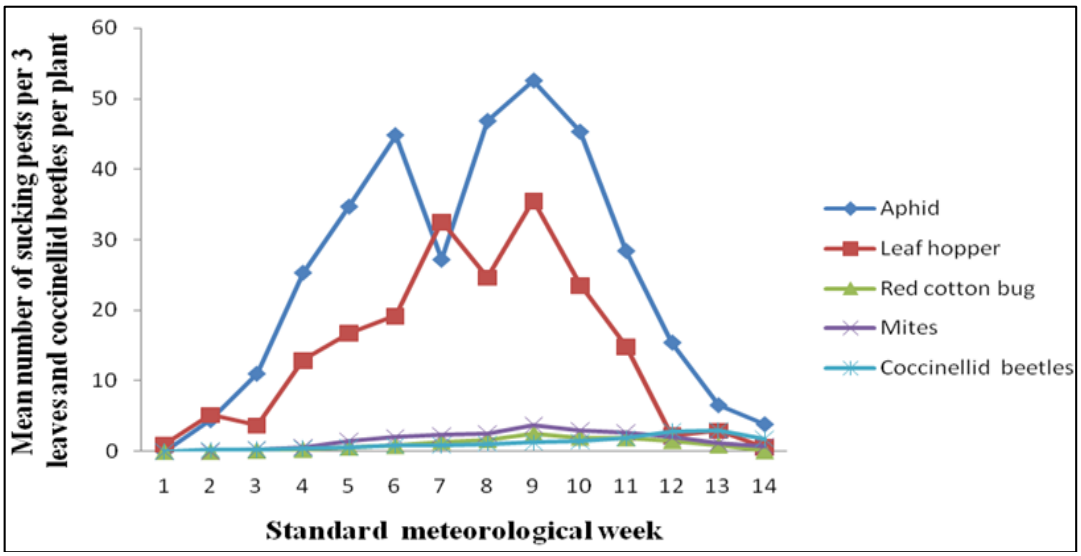

Fig 1: Seasonal incidence of sucking pests and natural enemy on okra during *Kharif*, 2015-16

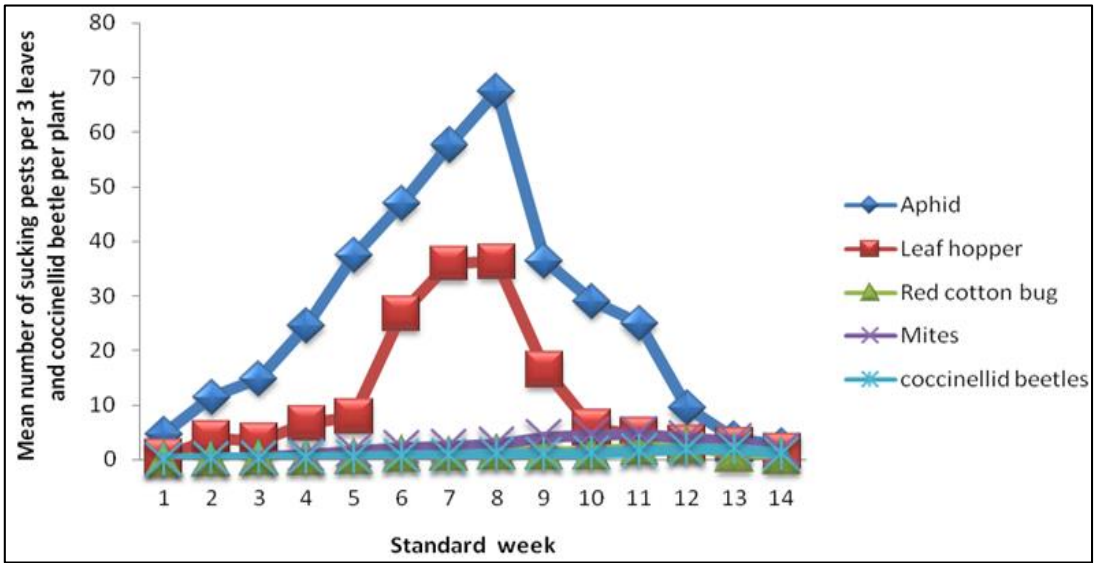

Fig 2: Seasonal incidence of sucking pests and natural enemy on okra during *rabi*, 2015-16

In general, it was observed that the incidence of leafhopper increased with the age of the crop. Generally, in the vegetative phase, population was comparatively less in all the bhendi lines than near maturing crop (60th day). This may be due to the thinner veins of early stage crop, which further developed into thicker vein and thereby favoured more number of hoppers on leaf. Similarly as the age of the plant increase, increase in the size of leaf lamina, decreases the hair density and increases the population of leafhoppers. This line of thinking was proposed by Ragumoorthi and Kumar (2000). However, there are no reports regarding the screening of these okra lines against any of the sucking pest of okra and their differential preference. But one report by Kumar and Singh (2002) [6] supports the present investigation, according to them, variety Arka Anamika harbored lesser population of leafhopper and minimum leaf injury. Pritha and Nadarajan (2007) [8], Hegde *et al*. (2004), Gulati (2004) [5] and Anita and Nandihalli (2008) [1] had also reported similar results.

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