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COMBINING ABILITY STUDIES FOR FIBRE TRAITS IN UPLAND COTTON (GOSSYPIUM HIRSUTUM L.) UNDER DROUGHT STRESS CONDITION

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Abstract

A eight parent diallel cross (without reciprocal) of *Gossypium hirsutum* L. were studied to determine general and specific combining ability (GCA , SCA) variance and effects under drought stress condition for five fibre traits (halo length, uniformity, halo strength, elongation and micronare index). GCA variance was significant for all the studied traits. SCA was significant only for elongation trait; GCA/SCA variance was greater than the unit for this trait. The variance of GCA and SCA showed the importance of additive genetic variance in the inheritance of fibre traits under drought stress condition. GCA effect indicated that the parental variety Tashkent 9 was one of the best combiners for all the studied traits. SCA effect showed that the cross Zaire x Paymaster 792 was interested from the breeding point of view for uniformity, halo strength and micronaire index.

Introduction

Fiber traits consider from the most affected traits by drought stress conditions. Lopez 1998 detected the presence of genotypic variation for halo length, resistance, uniformity, elongation and micronaire index under drought stress condition, which permit make genetic study for future using in breeding program. One of the most important steps in a breeding program to improve fiber traits under drought conditions is to detect the most suitable parents. In this work, we use combining ability analysis as a powerful tool to discriminate between good and poor combiners and for choosing appropriate crosses.

Materials and Methods

Eight parents of Upland cotton (*Gossypium hirsutum*, L) were crossed in all possible combinations excluding reciprocals to form 28 F1 crosses. The list of parental varieties, their origin and characters are presented in Table 1. The eight parents and their 28 F1 crossed were grown under drought stress condition in Tomijel, Carmona (Seville, SW Spain) during the 1998 season. Experimental design was a randomized complete block design with four replications; the main plot consisted of one row 5 m long and 0.95 cm between rows. Studied traits were: halo length, uniformity, halo strength, elongation and micronaire index, using the high volume instrument (HVI) with small random sample of fiber previously ginned for every genotype. Data were analyzed using Griffing diallel analysis (1956), model 1 method 2.

Results and Discussions

General combining ability (GCA) variance was significant for all the studied traits (Table 2). Specific combining ability (SCA) variance was significant only for elongation trait (Table). GCA/SCA variance (Table 2) was greater than the unit for all the studied traits, which indicate the importance of additive genetic variance in the inheritance of fiber traits under drought stress condition.

General combining ability effect (Table 3) indicated that the Tashkent 9 parent showed significant and desirable sign for all the studied traits. These results indicate that the parental variety Tashkent 9 could recommended as a good parent in a breeding program to improve fiber traits under drought stress condition.

Specific combining ability effect (Table 4) revealed that the cross Zaire x Paymaster 792 showed significant and desirable sign for uniformity, halo strength and micronaire index; and the cross Maria del Mar x Paymaster 792 showed the same for halo strength and elongation. Therefore these two crosses would be of practical interest in a breeding program for hybrid cotton production or for the conventional breeding procedures to improve fiber traits under drought stress condition.

The correlation coefficients (r) of parental mean performance with their corresponding general combining ability effects were found to be positive and highly significant for almost all the studied traits (Table 3), and the magnitude of additive genetic variance was high as previously shown. Therefore it may be concluded that the per se performance of the parents may be a good indicator of their general combining ability for yield and yield components under drought condition. These results are also in agreement with those obtained by El- Lawendey (1999).

References

El-Lawendey, M.M.A. 1999. Studies on cotton breeding. Ph.D. thesis. Faculty of Agriculture Kafr El-Sheikh. Tanta University. Egypt.

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Table 1. List of cotton genotypes with reference to their origin and characteristics.

Parental varieties	Abbreviation	Origin	Characteristics
María del Mar	MªMar	Spain	High drought tolerant- Mid season
Victoria	Victoria	Spain	Medium drought tolerant- Long season
Zaire (407/1157)	Zaire	Zaire	Low drought tolerant- Long season
Precoce 1	Precoce 1	Brazil	Medium drought tolerant - Early season
CNPA 3H	CNPA 3H	Brazil	Medium drought tolerant - Mid season
Acala 1517/77/BR	AC 1517	USA	Medium drought tolerant – Long season
Paymaster 792	Pay 792	USA	Low drought tolerant- Early season
Tashkent 9	Tashkent 9	Uzbekistan	High drought tolerant- Early season

Table 2. Mean Sum of Square for the combining ability analysis for halo length, resistance, elongation and micronaire index.

Source of Variance	D.F.	Halo Length	Uniformity	Halo Strength	Elongation	Micronaire
GCA	7	7.892**	12.828**	47.14**	5.66**	0.708**
SCA	28	1.084	1.756	2.58	0.26*	0.096
ERROR	105	0.98	1.430	2.14	0.16	0.097
GCA/SCA	-	7.28	7.31	18.22	22.11	7.38

* Significant at 5% level
** Significant at 1% level

Table 3. Estimates of General Combining Ability Effects for halo length, resistance, elongation and micronaire index.

Parents	Halo length	Uniformity	Halo strength	Elongation	Micronaire Index
María de Mar	0.55**	0.42*	-0.31	0.09	0.19**
Victoria	0.19	-0.09	-0.94**	-0.14*	0.18**
Zaire (407/1157)	-0.85**	-1.24**	-1.33**	-0.68**	-0.17**
Precoce 1	-0.04	-0.25	-1.07**	-0.36**	-0.09*
CNPA 3H	-0.07	0.03	0.19	0.08	-0.02
Acala 1517/77/BR	-0.08	0.26	1.44**	0.42**	0.04
Paymaster 792	-0.32*	0.32	0.71**	0.23**	-0.01
Tashkent 9	0.46**	0.55**	1.32**	0.36**	-0.12*
L.S.D 0.05 (g_i)	0.29	0.35	0.43	0.12	0.09
L.S.D 0.01 (g_i)	0.38	0.46	0.57	0.15	0.12
L.S.D 0.05 (g_i-g_j)	0.44	0.53	0.65	0.18	0.14
L.S.D 0.01 (g_i-g_j)	0.58	0.70	0.86	0.23	0.18
r	0.96**	0.94**	0.95**	0.98**	0.91**

* Significant at 5% level
** Significant at 1% level
r: correlation coefficient between parentales mean behaviors and their corresponding general combining ability effects

Table 4. Estimates of Specific Combining Ability Effects for halo length, resistance, elongation and micronaire index.

Crosses	Halo length	Uniformity	Resistance	Elongation	Micronaire Index
MªMar x Victoria	-0.43	0.19	-0.49	-0.21	-0.06
MªMar x Zaire	0.71	0.26	0.50	0.05	-0.05
MªMar x Precoce 1	0.01	-0.05	0.04	-0.12	0.07
MªMar x CNPA 3H	0.11	0.77	0.22	-0.01	-0.01
MªMar x AC 1517	-0.06	-0.32	-0.67	-0.15	0.16
MªMar x Pay 792	0.39	0.08	1.29*	0.47**	0.18
MªMar x Tashkent 9	-0.07	-0.92	-0.45	-0.09	-0.16
Victoria x Zaire	0.74	-0.28	-0.65	-0.18	-0.05
Victoria x Precoce 1	0.24	0.11	0.19	-0.05	0.03
Victoria x CNPA 3H	0.04	-0.38	-0.25	0.11	0.13
Victoria x AC 1517	-0.03	0.51	-0.92	-0.08	0.14
Victoria x Pay 792	0.12	0.41	0.56	0.33*	0.12
Victoria x Tashkent 9	-0.14	-0.02	0.65	0.08	-0.15
Zaire x Precoce 1	-0.15	1.01*	0.41	0.26	0.13
Zaire x CNPA 3H	0.83*	-0.25	0.42	0.07	0.03
Zaire x AC 1517	-0.15	-0.54	0.45	0.21	0.02
Zaire x Pay 792	0.73	1.11*	1.75**	0.20	-0.28*
Zaire x Tashkent 9	-0.78*	-0.17	-0.03	0.24	0.33**
Precoce 1 x CNPA 3H	0.50	0.61	0.86	0.53**	0.00
Precoce 1 x AC 1517	-0.20	-0.55	0.24	0.06	0.07
Precoce 1 x Pay 792	-0.15	-0.66	-1.31*	-0.30	-0.01
Precoce 1 x Tashkent 9	-0.53	-0.18	-0.92	-0.18	0.00
CNPA 3H x AC 1517	0.45	0.97*	0.90	0.17	-0.11
CNPA 3H x Pay 792	-0.14	-0.59	0.13	-0.37*	-0.34**
CNPA 3H x Tashkent 9	0.15	0.86	0.09	0.28	0.15
AC1517 x Pay 792	0.38	0.20	-0.44	-0.01	-0.15
AC1517 x Tashkent 9	0.49	1.35**	0.50	0.14	-0.17
Pay 792 x Tashkent 9	0.10	-0.15	0.16	0.00	0.11
L.S.D. 0.05 (Sij)	0.77	0.94	1.14	0.31	0.24
L.S.D. 0.01 (Sij)	1.02	1.24	1.51	0.41	0.32
L.S.D. 0.05 (Sij - Sik)	1.32	1.59	1.94	0.53	0.41
L.S.D. 0.01 (Sij - Sik)	1.74	2.10	2.57	0.70	0.55
L.S.D. 0.05 (Sij - Skl)	1.24	1.50	1.83	0.50	0.39
L.S.D. 0.01 (Sij - Skl)	1.64	1.98	2.42	0.66	0.52

* Significant at 5% level

** Significant at 1% level