TG/DRAGON(proj.4)
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UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

DRAFT

DRAGON FRUIT *

UPOV Code: HYLOC

Hylocereus
Selenicerus, IL (This was discussed before and was decided only to include *Hylocereus* MX)

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by an expert from Mexico

to be considered by the

the Technical Working Party for Fruit Crops
at its forty-first session, to be held in Cuernavaca, Morelos State, Mexico,
from September 27 to October 1, 2010

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Hylocereus spp.	Dragon Fruit, Strawberry pear Pitaya, IL (This name is used for other genus so is confusing, MX)	Pitahaya, Fruit du dragon, Œil 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* & *Selenicereus* and hybrids among them IL (This was discussed before and was decided only to include *Hylocereus* MX) 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 of 40 cm long, each sufficient to propagate 6 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

3.1.1 The minimum duration of tests should normally be two independent growing cycles. In particular, it is essential that the plants produce a satisfactory crop of fruit in each of the two growing cycles.

3.1.2 The growing cycle is considered to be the period ranging from the beginning of active vegetative growth or flowering, continuing through active vegetative growth or flowering and fruit development and concluding with the harvesting of fruit.

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. **(There might be a change in fruit qualities and some time appearance in the different cycles of flowering of the same year. Fruit size is among these parameters, IL) (MX: One solution might be "produce satisfactory crop in the main fruiting period")**

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 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.

4.1.4 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, all observations for the purposes of distinctness should be made on 6 plants or parts taken from each of 6 plants, disregarding any off-type plants.

In the case of observations of parts of plants, the number of parts to be taken from each of the plants should be 2.

4.1.5 Method of Observation

The recommended method of observing the characteristic for the purposes of distinctness is indicated by the following key in the second column of the Table of Characteristics (see document TGP/9 "Examining Distinctness", Section 4 "Observation of characteristics"):

MG: single measurement 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 plants or parts of plants

Type of observation: visual (V) or measurement (M)

"Visual" observation (V) is an observation made on the basis of the expert's judgment. For the purposes of this document, "visual" observation refers to the sensory observations of the experts and, therefore, also includes smell, taste and touch. Visual observation includes observations where the expert uses reference points (e.g. diagrams, example varieties, side-by-side comparison) or non-linear charts (e.g. color charts). Measurement (M) is an objective observation against a calibrated, linear scale e.g. using a ruler, weighing scales, colorimeter, dates, counts, etc.

Type of record: for a group of plants (G) or for single, individual plants (S)

For the purposes of distinctness, observations may be recorded as a single record for a group of plants or parts of plants (G), or may be recorded as records for a number of single, individual plants or parts of plants (S). In most cases, "G" provides a single record per variety and it is not possible or necessary to apply statistical methods in a plant-by-plant analysis for the assessment of distinctness."

In cases where more than one method of observing the characteristic is indicated in the Table of Characteristics (e.g. VG/MG), guidance on selecting an appropriate method is provided in document TGP/9, Section 4.2.

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 of vegetatively propagated varieties, a population standard of 1% and an acceptance probability of at least 95 % should be applied. In the case of a sample size of 6 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 further examined by testing a new plant stock to ensure that it exhibits the same characteristics as those shown by the initial 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 stem: reddish color (characteristic 1) (Might change in the same year depends on climatic conditions. Sign of stress!, IL)
(b) Stem: distance between areoles (characteristic 6) (Might change in the same year, IL)
(c)
(d) Stem: margin of rib (characteristic 8)
(e) Fruit: length (characteristic 26) (Might change in the same year, IL)
(f) Fruit: main color of middle bracts (characteristic 31)
(g) Fruit: color of flesh (characteristic 34) (Color intensity might change in the same year due to change in temperatures, IL)
(h)

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction and document TGP/9 “Examining Distinctness”.

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

6.2.1 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.

6.2.2 In the case of qualitative and pseudo-qualitative characteristics (see Chapter 6.3), all relevant states of expression are presented in the characteristic. However, in the case of quantitative characteristics with 5 or more states, an abbreviated scale may be used to minimize the size of the Table of Characteristics. For example, in the case of a quantitative characteristic with 9 states, the presentation of states of expression in the Test Guidelines may be abbreviated as follows:

State	Note
small	3
medium	5
large	7

However, it should be noted that all of the following 9 states of expression exist to describe varieties and should be used as appropriate:

State	Note
very small	1
very small to small	2
small	3
small to medium	4
medium	5
medium to large	6
large	7
large to very large	8
very large	9

6.2.3 Further explanation of the presentation of states of expression and notes is provided in document TGP/7 “Development of Test Guidelines”.

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.

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

MG, MS, VG, VS – see Chapter 4.1.5

(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. (*)		**Young stem: reddish color**	**Varies along season, IL**				
QN		absent or weak				Blanca	1
		medium				AgoCoa, Roja, Solferina	2
		strong				Pilas, Tepec, Zita	3
2. (+)		**Stem: length of segment**	**Varies along season, IL**				
QN	**(a)**	short				Solferina, Tepec	3
		medium				Chiyuramiyarabi, Roja, Zita	5
		long				Blanca, Pilas	7
3. (+)		**Stem: width**	**Varies along season, IL**				
QN	**(a)**	narrow				Pilas, Roja, Zita	3
		medium				Solferina, Tare	5
		broad				AgoCoa, Blanca	7
4.		**Stem: waxiness**	**Varies along season, IL**				
QN	**(a)**	weak				AgoCoa, Roja, Solferina	1
		medium				Nopa C1, Zita	2
		strong				Pilas, Tepec, Timbi	3
5.		**Stem: texture of surface (excluding areole)**					
QN	**(a)**	smooth				AgoCoa, Blanca, Solferina	1
		medium				Tepec	2
		coarse				Pilas, Zita	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
6. (*) (+)		**Stem: distance between areoles**	**Varies along season, IL**				
QN	**(a)**	short				Tare, Tepec	3
		medium				AgoCoa, Romo A1, Solferina	5
		long				Blanca, Pilas, Zita	7
7. (*) (+)		**Stem: arch height**					
QN	**(a)**	low				Nopa C1, Tepec, Zita	1
		medium				AgoCoa, Pilas, Roja	2
		high				Solferina	3
8. (*) (+)		**Stem: margin of rib**					
QN	**(a)**	concave				QR03	1
		flat				Tare	2
		convex				Pilas, Solferina, Zita	3
9.		**Stem: intensity of grey coloration of areoles (in single, IL)**					
QN	**(a)**	light				Blanca	1
		medium				Chiyuramiyarabi	2
		dark					3
10.		**Spine: length**					
QN	**(b)**	short				Tepec	3
		medium				Chiyuramiyarabi, Roja, Solferina	5
		long				Pilas, Zita	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
11.		**Spine: main color**					
QL	**(b)**	grey				Blanca, Chiyuramiyarabi	1
		brown				Zita	2
12.		**Flower bud: shape**					
(+)							
PQ	**(c)**	narrow elliptic				Chiyuramiyarabi, Solferina	1
		medium elliptic				AgoCoa, Blanca	2
		circular				Roja, Tepec	3
		oblate				Chiyuramiyarabi, Solferina	4
13.		**Flower bud: shape of apex**					
(+)							
QL	**(c)**	acute	**ONLY TWO SATES: MX**			Chiyuramiyarabi, Solferino	1
		rounded				Blanca, Roja	2
14.		**Flower bud: color**					
PQ	**(c)**	cream					1
		yellowish green				Chiyuramiyarabi	2
		green				AgoCoa, Blanca, Solferina	3
		reddish, IL					
		red				Roja, Tepec, Zita	4
15.		**Flower bud just before opening: length of pericarpel**					
(+)							
QN		short				Tepec, Zita	1
		medium				AgoCoa, Pilas, Roja	2
		long				Blanca	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
16. **(+)**		**Flower bud just before opening: pericarpel width**					
QN		narrow				Pilas, Tepec	1
		medium				AgoCoa, Roja, Solferina	2
		broad				Blanca	3
17. **(+)**		**Flower bud just before opening: length of flower top (bud tip, IL) (MX: is not just the tip, see figure)**					
QN		short				Roja, Zita	1
		medium				Pilas, Tepec	2
		long				AgoCoa, Blanca, Solferina	3
18. **(*)**		**Flower: red color of bract**					
QN	**(d)**	weak				Blanca	1
		moderate (medium, IL)				AgoCoa, Solferina	2
		strong				Pilas, Tepec, Zita	3
19.		**Petal: color**					
PQ	**(d)**	white				Blanca, Chiyuramiyarabi, Solferina	1
		yellowish green					2
		yellow					3
		cream				Pilas, Tepec, Roja	4
		red, IL					

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
20.		**Sepal: main color**	**Add mo. of colors (IL)**				
PQ	**(d)**	white					1
		green				Blanca, Chiyuramiyarabi	2
		red					3
21.		**Only varieties with two colors: (IL)**					
(+)		**Sepal: color pattern**					
QL	**(d)**	edged				Blanca, Chiyuramiyarabi	1
		striped				Pilas, Roja, Solferina	2
22.		**Flower: length of style**					
(+)							
QN	**(d)**	short					1
		medium					2
		long				Blanca, Pilas, Solferina	3
23.		**Flower: number of stigma lobes**					
(+)							
QN	**(d)**	few				Tepec	3
		medium				Roja, Solferina, Zita	5
		many				AgoCoa, Blanca	7
24.		**Flower: splitting of stigma lobes**					
(+)							
QL	**(d)**	absent				Blanca, Pilas, Tepec	1
		present				Chiyuramiyarabi, Solferina, Zita	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
25.		**Flower: color of stigma lobe**	**TO BE QL: MX**				
QL	**(d)**	cream				AgoCoa, Roja	1
		green				Blanca, Chiyuramiyarabi	2
26. (*)		**Fruit: length**	**Might change along the season (IL)**				
QN	**(e)**	short				Tepec	3
		medium				Pilas, Zita	5
		long				Blanca, Roja, Solferina	7
27. (*)		**Fruit: width**	**Might change along the season (IL)**				
QN	**(e)**	narrow				Tepec	3
		medium				Pilas, Zita	5
		broad				AgoCoa, Roja, Solferina	7
28. (*) (+)		**Fruit: ratio of length/width**	**Might change along the season (IL)**				
QN	**(e)**	moderately elongated	small (IL)			AgoCoa, Chiyuramiyarabi, Roja	3
		medium				Solferina	5
		moderately compressed	large (IL)			Zita	7
29.		**Fruit: number of bracts**					
QN	**(e)**	few				Solferina	1
		medium				AgoCoa, Blanca	2
		many				Pilas, Roja, Zita	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
30. **(+)**		**Fruit: length of longest bract of the apex**					
QN	**(e)**	short				Tepec, Solferina, Zita	3
		medium				AgoCoa, Pilas, Roja	5
		long				Blanca	7
31. **(*)** **(+)**		**Fruit: main color of middle bracts**					
PQ	**(e)**	yellowish green				AgoCoa, Chiyuramiyarabi	1
		green				Blanca	2
		pink					3
		red				Roja, Solferina, Tepec	4
		Angle of bracts towards the peel	NEW IL				
32. **(*)**		**Fruit: thickness of peel**					
QN	**(e)**	thin				Solferina, Zita	1
		medium				Chiyuramiyarabi, Pilas, Tepec	2
		thick				Blanca	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
33. (*)		**Fruit: color of peel (excluding bracts)**	**As it is is the color the external color (IL)**	**magenta, IL MX: not a permitted color in UPOV**			
PQ	**(e)**	whitish					1
		yellow					2
		green					3
		medium pink				AgoCoa, Chiyuramiyarabi	4
		dark pink				Blanca, Roja	5
		red				Solferina, Zita	6
		purple				Pilas, Tepec	7
34. (*)		**Fruit: color of flesh**					
PQ	**(e)**	white				Blanca	1
		light pink				Chiyuramiyarabi	2
		medium pink				AgoCoa, Solferina	3
		dark pink				Roja	4
		medium red					5
		dark red				Zita	6
		purple				Pilas, Tepec	7
35. (+)		**Fruit: sweetness (total soluble solids)**					
QN	**(e)**	low				Blanca	1
		medium				AgoCoa, Solferina, Zita	2
		high				Roja	3
		Acidity, low medium high	NEW, IL	MX: not to include acidity			

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
36. **(+)**	**Flowering habit (IL)**					
QL	once					1
	twice				Pilas, Tepec, Zita	2
	thrice				AgoCoa, Roja, Solferina	3
	four times				Blanca	4
	five or more times					5

8. Explanations on the Table of Characteristics

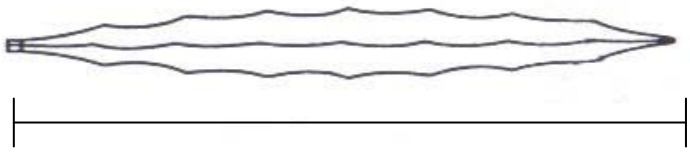
8.1 Explanations covering several characteristics

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/total soluble solids: The observations of fruit diameter, thickness of peel, and total soluble solids should be made in the middle part of the fruit.

8.2 Explanations for individual characteristics

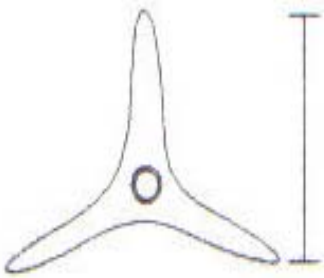
Ad. 2: Stem: length of segment



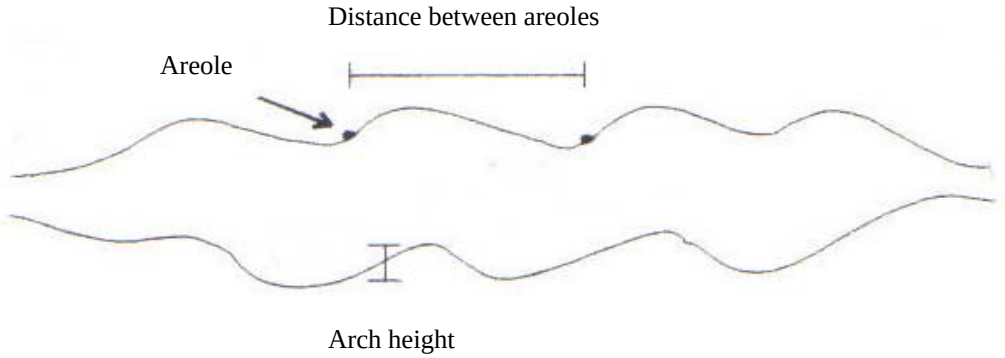
length

Ad. 3: Stem: width

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



Ad. 6: Stem: distance between areoles
Ad. 7: Stem: arch height



Ad. 8: Stem: margin of rib

1
concave

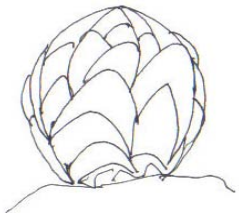
2
flat

3
convex

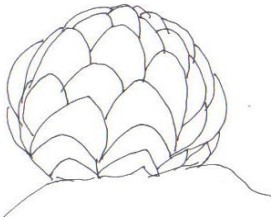
Ad. 12: Flower bud: shape

1
narrow elliptical

2
medium elliptical

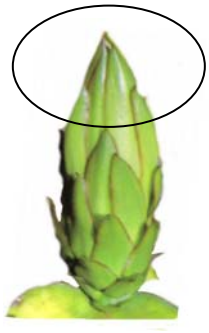


3
circular



4
oblate

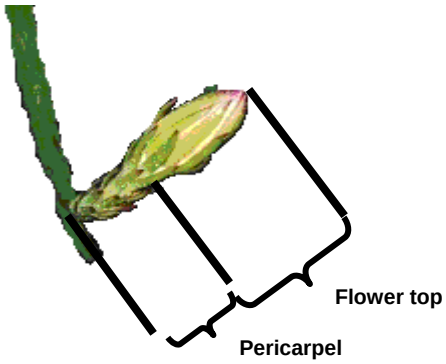
Ad. 13: Flower bud: shape of apex



1
acute

2
rounded

Ad. 15: Flower bud just before opening: length of pericarpel
Ad. 16: Flower bud just before opening: pericarpel width
To be taken at broadest part
Ad. 17: Flower bud just before opening: length of flower top

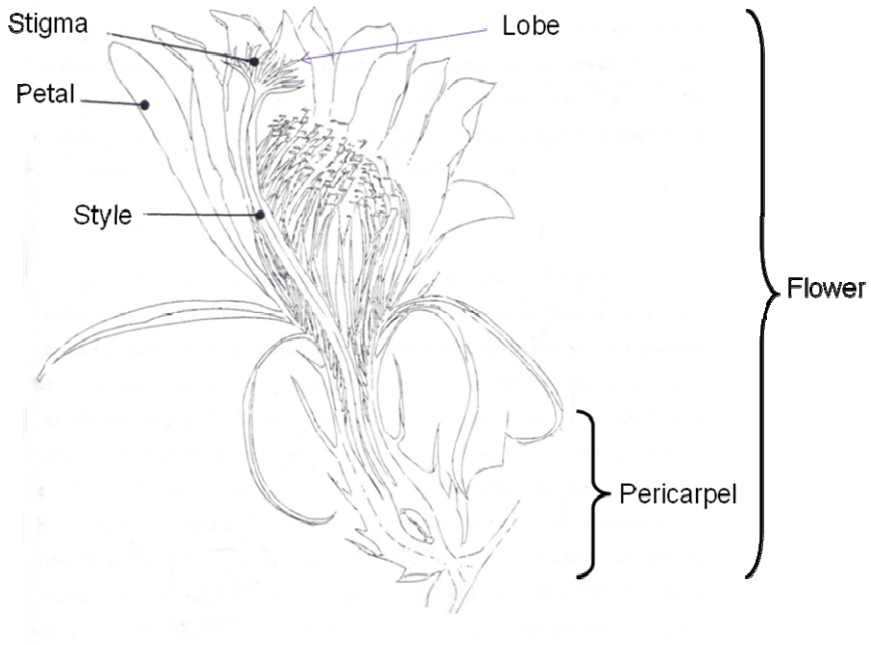


Ad. 21: Sepal: color pattern (only varieties with two colors)

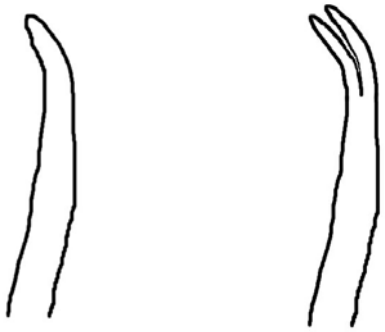
1
edged

2
striped

Ad. 22: Flower: length of style
Ad. 23: Flower: number of stigma lobes



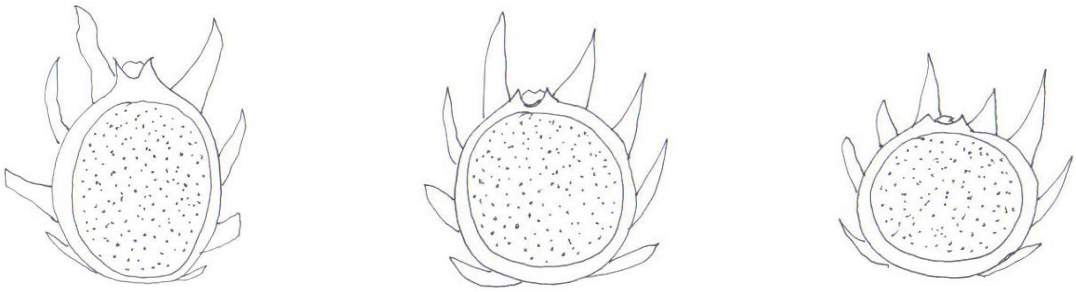
Ad. 24: Flower: splitting of stigma lobes



1
absent

9
present

Ad. 28: Fruit: ratio of length/width

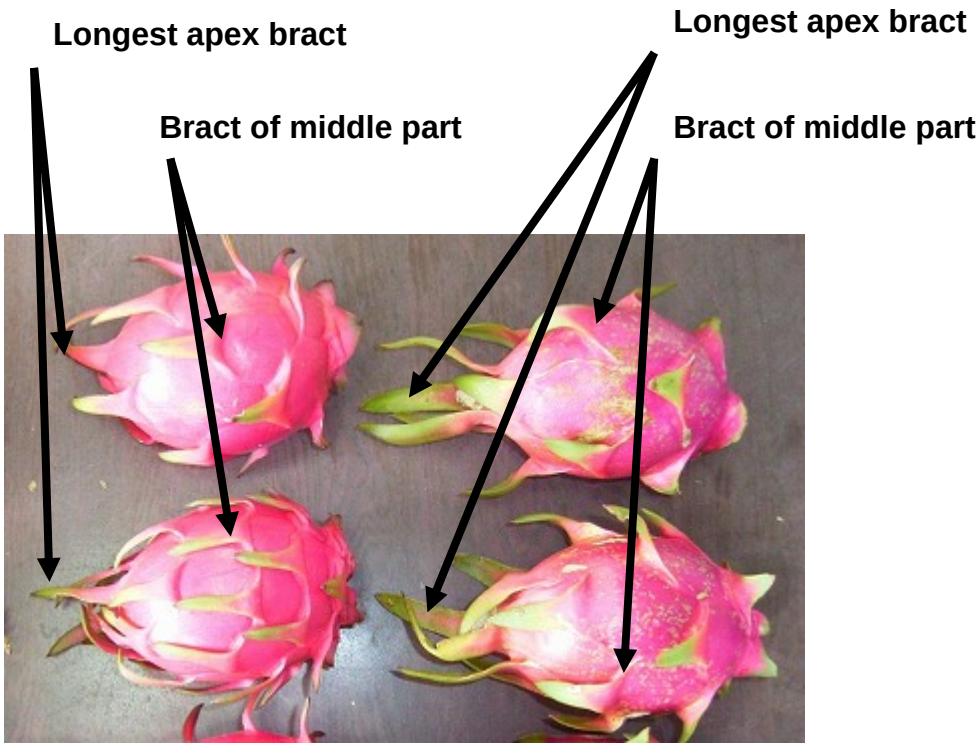


3
moderately elongated

5
medium

7
moderately compressed

Ad. 30: Fruit: length of longest bract of apex
Ad. 31: Fruit: main color of middle bracts



Ad. 32: Fruit: thickness of peel

To be determined by cutting in transversal section of the fruit.

IL:

Spines are present in *Selenicerus megalanthus* and in many intergeneric hybrids. It varies from: no spines, few spines & many spines.

There are clones with yellow colored peel. Some clones have green peel and some others various hues of red, yellow & green.

MX: *Selenicerus,* This was discussed before and was decided only to include *Hylocereus*

Ad. 35: Fruit: sweetness (total soluble solids)

For total soluble solids the middle part of the fruit must be used with the help of a refractometer.

Ad. 36: Flowering

To observe if there is presence of one or more independent flowering periods in a year.

9. Literature

Castillo-Martínez, R., Livera-Muñoz, M., Márquez-Guzmán, G.J. 2005. Caracterización morfológica y compatibilidad sexual de cinco genotipos de pitahaya (*Hylocereus undatus*). Agrociencia 39: 183-194.

Grimaldo J., O. 2001. Caracterización citológica y morfológica de 21 genotipos de pitahaya (*Hylocereus undatus*). Tesis Doctoral. Colegio de Postgraduados. ;Montecillo, México. 81 p.

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.

IL:

Weiss, J., Nerd, A. and Mizrahi, Y. (1994). Flowering behavior and pollination requirements in climbing cacti with fruit crop potential. HortScience. 29: 1487-1492

Weiss, J., Scheinvar, L. and Mizrahi, Y. (1995). *Selenicereus megalanthus* (The yellow pitaya) . A climbing cactus from Colombia. Cactus & Succulent Journal (US).67: 280-283

Tel-Zur, N., Abbo, S., Myslabodski, D. and Mizrahi, Y. (1999). Modified CTAB procedure for DNA isolation from epiphytic cacti of the genera *Hylocereus* and *Selenicereus* (Cactaceae).Plant Molecular Biology Reporter. 17: 249-254.

Can be used for finger printing DNA

Nerd. A., Guttman. F & Mizrahi. Y. (1999). Ripening and postharvest behaviour of fruits of two *Hylocereus* species (Cactaceae). Postharvest Biology and Technology 17: 39-45.

Metz, C., Nerd, A., and Mizrahi, Y. (2000). Long-term storage of pollen of two fruit crop cacti of the genus *Hylocereus* . HortScience. 35,(1): 22-24.

Difference in storage capacity

Lichtenzveig, J., Abbo, S., Nerd, A., Tel-Zur, N., & Mizrahi, Y. (2000). Cytology and mating system in the climbing cacti *Hylocereus* and *Selenicereus*. Amer. J. Bot. 87(7):1058-1065.

Nerd, A., Sitrit, Y., Kaushik, R. A. and Mizrahi, Y. (2002). High summer temperature inhibit flowering in vine pitaya crops (*Hylocereus spp.*). Scientia Horticulturae 96(1-4):343-350.

Pelah, D., Kaushik, R.A., Nerd, A. and Mizrahi Y. (2003). Validity of In Vitro Viability Tests for Predicting Response of Different Vine Cacti in the Field to High and Low Temperatures. Journal of the Association for Cactus Development. 5: 65-71.

Difference in heat tolerance exist in various clones.

Tel-Zur, N., Abbo, S., Bar-Zvi, D. and Mizrahi Y. (2003). Chromosome doubling in vine cacti hybrids. J of Heredity 94(4): 329-333.

Today we have at BGU haploids, doublé haploids, normal 2n, 3n, 4n, 5n, 6n & 8n genotypes. Many are intergeneric hybrids.

Tel-Zur, N., Abbo, S., Bar-Zvi, D. and Mizrahi, Y. (2004). Clone identification and genetic relationship among vine cacti from the genera* Hylocereus *and* Selenicereus *based on RAPD analysis. Scientia Horticulturae 100: 279-284.

Tel-Zur, N., Abbo, S., Bar-Zvi, D. and Mizrahi, Y. (2004). Genetic Relationships Among* Hylocereus *and* Selenicereus *Vine Cacti (Cactaceae): Evidence from Hybridization and Cytological Studies. Annals of Botany 93: 329-333.

Tel-Zur, N., Abbo, S. and Mizrahi, Y. (2005). Cytogenetics of semi-fertile triploid and 3x- uneuploid intergeneric vine cacti hybrids. Journal of Heredity 96(2):1-8.

***. Khaimov, A., and Mizrahi, Y. (2006). Effects of day-length, radiation, flower thinning and growth regulators on flowering of the vine cacti *Hylocereus undatus* and *Selenicereus megalanthus*. Journal of Horticultural Science & Biotechnology 81(3): 465-470.**
Flowering behaviour of various genotypes might be changed according to external conditions.

Wybraniec, S. and Mizrahi, Y. (2002) Fruit Flesh Betacyanin Pigments in *Hylocereus* Cacti. Journal of Agricultural and Food Chemistry. 50: 6086-6089.

Flesh fruit color profile is different among clones and hybrids and it is of nuclear heritage.

MX: Only to include literature useful for variety description or discrimination of morphological characteristics.

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 & Selenicerus,* IL (This was discussed before and was decided only to include *Hylocereus* MX)
1.2 Common name	Dragon fruit, pitaya IL (This name is used for other genus so is confusing, MX)

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::

(……..……..…)	x	(……..……..…)
female parent		male parent

(b) partially known cross [ ]
(please state known parent variety(ies))

(……..……..…)	x	(……..……..…)
female parent		male parent

(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)

[#] 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:

4.2 Method of propagating the variety

4.2.1 Vegetative propagation

(a) cuttings [ ]

(b) *in vitro* propagation [ ]

(c) other (state method) [ ]

4.2.2 Other [ ]
(please provide details)

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 (1)	**Young stem: reddish color**		
	absent or weak	Blanca	1[ ]
	medium	AgoCoa, Roja, Solferina	2[ ]
	strong	Pilas, Tepec, Zita	3[ ]
5.2 (6)	**Stem: distance between areoles**		
	very short		1 [ ]
	very short to short		2 [ ]
	short	Tare, Tepec	3 [ ]
	short to medium		4 [ ]
	medium	AgoCoa, Romo A1, Solferina	5 [ ]
	medium to tall		6 [ ]
	tall	Blanca, Pilas, Zita	7[ ]
	tall to very tall		8[ ]
	very tall		9[ ]
5.3 (26)	**Fruit: length**		
	very short		1 [ ]
	very short to short		2 [ ]
	short	Tepec	3 [ ]
	short to medium		4 [ ]
	medium	Pilas, Zita	5 [ ]
	medium to long		6 [ ]
	long	Blanca, Roja, Solferina	7[ ]
	long to very long		8[ ]
	very long		9[ ]

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

	Characteristics	Example Varieties	Note
5.4 (31)	**Fruit: main color of middle bracts**		
	yellowish green	AgoCoa, Chiyuramiyarabi	1[ ]
	green	Blanca	2[ ]
	pink		3[ ]
	red	Roja, Solferina, Tepec	4[ ]
5.5 (34)	**Fruit: color of flesh**		
	white	Blanca	1[ ]
	light pink	Chiyuramiyarabi	2[ ]
	medium pink	AgoCoa, Solferina	3[ ]
	dark pink	Roja	4[ ]
	medium red		5[ ]
	dark red	Zita	6[ ]
	purple	Pilas, Tepec	7[ ]

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

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 image 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]