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Impact of Different Varieties of Stub Cotton on Population Dynamics of Whitefly at Faisalabad, Pakistan

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Abstract.- The effect of temperature and relative humidity has beeen studied on the impact of six advanced varieties of stub cotton *(Gossypium hirsutum*) against cotton whitefly (*Bemisia tabaci)* under unsprayed conditions according to a Randomized Complete Block Design (RCBD) with three replicates from April 1st 2005 to July 30th 2005. The data regarding white flies were recovered on alternate day basis taking two leaves each from the top, middle and bottom of randomly selected cotton plants in each replication of each treatment for counting their population. The data regarding mean daily temperature and relative humidity were collected from the meteorological section of NIAB, Faisalabad. Correlation analysis of whitefly population and weather factors depicted that the temperature was negatively and significantly ($P < 0.05$) correlated with the whitefly population, while the relative humidity was positively correlated. Maximum and minimum whitefly population per leaf was 3.30 and 1.16 on IR-448 and NIAB-karishma variety of stub cotton, respectively. So, NIAB-karishma variety of stub cotton is recommended for cultivation to get maximum yield.

Key words: Population of whiteflies, stub cotton varieties, *Bemisia tabaci, Gossypium hirsutum.*

INTRODUCTION

In Pakistan, about 150 different species of insect and mite pests have been found attacking and reducing the cotton yield and quality (Attique and Rashid,1983). Among these sucking insect pests, whitefly and jassids are most harmful to the cotton crops. Whitefly has become the serious pest of cotton involving spread of cotton leaf curl virus (CLCV) during the last few years (Ali *et al.,* 1995; Malik *et al*., 1995; Singhal, 2003). Moreover, the honey dew secreted on leaves and exposed on cotton lint fiber of open bolls causes the development of sooty mould, affects and deteriorates the quality of lint fiber.

Cotton is vulnerable to the attack of large number of insect pests throughout its growth period, which causes losses to the tune of 39.50% (Naqvi, 1975; Chaudhry, 1976). So, there is a dire need to sort out or screen out new cotton lines/varieties relatively resistant to sucking insect pests and mites to fulfill the fiber demands of the population increasing at an alarming rate of 2.9% (Agric. Stat. of Pak., 2002-03).

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Stub cotton may be defined as the cotton stalks or of a previous crop which, after over wintering begin to show sign of growing by displaying buds which swell or sent out shoots of new plant growth. The stub cotton is a source of infestation/flourishing the different types of pests *viz.*, pink bollworm, *Heliothus* complex (tobacco budworm and bollworm), cotton leaf perforator and beet armyworm, are very dangerous and injurious insect pests of cotton and infestations. So, all cotton stalks of a previous crop and all stub or volunteer cotton found growing on idle lands, fallow lands in other crops, are in any other location shall be destroyed. In contrast to the chemical control, the present study is aimed to see the population fluctuation of whitefly in relation to abiotic factors, *i.e.* temperature and relative humidity, on different varieties of stub cotton under unsprayed conditions and to devise a pest management strategy to control these insect pests. The main objective of the present study was to identify the variety of stub cotton which has less infestation of whitefly.

MATERIALS AND METHODS

Six varieties of stub cotton *viz*. NIBGE-1, IR-443, IR-448, NIAB-Karishma, FH-901and FH-925 were sown in the last week of May 2004 according to a Randomized Complete Block Design (RCBD) with three replicates. After picking the final crop,

the stubbles remained in the field were irrigated. Flowering started on these stubbles. To record data, these cotton plants were observed from the 1st week of April to the last week of July 2005. The total area under observation was 89.9 x 13.7 m. The plot size for each treatment was 7.62 x 3.04 m. The row-to-row and plant-to-plant distance was maintained by 0.76m and 0.38m, respectively with five rows of each treatment in each replication.

Data regarding population dynamics of Whitefly were recorded on alternate day basis, by taking two leaves each from the top, middle and bottom of five randomly selected plants of stub cotton varieties in each replication of each treatment. Data pertaining to daily mean temperature and relative humidity were collected from meteorological observatory of Plant Physiology section of Ayub Agricultural Research Institute, Faisalabad, Pakistan.

The data was subjected to statistical analysis and Duncan's Multiple Range test at 5 % level of probability and correlation (Steel and Torri, 1986), between the cotton varieties and insect pest's population as well as weather factors were also estimated.

RESULTS AND DISCUSSION

Effect of different varieties of stub cotton on whitefly population

Mean population of whitefly and the comparison of per leaf whitefly population on different varieties of stub cotton showed that the maximum population (3.307±0.54/leaf) was recorded on the IR-448 which did not differ significantly (P>0.05) from 2.740±0.20/leaf and 2.587±0.09/leaf on the FH-925 and IR-443, respectively. The minimum population (1.160±0.04/ leaf) was recorded on NIAB-karishma while the varieties FH-901 and FH-925 showed the intermediate population which statistically did not differ significantly from each other. The results revealed significant (P<0.05) variations among all the varieties regarding the population of whitefly. The variety IR-448 was found comparatively susceptible showing maximum population of whitefly (3.307/leaf) and had non-significant differences with those recorded on varieties NIAB-1, IR-443, FH-901 and FH-925 (Table I). The minimum population of whitefly was observed to be 1.16/leaf on NIAB-karishma and did not show significant difference from those of recorded on FH-901 and FH-925 varieties of stub cotton. The present findings cannot be compared with those of Aheer *et al.* (1999), Anonymous (1999, 2002) due to differences in their methodology as well as ecological conditions.

Table I.- Relationship of Whitefly population (No. of individual/leaf) with different varieties of stub cotton

Varieties	Whitefly population (n=3)
NIBGE-1	2.740 ± 0.20a*
IR-443	2.587 ± 0.09a
IR-448	3.307 ± 0.54a
NIAB- karishma	1.160 ± 0.04b
FH-901	2.230 ±0.12ab
FH-925	2.157 ± 0.11ab

*Mean±SEM. Means sharing the same alphabets did not differ statistically at P > 0.05

Table II depicts that the population of whitefly remained highest (0.13/leaf) on IR-443 variety of stub cotton during the months of April, May and June at different temperature and humidity values. However, the population of whitefly remained lower on all the other varieties of stub cotton, under variable temperature and relative humidity during the months from April–June.

Relationship among whitefly population, stub cotton varieties and weather factors

Correlation analysis showed that the population of whitefly was negatively correlated with the temperature for all the varieties of cotton. Population of whitefly was negatively correlated with relative humidity in stub cotton varieties such as NIAB-I, NIAB- Karishma, FH-901 and FH-925, but it was positively correlated with that in the IR-443 and IR-441 varieties (Table III). These findings of the present study are in line with the results reported by Jagdave and Butter (1988) and Shah (2003). However, the present findings are partially comparable with those of Rote and Puri (1991), Rao and Chari (1992), Bishnol *et al.* (1996) and Saminathan *et al.* (2003).

Table II.- Whitefly population on different varieties of stub cotton, at different temperatures and relative humidities.

Months	Population of white fly in cotton varieties (No. of individuals / leaf)						Mean temperature (°C)		Mean relative humidity (%)	
	NIAB-1	IR-443	IR-448	NIAB-Karishma	FH-901	FH-925	Max.	Min.	8:00 am	5:00 pm
April	0.07±0.07	0.13±0.06	0.07±0.06	0.07±0.06	0.08±0.07	0.07±0.06	34.1±2.28	16.2±2.80	49.9±10.54	26±4.14
May	0.03±0.04	0.13±0.04	0.03±0.04	0.04±0.03	0.04±0.04	0.04±0.04	36.75±2.3	22.94±2.12	39.82±8.69	27.99±10.87
June	0.042±0.03	0.13±0.04	0.05±0.04	0.04±0.03	0.05±0.04	0.06±0.03	35.92±2.87	26.06±2.53	43.82±10.50	28.5±9.76

Table III.- Correlation coefficients of whitefly population on different varieties of cotton under the influence of temperature and relative humidity.

Varieties of stub cotton	Maximum temperature	Minimum temperature	Relative humidity at 8 am	Relative humidity at 5 pm	Mean population / leaf
NIAB-1	-0.2587*	-0.2846*	-0.0016	-0.242	2.921
IR-443	-0.3134*	-0.3284*	0.0486	0.0446	2.56
IR-448	-0.1468	-0.2111	0.0428	0.0180	3.30
NIAB- karishma	-0.1837	-0.2706*	-0.178	-0.0089	1.16
FH-901	-0.1718	-0.2227	0.0616	-0.0090	2.23
FH-925	-0.1853	-0.2665*	0.1214	-0.0967	2.15

*Significant ($P \leq 0.05$)

Maximum whitefly population buildup was significantly ($P<0.05$) correlated with the temperature in all varieties of stub cotton except IR-448 and FH-901 which had negative but non-significant ($P>0.05$) correlation with maximum and minimum temperature. The relative humidity was negatively correlated with the whitefly population on NIABGE-1, NIAB-karishma, FH-901 and FH-925, varieties, while IR-443 and IR-448 had positive and non significant correlation with whitefly population (Table III). Bishnol *et al.* (1996), Abdel Mageed *et al.* (1998) and Gupta *et al.* (1998) who reported negative correlation between relative humidity and the population of aleyrodid.

CONCLUSIONS

The present investigation has shown that NIAB-karishma variety of stub cotton attracted minimum infestation of whitefly. Hence, NIAB-karishma variety of stub cotton is recommended for cultivation for maximum yield.

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