

**Guidelines
for the conduct of test
for Distinctiveness, Uniformity and
Stability**

On

**Mulberry
(*Morus* spp.)**



**Protection of Plant Varieties and Farmers' Rights
Authority (PPV & FRA)
Government of India, New Delhi**

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Mulberry (*Morus* spp.)

I. Subject

These Test Guidelines shall apply to all vegetatively propagated varieties, hybrids, mutants, polyploids and transgenics of **Mulberry** (*Morus* spp.)

II. Planting Material Required

1. The Protection of Plant Varieties & Farmers' Rights Authority (PPV&FRA) shall decide on the quantity and quality of the plant material required for testing of the variety and when and where it is to be delivered for registration under the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001.
2. Applicants submitting such material(s) from a country other than India shall make sure that all customs and quarantine requirements stipulated under relevant national legislations are complied with.
3. The crop (mulberry) is a perennial, heterozygous tree plant cultivated as small to high bush and small trees by regular pruning and propagated clonally by stem cuttings in tropics and grafts in temperate regions.
4. The minimum quantity of planting material required to be supplied by the applicant per centre shall be 50 stem cuttings of 12 – 15 cm length and 1.0 – 1.5 cm diameter from 6 – 8 months mature shoots with 2 – 3 healthy buds or 50 saplings of four months old of about 120 cm height or 50 saplings/grafts on the root stock (popular root stock utilized in the region).
5. The planting materials supplied shall be healthy, not lacking in vigour or nutrition as well as free from pests or diseases or any mechanical damage.
6. The stem cuttings or grafted plants will be planted in nursery for rising of 4 months old saplings / grafts required for the test following the recommended cultivation practice in mulberry.
7. The plant material should not have undergone any treatment, which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

III. Conduct of tests

1. The minimum duration of DUS tests shall be normally 90 days each of 2 independent growing cycles per year (in June – August and September – November) and conducted for two years. The reproductive characteristics will be recorded after the second growing cycle during the natural flowering season (January – February) culminating with fruit development. The test will be initiated after 1 year of the establishment of the plants in an experimental plot. The tests will be conducted at two places or in on-site testing.
2. The growing cycle is considered as the period from the date of pruning of the plants followed by bud sprouting, and active vegetative growth.
3. If any essential characteristic of the candidate variety is not expressed at the time of visual observation at two locations, the variety shall be considered for further examination at another appropriate test site or under special test protocol on expressed request by the applicant, for which additional quantity of planting material shall be supplied.

4. 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 plants or parts of plants could be removed for measurement and observation without prejudice to the other observations on the standing plants until the end of the growing period.

5. Test plot design:

The plants shall be raised with a crown height of 60 cm and spacing of 150 cm x 150 cm in Pit system and nurtured following the package of practices recommended for the variety.

Planting system	: Pit system
Number of rows	: 03
Row to row distance	: 150 cm
Plant to plant distance	: 150 cm
Number of replications	: 03
Number of plants per replication	: 08

6. On-site testing:

The applicant or his/her nominee on his/her behalf shall submit a request to the Authority for conducting a reliable trial according to Test Guidelines and the instructions from the Authority before on-site examination of the candidate variety. The applicant or his/her nominee shall submit a request to the Authority for on-site examination prior to start of growing cycle as mentioned in Test Guidelines for on-site examination of the candidate variety. On-site testing may be conducted at places specified by the applicant. The age of the plants at on-site shall be a minimum of 2 years for tropical regions and 3 years for temperate regions. As a minimum, 24 plants with uniform spacing should be available for inspection and examination for 'on-site' DUS testing. The plants must be healthy and free from pest & disease and raised under standard and uniform management practices. For farmer's variety or landraces, the authority may notify suitable guidelines on the number of plant(s) and season(s), if any. On-site examination shall be arranged during the favourable growing season, when distinguishing characteristics of candidate variety can most easily be seen. The characteristics of the candidate variety can be examined and compared with those of the reference varieties as per the Test Guidelines. The Expert Committee constituted by the PPV & FRA in consultation with the DUS centre shall be authorized to inspect on-site testing and recording of the appropriate characters. Applicant shall supply the Expert Committee with summary of distinct characteristics supported by photographs. The Expert Committee shall take notes and observations on distinctiveness and shall confirm preliminary data and/or summary of distinctiveness from the applicant. The Expert Committee shall submit examination report to the Authority.

7. Observations shall not be recorded on plants in border rows.

8. Additional tests for special purpose shall be established by the PPV & FR Authority.

IV. Methods and observations

1. The characteristics described in the Table of Characteristics (refer Section – VII) shall be used for the testing of varieties for their DUS.
2. For the assessment of Distinctiveness and Stability, observations shall be made on 9 plants or parts of 9 plants, which shall be equally divided among 3 replications.
3. For the assessment of Uniformity of vegetatively propagated varieties, a population standard of 1% and an acceptance of probability of at least 95% shall be applied.
4. All observations on leaf characters shall be measured using fully expanded matured leaves in the middle portion (15th leaf) on the longest shoot.
5. All observations on shoot, leaf, bud characteristics shall be made on upper (*e.g.*, stipule nature), middle (*e.g.*, phyllotaxy), lower (*e.g.*, mature shoot color and shoot thickness in cm) 1/3rd portion of the longest shoot.
6. Observations on reproductive characteristics shall be taken during the natural flowering season or after about 2 – 3 weeks of pruning.
7. For the assessment of colour characteristics, the latest Royal Horticultural Society (RHS) colour chart shall be used.

V. Grouping of varieties

1. The candidate varieties for DUS testing should 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 of expression are fairly distributed evenly across all varieties in the collection, are suitable for grouping purposes.
2. The following characteristics shall be used for grouping mulberry varieties
 - a) Inter-nodal distance (Characteristic 08)
 - b) Phyllotaxy (Characteristic 09)
 - c) Leaf base (Characteristic 21)
 - d) Sex (Characteristic 29)
 - e) Mature inflorescence length (Characteristic 30)

VI. Characteristics and symbols

1. To assess distinctiveness, uniformity and stability, the characteristics and their states of expression 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 purpose of digital data processing and these notes shall be given against the states of different characteristics.
3. Legend
 - (*) Characteristics that shall be observed during the active growing season 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 regions. Under such situation, adequate explanation shall be provided.
 - (+) See explanations for the Table of characteristics in the section - VIII. It is noted that for certain characteristics the plant parts on which observations to be taken are given in the explanation of figure (s) for clarity and not for the colour variation.

4. A numerical code in the sixth column of Table of Characteristics is on or after the days indicated for the observation of respective characteristic during the growth and development of plants. The relevant growth stages corresponding to this numeric code are described below:

Code for the growth stages

Code	Growth stage
08	After 8 days of pruning, when the buds start sprouting
20	Matured or fully developed inflorescence in the natural flowering season or about 2 - 3 weeks after pruning
40	Fully matured fruit
45	On or after 45 days of pruning
60	On or after 60 days of pruning
90	On 90 th day of pruning / planting of cuttings

5. Characteristics denoted with symbols QL, QN and PQ in the first column of the Table of Characteristics shall be indicated as;

QL: Qualitative characteristic

QN: Quantitative characteristic

PQ: Pseudo-qualitative characteristic

6. Type of assessment of characteristics indicated in column seven of Table of Characteristics is as follows:

MS: Measurement of a number of individual plants or parts of plants

MG: Measurement by a single observation of a group of plants or parts of plants

VS: Visual assessment by observation of individual plants or parts of plants

VG: Visual assessment by a single observation of a group of plants or parts of plants

VII. Table of Characteristics

Sl. No.	Characteristic	State	Note	Example varieties	Stage of observation (Day - on or after)	Type of assessment
1	2	3	4	5	6	7
1 QN (*)	Plant: vigor	Low Medium High	3 5 7	Kajli, Surat, Harmutty Kanva-2 <i>M. laevigata</i> (Hybrid)	45	VG
2 PQ (*) (+)	Plant: growth habit	Erect Semi-erect Spreading Drooping	3 5 7 9	Philippines, Kanva-2, Mysore Local <i>M. multicaulis</i> , Kosen Kajli, Bilidevalaya, Doomar Nali, Mizusawa Creeping mulberry	60	VS
3 QN	Sprouting (days)	Early (<10) Medium (10-15) Late (>15)	3 5 7	Kanva-2, Harmuty Birds Foot, Philippines Urgam-1, French	8	MG
4 QN	Survival % of cuttings (rooting)	Low (<40) Medium (40 – 80) High (>80)	3 5 7	Doomar Nali Kosen, Philippines Kajli	90	MG
5 PQ (+)	Shoot: type	Straight Slightly curved Curved	3 5 7	Kanva-2 Kosen Doomar Nali	60	VS
6 QN	Shoot: thickness (cm)	Thin (<1.0) Medium (1.0-1.5) Thick (>1.5)	3 5 7	Harmutty <i>M. multicaulis</i> Mizusawa, Lazuraso, Kosen, Gajapathipur-2	60	MS
7 PQ	Mature shoot: color	Yellow-Green Group 147 Greyed-Green Group 195 Grey-Brown Group 199 Brown Group N200 Grey Group 201	1 3 5 7 9	Kokuso China-34 Asiyoake, Lazuraso, Birds Foot K2xBC (P11) Barbat Farm	90	VS
8 QN (*)	Inter-nodal distance (cm)	Short (<3) Medium (3-6) Long (>6)	3 5 7	Surat, Kokuso Railway Quarter, Kosen Phillipines, Doomar Nali, Moreti (Syringe), Birds Foot	90	MS
9 PQ (*) (+)	Phyllotaxy	Distichous (1/2) Tristichous (1/3) Pentastichous (2/5) Mixed type {(1/2 & 1/3), (1/2 & 2/5), (1/3 & 2/5), (1/2, 1/3 & 2/5)}	3 5 7 9	Birds Foot, Doomar Nali, <i>M. laevigata</i> (Hybrid) Bilidevalaya Lazuraso, Kosen, Harmutty, Mizusawa French, Mysore Local, Kanva-2, Asiyoake	60	VS
10 QN (+)	Leaf: angle	Acute Horizontal Obtuse	3 5 7	Kanva-2, Mysore Local Moreti (Seringe) Philippines	45	VG

11 QN (+)	Petiole: length (cm)	Short (<3)	3	Malakai Local, Surat	60	MS
		Medium (3-5)	5	Kanva-2, Punjab Local, Badodhi		
		Long (>5)	7	Railway Quarter, Doomar Nali, Creeping CP x V-1 (P5)		
12 QN	Petiole: thickness (cm)	Thin (<0.2)	3	Surat, Kajli, Acc.106, Harmutty	60	MS
		Medium (0.2-0.4)	5	Kanva-2, Barbat Farm		
		Thick (>0.4)	7	<i>M. multicaulis</i> , Phillipines, Doomar Nali, China-34		
13 QL	Stipule: nature	Bud scale	1	Surat, Acc.106	45	VS
		Free lateral	2	Mysore Local, Railway Quarter		
		Foliateous	3	Barbat Farm		
14 QN (*)	Leaf lamina: length (cm)	Short (<10)	3	Surat	60	MS
		Medium(10-20)	5	Kanva-2, Mysore Local		
		Long (>20)	7	<i>M. multicaulis</i> , Doomar Nali, Phillipines, <i>M. laevigata</i> (Hybrid)		
15 QN (*)	Leaf lamina: width (cm)	Narrow (<10)	3	Surat, French, Harmutty	60	MS
		Medium (10-15)	5	Kanva-2, Mysore Local, Railway Quarter		
		Broad (>15)	7	Doomar Nali		
16 QN (*) (+)	Leaf: size (sq. cm)	Small (< 200)	3	Surat	90	MG
		Medium (200-400)	5	Kosen, Kanva-2, Punjab Local		
		Large (> 400)	7	Doomar Nali, <i>M. laevigata</i> (Hybrid)		
17 PQ (+)	Leaf: shape	Cordate (L/W ratio=<1:1)	1	Kanranjotli-1	60	MS
		Wide ovate (L/W ratio= 1.2:1)	3	<i>M. multicaulis</i>		
		Ovate (L/W ratio=1.5:1)	5	Doomar Nali, Kanva-2, Mysore Local		
		Narrow ovate (L/W ratio=2:1)	7	Harmutty		
		Lanceolate (L/W ratio =3:1)	9	French		
18 PQ (+)	Leaf: color	Light Green -141 D	3	Kanva-2	60	VS
		Green-137C	5	Phillippines		
		Dark Green-137A	7	Railway Quarter, Kajli, <i>M. multicaulis</i>		
19 PQ	Leaf: hairiness	Glabrous	3	Kosen	90	VS
		Sparsely Hairy	5	Birds Foot, Badodhi, Malakai Local, Ranchi-5		
		Hairy (pubescent)	7	Urgam-1		
20 PQ	Leaf: texture	Membranaceous	3	Phillippines	90	VS
		Charataceous	5	Kajli, Surat, Mysore Local		
		Coriaceous	7	French, Barbat Farm		
21 PQ (*) (+)	Leaf: base	Acute	3	French	60	VS
		Truncate	5	Kanva-2, <i>M. laevigata</i> (Hybrid)		
		Cordate	7	Mizusawa, <i>M. multicaulis</i> , Punjab Local		
		Lobate	9	Kosen, Malakai Local		
22 PQ (*) (+)	Leaf: apex	Acute	3	Phillippines, French, China-34	60	VS
		Acuminate	5	Punjab Local, Mysore Local		
		Caudate	7	Barbat Farm, Harmutty, Badodhi, Ranchi-5		

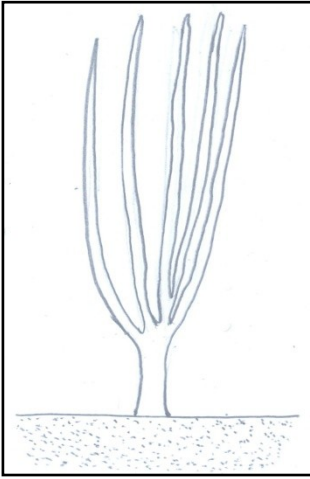
		Obtuse	9	-		
23 PQ (* (+)	Leaf: margin	Crenate	3	Philippines, Kosen	60	VS
		Dentate	5	Surat, Acc.106, Malakai Local		
		Serrate	7	<i>M. laevigata</i> (Hybrid)		
		Repand	9	Lamia Bay		
24 PQ (*	Leaf: type	Unlobed (entire)	1	<i>M. multicaulis</i>	60	VG
		Lobed	2	Kajli, Bilidevalaya		
		Mixed type	3	Mysore Local, Badodhi, Ranchi-5		
25 QN (+)	Mature bud size	Small	3	Philippines, Surat, Punjab Local	90	VG
		Medium	5	Kosen, <i>M. multicaulis</i> , Kajli		
		Large	7	Doomar Nali		
26 QL (+)	Bud attachment	Adhering to branch	1	Philippines, Surat, Mysore Local	60	VS
		Slanting out ward	2	<i>M. multicaulis</i> , Kajli, Barbat Farm		
		Tilting to one side	3	-		
27 PQ (* (+)	Mature bud shape	Round	3	Acc.106, Gajapathipur-2	90	VG
		Acute triangle	5	Philippines, Mysore Local, Punjab Local		
		Long triangle	7	Mizusawa, <i>M. multicaulis</i> , Birds Foot, Badodhi		
		Spindle	9	Doomar Nali		
28 QL (+)	Accessory bud	Absent	1	French	60	VS
		Present	9	<i>M. multicaulis</i> , Mysore Local		
29 QL (* (+)	Sex	Gynoecious	1	Kajli, , Doomar Nali, <i>M. multicaulis</i>	20	VG
		Androecious	2	Lamia Bay		
		Bisexual	3	Gajapathipur-2		
		Andromonoecious	4	-		
		Gynomonoecious	5	-		
		Androgynomonoecious	6	-		
30 QN (* (+)	Mature inflorescence: length (cm)	Short (<2)	3	Surat, Mysore Local, Bilidevalaya, Harmutty	20	MS
		Medium (2-4)	5	Mizusawa, <i>M. multicaulis</i> , Punjab Local		
		Long (>4)	7	Birds Foot, Doomar Nali, <i>M. laevigata</i> (Hybrid)		
31 QL	Stigma: nature	Pubescent	3	Mysore Local, Railway Quarter	20	VS
		Papillate	7	Philippines, Doomar Nali, Lazuraso		
32 QL	Stigma: type	Erect	3	Lasuraso, <i>M. multicaulis</i> , Kajli, Birds Foot	20	VS
		Spreading	5	Punjab Local, Kanva-2, Bilidevalaya		
		Divaricate	7	Mysore Local, Surat, Harmutty, Karanjotli-1		
		Twisted	9	Doomar Nali, Ranchi-5		
33 QN (+)	Mature fruit: length (cm)	Short(<2)	3	Surat, Mysore Local	40	MS
		Medium (2-4)	5	<i>M. multicaulis</i> , China-34, Kanva-2, Karanjotli-1, Moreti (Seringe)		
		Long (4-8)	7	Ranchi-5, <i>M. laevigata</i> (Hybrid)		
		Very long (>8)	9	Doomar Nali		

34 QN	Mature fruit: width (cm)	Narrow (<1)	3	Surat, Harmutti, Mysore Local, <i>M. laevigata</i> (Hybrid)	40	MS
		Medium (1-1.5)	5	Kajli, <i>M. multicaulis</i> , Doomar Nali		
		Broad (>1.5)	7	Railway Quarter		
35 PQ (+)	Mature fruit: color	Black Group 203 - Bluish Black C	1	<i>M. multicaulis</i> , Kajli, Bilidevalaya, Surat, Kanva-2, Mysore Local	40	VG
		Greyed-Orange Group 172 - Dark Reddish Orange B	2	<i>M. laevigata</i> (Hybrid)		
		Purple Group 76 - Very Pale Purple C	3	Punjab Local, RC-1		
		Yellow-Green Group 145 - Light Yellow Green D	4	Moreti (Seringe)		
		White	5	Ranchi-5		
		Green	6	Saravathi Tea Estate		

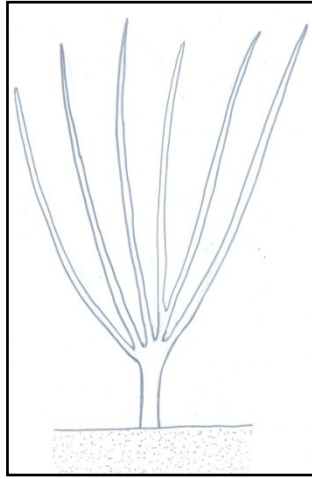
VIII. Explanation on the table of characteristics

Characteristic 2: Plant growth habit

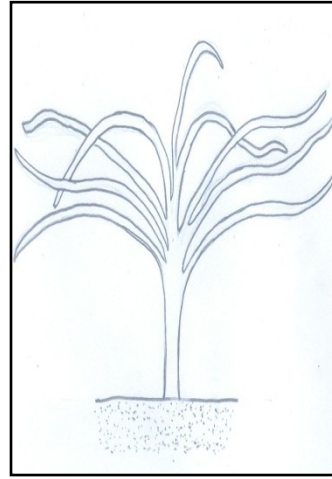




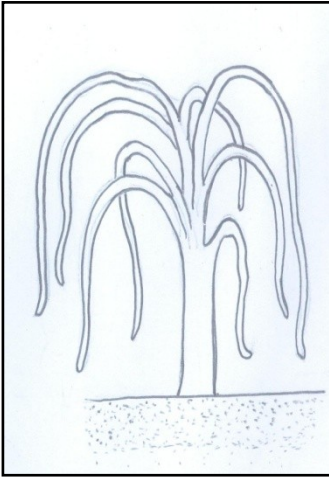
Erect
(3)



Semi-erect
(5)



Spreading
(7)



Drooping
(9)

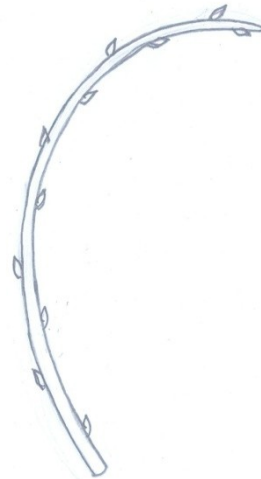
Characteristic 5: Shoot type



Straight
(3)

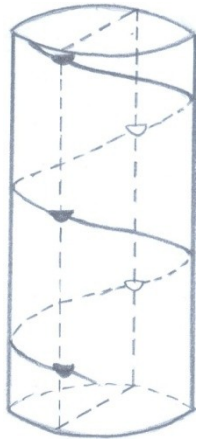


Slightly curved
(5)

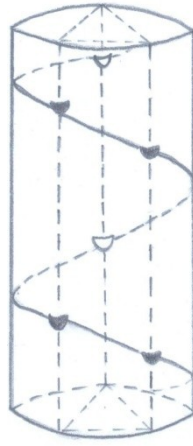


Curved
(7)

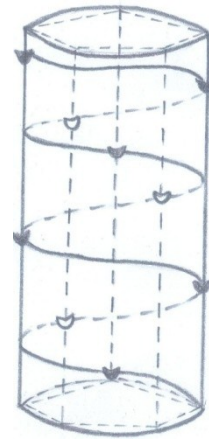
Characteristic 9: Phyllotaxy



**1/2
(3)**



**1/3
(5)**



**2/5
(7)**

Mixed type (9) - Include combination of 1/2 & 1/3 or 1/2 & 2/5 or 1/3 & 2/5 or 1/2, 1/3 & 2/5

Characteristic 10: Leaf angle



**Acute
(3)**



**Horizontal
(5)**



**Obtuse
(7)**

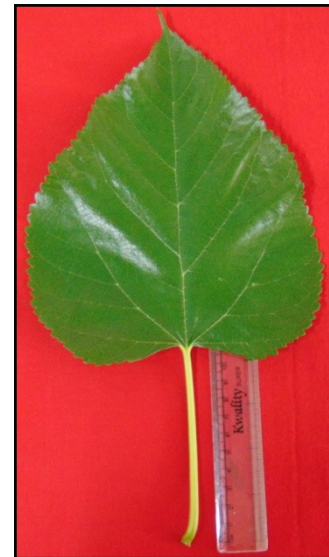
Characteristic 11: Petiole length



**Short
(3)**



**Medium
(5)**



**Long
(7)**

Characteristic 16: Leaf size



**Small
(3)**

**Medium
(5)**

**Large
(7)**

Characteristic 17: Leaf shape



**Cordate
(1)**



**Wide ovate
(3)**



**Ovate
(5)**



**Narrow ovate
(7)**



**Lanceolate
(9)**

Characteristic 18: Leaf color



**Light green 141 D
(3)**



**Green 137 C
(5)**



**Dark green 137 A
(7)**

Characteristic 21: Leaf base



Acute
(3)



Truncate
(5)



Cordate
(7)



Lobate
(9)

Characteristic 22: Leaf apex



Acute
(3)

Acuminate
(5)

Caudate
(7)

Characteristic 23: Leaf margin



Crenate
(3)



Dentate
(5)

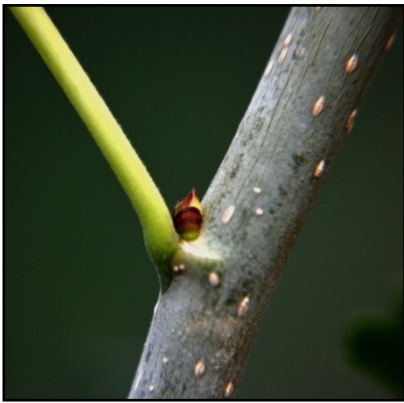


Serrate
(7)



Repand
(9)

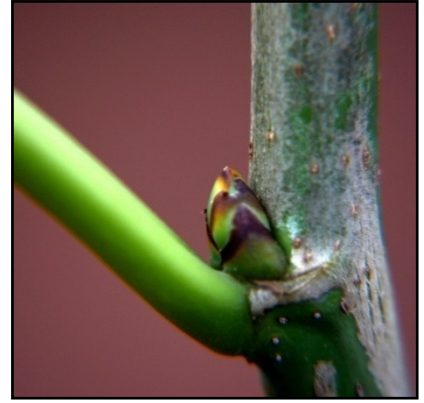
Characteristic 25: Mature bud size



**Small
(3)**

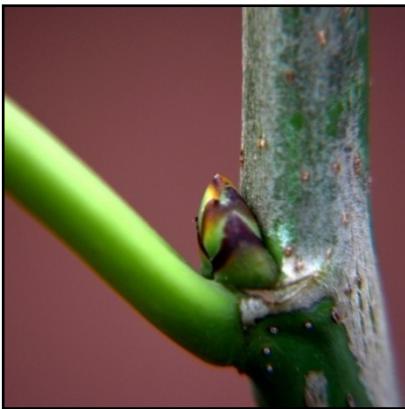


**Medium
(5)**



**Large
(7)**

Characteristic 26: Bud attachment



**Adhering to branch
(1)**

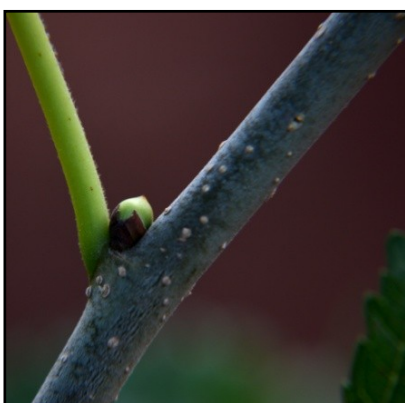


**Slanting outward
(2)**



**Tilting to one side
(3)**

Characteristic 27: Mature bud shape



**Round
(3)**



**Acute triangle
(5)**



**Long triangle
(7)**

Characteristic 28: Accessory bud



Absent
(1)



Present
(9)

Characteristic 29: Sex



Gynoecious (Female)
(1)



Androecious (Male)
(2)

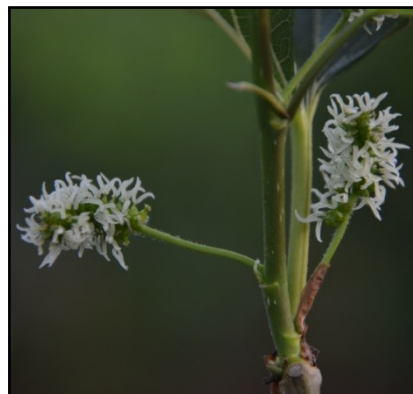


Bisexual
(3)

Characteristic 30: Mature inflorescence length (Female)



Short
(3)



Medium
(5)



Long
(7)

Characteristic 30: Mature inflorescence length (Male)



Short
(3)



Medium
(5)



Long
(7)

Characteristic 33: Mature fruit length



Short
(3)



Medium
(5)



Long
(7)



Very long
(9)

Characteristic 35: Mature fruit color



Bluish black
(1)



Dark reddish orange
(2)



Very pale purple
(3)



Light yellow green
(4)



White
(5)

IX. Working group details

The test guidelines developed by the task force (03/2016) constituted by the PPV & FR Authority for **Mulberry** (*Morus Spp.*) with consultation by Central Sericultural Research and Training Institute, Mysuru

Technical inputs also provided by the PPV & FR Authority and nodal officer.

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Secretary

X. DUS Testing Centres

Nodal DUS Test Centre	Co nodal DUS Test Centre
Central Sericultural Research and Training Institute, Central Silk Board, Manadavadi Road, Srirampura, Mysore-570008, Karnataka	_____