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Short Communication

Identification of petal spotted mutant in upland cotton (*Gossypium hirsutum* L.) with some desirable morphological and technological characters

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Morphological mutants of *Gossypium hirsutum* L. or Upland cotton have been extensively used in genetic mapping studies, varietal identification and in several instances have proven useful in agronomic improvement efforts [1]. Cultivated Upland cotton lacks an area of anthocyanin pigmentation at the base called a petal spot but it is not uncommon in the primitive cottons or race stocks [2]. Seed production systems all over the world are still based on visual differences and this character can therefore, be used by the breeders and seed producers as identification marker [3]. With the availability of a high yielding, high fibre quality mutant of this marker character, it is also essential to study the inheritance of the trait for its effective utilization.

MCU-5 is a variety derived from the combination of *G. hirsutum* species (A multiple cross derivative) and does not possess petal spot in its flowers. A population of 45 plants of germplasm line MCU5-2 genotype of *Gossypium hirsutum* (selection from MCU-5) cotton was grown at Central Institute for Cotton Research, Regional Station, Sirsa in *kharif*, 2003. A plant was observed having red round spots on the inner side of five petals in its flowers whereas other plants lacked petal spots (Fig. 1). Progeny of selfed seed of petal spotted plant was grown in off season at CICR, Regional Station Coimbatore and in glass house at CICR, Regional Station, Sirsa during December, 2003 along with parent strain and commercial cultivars of North zone; RS-2013 and H-1117 having no petal spot. All the plants of the progeny of petal spotted plant bred true for the presence of petal spot at both the locations. Reciprocal crosses were made in RS-2013 and H-1117 with MCU5-2 petal spotted plants during 2003 off-season. The crossing was initiated after confirming that all the plants had petal spotted flowers. The F_1s were raised, selfed and backcrossed during *kharif* 2004 crop season. Reciprocal crosses were also made during 2004 crop season after confirming that all the plants had petal spotted flowers in the progeny

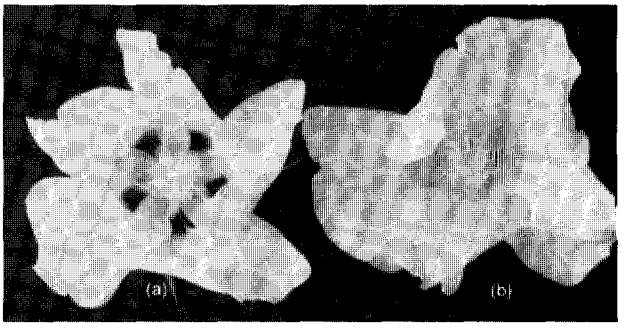

Fig. 1. MCU5-2 Pet: (a) Flower of petal spotted mutant; (b) Flower of normal parent

of MCU5-2 petal spotted plant. The parents, F_1, F_2 and BC_1 generations were raised in 2005. Eighteen rows of each generation and parents were grown to accommodate 19 plants per row (row length of 5.4 m with plant to plant spacing of 30cm). Number of plants with petal spot presence/absence were counted at full blooming stage in segregating generations. The chi-square test was applied for testing goodness of fit for different expected genetic ratios [4]. Observations were recorded during 2004 and 2005 crop seasons for morphological and fibre quality traits in MCU5-2 (parent strain), MCU5-2 petal spotted plant, RS-2013 and H-1117. MCU5-2 petal spotted plant identified during 2003 could be tagged as mutant because it bred true during 2003 off-season, 2004 and 2005 *kharif* seasons. It also had similarities for many morphological characters with the parent MCU5-2 (boll size, ovoid bolls, medium size green leaves, greenish red stem, fuzzy seed, number of leaves around 250 at maturity, number of nodes around 20, number of monopodial and sympodial branches around 7 and 15, respectively, light yellow colour pollen and petals). The mutant has been designated as MCU5-2-pet. The intensity of red pigmentation of the petal spot mutant increased with the increase in growth/age of the flower. The other dissimilar and desirable features of the mutant/variant

Table 1. Contrasting morphological and technological characteristics of petal spotted mutant of MCU5-2, parent strain and commercial cultivars

Character	MCU5-2 pet	MCU5-2 parent strain	RS-2013	H-1117
Petal spot presence (+)/absence (–)	+	-	-	-
Days to maturity	150-160	170-175	170-175	180-185
Seed cotton yield/plant (g)	220	185	190	200
No. of bolls/plant	70	45-55	85	77
Plant height (cm)	95	115	122	145
100 seed weight (g)	9.6	8.0	7.9	7.6
2.5 span length	25.7	24.3	23.2	23.9
Bundle strength (g/tex)	22.9	19.9	19.6	20.9
No. of seed/boll	26-28	22-24	30	30
No. of seeds/locule	6-7	5-6	7-8	6-9
Length of first sympodium (cm)	10	25	25	20

from the normal MCU5-2 are given in Table 1. The mutant identified is due to spontaneous mutation possibly in the gene (s) that control not only the formation of pigmented spot on the inner side of the petals but also few other traits. Various workers had reported mutants with desirable traits in *G. hirsutum* cotton *viz.*, a spontaneous fuzzless-lint less mutant of cotton variety MCU-5 was used as tester line with other 15 genotypes. The mutant had significantly favourable GCA effects for seed index, uniformity ratio and maturity of fibres, indicating that mutation has not only effected the major gene for presence of fuzz or lint . but also influenced other yield and fibre characters through pleiotropism [5].

All F_1 plants from four crosses (RS-2013 × MCU5-2 Pet, MCU5-2 Pet × RS-2013, H-1117 × MCU5-2 Pet and MCU5-2 Pet × H-1117) had petal spotted plants. Segregation for presence and absence of petal spot in BC_1 and F_2 generation was confirming to 1:1 and 3:1 ratio, respectively (Table 2). The segregation pattern in both BC_1 and F_2 populations indicated that a single dominant gene control petal spot in flowers of *G. hirsutum* cotton. A dominant gene (R_2R_2) inheritance has also been reported in cotton [6]. Wilson [7] obtained 2:1 rather than expected 3:1 ratio of petal spot : non-petal spot in F_2 population of a cross from T-1182 × DPL-16 in *G. hirsutum* cotton.

Table 2. Segregation for presence and absence of petal spot in F_2 and back cross generation

Cross	Segregation for presence (+)/absence (–) of spot		Expected ratio	χ^2	P 0.05/0.01
F_2 population	+	-	-	-	-
RS-20I3 × MCU5-2 Pet	207	67	3:1	0.04	3.84/6.63
MCU5-2 Pet × RS-2013	125	39	3:1	0.12	3.84/6.63
H-1117 × MCU5-2 Pet	206	62	3:1	0.49	3.84/6.63
MCU5-2 Pet × H-1117	112	34	3:1	0.22	3.84/6.63
Back crosses					
(RS-2013 × MCU5-2 Pet) × RS-2013	66	62	1:1	0.12	3.84/6.63
(H-1117 × MCU5-2 Pet) × H-1117	101	95	1:1	0.18	3.84/6.63

An evaluation of petal spot mutants showed that petal spot affect characters of economic significance (Table 1). The petal spotted plants had higher seed cotton yield/plant, number of bolls/plant, 100 seed weight, 2.5 % span length, bundle strength, boll weight, number of seeds/boll, number of seeds/locule The mutant has lesser plant height and earlier in maturity as compare to parent strain and the local cultivars. Therefore, petal spot in *G. hirsutum* cotton is likely to be of direct use in cotton improvement. The mutant can also be used in hybridization to develop recombinant genotypes showing promise. Petal spot is easily observable morphological trait, can be used as genetic marker in linkage studies along with isozymes and molecular markers.

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