

## Population Dynamics of Leafhopper, *Amrasca biguttula biguttula* (Ishida) in Cotton and its Relationship with Weather Parameters

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### ABSTRACT

The field experiments were conducted during *kharif* 2015 and 2016 at Cotton Improvement Project, Mahatma Phule Agricultural University, Rahuri to determine the effect of ecological factors on the incidence of leafhopper, *Amrasca biguttula biguttula* on Bt cotton. The pest population was started from first week of July on third weeks old crop, acquired its first peak in third week of August on twelve weeks old crop (7.28/3 leaves) and second peak in first week of November on twenty three weeks old crop. Maximum pest population (7.28 & 9.92/3 leaves) was build up at temperature ranged from 23 to 33°C, relative humidity ranges from 50 and 71 percent, zero rainfall and 5mm evaporation during first peak and 17 to 33°C temperature, 38 to 57% relative humidity, zero rainfall and 5mm evaporation during second peak. Leafhopper population build up showed positive correlation with maximum and minimum temperatures whereas; it had negative association with morning, evening relative humidity, evaporation, rainfall and rainy days. The determination of effects of different weather factors on population of leafhoppers in cotton was essential for effective pest management. This study will be very helpful not only for forecasting the out breaks of leafhopper population but also in formulating effective pest management strategies.

**Key words** *Jassids, Amrasca biguttula biguttula, Correlation, Weather parameters.*

Cotton, *Gossypium* spp. being the king of natural fiber 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 (Anonymous, 2005). Moreover, due to the top most position in Indian agriculture and it is also popularly known as white gold. 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 up to 62.3-68.3% (Khan *et al.*, 2003). The cotton is not only principal cash crop but also each and every parts of the cotton plant are useful to farmer in one way or the other (Shivanna *et al.*, 2009). Unfortunately, cotton is highly vulnerable to insect pests. During growth period, 148 insect pests have been recorded on cotton crop, out of which only 17 species have been recorded as major insect pests of cotton crop (Abbas, 2001). Cotton pests can be primarily divided into sucking pests and bollworms. Among the sucking pests, leafhopper, *A. biguttula biguttula* is of major importance in cotton crop. Leafhoppers occur at all the stages of the crop growth and responsible for indirect yield losses. Since, these pests suck

the sap from the plants which leads to reduction in growth and vigour of the plants. In severe case of infestation, the plants get dried up and eventually die (Madar and Katti, 2010).

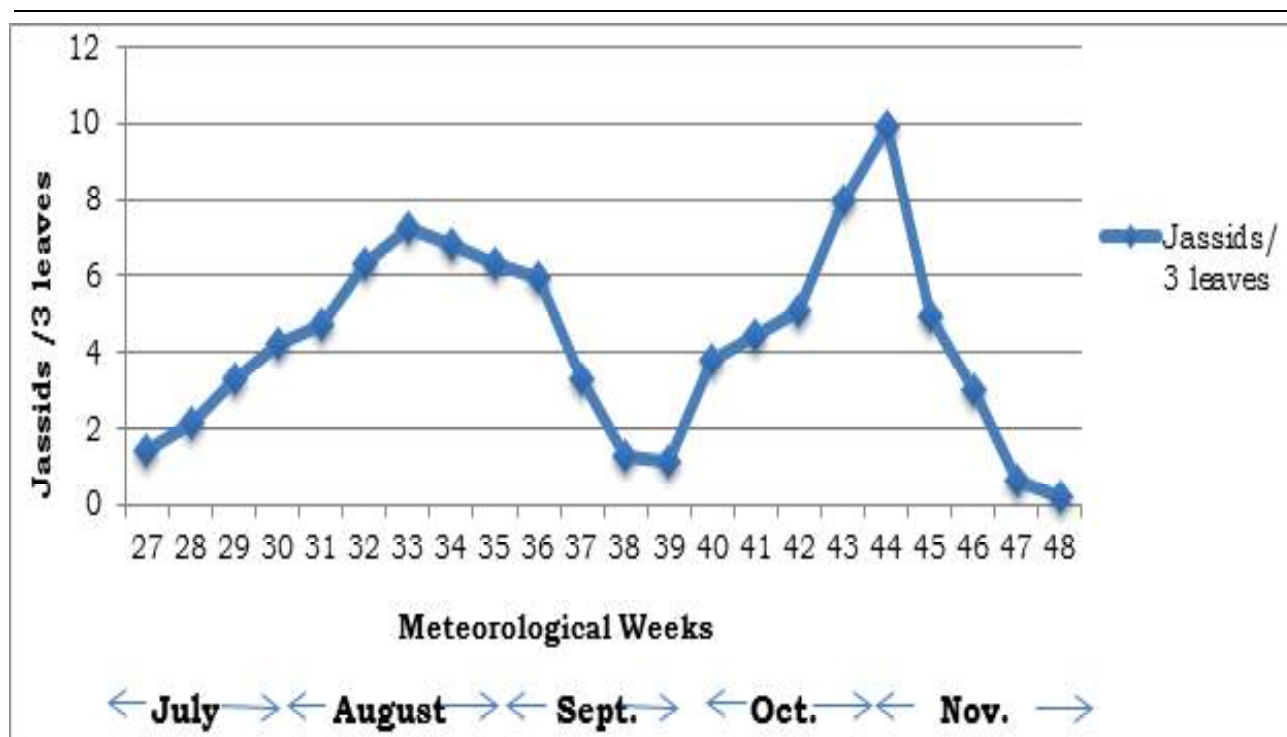
Pesticides continue to play the key role in cotton arthropod pest management. Most of the farmers are marginal and small farmers with poor financial condition and therefore, cannot afford to buy costly pesticides and sprayers. Lot of spurious chemicals is entering into the market which is effective and result in development of insecticide resistance and resurgence of pests. This made cotton cultivation uneconomical resulting in suicide of large number of disappointed farmers in Andra Pradesh and Maharashtra (Saini *et al.*, 2010). High populations of leafhoppers survive every year, despite extensive and intensive insecticide application. The incidence and development of these insect pests is very much dependent upon the prevailing physical environmental factors and crop stand. These insects multiply tremendously during the favourable weather conditions and take huge toll (Aheer *et al.*, 1994). Climatic conditions largely influence the pest numbers and activity as well as several predators and parasites either directly or indirectly (Arif *et al.*, 2006; Chaudhari *et al.*, 1999). For developing a weather based pest forewarning system, information regarding population dynamics in relation to prevalent meteorological parameters (temperature, relative humidity, rainfall, evaporation, etc.) is needed. Moreover, the same meteorological parameters also influence the growth and development of crop. Therefore, a thorough understanding of interaction between the crop growth stage and meteorological parameters/pest dynamics is a pre requisite for weather based pest forecasting model. Hence, the present study was focused on location specific seasonal occurrence of leafhoppers at different crop growth stages and its relation with weather factors which is of great significance in formulating efficient pest management tactics.

### MATERIAL AND METHOD

Studies on population dynamics of leafhopper, *A. biguttula biguttula* in Bt Cotton and its relationship with weather parameters was carried out at Cotton Improvement Project, Mahatma Phule Agricultural University, Rahuri during *kharif* 2015 and 2016. The seeds of Bt hybrid RCH-2Bt was sown in the first week of June at a spacing 90x90cm during both years and the crop was grown with recommended agronomic package of practices without any crop protection measures.. The data on abiotic factors i.e., temperatures, relative humidity, rainfall, rainy days and evaporation were taken from Department of Agronomy, MPKV, Rahuri. The data on leafhopper population were

**Table 1. Seasonal incidence and correlation matrix of jassids with weekly mean abiotic factors in *Bt* cotton 2015**

Month	SMW	Temp. (°C)		Humidity (%)		Rainfall (mm)	Rainy day	Eva. Mm	Jassids/3 leaves
		Max.	Min.	Mor.	Eve.				
July	27	35	24	66	43	0	0	8	1.40
	28	34	24	68	41	0	0	7	2.16
	29	31	24	74	58	17	1	6	3.28
	30	32	24	71	60	8	1	5	4.24
August	31	33	23	77	59	7	1	6	4.76
	32	32	22	76	60	4	1	4	6.32
	33	33	23	71	50	0	0	5	7.28
	34	33	22	71	49	1	0	6	6.84
	35	32	22	71	47	3	0	6	6.32
Sept.	36	31	23	81	55	21	2	6	5.96
	37	29	22	79	58	48	3	5	3.32
	38	28	23	79	60	55	3	4	1.28
	39	32	20	68	41	0	0	6	1.16
Oct.	40	31	21	76	50	21	3	6	3.80
	41	34	21	71	39	0	0	6	4.48
	42	35	19	56	30	0	0	7	5.12
	43	33	22	57	38	0	0	5	8.00
	44	33	17	57	38	0	0	5	9.92
Nov.	45	33	17	58	38	0	0	6	4.92
	46	33	15	50	30	0	0	6	3.00
	47	30	18	71	59	26	2	4	0.60
	48	32	18	72	44	0	0	6	0.20
Correlation Coefficient Value		0.28	0.02	-0.23	-0.14	-0.33	-0.27	-0.17	

Fig 1. Seasonal incidence of jassids in *Bt* cotton under unprotected condition 2015

**Table 2. Seasonal incidence and correlation matrix of jassids with weekly mean abiotic factors in *Bt* cotton 2016**

Month	Week No.	Temp. (°C)		Humidity (%)		Rainfall (mm)	Rainy day	Eva. mm	Jassids/3 leaves
		Max.	Min.	Mor.	Eve.				
July	27	29.6	23.6	79	70	9	1	4.8	1.76
	28	28.5	22.9	83	73	22.6	2	3.1	1.44
	29	29.6	22.8	76	67	2	0	4.7	5.96
	30	29.2	22.7	84	71	127.8	5	3.7	1.96
August	31	28.3	22.7	82	72	50.6	4	3.7	3.32
	32	30.1	23.1	70	65	1	0	4.6	5.56
	33	30.6	22	72	59	0	0	5.7	3.24
	34	31.8	22.2	72	55	0	0	6.9	3.88
	35	31.7	22.8	74	56	1.6	0	5	2.68
Sept.	36	30.9	20.3	70	53	0	0	5	13.52
	37	31.4	21.9	76	58	62	2	4.3	5.96
	38	28.8	22.3	83	77	163.6	4	2.5	1.44
	39	30.1	22.2	82	65	60.8	5	3.2	4.64
Oct.	40	28.5	21.7	87	71	110.6	3	3.3	3.56
	41	31.6	20.6	73	53	0	0	4.1	5.76
	42	31.8	17.1	67	38	0	0	5.26	8.76
	43	31.3	16.4	66	36	0	0	4.66	6.28
Nov.	44	30.1	13.4	51	41	0	0	4.57	6.40
	45	29.6	11.7	52	25	0	0	4.24	5.56
	46	29.5	12.6	64	41	0	0	3.77	5.24
	47	28.7	10.1	56	27	0	0	3.91	4.32
	48	30.9	10.5	62	26	0	0	4.76	3.76
Correlation Coefficient Value		0.45	-0.25	-0.41	-0.41	-0.42	-0.44	0.32	

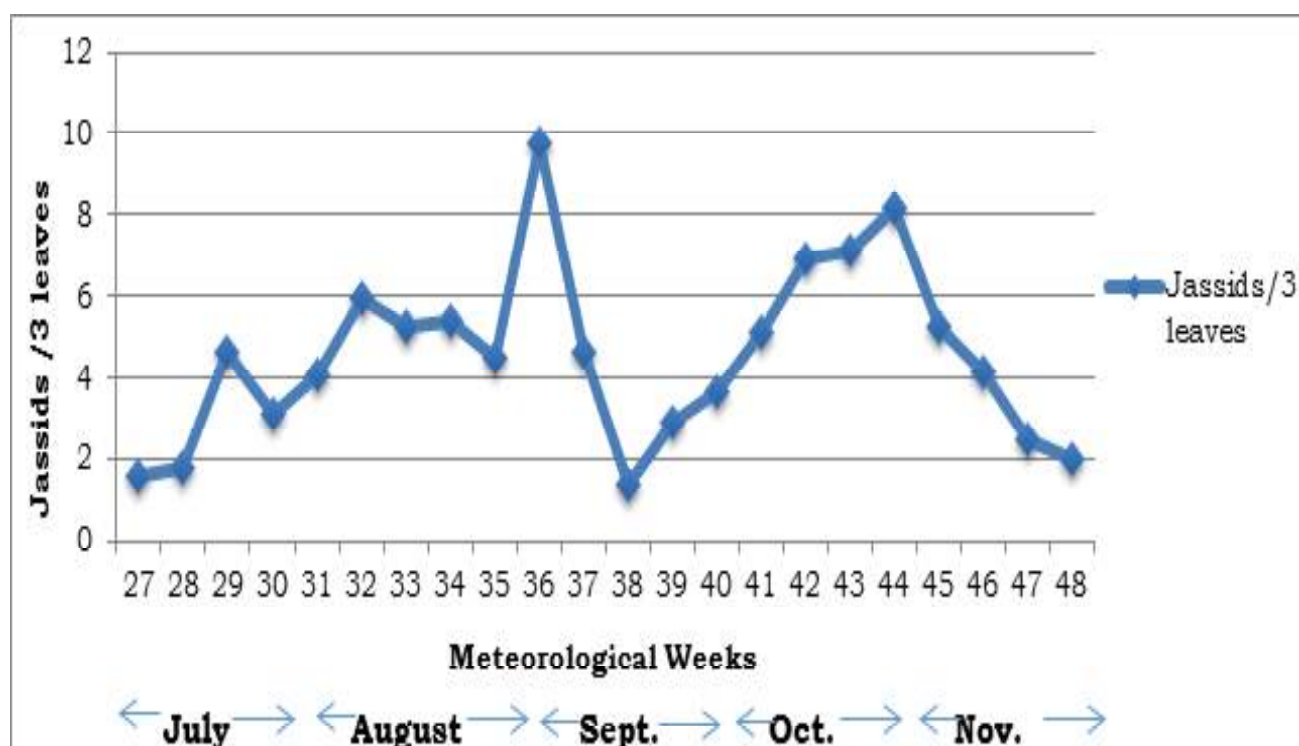


Fig 2. Seasonal incidence of jassids in *Bt* cotton under unprotected condition 2016

recorded from 3<sup>rd</sup> July to 28<sup>th</sup> November at weekly interval from three leaves. The observations on the number of nymphs and adults of leaf hoppers were recorded at weekly interval from three leaves per plant selected from top, middle and bottom canopy of five randomly selected plants per plot from 30<sup>th</sup> day after germination Kadam *et al.* (2015). The data obtained regarding relationship between weather parameters and leaf hopper was determined through correlations.

Statistical analysis: At the end of season, the data obtained were subjected to proper statistical analysis. The correlations between cotton leafhopper population and weather factors were estimated.

## RESULTS AND DISCUSSION

The influence of thermo-hygro parameters *viz.*, temperature (maximum and minimum), relative humidity (morning and evening), rainfall, number of rainy days on population of jassids was assessed and presented here under.

### Population dynamics of leafhoppers during Kharif 2015:

The incidence of jassids was first noticed during 27<sup>th</sup> MW. Population varied from 0.20 to 9.92 per 3 leaves. The peak activity of jassids in 44<sup>th</sup> MW by recording population 9.92 per 3 leaves followed by 8.00, 7.28 and 6.84 per 3 leaves during 43<sup>rd</sup>, 33<sup>rd</sup> and 34<sup>th</sup> MW respectively (Table 1). The correlation between abiotic factors and population of jassids revealed that the maximum temperature and minimum temperature correlated non-significantly and positively with the jassid population. Whereas the relative humidity (morning and evening), rainfall, rainy days and evaporation showed negative non-significant effect with the jassid population.

### Population dynamics of leafhoppers during Kharif 2016:

The population of jassids ranged between 1.76 to 13.52 per 3 leaves with its commencement in 27<sup>th</sup> MW. The peak period of jassid was during 36<sup>th</sup> MW during the season by recording population 13.52 per 3 leaves (Table 2). The maximum temperature correlated non-significantly and positively with the jassid population. Whereas the minimum temperature, relative humidity (morning and evening), rainfall, rainy days and evaporation showed negative non-significant effect with the jassid population.

The present findings are in accordance with Hegade *et al.* (2004) who reported that the leaf hopper incidence was noticed during 2<sup>nd</sup> fortnight of August, peaked during the first fortnight of September (23.8 and 16.3 leaf hoppers/ 3 leaves) and declined throughout the season. Aggrawal *et al.* (2007) reported jassids was active on *Bt* and non-*Bt* cotton hybrids during July and August. In addition, the present findings are in agreement with those of Prasad *et al.* (2008) and Kaur *et al.* (2009) who reported the maximum and minimum temperature ranged from 30.5 to 32.5°C and 20 to 23.5°C, respectively.

The population of leafhoppers showed positive correlation with maximum and minimum temperatures whereas; it had negative association with morning, evening relative humidity, evaporation, rainfall and rainy days. The present findings are in agreement with those of Shitole and Patel (2009), Kaur *et al.* (2009), Prasad *et al.* (2008), Dhaka

and Pareek (2008), Ramamurthy *et al.* (2000) and Rao *et al.* (2001) who reported significant negative correlation was found between the leafhopper population and relative humidity and rainfall. Similarly Ammar *et al.* (1986), Kavitha *et al.* (2003), Singh *et al.* (2004), Aheer *et al.* (2006), Shitole and Patel (2009) and Selvaraj *et al.* (2010) who reported the significant positive association with maximum and minimum temperature.

A partial agreement with those of Arif *et al.* (2006) who reported that rainfall and temperature showed a significant and positive correlation with the jassid population, whereas, relative humidity showed a non significant effect. The present findings are in close conformity with those of Purohit *et al.* (2006) and Hegde *et al.* (2004) who reported that increase in jassid population showed a significant positive correlation with minimum temperature and evening relative humidity.

## CONCLUSION

It may be concluded that climatic factors determine seasonal activity and population dynamics of leafhoppers in cotton. This information generated in present study would be helpful in developing efficient pest management strategies against insect pests of cotton crop for increased production efficiency, profit, besides safety to the environment.

## LITERATURE CITED

- Aggrawal, N., Brar, D. S. and Buttar, G. S. 2007. Evaluation of *Bt* and non-*Bt* version of two cotton hybrids under different spacings against sucking insect pest and natural enemies. *J. Cotton Res. Dev.*, **21**(1): 106-110.
- Abbas, M.A., 2001. General Agriculture. 2nd Edn., *Emporium Publ.*, Pakistan, pp: 352.
- Aheer, G.M., A. Ali and S. Hussain, 2006. Varietal resistance against jassid (*Amrasca devastans* Dist.) in cotton and role of abiotic factors in population fluctuation. *J. Agric. Res.*, **44**: 299-305.
- Aheer, G.M., K.J. Ahmad and A. Ali, 1994. Role of weather in fluctuating aphid density in wheat crop. *J. Agric. Res.*, **32**: 295-301.
- Ammar, E.D., S.H. Fouad, M.M. Megahad and G.H. Sewaift, 1986. Population density and vertical distribution of *Empoasca* leafhopper on cotton plants in kafer using two sampling methods. *Ann. Agric. Sci.*, **24**: 1655-1664.
- Anonymous, 2005. Training manual on DVS test in cotton with resistance to PPV and FR legislation, 2001. All India Coordinated Cotton Improvement Project, CICR, Coimbatore, Tamil Nadu, pp: 134-135.
- Arif, M.J., M.D. Gogi, M. Mirza, K. Zia and F. Hafeez, 2006. Impact of plant spacing and abiotic factors on population dynamics of sucking insect pests of cotton. *Pak. J. Biol. Sci.*, **9**: 1364-1369.
- Chaudhari, G.B., T.M. Bharpoda, J.J. Patel, K.I. Patel and J.R. Patel, 1999. Effect of weather on activity of cotton bollworms in middle Gujarat. *J. Agrometeorol.*, **1**: 137-142.
- Dhaka, S.R. and B.L. Pareek, 2008. Weather factors influencing population dynamics of major insect pests of cotton under Arid Agro ecosystem. *Indian J. Entomol.*, **70**: 157-163.
- Hegde, M., M. Srinivasa, D.P. Biradar, S.S. Udikeri and B.M. Khadi, 2004. Seasonal incidence of key insect pests and their natural enemies on cotton at Siruguppa.
- Proceeding of the International Symposium on Strategies for sustainable Cotton Production-A global vision, Nov. 23-25,

- Dharwad, Karnataka, India, pp: 114-115.
- Kaur, P., H. Singh and N.S. Butter, 2009. Formulation of weather based criteria rules for the prediction of sucking pests in cotton (*Gossypium hirsutum*) in Punjab. *Indian J. Agric. Sci.*, **79**: 375-380.
- Kavitha, G., P. Ram and R.K. Saini, 2003. Arthropod predatory fauna and its population dynamics in cotton in Haryana. *J. Cotton Res. Dev.*, **17**: 167-171.
- Khan, B.S., M. Afzal and M.A. Murtaza, 2003. Effect of abiotic factors against the infestation of american bollworm (*Heliothis armigera* Hub.) on different varieties of cotton under unsprayed conditions. *J. Biol. Sci.*, **3**: 82-85.
- Madar, H. and P. Katti, 2010. Incidence and diversity of leafhoppers on sunflower. *Karnataka J. Agric. Sci.*, **23**: 149-150.
- Mahmood, T., S.I. Hussain, K.M. Khokar, G. Jeelani and M. Ahmad, 2002. Population dynamics of leafhopper (*Amrasca biguttula biguttula*) on brinjal and effect of abiotic factors on its dynamics. *Asian J. Plant Sci.*, **4**: 403-404.
- Prasad, N.V.V.S.D., N.H.P. Rao and M.S. Mahalakshmi, 2008. Population dynamics of major sucking pests infesting cotton and their relation to weather parameters. *J. Cotton Res. Dev.*, **22**: 85-90.
- Purohit, D., O.P. Ameta and S.S. Sarangdevot, 2006. Seasonal incidence of major insect pests of cotton and their natural enemies. Rajasthan College of Agriculture (MPUAP), Udaipur. *Pestology*, **30**: 24-29.
- Ramamurthy, R., V. Rajaram, M. Rajendran and D. Krishnadoss, 2000. Impact of weather parameters on cotton pests. *J. Cotton Res. Dev.*, **14**: 193-195.
- Rao, G.R., P.P. Rao, P.H. Kumar, C.R.N. Rao and G.B. Madhavi, 2001. Population dynamics and management of Jassid, *Amrasca biguttula* Ishida on cotton. Proceeding of the National Conference: Plant Protection-New Horizons in the Millennium, Feb. 23-25, Entomological Research Association, Udaipur, pp: 19-19.
- Saini, T.M., G.M. Patel and M.K. Jat, 2010. Efficacy of farmers innovative plant protection practices against some pests of cotton. *Pestology*, **34**: 46-51.
- Selvaraj, S., D. Adiroubane and V. Ramesh, 2010. Population dynamics of important insect pests of bhendi in relation to weather parameters. *Pestology*, **34**: 35-39.
- Shitole, T.D. and I.S. Patel, 2009. Seasonal abundance of sucking pests and their correlation with weather parameters in cotton crop. *Pestology*, **33**: 38-40.
- Shivanna, B.K., D.N. Nagaraja, M. Manjunatha and M.I. Naik, 2009. Seasonal incidence of sucking pests on transgenic Bt cotton and correlation with weather factors. *Karnataka J. Agric. Sci.*, **22**: 666-667.
- Singh, S., R. Niwas, R.K. Saini and M.L. Khichar, 2004. Relationship of micro climatic parameters with population dynamics of leafhopper and whitefly in cotton. Proceeding of the National Symposium on Changing World Order-Cotton Research, Aug. 10-12, Hyderabad, pp: 104-104

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