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FULL LENGTH ARTICLE

Effects of plant morphology on the incidence of sucking insect pests complex in few genotypes of cotton

Huma Khalil, Abu Bakar Muhammad Raza, Muhammad Afzal, Muhammad Anjum Aqueel, Muhammad Sajjad Khalil, Muhammad Mudassir Mansoor *

Department of Entomology, University College of Agriculture, University of Sargodha, Pakistan

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Abstract The study was conducted to find the role of physico-morphic plant factors viz., number of gossypol glands, hair density, length of hair, plant height and thickness of leaf lamina per plant in fluctuating the population of thrips (*Thrips tabaci* Lind.), jassid (*Amrasca bigutella* Dist.) and whitefly (*Bemisia tabaci* Genn.) on six genotypes of cotton viz., BT-703, CIM-557, CIM-608, CIM-573, BT-3701 and FH-113. All the genotypes showed significant differences against sucking insect pest population. Whitefly adult population exhibited negative response with gossypol glands on leaf lamina, midrib and vein and also with plant height. Whitefly adult and nymphal population correlated positively with hair density on leaf lamina and vein and length of hair on leaf midrib. The nymphal and adult population of jassid showed positive correlation with gossypol glands on leaf lamina, vein and length of hair on leaf lamina, midrib and vein. Adult and nymph population of jassid revealed negative response with hair density on leaf lamina and midrib and also with plant height and leaf lamina thickness. Thrips population showed negative correlation with gossypol glands on leaf midrib, vein, length of hair on leaf lamina and vein. Thrips population correlated positively with hair density on leaf midrib, thickness of leaf lamina and plant height. The genotypes CIM-608 (3.70/leaf), CIM-608 (5.67 /leaf), BT-703(0.86/leaf), BT-703 (1.14/leaf) and FH-113 (0.34/leaf) were found to be susceptible, whereas FH-113 (2.85/leaf), CIM-557 (3.46/leaf), CIM-573 (0.40/

*Corresponding author.
E-mail addresses: hmkhalil25@gmail.com (H. Khalil), abu.bakar@ uos.edu.pk (A.B.M. Raza), mafzal@uos.edu.pk (M. Afzal), anjum_ento@uos.edu.pk (M.A. Aqueel), khan87350@gmail.com (M.S. Khalil), honeybeepak@gmail.com (M.M. Mansoor).

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leaf), CIM-557 (0.48/leaf) and BT-703 (0.08/leaf) were resistant to whitefly adult, whitefly nymph, jassid adult, jassid nymph and thrips population respectively.

1. Introduction

Cotton (*Gossypium hirsutum* L.), that's also named as "white gold" is very imperative non-food economy oriented fiber and cash crop of Pakistan. It occupies a key position as it contributes for 7.1% of value added in agriculture and about 1.5% to the GDP and due to this Pakistan ranked 4th position in the world (GOP, 2015). In Pakistan, both the cotton yield and quality have been reduced by the attack of 145 species of insect pests and a number of diseases are caused by these insects (Bo, 1992). Cotton is handicapped by both, chewing and sucking insect pests. Sucking insect pests reduces the plant vigor by sucking sap from leaves and other tender parts of cotton. In case of serious damage, drooping and wilting of leaves also occur (Abro et al., 2004). Among sucking insect pests i.e. *Bemisia tabaci* (Genn.), *Aphis gossypii* (Glover), *Thrips tabaci* (Lind.) and *Amrasca bigutella* (Dist.) cause significant loss in yield and cause 40–50% damage to the crop (Nizamani et al., 2002; Aslam et al., 2004; Amjad and Aheer, 2007). Farmers mostly rely on chemical insecticides for the control of sucking insects due to their prompt action (Soomro et al., 2000; Razaq et al., 2013). The extensive use of insecticides may result in the health hazard problems, resistance development in insects, resurgence of secondary pest, environmental pollution and interruption of natural balance (Palumbo et al., 2001; Costa et al., 2003). Therefore alternate methods are to be used for the control of sucking insect pests (Soomro et al., 2000).

Host plant resistance plays an important role in compatible with various pest control strategies of IPM (Bughio et al., 1984; Jin et al., 1999; Hua and Hua, 2001 and Khan et al., 2003). It offers an efficient control of insect pests as an environment and economically safe strategy (Pedigo, 1989; Khan and Sexena, 1998). Recent advances such as use of BT cotton varieties improve resistance levels in cotton and became an important tool for integrated pest management (IPM) program. BT can colonize and kill a variety of insect pests (De-Maagd et al., 2001).

Plant traits such as number of gossypol glands, hair density, length of hair, plant height and thickness of leaf lamina play an important role in the sustainable pest management of cotton crop by having positive and negative interactions. Amjad et al. (2009) studied five cotton cultivars viz., FH- 634, FH-643, FH-682, FS-628 and NIAB-78 for their performance against *T. tabaci*, *A. gossypii, A. bigutella* and *B. tabaci*. Cultivar FH-634 showed maximum resistant against the sucking insect pests complex. Naveed et al. (2011) evaluated the hair length and density of three cotton varieties Cyto-46, Cyto-55 and Cyto-12/91 for tolerance to *B. tabaci*, *A. bigutella* and *T. tabaci* and survival of predators and parasitoids. The total numbers of predators were significantly higher on Cyto-12/91 and Cyto-55 having > 600 trichomes per cm^2 whereas the level of parasitism remained the same on all the strains. This study revealed that the early season sucking insect pests can be managed by choosing the variety having moderate leaf hair density.

Keeping in view the work of above scientists, the present study was conducted on six (3 BT and 3 non BT) genotypes of cotton to determine the role of physico-morphic plant factors and to determine the comparative resistance and susceptibility of different cotton cultivars in fluctuating the population of *T. tabaci*, *A. bigutella* and *B. tabaci*. Although a lot of work has been done on physico-morphic interactions with insect pests little work (Khan et al., 2010 and Zia et al., 2011) is done on these cotton varieties.

2. Materials and methods

The experiment was conducted following Randomized Complete Block Design (RCBD), with plot size of 2023.43 m^2 (0.5 acre) in the research area of University College of Agriculture, University of Sargodha. Six genotypes of cotton viz., three BT (BT-703, BT-3701, FH-113) and three non-BT varieties (CIM-557, CIM-608, CIM-573) were the treatments and sown following bed sowing method keeping row to row and plant to plant distance 75 cm and 22–30 cm respectively. Three replicates, each of 6 treatments, produced a total of 18 plots. Each plot consisted of 3 rows of 10 cotton plants, for a total of 30 plants per plot.

Population of adult and nymphs per leaf of cotton whitefly, jassid and thrips were recorded early in the morning at weekly intervals. Three plants were selected randomly from each replication of each treatment and the population of jassid, thrips and whitefly were counted from upper, middle and lower portion of each plant (Arif et al., 2004). Nine plants were selected from one treatment and fifty-four plants from six treatments. Hand magnifying glass was used to count the population of sucking insect pests. A total of twenty observations regarding the population of sucking insect pests were taken for about five months during the course of the study.

For measuring plant characters three plants were chosen at random from each plot and one leaf from upper, middle and lower portion of each selected plant was cut and brought to laboratory (Sohail et al., 2003; Amjad and Aheer, 2007). The number of gossypol glands, hair density and length of hair on leaf lamina, midrib and veins was examined from lower side of the leaves under a CARL ZEISS binocular microscope MCX 100 (Austria) from three different portions of each leaf. For this purpose an iron made dye of 1 cm^2 was used (Arif et al., 2004). The area was one cm in length from midrib and veins, whereas for lamina, it was one cm^2 for determination of number of gossypol glands, hair density and length of hairs. A cross section of leaves was cut with the help of a fine razor and thickness of leaf lamina was determined in mm from three different places of each leaf by using an ocular micrometer under a binocular microscope. For plant height three plants were selected at random from each plot and their height in cm was determined with the help of meter rod.

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