GUIDELINES

FOR THE CONDUCT OF TEST FOR

DISTINCTIVENESS, UNIFORMITY AND STABILITY

On

Custard apple / Sugar apple

(Annona squamosa L.*)*

Protection of Plant Varieties and Farmers' Rights Authority

(PPV & FRA)

Government of India

CONTENTS

Custard Apple (*Annona squamosa* L.)

I. Subject

These guidelines shall be applied to all varieties, hybrids and parental lines of Custard apple (***A. squamosa L.***)

II. Plant material required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) shall decide the quantity and quality of the plant material required for testing the variety, when and where the material to be delivered for registration under the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001. Applicants submitting such plant material from a country other than India shall ensure that all customs and quarantine requirement(s) as stipulated under national legislation and regulations are fully complied.

2. The clonally propagated material is to be supplied in the form of grafted plants on *A. squamosa* rootstock for each location. The planting material should be at least one year old at the time of supply.

3. The minimum quantity of plant material to be supplied by the applicant should be eight plants.

4. The plant material supplied should be healthy, not lacking in vigour or unduly stressed nor affected by any pest or disease.

5. The plant material should be natural & should not have undergone any treatment that affects the expression of the characteristics of the variety, unless the PPV&FRA may allow / demand such treatment. If the material is pre-treated, the full details of treatment must be given at the time of submission.

III. Conduct of tests

1. The minimum duration of the DUS tests shall normally be at least two fruiting seasons. Tests shall be conducted at least at two places that shall be decided by the PPV & FRA or may be notified or identified by the Authority including an option for 'On-site' DUS testing.

2. The tests should be carried out under favorable conditions ensuring satisfactory growth and expression of the relevant characteristics for the conduct of test.

3. Test Plot Design: A field lay out is required with 5 plants with three replications for every entry. A spacing of 5 x 5m from plant to plant and row to row may be adopted. Finally the design shall facilitate the removal of plants or their parts for measurement/counting without prejudice to the observations to be recorded chronologically till the end of evaluation period.

IV. Methods and observations

1. The characters described in the Table of characteristics (section VII) shall be used for the testing of varieties for their DUS characters.

2. For the assessment of distinctiveness and stability, observation shall be made on at least five plants taken from clonally propagated scions on *A. squamosa* rootstock.

3. Observations on tree should be taken at the end of fruiting season.

4. Observations for leaf characters should be taken on fifth leaf from the apex of the current season when the shoot tip stop growing and new leaves stops emerging. The index leaf (5^{th}) should mature.

5. Observations on the flower should be recorded when completely open but before desiccation.

6. Observations on the fruit should be recorded on five fully matured fruits, sampled randomly from all directions of the tree canopy.

7. Observations on the seed and flakes should be recorded on fresh seeds and flakes.

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 varieties in the collection are suitable for grouping purpose.

2. Grouping of characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics to (a) select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctiveness; and (b) organize the growing trial so that similar varieties are grouped together.

The following characteristics are to be used for grouping Custard apple varieties:

a) Flower: Petal inner colour : (characteristic 12)
b) Fruit : Exocarp colour: (characteristic 15)
c) Fruit: Segmentation on surface (characteristic 19)
d) Fruit: Weight (characteristic 23)
e) Fruit: Pulp colour (characteristic 27)
f) Fruit: Shelf life (characteristic 34)
g) Fruit: No. of seeds/100g pulp: (characteristic 35)

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. A decimal code number in the sixth column of Table of characteristics indicates the optimum stage for observation of each characteristic during the growth and development

of the plant. The relevant growth stages corresponding to these decimal code numbers are described below : 4 Decimal code for the Growth Stage

Sl. No.	Stage of observation	Decimal coding
1	At Vegetative	10
2	At Flowering	20
3	At Fruit development	30
4	At edible stage of ripe fruit after harvest	40

3. Notes (1 to 9) shall be given for each state of expression for different characteristics for the purpose of electronic data processing.

4. Legend:

(*) Characteristics that shall be observed during every growing season in 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 for such characters shall be provided.

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

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

QL: Qualitative characteristic
QN: Quantitative characteristic
PQ: Pseudo-qualitative characteristic

6. The optimum stage of plant growth for assessment of each characteristic is given in the 6^{th} column of the table of characteristics [section VII].

7. Types of assessment of characteristics indicated in 7^{th} column of table of characteristics [section VII] is as follows:

MG : Single measurement of a group of plants or their parts.
MS : Measurement of number of individual plants or their parts.
VG : Visual assessment by a single observation of a group of plants or their parts.
VS : Visual assessment by observation of individual plant or their parts.

7. A code number in the sixth column of Table of characteristics for observation of each characteristics during growth and development of plants. The explanation of the type of characteristics is provided in general introduction.
(a) The observations on the plant growth habit and vigour, foliage density and leaf stipules should be made on plants shortly before flowering.
(b) The observations of the inflorescence (including the flower) should be made on plants during flowering. Unless otherwise indicated, observations on the flower should be made on

the secondary flower. In the case of remontant varieties, the characteristics should be observed on the first flush of flowers.
(c) The observations on leaves should be made during fruiting on fully matured leaves.
(d) The observations on fruits and stolon should be made after the fruiting.

VII. Table of characteristics

Sl. No	Characteristics	States	Notes	Example Variety	Stage of Observation	Type of assessment
1 (*) QN	Tree height (m)	Dwarf(<2.0)	3	Red Sitaphal	10	MG
		Medium (2.0-3.0)	5	Washington 05, Mammoth		
		Tall (>3.0)	7	Arka Sahan		
2 (*) QL	Growth habit	Erect	1	APK-1, Balanagar, Raidurg	10	MS
		Spreading	9	Arka Sahan		
3 PQ (+)	Leaf shape	Ovate	1	Local Sitaphal	10	VG
		Obovate	3	Barbados seedling		
		Lanceolate	5	Balanagar		
		Elliptic	7	Arka Sahan		
4 (+) PQ	Leaf base	Acute	3	Red sitaphal, Local Sitaphal	10	VG
		Obtuse	5	Balanagar, Mammoth		
		Rounded	7	Arka Sahan		
5 (+) PQ	Leaf apex	Acute	3	Balanagar, Raidurg, APK-1	10	VG
		Acuminate	5	Red sitaphal		
		Rounded	7	Arka Sahan		
6 QN	Leaf Length (cm)	Small <10.0	3	Red sitaphal, APK-1, Balanagar	10	MS
		Medium10.1 -12.0	5	Raidurg, Washington 05		
		Large > 12.0	7	Arka Sahan		
7 QN	Breadth (cm)	Small < 4.0	3	Washington05,	10	MS
		Medium 4.1 – 8.0	5	Mammoth, APK-1, Raidurg		
		Large > 8.0	7	Arka Sahan		
8 QN	Petiole Length (cm)	Short < 1.5	1	Balanagar, Mammoth, Raidurg	10	MS
		Long >1.5	9	Red Sitaphal		
9 QL	Leaf Colour	Green	3	Mammoth, Balanagar,APK-1, Raidurg (Green 143-B)	10	VG
		Reddish tinge	5	Red Sitaphal		
10 PQ	Petiole Colour	Green	3	Balanagar,Mammoth,APK-1, Raidurg (Green143)	10	VG
		Crimson Green	5	Red Sitaphal (Red Purple59)		
11 PQ	Flower Size	Small	3	APK- 1, Red Sitaphal	20	VG
		Medium	5	Mammoth, Washington 97		
		Large	7	Arka Sahan		

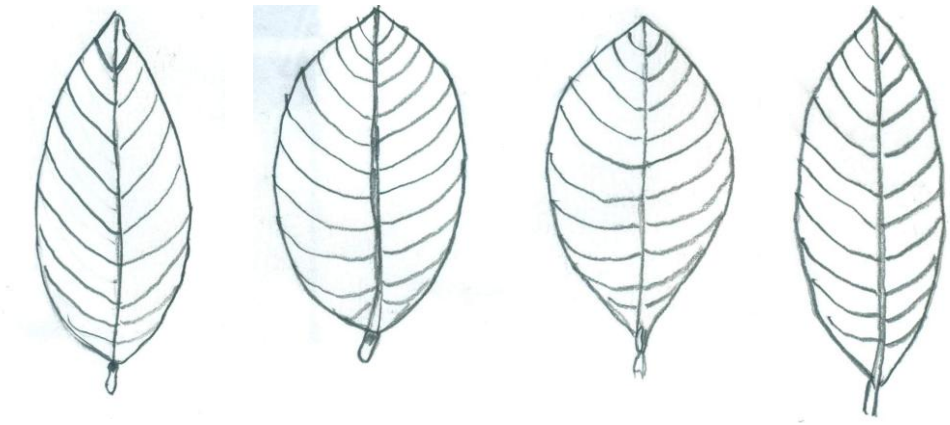
12 (*) PQ	Petal inner Colour	Greenish white	3	Balanagar, Local Sitaphal, Raidurg (White155)	20	VG
		Reddish White	5	Red Sitaphal (White 155 C)		
13 (*) (+) PQ	Fruit Shape	Round	3	Balanagar, Washington 97	30	VG
		Cordate	5	Arka Sahan		
		Broadly Cordate	7	Local Sitaphal, Barbados seedling		
14 (*) (+) PQ	Fruit Surface	Mammillated	3	Arka Sahan	30	VG
		Impressed	5	Mammoth,APK-1, Raidurg, Local Sitaphal		
15 (*) PQ	Fruit Exocarp Colour	Green	3	Balanagar, Arka Sahan, APK-1, Mammoth(143-B)	30	VG
		Crimson Red	5	Red Sitaphal (Red Purple 59)		
16 PQ	Time of harvest maturity	Early	3	APK1	30	MG
		Medium	5	Balanagar, Barbadoos Seedling		
		Late	7	Rai Durg & Arka Sahan		
17 PQ	Persistant Mummi-fied fruits/tree	Absent	1	Arka Sahan, Mammoth , APK-1, Washington 05, Washington 97	40	MG
		Present	9	Red Sitaphal		
18 PQ	Fruit shape at Peduncle end	Flattened	1	Raidurg APK-1	40	MG
		Depressed	3	Arka Sahan		
		Inflated	5	Balanagar, Barbados Seedling		
19 (*) + PQ	Segmentation on surface	Reticulate	1	APK1, Red Sitapal & Arka Sahan	40	VG
		Overlapping	3	RaiDurg, Washington97 & Balanagar		
20 + QN	Protuberances on surface	Very small	1	Washington97	40	VG
		Small	3	RaiDurg, Red Sitapal		
		Medium	5	Balanagar, APK1		
		Large	7	Arka Sahan		
21 (*) QN	Fruit length (cm)	Short < 7.0	3	Local Sitaphal, Raidurg, Barbados Seedling	40	MS
		Medium 7.1 -8.0	5	Mammoth		
		Long >8.0	7	Arka Sahan		
22 (*) QN	Fruit diameter (cm)	Small < 7.0	3	APK-1, Raidurg, Red Sitaphal	40	MS
		Medium 7.1 – 8.5	5	Barbados seedling, Washington 05		
		Long >8.5	**7**	Arka Sahan		
23 (*) QN	Fruit weight (g)	Low 150 – 200	3	Local Sitaphal, Raidurg, APK-1	40	MS
		Medium 201 – 300	5	Balanagar, Mammoth		
		High >300	7	Arka Sahan		
24 (*)	Number of Flakes with	Few < 40	3	Arka Sahan	40	MS
		Medium 40 – 60	5	APK-1, Raidurg Mammoth		

QN	seeds/ fruit	High > 60	7	Local Sitaphal, Red Sitaphal		
25 (*) QN	Number of Flakes without seeds/ fruit	Few < 20	3	Washington 97	40	MS
		Medium 20 – 30	5	Arka Sahan Local Sitaphal		
		High > 30	7	Mammoth		
26 (*) PQ	Fruit Thickness of rind (cm)	Thin <1.5	1	Arka Sahan	40	MS
		Medium 1.6-3.0	3	Mammoth, APK-1, Washington 97		
		Thick >3.0	5	Local Sitaphal, Washington 05		
27 (*) PQ	Fruit pulp Colour	Creamy White	1	Balanagar, Arka Sahan, APK-1, Mammoth(155-B)	40	VG
		Reddish White	9	Red Sitaphal (White 155 C)		
28 (*) (+) QN	Core length (cm)	Small < 4.0	3	APK- 1, Washington-97	40	VS
		Medium 4.1 – 8.0	5	Washington 05, Raidurg, APK -1		
		Long > 8.0	7	Mammoth, Arka Sahan		
29 PQ	Pulp texture	Soft	1	Arka Sahan, Balanagar, APK-1, Red Sitaphal	40	VG
		Gritty	9	Local Sitaphal,		
30 (*) QN	TSS (°Brix)	Low 20.0-25.0	3	Red Sitaphal, Mammoth, APK-1	40	MS
		Medium 25.1-30.0	5	Balanagar, Raidurg, Washington 97		
		High >30.0	7	Arka Sahan		
31 (*) QN	Acidity (%)	Low 0.2 – 0.3	3	Balanagar, Mammoth, Local Sitaphal	40	MS
		Medium 0.31 -0.4	5	Washington 05, Raidurg		
		High >0.4	7	Arka Sahan		
32 QL	Pulp aroma	Mild	1	Balanagar,	40	VG
		Strong	9	Mammoth, local Sitaphal, Arka Sahan, Washington 97, Washington 05		
33 (*) PQ	Eating quality	Good	3	Red Sitaphal, Local Sitaphal APK-1	40	VG
		Very good	5	Balanagar, Raidurg, Washington 97		
		Excellent	7	Arka Sahan		
34 (*) PQ	Shelf life	1-2 days	3	Barbadoos Seedling	40	MG
		1 week	5	Arka Sahan		
35 (*) PQ	Number of seeds/100 g fruit wt.	Low <10.0	3	Arka Sahan	40	MS
		Medium 30.0-60.0	5	Barbados seedling Mammoth		
		High >60.0	7	Local Sitaphal, Red Sitaphal, APK-1		
36 QN	100 seed weight (g)	Low <20.0	3	Local Sitaphal	40	MS
		Medium 21.0 - 35.0	5	Barbados seedling		
		High >35.0	7	Red Sitaphal		
37	Firmness of	Soft	3	Balanagar	40	MG

PQ	flesh	Medium	5	APK1		
		Firm	7	Arka Sahan		

VIII. Explanation for the table of characteristics

Characteristic 3 : Leaf Shape



1

Ovate

3

Elliptic

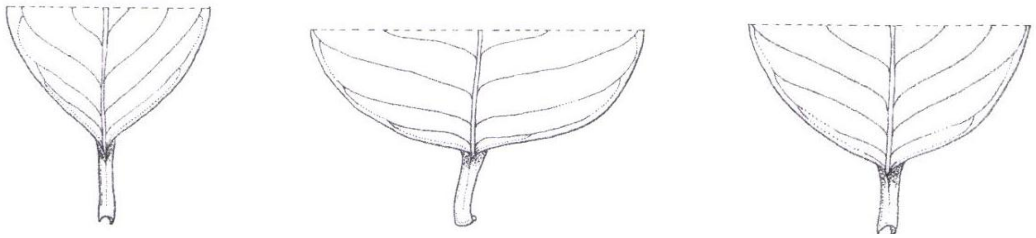
5

Obovate

7

Lanceolate

Characteristic 4 : Leaf base



3

Acute

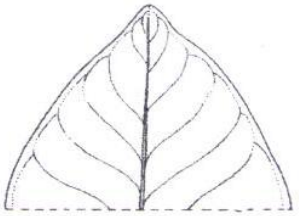
5

Rounded

7

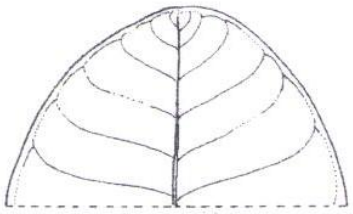
Obtuse

Characteristic 5 : Leaf apex



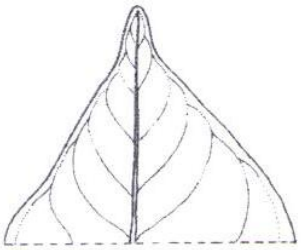
3

Acute



5

Rounded

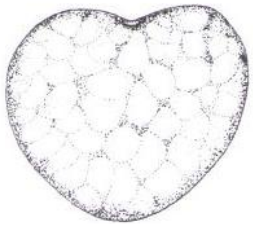


7

Acuminate

3

Round



5

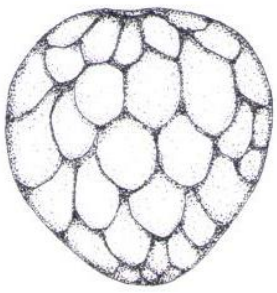
Cordate

7

Broadly cordate

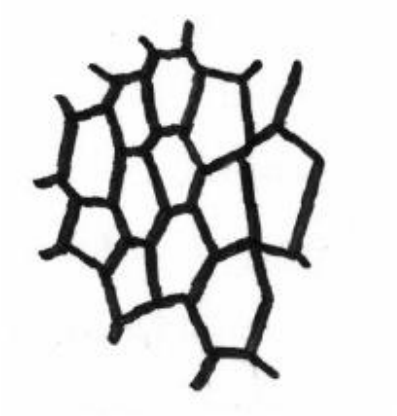
Characteristic 14 : Fruit Surface

3
Mammillated



5
Impressed

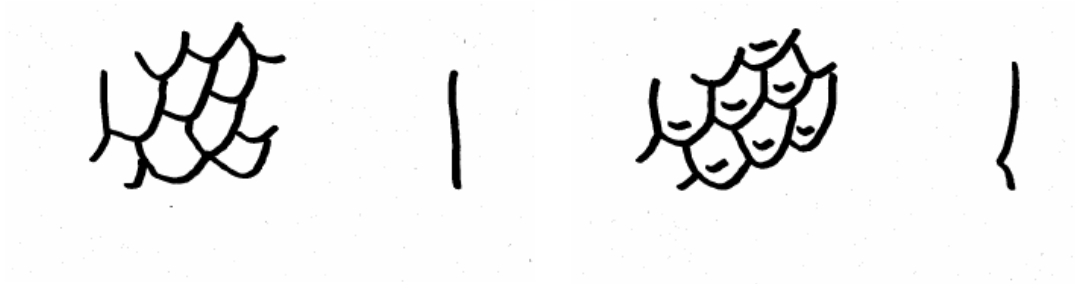
Characteristic 19: Segmentation of the Surface



1
reticulate

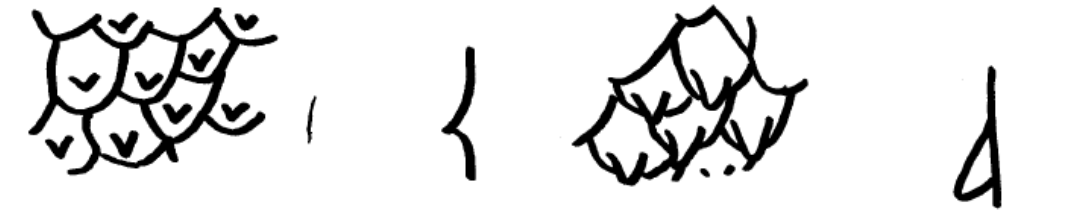
2
overlapping

Characteristic 20: Protuberance on Surface



1
absent or very small

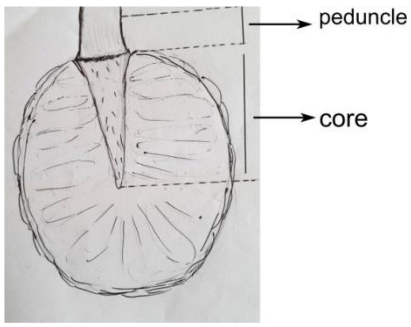
3
small



5
medium

7
large

Characteristic 28: Core length



IX. Working group details

The test guidelines have been developed by the task force (6/2011) constituted by the PPV&FR Authority with the following members.

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X. Name of DUS Test Centres:

Nodal DUS Centre	**Co-Nodal Centre**
Division of Fruit l Crops, ICAR-Indian Institute of Horticultural Research, Hesaraghatta Lake Post, Bengaluru - 560089.	Nil