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UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

DRAFT

DRAGON FRUIT *

UPOV Code: HYLOC_UND

Hylocereus undatus (Haw.) Britton & Rose

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by an expert from Mexico

to be considered by the

Technical Working Party for Fruit Crops

at its thirty-ninth session, to be held in Lisbon, Portugal, from June 2 to 6, 2008

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Hylocereus undatus (Haw.) Britton & Rose	Dragon Fruit	Pitahaya, Oeil de dragon	Pitahaya, Drachen-Frucht	Pitahaya

The purpose of these guidelines ("Test Guidelines") is to elaborate the principles contained in the General Introduction (document TG/1/3), and its associated TGP documents, into detailed practical guidance for the harmonized examination of distinctness, uniformity and stability (DUS) and, in particular, to identify appropriate characteristics for the examination of DUS and production of harmonized variety descriptions.

ASSOCIATED DOCUMENTS

These Test Guidelines should be read in conjunction with the General Introduction and its associated TGP documents.

* These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website (www.upov.int), for the latest information.]

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1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Hylocereus undatus* of the family *Cactaceae*.

2. Material Required

2.1 The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with.

2.2 The material is to be supplied in the form of one-year-old plants or, if accepted by the competent authority, stems.

2.3 The minimum quantity of plant material, to be supplied by the applicant, should be:

6 one-year old plants, or if accepted by the competent authority,

10 stem segments, each sufficient to propagate 5 plants.

2.4 The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.

2.5 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.

3. Method of Examination

3.1 Number of Growing Cycles

The minimum duration of tests should normally be two independent growing cycles.

3.2 Testing Place

Tests are normally conducted at one place. In the case of tests conducted at more than one place, guidance is provided in TGP/9 “Examining Distinctness”.

3.3 Conditions for Conducting the Examination

The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination. In particular, it is essential that the plants produce a satisfactory crop of fruit in each of the two growing years, since the species may have waves of fruiting within a year.

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 6 plants.

3.4.2 The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

3.5 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, all observations should be made on 5 plants or parts taken from each of 5 plants. In the case of parts of plants, the number to be taken from each of the plants should be 2. In the case of fruit characteristics, the observations should be made on 5 fruits.

3.6 Additional Tests

Additional tests, for examining relevant characteristics, may be established.

4. Assessment of Distinctness, Uniformity and Stability

4.1 Distinctness

4.1.1 General Recommendations

It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines.

4.1.2 Consistent Differences

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a two growing cycles is required to provide assurance that the differences observed between varieties are sufficiently consistent. One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic in at least two independent growing years.

4.1.3 Clear Differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness.

4.2 Uniformity

4.2.1 It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in these Test Guidelines:

4.2.2 For the assessment of uniformity, a population standard of 1% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 5 plants, no off-types are allowed.

4.3 Stability

4.3.1 In practice, it is not usual to perform tests of stability that produce results as certain as those of the testing of distinctness and uniformity. However, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable.

4.3.2 Where appropriate, or in cases of doubt, stability may be tested, either by growing a further generation, or by testing a new plant stock to ensure that it exhibits the same characteristics as those shown by the previous material supplied.

5. Grouping of Varieties and Organization of the Growing Trial

5.1 The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness are aided by the use of grouping characteristics.

5.2 Grouping 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: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together.

5.3 The following have been agreed as useful grouping characteristics:

(a) Young shoot: reddish color intensity (characteristic 2);

(b) Stem: distance between areoles (characteristic 7);

(c) Stem: margin (characteristic 10);

(d) Flower pericarpel: reddish color intensity of bracts (characteristic 22);

(e) Fruit: color of flesh (characteristic 40).

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction.

6. Introduction to the Table of Characteristics

6.1 Categories of Characteristics

6.1.1 Standard Test Guidelines Characteristics

Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.

6.1.2 Asterisked Characteristics

Asterisked characteristics (denoted by *) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate.

6.2 States of Expression and Corresponding Notes

States of expression are given for each characteristic to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical note for ease of recording of data and for the production and exchange of the description.

6.3 Types of Expression

An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction.

6.4 Example Varieties

Where appropriate, example varieties are provided to clarify the states of expression of each characteristic. A table of synonyms of example varieties is provided in Chapter 8.3.

6.5 Legend

(*) Asterisked characteristic – see Chapter 6.1.2

QL: Qualitative characteristic – see Chapter 6.3
QN: Quantitative characteristic – see Chapter 6.3
PQ: Pseudo-qualitative characteristic – see Chapter 6.3

(a)-(f) See Explanations on the Table of Characteristics in Chapter 8.1

(+) See Explanations on the Table of Characteristics in Chapter 8.2

7. Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de caracteres

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
1.		**Plant: vigor**					
QN		weak					3
		medium					5
		strong					7
2. **(*)**		**Young shoot: reddish color intensity**					
QN		low					3
		medium					5
		high					7
3. **(+)**		**Stem: length of segment**					
QN	**(a)**	short					3
		medium					5
		long					7
4. **(+)**		**Stem: maximum width**					
QN	**(a)**	narrow					3
		medium					5
		broad					7
5.		**Stem: waxiness**					
QN	**(a)**	weak					1
		medium					2
		strong					3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
6.		**Stem: surface (without considering areole)**					
QL	**(a)**	smooth					1
		prickled					2
7. **(*)** **(+)**		**Stem: distance between areoles**					
QN	**(a)**	short					3
		medium					5
		long					7
8.		**Stem: arch height**					
(+)							
QN	**(a)**	low					3
		medium					5
		high					7
9.		**Stem: ratio arch height/distance between areoles**					
QN	**(a)**	small					3
		medium					5
		large					7
10 **(*)** **(+)**		**Stem: margin**					
QN	**(a)**	concave					1
		strait					2
		convex					3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
11.		**Stem: grey coloration of areoles**					
QN	**(a)**	light					1
		medium					2
		dark					3
12.		**Longest spine: length**					
QN	**(b)**	short					3
		medium					5
		long					7
13.		**Longest spine: main color**	(JP: To check if is PQ, if there are other color)				
QL	**(b)**	grey					1
		brown					2
14.		**Longest spine: number of colors**					
QL	**(b)**	one					1
		two					2
		three					3
15.		**Flower bud: shape**					
(+)							
PQ	**(c)**	narrow elliptical					1
		medium elliptical					2
		circular					3
		ovate					4
16.		**Flower bud: shape of apex**					
(+)							
PQ	**(c)**	acute					1
		rounded					2

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
17.		**Flower bud: main color**					
PQ	**(c)**	cream					1
		yellowish green					2
		green					3
		red					4
18. **(+)**		**Flower bud just before opening: length of pericarpel**					
QN		short					3
		medium					5
		long					7
19. **(+)**		**Flower bud just before opening: pericarpel width at broadest part**					
QN		narrow					3
		medium					5
		broad					7
20. **(+)**		**Flower bud just before opening: length of top**					
QN		short					3
		medium					5
		long					7
21. **(+)**		**Flower pericarpel: separation of bracts**					
QL	**(d)**	absent					1
		present					9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
22. (*)		**Flower pericarpel: reddish color intensity of bracts**					
QN	**(d)**	low					3
		medium					5
		high					7
23.		**Flower pericarpel: shape of bracts**					
QL	**(d)**	triangular					1
		elliptic					2
24.		**Flower: color of petals**					
PQ	**(d)**	cream					1
		yellowish green					2
		yellow					3
25.		**Flower: main color of sepals**					
PQ	**(d)**	white					1
		green					2
		red					3
26.		**Flower: color pattern of sepals (only varieties with two colors)**					
QL	**(d)**	edged					1
		striped					2
27. (+)		**Flower: length of style**					
QN	**(d)**	short					3
		medium					5
		long					7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
28. **(+)**		**Flower: number of stigma lobes**					
QN	**(d)**	few					3
		medium					5
		many					7
29. **(+)**		**Flower: bifurcation of stigma lobes**					
QL	**(d)**	absent					1
		present					9
30.		**Flower: color of stigma lobe**					
QL	**(d)**	cream					1
		green					2
31. **(*)**		**Fruit: length**					
QN	**(e)**	short					3
		medium					5
		long					7
32. **(*)**		**Fruit: width at broadest part**					
QN	**(e)**	narrow					3
		medium					5
		broad					7
33.		**Fruit: ratio of length/width at broadest part**					
QN	**(e)**	small					3
		medium					5
		large					7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
34. **(+)**		**Fruit: shape in longitudinal section**					
PQ	**(e)**	narrow elliptic					1
		medium elliptic					2
		circular					3
		oblate					4
35.		**Fruit: number of bracts**					
QN	**(e)**	few					3
		medium					5
		many					7
36. **(+)**		**Fruit: length of longest bract of apex**					
QN	**(e)**	short					3
		medium					5
		long					7
37. **(*)** **(+)**		**Fruit: main color of middle bracts**					
PQ	**(e)**	yellowish green					1
		green					2
		pink					3
		red					4
38. **(*)**		**Fruit: thickness of peel**					
QN	**(e)**	thin					3
		medium					5
		thick					7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
39. (*)		**Fruit: main color of peel**					
PQ	**(e)**	whitish					1
		yellow					2
		green					3
		medium pink					4
		dark pink					5
		red					6
		purple					7
40. (*)		**Fruit: color of flesh**					
PQ	**(e)**	white					1
		light pink					2
		medium pink					3
		dark pink					4
		medium red					5
		dark red					6
		purple					7
41.		**Fruit: firmness of flesh**					
QN	**(e)**	soft					3
		medium					5
		firm					7
42.		**Fruit: total soluble solids**					
QN	**(e)**	low					1
		medium					2
		high					3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
43.		**Fruit: juiciness of flesh**					
QN	**(e)**	low					3
		medium					5
		high					7
44.		**Fruit: abundance of seed**					
QN	**(e)**	few					1
		medium					2
		many					3
45.		**Flowering frequency**					
QL		once					1
		twice					2

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

Characteristics containing the following keys in the second column of the Table of Characteristics should be examined as indicated below:

(a) Stem: Unless otherwise stated all observations on the stem should be made on mature stems segment at the end of the year's growth.

(b) Areoles and spines: Unless otherwise stated, all observations on the areole and spines should be made on intact mature stems.

(c) Unopened Flower: Unless otherwise stated all observations on the unopened flower should be made 15 days before anthesis.

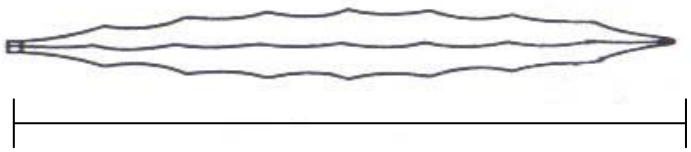
(d) Flower: All observations on flower should be made at full flower opening.

(e) Fruit: All observations on the fruit should be made on 5 intact fruits which are fully mature for consumption 3 to 5 days after first color change.

(f) Fruit diameter/thickness of peel/acidity/total soluble solids: The observations of fruit diameter, thickness of peel, acidity and total soluble solids should be made in the middle part of the fruit. For total soluble solids the middle part of the fruit must be used with the help of a refractometer.

8.2 Explanations for individual characteristics

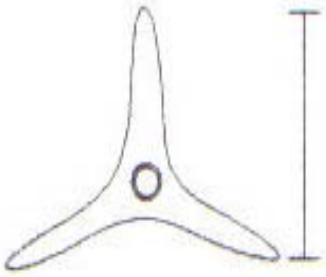
Ad. 3: Stem: length of segment



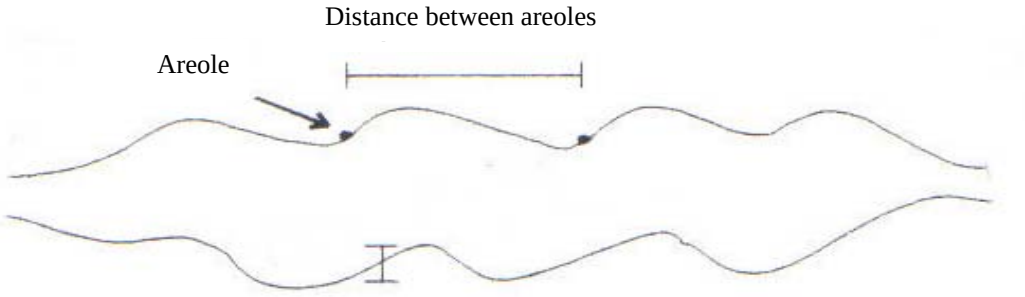
Length

Ad. 4: Stem: maximum width

To be taken at the middle part of the annual stem section.



Ad. 7: Stem: distance between areoles
Ad. 8: Stem: arch height



Ad. 10: Stem: margin

1
concave

2
strait

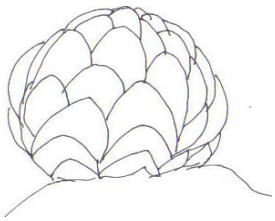
3
convex

Ad. 15: Flower bud: shape

1
narrow elliptical

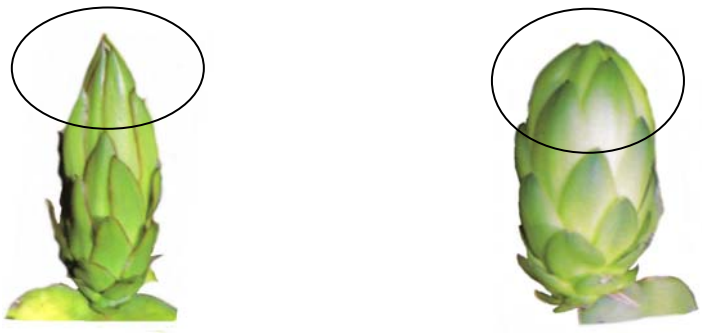
2
medium elliptical

3
circular



4
ovate

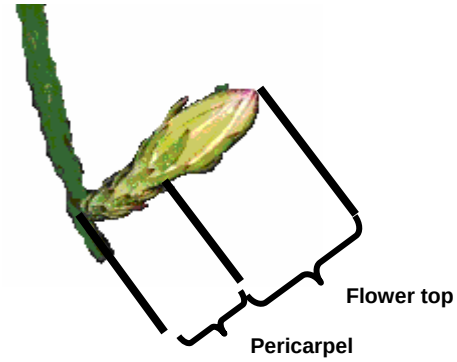
Ad. 16: Flower bud: shape of apex



1
acute

2
rounded

Ad. 18: Flower bud just before opening: length of pericarpel:
Ad. 19: Flower bud just before opening: pericarpel width at broadest part
Ad. 20: Flower bud just before opening: length of top

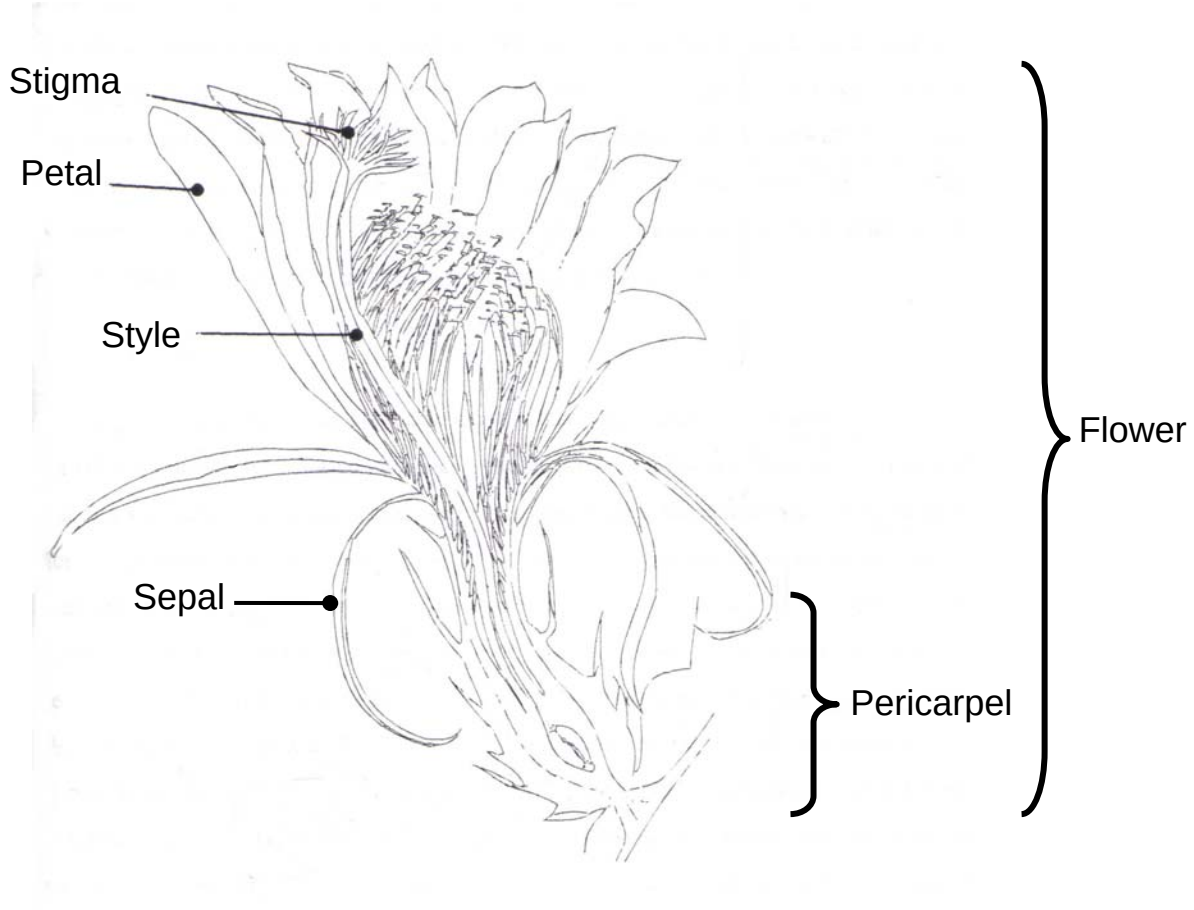


Ad. 21: Flower pericarpel: separation of bracts

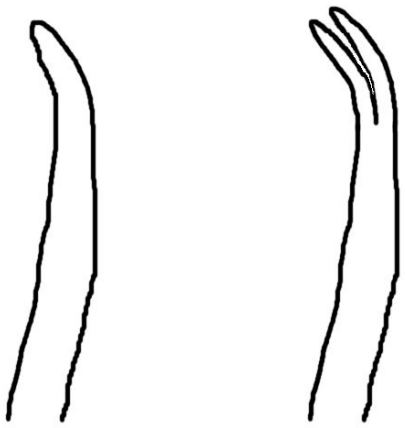
1
absent

2
present

Ad. 27: Flower: length of style
Ad. 28: Flower: number of stigma lobes



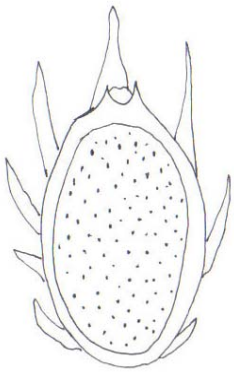
Ad. 29: Flower: bifurcation of stigma lobes



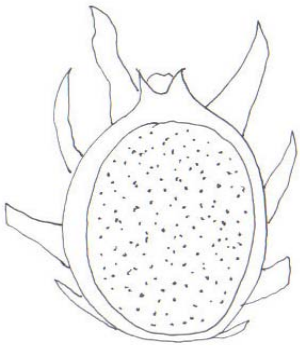
1
absent

2
present

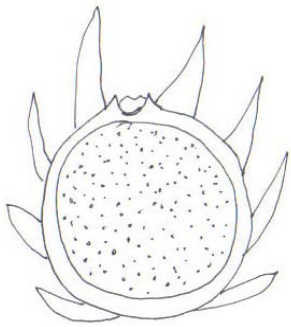
Ad. 34: Fruit: shape in longitudinal section



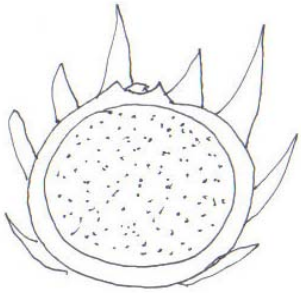
1
narrow elliptical



2
elliptical

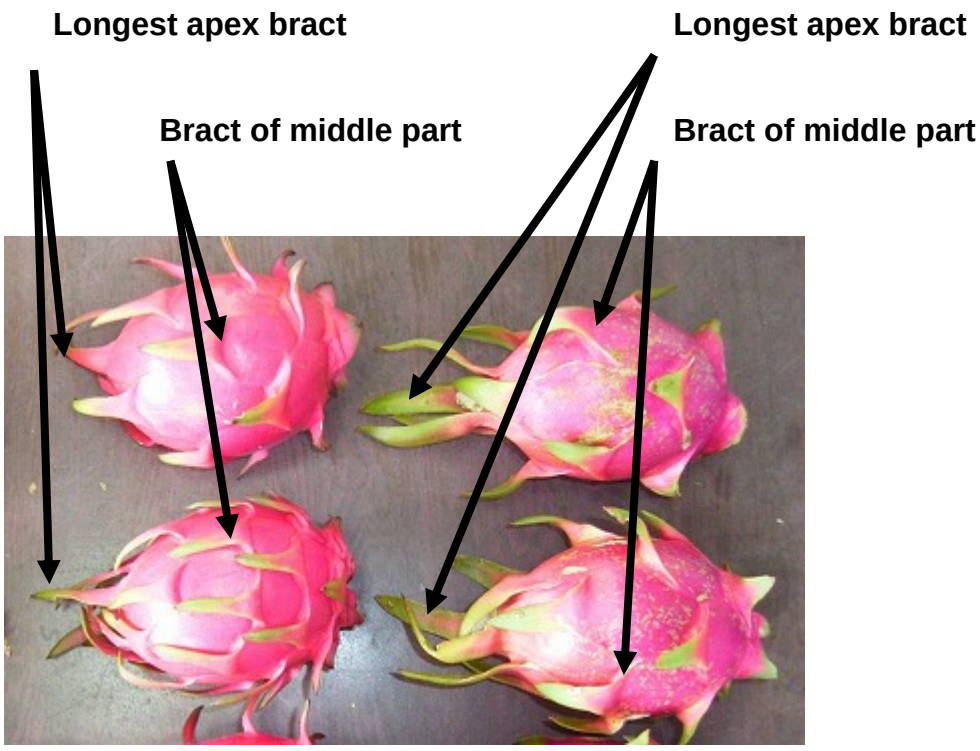


3
circular



4
oblate

Ad. 36: Fruit: length of longest bract of apex
Ad. 37: Fruit: main color of middle bracts



9. Literature

Ortiz Hernández, Y.D. 2000: Hacia el conocimiento y conservación de la pitahaya (*Hylocereus* spp.). IPN-SIBEJ-CONACYT-FMCN. Oaxaca, México, 124 p.

Ramírez Mireles, F. de J. 1999: Caracterización y compatibilidad en pitahaya *Hylocereus.* sp. Tesis de Maestría en Ciencias en Horticultura, Departamento de Fitotecnia, Universidad Autónoma Chapingo. Chapingo, México, 108 p.

10. Technical Questionnaire

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Application date: (not to be filled in by the applicant)

TECHNICAL QUESTIONNAIRE
to be completed in connection with an application for plant breeders' rights

1. Subject of the Technical Questionnaire

1.1 Botanical name	*Hylocereus undatus* (Haw.) Britton & Rose
1.2 Common name	Dragon fruit

2. Applicant

Name	
Address	
Telephone No.	
Fax No.	
E-mail address	
Breeder (if different from applicant)	

3. Proposed denomination and breeder's reference

Proposed denomination (if available)	
Breeder's reference	

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

[#]4. Information on the breeding scheme and propagation of the variety

4.1 Breeding scheme

Variety resulting from::

4.1.1 Crossing

(a) controlled cross [ ]
(please state parent varieties)
(b) partially known cross [ ]
(please state known parent variety(ies))
(c) unknown cross [ ]

4.1.2 Mutation [ ]
(please state parent variety)

4.1.3 Discovery and development [ ]
(please state where and when discovered
and how developed)

4.1.4 Other [ ]
(please provide details)

4.2 Method of propagating the variety

4.2.1 Vegetative propagation

(a) cuttings [ ]
(b) other (state method) [ ]

4.2.2 Other [ ]
(please provide details)

[#] Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds).

	Characteristics	Example Varieties	Note
5.1 (2)	**Young shoot: reddish color intensity**		
	low		1[ ]
	medium		2[ ]
	high		3[ ]
5.2 (7)	**Stem: distance between areoles**		
	short		3[ ]
	medium		5[ ]
	long		7[ ]
5.3 (31)	**Fruit: length**		
	short		3[ ]
	medium		5[ ]
	long		7[ ]
5.4 (37)	**Fruit: main color of middle bracts**		
	yellowish green		1[ ]
	green		2[ ]
	pink		3[ ]
	red		4[ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.5 (40)	**Fruit: color of flesh**		
	white		1[ ]
	light pink		2[ ]
	medium pink		3[ ]
	dark pink		4[ ]
	medium red		5[ ]
	dark red		6[ ]
	purple		7[ ]

6. Similar varieties and differences from these varieties

Please use the following table and box for comments to provide information on how your candidate variety differs from the variety (or varieties) which, to the best of your knowledge, is (or are) most similar. This information may help the examination authority to conduct its examination of distinctness in a more efficient way.

Denomination(s) of variety(ies) similar to your candidate variety	Characteristic(s) in which your candidate variety differs from the similar variety(ies)	Describe the expression of the characteristic(s) for the **similar** variety(ies)		Describe the expression of the characteristic(s) for **your** candidate variety	
		e.g	*note 3*	*e.g.*	*note 5*
Example	*Fruit: length*	*e.g.*	*short*	*e.g.*	*medium*

Comments:

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

[#]7. Additional information which may help in the examination of the variety

7.1 In addition to the information provided in sections 5 and 6, are there any additional characteristics which may help to distinguish the variety?

Yes [ ] No [ ]

(If yes, please provide details)

7.2 Are there any special conditions for growing the variety or conducting the examination?

Yes [ ] No [ ]

(If yes, please provide details)

7.3 Other information

A representative color photograph of the variety should accompany the Technical Questionnaire.

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to (b) is yes, please attach a copy of the authorization.

[#] Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

9. Information on plant material to be examined or submitted for examination.

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 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 the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

(a)	Microorganisms (e.g. virus, bacteria, phytoplasma)	Yes [ ]	No [ ]
(b)	Chemical treatment (e.g. growth retardant, pesticide)	Yes [ ]	No [ ]
(c)	Tissue culture	Yes [ ]	No [ ]
(d)	Other factors	Yes [ ]	No [ ]

Please provide details for where you have indicated “yes”.

.....

10. I hereby declare that, to the best of my knowledge, the information provided in this form is correct:

Applicant’s name

Signature Date

[End of document]