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SCREENING OF EXOTIC COTTON GERMPLASMS AGAINST CLCUV AND YIELD AT THE ENVIRONMENTAL CONDITIONS OF SAKRAND, SINDH

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ABSTRACT

Cotton Leaf Curl Virus is a major threat to cotton production and spreading in Sindh after Punjab. It affects whole cotton plant which results in drastically low cotton productions. It has destroyed thousands of hectares. The trial was conducted at Sakrand (Sindh) during the year 2015, to evaluate the 100 exotic cotton germplasms against CLCUV, out of them 5 lines (USG15-2515, USG15-2551, USG15-2554, USG15-2555 and USG15-2556) were found resistant against CLCUV and 39 lines were highly tolerant, 53 tolerant and 3 susceptible in the CLCUV rating scale. The CLCUV data were recorded on 30, 60, 90 and 120 days after planting. The analysis of variance indicated sufficient genetic diversity among the genotypes. Among the lines USG-15-2584 produced maximum number of bolls per plant (56.3) followed by USG15-2592 (53.6). Maximum boll weight obtained by USG15-2570 (5.1g). The maximum ginning outturn ginned by line US15-2551 (37.7%) followed by USG15-2596 (37.5%) and USG15-2564 (37.4%). For seed cotton yield per plant highest yield was produced by USG15-2595 (77.8g), whereas USG15-2588 was ranked second for seed cotton yield (74.4g). USG15-2566 gave finest fiber (3.0 µg $inch^{-1}$). Whereas USG15-2554 produced maximum fiber strength (32.3 G tex^{-1}). For staple length USG15-2554 and USG15-2585 measured long staple (31.4mm) followed by USG15-2588 and USG15-2555 which were (30.0mm).

Keywords: Screening of CLCUV, Yield, GOT, Fiber Traits and Cotton germplasm.

INTRODUCTION

Cotton is most important cash and fiber crop of Pakistan, The yield of the crop depends upon the environment and the management practices cultivar adaptability and incidence of cotton leaf curl virus disease. The performance of cotton varieties depends on the agro-climatic conditions. A well-performing variety in one area may not produce desired results if grown in a different agro-climatic zone.

Cotton leaf curls virus (CLCuV) disease appearing in cotton and symptoms shown by thickening of veins and curling of leaves. Under severe attack of this disease create foliar outgrowth called enations. The Whitefly (*Bemisia tabaci*) is the main vector which transmits this disease. The virus belongs to genus Begomovirus (family Gemini viridae) (Hameed *et al.*, 1994). Amongst the most severe uncertainties with cotton crop for last 10-15 years, cotton leaf curl virus disease found as the major factor which is influencing seed cotton yield (Farooq *et al.*, 2011). Cotton breeders of public and private sector make efforts to evolve CLCuV disease resistant varieties which combat this chronic disease through using various breeding techniques, however, those varieties become susceptible after 2-3 years. Out of 64 varieties/lines, Rashida *et al.* (2005) reported two varieties, Ravi and FDH170 to be highly resistant, 15 resistant and 12 moderately resistant to CLCuV disease. Based on screening of 11060 genotypes of cotton (exotic and local) at Cotton Research Station, Vehari during 2002 to 2007, Ahmad *et al.* (2010) reported a great deal of diversity of resistance against CLCuV on the basis of incidence and intensity of CLCuV. Li *et al.* (2008) reported that for developing elite genotypes, exploitation of existing germplasm and addition of new germplasm resources are essential to generate adequate genetic variation.

The present research was conducted to assess the exotic germplasm for resistant against cotton leaf curl virus (CLCuV) with attractive yield and economic characters for the utilization in hybridization program to evolve the new breeding material for combat with cotton leaf curl virus in Pakistan.

MATERIAL AND METHODS

The experiment was conducted to screen out the 100 US cotton germplasm for CLCuV in the environmental condition of Sakrand Sindh during the year 2015-16. Here environmental temperature ranged from 26 to 47^{o}C and relative humidity ranged from 22.3 to 54%. The sowing was conducted on the first week of May to scrutinize the potential genotypes for CLCuV susceptibility, yield, GOT and fiber traits.

The research study was performed through randomized complete block design with three replications. The plant to plant and row to row distance was kept by 30 and 75 cm, respectively. All the agronomic practices and irrigation were applied whenever required. One bag DAP fertilizer and 3 bags of Urea were applied per acre with the different growth stages (after 35 days of sowing, flowering and boll formation stage). For data collection 10 plants were randomly selected from each replication and tagged properly. The traits studied were seed cotton yield/plant (kg), boll weight (g), number of bolls per plant, ginning outturn (GOT), staple length (mm), Fiber Strength (g tex^{-1}), Micronaire value (µg $inch^{-1}$) and Uniformity Index (%). The data were to analyze statistically using Fisher's analysis of variance techniques at 5% and 1% level of probability following Steel *et al.* (1997) through using statistical softwares Statistix-8.1 and star 2.0.1.

The cotton leaf curl disease percentage was calculated by using the formula; VP = (sum of all rating scale / total numbers of plants) x 100. The CLCuV rating observations was taken on the basis of 30, 60, 90 and 120 days after sowing. The beginning of first CLCuV symptoms the plants were counted as diseased plants and tagged for more judgment of severity by diagram observation as per disease rating scale (Table-1). The disease rating scale was suggested by Akhtar *et al.* (2010) and Farooq *et al.* (2011).

Table 1. Disease rating scale for cotton leaf curl virus symptoms.

Rating	Disease Reaction	% Disease Index	Symptoms
0	Resistant	0	Complete absence of symptoms
1	Highly Tolerant	0.1-10.0	Small scattered vein thickening
2	Tolerant	10.1-30.0	Large groups of vein thickening and curling OR top of the plant affected
3	Susceptible	30.01-50.0	All vein thickening, enation and severe curling OR half of the plant affected
4	Highly Susceptible	50≤	All vein thickening, severe curling, enation and stunted plant OR whole of the plant affected and stunting

RESULTS AND DISCUSSION

The research was conducted to evaluated 100 exotic cotton germplasms at the environmental condition of Sakrand against CLCuV and yield. According to results, the CLCuV resistant/highly tolerant germplasm can utilize in breeding program to develop new resistant/ highly tolerant cotton variety. The analysis of variance presented in Table 2, which revealed that all the genotypes are highly significant for characters studied, which suggested the sufficient genetic diversity among them.

Field Screening of Cotton Leaf Curl Virus (CLCuV):

The 100 exotic cotton germplasms were screened for CLCUV in the environmental condition of Sakrand at 30, 60, 90 and 120 days after sowing. The CLCUV disease percentage was minimum (0%) in some germplasms which was resistant, whereas the highest disease percentage was observed (up to 70%) in several genotypes depicted in Table 3. In total 05 US germplasm were found resistant for CLCuV i.e. (USG15-2515, USG15-2551, USG15-2554, USG15-2555 and USG15-2556), while 39 were highly tolerant, 53 were tolerant and 03 susceptible against CLCuV after 120 days planting presented in Fig.1 a and b. These resistant parents can be utilized in breeding program at the environmental condition of Sakrand to develop resistant breeding material for overcoming the threat of CLCUV. Aslam and Gilani (2000) conducted field experiment to evaluate the 09 genotypes against CLCuV at 62, 75, 82, 97, 104 and 114 days after planting and found some difference in CLCuV percentage and reported resistant parents. Alim (1997) and Khan *et al.* (2000) conducted research and categorize the cotton genotypes for CLCuV.

The genetically diverse cotton genotypes were assessed for yield, GOT and fiber traits. The statistical data of all the traits are presented in Table-3 and graphical view of trait wise. The number of bolls $plant^{-1}$ is the most important determinant of yield; therefore high yield plant must be prolific and produce larger number of bolls. The maximum number of bolls $plant^{-1}$ was counted 56.3 and the minimum were 10.4. The line USG15-2584 formed maximum number of bolls $plant^{-1}$ ranked first as compared with other genotypes presented in Fig.2. The highest boll weight weighted by genotypes USG15-2570 (5.1g) and the lowest boll weight was (1.3g). Seed cotton yield is an important trait and the breeders of cotton have been determined hard for its improvement along with quality traits through various breeding techniques. The uppermost seed cotton yield per plant was observed in line USG15-2595 which was (77.8g), whereas the lowest yield was (14.9g). For the ginning outturn percentage the germplasm USG15-2551 ginned maximum GOT% (37.7) as compared with others, the lowest GOT was noted 20.6% which was very poor

ginned by USG15-2542. Fiber length is an important component of fiber worth. Staples of homogeneous length can manufacture higher count yarn and hence high quality material. It is quality of great interest to the cotton fiber processor. The staples were longer in genotypes USG15-2554 and USG15-2585 (30.1mm), while the shortest fiber was found in USG15-2538 (21.8mm). The strongest fiber was produced by USG15-2554 (32.3 g tex^{-1}) as compared to other germplasm. The USG15-2566 produced finest microniare value (3.0 µg $inch^{-1}$) as compared to other genotypes which gave coarse fiber up to (6.3 µg $inch^{-1}$). The uniformity index percent range was observed from 79.1 to 87.9. Aftzl *et al.* (2002), Khan *et al.* (2002) and Arshad *et al.* (2003) reported that yield, its contributing traits and fiber characteristics are affected by varietal difference in cotton.

Table 2. Analysis of variance (ANOVA) mean square values of genotypes.

SV	DF	BPP	BW	SCYPP	GOT	SL	FS	MV	UI
Replication	2	0.665	0.094	22.037	0.475	0.519	1.249	0.830	1.554
Genotypes	99	259.102**	1.887**	598.265**	35.276**	11.294**	13.391**	1.154**	9.904**
Error	198	0.521	0.032	0.622	0.166	0.027	0.069	0.071	0.089

* = significant, **= highly significant and ns= non significant

Table 3. Statistical analysis of traits of 100 cotton genotypes.

Traits	Minimum	Maximum	Average	LSD (0.5%)	S.E	C.V
CLCUV (%)	0.0	70.0	27.0	---	---	---
Bolls $plant^{-1}$	10.4	56.3	26.6	1.16	0.58	2.72
Boll weight (g)	1.3	5.1	2.9	0.28	0.14	6.08
Seed cotton yield $plant^{-1}$ (g)	14.9	77.8	43.0	0.64	1.26	1.83
Ginning outturn (%)	20.6	37.7	31.1	0.20	0.10	0.41
Staple Length (mm)	21.8	31.1	26.6	0.26	0.13	0.62
Fiber Strength (g tex^{-1})	22.1	32.3	27.2	0.42	0.21	0.97
Micronaire value (µg $inch^{-1}$)	3.0	6.3	4.5	0.43	0.21	5.85
Uniformity index (%)	79.1	87.9.	83.9	0.48	0.24	0.36

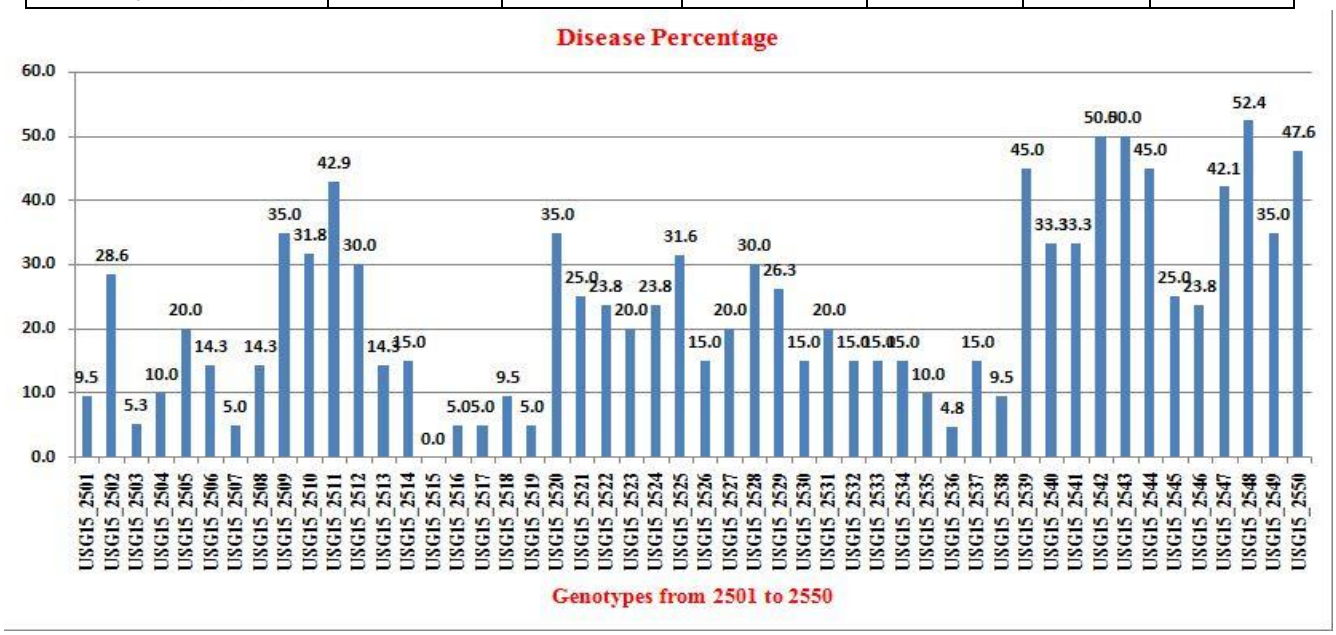

Fig. 1(a). Disease percentage of 100 exotic germplasms (from 2501 to 2550).

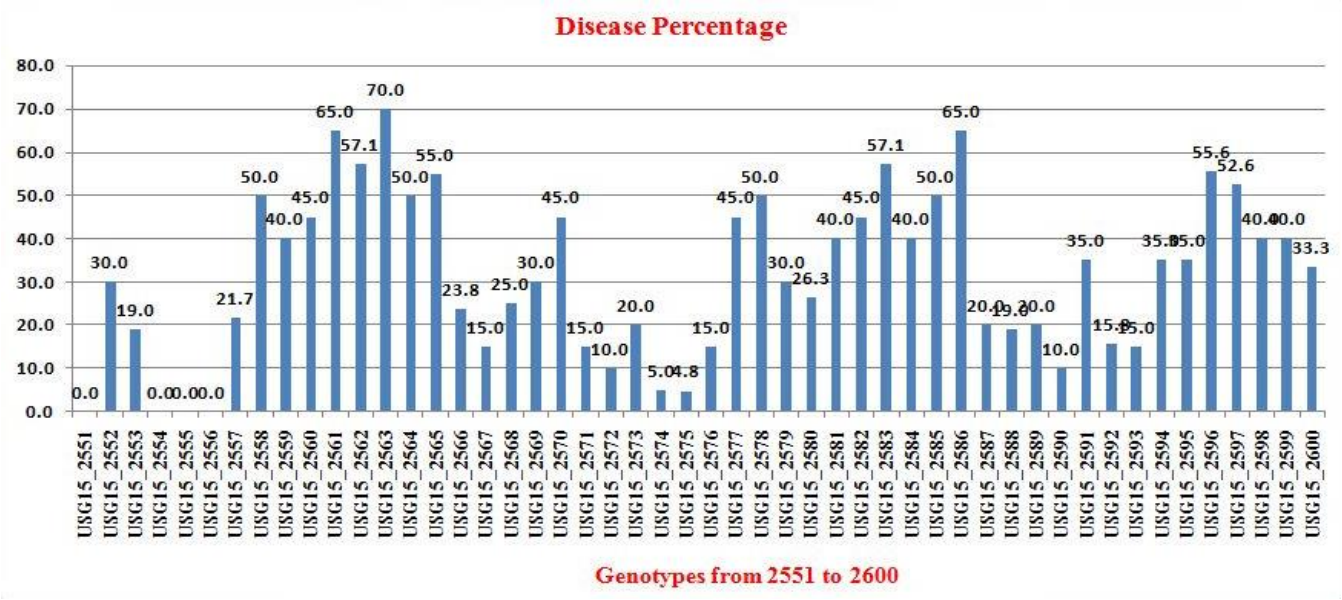

Fig. 1(b). Disease percentage of 100 exotic germplasms (from 2551 to 2600).

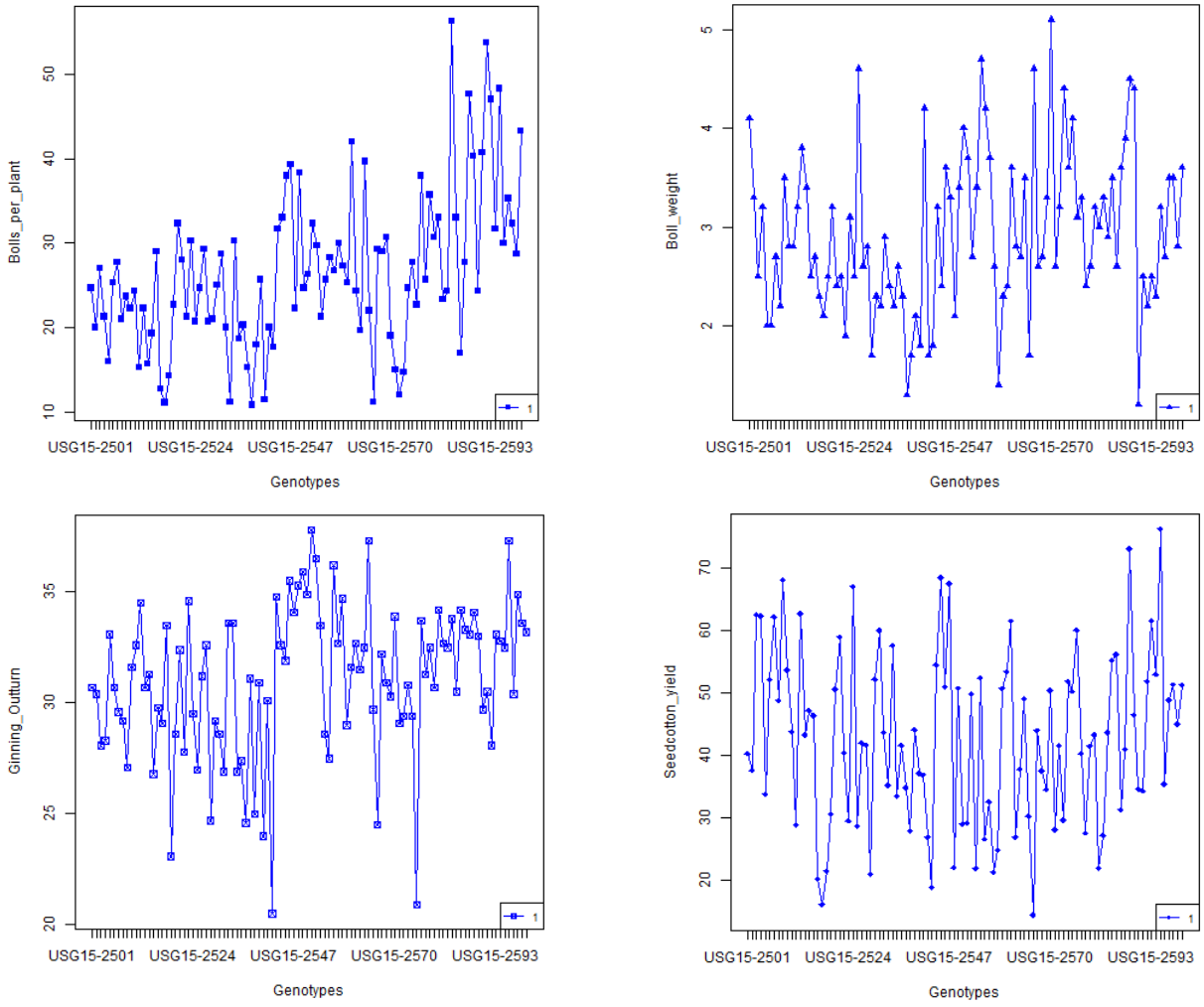

Fig.2a. Assessment of various germplasms for trails.

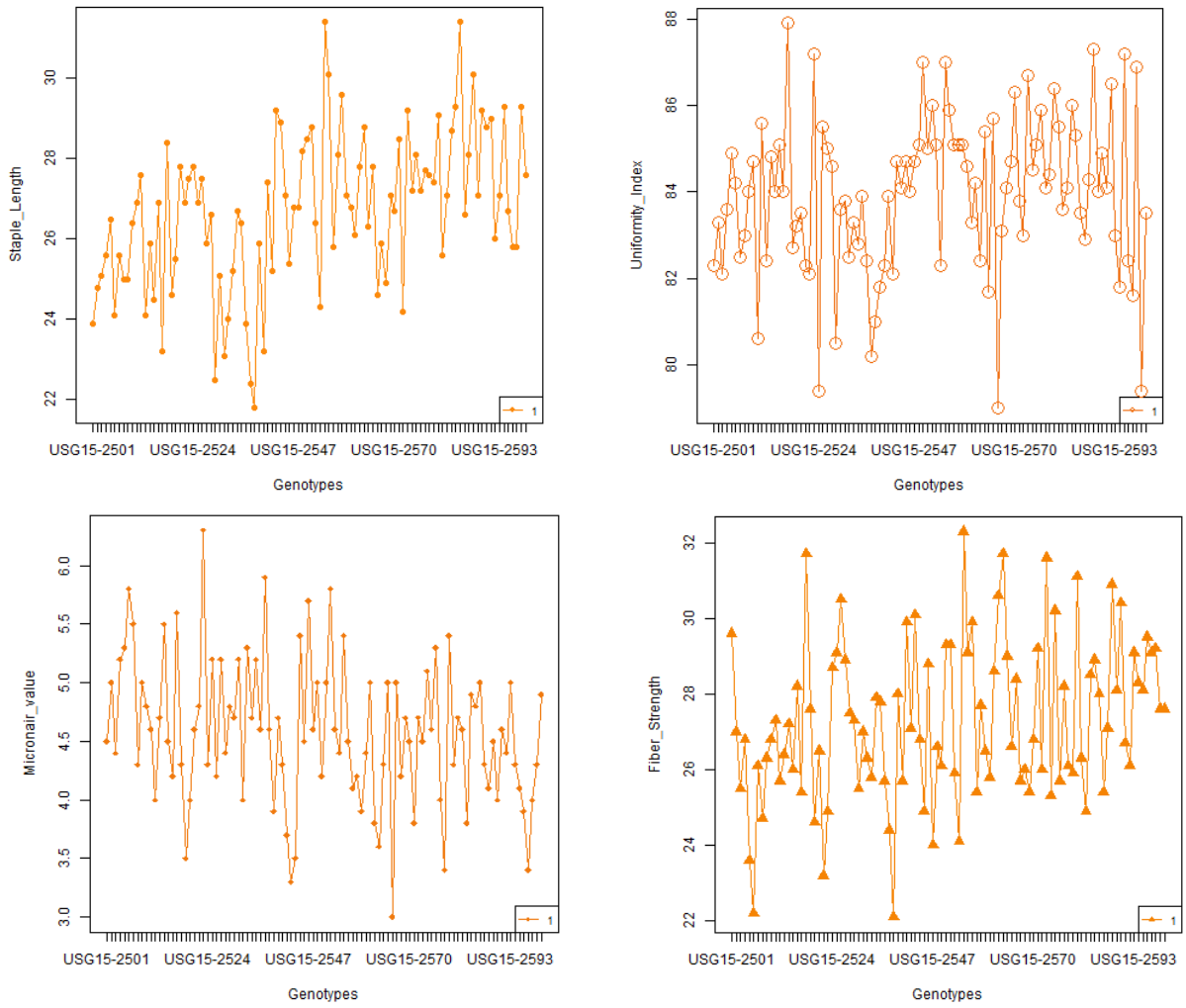

Fig.2b. Assessment of various germplasms for trails.

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