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Population Dynamics of Sucking Pests of Bt Cotton and Their Correlation with Abiotic Factors

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ABSTRACT
The population dynamics of major sucking pests of Bt cotton along with their correlation with weather parameters were studied during kharif 2013, at the Experimental Farm, Department of Agricultural Entomology, VNMKV, Parbhani. Five sucking insect pests were recorded viz, aphids (Aphis gossypii Glover), jassids (Amrasca biguttula biguttula Ishida), whitefly (Bemisia tabaci Gennadius), thrips (Scirtothrips dorsolis Hood) and mealy bug (Phenococcus solenopsis Tinsky) Linnman), under unprotected condition. Aphid infestation was recorded for the first time during third week of observation (30th MW) and maximum infestation was recorded (73.40 aphids/3 leaves) in 40th standard week of crop. Jassid infestation was started from 28th standard week of crop and acquired its peak in 45th standard week of crop and maximum percentage of infestation was recorded (42.60 jassids/3 leaves). The incidence of thrips started from 30th MW and Maximum population of thrips observed in 41st MW (44.33 thrips/3 leaves). Whitefly infestation was recorded in 30th MW of crop and continued it up to 44th MW of crop high percentage of infestation was recorded (22.60 whiteflies/3 leaves). In case of mealy bug infestation was recorded 33rd MW of crop and with peak (12.40 mealy bugs /3 shoots) continues infestation up to 50th MW. Simple correlation analysis revealed that maximum temperature showed significant positive effect on all the sucking pests. The minimum temperature showed negative effect on mealy bug population and non significant effect on jassids, whitefly and thrips population. Precipitation was negative effect, whereas relative humidity was non significant effect on all the sucking pests.
KEYWORDS: *population dynamics, abiotic factors, correlation, sucking pests, Bt cotton.*

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INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is the one of the important cash crops of the India. It occupies a very prominent position in the economy of the country. Because it provides livelihood to millions of people and is also one of the major foreign earner of the country. It is cultivated about 9.2 million ha with a production of 21.3 million bales of seed cotton (Anon, 2005). The average productivity of cotton in Indian is 463kg per ha (Anon., 2006). India is the third largest cotton producer contributing 18.3% of world production (Anon., 2007). Thus India ranks first in area and fourth in production on global basis. About 162 species of insects occur in cotton at various stages of growth of which 15 are key pests (Kannan *et al* 2004). The low productivity of cotton is caused by many factors but the most serious one is the infestation of insect pests attack.

Among sucking insect pests, aphid (*Aphis gossypii* Glover), jassids (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Gennadius), thrips (*Scirtothrips dorsolis* Hood) and mealy bug (*Phenococcus solenopsis* Tinsky) are major pests in India and cause considerable damage in Bt and non Bt- cotton. These are very destructive pests during seeding and vegetative phase of cotton as they suck the sap of the plant, make it weak and in case of severe infestation wilting shedding of leaves occur (A bro et al 2004). Information on seasonal activity of sucking pests on Bt cotton helps to take up effective management strategies. Keeping this in view present study was undertaken.

MATERIALS AND METHODS

The field experiment was carried out during *Kharif* 2013 at the Experimental Farm, Department of Agricultural Entomology, VNMKV, Parbhani.. *Bt* cotton hybrid 'Bunny-*Bt*' BG-II was used for the experiment. The crop was raised as per the package of practices recommended by the VNMKV. The observations were made on number of aphids, jassids, whiteflies and thrips on 5 randomly selected plants in each quadrate from top, middle and bottom three leaves at weekly interval, in case of mealy bugs observations were recorded from 2.5 cm shoot length from the selected plants.

RESULTS & DISCUSSION

Population dynamics of sucking insect pests in Bt- Cotton

Population dynamics of Aphids (*Aphis gossypii* (Glover)

The results (Fig.1) showed that the incidence of aphid population noticed throughout the year except August and September because of high rainfall. The population steadily increased from 33rd MW up to 37th MW of 2013. The peak incidence of aphid population was recorded to be 73.40 per three leaves during 40th meteorological week of October 2013. In general the aphid population recorded to be above the ETL during August, September, October & November.

These trends of aphid infestation were more or less similar with those reported by other research worker like Soujanya *et al.*, (2010) who reported major sucking pest aphids *A. gossypii* infested crop initial incidence of aphids was recorded 34th standard week (4th week of August) and peak incidence was observed from 39th standard week (4th week of September) to 46th standard week (3rd week of November). Mohapatra (2008) who reported major sucking pest aphids, *A. gossypii* infested crop from 30th standard week to 50th standard week.

Population dynamics of jassids (*Amrasca bigutulla bigutulla* Ishida)

The incidence of jassids started from 28nd MW (0.60 jassids/3 leaves). The peak incidence of jassids was recorded in 39th MW to 45th MW. Maximum population of jassids recorded (42.60 jassids/3 leaves) during 43rd MW. The jassid population recorded to be above the ETL during 36th MW to 47th MW of 2013 (Fig.1).

The present finding agreement are more or less similar with those of earlier researchers like Anitha and Nandihalli (2008) and Arif *et al.* (2006) who reported leafhopper population was found throughout the year. Prasad (2008) recorded that peak incidence of leaf hoppers was observed from 37th to 47th MW (mid September to November). Saujanya *et al.*, (2010) recorded the leaf hoppers incidence showed increasing trend from 39th standard week (2nd week of October to 3rd week of November). Rajput *et al.*, (2010) reported that population was less throughout the season and highest population was recorded in 42nd and 43rd standard week (15th to 28th MW October).

Population dynamics of thrips (*Trhips tabaci* Lindman)

The incidence of thrips started from 30th MW (0.70 thrips/3 leaves) and first peak observed from 37th MW (17.3 thrips/3 leaves) upto 45th MW. Maximum population of thrips observed in 41st MW (44.33 thrips/3 leaves). After that population of thrips decreases and reached up to 0.60 thrips/3 leaves in 52nd MW (Fig.1).

These trends of thrips infestation in present studies were more or less similar to those of Bhede (2003) reported that thrips *S. dorslis* commended in last week of August and reached peak during first week of October. Gosalwad *et al.*, (2009) studied population dynamics of major insect pest of cotton and showed that thrips attained its peak in August and November in 2004-05. Pawar *et al.*, (2008) recorded the highest thrips population (92.65 per leaf) during 35th MW and second peak (65.70 per leaf) was recorded in next week on *Bt* cotton. The population of thrips during the month of August after that it decrease continuously upto 49th MW except 41st MW and 44th MW.

Population dynamics of whitefly (*Bemisia tabaci*)

The incidence of whiteflies started from 30th MW (0.20 whiteflies/3 leaves). The peak activity of whitefly was observed from 41st MW to 44th MW, while highest incidence (22.60 whiteflies/3 leaves) of whiteflies population observed in 42nd MW. Thereafter population decreased from 46th MW to 52nd MW (Fig.1).

The present findings are similar with the finding of another research worker like Prasad *et al.*, (2008) observed that the peak incidence of whiteflies was from 41th to 48th standard metrological week (SMW) Pawar *et al.* (2008) observed that population of whitefly started to increase significantly and attained its peak/leaf (10.46 whitefly/3 leaves) during third week of October. Parasi and Shastry (2009) study the seasonal incidence of key pests on cotton variety JK-4 during 2005-06 and 2006-07 at main Cotton Research, Khandava. The incidence of whitefly was observed form 33-48 MW with its maximum (21.1 to 31.1whitefly /3 leaves) incidence during 31st MW.

Population dynamics of mealy bug (*Phenococcus solenopsis* Tinsky) Linnman)

The incidence of mealy bugs started from 33rd MW (0.20 mealy bugs /3 shoots). The peak activity of Mealy bugs was observed from 42nd to 46th MW while higher incidence (12.40 mealy bugs /3 shoots) of mealy bug observed in 45nd MW. Thereafter population decreases from 47th MW onwards (Fig.1).

The present findings are similar with the finding of other research workers like Laxman *et al*., (2009) studied the mealy bug *Phenococcus solenopsis.* Tinsky was recorded as major pest of *Bt* cotton. The percentage of infested plant ranged from 47th to 53th during September to December in 2007-08. Kharbade *et al*., (2011) studies the incidence of mealy but *Phenoccocus solenopsis* was recorded on both *Bt* and non *Bt* occurring 2nd fortnight July at experimental field of cotton, severe incidence was noticed from October to November during cold weather condition.

ROLE OF ABIOTIC FACTORS IN POPULATION FLUCTUATION OF SUCKING INSECT PESTS

Simple correlation

The results regarding the correlation between abiotic factors and population of aphid, jassid, whitefly, thrips and mealy bugs are given in Table1. The results revealed that incidence of aphid had positive correlation with all weather factors during 2013-14. Maximum temperature, minimum temperature was highly significant where as rainfall and evening RH had non-significant correlation. The above finding are in consonance with those of earlier research workers like Shitole *et al*., (2009) who noticed that Aphid population exhibited significantly positive correlation with average temperature, relative humidity, rainfall, while Aphid population had non- significant correlation with Aphid population. Shivanna *et al*., (2011) reported simple correlation analysis revealed that maximum temperature showed significant positive effect on the entire sucking pest and the minimum temperature showed negative effect on Aphid population. The correlation of jassids population with weather parameters, maximum temperature was positive and highly significant. Rainfall, morning humidity and evening RH were negatively non-significant and minimum temperature was positively non-significant. The above findings are in confirmation with the earlier research worker like Arif *et al*., (2006) reported correlation analysis revealed that rainfall and temperature showed significant non significant effect. Shitole *et al*., (2009) studied jassids population, jassids exhibited positive correlation with average temperature relative humidity, rainfall, rainy days and wind velocity. Mohapatra (2008) reported that among the weather parameters, temperature showed a positive correlation with jassids population. The thrips population shows positively significant with maximum temperature and negatively non-significant correlation with rainfall, morning RH and evening RH. The above findings are parallel with those of earlier research works Desai *et al*., (2009) recorded the incidence of sucking pests under natural condition. Thrips showed positive and significant correlation with maximum temperature, minimum temperature and relative humidity. Bharadwaj *et al*., (1984) observed that the population was negatively correlated with rainfall, relative humidity and positive with maximum temperature. The result brought out that whiteflies population showed positively significant correlation with maximum temperature and negatively non significant correlation with other weather parameters except minimum temperature. It shows positive correlation. The above findings are in confirmation with those of Dhaka *et al*., (2008) observed that the maximum temperature had positive significant and evening RH exerted negative significant effect on whitefly population. Shera *et al*., (2009) reported that thrips population has significant positive correlation with maximum and mean temperature. Soujanya *et al*., (2010) studied the seasonal incidence or occurrence of sucking pests was similar on Bt staked Bt and non Bt cotton hybrids. The mealy bug population shows negatively significant correlation with rainfall, minimum temperature, morning RH and evening RH. Whereas maximum temperature shows positively non significant correlation with mealy bug population. The above findings are in confirmation with Hameed *et al.,* (2012) reported that Increasing temperature and decreasing relative humidity had profound effect on the longevity of the females whereas longevity of males was less affected.

Table 1. Correlation matrix of sucking pests and abiotic factors

Name of the insect pest	Maximum temperature	Minimum temperature	Morning Relative humidity	Evening Relative humidity	Rainfall
Aphids	0.712**	0.567**	0.421*	0.273	-0.018
Jassids	0.667**	0.108	-0.060	-0.182	-0.217
Thrips	0.627**	0.088	-0.002	-0.161	-0.216
Whiteflies	0.626**	0.067	-0.060	-0.196	-0.238
Mealy bugs	0.345	-0.437*	-0.565**	-0.612**	-0.472**

Significant at 5%

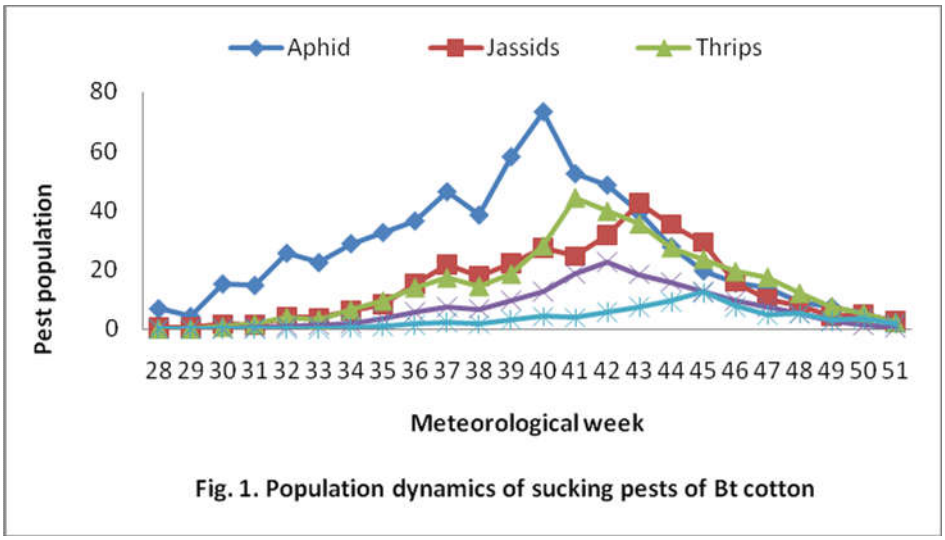

Fig. 1. Population dynamics of sucking pests of Bt cotton

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