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BREEDING VALUE OF A FUZZLESS–LINTLESS MUTANT IN *GOSSYPIUM HIRSUTUM* L.

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ABSTRACT

A study was undertaken to assess the genetic worth of a fuzzless–lintless spontaneous mutant of variety MCU 5 of *G. hirsutum*. It was crossed with other genotypes in line x tester design and the combining ability effects were worked out. This mutant had significantly favourable gca effects for seed index, uniformity ratio and maturity of fibres, indicating that the natural mutation has not only affected the major gene for the presence of fuzz or lint, but also influenced other yield and fibre characters through pleiotropism. It will be ideal to combine this mutant separately with MCU 5, DS 28 and MCU 9 to get favourable recombinants for all the fibre traits besides lint yield. The hybrid Express Sindh (W) x fuzzless–lintless mutant appears to be best, combining all the traits studied, thus paving way for exploitation of heterosis in intra-hirsutum crosses.

Key words: Breeding value, lintless mutant, cotton, *G. hirsutum*.

A single plant with fuzzless–lintless seeds was identified from the crop of cotton variety MCU 5 [1]. This spontaneous mutation has been maintained as a pure fuzzless–lintless type in the germplasm collections of *G. hirsutum* at the Cotton Breeding Station, Tamil Nadu Agricultural University, Coimbatore. Even though many workers have studied the inheritance of fuzzless [2, 3] and lintless [4, 5] traits in the *Gossypium*, species, no one has determined the breeding value of such genotypes. The present study has been undertaken to determine the breeding value of this fuzzless–lintless mutation.

MATERIALS AND METHODS

Fifteen genotypes with different geographic region, formed the lines. Three high yielding commercial strains, viz., MCU 5, MCU 7 and DS 28 along with the fuzzless–lintless type were taken as testers. The crosses were made between the lines and testers in line x

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tester design. The resultant 60 hybrids along with 19 parents were raised in randomised block design with three replications. Each genotype was accommodated in a single row of 3 m length. A spacing of 75 cm between and 30 cm within row was adopted. Observations on seven economic traits were recorded on all the ten plants in each genotype. The mean values of ten plants from each replication of all genotypes were subjected to analysis of variance for line x tester crossing design [6] for combining ability studies.

RESULTS AND DISCUSSION

The general combining ability (gca) effects of parents for all the seven traits studied are presented in Table 1. In the choice of parents, high mean value has been the main criterion for selection in the breeding programmes for a long time. However, combining ability of parents gives useful information on the choice of parents in terms of expected performance of their hybrids and their progenies. In the present study, the fuzzless–lintless mutant was

Table 1. General combining ability effects of parents in cotton

Parent	Lint yield per plant	Lint index	Seed index	2.5% span length	Uniformity ratio	Fibre fineness	Maturity coefficient
Lines:							
Saudi Arabia	0.49	0.03	0.20*	0.44**	–0.36	9.8*	0.56*
EL 405	–1.20*	0.71*	0.60*	1.70*	–1.02*	1.7	0.39
Miller 45-9	–1.28*	–0.13*	–0.33*	–0.52*	0.06	10.1*	0.64*
Express Sindh (W)	–2.50*	–0.52*	0.24*	–0.73*	1.56*	–18.4*	0.47
153E	1.25*	0.33*	–0.23*	–0.89*	0.14	–0.8	0.56*
Rex Smooth Leaf	1.68*	0.01	–0.16*	–0.49*	0.23	2.2	–0.60*
Krishna	1.61*	0.16*	0.33*	0.75*	–0.02	4.6*	–0.03
Coker 201	1.21*	0.14*	0.41*	0.73*	–0.27	4.6*	0.72*
MCU 9	2.36*	0.41*	0.71*	1.70*	–2.02*	–5.7*	–4.53*
BP52NC63	0.16	0.29*	0.10	–1.86*	–0.44*	8.6*	1.31*
JR 52	–0.56	–0.11*	0.14	0.50*	0.48*	0.7	–0.35
McNamara Wine Sap	–9.42*	–1.26*	–1.36*	–3.00*	0.39	9.2*	0.90*
Sindis Wild	0.99*	0.04	–0.20*	–0.08	1.39*	–21.1*	–1.86*
Piedmont Cleveland	3.58*	0.02	–0.28*	1.92*	–0.27	1.2	2.31*
Alagodenlas Brenas	1.68*	–0.12*	–0.17*	–0.15	0.23	–6.7*	–0.53*
S.E.*	0.41	0.05	0.08	0.13	0.21	1.8	0.26
Testers:							
MCU 5	1.70*	0.18*	0.41*	2.02*	0.68*	–11.6*	–2.49*
Fuzzless-lintless mutant	–4.51*	–0.84*	0.11*	–2.01*	1.37*	14.0*	1.44*
MCU 7	0.53*	–0.51*	–0.84*	–1.90*	1.19*	–2.4*	1.00*
DS 28	2.29*	1.17*	0.32*	1.89*	–3.21*	0.0	0.04
S.E.	0.21	0.03	0.04	0.07	0.11	0.9	0.13

*Significant at 5% level.

found to possess more favourable genes for seed index, uniformity ratio, and maturity coefficient as is apparent from the significantly high gca effects. Among the other parents, DS 28 was found to possess more favourable genes for lint yield, lint index, seed index and 2.5% span length. However, it was found to have undesirable genes for uniformity ratio as seen from the significant negative gca effects. Similarly, MCU 5 was found to be a good donor of lint yield, lint index, seed index, 2.5% span length, uniformity ratio, and fibre fineness; but apparently it does not have desirable genes for maturity coefficient. Likewise, MCU 9 carries favourable genes for lint yield, lint index, seed index, 2.5% span length and fibre fineness, but it also has unfavourable genes for uniformity and maturity of fibre. Sprague and Tatum [7] proposed that additive gene action is reflected by gca effects. Hence, only those parents, which possessed favourable gca effects for different traits, should be used for recombination so that many segregates can be obtained with superior performance for all the traits through recombination of additive genes. Therefore, it will be ideal to combine the fuzzless–lintless mutant type separately with DS 28, MCU 5 and MCU 9 so that more favourable gene recombinations could be obtained for all the important fibre traits besides lint yield. These combinations are likely to throw more recombinants possessing favourable additive genes from both the parents.

It was interesting to note that the fuzzless-lintless mutant of MCU 5 possessed directly opposite gca effects when compared to MCU 5 for all traits except seed index and uniformity ratio [Table 1). The variety MCU 5 had positive and significant gca effects for lint yield, lint index and 2.5% span length while its mutant possessed significantly negative gca effects for these traits. The fuzzless–lintless type possessed significantly positive gca effects for fibre coarseness while, MCU 5 had significantly negative gca effects indicating favourable genes for fibre fineness. For maturity coefficient, while MCU 5 had significantly negative gca effects its mutant had significantly positive gca effects. However, both MCU 5 and its mutant possessed significantly positive gca effects for seed index and uniformity ratio. The aforesaid points indicate that the spontaneous mutation has not only affected the major genes responsible for the presence of fuzz and lint, but also influenced the polygenes responsible for yield as well as other fibre traits.

While selecting an appropriate hybrid for commercial exploitation, three factors, viz., per se performance, sca effects, and heterosis should be taken into account rather than based on any single criterion. This has been emphasized earlier in cotton [8]. In the present study, the hybrids involving the fuzzless–lintless mutant as a parent were evaluated for their potential. The mean, sca effects, and heterosis over better parent (BP) of the 15 hybrids for different traits (Table 2) show that none of the hybrids can be selected as best for all three criteria of superior mean performance, high sca effects, and BP heterosis. However, the hybrid Express Sindh (W) x fuzzless–lintless mutant had significantly superior mean performance and heterosis for seed index, uniformity ratio, and maturity coefficient;

Table 2. Mean, sca effects and BP

Hybrid	Lint yield per plant			Lint index			Seed index		
	mean (g)	sca	d	mean	sca	d	mean	sca	d
Saudi Arabia x FLM	12.7	–2.6*	–26.0*	4.1	–0.2*	–9.6*	10.0	–0.3	1.7
EL 405 x FLM	10.9	–2.7*	–29.2*	4.9*	–0.1	–18.8*	10.9*	0.2	5.2*
Miller 45-9 x FLM	10.5	–3.0*	–30.4*	4.3	–0.2*	–0.7	10.0	0.3	7.5*
Express Sindh (W) x FLM	18.9	1.5	–10.4	4.4	0.4*	10.7*	10.6*	0.3	5.6*
153 E x FLM	14.1	–2.0*	–27.7*	4.7*	0.1	–16.6*	10.2	0.3	4.9*
Rex Smodh Leaf x FLM	12.7	–3.8*	–42.2*	4.3	0.0	–6.6*	10.4	–0.4*	6.6*
Krishna x FLM	22.0*	5.6*	–0.8	4.1	–0.3*	–15.2*	10.0	–0.4*	2.0
Coker 201 x FLM	14.2	–1.8*	–27.4*	4.4	0.0	–7.6*	10.8*	0.3	6.2*
MCU 9 x FLM	18.6	1.5	–24.1	4.5	–0.2*	–22.0*	11.2*	0.4*	1.3
BPS2NC63 x FLM	15.0	–0.1	–20.3	4.2	–0.4*	–22.8*	9.8	–0.4*	-3.3
JR 52 x FLM	17.8	3.5*	7.7	4.1	–0.1	–6.9*	10.0	–0.2	-3.6
McNamara Wine Sap x FLM	10.4	5.0*	21.4	2.6	–0.4*	–17.1*	8.2	–0.6*	–11.9*
Sindis Wild x FLM	15.7	–0.1	–13.7	4.4	0.1	–3.7	9.2	–0.7*	–11.0*
Piedmont Cleveland x FLM	20.3	1.9*	2.2	4.4	0.2*	–2.9	10.0	0.2	-3.3
Alagodenlas Brenas x FLM	16.6	0.1	–28.5*	4.6*	0.5*	5.3	10.2	0.3	–0.7

*Significant at 5% level.

FLM — fuzzless–lintless mutant; d — BP heterosis (%).

significantly higher mean and sca effects for fibre fineness; and significantly superior sca effects and BP heterosis for lint index and 2.5% span length. For lint yield, it had satisfactory mean performance and nonsignificant sca effects and BP heterosis. Therefore, the hybrid Express Sindh (W) x fuzzless–lintless mutant appears to be better than others, having significant superiority for any two out of three parameters for almost all the traits studied. Therefore, the fuzzless–lintless mutation has high breeding value for both recombination and heterosis breeding.

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2.5% span length			Uniformity ratio			Fibre fineness			Maturity coefficient		
mean (mm)	sca	d	mean (%)	sca	d	mean (millitex)	sca	d	mean	sca	d
26.2	0.0	-7.5*	48.7*	0.5	-1.2	185	2.4	5.3	78.0*	-0.4	-1.3
27.7	0.2	-8.7*	46.7	-0.9*	-2.7*	180	5.3	14.2*	78.3*	0.1	1.7
23.8	-1.5*	-7.5*	48.0	-0.6	1.5	177	-5.8	2.3	78.0*	-0.4	0.0
26.1	1.1*	4.3*	50.3*	0.2	2.7*	139*	-15.0*	1.9	78.3*	0.1	2.6*
26.0	1.2*	2.9*	47.3*	-1.4*	2.2	168	-4.3	4.8	77.3	1.0	0.0
24.5	-0.8*	-4.3*	48.7*	-0.1	3.0*	185	10.0*	9.5*	78.7*	1.5*	2.6*
27.0	0.5	-6.4*	48.0	-0.5	3.7*	181	3.7	4.6	78.0*	0.2	0.9
26.0	-0.5	-6.9*	48.3	0.0	5.0*	176	-1.6	4.0	78.0*	-0.5	1.3
26.3	-1.1*	-18.6*	48.3	1.5*	9.8*	166	-0.8	12.9*	76.3	3.1*	0.8
23.2	-0.7*	-0.9	49.0*	0.9*	1.5	181	-0.3	7.1*	79.3*	0.2	1.7
25.4	-0.8*	-5.2*	48.3	-0.7	-2.0	176	2.3	4.0	78.0*	0.6	2.6*
23.2	0.4	4.8*	49.3*	0.4	-0.8	197	15.0*	4.1	78.0*	-0.7	-0.9
25.0	-0.7*	-2.5	50.0*	0.1	4.8*	134*	-17.7*	2.1	72.7	-3.3*	0.8
29.5*	1.8*	-3.1*	49.3*	1.0*	6.5*	176	1.7	7.3*	79.0*	-1.1*	3.0*
26.5	0.9*	2.2	48.3	-0.5	2.1	172	5.6	22.0*	79.0*	1.7*	2.6*

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