Casuarina (*Casuarinaequisetifolia*L. and *Casuarinajunghuhniana*Miq.)

I. Subject

These test guidelines shall apply to all clonally propagated varieties of Casuarina viz. *Casuarinaequisetifolia* L. and *Casuarinajunghuhniana*Miq.,intra-specific hybrids and inter-specific hybrids.

II. Planting Material required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) shall decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered for registration under the Protection of Plant Varieties and Farmers' Rights (PPV & FRA) Act, 2001.

2. Applicants submitting such plant 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.

3. The minimum number of planting material to be supplied by the applicant or his nominee during June-July shall be 50numbers rooted cuttings of the candidate variety.

4. The plant material shall be visibly healthy, not lacking in vigour or nutrient deficiency as well as freefrom pests or diseases. The planting material shall be at least three months old measuringa minimum20 cm from collar to apical tip with a well-developed root system and proper identification for each plant.

5. The planting material should not have undergone any treatment 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 tests shall normally be conducted attwo locations. If any essential characteristics of the candidate variety are 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 expression of interest of the applicant.
2. The field tests shall be carried out under conditions favouring normal growth and expression of all characteristics.
3. The minimum duration of the DUS tests shall normally be at least two flowering seasons in different years.
4. Each test shall include 15 plants planted in three replications with five plants in each replication planted in a row at a spacing of 3 x 2 m. All the replications shall be sharing similar environmental conditions of the testlocation.
5. On-site assessment of adult trees: The Expert Committee constituted by the PPV & FRA in consultation with the DUS Centre shall be authorized to inspect the adult plants of the candidate variety 'on-site' and record the characteristics. A minimum of15 trees of the candidate variety planted at uniform spacing should be available for inspection and examination for on-site DUS testing. The trees should be aged 2 to 4 years and healthy and free from pests and diseases and raised under standard management practices.
6. Additional test protocol 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 testing of candidate varieties for their DUS.
2. The assessment of Distinctiveness and Stability, observations will be made on 9plants or parts of 9 plants, which will be equally divided among the replications (3 plants per replication).

3. The assessment of Uniformity of characteristics shall be made in 3 plants per replication with an acceptance probability of at least 95%. The maximum number of off-type allowed would be 1 in nine plants.
4. The stem and bark characteristics should be observed at a height of 1.37 m from ground level. Branching characteristics should be evaluated in the mid one-third portion of the crown.
5. The branchlet, flower and fruit characteristics should be evaluated from 10 samples each collected from nine trees. Samples should be collected from the longest primary branch in the mid portion of the crown.
6. Observations on the inflorescences should be made at the time of peak flowering on inflorescences borne on typical shoots from the exposed regions of the tree.
7. Observations on the mature fruit should be recorded when the fruit is ready for harvesting. At this stage the valves containing seeds (samara) are still closed but the fruit colour turns from green to brown.
8. For the assessment of all colour characteristics, the latest Royal Horticultural Society (RHS) colour chart shall be used.

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 all the varieties in the collection are suitable for grouping purpose.
2. The following characteristics shall be used for grouping of Casuarinavarieties:

    1. Branchlet: Length (Characteristic 2)
    2. Branchlet: Leaves per node (Characteristic 4)
    3. Anthocyanin in the leaf tip (Characteristic 6)
    4. Lenticels: Grouping (Characteristic 10)
    5. Bark: Colour (Characteristic 16)
    6. Sexual system: (Characteristic 23)
    7. Male Flower: Anther colour(Characteristic 27)

8. Cone: Pedicel shape (Characteristic 34)

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. Type of assessment of characteristics indicated in column seven 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 observation of individual plant or parts of plants

3. Legend:

a. (*) 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 phonological characteristic or by the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.

b. (+) See explanation on the Table of Characteristics in Section VIII. It is to be noted that for certain characteristics, the plant parts on which observation to be taken are given in the explanation or figure(s) for clarity and not the colour variation.

4. A decimal code number mentioned in the sixth column of Table of characteristics indicates the optimum stage for the observation of each characteristic during the growth and development of the plant. The relevant growth stages corresponding to the decimal code number are described below.

Decimal Code for the Growth Stage

Code	Growth Stage
12	Tree is minimum 1 m tall; minimum 5 well developed primary branches seen. The main stem turns woody.
18	Tree is minimum 3 m tall; internodal portions in the main stem are minimum 15 cm in the lower 20%. Lenticels clearly visible.
24	Tree is minimum 4 m tall; internodal portions in the main stem are minimum 15 cm in the lower 40%. Male flowering appears on deciduous branchlets and female flowers appear on primary and secondary branches.
30	Tree is minimum 5 m tall; Male flowering appears on deciduous branchlets and female flowers appear on primary and secondary branches. matured cones develop on primary and/or secondary branches.
36	Tree is minimum 6 m tall; Male flowering appears on deciduous branchlets and female flowers appear on primary and secondary branches. Cones set during stage 30 shed winged fruits and abscise. New cones develop on primary and/or secondary branches.

VII. Table of Characteristics

S. No.	Characteristic	State	Note	Example clone	Stage of observation	Type of assessment
1	2	3	4	5	6	7
1 (*)	Branchlet: Colour	Light green	1	CE30,CE40	12& 18	VG
		Dark green	2	CE93, CJ12		
		Bluish green	3	CE29		
		Yellowish green	4	CJ19, MTP2		
2 (*)	Branchlet: Length	Short (<15 cm)	3	CE138,CJ66	12 & 18	MS
		Intermediate (15-25 cm)	5	IFGTB-3,CJ48		
		Long (>25 cm)	7	CE48,CJ16		

3	Branchlet: Thickness	Thin (<0.3 mm)	3	CJ52	12 & 18	MG
		Intermediate (0.3- 0.6 mm)	5	IFGTB-3, CJ21		
		Thick (>0.6 mm)	7	CE48,CJ70		
4 (*)	Branchlet: Leaves per node	Less than 6 leaves	1	--	12 & 18	VS
		6 leaves	2	CE52, CE64		
		7 leaves	3	CE101, CE110		
		8 leaves	4	CE93,CJ23		
		9 leaves	5	CJ24		
		10 leaves	6	CJ25		
		More than 10 leaves	7	CJ10		
5	Branchlet: Internode length	Short (< 5 mm)	1	CJ 86,CJ 73	12 & 18	MG
		Medium (5-8mm)	9	IFGTB1, CJ29, CJ 13		
		Long (>8mm)	7	CE54, CJ19, CJ64		
6 (*)	Anthocyanin in the leaf tip	Absent	1	CE101, CE51	12 & 18	VS
		Weak	2	--		
		Medium	3	--		
		Strong	4	CJ22		
7	Pubescence in leaf tips	Absent	1	CE73,CE100	12 & 18	VS
		Present	9	CE66,CE11, CJ47		
8	Leaf tip marks	Absent	1	CE100,CJ41	12 & 18	VS
		Present	9	CE109,CJ58		
9 (+)	Pruning Scars	Isosceles triangular	1	CE65, CJ74	18& 24	VS
		Equilateral triangular	2	CE59		
		Eye-shaped	3	CE107		
10 (*) (+)	Lenticels: Grouping	Individual	1	IFGTB- 4, CJ48,CE51	18 & 24	VS
		Vertical lines	2	CE74, CJ45,CJ81		
		Slanting / Curved lines	3	CE61,CE135		
		Cluster	4	CE73,CE107		
		Mixed	5	CE72, CE132, CJ28		
11	Lenticels: Density	Very Low (<20 per sq. cm)	1	CE109,CJ21,MTP1	18 & 24	MS
		Low (21-30per sq. cm)	3	CE74,CJ22		
		Intermediate (31-40per sq. cm)	5	CE51,CJ54		
		High (41-50per	7	CE40,CE107, CJ71		

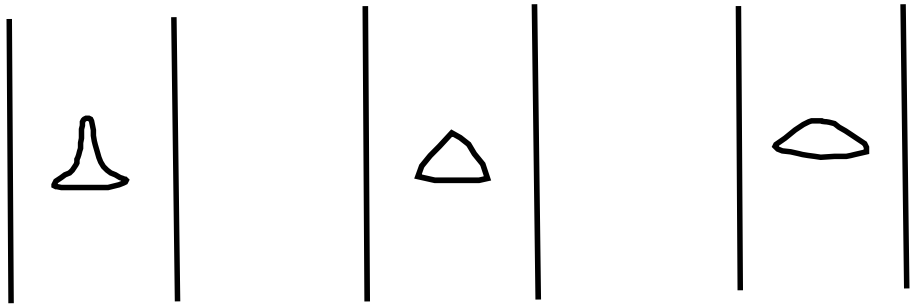
		sq. cm)				
		Very High (>50 per sq. cm)	9	IFGTB3		
12 (+)	Lenticel: Shape	Round	1	CE4	18 & 24	VS
		Oval	2	IFGTB1, CJ81		
		Eye shape	3	CE64, CJ32		
13	Lenticel: Size	Small (<0.5 mm)	3	IFGTB-4,CJ19	18 & 24	MS
		Medium (0.5-1.5 mm)	5	CE51, CJ29,MTP1		
		Large (>1.5 mm)	7	CE72		
14 (+)	Crown: Shape	Lanceolate	1	IFGTB -1, CJ11	24& 30	VG
		Conical	2	IFGTB-4,CH140		
		Columnar	3	CE75,CE101, CJ66		
15	Bark: Texture	Smooth	1	CE54, MTP 1, CJ19	24& 30	VS
		Rough	2	CJ22,CJ94		
		Very rough	3	CJ41, CJ59		
16 (*)	Bark:Colour	Grey	1	CE54,CJ 20, CJ52	24& 30	VS
		Purple	2	IFGTB3		
		Pinkish purple	3	CE49,CJ29,MTP 2		
		Brown	4	CE206,CJ13		
17	Protrusionon main stem	Absent	1	CE64,CJ41, MTP2	24& 30	VS
		Present	9	CE90, CE100		
18 (+)	Branching pattern	Single	1	CE41,CJ20	24& 30	VG
		Paired	2	CE54,CJ13		
		Cluster	3	--		
19 (+)	Branch: Angle	Upward (<60^{o})	1	CE51, CJ12, MTP 2	24& 30	VS
		Horizontal (60 to 90^{o})	9	CE111, CJ23		
20	Branch: Thickness	Thin (<1.5 cm)	3	CJ17,CJ72	24& 30	VG
		Medium (1.5-2.5 cm)	5	CE111, CJ18		
		Thick (>2.5 cm)	7	CJ16		
21	Protrusions on primary branches	Absent	1	CE61,CE49, MTP 1, CJ17	24& 30	VS
		Present	9	CE32, CE64		
22 (+)	Bearing of deciduous branchlets	Straight	3	CE107	24& 30	VG
		Drooping	5	CE100		
23 (*)	Sexual system	Not flowering	1	CJ13	24& 30	VS
		Dioecious Male	2	IFGTB4, CE107, CH140,		

				CJ22, CJ25		
		DioeciousFemale	3	IFGTB2, CE73, CJ11		
		Monoecious (Male + Female)	4	CE49, CE90, CE92		
24 (+)	Male Inflorescence: Position	Terminal	1	IFGTB4, CE107, CH140, CJ22, CJ25	24& 30	VS
		Axillary	2	CJ23		
		Mixed	3	CJ54		
25	Male inflorescence: Length	Short (<1.5 cm)	3	IFGTB1, CE107	24& 30	MG
		Medium(1.6 to 3.5 cm)	5	CE102, CJ25		
		Long (3.6 to 5.5 cm)	7	CJ48		
		Very long (>5.5 cm)	9	CJ23		
26	Male inflorescence: flowers per whorl	Less than 6 flowers	1	--	24& 30	MS
		6 flowers	2	IFGTB4		
		7 flowers	3	CE101		
		8 flowers	4	CE107		
		9 flowers	5	CE92		
		10 flowers	6	--		
		More than 10	7	CJ69		
27 (*)	Male flower: Anther colour	Cream	1	CH890304,CJ23, CJ64	24& 30	VS
		Yellow	2	CJ69		
		Pink	3	IFGTB4,CPCE890401,CJ25		
		Red	4	CJ41		
28	Cone: Length	Short (<1 cm)	3	CJ19, CJ55	30 &36	MG
		Intermediate (1.1 to 2.5 cm)	5	CJ15, CJ18, CE193		
		Long (>2.5 cm)	7	CE109, CE134		
29 (+) (*)	Cone: Shape	Round	1	IFGTB 2, CJ19	30 & 36	MG
		Cylindrical	2	CE51, CJ18		
		Ovate	3	--		
30	Cone:Breadth	Narrow (<1 cm)	3	CJ21, CJ59	30 & 36	MG
		Intermediate (1-2 cm)	5	CE109, CJ18, CJ62		
		Broad (>2cm)	7	--		
31	Cone: Valves per whorl	Up to 6 valves	1	--	30 & 36	MG
		7 valves	2	CE54, CE134		
		8 valves	3	CE135		
		9 valves	4	CJ26		
		10 valves	5	CJ29		
		More than 10	6	--		
32	Cone: Valve	Spiny	1	CE49	30 & 36	VG

	texture	Blunt	9	CE136,CJ59		
33	Cone: Pedicel length	Short (<1 cm)	3	CE49,CJ19	30 & 36	MG
		Intermediate (1-2.5 cm)	5	CE65, CE73		
		Long (>2.5 cm)	7	--		
34 (*) (+)	Cone: Pedicel shape	Straight	1	CE32, CJ15	30 & 36	VG
		Curved	9	CE73, CJ59		

VIII. Explanation for the Table of Characteristics

Characteristic 9: Stem Scars

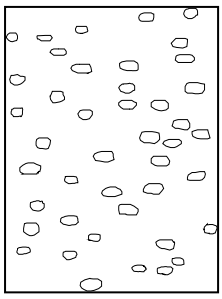


1
Isosceles triangular

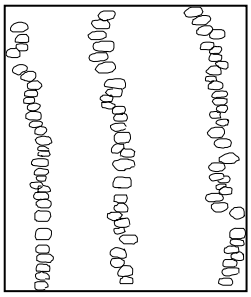
2
Equilateral triangular

3
Eye-shaped

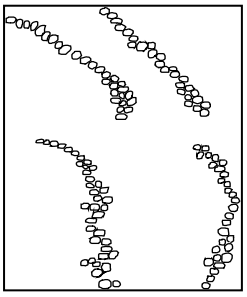
Characteristic 10: Lenticels: Grouping



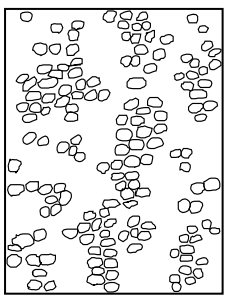
1
Random



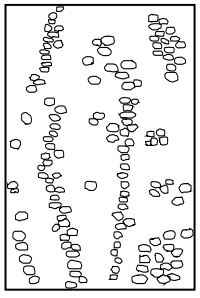
2
Beads Lines



3
Beads curved

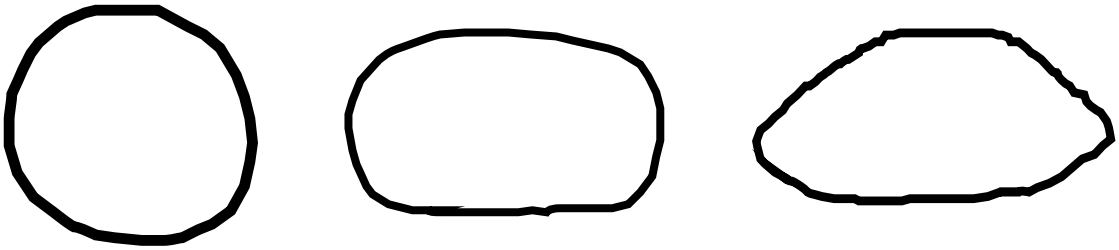


4
Aggregated



4
Aggregated

Characteristic 12: Lenticels: Shape

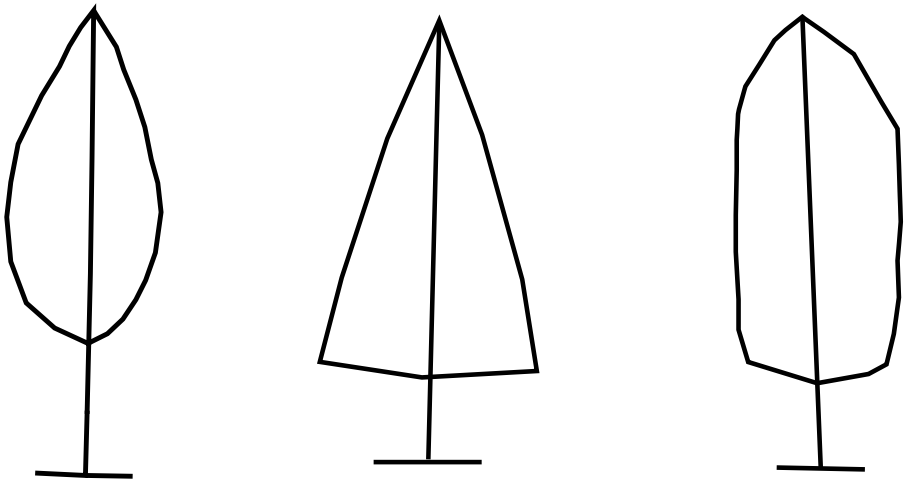


1
Circular

2
Oval

3
Eye-shaped

Characteristic 14: Crown: shape

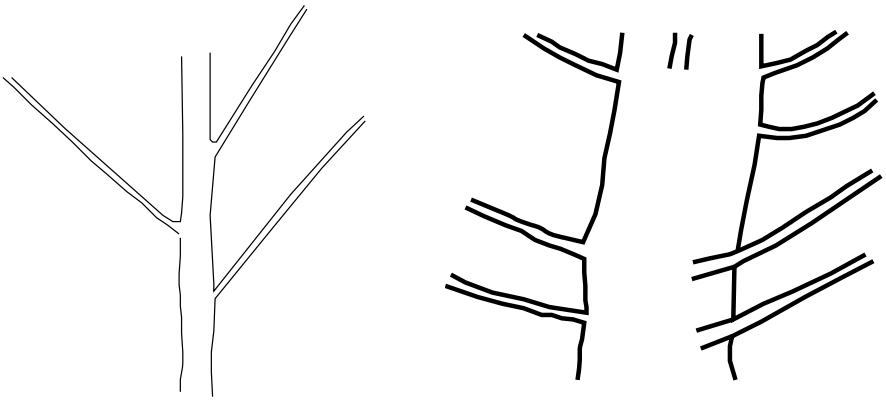


1
Lanceolate

2
Conical

3
Columnar

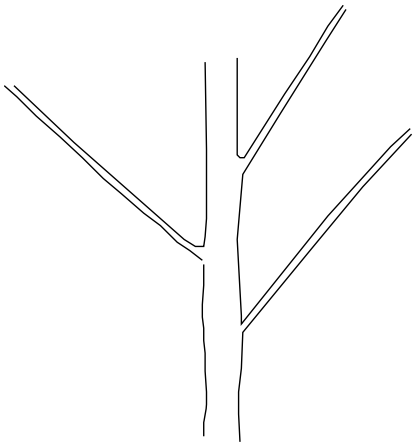
Characteristic 18: Branching Pattern



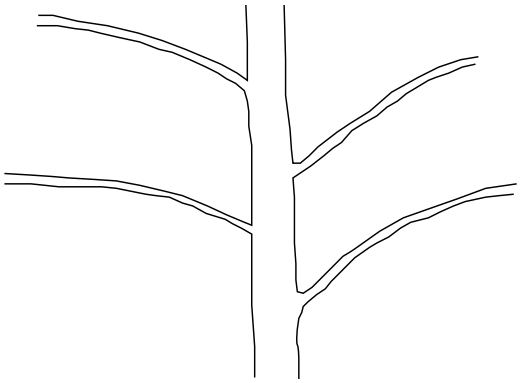
1
Single

2
Paired

Characteristic 19: Branch: Angle

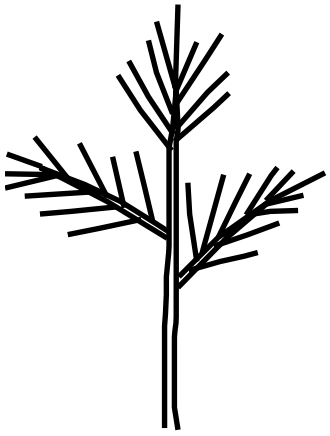


1
Upward

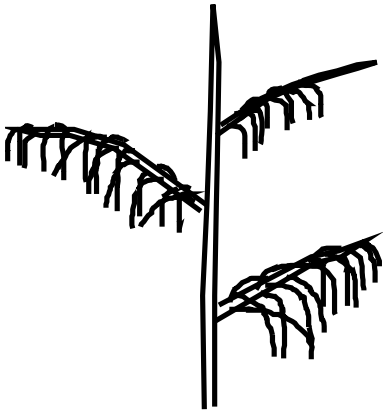


9
Horizontal

Characteristic 22: Bearing of deciduous branchlets

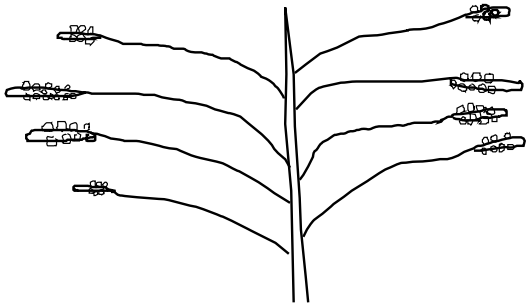


3
Straight

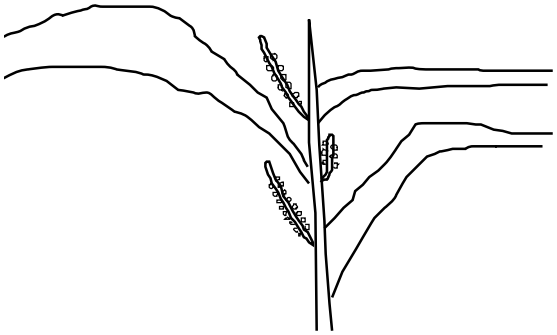


5
Drooping

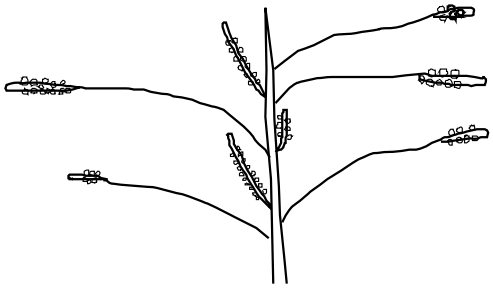
Characteristic 24: Male inflorescence: Position



1
Terminal

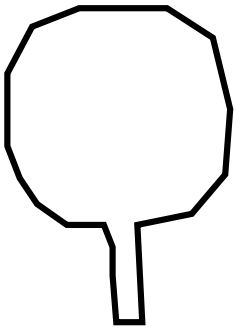


2
Axillary

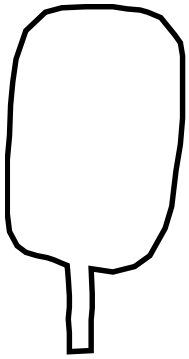


3
Mixed

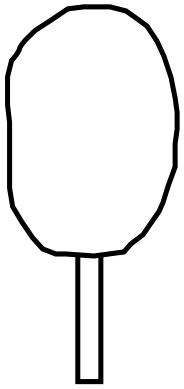
Characteristic 29: Cone: Shape



1
Round

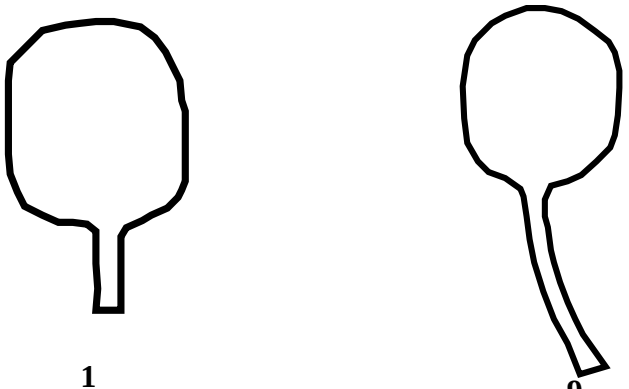


2
Cylindrical



3
Ovate

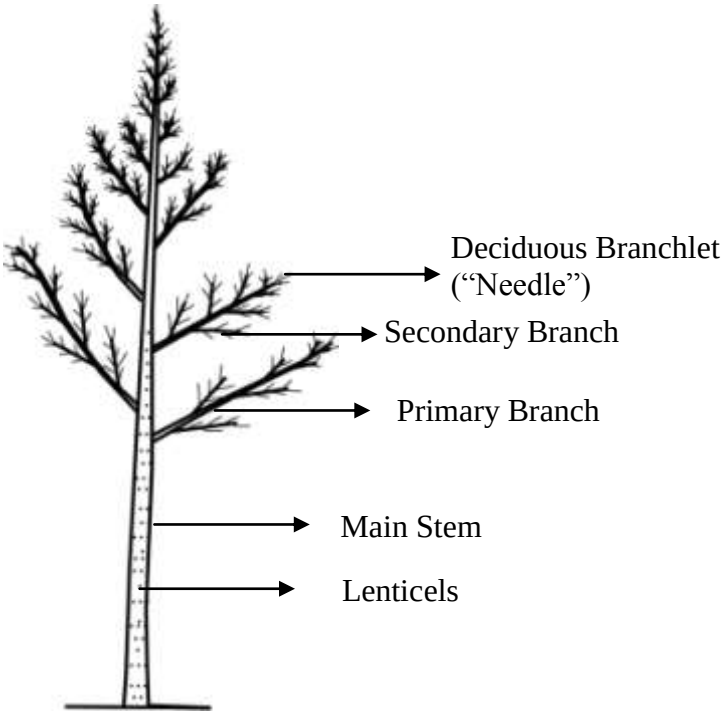
Characteristic 34: Cone: Pedicel Shape



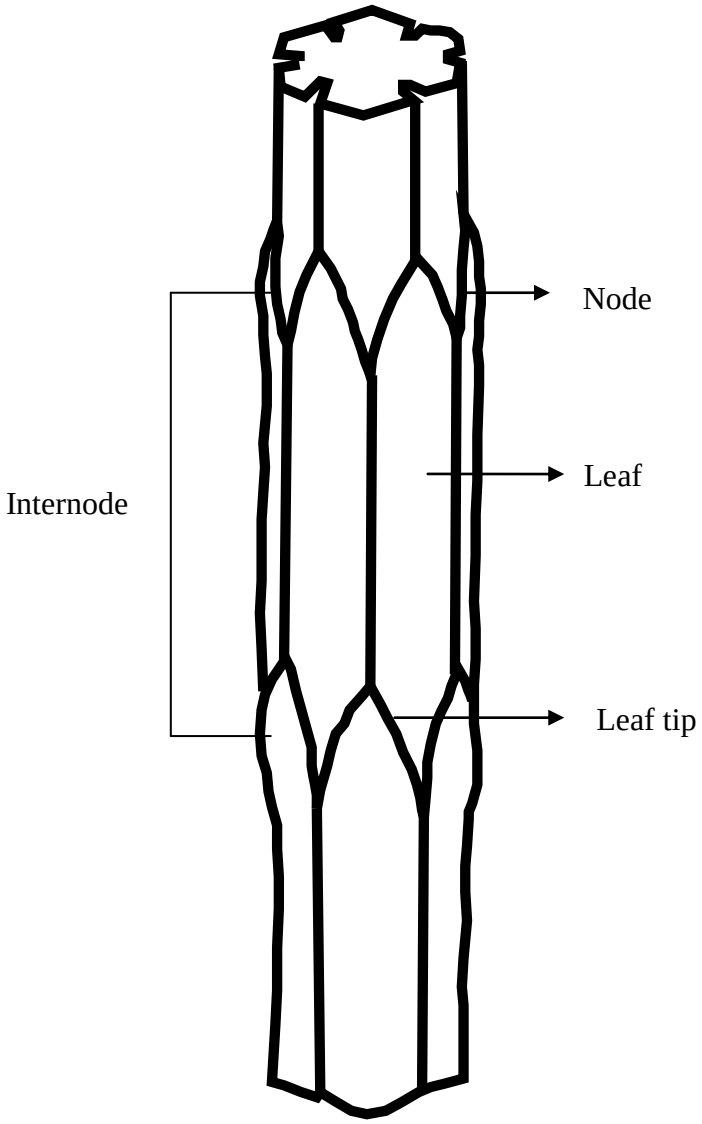
1
Straight

9
Curved

Morphology of Casuarina Tree



Morphology of Deciduous Branchlet



IX DUS Testing Centre

Nodal Centre	Other Centres
Institute of Forest Genetics and Tree Breeding, Coimbatore, Tamil Nadu.	IFGTB Regional Field Station, Chennai, Tamil Nadu. IFGTB Regional Field Station, Puducherry.