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THE RESISTANCE LEVELS OF DIFFERENT COTTON VARIETIES AGAINST SUCKING INSECT PESTS COMPLEX IN PAKISTAN

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ABSTRACT

The resistance levels of six cotton varieties viz. MNH-635, NIAB-86, SLH-257, CIM-446, CIM-482 and NIAB Karishma to sucking complex i.e. thrips, jassids, and whiteflies were evaluated in the experimental field at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad. It was observed that the cultivar CIM-446 showed comparatively greater resistance to the attack of whiteflies (3.028 per leaf) and cultivar NIAB-86 was found to be highly susceptible to whiteflies 3.821 per leaf. Similarly NIAB-86, MNH-63 and SLH-257 were highly susceptible to jassid (i.e. 0.9689 per leaf, 0.8761 per leaf and 0.8678 per leaf, respectively). Whereas, the cultivar NIAB Karishma and CIM-482 showed medium response to jassid attack (i.e. (0.6911 per leaf and 0.6700 per leaf). The population of thrips illustrated that cultivar SLH-257 was found resistant to a greater level against this pest per leaf population basis (5.011 per leaf). It is observed that all the tested varieties were susceptible to the whiteflies, jassids and thrips. Although, the population of these pests remained below the economic threshold level except in case of jassids, whose population during 3rd and 4th weeks of July remained above the economic threshold level.

Keywords: Cotton, resistance, sucking insect pests, varieties

INTRODUCTION

Cotton (*Gossypium hirsutum* L.), the crop of commerce, history, industry and civilization, attracts renewed global interest being the silver fibre of world. Besides, earning a substantial foreign exchange of over 68 percent from the export of raw cotton and for 7.3 percent of the value added in agriculture and about 1.6 percent to GDP (Economic Survey, 2009). It also provides bread and butter to million of people from field to the factories. It contributes about 55% of

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the total edible oil production in Pakistan (Shah *et al*., 1999). It involves as an occupation of 1.5 million farming families and a source of livelihood for several millions of labors in cities and towns. Cotton crop in Pakistan feeds to over 503 textile mills, 1263 ginning factories, 443 spinning mills, 8.1 million spindles, 2622 oil expelling units. There are more than 5 million labors associated with cotton and cotton related business, which indicates that cotton will continue to remain an important crop of Pakistan (Pakistan Cotton Ginners Association, 2005).

Pakistan cotton yields have been stagnant due to many reasons i.e., excessive rains at the time of sowing, high temperatures at the flowering stage, late wheat harvesting resulting in a decline of area planted to cotton, incidence of Cotton Leaf Curl Virus and improper production technology in the major cotton growing areas of Punjab and Sindh (Economic Survey, 2007). One of the many factors that contribute for reducing cotton quantity and quality is attack of different insect pests (Mallah *et al*., 1997). More than 1326 species of insects have been reported attacking cotton in the world (Atwal, 2002) while about 93 insect and mite pests have been reported to attack cotton crop in Pakistan (Yunus and Yousaf, 1979). The insect pests cause heavy qualitative and quantitative losses varying from 40-50% (Naqvi, 1976). Among the insect pests, the sucking insect pests are regarded as key pests i.e. sucking pest complex: Jassid (*Amerasca devastans* Dist.), Thrips (*Thrips tabaci* Lind), Whitefly (*Bemisia tabaci* Gennadius) and Aphids (*Aphis gossypii* Glov) and might be responsible for 50% reduction in boll production. Futhermore, bolls from healthy plants produce about 33.3% more lint than those from normally infested plants (Hussain and Trehan, 1942).

The continuous and indiscriminate use of synthetic pesticides led to adoption of IPM approaches which are very useful potential means of ameliorating commodity losses to pests, thereby enhancing the long term sustainability of agro ecosystem. Under Integrated Pest Management (IPM), host plant resistance is internationally recognized approach. The varietal resistance can play an important role in compatible with different pest control tactics of IPM (Ali and Ahmad, 1982; Bughio *et al*., 1984; Jin *et al*., 1999; Hua and Hua, 2001 and Khan *et al*., 2003). Plant resistance provides an effective management of insect pests as a economical and environmentally safe strategy (Pedigo, 1989; Khan and Sexena, 1998). Current approaches improve resistance levels in cotton include use of genetic engineering that is gaining momentum in developed as well as developing countries. Transgenic cotton varieties containing *Bacillus thuringiensis* (Bt) have become an important tool for integrated pest management (IPM) program. Bt can colonize and kill a variety of host insects and even nematodes. But each strain of Bt does so with a high degree of specificity, which is mainly determined by the type of crystal proteins that the bacterium produces during sporulation (De-Maagd *et al*., 2001).

Bhatnagar and Sharma (1991) studied the population of sucking insect pests on different cotton varieties and concluded that okra leaf and frego bract varieties were less infested than glandless varieties. Fair banks *et al.* (1999) evaluated cotton varieties for tolerance to thrips feeding. Hernandez *et al.* (1999) studied upland cotton varieties to assess whitefly incidence and its effect on lint and seed cotton yield and observed no significant difference in yield. Other researchers who found significant results include Sontakke *et al.* (2000); Natwick *et al.* (2002) and Nizamani *et al.* (2002).

Keeping in view the endeavor of aforementioned researchers, this project was planed to study the resistance level of different cotton varieties to sucking complex i.e. thrips, jassids and whiteflies.

MATERIALS AND METHODS

Experimental trail was conducted at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad. The materials employed in the present studies were a field grown crop of six cotton varieties, viz. MNH-635, NIAB-86, SLH-257, CIM-446, CIM-482 and NIAB Karishma as well as a field available a lot of three sucking insect pests viz. cotton whiteflies, cotton jassids and cotton thrips. The trail was laid out in randomized complete block design (RCBD). There were three replicates for each treatment of variety combination. The data were collected early in the morning at weekly interval. Three plants were selected from each replicate at random and population of whitefly, jassid and thrips was counted from upper, middle and lower portion of each plant. The average population of insect pests per leaf basis was considered to be an indirect reflection of insect pests resistance in plants, under reference, in these studies. The difference between treatment means for various parameters was calculated through a Duncan’s multiple range test (Steel and Torrie, 1980) at 5% level of probability with the help of randomized complete block design (RCBD).

RESULTS AND DISCUSSION

The data regarding the over all mean population of whitefly on different varieties is shown in Table-1. The results revealed that the maximum mean population of whitefly was observed on NIAB-86 (3.821/Leaf) which was statistically different from all other varieties, whereas MNH-635 (3.501/Leaf) and SLH-257 (3.49/Leaf) showed medium population of whitefly and were statistically at par with one another. The minimum mean population of whitefly was observed on CIM-446 (3.028 /Leaf) which was statistically similar to CIM-482 (3.119/Leaf) and statistically different from all other tested varieties.

The data regarding mean population of jassid on different genotypes of cotton is displayed in Table 2. The results revealed that the maximum jassid population was observed on NIAB-86 (0.968 /Leaf) followed by SLH-257 (0.876 /Leaf) and MNH-635 (0.876 /Leaf) and were statistically similar to each other. Whereas the minimum jassid population was observed on CIM-446 (0.548/Leaf) which was statistically at par with CIM-482 (0.670 /leaf) and NIAB Karishma (0.6911/Leaf) and statistically at par with each other.

Table 1. Comparison of means of Whitefly population on different cotton cultivars.

Sr. No.	Cultivars	Means
1.	NIAB-86	3.821 a
2.	MNH-635	3.501 b
3.	SLH-257	3.494 b
4.	NIAB-Karishma	3.254 c
5.	CIM-482	3.119 d
6.	CIM-446	3.028 d

LSD=0.4115 any two means not sharing a common letter differ significantly.

Table 2. Comparison of means of Jassid population on different cotton cultivars.

Sr. No.	Cultivars	Means
1.	NIAB-86	0.9689 a
2.	MNH-635	0.8761 a
3.	SLH-257	0.8678 a
4.	NIAB-Karishma	0.6911 b
5.	CIM-482	0.6700 b
6.	CIM-446	0.5486 b

LSD= 0.1853 any two means not sharing a common letter differ significantly.

Table 3. Comparison of means of Thrips population on different cotton cultivars.

Sr. No.	Cultivars	Means
1.	CIM-446	6.094 a
2.	NIAB-Karishma	5.869 b
3.	NIAB-86	5.517 b
4.	CIM-482	5.313 bc
5.	MNH-635	5.211 cd
6.	SLH-257	5.011 d

LSD=0.2548 any two means not sharing a common letter differ significantly.

Table-3 displayed the comparison of thrips population in different cotton varieties. The perusal of the data showed that the maximum thrips population was observed on CIM-446 (6.094 /Leaf) which showed statistically incompatibility with other varieties, whereas, NIAB- Karishma (5.869 /Leaf), NIAB-86(5.517) and CIM-482(5.313) revealed intermediate thrips population and found statistically similar one another. Minimum thrips population was recorded on SLH-257(5.0111/Leaf) and was statistically at par with MNH-635 (5.21 /Leaf).Table 4 displayed the population of whitefly, jassid and thrips on different cotton varieties from 3rd of July to 2nd week of October. The perusal of the data showed that the population trend of all the insects remained below ETL except the population of jassid during 3rd, 4th weeks of July and 1st week of August remained above ETL on MNH-635, NIAB-86 and SLH-257 while on CIM-446 and NIAB-Karishma

Table 4. Population of Whitefly, Jassid and Thrips on different cotton cultivars from July to October.

Dates	MNH-635			NIAB-86			SLH-257			CIM-446			CIM-482			NIAB-KARISHMA		
	Whitefly	Jassid	Thrips	Whitefly	Jassid	Thrips	Whitefly	Jassid	Thrips	Whitefly	Jassid	Thrips	Whitefly	Jassid	Thrips	Whitefly	Jassid	Thrips
D1	4.513	3.717	5.330	4.367	5.279	5.517	4.257	3.797	5.440	4.627	3.063	6.400	4.627	2.957	5.437	5.480	3.787	5.810
D2	3.700	1.863	5.477	4.623	1.357	5.920	2.293	2.643	5.697	3.700	0.510	6.623	4.627	0.770	5.957	4.920	0.507	6.513
D3	3.623	1.550	6.143	4.513	1.553	5.180	4.103	2.067	5.773	3.513	0.773	6.847	4.257	1.367	6.80	4.513	1.363	7.067
D4	3.590	0.403	6.290	4.403	0.477	6.550	5.993	0.847	5.773	3.400	0.660	7.180	3.513	1.070	6.477	4.217	0.330	7.257
D5	3.590	0.33	6.217	4.180	0.110	6.180	3.697	0.110	5.660	3.030	0.073	6.960	3.253	0.147	6.143	3.440	0.660	7.030
D6	3.513	0.073	5.737	4.067	0.367	5.993	3.437	0.293	5.367	2.993	0.293	6.700	2.847	0.773	5.887	2.770	0.220	6.480
D7	3.587	0.073	5.403	3.773	0.220	5.737	3.367	0.330	5.033	2.957	0.293	6.327	2.847	0.257	5.660	2.847	0.220	6.107
D8	3.550	0.367	5.070	3.590	0.110	5.513	3.433	0.147	4.847	2.733	0.147	5.887	2.847	0.073	5.073	2.623	0.147	5.590
D9	3.253	0.550	4.627	3.357	0.403	5.107	3.553	0.147	4.513	2.660	0.257	5.627	2.253	0.220	4.627	2.403	0.220	5.143
D10	3.143	0.367	4.330	3.400	0.560	4.773	3.067	0.293	4.217	2.180	0.073	5.363	2.440	0.293	4.257	2.147	0.257	4.740
D11	3.847	0.380	4.067	3.293	0.563	4.553	2.590	0.293	4.107	2.107	0.220	4.887	1.993	0.257	3.960	1.883	0.183	4.513
D12	3.107	0.737	3.847	2.290	0.610	4.180	2.143	0.147	3.700	2.440	0.220	4.330	1.920	0.110	4.103	1.807	0.147	4.180
Total	42.012	10.513	62.532	45.852	11.628	66.204	41.928	10.413	60.132	36.336	6.576	73.128	37.428	8.04	63.756	39.048	8.293	70.428
Mean	3.501	0.876	5.211	3.821	0.968	5.517	3.494	0.867	5.011	3.028	0.548	6.094	3.119	0.670	5.313	3.254	0.691	5.869

D1=3rd week of July
D2=4th week of July
D3= 1st week of August
D4= 2nd week of August
D5= 3rd week of August
D6= 4th week of August
D7= 1st week of September
D8= 2nd week of September
D9= 3rd week of September
D10= 4th week of September
D11= 1st week of October
D12= 2nd week of October

during 3rd week of July and on CIM-482 during 3rd week of July and 1st week of August remained above ETL.

On the whole, it was observed that the cultivar CIM-446 showed comparatively greater resistance to the attack of whiteflies and cultivar NIAB-86 was found to be highly susceptible to whiteflies. Similarly NIAB-86, MNH-635 and SLH-257 were highly susceptible to jassid. Where as the NIAB Karishma and CIM-482 showed medium response to jassid attack. The population of thrips illustrated that cultivar SLH-257 was found resistance to a greater level against this pest per leaf population basis. There are different physio-morphic traits of cotton varieties that inflict various resistance levels against the attack of sucking complex. Many previous researchers who found significant results of host plant resistance against sucking complex i.e. Sontakke *et al.* (2000); Natwick *et al.* (2002) and Nizamani *et al* (2002). Bhatnagar and Sharma (1991) conducted host plant resistance against the population of sucking insect pests i.e. jassid, whitefly and thrips that showed okra leaf and frego bract cotton varieties were less infested than glandless varieties. Likewise, Fairbanks *et al.* (1999) evaluated cotton varieties for comparative tolerance to thrips feeding in the field condition. Hernandez *et al.* (1999) studied upland cotton varieties to assess whitefly incidence and its effect on lint and seed cotton yield and observed no significant difference in yield.

CONCLUSION

One of the safe measures to evade pest situation is to grow resistant cotton variety i.e., finding out comparative resistance in conventional cotton genotypes, is a pre-requisite for the success of an Integrated Pest Management (IPM) approach for sustainable cotton production. It is therefore inferred that host plant resistance provides an effective management of insect pests as an economical and environmentally safe strategy.

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