

Morphological and Fibre Characteristics of *Gossypium arboreum* L. Germplasm Lines Immune to Grey Mildew (*Ramularia areola* ATK.) Disease of Cotton

Punit Mohan, VV Singh and PM Mukewar

Central Institute for Cotton Research, Post Bag No. 2, Shankar Nagar Post Office, Nagpur-440010 Maharashtra

A total number of 1489 *Gossypium arboreum* germplasm lines maintained at the CICR, Nagpur were evaluated for their reaction to grey mildew disease caused by the fungus *Ramularia areola* wherein 7 lines immune (no symptoms) to the disease were identified. These 7 lines namely, Bangladesh (EC 174092) and G-135-49 belonging to race *bengalense* and 30805, 30814, 30826, 30838 and 30856 belonging to race *cernuum* were evaluated for various morphological attributes like leaf, flower and capsule, and the fibre quality parameters viz. 2.5% span length, fibre strength, uniformity ratio and fibre fineness for their use in crop improvement programme. The studies revealed wide variability for leaf, flower and boll characters among germplasm lines of race *bengalense* as well as that of race *cernuum*. The genotypes of race *cernuum* indicated high range of variability for economic characters like ginning out-turn (42.15 to 50.75%), boll weight (3.79 to 7.39 g), seed cotton yield (31.71 to 48.32 g/plant) and the fibre properties. The germplasm lines can be used as a good source of resistance for developing resistant cultivars to grey mildew in *arboreum* cotton.

Key Words: *Gossypium arboreum*, Grey Mildew Disease, Race *Bengalense*, Race *Cernuum*

Gossypium arboreum L., commonly known as tree cotton or 'desi' cotton, is a native of India which is cultivated in about 18 % of the total area under cotton, contributes about 10-12 % to the national production. In India, three races of this species viz. *bengalense*, *cernuum* and *indicum* are cultivated.

The grey mildew disease (Dahiya) of cotton caused by the fungus *Ramularia areola* Atk. [*Ramularia gossypii* (Speg.) Ciferri] has been reported as a disease of great economic importance in Central India (Sangitrao *et al.*, 1993). Assessment of yield loss has been recorded to the extent of 68 % in intra-*hirsutum* hybrid H4 in disease endemic areas of Vidarbha (Shivankar and Wangikar, 1992). Severe out-breaks of grey mildew have been reported in Central India during the crop seasons of 1958-59 (Gokhale and Moghe, 1965), 1988-89 and 1993-94 (Mukewar *et al.*, 1994). Considering the seriousness of this disease in *G. arboreum* cultivars, a screening programme was undertaken to find out the sources of resistance in the national germplasm collections available at Central Institute for Cotton Research (CICR), Nagpur and as a result seven germplasm lines immune (no symptoms) to the disease were identified (Mukewar *et al.*, 1995).

Present investigation was therefore undertaken to study morphological characteristics and fibre technological properties of the immune lines for improvement of 'desi' cotton.

Materials and Methods

The grey mildew immune lines of *G. arboreum* cotton viz. 'Bangladesh' (EC 174902), 'G 135-49', '30805', '30814', '30826', '30838' and '30856' were grown during 1997-98, 1998-99 and 1999-2000 crop seasons at CICR Main Research Farm, Nagpur, and the genotypes were evaluated for morphological characterisation and fibre technological properties. Standard procedures were followed for recording morphological characters and disease reaction. The lint samples of the above designated germplasm lines were analysed at the Central Institute for Research on Cotton Technology (CIRCOT), and for fibre technological properties at the Regional Quality Evaluation Unit, Nagpur.

Results and Discussion

The data presented in Table 1 and Fig. 1 indicate that the germplasm lines Bangladesh (EC 174092), G. 135-49, 30805, 30814, 30826, 30838 and 30856 have a broad variation for leaf, flower and boll characters. Germplasm lines of race *cernuum* had long leaf stalk except accession '30856'. However, genotypes 'Bangladesh' and 'G 135-49' race *Bengalense* had short petiole (Table 1, Fig. 1).

The boll weight is the basic feature of breeding importance in *arboreum* cotton. The race *cernuum* is a low yielder due to less number of bolls/plant. However, high boll weight was recorded in the germplasm

Table 1. Variability in morphological features of germplasm lines of *Gossypium arboreum*

Character	Germplasm Line Identity No.						
	Bangladesh (EC No. 174092)	G-135-49	30805	30814	30826	30838	30856
RACE	<i>Bengalense</i>	<i>Bengalense</i>	<i>Cernuum</i>	<i>Cernuum</i>	<i>Cernuum</i>	<i>Cernuum</i>	<i>Cernuum</i>
LEAF							
Leaf shape	5 long narrow lobe, deeply palmate	4-5 small broad lobe, incision; ovate, curvilinear and slightly acute	4-5 long and narrow lobe	5 long and narrow lobe, deeply palmate, rudimentary lobe present	5 elongated lobe, rarely deeply palmate, rudimentary lobe present	5 narrow elongated lobe rarely deeply palmate, rudimentary lobe present	4-5 long narrow lobe, deeply palmate, rudimentary lobe absent
Leaf petiole	Short stalk	Short stalk	Long stalk (upto 8 inches)	Short stalk (upto 3 inches)	Long stalk (upto 8 inches)	Long stalk (upto 8 inches)	Short stalk (upto 3 inches)
Leaf Length (cm)	10.5	7.3	8.5	12.2	Upto 13.0	8.9	8.0
Lobe length (cm)	9.4	4.2	8.4	10.5	12.0	6.2	7.0
Lobe width (cm)	1.8	2.2	1.5	2.3	1.3	2.1	1.5
Lobe sinus (cm)	2.1	2.7	1.6	2.2	1.3	2.1	1.3
Leaf venation	Reticulate and palmate divergent	Reticulate and palmate divergent	Reticulate and palmate divergent	Reticulate and palmate divergent	Reticulate and palmate divergent	Reticulate and palmate divergent	Reticulate and palmate divergent
Leaf surface	Moderately hairy	Moderately hairy	Smooth and glabrous	Smooth	Sparsely hairy	Sparsely hairy	Sparsely hairy
FLOWER							
Pedicel	Long pedicel	Long pedicel	Long pedicel	Short pedicel	Short pedicel	Long pedicel	Short pedicel
Petal colour	Yellow	Yellow-creamy	Yellow	Creamy	Yellow	Yellow	Yellow
Petal claw	Short claw	Short claw	Long claw	Long claw	Short claw	Short claw	Short claw
Petal blotch (length and colour) cm	1.1 (Red)	1.6 (Red)	1.2 (Red)	1.2 (Red)	0.7 (Red)	1.3 (Red)	0.7 (Red)
Petal length (cm)	4.1	3.7	3.5	3.5	3.5	3.9	3.6
Petal width (cm)	2.5	2.7	2.7	3.3	3.5	2.4	3.1
Anther colour and filaments	Yellow and filaments short	Yellow and filaments short	Creamy and filaments short	Creamy and filaments short	Yellow and filaments short	Yellow and filaments long	Yellow and filaments short
Stigma	Short	Short	Short	Short	Short	Short	Short
Bracteole/Bract No.	3, broad	3, small broad	3, small and ovate, acute	3 large and broad	3 large and broad	3 large and broad	3 large and broad
Bract margin and serration	2-4 teeth, margin serrated, apex pointed	2-4 teeth and serrated at anterior part	3-4 teeth and deeply serrated at apex	4-6 teeth, normally serrated at anterior portion	3-4 teeth serrated at apex portion	2-3 teeth normally serrated at apex	5-6 long teeth normally serrated at apex
Bract length (cm)	4.3	2.9	3.7	4.1	5.5	4.4	5.4
Bract width (cm)	3.9	2.5	3.5	3.7	5.0	3.7	4.4
BOLL/CAPSULE							
Boll shape and surface	Conical with tapering end, surface sparsely pitted	Oblong and tapering end, surface densely pitted	Oblong and tapering end, surface densely pitted	Elongated and big, tapering apex, surface sparsely pitted	Elongated and tapering end, surface densely pitted	Big and elongated with tapering end, surface densely pitted	Small conical with pointed apex surface sparsely pitted
Peduncle	Long	Long	Long	Short	Short	Long	Short
Maximum boll length (cm)	4.8	4.4	4.5	5.8	6.2	6.2	5.1
Maximum boll diameter (cm)	3.4	2.5	2.8	3.4	3.6	3.6	2.5
Locule	Trilocular	Trilocular	Trilocular	Trilocular	Trilocular	Trilocular	Trilocular
Locule width (cm)	2.7	2.1	2.4	2.7	2.7	2.7	2.3
Boll volume (cc)	30.2	17.0	15.8	28.0	32.0	38.0	16.0
Boll weight (seed cotton/boll) g	4.10	2.33	3.79	6.11	7.39	7.15	3.98

accessions Bangladesh (4.10 g), 30814 (6.11 g), 30826 (7.39 g) and 30838 (7.15 g) (Table 1).

The capsules/boll are yield contributing components of the cotton plant. Boll volume, boll length and width of septum/locule width showed broad variation between the accessions of race *bengalense* and race *cernuum*.

The seven germplasm lines belonging to *Bengalense* and *Cernuum* races have broad variation in ginning

out-turn which ranged between 35.64 to 50.75% (Table 2), however, various researchers in India (Singh and Nandeshwar 1983; Singh and Raut, 1983; Punit Mohan *et al.*, 1992) have reported higher ginning out-turn (GOT) with high seed density/boll and locule in selected genotypes of *cernuum* race.

Improvement in harvest index has played a key role in increasing seed cotton yields in India. Basu and Bhat

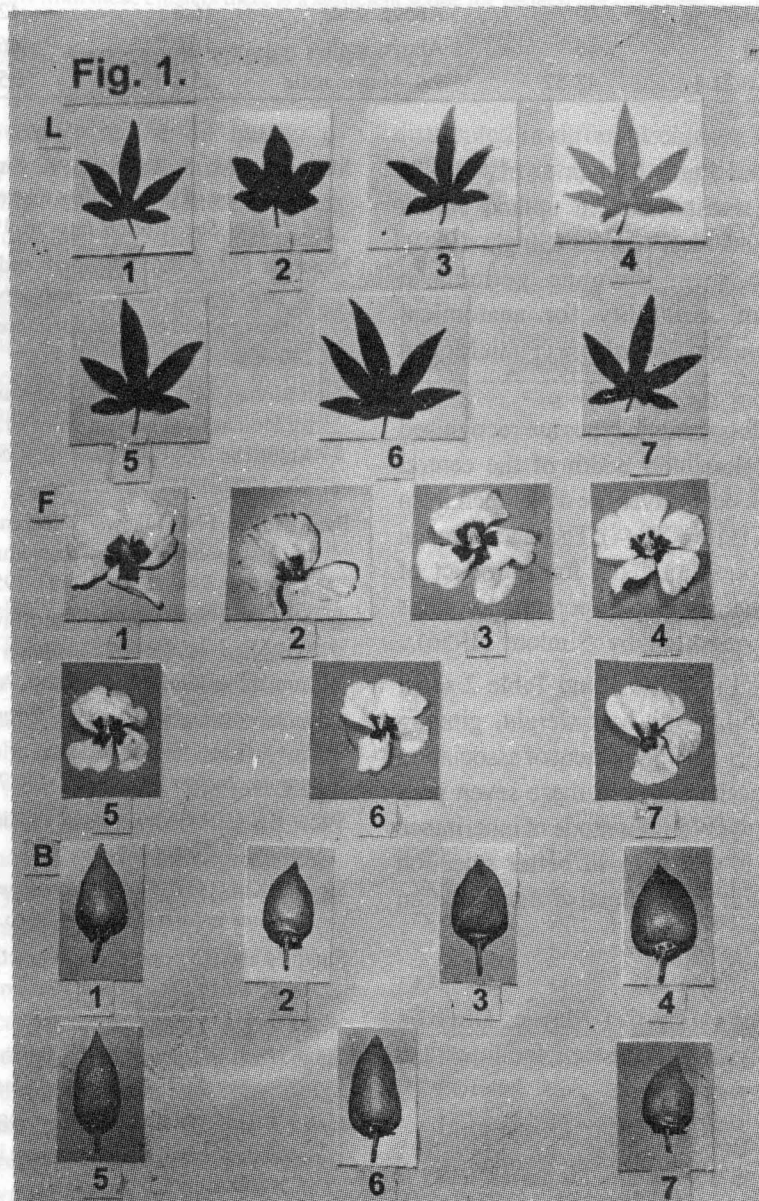


Fig. 1. Variability in morphological features of *Gossypium arboreum* L. germplasm lines immune to Grey mildew (*Ramularia areola* Atk.) disease.

L: Leaf, F: Flower, B: Boll/capsule

1: Bangladesh (EC 174092), 2: G 135-49, 3: 30805, 4: 30814, 5: 30826, 6: 30838, 7: 30856

Table 2. Variability in fibre characteristics and seed yield in germplasm lines *Gossypium arboreum* L.

Germplasm lines	2.5% span length (mm)	Uniformity ratio (%)	Fineness micro-naire 10 ⁶ g/m	Bundle strength tenacity (g/t 3.2 mm)	Ginning outturn (%)	Seed cotton yield/plant (g)
Bangladesh (EC 174092)	18.4	49	7.4	15.3	44.64	40.73
G 135-49	21.8	50	7.5	19.7	35.64	39.15
30805	20.2	50	7.9	17.9	43.10	44.33
30814	17.5	52	Above scale	16.4	42.75	31.71
30836	18.5	49	Above scale	17.0	50.75	48.32
30838	20.3	50	Above scale	16.6	42.15	44.59
30856	17.0	48	Above scale	16.0	46.10	37.13
Range	17.0-21.8	48-52	7.4-Above scale	15.3-19.7	35.64-50.75	31.71-48.32

(1987), Singh (1988) and Punit Mohan *et al.*, (1992) reported variation in harvest index in upland cotton (*Gossypium hirsutum*) and 'desi' cotton (Singh, 1989). The studies for these seven immune germplasm accessions have shown variability for anatomical structures in race *cernuum* and *bengalense* (Punit Mohan *et al.*, 1997).

In race *bengalense*, four genetic types are recognised on the basis of petal colour and width of the central leaf lobe. However, some derivatives are developed from inter-racial hybridisation (Silow, 1944). The race *cernuum* is really an ecotype representing the final product of localised selection tendencies among perennial cottons in North-East India as reported by Simlote (1956).

The results presented in Table 1 and Table 2 show that a significant variability for boll weight, ginning percentage, fibre properties and their extent of association with several economic traits exists in these seven grey mildew immune lines, however, their mode of inheritance need to be studied as it will help in better selection of parental genotypes and their effective manipulation in breeding programme.

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References

- Basu AK and MG Bhat (1987) Variability for harvest index in upland cotton. *Indian J. Agric. Sci.* **57**: 236-240.
- Gokhale VP and PG Moghe (1965) Preliminary investigations on dahiya disease of cotton caused by *Ramularia areola* Atk. in Vidarbha. *Nagpur Agric. Coll. Mag.* **38**: 27-31.

Mukewar PM, S Raj and PK Chakrabarty (1994) Epidemic occurrence of grey mildew disease of cotton in Central India. *J. Indian Soc. Cotton Improv.* **19**: 170-172.

Mukewar PM, S Raj, VV Singh and GR Anap (1995) Screening of tree cotton (*Gossypium arboreum*) germplasm to grey mildew caused by *Ramularia areola*. *Indian J. Agric. Sci.* **65**: 298-300.

Punit Mohan, MG Bhat, VV Singh and P Singh (1992) Variability for biomass and harvest index in Asiatic (*G. arboreum* L.) and American (*G. hirsutum* L.) cottons. *Adv. Plant Sci.* **5**: 100-105.

Punit Mohan, PM Mukewar, S Raj and VV Singh (1997) Anatomy of *Gossypium arboreum* lines immune to grey mildew disease. *J. Cotton Res. Dev.* **11**: 191-195.

Sangitrao CS, PG Moghe, SK Shivankar, KK Dahule and PD Wangikar (1993) *Compendium of Grey Mildew of Cotton* Punjabrao Krishi Vidyapeeth, Akola. 66p.

Shivankar SK and PD Wangikar (1992) Estimation of crop losses due to grey mildew disease of cotton caused by *Ramularia areola*. *Indian Phytopath.* **45**: 74-76.

Silow RA (1944) Genetics of species development in old world cotton. *J. Genet.* **66**: 62-67.

Simlote KM (1956) *Cotton Improvement in India* Simlote Institute of Plant Industry, Indore, 201p.

Singh M and RN Raut (1983) Genetic research on cotton and jute In:BP Pal (ed.) *Genetical Research in India*, ICAR, New Delhi, pp 154-171.

Singh P (1989) Variability for harvest index in *Gossypium arboreum* L. *J. Indian Soc. Cotton Improv.* **14**: 1-2.

Singh P and SB Nandeshwar (1983) Variability in *Gossypium arboreum* Linn. Race *cernuum* in Garo Hills of India. *Indian J. Agric. Sci.* **53**: 511-513.

Singh VV (1988) Variability and correlations for biomass attributes in upland cotton *Gossypium hirsutum* L. *Indian J. Agric. Sci.* **58**: 401-402.