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GENETIC VARIATION FOR SOME MORPHOLOGICAL CHARACTERS IN *DESI* COTTON (*Gossypium arboreum* L.)

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ABSTRACT

The present investigation was carried out to assess genetic variation for some easily observable traits in a set of 64 germplasm lines of Asiatic cotton (*Gossypium arboreum* L.). The morphological characters included plant body colour, colour of petals and anthers, leaf shape and presence/absence of leaf nectary. Green plant colour, yellow petal and anther colour, digitate leaf shape, and absence of nectary were observed to be predominant morphological characters among the *desi* cotton lines studied. Of the 64 cotton genotypes evaluated, 56 were observed to have green and eight pigmented plants. *Desi* cotton genotypes exhibited following petal colours: yellow (38), white (13), variegated (7), cream (4), red (1) and off-white (1). Majority of the genotypes (59) possessed digitate (narrow lobed) leaves. The present study has provided an insight into the genetic variation for some morphological characters in *desi* cotton genotypes. Though morphological markers have their own limitations, yet these traits being independent of the effects of environment, may be used for the identification of cotton germplasm especially in seed production plots.

Key words: *Gossypium arboreum*, leaf shape, nectarines, petal colour, pollen

INTRODUCTION

Of the more than 50 species belonging to genus *Gossypium* only four are cultivated which include two AD-genome tetraploid (2n = 4x = 52) species: *G. hirsutum* and *G. barbadense*, and two A-genome diploids: *G. arboreum* and *G. herbaceum*. *G. hirsutum* contributes about 95% of current world production of 118 million bales (Lee and Fang, 2015). Diploid cottons were pre-dominantly cultivated cotton species in India. However, due to several reasons including the commercialization of bollworm-resistant transgenic Bt cotton *G. hirsutum* hybrids, the area under *desi* (indigenous) cottons has largely been displaced. Nevertheless, breeding programmes of *G. arboreum* are active at many centres in the country. Several reports suggest that narrow genetic base of dominating cotton species *G. hirsutum* are available. Cultivated diploid cottons, also known as Asiatic cottons, are important reservoir of genes of economic importance. For example, Asiatic cottons have contributed high fibre strength and resistance to *Pectinophera gossypiella*, *Puccinia cacabata*, *Xanthomonas campestris* pv. *malvacerum* (Fryxell, 1984; Meredith, 1991). *G. arboreum* is also known to be resistant to cotton leaf curl disease (Singh *et al.*, 1997; Narula *et al*., 1999; Rashida *et al*., 2005; Gupta *et al*., 2006), a serious threat to American cotton cultivation in North zone cotton growing states of India and Pakistan. Thus, it has been suggested that assessment of genetic diversity of *G. arboreum* is essential for cotton breeding programmes including those of American cotton (Stanton *et al*., 1994).

Morphological characterization of many genotypes included in the present set has not been reported earlier. The present study was aimed to assess genetic variation for some easily observable morphological traits in a set of 64 germplasm lines of *desi* cotton.

MATERIALS AND METHODS

In India, cotton is grown in three distinct eco-geographical regions namely North zone, Central zone, and South zone. About 65% of the area under cotton cultivation in India is rainfed. However, most of the cotton growing areas in North zone namely Punjab, Haryana and Rajasthan are irrigated. A set of 64 *G. arboretum* genotypes including the released varieties and advance lines originating from all these three diverse eco-geographical zones (Singh *et al*., 2016), was used as experimental plant material and evaluated in a partially balanced lattice design (8 x 8) with two replications at the experimental area of Department of Plant Breeding & Genetics, PAU, Ludhiana (India) during *kharif* 2012. Crop was planted in April with row to row spacing of 67.5 cm and plants in a row spaced 45.0 cm apart. The recommended package of practices developed at PAU were followed to raise a good crop. Plants of each genotype were observed at peak flowering stage for easily observable morphological traits such as plant body colour, petal colour, anther colour, leaf shape and leaf nectary. Plant body colour was noted as either green or pigmented (red). On the day of anthesis, petals of flowers of each genotype were observed for their colour. Similarly, dehisced anthers were observed to note pollen colour. Leaf shape was recorded as broad, narrow (digitate) and super okra (Manickam, 2005). The abaxial leaf surface was observed for the presence/absence of leaf nectary on the midrib of leaf.

RESULTS AND DISCUSSION

Description of each *desi* cotton genotype for selected morphological traits is presented in Table 1 and Fig.1-5. *G. arboreum* possesses either of the two plant-body colours *viz.*, green or pigmented. Of the 64 cotton genotypes evaluated, 56 were observed to have green and eight pigmented plants (Fig. 1). Sangwan *et al*. (2008) have reported 115 and 23 *desi* cotton accessions with green and pigmented plant body colour, respectively. Thus, green *desi* cotton genotypes appear to be more common than the pigmented ones. Among others,

Fig. 1: Plant body colours: pigmented (left), green (right)

Fig. 2: Petal colours in sequence a) red, b) yellow, c) cream d) white e) variegated

Fig. 3: Anther colour: mustard (left), yellow (right)

Fig. 4: Leaf shapes; super okra (left), medium lobed (middle), narrow lobed(right)

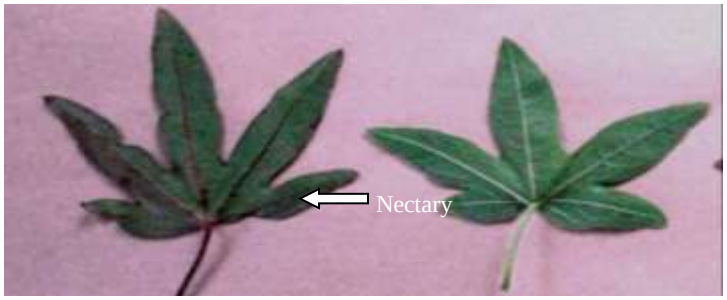

Fig. 5: Leaf nectary present in left side leaf only

these plant body colours have also been reported by Sarao *et al*. (2009).

The petal colours observed in the plant material evaluated were: yellow (38), white (13), variegated (7), cream (4), red (1) and off-white (1) [Fig. 2]. The present finding is consistent with those of Sangwan *et al*. (2008) who observed *desi* cotton genotypes possessing cream, red, pink, yellow and white petals. In tested cotton genotypes, the anther/pollen colour was either yellow or mustard (Fig. 3). Leaf shape was categorized as medium, super okra and narrow. Majority of genotypes (59) had narrow leaves and 4 genotypes possessed medium leaves (SC 97, IC 440309, IC30839 & G 27); whereas one entry HAGHA 46 exhibited super okra leaf shape (Fig. 4). All these leaf

Table 1: Morphological description of *desi* cotton germplasm

S. No.	Accessions	Plant body colour	Petal colour	Anther colour	Leaf shape	Leaf nectary
1	LD 733	Green	Yellow	Yellow	Narrow	Absent
2	SC 97	Green	Cream	Yellow	Medium	Absent
3	LD 1018	Green	White	Yellow	Narrow	Absent
4	LD 491	Green	White	Yellow	Narrow	Present
5	LD 929	Green	Yellow	Yellow	Narrow	Present
6	Arabha 35	Green	Yellow	Yellow	Narrow	Present
7	LD 903	Pigmented	Variegated	Mustard	Narrow	Absent
8	LD 936	Green	Yellow	Yellow	Narrow	Present
9	FDK 124	Green	White	Yellow	Narrow	Absent
10	LD 987	Pigmented	Red	Mustard	Narrow	Present
11	LD 784	Green	White	Yellow	Narrow	Absent
12	LD 230	Green	White	Yellow	Narrow	Absent
13	LD 909	Green	Yellow	Yellow	Narrow	Absent
14	LD 327	Pigmented	Variegated	Mustard	Narrow	Present
15	LD 944	Pigmented	Variegated	Mustard	Narrow	Present
16	PA 255	Green	Yellow	Yellow	Narrow	Absent
17	PSRSV 12516	Green	Cream	Yellow	Narrow	Present
18	IC 440309	Green	Yellow	Yellow	Medium	Present
19	JLA 0914	Green	Yellow	Yellow	Narrow	Present
20	LD 955	Green	Yellow	Yellow	Narrow	Absent
21	RG 595	Green	Yellow	Yellow	Narrow	Present
22	HAGHA 46	Green	White	Yellow	Super okra	Absent
23	IC 30839	Green	Yellow	Yellow	Medium	Absent
24	LD 949	Pigmented	Variegated	Yellow	Narrow	Absent
25	LD 210	Green	White	Yellow	Narrow	Absent
26	IC 412309	Green	Yellow	Yellow	Narrow	Absent

S. No.	Accessions	Plant body colour	Petal colour	Anther colour	Leaf shape	Leaf nectary
27	TMC- L 111	Pigmented	Variegated	Mustard	Narrow	Present
28	LD 694	Pigmented	Variegated	Mustard	Narrow	Absent
29	AKA 8401	Green	Yellow	Yellow	Narrow	Present
30	LD 960	Green	Yellow	Yellow	Narrow	Absent
31	TMC-L 112	Green	Yellow	Yellow	Narrow	Absent
32	G 27	Pigmented	Variegated	Mustard	Medium	Absent
33	CISA 614	Green	White	Yellow	Narrow	Absent
34	LD 937	Green	White	Yellow	Narrow	Absent
35	CISA 105	Green	Yellow	Yellow	Narrow	Absent
36	GAM 147	Green	Yellow	Yellow	Narrow	Absent
37	GBaV 124	Green	Yellow	Yellow	Narrow	Absent
38	NDLA 2981	Green	Yellow	Yellow	Narrow	Absent
39	CISA 7 R	Green	Yellow	Yellow	Narrow	Absent
40	ARBAS 131	Green	Yellow	Yellow	Narrow	Present
41	KWA 1001	Green	Yellow	Yellow	Narrow	Present
42	CCA A1	Green	Yellow	Yellow	Narrow	Absent
43	DAS 1042	Green	Yellow	Yellow	Narrow	Absent
44	RG 590	Green	Yellow	Yellow	Narrow	Present
45	GAM 162	Green	Cream	Yellow	Narrow	Absent
46	LD 973	Green	White	Yellow	Narrow	Absent
47	RAAS 1031	Green	Yellow	Yellow	Narrow	Absent
48	RAC 024	Green	Yellow	Yellow	Narrow	Absent
49	PA 710	Green	Yellow	Yellow	Narrow	Absent
50	CN A 1008	Green	Yellow	Yellow	Narrow	Present
51	RG 600	Green	Yellow	Yellow	Narrow	Absent
52	FDK 178	Green	Yellow	Yellow	Narrow	Absent
53	GBaV 127	Green	Yellow	Yellow	Narrow	Absent
54	FDK 190	Green	White	Yellow	Narrow	Absent
55	DAS 1041	Green	Yellow	Yellow	Narrow	Absent
56	CCA 1010	Green	Yellow	Yellow	Narrow	Absent
57	RG 598	Green	Yellow	Yellow	Narrow	Present
58	DWDARB 10-1	Green	Yellow	Yellow	Narrow	Present
59	AKA 9009	Green	Yellow	Yellow	Narrow	Absent
60	CINA 385	Green	Yellow	Yellow	Narrow	Absent
61	RG 585	Green	White	Yellow	Narrow	Absent
62	CAD 3	Green	White	Yellow	Narrow	Absent
63	AC811	Green	Yellow	Yellow	Narrow	Absent
64	RG 8	Green	Off White	Yellow	Narrow	Absent

Shapes were also recorded by Sangwan *et al*. (2008) who observed 114 as digitate/narrow, 4 as super okra and 20 as broad leaved in shape. Present study showed that narrow leaf shape is most common among the *G. arboreum* germplasm. As opposed to broad leaf lobes, narrow and super okra leaf shapes allow better penetration of sunlight and pesticides to the lower canopy of plant. Of the 64 *desi* cotton accessions, nectary on the midrib was present in 19 genotypes and absent in 45 test entries (Fig. 5). In *G. tomentosum*, a wild tetraploid cotton species, lack of nectarines in leaves, bracts and extra floral regions has been reported to reduce some insect populations (Lukefahr and Rhyne, 1960). According to Meredith *et al*. (1973), nectar-less cottons reduced tarnished plant bug numbers, flea hoppers, boll rot and bollworm damage; whereas, they recorded equal lint yield and fibre quality as those of their isogenic commercial counterparts.

The present investigation has provided an insight into the genetic variation for some easily observable morphological characters in *G. arboreum*. Though morphological markers have their own limitations, yet, these traits being independent of the effects of environment, may be used as indicators for the identification of cotton germplasm especially in the seed production plots.

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