



European Union
Community Plant Variety Office

PROTOCOL FOR DISTINCTNESS, UNIFORMITY AND STABILITY TESTS

Daucus carota L.

CARROT

UPOV Code: DAUCU_CAR

Adopted on 13/03/2008

I - SUBJECT OF THE PROTOCOL

The protocol describes the technical procedures to be followed in order to meet the Council Regulation 2100/94 on Community Plant Variety Rights. The technical procedures have been agreed by the Administrative Council and are based on general UPOV Document TG/1/3 and UPOV Guideline TG/49/8 dated 28/03/2005 for the conduct of tests for Distinctness, Uniformity and Stability. This protocol applies to varieties of *Daucus carota* L.

II - SUBMISSION OF SEED AND OTHER PLANT MATERIAL

1. The Community Plant Variety Office (CPVO) is responsible for informing the applicant of

- the closing date for the receipt of plant material;
- the minimum amount and quality of plant material required;
- the examination office to which material is to be sent.

A sub-sample of the material submitted for test will be held in the variety collection as the definitive sample of the candidate variety.

The applicant is responsible for ensuring compliance with any customs and plant health requirements.

2. Final dates for receipt of documentation and material by the Examination Office

The final dates for receipt of requests, technical questionnaires and the final date or submission period for plant material will be decided by the CPVO and each Examination Office chosen.

The Examination Office is responsible for immediately acknowledging the receipt of requests for testing, and technical questionnaires. Immediately after the closing date for the receipt of plant material the Examination Office should inform the CPVO whether acceptable plant material has been received or not. However if unsatisfactory plant material is submitted the CPVO should be informed as soon as possible.

3. Plant material requirements

The current quality and quantity requirements as well as the final dates for submission of the plant material are available on the CPVO website (www.cpvo.europa.eu) and are published in the CPVO gazette 'S2'.

Quality of seed: Should not be less than the standards laid down for certified seed in Annex II of Council Directive 2002/55/EC.

Seed Treatment:The plant material must not have undergone any treatment unless the CPVO and the Examination Office allow or request such treatment. If it has been treated, full details of the treatment must be given.

Special requirements: -

Labelling of sample:..... - Species
- File number of the application allocated by the CPVO
- Breeder's reference
- Examination reference (if known)
- Name of applicant
- The phrase "On request of the CPVO"

III - CONDUCT OF TESTS

1. Variety collection

A variety collection will be maintained for the purpose of establishing distinctness of the candidate varieties in test. A variety collection may contain both living material and descriptive information. A variety will be included in a variety collection only if plant material is available to make a technical examination.

Pursuant to Article 7 of Council Regulation No. 2100/94, the basis for a collection should be the following:

- varieties listed or protected at the EU level or at least in one of the EEA Member States;
- varieties protected in other UPOV Member States;
- any other variety in common knowledge.

The composition of the variety collection in each Examination Office depends on the environmental conditions in which the Examination Office is located.

Variety collections will be held under conditions which ensure the long term maintenance of each accession. It is the responsibility of Examination Offices to replace reference material which has deteriorated or become depleted. Replacement material can only be introduced if appropriate tests confirm conformity with the existing reference material. If any difficulties arise for the replacement of reference material Examination Offices must inform the CPVO. If authentic plant material of a variety cannot be supplied to an Examination Office the variety will be removed from the variety collection.

2. Material to be examined

Candidate varieties will be directly compared with other candidates for Community plant variety rights tested at the same Examination Office, and with appropriate varieties in the variety collection. When necessary an Examination Office may also include other candidates and varieties. Examination Offices should therefore make efforts to co-ordinate the work with other Offices involved in DUS testing of carrot. There should be at least an exchange of technical questionnaires for each candidate variety, and during the test period, Examination Offices should notify each other and the CPVO of candidate varieties which are likely to present problems in establishing distinctness. In order to solve particular problems Examination Offices may exchange plant material.

3. Characteristics to be used

The characteristics to be used in DUS tests and preparation of descriptions shall be those referred to in the Annex 1. All the characteristics shall be used, providing that observation of a characteristic is not rendered impossible by the expression of any other characteristic, or the expression of a characteristic is prevented by the environmental conditions under which the test is conducted. In the latter case, the CPVO should be informed. In addition the existence of some other regulation e.g. plant health, may make the observation of the characteristic impossible.

The Administrative Council empowers the President, in accordance with Article 23 of Commission Regulation N° 1239/95, to insert additional characteristics and their expressions in respect of a variety.

4. Grouping of varieties

The varieties and candidates to be compared will be divided into groups to facilitate the assessment of distinctness. Characteristics which are suitable for grouping purposes are those which are known from experience not to vary, or to vary only slightly, within a variety and which in their various states of expression are fairly evenly distributed throughout the collection. In the case of continuous grouping characteristics overlapping states of expression between adjacent groups is required to reduce the risks of incorrect allocation of candidates to groups. The characteristics used for grouping are the following:

- a) Leaf: length (including petiole) (characteristic 3)
- b) Root: length (characteristic 7)
- c) Root: width (characteristic 8)
- d) Root: shape in longitudinal section (characteristic 10)
- e) Root: tip (when fully developed) (characteristic 13)
- f) Root: external colour (characteristic 14)
- g) Plants: proportion of male sterile plants (characteristic 30)
- h) Plant: type of male sterility (characteristic 31)

5. Trial designs and growing conditions

The minimum duration of tests will normally be two independent growing cycles. For vegetatively propagated varieties, the duration of the testing may be reduced to one growing cycle if the results on distinctness and uniformity are conclusive. Tests will be carried out under conditions ensuring normal growth. The size of the plots will be such that plants or parts of plants may be removed for measuring and counting without prejudice to the observations which must be made up to the end of the growing period.

The test design is as follows:

As a minimum, each test should include a total of 400 plants divided between two or more replicates.

All observations determined by measurement or counting should be made on 40 plants or parts of 40 plants.

6. Special tests

In accordance with Article 83(3) of Council Regulation No. 2100/94 an applicant may claim either in the Technical Questionnaire or during the test that a candidate has a characteristic which would be helpful in establishing distinctness. If such a claim is made and is supported by reliable technical data, a special test may be undertaken providing that a technically acceptable test procedure can be devised.

Special tests will be undertaken, with the agreement of the President of CPVO, where distinctness is unlikely to be shown using the characters listed in the protocol.

7. Standards for decisions

a) **Distinctness**

A candidate variety will be considered to be distinct if it meets the requirements of Article 7 of Council Regulation No. 2100/94.

b) **Uniformity**

For the assessment of uniformity of:

- (i) - cross pollinated varieties: relative uniformity standards should be applied. However, for the characteristics “external colour of root” (characteristic 13) and “colour of core of root” (characteristic 19), a population standard of 2 % and an acceptance probability of 95% should be applied. In the case of a sample size of 400 plants, 13 off-types are allowed.

- (ii) - single cross hybrids and inbred lines: a population standard of 2% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 400 plants, 13 off-types are allowed.

c) **Stability**

A candidate will be considered to be sufficiently stable when there is no evidence to indicate that it lacks uniformity.

IV - REPORTING OF RESULTS

After each recording season the results will be summarised and reported to the CPVO in the form of a UPOV model interim report in which any problems will be indicated under the headings distinctness, uniformity and stability. Candidates may meet the DUS standards after two growing periods but in some cases three growing periods may be required. When tests are completed the results will be sent by the Examination Office to the CPVO in the form of a UPOV model final report.

If it is considered that the candidate complies with the DUS standards, the final report will be accompanied by a variety description in the format recommended by UPOV. If not the reasons for failure and a summary of the test results will be included with the final report.

The CPVO must receive interim reports and final reports by the date agreed between the CPVO and the examination office.

Interim reports and final examination reports shall be signed by the responsible member of the staff of the Examination Office and shall expressly acknowledge the exclusive rights of disposal of CPVO.

V - LIAISON WITH THE APPLICANT

If problems arise during the course of the test the CPVO should be informed immediately so that the information can be passed on to the applicant. Subject to prior agreement, the applicant may be directly informed at the same time as the CPVO particularly if a visit to the trial is advisable.

The interim report as well as the final report shall be sent by the Examination Office to the CPVO.

ANNEXES TO FOLLOW

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Legend:

Note: For the CPVO numbered characteristics, all characteristics in the table are compulsory; notwithstanding, in the case of disease resistance characteristics, only those resistances marked with an asterisk (*) in the CPVO column are compulsory. The asterisks in the UPOV numbered characteristics are there for information purposes and denote those characteristics which should always be observed when a UPOV guideline is utilised.

In general for the assessment of resistance characteristics, the facilities of other Examination Offices or specialised institutions might be used, subject to previous arrangements.

Some characteristics may be discarded: if there are already phytosanitary restrictions.

(+) See explanations on the Table of characteristics

(a) – (c) See explanations on the table of characteristics

G Grouping characteristic

Types of expression of characteristics:

QL – Qualitative characteristic

QN – Quantitative characteristic

PQ – Pseudo-qualitative characteristic

Type of 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

When a method of observation is attributed to a certain characteristic, the first differentiation is made depending if the action taken is a visual observation (V) or a measurement (M).

The second differentiation deals with the number of observations the expert attributes to each variety, thus the attribution of either G or S.

If a single observation of a group consisting of an undefined number of individual plants is appropriate to assess the expression of a variety, we talk about a visual observation or a

measurement made on a group of plants, thus we attribute the letter G (either VG or MG). If the expert makes more than one observation on that group of plants, the decisive part is that we have at the end only one data entry per variety which means that we have to deal with G (e.g. measurement of plant length on a plot – MG, visual observation of green colour of leaves on a plot – VG).

If it is necessary to observe a number of individual plants to assess the expression of a variety, we should attribute the letter S (thus either VS or MS). Single plant data entries are kept per variety for further calculations like the variety mean (e.g. measurement of length of ears – MS, visual observation of growth habit of single plants in grasses – VS). The number of individual plants to be observed in such cases is stated in section III.5.

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ANNEX II

Technical Questionnaire

ANNEX I

TABLE OF CHARACTERISTICS TO BE USED IN DUS-TEST AND PREPARATION OF DESCRIPTIONS

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note
1.	1.	VG	Foliage: width of crown		
(+)	(+)	(a)	narrow	Amsterdam 2	3
QN	QN		medium	Nantaise améliorée 2, Rothild	5
			broad	Chantenay à cœur rouge 2	7
2.	2.	VG	Leaf: attitude		
QN	QN	(a)	erect	Touchon	1
			semi-erect	Nantaise améliorée 2	3
			prostrate		5
3.	3.	VG/MS	Leaf: length (including petiole)		
	(*)		very short	Mokum, Mignon	1
QN	QN	(a)	short	Amsterdam 2, Amsterdam 3	3
			medium	Juwarot, Nantaise améliorée 2	5
			long	Chantenay, Chantenay à cœur rouge 2	7
G			very long	De Colmar à cœur rouge 2, Rothild	9
4.	4.	VG	Leaf: division		
	(*)	(a)	fine	Amsterdam 2, Amsterdam 3	3
QN	QN		medium	Nantaise améliorée 2, Nantaise améliorée 3	5
			coarse	Hytop	7
5.	5.	VG	Leaf: intensity of green colour		
	(*)	(a)	light	Adelaide, Leonor	3
QN	QN		medium	Amsterdam 2, Amsterdam 3	5
			dark	Rothild	7

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note		
6.	6.	VG	Leaf: anthocyanin coloration of petiole				
			(*)	(a)	absent	Amsterdam 2	1
QL	QL		present	Tarenco	9		
7.	7.	VG/MS	Root: length				
			(*)	(b)	very short	Parijse Markt 2, Parijse Markt 3	1
			QN	QN	short	Chantenay	3
					medium	Nantaise améliorée 2, Nantaise améliorée 3	5
					long	Berlikumer 2, Berlikumer 3	7
G			very long	Lange Stompe Winter	9		
8.	8.	VG/MS	Root: width				
			(*)	(b)	narrow	Amsterdam 2, Amsterdam 3	3
			QN	QN	medium	Nantaise améliorée 2, Nantaise améliorée 3	5
G			broad	De Colmar à cœur rouge 2, Parijse Markt 2, Parijse Markt 3	7		
9.	9.	VG/MS	Root: ratio length/ width				
			(*)	(b)	very small	Parijse Markt 3, Parmex	1
			QN	QN	small	Courte améliorée à forcer	3
					medium	Chantenay	5
					large	Nantaise améliorée 2, Nantaise améliorée 3	7
			very large	Amsterdam 2	9		

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note
10.	10.	VG	Root: shape in longitudinal section		
(+)	(+)	(b)	circular	Parijse Markt 2, Parijse Markt 3	1
	(*)		obovate		2
PQ	PQ		obtriangular	Chantenay, De Colmar à cœur rouge 2	3
			narrow obtriangular	De Colmar à cœur rouge 3, Imperator	4
			narrow obtriangular to narrow oblong	Maestro	5
G			narrow oblong	Amsterdam 2, Berlikumer 2, Berlikumer 3, Nantaise améliorée 3, Touchon	6
11.	11.	VG	Varieties scoring between 4 and 6 for characteristic 10 only: Root: tendency to conical shape		
(+)	(+)	(b)	very weak		1
QN	QN		weak	Amsterdam 2	3
			medium	Nantaise améliorée 2, Nantaise améliorée 3	5
			strong	Giganta	7
			very strong		9
12.	12.	VG	Root: shape of shoulder		
(+)	(+)	(b)	flat	De Colmar à cœur rouge 2	1
	(*)		flat to rounded	Parijse Markt 2	2
PQ	PQ		rounded		3
			rounded to conical		4
			conical	Touchon	5
13.	13.	VG	Root: tip (when fully developed)		
	(*)	(b)	blunt	Berlikumer 3	1
PQ	PQ		slightly pointed	Mello Yello	2
G			strongly pointed	Allred, Orbit	3

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note
14.	14.	VG	Root: external colour		
	(*)	(b)	white	White Satin	1
PQ	PQ		yellow	Mello Yello	2
			orange	Bingo, Goliath, Karotan, Pinocchio, Tancar	3
			pinkish red	Nutri-red	4
			red	Pulsor	5
G			purple	Purple Haze	6
15.	15.	VG	<u>Excluding varieties with white external root colour:</u> Root: intensity of external colour		
QN	QN		light	Bingo, Mello Yello, Tancar	3
			medium	Goliath, Nutri-red	5
			dark	Karotan, Pinocchio, Purple Haze	7
16.	16.	VG	Root: anthocyanin coloration of skin of shoulder		
QL	QL	(b)	absent	Trevor	1
			present	Touchon	9
17.	17.	VG	Root: extent of green colour of skin of shoulder		
(+)	(+)	(b)	absent or very small	Karotan	1
QN	QN		small	Scarla	3
			medium	De Colmar à cœur rouge 2	5
			large	Touchon	7
			very large	Lange Stompe Winter	9

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note
18.	18.	VG	Root: ridging of surface		
QN	QN	(b)	absent or very weak	Favor, Sytan	1
			weak	Major	3
			medium	Chantenay	5
			strong	De Colmar à cœur rouge 2	7
			very strong		9
19.	19.	VG	Root: diameter of core relative to total diameter		
	(*)	(b)	very small	Amsterdam 2, Amsterdam 3, Tourino	1
QN	QN		small	Nantaise améliorée 2, Nantaise améliorée 3	3
			medium	Berlikumer 2, Berlikumer 3	5
			large	De Colmar à cœur rouge 2	7
			very large	Giganta	9
20.	20.	VG	Root: colour of core		
	(*)	(b)	white	White Satin	1
PQ	PQ		yellow	Jaune de Lobberich, Pariser Markt	2
			orange	Nantaise améliorée 2, Nantaise améliorée 3	3
			pinkish red		4
			red	Nutri-red	5
			purple	Afghan purple, Black Deshi	6
21.	21.	VG	<u>Excluding varieties with white core:</u> Root: intensity of colour of core		
QN	QN	(b)	light		3
			medium		5
			dark		7

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note
22.	22.	VG	Root: colour of cortex		
	(*)	(b)	white	White Satin	1
PQ	PQ		yellow	Mello Yello	2
			orange	Allred, Carlo	3
			pinkish red		4
			red	Nutri-red	5
			purple	Afghan purple, Black Deshi	6
23.	23.	VG	<u>Excluding varieties with white cortex:</u> Root: intensity of colour of cortex		
QN	QN	(b)	light		3
			medium		5
			dark		7
24.	24.	VG	Root: colour of core compared to colour of cortex		
QN	QN	(b)	lighter		1
			same		2
			darker		3
25.	25.	VG	Root: extent of green coloration of interior (in longitudinal section)		
	(*)	(b)	absent or very small	Major	1
QN	QN		small	Meaux	3
			medium	Chantenay à cœur rouge 2, De Colmar à cœur rouge 3	5
			large	Touchon	7
			very large	Muscade	9

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note
26.	26.	VG	Root: protrusion above soil		
QN	QN	(b)	absent or very small	Karotan, Parijse Markt 3	1
			small	Amsterdam 2, Amsterdam 3, Nantaise améliorée 2, Nantaise améliorée 3	3
			medium	Tancar, Toudo	5
			large	Lange Stompe Winter, Touchon	7
			very large	Blanche à collet vert hors terre	9
27.	27.	MS	<u>Varieties with blunt tip only:</u> Root: time of development of rounded tip		
(+)	(+)		early	Touchon	3
QN	QN		medium	Nantaise améliorée 2, Nantaise améliorée 3, Tiana	5
			late	Bureau, Nantaise améliorée 7, Tancar	7
28.	28.	MS	Root: time of coloration of tip		
(+)	(+)		very early	Parijse Markt 3	1
QN	QN		early	Amsterdam 2, Amsterdam 3	3
			medium	Nantaise améliorée 2, Nantaise améliorée 3	5
			late	De Colmar à cœur rouge 2, Touchon	7
			very late	Goliath	9
29.	30.	VG	Plant: height of primary umbel at time of its flowering		
QN	QN	(c)	short		3
			medium		5
			tall		7
30.	31. (*)	VS	Plants: proportion of male sterile plants		
(+)	(+)	(c)	absent or very low	Nantaise améliorée 2, Touchon	1
QN	QN		intermediate		2
G			high	Nanco, Tino	3

CPVO No.	UPOV No.	Stage, Method	Characteristics	Examples	Note
31. (+)	32. (* (+)	VS	Plant: type of male sterility		
QL	QL		brown anthers	Nanco	1
G			petaloid anthers	Tino	2

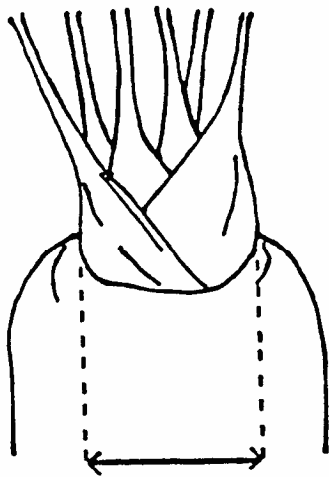
EXPLANATIONS AND METHODS

Explanations for covering several characteristics

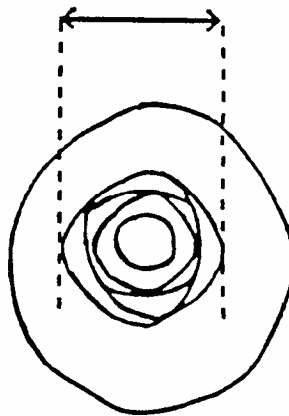
Characteristics containing the following key in the second column of the Table of Characteristics should be examined as indicated below:

- (a) Foliage and leaf: Observations on the foliage and the leaf should be made at the time of full development of the foliage.
- (b) Root: Observations on the root should be made when the root is fully developed.
- (c) Observations should be made when the plant is flowering during the second growing cycle.

Ad 1: Foliage: width of crown



lateral



vertical

Ad 10: Root: shape in longitudinal section



1
circular



2
obovate



3
obtriangular



4
narrow obtriangular



5
narrow obtriangular to
narrow oblong



6
narrow oblong

Ad. 11: Varieties scoring between 4 and 6 for characteristic 10 only: Root: tendency to conical shape



1
absent to
very weak



3
weak



5
medium

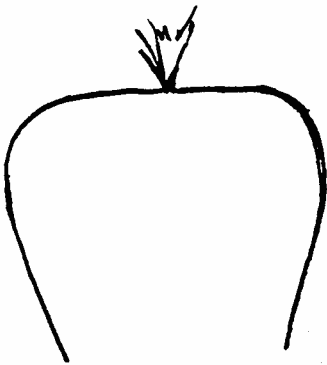


7
strong

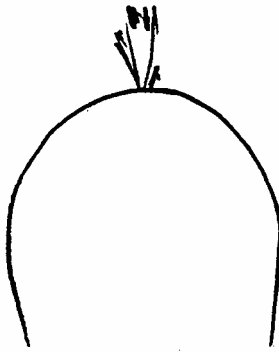


9
very strong

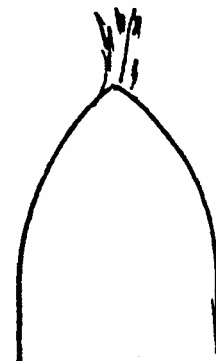
Ad 12: Root: shape of shoulder



1
flat

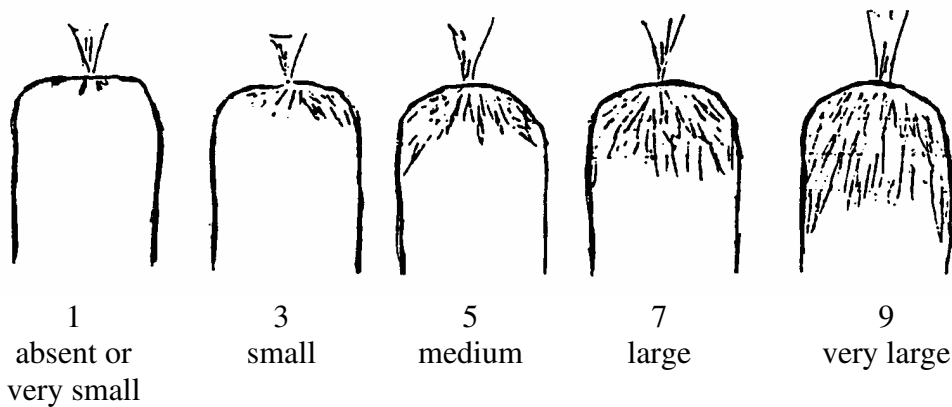


3
rounded



5
conical

Ad 17: Root: extent of green colour of skin of shoulder



Ad 27: Varieties with blunt tip only: Root: time of development of rounded tip

Ad 28: Root: time of coloration of tip in longitudinal section

The earliness of carrot varieties can be judged according to two criteria, characteristic 27, time of development of “rounded tip” for the varieties with a blunt tip at maturity and characteristic 28, time of coloration of the tip in longitudinal section.

Three weeks before the normal maturity date of the varieties (where the variety ‘Touchon’ has a blunt tip): pull up of part of the test roots in order to judge the shape of the tip, characteristic 27 (early: blunt tip: variety ‘Touchon’; medium: intermediate tip: varieties ‘Tiana’, ‘Nantaise améliorée 2’, ‘Nantaise améliorée 3’; late: pointed tip: varieties ‘Bureau’, ‘Tancar’, ‘Nantaise améliorée 7’).

Following longitudinal cutting of the roots: examination of the coloration of the tip, characteristic 28 (early: coloured tip: varieties ‘Amsterdam 2’, ‘Amsterdam 3’, late: whitish tip: varieties ‘De Colmar à coeur rouge 2’, ‘Touchon’).

A good example of the difference in earliness according to the two characteristics is the variety ‘Touchon’, which is early for characteristic 27 and late for characteristic 28.

Ad. 30: Plants: proportion of male sterile plants

Note 1: absent or very low: $\leq 20\%$
Note 2: intermediate: 21-79 %
Note 3: high: $\geq 80\%$

Ad. 31: Plant: type of male sterility

Type of male sterility:

Brown anther type: rudimentary brown anthers;

Petaloid anther type: anthers transformed into petals with different shapes (e.g. bract-like, spoon-like)

LITERATURE

No specific literature.

ANNEX II

The Technical Questionnaire is available on the CPVO website under the following reference:
CPVO-TQ/049/3