# Effect of Abiotic Factors on Population Dynamics of Whitefly and Jassid on Bt-Cotton

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**Abstract**
*Studies was carried out to investigate population dynamics and the effect of abiotic factors on population dynamics of sucking insect pests of BT cottonwhitefly (Bemisiatabaci) andjassid (Amrascabiguttula), under unprotected condition. The results of the field study revealed that the sucking pest (whiteflies and jassids) population were maximum at highest temperature. (11.68) of whiteflies per leaf was recorded at highest temperature (45 oC) and lowest humidity (30%). Similarly the maximum population (3.53) of jassids per leaf was recorded at maximum temperature (45 oC) and lowest humidity (30%) on July 10th, 2017. The rainfall had slight impact on the population of whiteflies and Jassids. Simple correlation analysis revealed that maximum temperature showed significant positive effect and the minimum temperature showed negative effect on these pests. The relative humidity was non significant effect, whereas precipitation was negative effect on all the sucking pests.*

## Introduction

Cotton(Gossypium hirsutumL.) contributes much to the economy of Pakistan (Ibrahim et al., 2007). It supports our textile industries. Cotton being a natural fiber crop is also called silver-fiber for its unique quality (Arshad and Anwar, 2007). Cotton uses are ranging from garments to furnishings of homes and medicines. Pakistan stands 5th biggest producer and 4th major cotton user throughout the world and the major exporter of cotton yarn (APTMA, 2015). Cotton is cultivated over 3 million hectares in Pakistan and its share in GDP is 1.5%. It contributes 7.0% in value added to agriculture (Anonymous, 2015).

Among a variety of reasons of low yield, the magnitude of insect-pests, which damage the cotton crop from sowing to maturity, plays an important role. The insect-pests cause 5-10% losses on an average but in severe attack, insect-pests can cause heavy qualitative and quantitative losses varying from 40-50% (Naqvi, 1976). There are different pest control tactics, in which varietal resistance is immense without insecticide application (Bughioet al., 1984; Jin et al., 1999 and Khan et al., 2003).

Cotton insect pest complex is divided into two categories; sucking insect pests and chewing insect pests. Important sucking insect pests are whitefly (Bemisiatabaci), jassid (Amrascabiguttula), thrips(Thripstabaci)and aphid (Aphis gossypii) which are also designated as key pests causing most of the damage to cotton crop. Cotton whitefly damages the plant by sucking cell sap resulting in 50% reduction in boll production (Ahmad et al., 2002) and act as a vector of leaf curl virus disease (CLCV) (Nelson et al., 1998), which is threatening our cotton-based economy. It acts as a sole vector of more than 100 plant viruses, which cause diseases to many commercial crops in different parts of the world (Jones, 2003).

Heavy infestation may reduce plant vigor and growth, cause chlorosis and uneven ripening of bolls. It's direct feeding induces physiological disorders resulting in shedding of immature fruiting parts. It's nymphs produce honeydew, on which black sooty mold grows, reducing the photosynthetic capabilities of plants. Similarly, jassid is also a notorious sucking insect pest of cotton plant (Bashir et al., 2001). Whitefly and jassid populations are usually positively correlated with the temperature while negative with relative humidity. In discriminate use of insecticides has not only caused the resistance problem in these pests but also has polluted the environment along with other health hazards (Bashir et al., 2001 & Raza Afzal, 2000). Understanding the host selection behavior and the effect of various morphological plant characters is an important prerequisite for developing the pest management strategy.

Cotton Jassid, Amrascabiguttula is one of the most serious sucking pests of cotton in India causing reduction in yield to an extent of 20 percent. Nymphs and adults suck sap from the under surface of the leaves and causing downward curling, yellowing and reddening of leaf lamina which results later in hopper burn and in severe cases leaves dry and drop down. A good cotton crop with minimal pest attack brings prosperity, while severe incidence brings misery. Thus pest is an important determinant of the prosperity of the farmers. The knowledge about incidence of pest during the cropping season and its possible dynamics help in designing pest management strategies.

## Objective

Keeping in view the present studies were carried out to study population dynamics of whitefly and jassid on cultivar of cotton MNH-886 (Bt-cultivar) in agro climatic conditions of Dera Ismail Khan, Pakistan.

## Materials and Methods

A field study was carried out during the months of July and August (2017) at Department of Entomology, Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan. The cotton Bt-variety MNH-886 was grown in the observation plot with recommended agronomic package of practices. Observations on the number of nymphs and adults ofwhiteflies andjassidswere recorded 9 times on weekly basis from three leaves per plant selected from top, middle and bottom on 30 randomly selected plants.

Weather data (temperature, relative humidity, wind speed and rainfall) of concerned dates was obtained and compared with the fluctuating population of jassids and whiteflies.

**Economic threshold levels of different insect pests of cotton crop**

| Insect Pests | Economic Threshold Level |
|---|---|
| Jassid | 1 adult/nymph per leaf |
| Whitefly | 5 adult/nymph per leaf |
| Thrips 8-10 per leaf Aphid | 10/leaf or on visible damage |
| Mite | 15/leaf or on visible damage |
| American boll worm | 5 brown eggs or 3 larvae/plant |
| Spotted bollworm | 3 larvae/plant |
| Pink bollworm | 5% damage or presence of larvae in boll |
| Army bollworm | Just at appearance |

## Result and Discussion

The data presented in Table-1 show that the increasing temperature positively affected the population of whiteflies and jassids on cotton. The maximum population (11.68) of whiteflies was recorded at highest temperature (45 oC) and lowest humidity (30%). Similar trend of jassid population build up was recorded. The maximum population (3.53) of jassids was recorded at maximum temperature (45 oC) and lowest humidity (30%) on July 10th, 2017. The rainfall had slight impact on the population of whiteflies and Jassids. In case of no rainfall, favourable environmental conditions like high temperature and low humidity were found for the population build-up of whiteflies and jassids.

Similar results have been reported by different scientists Gogoiet 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 Bishnolet al. (1996) who reported that jassid population increased with maximum temperature.

**Table Population dynamics of whiteflies and jassids on cotton crop in agro-climatic conditions of Dera Ismail Khan during 2017-2018**

| Observation Dates | Weeks | W. flies/ leaf | Jassids/ leaf | Temperature (oC) | | R. humidity (%) | | Wind speed Km/hr | Rainfall (mm) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Max | Min | Max | Min | | |
| 03-July | 1 | 10.9 | 3.50 | 42 | 26 | 34 | 27 | 4.08 | - |
| 10-July | 2 | 11.68 | 3.53 | 45 | 24 | 30 | 27 | 3.25 | - |
| 16-July | - | - | - | - | - | - | - | - | 34 |
| 17-July | 3 | 6.94 | 3.25 | 38 | 22 | 39 | 32 | 2.75 | - |
| 24-July | 4 | 10.73 | 3.44 | 40 | 24 | 40 | 27 | 2.66 | - |
| 25-July | - | - | - | - | - | - | - | - | 16 |
| 31-July | 5 | 10.71 | 3.46 | 40 | 22 | 40 | 32 | 2.50 | - |
| 07-August | 6 | 10.4 | 3.42 | 40 | 25 | 58 | 141 | 2.42 | - |
| 14-August | 7 | 10.1 | 3.40 | 36 | 25 | 46 | 41 | 3.12 | - |
| 21-August | 8 | 9.85 | 3.22 | 32 | 22 | 44 | 30 | 1.88 | - |
| 26-August | - | - | - | - | - | - | - | - | 80 |
| 28-August | 9 | 8.74 | 3.12 | 34 | 22 | 50 | 40 | 2.84 | - |

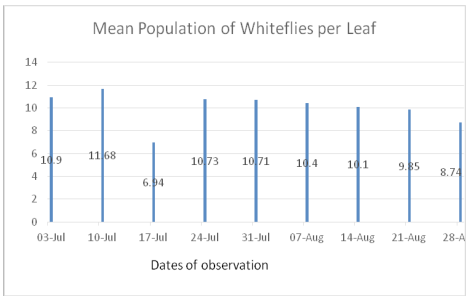


**Fig. 1 Population dynamics of whiteflies on cotton crop in agro-climatic conditions of Dera Ismail Khan during 2017-2018**

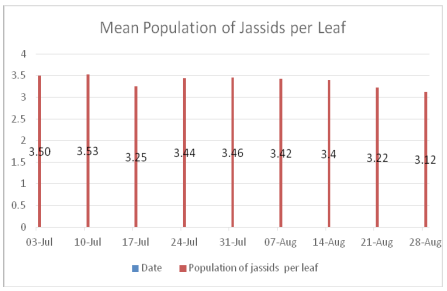


**Fig. 2: Population dynamics of jassids on cotton crop in agro-climatic conditions of Dera Ismail Khan during 2017-2018**

## Conclusion

On the basis of obtained results it is concluded that the increasing temperature positively affected the population of whiteflies and jassids whereas relative humidity and rainfall negatively affected the population of the tested insects. The abiotic factors did not playsignificant role in mediating population dynamics of these pests.

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