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BIOMETRICAL ANALYSIS OF SOME QUANTITATIVE TRAITS OF COTTON (*GOSSYPIUMHIRSUTUM* L.)

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Abstract: The present investigation was aimed to determine the general specific combining of the parents and hybrids respectively. Five parents viz. NIAB-78, Chandi, Haridost, CRIS-134 and Shahbaz were used to evolve in ten F_1 hybrids through diallel mating design. The seeds of F_1 hybrids along with their parents were sown in Randomized complete Block Design (RCBD) with three replication during 2011-12. All the characters were highly significant at $P \leq 0.01$ and GCA and SCA variances were also significant for all the character studied. Among the parents, NIAB-78, Haridost and CRIS-134 were best combiners for plant height, sympodial branches per plant, bolls per plant, and seed cotton yield per plant. The progeny NIAB-78 x Chandi proved to be the best specific combiner for plant height and bolls per plant and CRIS-134 x Haridost for sympodial branches per plant.

Introduction

Cotton is an important crop all over the world due to its utilization and cultivation. It is one of the most significant cash crops beside groundnut (Simon et al2013). It is the major source of foreign exchange of Pakistan and provides fibre, food and fuel to millions of people in the world and also useful to animals (Syed et al 1993). All parts of the cotton plant is useful however, the most important part is the fiber or lint, which is used in making cotton cloth. Linters, the short fuzz on the seed are the fine silky fibres which adhere to the seeds after

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ginning. Many fabrics are made completely of cotton, some materials blend cotton with other fibers, including rayon and synthetic fibers such as polyester. There is clear archaeological evidence that people in India and South America domesticated different species of cotton independently thousands of years ago (WTO, 2006).

It is well known phenomenon to cotton breeders that, certain crosses make better combinations than the others in transmitting favourable parental traits/genes to their offspring. Diallel analysis is a useful breeding method in genetics which provide information of inheritance for a fixed set of parents, including general and specific combining abilities (anastolva). It is a technique in plant breeding useful for identification and choice of superior genotypes with desirable characters imposing promising increase in production per unit area (Naqibullah et al 2009).

The diallele analysis has been used more than any other matting design to designate general combining ability (GCA) and specific combine ability (SCA) of the parents, thereby, obtaining the information on the types of gene actions controlling different quantitative traits in cotton (Paulo Antonio et al 2007).

Keeping in view the need of increasing yield of cotton and to the face ever increasing human population, the present study was designed to generate the information about the combining ability of parents in various plant characters of cotton.

Material and Methods

An experiment was conducted at the experimental field of Botanical Garden at the Department of Plant Breeding and Genetics, Sindh Agriculture University Tandojam, Hyderabad, Pakistan, during Kharif season 2011-12. The experimental material consisted of five parental varieties viz. NIAB-78, Chandi-95, CRIS-134, Haridost and Shahbaz belonging to upland cotton (*Gossypiumhirsutum*L.). The seed of ten hybrids developed by half diallel crosses was obtained from the Department of Plant Breeding and Genetics, Sindh Agriculture University, Tandojam. The seed was sown in Randomized Complete Block Design (RCBD) with three replications. The characters studied were plant height (cm), sympodial branches plant^{-1}, number of bolls plant^{-1} and seed cotton yield plant^{-1} (g).

Statistical analysis:

The analysis of variance was carried-out according to procedures adopted by Gomez and Gomez (1984). The general combining ability and specific combing ability was analyzed as described by Comstock and Robinson 1948 adopted by Haullauer and Miranda 1986. GCA and SCA effects of parents will be calculated by adopting Griffing (1956) statistical procedures described by Singh and Chaudhary (1974).

Results and Discussion

The mean squares from analysis of variance for genotypes general and specific combining ability showed highly significant at $P \leq 0.01$ (Table-1) for the traits plant height (cm), sympodial branches plant^{-1}, number of bolls plant^{-1} and seed cotton yield plant^{-1} (g).In previous studies also the mean squares for general combining ability (gca) and specific combining ability (sca) effects were highly significant for all the traits which proposed that additive and non-additive type of gene action controlled the traits.(Pauolo et al 2007; Wankhade*et al.* 2008; Saadabadi and Tahmasebi 2008).The maximum (4.420) GCA effect was produced by the parent Haridost followed by NIAB-78 (4.208) for plant height (cm). However, four crosses out of ten recorded positive SCA effects while rest showed negative SCA effect for plant height. The top three crosses were, NIAB-78 x Chandi, NIAB-78 x CRIS-134 and Chandi x Shahbaz (10.91, 8.351 and 3.35) SCA effect for plant height respectively (Table -2).Leghari*et al.* (2004) and Fan *et al.* (2004) also reported significant positive GCA and SCA effects for plant height. For sympodial branches per plant (Table-2) showed that three parent, CRIS-134, NIAB-78 and Haridost (2.800, 2.890 and 2.150) contributed positive GCA effect for sympodial branches per plant while Chandi and Shahbaz gave negative (-4.310 and -2.85) GCA effect for this trait respectively. Among the hybrids, four recorded negative SCA effect and rest showed positive SCA effects for sympodial branches per plant. However, the cross CRIS-134 x Haridost revealed highest (4.40) SCA effect for this trait.Similar results were obtained by Basal and Turgut (2003) who observed positive GCA and SCA effects for sympodial branches per plant. Theparent CRIS-134 (3.450) revealed better GCA effects than other parents for bolls per plant. The hybrid NIAB-78 x Chandi, NIAB-78 x Shahbaz ,Chandi x Haridost and CRIS-134 x Shahbaz produced maximum (6.68, 5.51, 4.15 and 4.15) SCA effects number of bolls per plant

respectively (Table-2). Significant GCA and SCA variance for number of bolls per plant was reported also by previous investigators (Ahmed (2006) and Gong *et al.* (2005) For grain yield three parents Haridost, Shahbaz and CRIS-134 had positive (15.150, 10.410 and 1.190) GCA effects for seed cotton yield per plant while NIAB-78 (-17.00) and Chandi (-13.450) regarding negative GCA effects for seed cotton yield per plant. Eight crosses out of ten showed positive SCA effects for seed cotton yield per plant. The top three scoring in SCA effects were Chandi x CRIS-134 (17.50), NIAB-78 x Shahbaz (13.41) and NIAB-78 x Haridost (12.350) for seed cotton yield per plant. Similar results were obtained by Kiani*et al.* (2007), Pole *et al.* (2008), Gong *et al. (*2005), Channa*et al.,* (2006) and Rashid *et al.* (2008) they all reportedsignificant GCA and SCA variances for seed cotton yield per plant and proved that the hybrids will be good general combiners for characters like plant height (cm), sympodial branches plant^{-1}, number of bolls plant^{-1} and seed cotton yield (g) concluding as allthe traits were controlled by both additive and non-additive type of gene action.

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Table-1: Mean square from analysis of variance for genotypes, GCA and SCA for some quantitative traits of cotton

Source of variation	D.F	Plant height (cm)	Sympodial branches plant^{-1}	No. of bolls plant^{-1}	Seed cotton yield plant^{-1} (g)
Replications	2	0.550	2.110	4.692	70.350
Genotypes	14	214.35**	42.410**	120.35**	1200.35**
GCA	4	290.00	40.430	75.340	1000.45
SCA	9	160.78	35.395	55.350	820.10
Error	28	2.359	1.698	1.435	60.350

** Significant at 1% level of probability, * Significant at 5% level of probability, N.S Non-significant

Table-2: General combining ability (GCA) and Specific combining ability (SCA) effects recorded for various quantitative traits.

		Plant height (cm)	Sympodial branches plant^{-1}	No. of bolls plant^{-1}	Seed cotton yield plant^{-1} (g)
S. No	**Genotypes**	**GCA and SCA**			
1	NIAB-78	4.208	2.890	-1.860	-17.00
2	Chandi	-4.10	-4.310	-2.350	-13.45
3	CRIS-134	-0.564	2.800	3.450	5.190
4	Haridost	4.420	2.150	-1.341	15.150
5	Shahbaz	-5.300	-2.85	-1.650	10.410
	S.E (gi-gj)	±0.415	±0.391	±0.439	±4.352
6	NIAB-78 x Chandi	10.91	2.61	6.68	0.75
7	NIAB-78 x CRIS-134	8.351	3.51	-3.41	10.15
8	NIAB-78 x Haridost	- 4.41	-2.31	-3.15	12.35
9	NIAB-78 x Shabaz	-4.40	4.35	5.51	13.41
10	Chandi x CRIS-134	-3.51	-1.89	3.35	17.50
11	Chandi x Haridost	- 10.89	-4.30	4.15	-14.30
12	Chandi x Shahbaz	4.35	-2.14	-3.20	-11.10
13	CRIS-134 x Haridost	3.44	4.40	-3.41	10.75
14	CRIS-134 x Shahbaz	-3.35	2.15	4.15	2.20
15	Haridost x Shahbaz	-6.60	1.89	3.151	4.45
	L.S.D	1.744	1.680	1.865	0.191
	S.E. (gi)	- ± 1.340	- ± 0.675	- ± 1.890	- ± 8.359