academicJournals

Vol. 8(28), pp. 3814-3819, 26 July, 2013
DOI: 10.5897/AJAR12.1743
ISSN 1991-637X ©2013 Academic Journals
http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Population dynamics of sucking insect pests and its natural enemies on okra agro-ecosystem in Chitrakoot region

Yajuvendra Singh[1], Aastik Jha[2]*, Savita Verma[1], V. K. Mishra[2] and S. S. Singh[1]

[1]Mahatama Gandhi Chitrokoot Gramodya Vishwvidyalay, Satna (M. P.) India.
[2]Indian Institute of Vegetable Research, Varanasi (U. P.) India.

Accepted 24 May, 2013

Okra crop was found infested with sucking insect pests, these are, whitefly (*Bemisia tabaci*), leafhopper (*Amrasca bigutulla bigutulla*) and aphid (*A. gossypii*) during 2008. 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 Rajaula Farm of Mahatama Gandhi Chitrokoot Gramodya Vishwvidyalay (MGCGV), Chitrakoot, Satna, M. P. The observations on aphid, whitefly and leafhopper and natural enemy incidence was carried out simultaneously on 5 randomly selected plants per plot, taking 6 leaves, that is, 2 each from upper, middle and lower strata. Aphid population showed negative correlation with minimum and mean temperature, rainfall and maximum and minimum relative humidity whereas, positive correlation with maximum temperature and coccinellids. 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. Whitefly and leafhopper population showed negative correlation with maximum, minimum and mean temperature and maximum and minimum relative humidity whereas positive correlation with rainfall.

Key words: 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).

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). One of the important limiting factors in the cultivation of okra is insect pests. Many of the pests occurring on cotton are found to ravage okra crop. As high as 72 species of insects have been recorded on okra (Srinivasa and Rajendran, 2003), of which, the sucking pests comprising of Aphids, *Aphis gossypii* (Glover), leafhopper, A*mrasca biguttula biguttula*

*Corresponding author E-mail: aastikiivr@gmail.com. Tel: +91-9453909227.

(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). 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). The spider mite, *T. cinnabarinus* has assumed the status of major pest and caused 17.46% yield loss in okra (Sarkar et al., 1996).

Okra crop is susceptible from early stage to maturity. Among the wide array of insect pests infesting okra crop, the sucking pests which are, aphid, *A. gossypii* (Glover), leafhopper (*A. biguttula biguttula (*Ishida), and whitefly, *B. tabaci (*Gennadius), were reported to be quite serious during all stages of the crop growth (Channabasavanna 1981; Singh et al., 1987).

Jassids (*A. biguttula biguttula* (Ishida), both nymphs and adults suck the cell sap usually from the ventral surface of the leaves and while feeding inject toxic saliva into plant tissues, affected leaves turn yellowish and curl (Singh et al., 2008). Whitefly (*B. tabaci*), the milky white minute flies; nymphs and adults suck the cell sap from the leaves. The affected leaves are curled and dried. The affected plants show a stunted growth. Whiteflies are also responsible for transmitting yellow vein mosaic virus. Aphids, *A. gossypii* (Glover) is considered as the major pest of okra. It is a polyphagous pest, attacking a wide range of plant belonging to 46 families. The nymph and adult are found in large numbers and they suck the sap from different parts of the plants.

Heavily infested leaves turn yellow, get deformed, curled and dried up causing serious reduction in fruit yield. Besides, causing direct losses, it is capable of transmitting viral diseases on different host plants (Butani and Verma, 1976). Aphidophagous predators like *Coccinella septumpunctata* 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.

METHODS AND MATERIALS

The field experiment was carried out in populations of sucking pests infesting okra during 2008 and 2009 at Rajaula Farm of Mahatama Gandhi Chitrokoot Gramodya Vishwvidyalay (MGCGV), Chitrakoot, Satna, M.P. The observations were made on number of aphid, whitefly, leafhopper, and natural enemy incidence on 5 randomly selected plants per plot, taking 6 leaves that is, 2 each from upper, middle, and lower strata, throughout the year (summer, kharif and rabi) in 3 replications.

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 47^{th} 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) who reported that, population of *A. gossypii* increased during the months of August and October. Patel and Rote (1995) 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), Hegde et al. (2004), Gulati (2004) and Anita and Nandihalli (2008).

Leafhopper

Aphid

Whitefly

Lady bird Beetle grub feeding on aphid

Lady bird Beetle adult feeding on aphid

Figure 1. Seasonal incidence of okra sucking pests and its natural enemy.

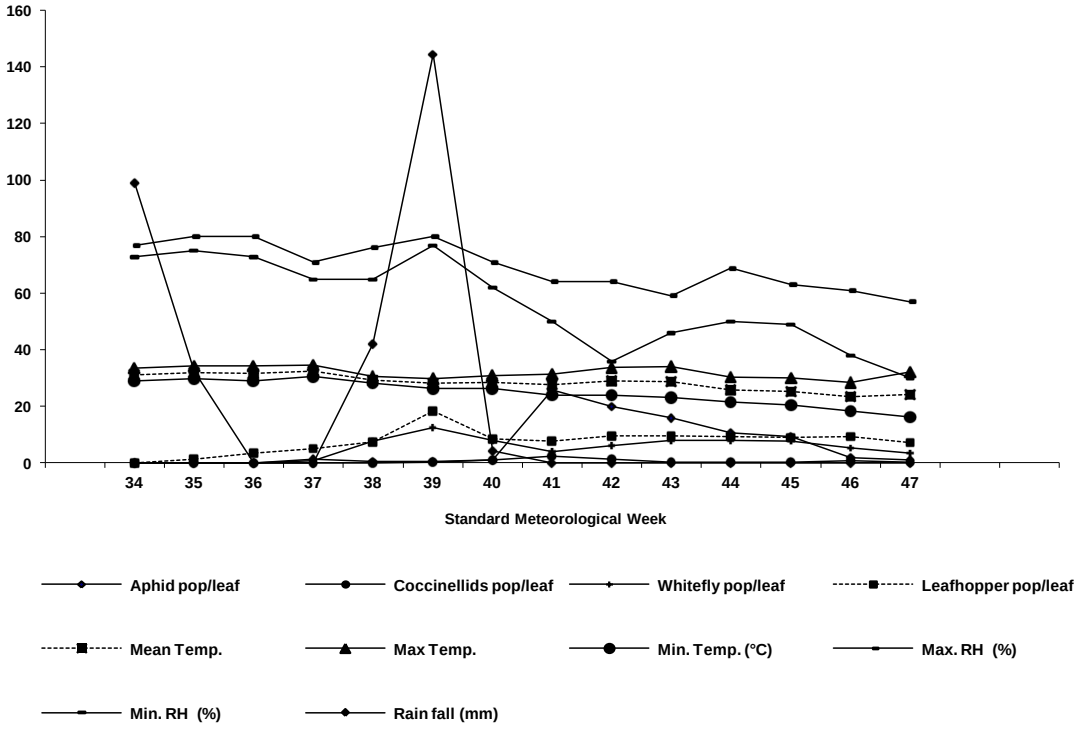

Plate 1. Correlation between okra sucking insect pests and its natural enemy and weather parameters during 2008 to 2009.

Natural enemy

Subsequent sampling showed the presence of aphidophagous predators (coccinellids) in the aphid colonies. The coccinellids appeared more or less after the fifth week of the occurrence of aphid that is, fourth week of September (39th standard week) with 0.33 coccinellid per leaf. The population gradually increased and peaked with 2.51 coccinellids/leaf at the second week of October (41st standard week) which was found coincided with peak density of the aphid. The population then decreased but continued till third week of November (47th standard week).

The population of coccinellids ranged from 0.18 to 2.51 coccinellid/leaf. Altogether, 2 species of coccinellid predators which are *Coccinella transversalis* Fabr. and *C. septumpunctata* L were found associated with the aphid population (Figure 1 and Plate 1). The coccinellids showed negative correlation with maximum (r = -0.2453), minimum (r = -0.2582), and mean (r = -0.2863), temperature, rainfall (r = -0.2622), and maximum (r = -0.4128), and minimum (r = -0.3993) relative humidity. The aphidophagous predators (Coccinellids predators) which are, *C. Transversalis* and *C. septumpunctata* were found feeding in aphid colonies. The coccinellids appeared in third week of September (1.00 coccinellid/leaf) and peaked at second week of October (2.51 mean coccinellid/leaf).

The coccinellids showed negative correlation with maximum, minimum and mean temperature, rainfall and maximum and minimum relative humidity. The natural enemies' fauna in okra showed maximum number of natural enemies' which coccinellids were recorded. This finding is in agreement with Katole and Patil (2000); they reported that, though non-significant difference in occurrence of natural enemies (Coccinellids) was noticed, the plots with seed treatments recorded relatively higher population of natural enemies as compared to foliar sprays. Subhadra Acharya et al. (2002) reported the safety of acetamiprid, thiamethxam and imidacloprid to lady bird beetle.

Whitefly

There was no infestation in the month of August (34th and 36th standard weeks). The incidence of okra whitefly commenced from the 3rd week after sowing that is, first fortnight of September (36th standard week) with an average population level of 0.1 whitefly population/leaf.

An average maximum, minimum and mean temperature (34.4°, 28.8°, 31.6°C), relative humidity (80 and 73%) and rainfall (0.0 mm) were observed during this period (Figure 1 and Plate 1). Similar findings were reported by Obnesorge (1981) who reported that, the density of *B. tabaci* was lowest in kharif and winter crops.

The whitefly population gradually increased and reached the peak level of 12.4 whitefly/leaf during fourth week of September (39th standard week). 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 declined trend was observed and population of whitefly reached its lowest level of being average of 3.4 whitefly per leaf in 47th standard week that is, the third week of November. Whitefly showed negative correlation with maximum (r = -0.6679), minimum (r = -0.3590), and mean (r = -0.5141) temperature and maximum (r = -0.1807), and minimum (r = -0.1856), relative humidity whereas, it showed positive correlation with rainfall (r = 0.2252). The whitefly appeared in the first week of September with an average population of 0.1 mean whitefly/leaf. The whitefly population reached the peaked in the fourth week of October (12.4 mean whitely /leaf). Whitefly showed negative correlation with maximum, minimum and mean temperature and maximum and minimum relative humidity whereas showed positive correlation with rainfall.

These results are in line with that of Watson et al. (2003) who reported that, temperature above 300°C increased the rate of egg laying above 400°C reduced the length of life cycle of *B. tabaci* to less than 2 weeks. Threhan (1944) reported that, high temperature and low rainfall were found to favour the rapid multiplication of the pest. The same results were reported by Ozgur et al. (1990), Rao et al. (1989), Pritha and Nadarajan (2007), Hegde et al. (2004), Gulati (2004) and Anita and Nandihalli (2008).

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 and Plate 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.

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) supports the present investigation, according to them, variety Arka Anamika harbored lesser population of leafhopper and minimum leaf injury. Pritha and Nadarajan (2007), Hegde et al. (2004), Gulati (2004) and Anita and Nandihalli (2008) had also reported similar results.

REFERENCES

Anita KR, Nandihalli BS (2008). Seasonal incidence of sucking insect pests in okra ecosystem. Krnataka J. Agric. Sci. 21:137-138.

Aykroud WR (1963). I.C.M.R. Special Report series P. 42.

Butani DK, Verma S (1976). Pests of vegetable and their control. Brinjal. Pest 10(2):32-35.

Channabasavanna GP (1981). Contributions to Acarology Society of India. Bangalore P. 256.

Chaudhary HR, Dadeech (1989). Incidence of insects attacking okra and the available losses caused by them. Ann. Arid Zone 28(3):305-307.

Chauhan DVS (1972). Vegetable production in India. 3rd Ed., Pub. Ram Prasad and Sons, Agra.

Gulati R (2004). Incidence of Tetranychus cinnabarinus (Boisd.) Infestation in different varieties of *Abelmoschus esculentus* L. Ann. Pl. Prot. Sci. 12:45-47.

Hegde M, Srinivasa M, Biradar DP, Udikeri SS, Khadi BM (2004). Seasonal incidence of key insect pests and their natural enemies on cotton at Siruguppa paper presented. Int. Symp. Strat. Sust. Cotton Prodn. – A Global vision. Karnataka, India. pp. 23-25.

Krishnaiah K (1980). Methodology for assessing crop losses due to pests of vegetable. Assessment of crop losses due to pests and diseases. Proc. of Workshop held from Sept, 19-30, 1977 at U.A.S., Bangalore. pp. 259-267.

Kumar M, Singh AK (2002). Varietal resistance of okra against cotton jassid, Amrasca biguttula biguttula under field conditions. Ann. Pl. Prot. Sci. 10(2):365-410.

Obnesorge B (1981). Studies on the population dynamics of the whitefly, Bemisia tabaci (Genn.) in winter months. Mitt. Dt. Ges. Allag. Angew. Ent. 3:324-327.

Ozgur AF, Sekeroglu E, Ohnesorge B, Gocmen H (1990). Studies on host plant changes, migration and population dynamics of the cotton whitefly (Bemisia tabaci) in Cukurova (Turkey). Mitte-der. Deutsch. Gesell. Fur., Allg. Und-Ang. Ent. 7(4-6):653-656.

Patel IS, Rote NB (1995). Seasonal incidence of sucking pest complex of cotton under rainfed condition of southern Gujarat. Gujarat Agric. Univ. Res. J. 21(1):127-129.

Preetha G, Nadarajan L (2007). Validation of IPM modules against sucking pests of okra in Karaikal. Indian J. Entomol. 69(3):210-214.

Ragumoorthi KN, Kumar S (2000). Biophysical factors of Bhendi, *Abelmoschus esculentus* (L.) Moench. Offering resistance to leaf hopper Amrasca biguttula biguttula (Ishida) cicadellidae : Homoptera. Pestology, 23(12).

Rao NV, Reddy AS, Rao KT (1989). Natural enemies of cotton whitefly, Bemisia tabaci Gennadius in relation to host population and weather factors. J. Biol. Control 3(1):10-12.

Rawat RR, Sadu HR (1973). Estimation of losses in growth and yield of okra due to Empoasca devastans (dist). and Erias spp. Indian J. Ent. 35:252-254.

Sarkar PK, Mukherjee AB, Ghosh J (1996). Assessment of loss of bhendi against red spider mite. Env. Eco. 14(2):480-481.

Singh J, Singh RK, Mukherjee IN, Singh RN, Agarwal L (1987). Mites of agricultural importance and their management in India. In: Recent Advances in Entomology (Eds. Mathur, Y.K., Bhattacharya, A.K., Pandey N.D., Upadhyay, K.D. and Srivastava, J.P.) Gopal Prakashan. Kanpur, pp. 170-185.

Singh S, Choudhary DP, Sharma HC, Mahla RS, Mathur YS. Ahuja DB (2008). Effect of insecticidal modules against jassid and shoot and fruit borer in okra. Indian J. Entomol. 70(3):197-199.

Slosser JE, Pinchak WE, Rummel DR (1998). Biotic and abiotic regulation of Aphis gossypii Glover in West Texas dryland cotton. South-West Entomol. 23(1):31-65.

Srinivasa R, Rajendran R (2003). Joint action potential of neem with other plant extracts against the leaf hopper Amrasca devastance (Distant) on Okra. Pest Manage. Econ. Zool. 10:131-136.

Threhan KN (1944). Distribution of whitefly in the Punjab. Indian Farming 5:514-515.

Watson JS, Hopper BS, Tipton JD (2003). Whitefly and the problem of sticky cotton. Span (Shell) 25:71-73.