



IMPACT OF ABIOTIC FACTORS ON POPULATION DYNAMICS OF SUCKING PESTS IN TRANSGENIC COTTON ECOSYSTEM

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ABSTRACT

Studies was carried out to investigate population dynamics and the impact of abiotic factors on population dynamics of sucking insect pests of transgenic cotton viz., leafhopper (*Amrasca biguttula biguttula* Ishida), aphid (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius) and thrips (*Thrips tabaci* Linnman), under unprotected condition. The results of the field study revealed that the sucking pest population was found throughout the year except in July and August months. The peak population of leafhopper, aphid, whitefly and thrips were 19.20, 45.07, 29.50 and 26.81 per three leaves during May second fortnight for leafhopper and aphid, April second fortnight for whitefly thrips, respectively. Simple correlation analysis revealed that maximum temperature showed significant positive effect on all the sucking pests. The minimum temperature showed negative effect on aphid population and non significant effect on leafhopper, whitefly and thrips population. The relative humidity was non significant effect, whereas precipitation was negative effect on all the sucking pests.

KEYWORDS: population dynamics, abiotic factors, correlation, sucking pests.

INTRODUCTION

Cotton (*Gossypium* Spp.) being the king of natural fibre is grown in 111 countries all along the world. In India it is cultivated in 8.97 million ha with a production of 21.3 million bales of seed cotton (Anon., 2005). The average productivity of cotton in India is 463 kg per ha (Anon., 2006) as compared to world average of 621 kg per ha India occupies 26 per cent of global cotton area contributing 18.3 per cent of world production (Anon., 2007). Thus India ranks first in area and fourth in production on global basis. Despite the large area, the productivity in India is very low. In Karnataka, cotton is being grown in an area of 5.50 lakh ha with a productivity of 248 kg per ha (Anon., 2005). Cotton fiber is an important raw material to the textile industries and plays a key role in national economy in terms of employment generation and foreign exchange.

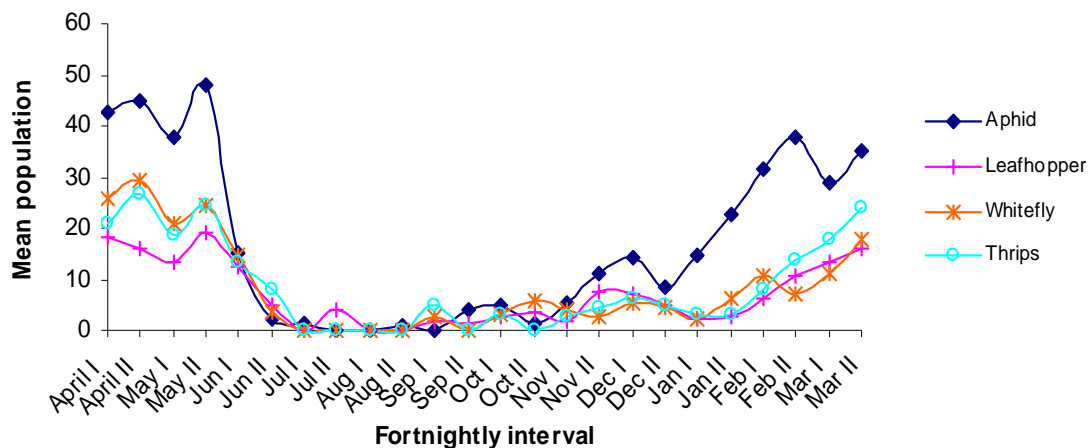
Among the insect pests, a complex of sucking pests viz., green leafhopper, *Amrasca biguttula biguttula* (Ishida),

aphid, *Aphis gossypii* (Glover), whitefly, *Bemisia tabaci* (Gennadius) and thrips, *Thrips tabaci* (Linnman) occupy major pest status and cause considerable damage in Bt cotton. 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 2008 to 2009 at ZARS, College of Agriculture, Shimoga. Transgenic cotton MRC 7201 (BG-II) sown at four months interval covering one year period of 2008-09. The crop was raised as per the package of practices recommended by the UAS(B). The observations were made on number of leafhoppers, aphids, whiteflies and thrips on 10 randomly selected plants from top, middle and bottom three leaves at fortnightly interval, throughout the year (summer, kharif and rabi).

FIGURE-1. Seasonal incidence of mean population of sucking pests on transgenic cotton



RESULTS AND DISCUSSION

Aphid population

The results (Fig.1) showed that the incidence of aphid population noticed throughout the year except July, August and September because of high rainfall. The peak incidence of aphid population was recorded to be 48.11 per three leaves during second fortnight of May 2008.

June second fortnight onwards population was decreased and fluctuated without a definite pattern and it was almost negligible and continued up to November. The population steadily increased from second fortnight of November up to March 2009. In general the aphid population recorded to be above the ETL during April, May and February & March.

TABLE 1. Correlation matrix of sucking pests and abiotic factors

Name of the insect pest	Maximum temperature	Minimum temperature	Relative humidity	Rainfall
Aphid	*0.76	-0.03	0.21	-0.39
Leafhopper	*0.78	0.22	0.22	-0.25
Whitefly	*0.75	0.27	0.31	-0.23
Thrips	*0.80	0.18	0.16	-0.23

Significant at 5%

The present findings are in partial agreement with the findings of Bakhetia and Sidhu (1976) who revealed that the aphid population remaining active throughout the year. The present findings are in close association with the findings of Roy and Behura (1979) was noticed that *A. gossypii* was found throughout the year on aubergine plants with a peak during March- April. The present findings are not agreement with the findings of Dugger and Richter (1998) reported peak aphid incidence on cotton during July months it is strongly due to high rainfall during that months.

Leafhopper population

The incidence of leafhopper population was noticed throughout the year except August. Maximum population of leafhopper above the ETL was recorded to be 19.20 per three leaves during may second fortnight followed by 18.33, 16.01, 13.24, 12.23, 10.77, 13.38 and 15.92 per three leaves during first and second fortnight of April, first fortnight of May, first fortnight of June, second fortnight of February and First and second fortnight of March, respectively. June second fortnight onwards the leafhopper population was declined below ETL and continued up to first fortnight of February (Fig.1).

Anitha and Nandihalli (2008) and Arif *et al.* (2006) who reported leafhopper population was found throughout the year. Reports of Senapati and Mohanty (1980) support the present findings of population decline in July and further increase from January up to March.

Whitefly population

The observations regarding whitefly population (Fig.1) recorded maximum from April to May, on second fortnight of April 2008 showed a peak with 29.50 whiteflies per three leaves. Population was declined below ETL from June first fortnight onwards and similar trend was continued up to January. The lowest whitefly population of 0.00 per three leaves was recorded during July and August months. Again from February onwards, the whitefly population gradually increased.

The present findings are inline with the findings of Hegde *et al.* (2004) who reported peak whitefly population in October with 6.43 per three leaves. Jeyakumar *et al.* (2008) reported higher incidence of whitefly in Bt cotton

hybrids. The present findings are in close agreement with the findings of Anitha and Nandihalli (2008) who reported peak incidence of whitefly was noticed in last week of April.

Thrips population

The incidence of thrips population (Fig. 1) noticed throughout the year except July and August months because of high rainfall. The maximum incidence of thrips population was noticed from April to May with a peak incidence of 26.81 per three leaves was recorded in April second fortnight. June onwards the population was declined up to February without a definite pattern reached to zero during July and August. Again from March onwards population increased gradually.

ROLE OF ABIOTIC FACTORS IN POPULATION FLUCTUATION OF SUCKING INSECT PESTS

Simple correlation

The results regarding the correlation between abiotic factors and population of leafhopper, aphid, whitefly and thrips are given in Table1. The results revealed that the maximum temperature was significant and positively correlated with the leafhopper population. The rainfall is negatively correlated where as minimum temperature and relative humidity were showed non significant effect.

Gogoi *et al.* (2000), Murugan and Uthamasamy (2001) and Panicker and patel (2001) reported that meteorological parameters play an important role in the population fluctuation of sucking insect pests. The present findings are in agreement with the findings of Umar *et al.* (2003) and Bishnol *et al.* (1996) who reported that leafhopper population increased with maximum temperature.

The effect of maximum temperature was also correlated positively with aphid, whitefly and thrips population. The minimum temperature and rainfall was negatively correlated with aphid population and relative humidity was non significant. The present findings are inline with the findings of patel *et al.* (1997) who reported during high rainfall period the aphid population did not attain peak. Whitefly and thrips population did not show significant effect with minimum temperature and relative humidity whereas precipitation was negatively correlated with the whitefly and thrips population. Umar *et al.* (2003) and Saif

(1980) support the present findings, who reported whitefly population was positively correlated with temperature and relative humidity. Vennila *et al.* (2007a & c) reported that high temperature and scanty rainfall aggravate the severity of sucking pests and also reported *Thrips tabaci* has population peaks during dry spell with high temperature and low humidity which are optimum for population build up.

REFERENCES

- Anitha, K. R. and Nandihalli, B. S. (2008) Seasonal incidence of sucking pests in okra ecosystem. *Karnataka J. Agric. Sci.*, 21: 137-138.
- Anonymous (2005) Training manual on DVS test in cotton with resistance to PPV and FR legislation, 2001. All India co-ordinated cotton improvement project, CICR, Coimbatore, Tamil Nadu, pp: 134-135.
- Anonymous (2006) Annual report for all India co-ordinated cotton improvement project, CICR, Coimbatore, Tamil Nadu, pp:1-2.
- Anonymous (2007) *Project Co-ordinators Rep.*, Annual group meeting of AICCRP, CICR, Coimbatore.
- Bakhetia, D. R. C. and Sidhu, A. S. (1976) Biology and seasonal activity of the groundnut aphid *Aphis craccivora* Koch. *J. Res.*, 14: 299-303.
- Arif, M. J., Gogi, M. D., Mirza, M., Zia, K. and Hafeez, F. (2006) Impact of plant spacing and abiotic factors on population dynamics of sucking insect pests of cotton. *Pak. J. Biol. Sci.*, 9: 1364-1369.
- Bakhetia, D. R. C. and Sidhu, A. S. (1976) Biology and seasonal activity of the groundnut aphid, *Aphis craccivora* Koch. *J. Res.*, 14: 199-303.
- Bishnoi, O. P., Singh, M., Raq, V. U. M., Niwas, R. and Sharma, P. D. (1996) Population dynamics of cotton pests in relation to weather parameters. *Indian J. Entomol.*, 58: 103-107.
- Duggger and Richter, D. (1998) Mid-season cotton aphid infestation in California; effects on cotton yield. *Proc. Of Beltwide Cotton Confe.* San-Diego-California, USA, 5-9, January 1998, 2: 1056-1058.
- GOGOI, I., DUTTA, B. C. AND GOGOI, 2000, Seasonal abundance of cotton jassid on okra. *J. Agric. Sci. society, North –East India*, 13: 22-26.
- Hegde, M., Srinivasa, M. Biradar, D. P., Udikeri, S. S. and Khadi, B. M. (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.
- Jeyakumar, P., Tanwar, R. K., Mangal Chand, Amar Singh, Monga, D. and Bambawale, O. M. (2008) Performance of Bt cotton against sucking pests. *J. Biopesticides*, 1: 223-225.
- Murugan, M. and Uthamasamy, S. (2001) Dispersal behaviour of cotton whitefly, *Bemisia tabaci* under cotton based garden land agro ecosystem of Coimbatore. *Madras Agric. J.*, 88: 1-6.
- Panickar, B. K. and Patel, J. B. (2001) Population dynamics of different species of thrips on chilli, cotton and pigeon pea, *Indian J. Entomol.*, 63:170-175.
- Patel, K. I., Patel, J. R., Jayani, D. B., Shekh, A. M. and Patel, N. C. (1997) Effect of seasonal weather on incidence and development of major pests of okra (*Abelmoschus esculentus*). *Indian J. Agric. Sci.*, 67: 181-183.
- Roy, D. K. and Behura, B. K. (1979) Seasonal variation in the population of *Aphis gossypii* G. on brinjal. *Proc. Symp. on aphids.* Ed. B. k., Behura, Zool. Soc. Orissa, pp. 60-64.
- Umar, M. S., Arif, M. J., Murtaza, M. A., Gogi, M. D. and Salman, M. (2003) Effect of abiotic factors on the population fluctuation of whitefly, *Bemisia tabaci* (Genn.) in nectaried and nectariless genotypes of cotton. *Intl. J. Agric. Biol.*, 5: 362-368.
- Seif, A. A. (1980) Seasonal fluctuation of adult population of whitefly *Bemisia tabaci* Genn. on cotton and its relationship with weather parameters. *J. Cotton Res. Dev.*, 5: 181-189.
- Senapati, B and Mohanty, G.B. (1980) A note on the population fluctuation of sucking pests on cotton. *Madras Agric. J.*, 67: 624-630.
- Vennila, S., Biradar, V. K., Sabesh, M. and Bambawale, O. M. (2007a) know your cotton insect pest whiteflies. *Crop Prot.* Folder series: 4.
- Vennila, S., Biradar, V. K., Sabesh, M. & Bambawale, O. M. (2007c) know your cotton insect pest thrips, *Crop Prot.* Folder series: 3.