R-2618
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REVIEW ARTICLE Agricultural Reviews

Population Dynamic of Cotton Leafhopper, *Amrasca devastans* (Homoptera: Jassidae): A Review

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10.18805/ag.R-2618

ABSTRACT

Cotton leafhopper, *Amrasca devastans* has become very serious pest in recent years. Both nymphs and adults suck the sap from under surface of the leaf causing specking symptoms, crinkling and distortion of leaves and reddening all along the sides of leaves with downward curling. *A. devastans* caused significant damage during early stage by sucking the cell sap of the cotton leaves. The incidence of leafhopper was recorded from 23rd SMW to 38th SMW at seven days interval. The maximum leafhopper population on RCH 650 BGII Bt (2.26/ leaf) was found during 33rd SMW and on H-1098-i non-Bt (1.89/ leaf) was found during 32nd SMW. Throughout the season the leafhopper incidence was found lower than the economic threshold in H-1098-i non-Bt. Nymphal population exhibited significant positive correlation with relative humidity and rainy days.

Key words: Climate, Cotton, Leafhopper, Population.

Cotton (*Gossypium spp.*) is a major commercial crop unanimously designated as "King of Fibres" and has a global significance which is grown for its lint and seed. It provides fibre, an important raw material for textile industry. It is grown under diverse agro-climatic conditions around the world. There are a number of causes responsible for low yield of cotton but losses caused by insect-pests are of prime importance. In India 162 species have been recorded (Dhaliwal *et al.* 2008). Sucking pests like leafhopper (*Amrasca biguttula biguttula*), aphid (*Aphis gossypii*), thrips (*Thrips tabaci*) and whiteflies (*Bemisia tabaci*) *etc*., are responsible for the major threat and destruction of cotton crop (Gahukar, 1997). However, the jassid population decreased with decrease in air temperature and increase in relative humidity over optimum range (Bishnoi *et al.,* 1996). For development and population build- up of insect species the meteorological factors play a vital role. Among these factors, temperature and relative humidity are the most important. For developing a weather based pest forewarning system, information regarding population dynamics in relation to prevalent weather parameters pest forecasting model is required. Moreover, the elevated global temperature was found to create favourable conditions for the survival and reproduction of many insect pests including cotton leafhopper. Krishnaiah *et al.* (1979) described the method of jassid population estimation by counting on second, third and fourth leaves from top on okra plant.

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Sharma and Sharma (1996) found that nymphal population of leafhopper on cotton reached at peak during the first week of August. The population increment showed negative relationship with the maximum temperature and positive correlations with minimum temperature and average relative humidity.

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How to cite this article: Kumar, K. and Chauhan, V. (2023). Population Dynamic of Cotton Leafhopper, *Amrasca devastans* (Homoptera: Jassidae): A Review. Agricultural Reviews. doi:10.18805/ag.R-2618.

Submitted: 07-01-2023 **Accepted:** 22-05-2023 **Online:** 02-06-2023

Patel *et al.* (1997) found that during monsoon season population of *Amrasca biguttula biguttula* in okra increased rapidly with increase in maximum temperature from 30-34°C and incidence was more when maximum temperature was more than 36°C. A positive relationship was found between jassid population and maximum temperature, significantly.

Prasad and Logiswaran (1997) showed a positive association of the population of leafhopper with the minimum temperature and relative humidity, while the negative association with the maximum temperature in brinjal.

Kumar and Stanley (2006) reported non-significant difference among the sucking pest population in the *Bt* and *non-Bt* cotton cultivars.

Arif *et al.* (2006) found positive and significant correlation of rainfall and temperature with leafhopper population on cotton whereas relative humidity showed non significant effect and incidence of leafhopper started from first week of July.

Dhaka and Pareek (2008) found that the incidence of jassid (*A. biguttula biguttula*) on cotton started from the second and third week of June and reached its peak (90 nymphs/30 leaves) in August. The maximum temperature had negative significant and morning and evening RH showed positive significant effect on jassid population.

Mohapatra (2008) showed peak population of leafhopper on cotton during 41st standard week. There was positive correlation between temperature, relative humidity and rainfall with leafhopper.

Ashfaq *et al*. (2010) found that maximum population of the whitefly and jassid was observed on transgenic cotton genotypes (VH-255 and I-2086) while, the lowest population was recorded on non-transgenic genotype CIM-496 (control). The data showed whitefly and jassid populations to be positively correlated with the temperature while the correlation between the relative humidity was found to be negative for both the whitefly and jassids. The rainfall showed a positive effect on the whitefly and negative effect on the jassids.

Iqbal *et al.* (2010) concluded that minimum temperature had significant and positive correlation with the jassid population on okra and the other factors were not effective on jassid population. Rainfall and relative humidity showed negative and non significant correlation with leafhopper population.

Selvaraj *et al*. (2011) observed that maximum leafhopper population on cotton (9.30 nymphs/3 leaves) was build up at temperature ranged from 21° to 31°C and relative humidity reached at 82 per cent. Leafhopper population build up showed a significant and positive correlation with morning and evening relative humidity and rainfall whereas, it was significant and negative association with minimum temperature, wind velocity and dewfall.

Bhute *et al.* (2012) conducted a study which revealed that weather parameters *viz.,* rainfall, rainy days, morning RH and evening RH showed significant and negative correlation with aphids and whitefly population while maximum temperature showed significant positive correlation with jassids, thrips and whitefly populations in cotton.

Dahiya *et al.* (2013) analysed correlation between leafhopper and weather parameter which indicated significantly positive correlation between leafhoppers and minimum temperature and was significantly negative with maximum temperature and positive with morning relative humidity for leafhoppers on cotton.

Akram *et al.* (2013) found that among *Bt* cotton genotypes, maximum and minimum temperature showed significant and positive effect on whitefly population whereas relative humidity exerted negative effect on whitefly. But in case of *non-Bt,* it had negative correlation with maximum temperature and positive with relative humidity.

Dabhi and Koshiya (2014) reported peak activity of leafhopper population during 18th, meteorological standard week (MSW) in *kharif* season on cotton. Temperature showed positive whereas relative humidity, rainfall and wind speed had negative and non significant correlation with leafhopper population.

Laxman *et al.,* (2014) observed that the leaf hopper infestation was started from 3rd week and reached at its peak in 21st week of crop sowing and maximum percentage of infestation was found to be (39.66±0.69) in *Bt* and (33.99± 1.76) in *non-Bt*. Leafhopper infestation showed positive correlation with morning relative humidity and negative correlation with maximum and minimum temperature, evening relative humidity and rainfall in *Bt*-cotton and non-*Bt* cotton.

Badgujar *et al.* (2015) found that among BG-I minimum jassid population was recorded on ACH-21-1-BG-I which was found significantly superior over rest of BG-I hybrids while maximum jassid population was recorded on RCH-2 BG-I. Among BG-II, minimum jassids population was recorded on ACH-155 and maximum jassids population was recorded on RCH-2 BG-II.

Kalkal *et al.* (2015) found that leafhopper population was significantly and positively correlated with temperature (r = 0.49), relative humidity (r = 0.42) and wind speed (r = 0.30) while significantly negatively correlated with rainfall (r = -0.47). Mean leafhopper population/leaf varied significantly amongst the *Bt* and *non-Bt* cotton genotypes. The results of present studies indicated that the leafhopper population was negatively correlated with maximum temperature and morning relative humidity.

Zia *et al.* (2015) studied on the selected cultivars of cotton and correlated with environmental factors. Population of whitefly was more on transgenic varieties as compared to Non-Transgenic varieties. Correlation among weather factors and whitefly population showed that rainfall was negatively correlated while temperature and relative humidity were positively correlated with whitefly population weekly intervals during morning time.

Khating *et al.* (2016) found that leafhoppers incidence on cotton reached its peak activity during the second week of September. The minimum temperature showed positive non-significant correlation with leafhoppers (r =0.131). The morning relative humidity showed positive non-significant correlation with occurrence of the leafhoppers (r = 0.454). Similarly, the evening humidity showed negative non-significant correlation with leafhoppers (r = -0.100). The rainfall had non-significant effect at 5 per cent and 1 per cent level with leafhopper.

Rehman *et al.* (2016) studied the correlation of leafhopper with different environmental variables and showed negative correlation with maximum temperature and positive significant correlation with relative humidity at morning.

Soni and Dhakad (2016) found the jassid population on cotton was highly active during September and October. Maximum temperature found non-significant positive correlation for population buildup of cotton jassid while morning humidity and rainfall noted significant negative correlation with jassid population.

Vennila *et al.,* (2016) conducted a study on cotton and found that *A. biguttula biguttula* positively correlated with temperature, rainfall and mean relative humidity.

CONCLUSION

From the above discussion, it is concluded that leaf hopper remained active throughout the crop season with a peak population of leafhopper population on RCH 650 BGII Bt, and H-1098-i non-Bt was observed in the first fortnight of August. Throughout the season the leafhopper incidence was found lower than the economic threshold in H-1098-i non-Bt. Leafhopper has a significant positive correlation with relative humidity and rainy days whereas a negative correlation with temperature. Research works are planned to understand pest dynamics with the use of systematic procedures on pest surveillance data sets. This research work can further be used to understand pest dynamics forecasting models which would help the farmers in the pest management strategies.

Conflict of interest: None.

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