The Andhra Agric. J 58(1): 28-32, 2011

Characterization of Cotton Genotypes

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ABSTRACT

The problem normally in germplasm collection is uncharacterization for common germplasm descriptors. A systematic study was conducted to characterize the forty cotton germplasm lines collected from different parts of the country using IBPGR descriptors at Agricultural College, Bapatla, India. The data was collected on days to 50% flowering, stem, leaf, flower, boll, and quality parameters. Variability was observed for twenty two parameters out of twenty nine descriptors studied in the forty genotypes. The descriptors are helpful in breeding for multiple disease resistant cultivars and improving the fibre quality characteristics.

Key words : Characterization, Cotton, Descriptors, IBPGR.

Germplasm collection is one of the important objective in plant breeding programmes to overcome the genetic erosion. In this, uncharacterization of germplasm for common descriptors is considered as the main bottleneck for their utilization in breeding programmes. Keeping this in view, a systematic effort was made to characterize the cotton germplasm by using International Board of Plant Genetic Resources (IBPGR) descriptors of cotton to document the data for easy identification and also to avoid the duplication and unnecessary evaluations of repetitive accessions in the collection and for locating useful genes from the germplasm accessions. This ultimately aims at development of desirable cotton varieties for commercial cultivation by farmers.

MATERIAL AND METHODS

The main objective of the investigation was to characterize the cotton germplasm to assess their potential to contribute to future crop improvement programmes. The forty cotton germplasm lines collected from different sources were evaluated during *kharif* 2009 at Agricultural College Farm, Bapatla, Andhra Pradesh, India. The experiment was laid out in randomized block design in three replications with spacing of 120x 60 cm.

The study was divided into four parts *i.e.,* the first data collection was taken on days to 50% flowering; second on stem, leaf, and flower characteristics during peak flowering stage; third during peak boll development and the fourth on quality parameters of the cotton fibre after harvest.

Data was collected by selecting randomly ten plants per genotype and were used for the differentiation of the germplasm lines based on IBPGR descriptors. The descriptors recorded for the present investigation were days to 50% flowering, stem pigmentation, stem hairiness, leaf shape, leaf lobe number, leaf size, leaf colour, leaf pubescence, leaf appearance, leaf gossypol glands, leaf nectarines, leaf petiole pigmentation, bract shape, bract number of serration, flower sepal pigmentation, petal colour, petal spotting, position of stigma, filament colouration, anther colour, boll bearing habit, boll size, boll colour, boll shape, boll surface, boll prominence at tip, boll opening, plant habit, plant height, fibre length, fibre strength, fibre fineness and fibre uniformity.

RESULTS AND DISCUSSION

The frequency and descriptor values of the forty cotton germplasm lines are summarized in Table1. None of the germplasm lines evaluated showed a deviation to characteristic from the mentioned descriptors in Table 2. Xavier Zumba (2004) also studied the shafter cotton collection of USA for the descriptors and reported the use of lines in breeding programmes. Padmavathi *et al*. (2009) and Gill *et al*. (2009) also characterized the cotton germplasm lines and CMS lines, respectively by using different descriptors for easy varietal identification and also to know the relationship between parent - offspring relationship.

Stem pigmentation was not observed in any of the lines. Stem hairiness was sparse in two lines

Table 1. Description of various IBPGR descriptors in forty cotton genotypes.

S.NO	GENOTYPE	50%D	StP	SH	LS	LL	LC	LP	PP	SP	PC	P-SPOT	Stigma-P
1.	NDLH-575	57.33	1	5	1	3	2	5	1	1	2	1	2
2.	NDLH-779	53.67	1	5	1	2	2	5	1	1	2	1	1
3.	NDLH-849	53.67	1	5	1	2	2	5	1	1	2	1	2
4.	NDLH7122	52.67	1	5	1	3	2	5	1	1	2	1	1
5.	CPD-1050	59.67	1	3	1	2	2	5	1	1	2	1	2
6.	NDLH-1101	53.00	1	5	1	2	2	5	1	1	2	1	1
7.	NDL-770	55.33	1	5	1	2	2	5	9	1	2	1	2
8.	H1-1117/08	55.67	1	5	1	2	2	5	1	1	2	1	2
9.	NDLH-152	54.67	1	5	1	3	2	5	1	1	2	1	2
10.	MALE-223/08	58.33	1	5	1	3	2	5	1	1	2	1	1
11.	H-1226/08	55.67	1	5	1	2	2	5	1	1	2	1	2
12.	Female223/08	55.67	1	3	4	3	2	5	9	1	2	1	1
13.	H-1236/08	54.67	1	5	3	2	2	5	1	1	2	1	1
14.	NH-452	54.33	1	5	1	2	2	5	1	1	2	1	2
15.	NDLH-1906	54.67	1	5	1	2	2	5	1	1	2	1	2
16.	H-1098/08	61.33	1	5	1	2	2	5	1	1	2	1	2
17.	FEMALE287/08	58.33	1	5	1	2	2	5	1	1	2	1	1
18.	H-1098-1/08	53.67	1	5	3	2	2	5	1	1	2	1	2
19.	MALE-2097/08	62.33	1	5	3	2	2	5	1	1	2	1	1
20.	HS-6/08	54.33	1	5	1	3	2	5	1	1	2	1	1
21.	NH-630	62.33	1	5	1	2	2	5	1	1	2	1	2
22.	P-21-15	54.67	1	5	1	2	2	5	1	1	2	1	2
23.	NH-545	55.67	1	5	1	2	2	5	9	1	2	1	2
24.	F-2170	60.67	1	5	1	2	2	5	1	1	2	9	2
25.	CPD-821	54.33	1	5	1	2	2	5	1	1	2	1	2
26.	NA-1325	56.33	1	5	1	3	2	5	1	1	2	1	2
27.	L-801	56.67	1	5	1	2	2	5	1	1	2	1	2
28.	TCH-1705	62.33	1	5	1	2	2	5	1	1	2	1	2
29.	GBHV-156	54.33	1	5	1	3	2	5	1	1	2	1	2
30.	CPS-141	55.67	1	5	1	2	2	5	1	1	2	1	2
31.	CSH-3129	59.67	1	5	1	2	2	5	1	1	2	1	2
32.	PH-348	53.00	1	5	1	3	2	5	1	1	2	1	2
33.	ADB-28	54.00	1	5	1	2	2	5	1	1	2	1	2
34.	ARBH-225	52.00	1	5	1	2	2	5	1	1	2	1	2
35.	CNDJS-55	52.33	1	5	1	3	2	5	1	1	2	1	2
36.	NH-615	51.33	1	5	1	3	2	5	1	1	2	1	2
37.	NARASIMHA	59.67	1	5	1	3	2	5	1	1	2	1	2
38.	SIVANAMELI	51.67	1	5	1	2	2	5	1	1	2	9	1
39.	NDLH-1905	53.00	1	5	1	2	2	5	1	1	2	1	2
40.	NDLH-1938	52.67	1	5	1	2	2	5	1	1	2	1	2

S.NO	GENOTYPE	FC	AC	BS	BC	B-SHAPE	BT	FL	FS	FF	FU
1.	NDLH-575	1	2	5	1	1	1	5	3	3	7
2.	NDLH-779	1	3	5	1	2	2	7	3	5	7
3.	NDLH-849	1	3	5	1	3	2	5	3	7	7
4.	NDLH7122	1	2	5	1	2	2	5	5	5	7
5.	CPD-1050	1	2	5	1	1	2	5	5	5	7
6.	NDLH-1101	1	2	5	1	2	2	5	3	5	7
7.	NDL-770	1	2	5	1	1	1	5	5	5	7
8.	H1-1117/08	1	3	5	1	1	1	5	3	5	7
9.	NDLH-152	1	2	3	1	2	1	5	3	5	7
10.	MALE-223/08	1	3	5	1	2	2	5	3	5	7
11.	H-1226/08	1	2	5	1	2	2	5	5	5	7
12.	Female223/08	1	2	5	1	2	2	5	3	5	7
13.	H-1236/08	1	2	3	1	1	1	5	5	5	7
14.	NH-452	1	2	5	1	2	2	5	5	5	7
15.	NDLH-1906	1	2	5	1	2	2	5	3	5	7
16.	H-1098/08	1	2	5	1	2	2	5	5	5	7
17.	FEMALE287/08	1	2	5	1	1	1	5	5	3	7
18.	H-1098-1/08	1	2	5	1	2	2	5	5	5	7
19.	MALE-2097/08	1	2	5	1	3	2	5	5	5	7
20.	HS-6/08	1	2	5	1	2	2	5	5	5	7
21.	NH-630	1	2	5	1	2	2	5	5	3	7
22.	P-21-15	1	3	5	1	1	1	5	5	5	7
23.	NH-545	1	3	5	1	2	2	3	5	5	7
24.	F-2170	1	2	5	1	2	2	5	3	5	7
25.	CPD-821	1	2	5	1	2	2	3	3	5	7
26.	NA-1325	1	2	5	1	2	2	5	5	5	7
27.	L-801	1	2	5	1	2	2	5	5	5	7
28.	TCH-1705	1	2	3	1	2	2	5	5	5	7
29.	GBHV-156	1	2	5	1	2	2	5	3	5	7
30.	CPS-141	1	3	3	1	2	2	3	3	7	7
31.	CSH-3129	1	3	5	1	2	2	5	3	7	7
32.	PH-348	1	2	5	1	2	2	5	3	5	7
33.	ADB-28	1	2	5	1	2	2	5	5	5	7
34.	ARBH-225	9	2	5	1	2	2	5	5	5	7
35.	CNDJS-55	1	2	5	1	2	2	5	5	3	5
36.	NH-615	1	2	5	1	2	2	7	5	5	7
37.	NARASIMHA	1	2	5	1	2	2	7	5	5	7
38.	SIVANAMELI	9	2	3	1	2	2	7	5	5	7
39.	NDLH-1905	1	2	5	1	2	2	5	5	5	7
40.	NDLH-1938	1	2	5	1	2	2	5	5	5	7

50% D:Days to 50% flowering(3=<45%-early,5=45-60 –medium, 7= > 60-late);StP: Stem pigmentation (1= absent, 9=present); SH: Stem Hairiness (3= sparse ; 5=medium); LS: Leaf Shape (1=palmate; 3=okra): LL: Leaf Lobes (2=three; 3=five); LC: Leaf Colour (2=green, 4=dark red); LP : Leaf Pubescence (5=medium; 9= strong); PP: Petiole pigmentation (1= absent, 9= present) SP: Sepal pigmentation (1=absent, 9= present); PC :Petal Colour(2=cream, 3=yellow, 6=brown); P spot (1=absent,9=present); StigmaP: Stigma Position (1=embedded;2= exserted); FC: Filament Colour (1=absent, 9=present); AC: Anther colour (2=cream , 3=yellow,4=purple); BS: Boll Size (3=small,5=medium); BC Boll colour (1=green ,2=red); Bshape : Boll Shape (1=round, 2= ovate, 3=elliptic); BT= Boll Tip(1=blunt;2=pointed); PH = Plant Height (3=short- 61-90cm, 5= medium ,91-120 cm 7= long ->120 cm); FL: Fibre Length (1=very short <20mm ,3= short 20.5-24.5mm, 5=medium 25-29mm, 7= long 29.5-33.5mm ,9= extra long>33.5mm); FS= Fibre Strength (3=weak-<20gtex, 5=medium 21.1-25.0 gtex, 7=strong >25.0gtex); FF= Fibre Fineness 1= very fine <3, 3=fine -3-3.9, 5=medium 4-4.9, 7=coarse 5-5.9, 9= very coarse >5.9); FU= Fibre Uniformity (3=poor-<40, 5= average-42-45, 7= good ->45)

Table 2. Frequency of cotton genotypes for different IBPGR descriptors

Score	50%D	StP	SH	LS	LL	LC	LP	PP	SP	PC	PSpot
1		40		36				37	40		38
2					28	40				40	
3			2	3	12						
4				1							
5	34		38				40				
6											
7	6										
8											
9								3			2

SCORE	Stigma P	FC	AC	BS	BC	B shape	BT	PH	FL	FS	FF	FU
1	10	38			40	7	6					
2	30		32			31	34					
3			8	5		2			3	15	4	
4												
5				35				34	33	25	33	1
6												
7								6	4		3	39
8												
9		2										

50% D:Days to 50% flowering(3=<45%-early,5=45-60 –medium, 7= > 60-late);StP: Stem pigmentation (1= absent, 9=present); SH: Stem Hairiness (3= sparse ; 5=medium); LS: Leaf Shape (1=palmate; 3=okra): LL: Leaf Lobes (2=three; 3=five); LC: Leaf Colour (2=green, 4=dark red); LP : Leaf Pubescence (5=medium; 9= strong); PP: Petiole pigmentation (1= absent, 9= present) SP: Sepal pigmentation (1=absent, 9= present); PC :Petal Colour(2=cream, 3=yellow, 6=brown); P spot (1=absent,9=present); StigmaP: Stigma Position (1=embedded;2= exserted); FC: Filament Colour (1=absent, 9=present); AC: Anther colour (2=cream , 3=yellow,4=purple); BS: Boll Size (3=small,5=medium); BC Boll colour (1=green ,2=red); Bshape : Boll Shape (1=round, 2= ovate, 3=elliptic); BT= Boll Tip(1=blunt;2=pointed); PH = Plant Height (3=short- 61-90cm, 5= medium ,91-120 cm 7= long ->120 cm); FL: Fibre Length (1=very short <20mm ,3= short 20.5-24.5mm, 5=medium 25-29mm, 7= long 29.5-33.5mm ,9= extra long>33.5mm); FS= Fibre Strength (3=weak-<20gtex, 5=medium 21.1-25.0 gtex, 7=strong >25.0gtex); FF= Fibre Fineness 1= very fine <3, 3=fine -3-3.9, 5=medium 4-4.9, 7=coarse 5-5.9, 9= very coarse >5.9); FU= Fibre Uniformity (3=poor-<40, 5= average-42-45, 7= good ->45)

(CPD-1050 and Female-223/08) and medium in 38 lines. A hairy stemmed plant is common cotton plant characteristic and all most cotton breeders would rather prefer smooth plants in their breeding programmes as absence for hairiness reduces the egg lying as much as 50% making the plant unattractive as an oviposition site for the Bollworm (Ledge *et al.,* 1992).

Among the leaf characteristics, variation was observed for leaf colour, leaf pubescence, leaf lobes and leaf shape. No variation was observed for leaf size (Large type), leaf appearance (Flat), leaf gossypol glands and leaf nectaries. Large leaf size is helpful to bring optimum plant growth with high dry matter accumulation. Presence of leaf gossypol glands is good for the plant as it had antibiosis ef-

fect on insects like bollworms, black flea hopper (Bottger *et al.,* 1964).

Hairiness on the leaves and modified leaves are common cotton characteristic and among forty lines, all lines showed medium pubescence only. Green leaf colour is a common characteristic and all lines showed green leaf character only. Leaf lobes are five in 12 lines and three in remaining 28 lines. Leaf shape is okra in 3 lines and super okra in one line (Female -223/08) and the remaining 36 lines had normal palmate leaf shape which is not prefferd by bollworms for egg lying.

Bract is normal and the number of serrations on the bract is many in all the lines. Sepal pigmentation is absent in all the forty lines. The cream colour is a common petal characteristic of upland cotton and all lines had cream colour only. Petal spot is present only in two lines (Sivanameli and F-2170) out of 40 lines which is a distinguishing character of Acala and Pima cottons and can be used as character for the parental or varietal identification. Stigma is exerted in most of the lines (30) and embedded in 10 lines. Filament colouration is absent in all the lines except in two lines (ARBH-225 and Sivanameli). Anther colour is cream in 32 lines and yellow in 8 lines.

Boll bearing habit is solitary and Boll size is medium in 35 lines and remaining 5 lines had small boll size. Boll colour is green in all 40 lines. Boll shape is round in 7 lines, elliptic in 2 lines and ovate in remaining 31 lines. Boll prominence at tip is blunt in 6 lines and pointed in remaining 34 lines. Boll opening is open in all the lines. Plant habit is indeterminate in all the lines and is the common character in cotton.

The plant height showed variation from 58 to 151cm among the lines. Most of the germplasm lines have the height of medium (90-120) stature which is preferred mostly for breeding programmes to make them adoptable to picker harvesting.

The variability of the fibre properties in cotton is an unfavorable element in a market that pits this natural fibre against artificial more uniform products represented by synthetic fibres. Most of the germplasm lines evaluated *i.e.,* 33 were considered as having medium fibre length between 25.0 to 30.0 mm while 3 lines had short length and 4 lines showed long fibre length. 39 germplasm lines had good fibre uniformity and one (CNDCJS-55) had average fibre uniformity.

Twenty five lines had medium fibre strength (21.0 to 25.0g/ tex) and 15 lines had fibre strength of below 20.0g/tex. High fibre strength lines are desirable as fibre strength is directly correlated with yarn tenacity (Suh *et al.,* 1998). Thirty three germplasm lines had medium fibre fineness, 3 lines had very fine fibre and four lines had coarse fibre characteristics.

Thus characterization of the germplasm using IBPGR descriptors is helpful for varietal identification and protection. The forty lines are reservoirs of variability for different parameters and they can be utilized in crop improvement.

First author of this paper gratefully acknowledges the support received from Dr.JSV Samba Murthy, Professor and CIRCOT Regional Laboratory, Lam Farm for quality parameters estimation.

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(Received on 03.07.2010 and revised on 15.09.2010)