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INFLUENCE OF WEATHER PARAMETERS ON POPULATION DYNAMICS OF LEAFHOPPER, *HISCHIMONUS PHYSITIS* IN *Bt* AND NON-*Bt* COTTON

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ABSTRACT

A study was conducted to investigate the performance of three *Bt* (Bahubali, DCH-32 and Puli) and one non-*Bt* (DCH-32) cotton genotype against leafhopper *Hischimonus physitis* population fluctuation at AICRP on Cotton, Chamarajanagara, UAS, Bangalore during *Kharif* 2020-21. The incidence of leafhopper was observed from 30th Standard Meteorological Week (SMW) and persists throughout cropping season. Peak population was recorded at 46th SMW in all genotypes and highest mean incidence was recorded in Bhubali *i.e*., 9.51 per three leaves. Correlation study revealed that, Among weather parameters studied, maximum temperature, morning relative humidity showed significant positive effect and rainfall, number of rainy days had significantly negative on leafhopper population. Incidence of leafhopper was found equally in all genotypes studied indicating the possible influence of weather parameter.

Key words : Cotton genotypes, Leafhopper, Weather parameters, Correlation studies.

Introduction

Cotton is a soft, fluffy staple fiber that grows inside a boll or protective case in plants of the genus *Gossypium* in the family Malvaceae. The fiber is almost pure cellulose and is the most extensively utilized part of the plant, act as a starting raw material for variety of products, such as textiles, edible oil, paper, livestock feed and pharmaceutical products (Shahrajabian *et al*., 2020). Cotton is popularly known as "whitegold" because of its wider application. Cotton is generally grown in tropical and sub-tropical warm humid climate. The required annual temperature range is 20-28°C. Uniform distribution of temper-ature and bright sunshine is required. 55-100 cm of annual rainfall is ideal but rain during harvest is harmful. About 180 frost-free days are necessary for cotton cultivation while, at least 200 frost-free days are desirable. Cotton is continuously damaged by nearly 160 species of various insect pests from vegetative phase to till harvest (Agarwal, 1978). Major loss in cotton yield is by bollworm complex and sucking pests. After the introduction of *Bt* cotton genotypes, the bollworm complex is checked but sucking pest population reaching EIL regularly and they cause 35.61 per cent yield loss (Makwana *et al*., 2018). Among the sucking pest of *Bt* cotton, the cotton leafhopper, *Amrasca biguttula biguttula* (Ishida) (Homoptera: Cicadellidae) causes both qualitative and quantitative losses and now it became an alarming pest in many regions of India (Mohan and Nandini, 2011) and *Emposca* sp. also a key pest on *Bt* cotton genotypes in recent days (Kranthi *et al*., 2011). Pest population is strongly influenced by weather parameters, affects seasonal activity and builds up of population. Maximum temperature encourages leafhopper population (Akhila *et al*., 2020). This study is revealing the possible effect of weather parameters on occurrence of leafhopper, *Hischimonus phycitis* is an emerging jassid species in cotton.

Materials and Methods

A field experiment was conducted at AICRP on Cotton, Haradanahalli, Chamarajanagara during 2020-21. A popular cotton hybrids Bahubali (*Bt*), DCH-32 (*Bt*), DCH-32 (non-*Bt*) and Puli (*Bt*) were sown with a spacing of 90 × 60 cm between rows and plants, respectively. All recommended agronomic practices were followed except crop protection measures for insects (Anonymous, 2018). Such three blocks (12 × 9 m) were maintained to investigate population dynamics and damage caused by leafhopper. The observation on seasonal incidence of leafhoppers per three leaves (top, middle and bottom) was recorded on 10 randomly selected plants in each block. To investigate the influence of meteorological variable on the incidence of leafhopper, the data collected on the mean population in weekly interval from 2nd week after sowing till harvest were worked out. Further to know the relationship between leafhopper population and the meteorological variable on the incidence of pest and their damage, the weather parameters *viz.*, maximum and minimum temperature, morning and evening relative humidity, number of rainy days and total rainfall were collected from agro-meteorological observatory unit, Krishi Vignan Kendra, Haradanahalli, Chamarajanagara and means were worked out. The data on weekly mean observation made on incidence of leafhopper and weather parameters was subjected to Pearson's Rank Correlation with the corresponding data of meteorological variables *viz.*, maximum and minimum temperature, morning and evening relative humidity, number of rainy days and total rainfall.

Results

The species of leafhoppers found feeding on cotton were collected and preserved. The collected specimens along with labels were identified by the experts at ICAR-Niche area of Excellence and Capacity building on taxonomy of insects and mites, Department of Entomology, UAS, GKVK, and Bangalore. Among the identified species *Hischimonus physitis* was also abundantly seen during the course of investigation as a major species in Chamarajanagara on cotton during the study period, but late in the season *i.e.*, in October and November. According to the earlier reports it is a major and key pest in Citrus, Brinjal and Sesamum, where it acts as a vector of phytoplasma to cause witches broom, little leaf and phyllody respectively, but in cotton do not found any such symptoms.

Observation was made on leafhopper population from 15 DAS in weekly intervals were correlated with meteorological variables *viz.*, maximum and minimum temperature, morning and evening relative humidity, number of rainy days and total rainfall received.

Incidence of leafhopper in cotton hybrid Bahubali (Bt) in relation to meteorological variables

During *Kharif* 2020, infestation of *H. physitis* population is started from 30 DAS and increased up to 46th SMW, but persist more or less throughout the cropping season. Maximum population of *H. physitis* (9.51/3 leaves) (Fig. 1) was observed at 46th SMW. *H. physitis* was positive and significantly correlated with maximum temperature (r=0.44*), morning relative humidity (r=0.39*), negative and significantly related with rainfall (r=-0.39*), number of rainy days (r=-0.42*) and negative and non-significantly correlated with minimum temperature (r=-0.29) and evening relative humidity (r=-0.11) (Table 1).

Incidence of leafhopper in cotton hybrid DCH-32 (Bt) in relation to meteorological variables

*H. physitis*is started from 31st SMW (0.83/3 leaves) and reached its peak at 46th SMW (9.50/3 leaves) *i.e.*, 3rd week of November (Fig. 1). *H. physitis* had positive significant association with maximum temperature (r=0.42*), morning relative humidity (r=0.40*) and negative significant with rainfall (r=-0.39*) and number of rainy days (r=-0.42*) but had negative non-significant association with minimum temperature (r=-0.30) and evening relative humidity (r=-0.11) (Table 1).

Incidence of leafhopper in cotton hybrid Puli (Bt) in relation to meteorological variables

H. physitis started to build up from 31stSMW (0.70/3 leaves) (Fig. 1.), persist up to 51stSMW (2.00/3 leaves) and reached peak during 3rd week of November *i.e.*, 46thSMW (8.80/3 leaves). *H. physitis* had significantly positive correlation with maximum temperature (r=0.40*), morning relative humidity (r=0.43*) negatively significant with rain fall (r=-0.38*), number of rainy days (r=-0.41*) and negatively non-significant with minimum temperature (r=-0.28) and evening relative humidity (r=-0.10) (Table 1).

Incidence of leafhoppers in cotton hybrid DCH-32 (non-Bt) in relation to meteorological variables

H. physitis was start to build up from 30thSMW and reached peak at 46th SMW (9.13/3 leaves) *i.e.*, 3rd week of November. *H. phycitis* had significant positive relationship with maximum temperature (r=0.44*) (Table 1) and morning relative humidity (r=0.40*), significant negative association with rain fall (r=-0.39*) and number of rainy days (r=-0.42*) and non-significant negative association with minimum temperature (r=-0.29) and

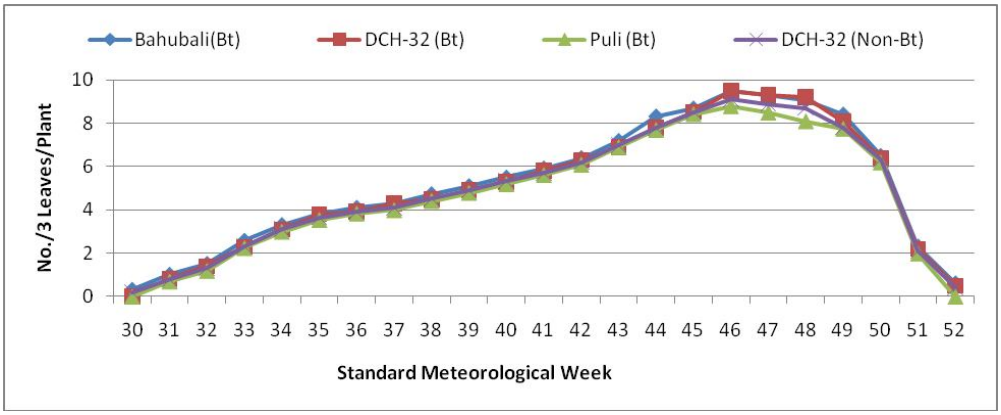

Fig. 1 : Population dynamics of leaf hopper *H. phycitis* on cotton hybrids in *Kharif* 2020-21.

Table 1 : Relationship between *H.phycitis* and abiotic factors on cotton genotypes, *Kharif* 2020-21.

H. phycitis	Maximum temperature	Minimum temperature	Morning relative humidity	Evening relative humidity	Rain fall	No. of rainy days
Bahubali (*Bt*)	0.44*	-0.29	0.39*	-0.10	-0.39*	-0.42*
DCH-32 (*Bt*)	0.43*	-0.30	0.39*	-0.11	-0.39*	-0.42*
Puli (*Bt*)	0.43*	-0.28	0.40*	-0.10	-0.38*	-0.41*
DCH-32 (non-*Bt*)	0.44*	-0.29	0.40*	-0.11	-0.39*	-0.42*

N = 26, **. Correlation is significant at the 0.01 level (2-tailed): *. Correlation is significant at the 0.05 level (2-tailed).

evening relative humidity (r=-0.11).

In all studied genotypes *H. physitis* reached peak population at 46th SMW (9.50/3 leaves) *i.e.*, 3rd week of November. When the maximum temperature 29.86, morning relative humidity 99.70% and rain fall was 6.20 mm. In present study there was no significant difference in terms of leafhopper population in between *Bt* and non-Bt hybrids. It is purely indicated that studied genotypes do not have direct role in population fluctuation of leafhopper so there might be an influence of weather parameters.

The present investigation, identified *Hischimonus physitis* as one of major threatening leafhopper species to the cotton cultivation in Chamarajanagara. Unlike other species of leafhoppers *viz.*, *A. biguttula biguttula* and *Emposca* sp., the abundance of *H. physitis* was more at matured crop *i.e.*, increased activity of *H. physitis* was seen during later months of crop duration (October and November).

Discussion

Since, there are very rare numbers of scientific reports on *H. physitis* as a major pest in cotton, we are taking the support of other leafhopper species *viz.*, *A. biguttula biguttula* and *Emposca* sp., to discuss the result of present investigation. This findings are driven support from the study conducted by Reddy *et al.* (2011) found that there was no significant difference of leafhopper population recorded among the various *Bt* cotton genotypes and Raja *et al*. (2014) and Kalkal *et al*. (2015) found non-significant difference among *Bt*, non-*Bt* and conventional hybrids. Likewise, Roomi (2016) observed no difference among *Bt* and non-*Bt* cotton genotypes with respect to leafhopper population.

These results are in support from study conducted by Majumdar and Das (2020) revealed that *A. biguttula biguttula* was dominantly prevalent in brinjal throughout the growth stage. However, *H. physitis* was absent or rarely present at early periods of plant growth, but its number tended to increase towards the end of the season. Similarly, Phooken *et al*. (2021) proved that during summer season the temperature and relative humidity were positively correlated, while diurnal variation and sunshine hours were negatively correlated with incidence of *H. Physistis*. During *kharif* season, maximum temperature and diurnal variation were positively correlated while wind speed, total rainfall and number of rainy days were negatively correlated with the incidence.

The observation regarding influence maximum temperature was close line with Krishna *et al.* (2020)[14] found significant positive relation with maximum temperature but Devi *et al.* (2018) observed significant and negative correlation with maximum temperature.

Influence of relative humidity on population fluctuation is supported by the results of Arun *et al.* (2017), Dahiya *et al.* (2018) and Pal *et al.* (2020) reported significant positive association of leafhoppers with morning relative humidity. Results in the present study with respect to rain fall and number of rainy days close line with findings of Kalkal *et al.* (2015), Roomi (2016) and Krishna *et al.* (2020) observed negative relation of leafhopper population with rainfall.

Conclusion

After introduction of *Bt* cotton various minor pests assuming major pest status. In leafhoppers not only *A. biguttula biguttula* other leafhopper species *viz*., *H. physitis* also posing threaten to cotton cultivation in Chamarajanagara district of Karnataka. In this view protective measure should be taken to avoid the crop loss as well as to avoid the spread to other parts of cotton growing areas.

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References

Agarwal, R.A. (1978). Cotton insect pests and their control. *Richer Harvest*, **1**, 22-29.

Akhila, E., Upendhar S., Vanisree K. and Sagar V.B. (2020). Population dynamics of leafhopper *Amrasca biguttula biguttula* (Ishida) (Homoptera: Cicadellidae) on popular cotton hybrids in Telangana. *J. Entomol. Zool. Stud.*, **8(5)**, 511-515.

Anonymous (2018). *Package of practices for higher yield*. University of Agricultural Sciences Bangalore, Karnataka, India, p. 423.

Arun, J., Dahiya K.K. and Pritish J. (2017). Population dynamics of leafhopper, *Amrasca biguttula biguttula* (Homoptera: Cicadellidae) in upland cotton (*Gossypium hirsutum* L.). *J. Cotton Res. Dev*., **31(2)**, 298-304.

Dahiya, K., Rolania K., Jaglan R. and Janu A. (2018). Influence of abiotic factors on the population dynamics of leafhopper, Ishida in upland cotton. *J. Agrometeorol.*, **20**, 349-354.

Devi, S., Rolania K., Ram P., Devi M., Lalita and Chitralekha (2019). Effect of abiotic factors on the population dynamics of whitefly, *Bemisia tabaci* (Gennadius) and leafhopper, *Amrasca biguttula biguttula* (Ishida) in desi cotton, *Gossypium Arborium* L. *J. Agrometeorol.*, **21**, 259-263.

Kalkal, D., Lal R., Dahiya K.K., Singh M. and Kumar A. (2015). Population dynamics of sucking insect pests of cotton and its correlation with abiotic factors. *Indian J. Agric. Res*., **49(5)**.

Kranthi, S., Kranthi K.R., Rishi K., Udikeri S.S., Rao G.M.V.P., Zanwar P.R., Nagrare V.N., Naik C.B., Singh V., Ramamurthy V.V. and Monga D. (2011). Emerging and key insect pests on *Bt* cotton-their identification, taxonomy, genetic diversity and management. In: *World Cotton Research Conference-5*, Mumbai, India, p.281-286.

Krishna, M.S., Reddy Y.R. and Chandrayudu E. (2020). Impact of weather parameters on seasonal incidence of insect pests in *Bt* and non-*Bt* cotton. *J. Pharmacogn. Phytochem*., **9(6)**, 696-701.

Majumdar, S. and Das B.K. (2020). Studies on little leaf of brinjal and morphotaxonomy of the leafhopper species associated from Bengal. *J. Entomol. Zool. Stud*., **8(3)**, 514-521.

Makwana, D.K., Chudasama K.A. and Balas T.K. (2018). Estimation of yield losses due to major sucking insect pests of *Bt* Cotton. *Int. J. Curr. Microbiol. App. Sci.*, **7(5)**, 956-959.

Mohan, S. and Nandini, S. (2011). A promising entry for cotton leafhopper. *Pestology*, **35(6)**, 11-13.

Pal, M.R., Kumar S., Singh S. and Singh P. (2020). Seasonal incidence of whitefly (*Bemisia tabaci* Gennadius) and jassid (*Amrasca bigutulla bigutulla* Ishida) on transgenic cotton in south-western Punjab, India. *J. Agrometeorol.*, **22(4)**, 545-550.

Phookan, J., Kalita M.K. and Nath P.D. (2020). Incidence of sesame phyllody disease in relation to dates of sowing and meteorological parameters and its effect on sesame growth, yield and oil quality. *Phytopathogenic Mollicutes*, **10(2)**, 173-181.

Raja, B., Singh T.V.K., Vijaya Lakshmi K. and Sreenivas C.H. (2014). Relative incidence of insect-pest complex in *Bt* and non-*Bt* cotton cultivars. *Int. J. Bioresour. Stress Manag*., **5(3)**, 413-415.

Reddy, G.V., Suryakala I., Sheshaiah B., Ramesh V. and Sunitha V. (2011). Studies on population dynamics of leafhopper, *Amrasca bigutula bigutula* (Ishida) on transgenic *Bt* cotton. *Int. J. Advances Appl. Sci.,* **26**.

Roomi, R. (2016). Inter-relationship between abiotic factors and population dynamics of sucking insect pests in genetically modified cotton. *Int. J. Agric. Sci*., 0975-3710.

Shahrajabian, M.H., Sn W. and Cheng Q. (2020). Considering white gold, cotton for its fiber, seed oil, traditional and modern health benefits. *J. Biol. Environ. Sci.*, **14(40)**, 25-39.