



# Draft National Test Guidelines for the Conduct of Tests for Distinctiveness, Uniformity and Stability of Cotton (*Gossypium* spp.)



*Gossypium hirsutum* L.



*Gossypium barbadense* L.

*Gossypium arboreum* L.



*Gossypium herbaceum* L.



**All India Coordinated Cotton Improvement Project  
Central Institute for Cotton Research  
(Indian Council of Agricultural Research)  
Regional Station, Coimbatore**



Printed : 2006 (250 Copies)

Compiled and Edited by :

**CICR, Coimbatore :**

**Dr. K. Rathinavel**, Sr. Scientist (Seed Technology)  
**Dr. S. Manickam**, Scientist (Senior Scale) (Genetics)  
**Sh. K.N. Gururajan**, Principal Scientist (Plant Breeding)

**CICR, Nagpur :**

**Dr. R.K. Deshmukh**, Principal Scientist (Seed Technology)  
**Dr. V. Shanthy**, Scientist (Senior Scale) (Seed Technology)

Correct Citation :

Draft National Test Guidelines for the conduct of  
DUS Test of Cotton (*Gossypium spp.*) Total Page Nos. 40.  
Central Institute for Cotton Research, Regional Station, Coimbatore  
2006

Published by :

**Dr. N. Gopalakrishnan**,  
Project Coordinator (Cotton Improvement),  
Central Institute for Cotton Research,  
Regional Station, Coimbatore,  
Tamil Nadu - 641 003.  
INDIA

Phone : 0422 - 2431238, 2430045

Fax : 0422 - 2454021

Email : [cicrcbe@gmail.com](mailto:cicrcbe@gmail.com)

Website : [www.cicr.nic.in](http://www.cicr.nic.in)





## FOREWORD

As a signatory of Trade Related Aspects of intellectual property right (TRIPs), India has to make provisions for giving effect to Article 27.3 (b) of the Agreement by an effective system of protection of Plant varieties. This will stimulate investment for R & D, encourage development of new varieties and hybrids and accelerate agricultural development in the country.

Registration of new plant varieties in the Registry of Protection of Plant Varieties and Farmers' Right Authority will enable the Breeders to seek exclusive rights to produce and sell the seeds and will ensure benefit sharing in the future use of his/her variety by other Breeders. However, for the registration of any variety under this Act, the variety should confirm to the criteria of Novelty, Distinctiveness, Uniformity and Stability.

The Indian Council of Agricultural Research, New Delhi have the mandate of preparing the detailed DUS guidelines for different crops. I appreciate the efforts of the Project Coordinator, All India Coordinated Cotton Improvement Project and the Scientists of the Central Institute for Cotton Research, Nagpur in publishing the Draft Guidelines for Cotton. I hope this bulletin will serve as a useful reference material for all concerned.

**Dr. B.M. Khadi**

Director

Central Institute for Cotton Research, Nagpur



## PREFACE

General Agreement on Tariffs and Trade (GATT) recognized agriculture as an enterprise of investment and profit making and included it in the negotiations for the first time in Uruguay Round Talks (1886-1994). These negotiations led to the establishment of World Trade Organisation (WTO) in January 1995 of which India is a signatory. By placing Intellectual Property Rights in the WTO and making them subject to its binding disputes procedure, proponents of a strong IPRs regime have made it possible for noncompliant WTO members to face trade sanctions. Having ratified the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) India has to make provisions for giving effect to Article 27.3 (b) of the agreement relating to protection of plant varieties.


In order to provide for the establishment of an effective system for protection of plant varieties and to encourage the development of new varieties of plants, it has been considered necessary to recognize and protect the rights of the farmers in respect of their contribution made at any time in conserving, improving and making available plant genetic resources for the development of the new plant varieties. Moreover to accelerate agricultural development, it is necessary to protect plant breeders' rights to stimulate investment for research and development for the development of new plant varieties.

To give effect to the above said objectives, the Protection of Plant Varieties and Farmers' Rights Act, 2001 (53 of 2001) was enacted by Parliament on 30<sup>th</sup> October 2001. The rules of this Act have also been notified in September 2003.

Protection of Plant Varieties and Farmers' Rights Authority has come into existence under this Act. General functions of the Authority include the registration of new plant varieties by any person seeking protection under this Act. A new variety shall be registered under this Act, if it conforms to the criteria of novelty, distinctiveness, uniformity and stability.

The Indian Council of Agricultural Research, New Delhi is vested with the responsibility of conducting the DUS test to establish the Distinctiveness, Uniformity and Stability of the varieties received for Registration by the PPV & FR authority. Hence, test Guidelines for DUS testing are being finalized for different crops.

Cultivated cottons belong to both Tetraploid (*Gossypium hirsutum* L. and *Gossypium barbadense* L) and Diploid (*G. arboreum* L. & *G. herbaceum* L.) groups. DUS test guidelines for cotton have been developed taking UPOV



guidelines as a basis and includes 36 descriptors. However, UPOV guidelines for cotton is mostly based on Tetraploid cotton, which constitutes as much as 92 per cent of the world crop. However, India is unique in that both Tetraploid and Diploid cottons occupy a large area in our country. Looking into the total variability and range of characteristics, it was felt necessary to have separate sets of DUS guidelines for the Tetraploid and Diploid cottons.

We place on record, the dedicated efforts taken by Dr. B.M. Khadi, Director, CICR, Nagpur, Dr. R.K. Chowdhury, Professor, Division of Seed Science & Technology, IARI, New Delhi, Dr. Malavika Dadlani, Head, Division of Seed Science & Technology, IARI, New Delhi and Dr. P. Singh, Principal Scientist, CICR, Nagpur in preparing the initial draft guidelines and thankfully acknowledge them. We are also indebted to Dr. S.S. Narayanan, Principal Scientist (Retd.), CICR, Nagpur and Dr. L.A. Deshpande, Head, Division of Crop Improvement, Nagpur for critically going through the manuscript and offering useful suggestions.

**Dr. N. Gopalakrishnan,**  
Project Coordinator (Cotton Improvement) & Head,  
Central Institute for Cotton Research,  
Regional Station,  
Coimbatore - 641 003.



# Draft National Test Guidelines for the Conduct of Tests for Distinctiveness, Uniformity and Stability of Diploid Cotton (*Gossypium arboreum* L. & *Gossypium herbaceum* L.)



*Gossypium arboreum* L.



*Gossypium herbaceum* L.

## I. Subject

These test guidelines shall apply to all varieties of Tetraploid cotton viz., *Gossypium arboreum* L. and *Gossypium herbaceum* L. lines, intra specific hybrids, inter-specific hybrids and parental lines.

## II Material required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) shall decide when, where and in what quantity and quality the seed materials are required for testing a variety denomination applied for registration under the Protection of Plant Varieties and Farmers' Rights (PPV & FR) Act, 2001. Applicants submitting such seed material from a country other than India shall make sure that all customs and quarantine requirements stipulated under relevant national legislations and regulations are complied with. The minimum quantity of the seed to be provided by the applicant shall be 1500 grams in the case of the candidate variety or hybrid and 750grams for each of the parental line of the hybrid. Each of these seed lots shall be packed, sealed and properly labeled with details, in ten equal weighing packets and submitted in one lot.
2. The seeds submitted shall have at least 75 % germination, 98 % physical purity and the highest genetic purity. The moisture content of the seed shall not exceed 10 % to meet the safe storage requirement. A certificate indicating germination percentage recorded not more than one month before the submission of sample shall be attached.
3. The seed material submitted shall not have been subjected to any chemical or bio-physical treatment.

## III. Conduct of tests

1. The minimum duration of DUS tests shall normally be at least two independent similar growing seasons.
2. The test shall normally be conducted at two test locations. If any essential characteristics of the candidate variety is not expressed for visual observation at these locations, the variety shall be considered for further examination at another appropriate test site or under special test protocol on expressed request of the applicant.
3. The field tests shall be carried out under conditions favouring normal growth and expression of all test characteristics. The size of the plots shall be such that parts of plants could be removed for measurement and observation without prejudicing the observations on the standing plants until the end of the growing period. Each test shall include a minimum of 300 plants in the plot size and planting space specified below across three replications. Separate plots for observation and for measurement can only be used if they have been subjected to similar environmental conditions. All the replications shall be sharing similar environmental conditions of the test location.

#### 4. Test Plot Design :

Number of rows	:	6
Row length	:	6 m
Row to row distance	:	90 cm
Plant to plant distance	:	30 cm
Expected plants/ replication	:	120
Number of plants / hill	:	One
Number of replications	:	3

5. Observations should not be recorded on plants in border rows.

6. Additional test protocols for special purpose shall be established by the PPV & FR Authority.

#### IV. Methods and Observations

1. The characteristics described in the table of characteristics (see Section VII) shall be used for the testing of varieties, parental lines and hybrids for their DUS.
2. For the assessment of Distinctiveness and Stability, observations shall be made on 30 plants or parts of 30 plants, which shall be equally divided among three replications (10 plants per replication).
3. For the assessment of Uniformity of characteristics on the plot as a whole (visual assessment by a single observation of a group of plants or parts of plants), a population standard of 0.5 % with an acceptance probability of at least 95 % shall be obtained. In the case of a sample size of 300 plants, the number of off types should not exceed 4.
4. All leaf characteristics shall be observed on the fourth fully expanded leaf from the top of the main stem at 50 % flowering stage.
5. For the assessment of colour characteristics, the latest Royal Horticultural Society (RHS) colour chart shall be used.
6. All observations on the flower shall be made on the first day of flowering and at anthesis.
7. Observations on the boll shall be made at full maturity and before boll bursting.

#### V. Grouping of Varieties

1. The candidate varieties for DUS testing shall be divided into groups to facilitate the assessment of Distinctiveness. Characteristics which are known from experience not to vary, or to vary only slightly within a variety and which in their various states are fairly evenly distributed across varieties in the collection are suitable for grouping purpose.
2. The following characteristics are proposed to be used for grouping cotton varieties:
  - i) Leaf : Shape (Characteristic 6)
  - ii) Flower : Petal Colour (Characteristic 10)
  - iii) Pollen Colour (Characteristic 14)
  - iv) Boll : Shape (Longitudinal Section) (Characteristic 16)
  - v) Fibre : Length (Characteristic 26)



## VI. Characteristics and Symbols

1. To assess Distinctiveness, Uniformity and Stability, the characteristics and their states as given in the Table of Characteristics (Section VII) shall be used.
2. Notes (1 to 9), shall be used to describe the state of each character for the purposes of digital data processing
3. Legend :
  - (\*) Characteristics that shall be observed during every growing season on all varieties and shall always be included in the description of the variety, except when the state of expression of any of these characters is rendered impossible by a preceding phenological characteristic or by the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.
  - (+) See explanations on the Table of Characteristics in Section VIII.
4. A decimal code number in the sixth column of Table of Characteristics indicates the optimum stage for the observation of each characteristic during the growth and development of plant. The relevant growth stages corresponding to these decimal code numbers are described below.

### Decimal Code for the Growth Stages :

Growth Stage	Code
Seedling	5
Square formation	30
50% Flowering (at least one flower should have opened in 50% of the population in the plot)	40
Boll bursting	65
First picking (20% of bolls in each plant must have opened)	75
Final harvest	95

5. Type of assessment of characteristics indicated in column 7 of Table of Characteristics is as follows :
  - MG** : Measurement by a single observation of a group of plants or parts of plants.
  - MS** : Measurement of a number of individual plants or parts of plants.
  - VG** : Visual assessment by a single observation of a group of plants or parts of plants.
  - VS** : Visual assessment by observations of individual plants or parts of plants.

## VII. Table of Characteristics

Sl. No.	Characteristics	States	Notes	Example Varieties	Stage of Observation	Type of Assessment
1	Hypocotyl : Pigmentation	Absent	1	Ragavendra (h)	5	VS
		Present	9	PA 183 (a)		
2(*)	Leaf : Colour	Light green	1	G.Cot.23 (h)	40	VS
		Green	2	PA 183 (a)		
		Light red	3	Lohit (a)		
		Dark red	4	G 27 (a)		
3 (*)	Leaf : Pubescence	Sparce	1		40	VS
		Medium	5	PA 183 (a)		
		Dense	9	AKA 8401 (a)		
4(*)	Leaf : Nectaries	Absent	1		40	VG
		Present	9	Jawahar Tapti (a)		
5	Leaf : Petiole Pigmentation	Absent	1	Jawahar Tapti (a)	40	VS
		Present	9	V 797 (h)		
6(*) (+)	Leaf : Shape	Palmate (Normal)	1	K 9 (a)	40	VS
		Semi-digitate (Semi-okra)	2			
		Digitate (Okra)	3			
7	Plant : Stem Hairiness	Absent	1		30	VS
		Sparse	3	AKA 7 (a)		
		Medium	5	PA 183 (a)		
		Dense	7	G. Cot. 23 (a)		
8	Plant : Stem Pigmentation	Absent	1	Ragavendra (h)	30	VS
		Present	9	PA 183 (a)		
9	Flower : Time of flowering (50% of plants with at least one open flower)	Early (<50 days)	3	PA 183 (a)	40	VG
		Medium (50-60 days)	5	PA 255 (a)		
		Late (>60 days)	7	Digvijay (h)		
10(*)	Flower : Petal Colour	White	1	Sanjay (a)	40	VS
		Cream	2	AKA 7(a)		
		Yellow	3	PA 183 (a)		
		Pink	4	LD 327 (a)		
		Red	5	G 27 (a)		
		Variegated	9			
11(*)	Flower : Petal Spot	Absent	1	Chinese Spotless (a)	40	VS
		Present	9	Jawahar Tapti (a)		
12(*) (+)	Flower : Stigma	Embedded	3	Jawahar Tapti (a)	40	VG
		Exerted	5	Aravinda (a)		



Sl. No.	Characteristics	States	Notes	Example Varieties	Stage of Observation	Type of Assessment
13	Flower : Anther Filament Coloration	Absent	1	Jawahar Tapti (a)	40	VG
		Present	9	PA 183 (a)		
14(*)	Flower : Pollen Colour	Cream	1		40	VS
		Yellow	2	Jawahar Tapti (a)		
		Deep Yellow	3			
15	Boll : Colour	Green	3	Ragavendra (h)	65	VS
		Red	5	RG 18 (a)		
16(*) (+)	Boll : Shape (Longitudinal Section)	Round	3	Ragavendra (h)	65	VG
		Ovate	5	Jawahar Tapti (a)		
		Elliptic	7			
17(*)	Boll : Surface	Smooth	1		65	VG
		Pitted	9	Jawahar Tapti (a)		
18(*)	Boll : Prominence of Tip	Blunt	1	Ragavendra (h)	65	VG
		Pointed	9	Jawahar Tapti (a)		
19(*) (+)	Boll : Opening	Open	3	Jawahar Tapti (a)	75	VG
		Semi-open	5	V 797 (h)		
		Close	7	Wagad Local		
20(*)	Boll : Weight of Seed Cotton/Boll	Small (<2.0 g)	1	G 27 (a)	75	MS
		Medium (2.0-3.0 g)	3	PA 255 (a)		
		Large (>3.0)	5	PA 402 (a)		
21(*)	Seed : Fuzz	Medium	1	Jawahar Tapti (a)	95	VG
		Dense	3	Digvijay (h)		
22(*)	Seed : Fuzz color	Grey	1	Jawahar Tapti (a)	95	VS
		Brown	2			
23(*)	Seed : Size (100 Seed wt.)	Very Small (<3.0g)	1		95	MS
		Small (3.0-5.0g)	3	LD 210 (a)		
		Medium (5.1-7.0g)	5	AKA 7 (a)		
		Bold (7.1-9.0g)	7	PA 183 (a)		
		Very Bold (>9g)	9	G.Cot. 23 (h)		
24(*)	Ginning %	Very Low (<30)	1		95	MG
		Low (31-32)	3	Ragavendra (h)		
		Medium (33-34)	5	Jawahar Tapti (a)		
		High (35-36)	7	AKA 8401 (a)		
		Very High (≥37)	9	AKA 7 (a)		
25(*)	Fibre : Color	White	1		75	VS
		Cream	2			
		Green	3			
		Brown	4			



Sl. No.	Characteristics	States	Notes	Example Varieties	Stage of Observation	Type of Assessment
26(*) (+)	Fibre : 2.5% Span Length	Short ( $\leq 20$ mm)	1		95	MG
		Medium (20.5- 24.5mm)	3			
		Medium long (25.0 - 27.0 mm)	5	Jawahar Tapti (a)		
		Long (27.5 - 32.0 mm)	7	PA 183(a)		
		Extra long ( $\geq 32.5$ mm)	9	PA 255(a)		
27(*) (+)	Fibre : Strength	Very Weak ( $\leq 16$ g/tex)	1		95	MG
		Weak (17.0- 20 g/tex)	2			
		Medium (21.0-24.0 g/tex)	3			
		Strong (25.0 - 28.0 g/tex)	4			
		Very Strong ( $\geq 29$ g/tex)	5			
28 (+)	Fibre : Fineness (Micronaire Value)	Very Fine ( $\leq 3.0$ )	1		95	MG
		Fine (3.0-3.9)	3			
		Medium (4.0- 4.9)	5			
		Coarse (5.0-5.9)	7			
		Very Coarse ( $\geq 6.0$ )	9			
29 (+)	Fibre : Uniformity	Poor ( $< 42$ )	1		95	MG
		Fair (42-43)	3			
		Average (44-45)	5			
		Good (46-47)	7			
		Excellent ( $> 47$ )	9			
30 (+)	Fibre : Maturity (%)	Very Immature ( $\leq 31$ )	1		95	MG
		Immature (32-49)	3			
		Average (50-65)	5			
		Good (66-80)	7			
		Very Good ( $\geq 81$ )	9			

## VIII. Explanations and Methods

### Characteristic 6. Leaf : Shape



1. Palmate (Normal)



2. Semi-digitate (Semi-Okra)

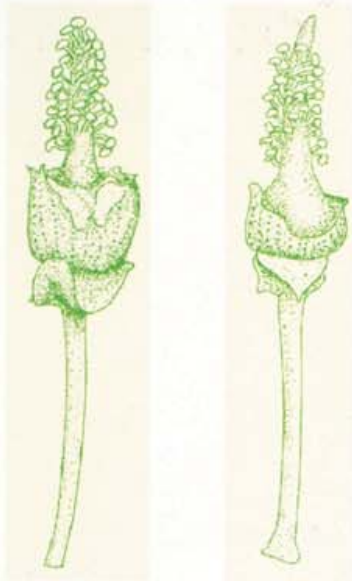


3. Digitate (Okra)



4. Lanceolate (Super Okra)

### Characteristic 12. Flower : Stigma



1. Embedded 2. Exserted

### Characteristic 16. Boll : Shape

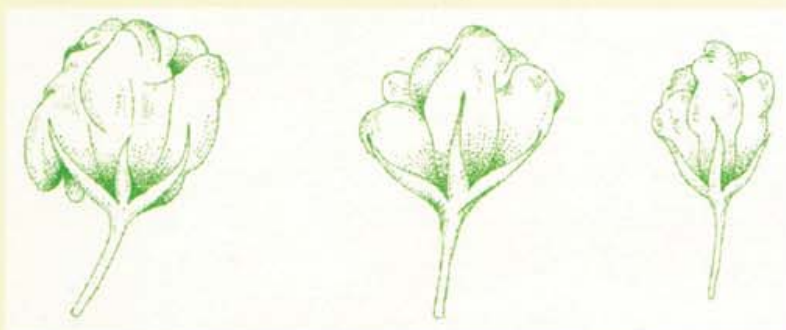


1. Rounded

5. Ovate

7. Elliptic

### Characteristic 19. Boll : Opening



3. Open

5. Semi-Open

7. Close

### Characteristics 26 (2.5% Span Length), 27 (Fibre strength), 28 (Fibre fineness), 29 (Fibre Uniformity) and 30 (Fibre Maturity)

The major fibre properties viz., 2.5% Span Length, Fibre Strength, Fibre Fineness (Micronaire), Fibre Uniformity and Fibre Maturity (%) shall be determined under ICC mode using a standard High Volume Instrument (HVI).

Fifty grams of lint pooled equally from all the replications shall be used for determining the above fibre parameters. The samples should be conditioned for at least 2 hours at a room temperature of  $27 \pm 2^\circ\text{C}$  and Relative Humidity of  $65 \pm 2\%$ . The moisture content of the sample should be around 7-8 %.

Calibration with HVI Calibration cotton supplied by the CIRCOT shall be done before testing the samples.

A fibro comb containing the test sample prepared with the help of a fibre sampler is placed in the comb track. The test cycle consists of automatic brushing of the sample in the fibro comb and placing it on the comb holder. The test specimen then moves through a light beam. Using the optical mass generated and the software installed, **2.5% Span Length** and **Uniformity Ratio** are derived.

After the test specimen passing through the sensor, the beard is positioned at the break point over a set of clamping jaws with 3 mm spacing between the jaws. The force required to break the beard is calculated in units of g /tex with the help of software and is recorded as **Fibre Strength**.

The cycle is repeated four times and the average values are taken.

To measure the **Fibre Fineness (Micronaire)**, the lint sample is opened thoroughly after removing all the trash. Approximately 10 g of lint is weighed and inserted into the porosity chamber and the lid is closed. Compressed air is allowed to flow through the sample inside the chamber. From the measured values of mass and pressure, the microprocessor calculates the specific surface, which is converted into the Micronaire value. Using the Micronaire value the software also derives **Fibre Maturity (%)**.

## IX. Technical Questionnaire

Reference Number  
(not to be filled in by the applicant)

### Technical Questionnaire

(To be completed with every seed submission of a candidate variety in accordance with specific Indian DUS test guidelines for registration under PPV & FR Act 2001)

#### 1. Genus

**Gossypium L.**

**DIPLOID COTTON**

- |      |   |   |   |
|------|---|---|---|
| 1.1. | <i>Gossypium arboreum</i> L.                        | [ | ] |
| 1.2. | <i>Gossypium herbaceum</i> L.                       | [ | ] |
| 1.3. | Intra specific hybrid (Hybrids of 1.1)              | [ | ] |
| 1.4. | Intra specific hybrid (Hybrids of 1.2)              | [ | ] |
| 1.5. | Inter specific hybrid (Hybrids between 1.1 and 1.2) | [ | ] |
| 1.6. | Others (Please specify)                             | [ | ] |

#### 2. Applicant (Name and address) :

(In concurrence with column 3 of Form No.1)

-----

-----

-----

-----



3. Proposed denomination of the variety as given in Form No. 1

-----  
 -----

4.

Information on Origin, maintenance and reproduction of the, variety

4.1. Type of Material

- a. Variety [        ]
- b. Hybrid
  - Intra arboreum hybrid [        ]
  - Intra herbaceum hybrid [        ]
  - G. herbaceum* x *G. arboreum* hybrid [        ]
- c. Line
  - Parental line (Female) [        ]
  - Parental line (Male) [        ]
- d. Others (Please specify) [        ]

Note : In case of use of male sterility system, indicate the type of male sterility and the name of the maintainer line of female parental line.

4.2. If applicable, for each component of 4.1 the information according to the following chapters V to VII to be furnished in separate sheets

4.3 Genetic origin & Breeding methods :

-----  
 -----

4.4

Method of propagating the variety :

-----  
 -----

4.5 Other information :

-----  
 -----

5 Characteristics of the candidate variety to be given (The number in Notes column refers to the different states of expression described in column 4 of the Table of Characteristics. Tick out within the brackets which best corresponds to the character expression of the candidate variety).



S.No.	Characteristics	States	Example Varieties	Notes
5.1	Leaf : Shape (6)	Palmate (Normal) Semi-digitate Digitate (okra)		1 [ ] 2 [ ] 3 [ ]
5.2	Flower : Petal Colour (10)	White Cream Yellow Pink Red Variegated		1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 9 [ ]
5.3	Flower : Petal Spot (11)	Absent Present		1 [ ] 9 [ ]
5.4	Flower: Pollen Colour (14)	Cream Yellow Deep Yellow		2 [ ] 3 [ ] 4 [ ]
5.5	Boll : Shape (Longitudinal Section) (16)	Round Ovate Elliptic		1 [ ] 2 [ ] 3 [ ]
5.6	Fibre : 2.5% Span Length (26)	Very Short ( $\leq 20.0$ mm) Short (20.0 - 24.5 mm) Medium (25.0 - 27.0 mm) Long (27.5 - 32.0mm) Extra Long ( $\geq 32.5$ mm))		1 [ ] 3 [ ] 5 [ ] 7 [ ] 9 [ ]

#### 6. Differences of Candidate variety from similar Variety

Denomination (s) of Similar variety	Characteristic in which candidate variety is different from similar variety *	State of expression of similar variety	State of expression of Candidate variety

\* In the case of identical states of expressions of both varieties, please indicate the size of the difference, in the grade of expression.





7. Additional information which may help to distinguish the variety :

7.1 Resistance to pests and diseases (indicate races, if any) :

-----  
-----

7.2. Special conditions for the examination of the variety :

-----  
-----

7.3. Other information, if any :

-----  
-----

### Photo Gallery (Diploid)

#### 1. Hypocotyl Pigmentation



Absent      Present

#### 4. Leaf : Nectaries

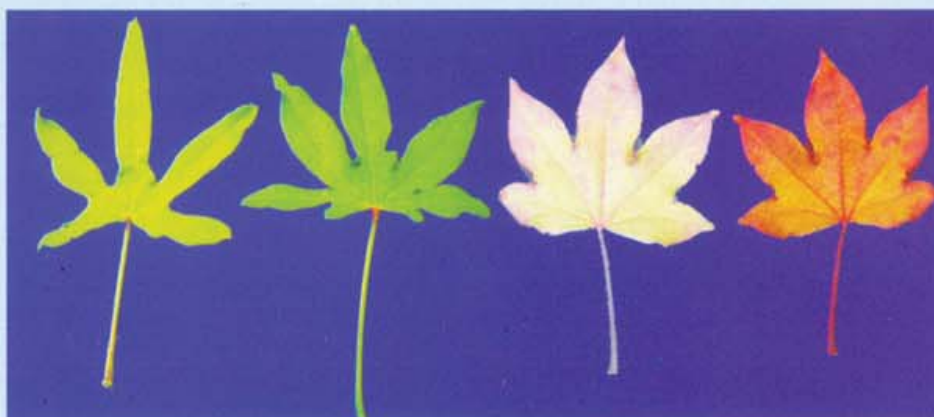


Absent



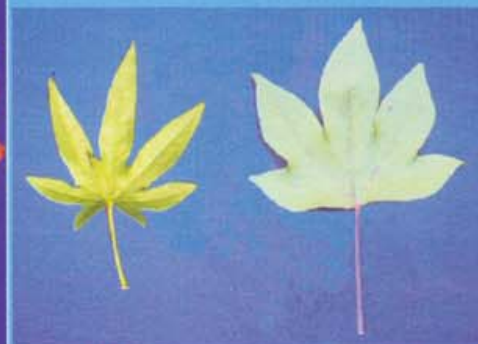
Present

#### 3. Leaf : Colour



Light Green      Green      Light Red      Dark Red

#### 5. Leaf : Petiole Pigmentation



Absent      Present



## 6. Leaf : Shape



Palmate  
(Normal)

Semi-digitate  
(Semi- okra)

Digitate  
(Okra)

## 7. Plant : Stem Hairiness



Absent



Medium



Sparse



Dense

## 8. Plant : Stem Pigmentation



Absent

Present

## 10. Flower : Petal Colour



## 11. Flower : Petal Spot



Absent

Present

## 12. Flower : Stigma



Embedded

Exserted

## 13. Flower : Anther Filament Coloration



Absent

Present

## 14. Flower : Pollen Colour



Cream

Yellow

Deep Yellow

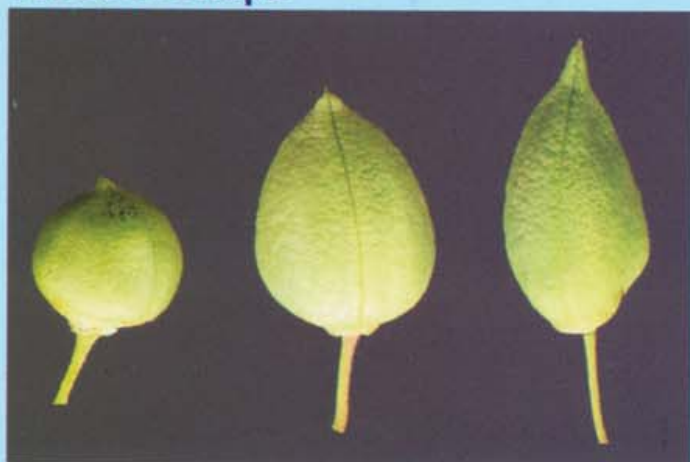
## 15. Boll : Colour



Green

Red

### 16. Boll : Shape



Round

Ovate

Elliptic

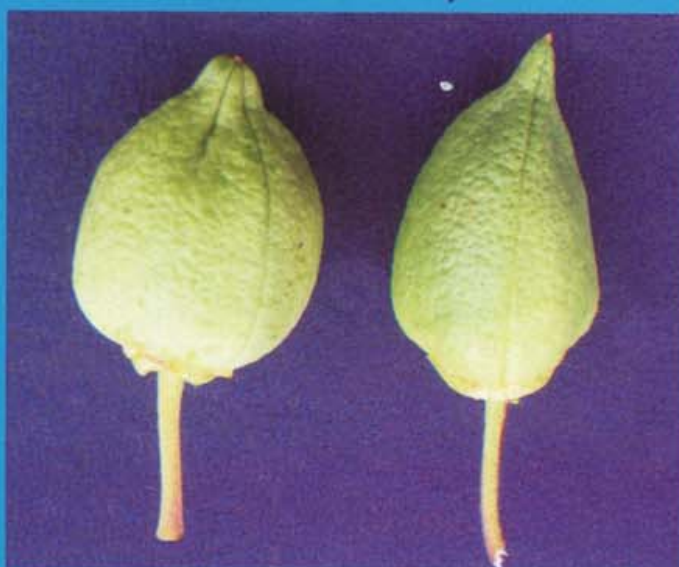
### 17. Boll : Surface



Smooth

Pitted

### 18. Boll : Prominence of Tip



Blunt

Pointed

### 23. Seed : Size (100 Seed weight)



Very Small  
( $<5.0g$ )

Small  
( $3.0-5.0g$ )

Medium  
( $5.1-7.0g$ )



Bold  
( $7.1-9.0g$ )

Very Bold  
( $>9.0g$ )

### 21. Seed : Fuzz



Present

Sparse

Medium

Dense

