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UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

DRAFT

CACAO *

UPOV Code: THEOB_CAC

Theobroma cacao L.

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by experts from Mexico

to be considered by the
Technical Working Party for Fruit Crops
at its fortieth session, to be held in Angers, France, from September 21 to 25, 2009

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Theobroma cacao L.	Cacao	Cacaoyer	Schokolade	Cacao

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 *Theobroma cacao* L.

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 seed or plants.

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

seed-propagated varieties: 50 fresh seeds
vegetatively propagated varieties: 10 plants

The seeds should meet the minimum requirements for germination and health specified by the competent authority. The vegetative propagation technique should be specified.

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 significant fruiting years.

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

3.3.1 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 trees produce a satisfactory crop of fruit in each of the two growing cycles.

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 10 plants in the case of seed-propagated plants or, in the case of vegetatively propagated varieties, in a total of at least 5 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 10 plants in the case of seed-propagated varieties or, in the case of vegetatively propagated varieties, on 5 plants.

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 single growing cycle 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 cycles.

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 of seed-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 10, one off-type is allowed.

4.2.3 For the assessment of uniformity of vegetatively propagated varieties, a population standard of 1% and an acceptance probability of 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 seed 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 flush leaf: color (characteristic 5)
(b) Petiole: axil spot (characteristic 7)
(c) Flower: intensity of anthocyanin on sepal (characteristic 11)
(d) Fruit: shape (characteristic 14)
(e) Fruit: basal constriction (characteristic 15)
(f) Fruit: shape of apex (characteristic 17)

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.

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)-(c) 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.		**Leaf blade: size**					
QN	**(a)**	small					3
		medium					5
		Large					7
2.		**Leaf blade: base**					
PQ	**(a)**	acute				**needed**	1
		obtuse				**needed**	2
		rounded				**needed**	3
		cordate				**needed**	4
3.		**Leaf blade: intensity of green color**					
QN	**(a)**	light green				**needed**	1
		medium green				**needed**	2
		dark green				**needed**	3
4.		**Leaf blade: apex**					
(+)							
PQ	**(a)**	acuminate					1
		apiculate					2
		acute					3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
5.		**Young flush leaf: color**					
(+)							
PQ		light green					1
		medium green					2
		brown					3
		light red					4
		medium red					5
		dark red					6
6.		**Petiole: length**	**TO CHECK**				
QN	**(a)**	short					3
		medium					5
		long					7
7.		**Petiole: axil spot**					
(+)							
QL	**(a)**	absent					1
		present					9
8.		**Flower: pedicel color**					
PQ		green					1
		green and reddish					2
		reddish					3
9.		**Flower: length of sepal**					
(+)							
QN		short					3
		medium					5
		long					7

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
10.	**Flower: width of sepal**					
QN	short					3
	medium					5
	long					7
11. (*)	**Flower: intensity of anthocyanin on sepal**					
QL	absent or very low					1
	low					2
	medium					5
	high					7
12. (+)	**Flower: intensity of anthocyanin on ligula**					
PQ	absent or very low					1
	low					2
	medium					5
	high					7
13. (+)	**Flower: color of stamen filament**					
QL	white					1
	reddish					2
	purple					3
14. (*) (+)	**Fruit: shape**					
PQ	oblong				**needed**	1
	elliptic				**needed**	2
	obovate				**needed**	3
	circular				**needed**	4

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
15. **(+)**		**Fruit: basal constriction**					
QL	**(b)**	absent					1
		present					9
16. **(+)**		**Fruit: intensity of basal constriction**					
QN	**(b)**	weak					3
		medium					5
		strong					7
17. **(+)**		**Fruit: shape of apex**					
PQ	**(b)**	attenuate					1
		acute					2
		obtuse					3
		rounded					4
		acuminate					5
18.		**Fruit: length**					
QN	**(c)**	short					3
		medium					5
		long					7
19.		**Fruit: diameter at broadest part**					
QN	**(c)**	small					3
		medium					5
		large					7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
20.		**Fruit: length/ diameter ratio at broadest part**					
QN	**(c)**	small					3
		medium					5
		large					7
21. (*)		**Fruit: surface**					
PQ	**(b)**	smooth				**needed**	3
		medium				**needed**	5
		rough				**needed**	7
22. (+)		**Fruit: ridge pair separation**					
QN	**(b)**	fused					1
		slightly separated					2
		medium separated					3
		well separated					4
23. (*) (+)		**Fruit: color**					
PQ	**(c)**	yellow					1
		orange					2
		medium red					3
		dark red					4
		purple					5
24. (*) (+)		**Fruit: exocarp thickness**					
QN	**(c)**	thin				**needed**	3
		medium				**needed**	5
		thick				**needed**	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
25.		**Fruit: color of pulp**					
QL	**(c)**	white					1
		cream					2
26.		**Fruit: sweetness of pulp**					
QN	**(c)**	low					3
		medium					5
		high					7
27. (*) (+)		**Seed: shape in longitudinal section**					
PQ		oblong				**needed**	1
		elliptic				**needed**	2
		ovate				**needed**	3
28.		**Seed: length**					
QN	**(c)**	short					3
		medium					5
		long					7
29.		**Seed: width**					
QN	**(c)**	narrow					1
		medium					3
		broad					5
30.		**Seed: ratio length/width**					
QN	**(c)**	small					1
		medium					2
		large					3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
31.		**Seed: thickness**					
QN	**(c)**	thin					1
		medium					2
		thick					3
32.		**Seed: cotyledon color**	**TO SUPPLY A PHOTO**				
(+)							
PQ	**(c)**	white					1
		cream					2
		pink					3
		dark red					4
		dark purple					5
33.		**Seed: number per fruit**					
QN	**(c)**	few					3
		medium					5
		many					7
34.		**Seed: total fat content**		**France to supply method**			
(+)							
QN	**(c)**	low					3
		medium					5
		high					7
35.		**Seed: free fatty acid content**		**France to supply method**			
(+)							
QN	**(c)**	low					3
		medium					5
		high					7

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

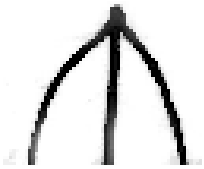
Characteristics containing the following key in the second column of the Table of Characteristics should be examined as indicated below:

(a) Observations on the leaf which should be made on fully developed leaves, when the first fruit is fully developed.
(b) Observations should be made on fully developed fruit, before physiological maturity.
(c) Observations should be made on fruit at physiological maturity.

8.2 Explanations for individual characteristics

Ad. 4: Leaf blade: apex

1
acuminate



2
apiculate

3
acute

Ad. 5: Young flush leaf: color

1
light green

2
medium green

3
brown

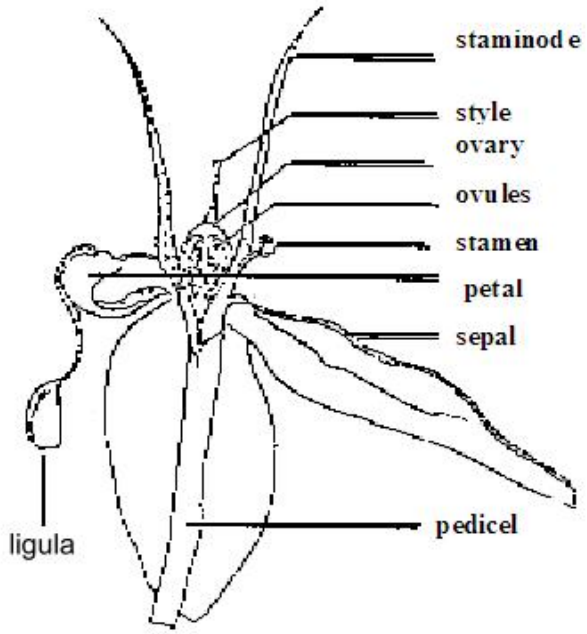
4
light red

5
medium red

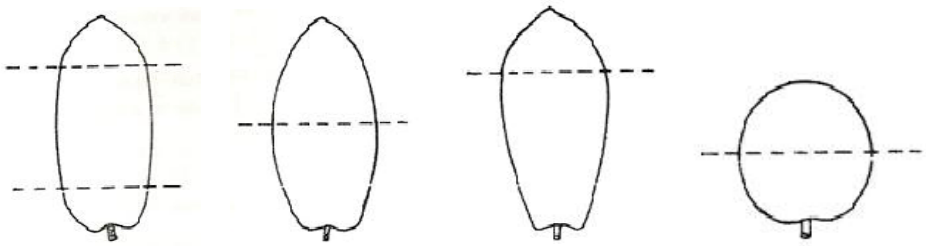
6
dark red

Ad. 7: Petiole: axil spot

Ad. 9: Flower: length of sepal
Ad. 12: Flower: intensity of anthocyanin on ligula
Ad. 13: Flower: color of stamen filament



Ad. 14: Fruit: shape



1	2	3	4
oblong	elliptic	obovate	circular

Ad. 15: Fruit: basal constriction

1 absent

9 present

Ad. 16: Fruit: intensity of basal constriction

3 weak

5 medium

7 strong

Ad. 17: Fruit: shape of apex

1 attenuate

2 acute

3 obtuse

4 rounded

5 acuminate

Ad. 22: Fruit: ridge pair appearance

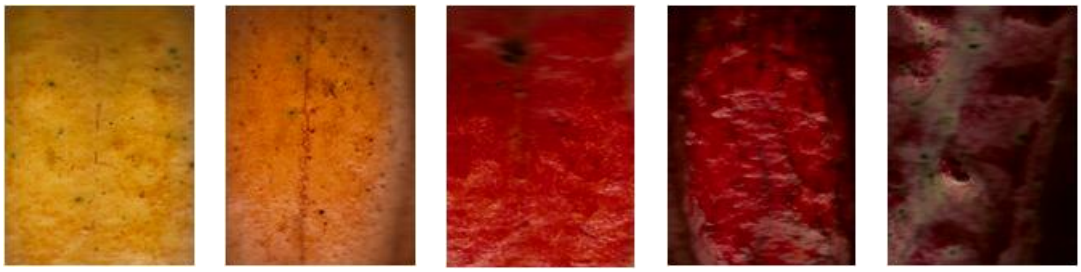
1 fused

2 slightly separated

3 medium separated

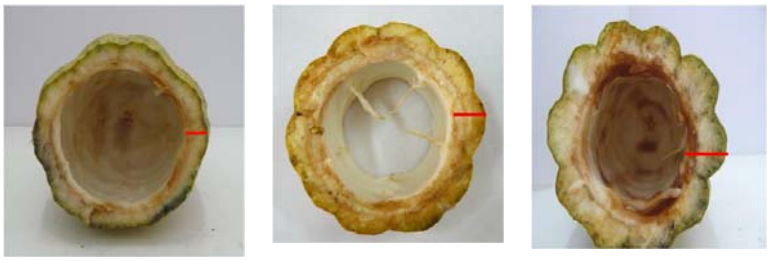
4 well separated

Ad. 23: Fruit: color



1 yellow | 2 orange | 3 medium red | 4 dark red | 5 purple

Ad. 24: Fruit: exocarp thickness



3 thin | 5 medium | 7 thick

Ad. 27: Seed: shape in longitudinal section

1 oblong | 2 elliptic | 3 ovate

Ad. 32: Seed: cotyledon color

1 white | 2 cream | 3 pink | 4 dark red | 5 dark purple

9. Literature

Engels, J. M.M.; Bartley; B.G.D., Enriquez, G.A., 1980: Cacao descriptors, their states and modus operandi. Turrialba, 30(2), Costa Rica, pp. 209-218.

Engels, J.M.M., 1981: Genetic Resources of Cacao. A Catalogue of the CATIE Collection. CATIE. Plant Genetic Resources Unit. Technical series. Technical bulletin; No. 7 Turrialba, Costa Rica, 196 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	*Theobroma cacao* L.
1.2 Common name	Cacao

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

Seed-propagated varieties

(b) Cross-pollination [ ]

(c) Hybrid [ ]

(d) 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 (5)	**Young flush leaf: color**		
	light green		1[ ]
	medium green		2[ ]
	brown		3[ ]
	light red		4[ ]
	medium red		5[ ]
	dark red		6[ ]
5.2 (7)	**Petiole: axil spot**		
	absent		1[ ]
	present		9[ ]
5.3 (11)	**Flower: intensity of anthocyanin on sepal**		
	absent or very low		1[ ]
	low		2[ ]
	medium		5[ ]
	high		7[ ]
5.3 (14)	**Fruit: shape**		
	oblong		1[ ]
	elliptic		2[ ]
	obovate		3[ ]
	circular		4[ ]
5.4 (15)	**Fruit: basal constriction**		
	absent		1[ ]
	present		9[ ]

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

	Characteristics	Example Varieties	Note
5.5 (17)	**Fruit: shape of apex**		
	attenuate		1[ ]
	acute		2[ ]
	obtuse		3[ ]
	rounded		4[ ]
	acuminate		5[ ]

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 7*	*e.g.*	*note 4*
Example	*Fruit: color*	*e.g.*	*purple*	*e.g.*	*orange*

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]