CICR TECHNICAL BULLETIN NO: 5

WILD AND CULTIVATED SPECIES OF COTTON

Dr V Gotmare

Dr P Singh

BN Tule

Central Institute for Cotton Research
Nagpur

WILD AND CULTIVATED SPECIES OF COTTON

Introduction

The genus Gossypium which belongs to the family Malvaceae and tribe Gossypieae, includes about 50 species, out of which four species are cultivated for their spinnable fibre. The remaining 46 species are distributed throughout the tropics and subtropics of the world in wild forms (Table-1). The wild species of Gossypium are important sources of useful traits such as special of Gossypium are important sources of useful traits such as special and superior fibre properties, cytoplasmic male sterility, resistance to biotic and abiotic stresses etc. which can be introgressed into the cultivated species for improvement (Table-2). Since the variability available in cultivated germplasm is limited and has been exhaustively utilized in breeding programmes, it has become a necessity to develop basic germplasm materials enriched with rare useful genes from wild species through introgression.

Species of Gossypium

There are 43 diploid species with 2n = 26 chromosomes which have been classified into 7 genomes from A to G, and 7 tetraploid species with 2n = 52 chromosomes with genome designation AD (Table-1). Of the 50 species, two diploids viz. G.arboreum and G.herbaceum and two tetraploids viz. G.hirsutum and G.barbadense are cultivated for their spinnable fibre and the remaining 46 are wild species. In India, all the four species are commercially cultivated. At CICR, Nagpur we are maintaining a species garden with 25 species and the description of each of the 25 species is given in this bulletin.

Table-1: SPECIES OF GOSSYPIUM

S.No. Species of	Genome	Distribution
DIPLOID (2n=26)		
1. G.africanum	A	Africa
2. G.herbaceum (cultivated)	A_1	Afghanistan
3. G.arboreum (cultivated)	A_2	Indo-Burma, China and Arab
4. G.anomalum	B_1	Africa
5. G.triphyllum	B_2	Africa
6. G.barbosanum	B_3	Cape Verede
7. G.capitis-viridis	B_4	Cape Verede
8. G.sturtianum	C_1	Australia
9. G.nandewarense	C_{1-n}	Australia
10. G.robinsoni	C_2	Australia
11. G.australe	C_3	Australia
12. G.pilosum	“C”	Australia
13. G.costulatum	C_5	Australia
14. G.populifolium	C_6	Australia
15. C.cunninghamii	C_7	Australia
16. G.pulchellum	C_8	Australia
17. G.nelsonii	C_9	Australia
18. G.enthyle	“C”	Australia
19. G.londonderriense	“C”	Australia
20. G.marchantii	“C”	Australia
21. G.exiguum	“C”	Australia
22. G.rotundifolium	“C”	Australia
23. G.fryxellii	“C”	Australia
24. G.binatum	“C”	Australia
25. G.nobile	“C”	Australia
26. G.thurberi	D_1	America

27. G.armouianum	D_{2-1}	America
28. G.harknessii	D_{2-2}	America
29. G.klotzschianum	D_{3-K}	America
30. G.davidsonii	D_{3-d}	America
31. G.aridum	D_4	America
32. G.raimondii	D_5	America
33. G.gossypioides	D_6	America
34. G.lobatum	D_7	America
35. G.trilobum	D_8	America
36. G.laxum	D_9	America
37. G.turneri	"D"	America
38. G.stocksii	E_1	Arabia
39. G.somalense	E_2	Arabia
40. G.areysianum	E_3	Arabia
41. G.incanum	E_4	Arabia
42. G.longicalyx	F_1	Africa
43. G.bickii	G_1	Australia
TETRAPLOID (2n=52)		
44. G.hirsutum (cultivated (AD)	$(AD)_1$	America
45. G.barbadense (cultivated)	$(AD)_2$	America
46. G.tomentosum	$(AD)_3$	Hawai
47. G.lanceolatum	(AD)	America
48. G.mustelinum	(AD)	America
49. G.darwinii	(AD)	America
50. G.caicoense	(AD)	America

Table-2: Characters of breeding value found in different species.

Characters of Breeding Value	**Species**
I. Donors for Fibre Quality	
1. Fibre length	G.anomalum, G.stochsii,
	G.raimondii, G.areysianum,
	G.longicalyx
2. Fibre strength and elongation	G.stocksii, G.areysianum,
	G.thurberi, G.anomalum,
	G.sturtianum, G.raimondii,
	G.longicalyx
3. Fibre fineness	G. longicalyx **,** G.anomalum,
	G.rainmondii
4. Fibre yield	G.anomalum, G.sturtianum,
	G.australe, G.stocksii, G.areysianum
5. High ginning	G.australe
II. **Donors for Resistance to Insect Pests**	
1. Bollworms	G.thurberi, G.anomalum
	G.raimondii, G.armourianum,
	G.somalense
2. Helicoverpa	G.somalense
3. Jassids	G.anomalum, G.armourianum,

	G.raimondii, G.tomentosum
4. Whitefly	G.armourianum
5. Mites	G.anomalum
6. Aphids	G.davidsonii
III. Donors for Resistance to Diseases	
1. Bacterial Blight	G.anomalum, G.armourianum,
	G.raimondii
2. Verticillium Wilt	G.hirsutum race mexicanum,
	var.nervosum, G.harknessii
3. Fusarium Wilt	G.sturtianum, G.harknessii,
	G.thurberi
4. Nematode	G.darwinii
IV. **Donors for Other Characters**	
1. Cytoplasmic male sterility	G.harknessii, G.trilobum,
	G.aridum
2. Drought resistance	G.darwinii, G.tomentosum,
	G.stocksii, G.areysianum,
	G.anomalum, G.australe,
	G.harknessii, G.aridum,
	G.raimondii
3. Frost resistance	G.thurberi
4. Delayed morphogenesis Of Gossypol gland	G.australe, G.bickii.

G.africanum (Hutch and Ghose)

Genome : A
Ploidy level : 2n=26
Distribution : Africa

Morphological features :

Perennial shrub, 2.5m tall, finely tomentose, hair on shoot tip,leaf thin, constricted at the base. Plants are bushy, well branched. Leaves are light green and leathery. Chromosomes belong to A genome. Leaf lobes round with smooth surface, bract with very small serrations. Locules – 3-4, bolls are small, round and deeply pitted. Seeds are small and linted.

Characters of breeding value : Disease, insects and drought resistance.

Key character for identification : Leaf lobes round shape with one third cit. Bright yellow flower with maroon petal spot. Seed is linted**.**

G.herbaceum (cultivated)

Genome : **A_1**
Ploidy level : **2n=26**
Distribution : **Afghanistan**

Morphological features :

Annual herd stems and branches round, faintly striated, bent slightly at the joints, sparsely hairy. Leaves leathery, prominently reticulate, deeply cordate, less than half cut into 5-7 broad ovate rotund, suddenly acute or apiculate lobes, below distinctly pilose, especially along the veins. Bracteoles large, green coloured, broadly ovate rotund obtuse, only very slightly united at the bottom, but profoundly cordate, gashed across the top into 7-9 fairly long teeth. Flowers not very large, yellow with purple claws and rotating to right; calyx large, loose, undulate, and with large glands. Capsule small, round, pitted with 3-4 valves, seeds large, angled beaked, coated with grey fuzz and harsh grayish-white wool.

Characters of breeding value : Disease, insects and drought resistance.
Key character for identification : Bushy annual. Bracteoles flaring widely from the flower bud, usually broader than long, upper margin usually serrated into 6-8 teeth. Capsule small, round with 3-4 locules

Races of G.herbaceum : **Persicum, Kuljianum, Acerifolium and Wightianum.**

G.arboreum

Genome : **A_2**
Ploidy level : **2n=26**
Distribution : **Indo-Burma, China and Arab**

Morphological features :

A perennial, usually 6 to 10 feet in height, having long trailing thin branches, stems and more especially the young branches, petioles, peduncles and bracteoles of a deep glossy purple colour, a peculiarity sometimes even possessed by the young leaves, especially on the under surface. Leaves of a thick and leathery consistence, gland dotted, sub-glabrous or having short, abortively stillate hairs on the blade, especially more under surface, and a few younger spreading hairs on the petiole and young shoots, blade of the leaf mostly five lobed. Flowers yellow with purplish red petal spot. Capsules round to tapering with 3-4 loculi.

Characters of breeding value : Disease, insects and drought resistance.

Key character for identification : Bracteoles closely investing the flower bud, entire or with 3-4 coarse teeth near the apex, longer than broad. Capsule round to tapering with 3-4 loculi.

Races of Arboreum : **Soudanense, Sinense, Burmanicum, Cernuum, Bengalense and Indicum.**

G.anomalum (Wawra and Peyritsch)

Genome : B
Ploidy level : 2n=26
Distribution : Africa

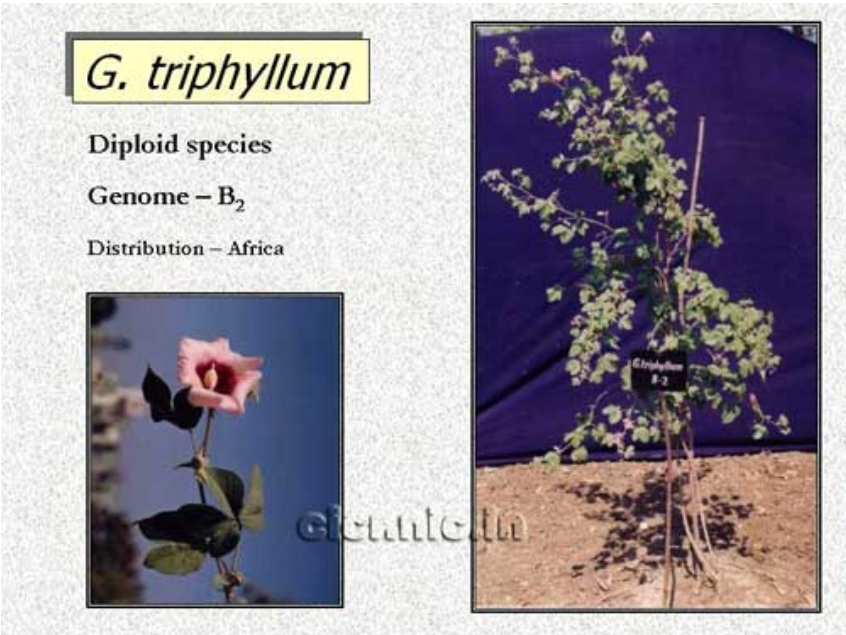
Morphological features :

Perennial shrub, 2 m tall, stem hairy, leaf five lobed, entire, pubescent, foliar nectarines present, flowers and fruits solitary, pedicel pubescent, bracts of involucel three, reflexed, 20 mm long, dull violet with dark red spot at the base, glanded, staminal column non-glandular, anther white, style exceeding the androecium, sparsely glanded, stigmatic lobe decurrent, capsules ovoid, beaked 15 to 22 mm long, glabrous, trilocular glanded, seeds 5 mm long with brown fibre.

Characters of breeding value : Fibre yield, fineness, strength, maturity and length, rust, mites, jassid, bollworm, and bacterial blight resistance.

Key character for identification : Leaves lobed, round in shape and joined at the base. Pedicel 0.5 cm long. Few bracteole serrations present.

G.triphyllum (Hochreutiner)



Genome : B_2
Ploidy level : 2n=26
Distribution : Africa

Morphological features :

Perennial weak shrub, 2 m tall, stem with tomentose hair, leaves with short petiole,palmately trifoliate, hairy, leaf nectarines present, bracts three, calyx five lobed, petals 35 mm. long dull violet, dark purple spot on lower half, glanded, staminal column purplish glanded, style slender exceeding the androecium, non-glandular style exceeding the androecium, capsules ovoid,

beaked, trilocular, pubescent, seeds 6 mm long, fibres creamy.

Characters of breeding value : Jassid, bollworm resistance highly resistant to bacterial blight

Key character for identification : Leaves 3-5 lobed with deep cut for 3 major lobes. The two extra lobes at the bottom joint,sepals 1.5 to 2 cm long, stigma entire. Pedicel 0.7 cm long, bracteole serrations absent.

G.triphyllum (Hochreutiner)

Genome : **B_3**
Ploidy level : **2n=26**
Distribution : **Cape Verede**

Morphological features :

Shrub, 1.5 m tall, stem pubescent, glanded, leaves petiolate, deeply five lobed, basically constricted pubescent, one to three minute foliar nectarines, flowers and fruits solitary, pedicels pubescent, bracts three, calyx five lobed, pubescent, glanded, petals smaller than that of Capitis viridis (>25 mm), dull violet withdark red spot at base, sparsely glanded, staminal column non- glandular style exceeding the androecium, sparsely glanded, stigmatic lobes decurrent, capsules ovoid.

Characters of breeding value : Bacterial blight and jassid resistance

Key character for identification : Sepals smaller in size as compared to that of G.triphyllum. Petioles smaller than that of Capitis viridis (>25 mm).

G.capitis viridis

Genome : **B_4**
Ploidy level : **2n=26**
Distribution : **Cape Verede**

Morphological features :

Shrub, 1.5 m tall, stem pubescent, glanded, leaves petiolate, deeply five lobed, basically constricted pubescent, one to three minute foliar nectarines, flowers and fruits solitary, pedicels pubescent, bracts three, calyx five lobed, pubescent, glanded, petioles about 25 mm long, yellow with dark red spot at base, sparsely glanded. Staminal column non- glandular style exceeding the androecium, sparsely

glanded, stigmatic lobes decurrent, capsules ovoid, beaked, 20 mm long, 3 to 5 locular glanded, seed 6 mm long, fibres brownish.

Characters of breeding value : Immune to bacterial blight

Key character for identification : Stigma bifurcated at the tip, petioles about 25 mm long.

G.sturtianum (J.H.Wills)

Genome : C_1
Ploidy level : 2n=26
Distribution : Australia

Morphological features :

Shrub widely branching, 2 to 2.5 m tall, stem glabrous, glanded, leaves glabrous, glanded, nectary present, stipules caduceus, nectarines reddish, bracts three, calyx prominently glanded, petals violet with dark maroon spot at the base, non- glandular, staminal column pallid, glabrous non-glandular, pinkish anther, pollen yellow to orange. Style exceeding the androecium, sparsely glanded, capsules ovoid, five loculed, glanded, seeds densely pubescent, brownish fibre.

Characters of breeding value : Fibre strength and elongation, resistance to frost, cold and wilt. Insensitivity to photo period.

Key character for identification : Flowers violet in colour with dark maroon spot at the base. Anther and filament maroon coloured, highly susceptible to bacterial blight.

G.nandewarense

Genome : C_{1-n}
Ploidy level : 2n=26
Distribution : Australia

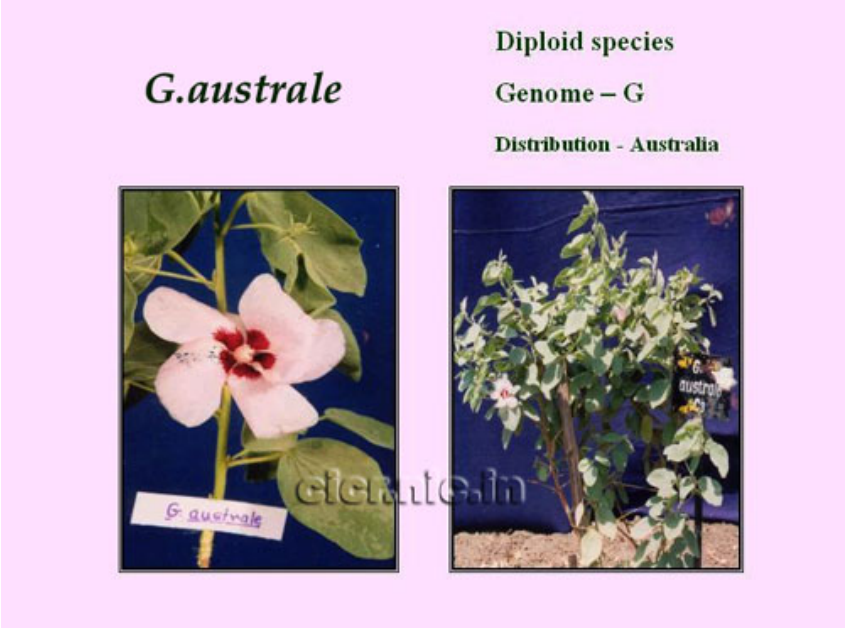
Morphological features :

A perennial shrub, widely branching, 1.0 to 1.5 m tall, stem glabrous, glanded, leaves glabrous, glanded, nectary present, stipules caduceus, nectarines reddish, bracts three, calyx prominently glanded. It has not flowered under the climatic conditions prevailing at Nagpur (Only plant photograph is available).

Characters of breeding value : Resistance to frost and cold

Key character for identification : Plant is similar to that of G.sturtianum but is shorter i.e. 1.0-1.5 m talls

G.australe (F.Von.Muller)



Genome : C_3
Ploidy level : 2n=26
Distribution : Australia

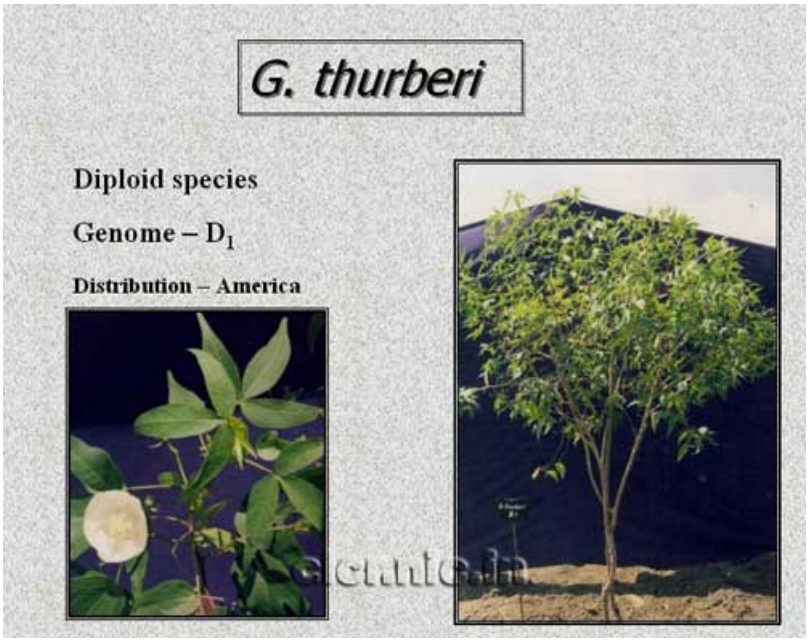
Morphological features :

Shrub 2 to 3m tall, stem softly stellate, tomentose, glanded, leaves ovate elliptical, stillate, tomentose hairs, elongate reddish foliar nectary present, involucellar nectaries 1-3, bracts three, calyx basally constricted, glands present or absent, petals pink with dark red spot at base, mimutely gland dotted, staminal column pallid, glabrous, without glands, anther pinkish, style exceeding the androecium, glanded densely, capsule 3 or 4 celled, glanded, fibre brownish and straight. Immune to bacterial blight.

Characters of breeding value : Glandless seeds (delayed morphogenesis of gossypol gland), high GOT and drought resistance

Key character for identification : Thick and succulent leaf with three lobes. Pinks flowers with dark red spot at the base.

G.thurberi (Todaro)



Genome : **D**
Ploidy level : **2n=26**
Distribution : **America**

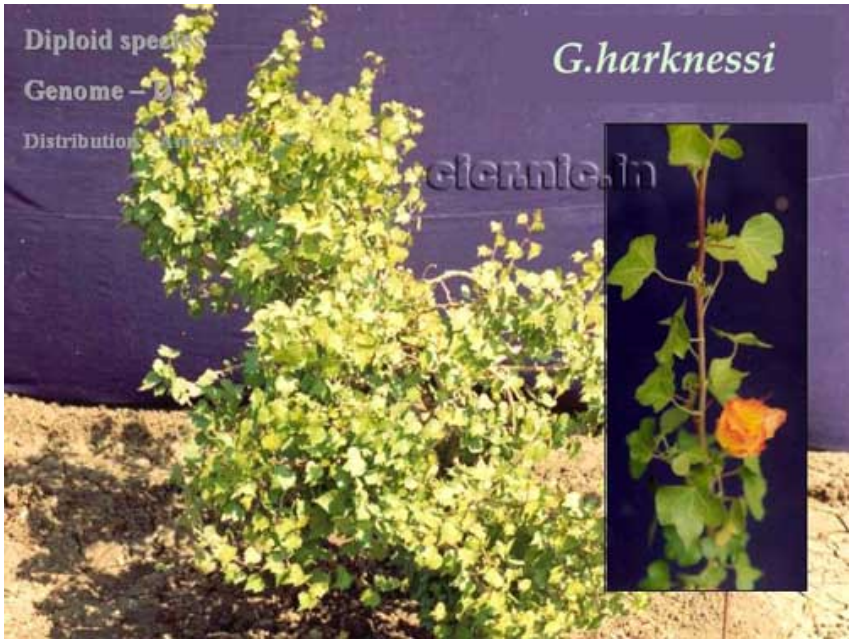
Morphological features :

Perennial upright shrub 2m tall, stem gland dotted pentangular when young, glabrous, leaves with two ridged petiole, 3 to 5 deep lobes, glabrous, the central lobe basally constricted, single foliar nectary near base of the midrib, pedicel surrounded by triangular nectarines, bracts three, calyx glanded, glabrous, petals cream spot present at the base, bracteole size 0.8 cm long and 0.4 cm wide. Bracteole serrations – nil. Minutely gland dotted, pollen bright yellow, style slightly exceeding the androecium, capsules glabrous, three loculed, seeds blackish naked. Boll shape round to oval with pointed tip, smooth surface.

Characters of breeding value : Fibre fineness, strength and elongation, resistance to Fusarium wilt, frost and bollworms. Prolific boll bearing, high ginning out turn, better spinning

Key character for identification : Leaf with distinguished three lobes. Flowers with cream coloured petals with a spot present at the base.

G.harknessii



Genome : D_{2-2}
Ploidy level : 2n=26
Distribution : America

Morphological features :

Perennial spreading herb, leaves small, ivy-like, thick, quite glabrous, faintly 3 lobed, bracteoles broadly ovate acuminate, entire leaves thick, leathery, prominently reticulated, 1.5 inches, ovate rotund cordate, petiole an inch or more long and equaling the length of the blade. Twigs round, woody, with firm red bark, wrinkled on drying glabrous but young shoots, as also the petioles prominently gland-dotted, bracteoles free, broadly ovate acuminate, entire, less than half the length of the corolla, bracteole 1.1 cm wide. Bracteole serrations nil, apparently caduceus as the fruit ripens. Flowers sulphur yellow in colour, twice the length of the bracteoles, petals with purple spots at the base, calyx truncate, persistent, but ruptured by the fruit, glabrous, many veined, prominently gland dotted. Extra floral and intra floral nectaries absent. Fruit ovate rotund only slightly pointed, cells three, with four seeds in each cell semi adherent together, woolly coating exceeding short and not separable into two layers or coats.

Characters of breeding value : Resistance to Verticillium wilt, Fusarium wilt, drought, source for cytoplasmic male sterility, lustrous fibre, caduceus and narrow bract, fertility restorer

Key character for identification : Bushy plant with bright green smooth leaves. Sulphur yellow coloured flower with purple spot at the base.

G.davidsonii (Kelogg)

Genome : D_{3-d}
Ploidy level : 2n=26
Distribution : America

Morphological features :

Perennial upright shrub, stem round, bright red, wrinkled, glabrous and very minutely hairy above. Leaves 1.5 x 5 inches broad, ovate cordate, suddenly acute but sometimes showing a tendency to be three angled on upper half, minutely stellately hairy, especially on the veins, petiole nearly as long as the

blade 1.6 cm, stipules very minute linear acuminate, caduceus, inflorescence, short axillary shoots, one to three flowered, peduncle 2 to 3 inches long, bracteoles ovate quite free from each other, extrafloral nectaries presents, glands not visible within, membranous, turning red brown, accrescent, flowers-medium sized, bright yellow with purple claws, calyx, open loose, companulate, many veined with rows of glands and very few hairs on the veins. Fruit ovate rounded acute, 4 celled, seeds large free, flattened on the face, closely compacted, golden coloured floss.

Characters of breeding value : Resistance to aphids, salinity and bacterial blight

Key character for identification : Petiole as long as the blade. Flowers bright yellow with prominent red spot at the base

G.klotzschianum

Genome : D_{3-k}
Ploidy level : **2n=26**
Distribution : **America**

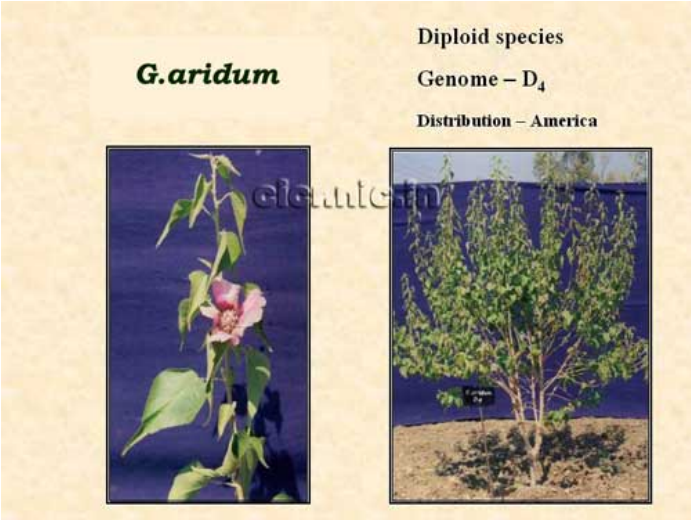
Morphological features :

Perennial upright shrub to small tree, having long spreading branches, the twigs smooth, reddish brown and minutely tomentose when young. Stem tip glabrous. Leaves 2.5 inches long and 2 inches broad, gland dotted very obscure, stellately pubescent, especially below, inflorescence auxillary, lateral shoots with peduncle twice the length of the subtended petiole, petiole size 0.6 cm on e of to three flowered, bracteoles softly tomentose, broad, deeply auriculate, scarcely ovate, the apex being rounded, no glands on the pedicel non extrafloral nectaries absent within the bracteoles, pedicel about 1 inch long, angled and furrowed. Flowers fairly large, 1.5 inches broad, 1/3 exceeding the bracteoles in length, corolla pale yellow, with convolvulate, petal spot inconspicuous to absent, calyx cut almost square across or with 5 shallow undulations, fruits ovate rounded, 4 celled, seeds large free and flattened on the face.

Characters of breeding value : Resistance to sucking pests

Key character for identification : Flowers with pale yellow petals and a very faint spot (dotted) at the base; inconspicuous to absent.

G.aridum (Skovsted)



Genome : **D_4**
Ploidy level : **2n=26**
Distribution : **America**

Morphological features :

Trees 4 to 8 m tall, black glanded, stems minutely pubescent, eventually glabrate, leaves petiolate, ovate, pubescent, flowers solitary, or paired in the leaf axels, nectaries present, 3 bractlets, calyx yellowish, corolla funnel shaped, rose, anther purplish, pollen yellow orange, style exceeding the androecium, gland dotted, stigmatic lobes decurrent, capsules prominently black gland dotted, 3 to 4 celled, seed with dense brown fibres.

Characters of breeding value : Resistance to drought, high seed number, seed index, cytoplasmic male sterility and fibre strength.

Key character for identification : Tree with upright branches. Flowers pink with purplish anthers, corolla funnel shaped.

G.raimondii (Ulbrich)

Genome : **D_5**
Ploidy level : **2n=26**
Distribution : **America**

Morphological features :

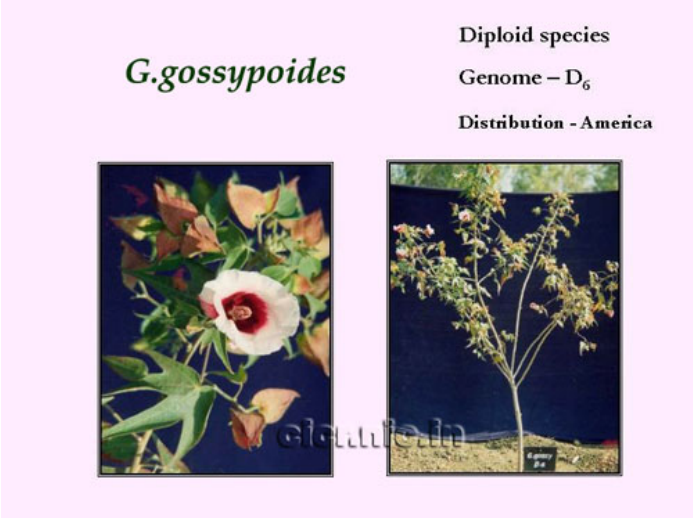
Perennial upright shrub to small tree, stem tip densely hairy. Leaf nectaries absents, stem softly tomentose, gland dotted, pentangular, leaves broadly ovate, tomentose glanded, with one to three foliar nectaries, pubescent, bracteole serrations generally 20 in number, narrow, long and prominently marked, calyx truncate, gland dotted, corolla cream with petal spot, staminal column sparsely glanded, purplish, style exceeding the androecium, anther dark red, non-glandular. Large cream coloured flowered with purplish pink spot spread at the base of each petal. Stigma protruding about 1.5 cm long. Capsules four celled, densely glanded, seeds densely pubescent, fibres tan, more or less appressed. Bolls elongated with pointed tip, surface slightly pitted.

Characters of breeding value : Fibre length, fibre strength and elongation, fibre fineness, resistance to bollworm,

jassids, drought, thrips, leaf roller, rust, bacterial blight, high lint index, high ginning out turn.

Key character for identification : Flowers large with cream coloured petals and purplish pink spot spread at the base of each petal, anther and filament purplish pink.

G.gossypioides (Standley)



Genome : **D_6**
Ploidy level : **2n=26**
Distribution : **America**

Morphological features :

A shrub 3 to 4m tall, stems pubescent with green tip and very short dense hair, leaves cordate, three lobed, glanded , nectaries absent, bracts three, calyx glanded prominently, truncate, petals light pink, dark red or purple spot at lower half, staminal column gland dotted, filaments purplish, yellow anther, style exceeding the androecium, prominently glandular, capsule 3 celled, ovoid, apiculate, glanded, seeds with sparse appressed fibre.

Characters of breeding value : Resistance to jassids

Key character for identification : Flowers light pink with red or purplish petal spot and purplish filaments.

G.lobatum (Gentry)

Genome : **D_7**
Ploidy level : **2n=26**
Distribution : **America**

Morphological features :

Trees 3 to 7m tall, branches lax, pubescent, leaves petiolate, distichously arranged, obscurely gland dotted pubescent, flowers and fruits in fascieles of one to five in the leaf axils, bracts broadly triangular, glanded, calyx yellowish, densely pubescent, petals lavender with dark purplish spot covering lower half of petal, staminal column long, anther purplish, pollen yellow orange, style exceeding androecium, slender, capsules 3 celled, minutely pubescent, prominently gland dotted, seeds several per locule, fibres whitish to tan.

Characters of breeding value : Resistance to bollworm

Key character for identification : Big tree, flowers lavender with dark purplish spot covering lower half of petal. Flowering from January to April. Most of the leaves shed before flowering.

G.trilobum (Skovsted)

Genome : D_8
Ploidy level : 2n=26
Distribution : America

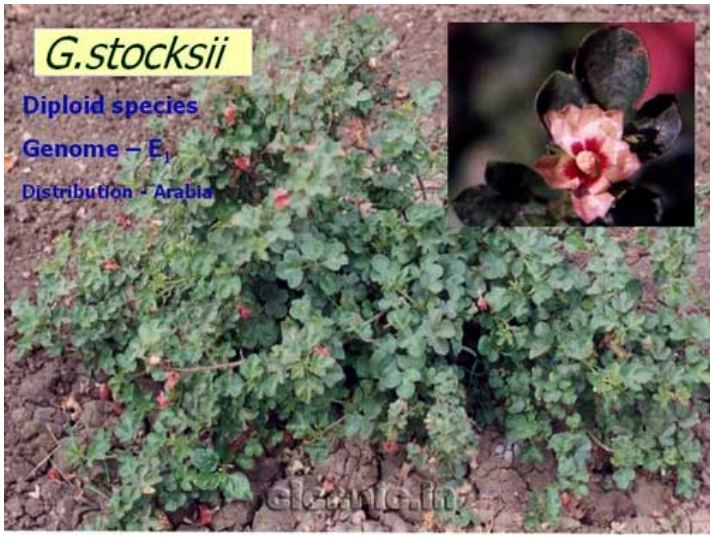
Morphological features :

A shrub, 2.5 m tall, stem minutely dotted, stem tip green, glabrous, pentangular, pubescent leaves with quadrangular petioles, extrafloral nectaries present and intrafloral nectaries absent, bracteole size 1.2 cm long and 0.1 cm wide, calyx prominently gland dotted, petals pale yellow with small red spot, glanded, staminal column pallid, gland dotted, style slender, exceeding the androecium, anther yellow and slightly protruding stigma, capsule glabrous, 3 loculed, seeds blackish, angular with minute tan fuzz. Boll shape oval with pointed tip and pitted surface.

Characters of breeding value : Glabrous leaves

Key character for identification : Leaves with distinguished three lobes and each lobe is broader as compared to G.thurberi, petals pale yellow with small red spot at the base.

G.stocksii



Genome : E_1
Ploidy level : 2n=26
Distribution : America

Morphological features :

A small perennial, much branched, woody shrub, leaves usually not more than 1 inch each way, more rarely three lobed or simple. Inflorescence on lateral axillary shoots, 1 to 2 inches long, arrested by the production of one or more flowers and a few small leaves. Bracteoles 3, quite free from each other tapering below into thick prominent claws, inserted near the base of the calyx tube. Flowers large, fully twice the length of the

bracteoles, yellow, gland dotted, with faint irregular red spot at the base, the older flowers having a pinkish tinge, petals rotating to right, firmly united by their claws, and inconsequence forming a short constricted tube, sparsely hairy. Pollen grains pale yellow having the surface of the exine packed with short sharp spines. Fruit prominently dotted with black glands on a dark green blue surface, 3 celled, seeds 2 to 3 in each cell closely compacted together, seed smooth, black coloured, slightly beaked fibre brownish in colour.

Characters of breeding value : Fibre yield strength, elongation, resistance to drought.

Key character for identification : Plant very small and bushy. Flowers light yellow with faint irregular spot at the base, petals rotating to right. Older flowers have a pinkish tinge.

G.somalense (Hutchinson)

Genome : **E_2**
Ploidy level : **2n=26**
Distribution : **Africa**

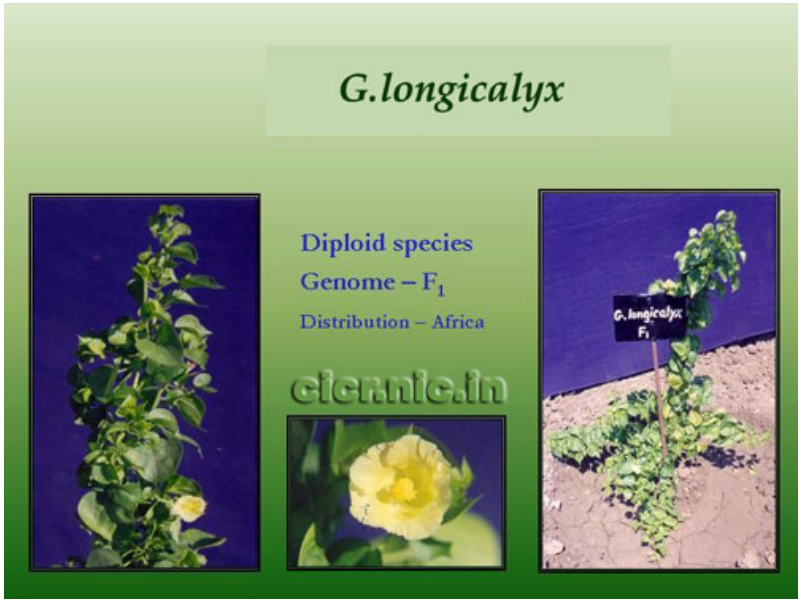
Morphological features :

Perennial upright shrub 3 m tall, stem stellate to tomentose, green, stem tip lightly hairy, leaves petiolate, cordate, tomentose, nectary on midrib, beneath, bracts three, garlanded, clayx five lobed, tomentose, black glands, petals yellow with prominent dark red spot at base anther and pollen yellow with protruding stigma, non-glandular, staminal column glabrous, non-glandular, styal gland dotted, capsules ovoid beaked, three or four celled, glanded, seeds densely pubescent, fibres brownish. Pedicel size 2.0cm extra floral nectaries present, intrafloral nectaries absent. Bracteole size 4.0 cm long and 3.4 cm wide, serrations 12-15 resembling saw teeth.

Characters of breeding value : Resistance to bollworm and drought.

Key character for identification : Bracts convolulated. Flowers with yellow petals and prominent dark red spot at the base.

G.longicalyx (Hutchinson and Lee)



Genome : **F_1**
Ploidy level : **2n=26**
Distribution : **Africa**

Morphological features :

A perennial crawling shrub with slender stem, pubescent, prominently glanded, leaves ovute, glanded, inconspicuous foliar nectary, involuceller nectary lacking, bract 3 entire, pedicel size 1.5 cm extra floral nectaries absent, pollen colour deep yellow, stigma non-protruding, gland dotted calyx prominently glanded, deeply divided lobes triangular, petal long yellow, minutely glanded, pubescent, staminal column pallid, glabrous, non-glandular, style exceeding androecium, capsules ovoid, 3 locule, glanded, seed 2 to 3 per locule, denely pubescent, lintless, boll shape elongated with pointed tip.

Characters of breeding value : Probable source of cytoplasmic male sterility, fibre length, strength, enlongation and fineness.

Key character for identification : Perennial crawling shrub with bright green elongated leaves and yellow flowers without petal spot.

G.bickii (Prokhanov)

Genome : **G_1**
Ploidy level : **2n=26**
Distribution : **Australia**

Morphological features :

Spreading shrub, 0.5 m tall, stems glanded, pubescent, leaves ovate elliptical, sometimes three lobed, inconspicuous foliar nectary, three prominent involuceller nectaries, bracts 3, linear, shorter than calyx, broadly companulate, five lobed, prominently gland dotted, petal pink with red spot at the base, minutely gland dotted, staminal column pallid, glabrous, non-landular, anther pallid. Style glanded, capsules 3-5 loculed; prominently glanded, long beaked, seed densely pubescent with tightly appressed.

Characters of breeding value	**:**	Glandless seed
Key character for identification	**:**	Spreading shrub with ovate elliptical three lobed leaves. Flowers pink with red spot at the base.

G.hirsutum (cultivated)

Genome : **$(AD)_1$**
Ploidy level : **2n=52**
Distribution : **America**

Morphological features :

Annual shrub, stem tip green to pigmented, glabrous to densely hairy. Leaf broad to very narrow, nectaries present, pedicel large variable, bracteole size large but variable, serrations few to several. Corolla yellow, petal spot usually absent. Anther colour greenish to yellow. Stigma generally non protruding. Boll round, oval or elongated large. Locules 3-5, generally smooth, tip blunt, lint white, cream, brown, green etc.

Characters of breeding value	**:**	Fibre yield, length, strength, fineness and elongation, resistance to Verticillium wilt
Key character for identification	**:**	Flower yellow and petal spot usually absents
Races of G.hirsutum	**:**	**Latifolium, Punctatum, Morilli, Richmondii, Palmeri, Marie Galente, and Yucatenense.**

G.barbadense

Genome : **$(AD)_2$**
Ploidy level : **2n=52**
Distribution : **America**

Morphological features :

A shrub, 1.5 to 2 m tall, broad leaves, slightly hairy with deep 3-5 lobes. Nectaries present, stem weak, pedicel 1.0 cm. long, bracteole size 3.0-3.5 cm, fused at base, serrations 8-13 in number. Corolla yellow, size 4.5-5.5 cm, petal spot present, anther yellow, pollen yellow, stigma protruding, boll elongated, locules 3, slightly pitted, tip pointed, lint white.

Characters of breeding value	**:**	Fibre fineness
Key character for identification	**:**	Petal spot present, deeply pitted pointed bolls.
Races of G.barbadense	**:**	**Brasiliense**

UTILISATION OF WILD SPECIES

In cotton, introgressive hybridisation has played significant role in transferring fibre quality; disease and insect resistance, drought resistance, and male sterility from various species, besides improvement in yield by releasing hybrids. These aspects are briefly discussed below:

- **Improvement in Quality**
  In cotton, improvement in fibre quality has been achieved through interspecific hybridisation. For example, high fibre length from G.thurberi, G.raimondii and G.barbadense has been transferred to upland cotton (G.hirsutum). High fibre strength of G.thyrberi has been transferred to G.arboreum to G.herbaceum. In India, two long staple varieties of upland cotton, viz. MCU 2 and MCU 5 have been obtained by long duration selection from G.hirsutum x G.barbadense cross followed by further series of multiple cross. In G.hirsutum, ginning percentage has been improved through the use of G.armourianum. Long staple G.arboreum variety AKA 8401 has been obtained from a cross between G.arboreum and G.anomalum.

- **Disease Resistance**
  Introgressive hybridisation has been useful in transferring disease resistance in cotton. For example, blackarm resistance has been transferred from G.arboreum to G.barbadense and rust resistance from G.raimondii to upland (G.hirsutum) cotton. Resistant strains of G.hirsutum to blackarm were isolated from a cross between G.hirsutum and G.arboreum. In USSR, an upland cultivar (C 4537) resistant to Verticillium wilt was isolated from a trispecies cross.

- **Insect Resistance**
  Resistance to certain insects in cotton has been achieved through introgressive hybridisation. For example, jassid resistance from G.tomentosum and boll weevil resistance from G.armourianum have been transferred to upland cotton (G.hirsutum). In india, varieties Badnawar 1, B 1007 and other CTI (Cambodia Tomentosum Indore) types such as SRT 1, Khanfwa 1 and Khandwa 2 have resulted from G.hirsutum x G.tomentosum crosses. These varieties B 1007 and DHY 286 have been developed by involving material derived from interspeecific cross (CTI material).
- **Drought Resistance**
  In upland cotton, resistance to drought has been improved through interspecific hybridisation. In India, drought resistance in upland cotton (G.hirsutum) was transferred from Asiatic Cottons. Varieties Deviraj (170 Co2), Deviraj (130 Co2 M) and G. 67, with wide adaptability, have resulted from interspecific hybridisation between upland and Asiatic species. Variety G67 has high degree of resistance from Hibiscus Panduraeformis (2n=24) to G.hirsutum is also possible.
- **Male Sterility**
  Wild species are important sources of sterile cytoplasm. Interspecific hybridisation has been useful in discovering cytoplasmic male sterility in several crops including cotton. Sterile cytoplasm from wild species can be transferred to cultivated species through interspecific hybridisation and backcrossing. In cotton, G.harknessii, G.anomalum and G.aridum are important sources of sterile cytoplasm. Cytoplasmic male sterility from G.harknessii and G.aridum have been transferred to upland cotton through backcross method. Cytoplasmic male sterility (CMS) is an economic device for hybrid seed production. The cytoplasm of G.anomalum has been used to create cytoplasmic male sterility in G.arboreum.

- **Important in Yield**
  Improvement in yield has also been achieved through introgressive hybridisation especially by interspecific hybridisation. In cotton, improvement in yield has been achieved by developing high yielding varieties and interspecific hybrids. In upland cotton, varieties Arogya, PKV 081, Rajat, Gujarat 67, MCU 2, MCU 5, Deviraj, Devitej, Khandwa 1, Khandwa 2 and Badnawar 1 are derivative

of interspecific hybridisation. Commercially cultivated hybrids have been developed both at tetraploid and diploid levels using cultivated soecies (Table-3). In upland cotton, varieties PKV 081 and Rajat have been recently developed from a cross between G.hirsutum and G.anomalum.

Table-3: Some useful characters transferred through introgressive hybridisation in cotton

Character transferred	Species transferred from	Species transferred to
Jassid resistance	G.tomentosum	G.hirsutum
Smoothness for boll weevil resistance	G.armourianum	G.hirsutum
Rust resistance	G.raimondii	G.hirsutum
Blackarm resistance	G.arboreum	G.barbadense
Fibre length	G.thurberi	G.hirsutum
	G.raimondii	G.hirsutum
Fibre strength	G.thurberi	G.hirsutum
Cytoplasmic male sterility	G.anomalum	G.hirsutum
	G.anomalum	G.arboreum
	G.harknessii	G.hirsutum
	G.aridum	G.hirsutum
Drought resistance	G.arboreum	G.hirsutum
	G.herbaceum	G.hirsutum
Fibre length	G.barbadense	G.hirsutum
Fertility restorer	G.harknessii	G.hirsutum
High ginning outturn	G.arboreum	G.hirsutum
Hairiness	G.tomentosum	G.barbadense
Caduceus bract	G.armourianum G.harknessii	G.hirsutum G.hirsutum

PRACTICAL ACHIEVEMENTS

In India, varieties as well as hybrids have been developed for commercial cultivation through interspecific hybridisation. In upland cotton, varieties Arogya, PKV 081, Rajat, Gujarat 67, MCU 2, MCU 5, Deviraj, Devitej, Khandwa 1, Khandwa 2 and Badnawar 1 are derivative of interspecific hybridisation. Interspecific hybrids have been developed both at tetraploid and diploid levels using cultivated soecies (Table-4). Important tetraploid interspecific hybrids (G.hirsutum x G.barbadense) include, Varalaxmi, DCH 32 (Jaylaxmi), NHB 12, HB 224, DHB 105, Surthi and TCHB 213. These hybrids, viz. DH 7, DH 9, DDH 2 and Pha 46 have been released between G.herbaceum and G.arboreum. The first two hybrids (DH 7 and DDH 9) are cultivated in Gujarat State, DDH 2 in Karnataka and Pha 46 in Maratwada region of Maharashtra State.

Table-4 : Cotton varieties and hybrids developed through interspecific hybridisation.

Research Centre	Species involved	Varieties/hybrids released
A. Varieties		
JNKVV, Indore	G.hirsutum x G.tomentosum	Badnawar 1, Khandwa 1 and Khandwa 2
GAU, Surat	G.hirsutum x G.arboreum	Deviraj (170 Co2), Gujarat 67
	G.hirsutum x G.herbaceum	Devitej (130Co2 M)
TNAU, Coimbatore	G.hirsutum x G.barbadense	MCU 2, MCU 5
PKV, Akola	G.hirsutum x G.anomalum	PKV 081

	G.hirsutum x (G.thurberi x	Rajat
	G.anomalum)	
	G.arboreum x G.anomalum	AKA 8401
CICR, Nagpur	G.hirsutum x G.anomalum	Arogya
B. Hybrids		
UAS,Dharwad	G.hirsutum x G.barbadense	Varalaxmi, DCH 32 and DHB 105
	G.herbaceum x G.arboreum	DDH 2
GAU, Surat	G.herbaceum x G.arboreum	DH 7, DH 9
MAU,Nanded	G.hirsutum x G.barbadense	NHB 12
	G.herbaceum x G.arboreum	Pha 46
TNAU, Coimbatore	G.hirsutum x G.barbadense	TCHB 213
CICR(RS)Coimbatore	G.hirsutum x G.barbadense	HB 224, Sruthi

---- End of the Report ----