CPVO · OCVV
Community Plant Variety Office
Office Communautaire des Variétés Végétales

PROTOCOL FOR TESTS ON DISTINCTNESS, UNIFORMITY AND STABILITY

Phaseolus vulgaris L.

FRENCH BEAN

UPOV Code: PHASE_VUL

Adopted on 27/02/2013

Entry into force on 27/02/2013

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CPVO-TP/012/4

1. SUBJECT OF THE PROTOCOL AND REPORTING

1.1 Scope of the technical protocol

This Technical Protocol applies to all varieties of ***Phaseolus vulgaris* L.**

The protocol describes the technical procedures to be followed in order to meet the requirements of Council Regulation 2100/94 on Community Plant Variety Rights. The technical procedures have been agreed by the Administrative Council and are based on documents agreed by the International Union for the Protection of New Varieties of Plants (UPOV), such as the General Introduction to DUS (UPOV Document TG/1/3 http://www.upov.int/export/sites/upov/resource/en/tg_1_3.pdf), its associated TGP documents (http://www.upov.int/tgp/en/) and the relevant UPOV Test Guideline TG/12/9 Rev. dated 28/03/2012(http://www.upov.int/en/publications/tg-rom/tg012/tg_12_9.pdf) for the conduct of tests for Distinctness, Uniformity and Stability.

1.2 Entry into Force

The present protocol enters into force on **27.02.2013**. Any ongoing DUS examination of candidate varieties started before the aforesaid date will not be affected by the approval of the Technical Protocol. Technical examinations of candidate varieties are carried out according to the TP in force when the DUS test starts. The starting date of a DUS examination is considered to be the due date for submitting of plant material for the first test period.

In cases where the Office requests to take-over a DUS report for which the technical examination has either been finalized or which is in the process to be carried out at the moment of this request, such report can only be accepted if the technical examination has been carried out according to the CPVO TP which was in force at the moment when the technical examination started.

1.3 Reporting between Examination Office and CPVO and Liaison with Applicant

1.3.1 Reporting between Examination Office and CPVO

The Examination Office shall deliver to the CPVO a preliminary report ("the preliminary report") no later than two weeks after the date of the request for technical examination by the CPVO.

The Examination Office shall also deliver to the CPVO a report relating to each growing period ("the interim report") and, when the Examination Office considers the results of the technical examination to be adequate to evaluate the variety or the CPVO so requests, a report relating to the examination ("the final report").

The final report shall state the opinion of the Examination Office on the distinctness, uniformity and stability of the variety. Where it considers those criteria to be satisfied, or where the CPVO so requests, a description of the variety shall be added to the report. If a report is negative the Examination Office shall set out the detailed reasons for its findings.

The interim and the final reports shall be delivered to the CPVO as soon as possible and no later than on the deadlines as laid down in the designation agreement.

1.3.2 Informing on problems in the DUS test

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 permanent agreement, the applicant may be directly informed at the same time as the CPVO particularly if a visit to the trial is advisable.

1.3.3 Sample keeping in case of problems

If the technical examination has resulted in a negative report, the CPVO shall inform the Examination Office as soon as possible in case that a representative sample of any relevant testing material shall be kept.

2. MATERIAL REQUIRED

2.1 Plant material requirements

Information with respect to the agreed closing dates and submission requirements of plant material for the technical examination of varieties can be found on http://cpvo.europa.eu/applications-and-examinations/technical-examinations/submission-of-plant-material-s2-publication in the special issue S2 of the Official Gazette of the Office. General requirements on submission of samples are also to be found following the same link.

2.2 Informing the applicant of plant material requirements

The CPVO informs the applicant that

- he is responsible for ensuring compliance with any customs and plant health requirements.
- the plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.
- 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.

2.3 Informing about problems on the submission of material

The Examination Office shall report to the CPVO immediately in cases where the test material of the candidate variety has not arrived in time or in cases where the material submitted does not fulfil the conditions laid down in the request for material issued by the CPVO.

In cases where the examination office encounters difficulties to obtain plant material of reference varieties the CPVO should be informed.

3. METHOD OF EXAMINATION

3.1 Number of growing cycles

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

The two independent growing cycles should be in the form of two separate plantings.

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" http://www.upov.int/edocs/tgpdocs/en/tgp_9.pdf.

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.

3.4 Test design

3.4.1 Each test should be designed to result in a total of at least150 plants for dwarf beans and 60 plants for climbing beans, which should be divided between at least 2 replicates.

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

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, an additional test may be undertaken providing that a technically acceptable test procedure can be devised.

Additional 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.

3.6 Constitution and maintenance of a variety collection

The process for the constitution and the maintenance of a variety collection can be summarized as follows:

Step 1: Making an inventory of the varieties of common knowledge.

Step 2: Establishing a collection ("variety collection") of varieties of common knowledge which are relevant for the examination of distinctness of candidate varieties.

Step 3: Selecting the varieties from the variety collection which need to be included in the growing trial or other tests for the examination of distinctness of a particular candidate variety.

3.6.1 Forms of variety collection

The variety collection shall comprise variety descriptions and living plant material, thus a living reference collection. The variety description shall be produced by the EO unless special cooperation exists between EOs and the CPVO. The descriptive and pictorial information produced by the EO shall be held and maintained in a form of a database

3.6.2 Living Plant Material

The EO shall collect and maintain living plant material of varieties of the species concerned in the variety collection.

3.6.3 Range of the variety collection

The living variety collection shall cover at least those varieties that are suitable to climatic conditions of a respective EO.

3.6.4 Making an inventory of varieties of common knowledge for inclusion in the variety collection

The inventory shall take into account the list of protected varieties and the official, or other, registers of varieties, in particular:

The inventory shall include varieties protected under National PBR (UPOV contracting parties) and Community PBR, varieties registered in the Common Catalogue, the OECD list, the Conservation variety list and varieties in trade or in commercial registers for those species not covered by a National or the Common Catalogue.

3.6.5 Maintenance and renewal/update of a living variety collection

The EO shall maintain seeds in conditions which will ensure germination and viability, periodical checks, and renewal as required. For the renewal of existing living material the identity of replacement living plant material shall be verified by conducting side-by-side plot comparisons between the material in the collection and the new material.

4. ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY

The prescribed procedure is to assess distinctness, uniformity and stability in a growing trial.

4.1 Distinctness

4.1.1 General recommendations

It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 9 'Examining Distinctness' (http://www.upov.int/edocs/tgpdocs/en/tgp_9.pdf) prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in this Technical Protocol.

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 Technical Protocols are familiar with the recommendations contained in the UPOV-General Introduction to DUS prior to making decisions regarding distinctness.

Decision standards

4.1.4 Number of plants/parts of plants to be examined

Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 20 plants or parts taken from each of 20 plants and any other observations made on all plants in the test, disregarding any off-type plants.

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 third 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

It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 10 'Examining Uniformity' (http://www.upov.int/edocs/tgpdocs/en/tgp_10.pdf) prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in this Technical Protocol:

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 150 plants, 4 off-types are allowed. In the case of a sample size of 60 plants, 2 off-types are allowed.

4.3 Stability

4.3.1 It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 11 'Examining Stability' (http://www.upov.int/edocs/tgpdocs/en/tgp_11.pdf°;

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 seed 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) Plant: growth type (characteristic 2)

b) Flower: colour of standard (characteristic 15)

c) Pod: shape of cross-section (through seed) (characteristic 21)

d) Pod: ground colour (characteristic 22)

e) Pod: stringiness on ventral suture (characteristic 27)

f) Seed: number of colours (characteristic 41)

g) Seed: main colour (largest area) (characteristic 42)

h) Seed: predominant secondary colour (characteristic 43)

i) Resistance to Bean anthracnose (*Colletotrichum lindemuthianum*), Race 6 (characteristic 47.1)

j) Resistance to Bean Common Mosaic Necrosis Virus (BMCNV) (characteristic 48)

5.4 If other characteristics than those from the TP are used for the selection of varieties to be included into the growing trial, the EO shall inform the CPVO and seek the prior consent of the CPVO before using these characteristics.

6. INTRODUCTION TO THE TABLE OF CHARACTERISTICS

6.1 Characteristics to be used

The characteristics to be used in DUS tests and preparation of descriptions shall be those referred to in the table of characteristics. 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 or by specific legislation on plant health. In the latter case, the CPVO should be informed.
The Administrative Council empowers the President, in accordance with Article 23 of Commission Regulation N°874/2009, to insert additional characteristics and their expressions in respect of a variety.

Technical Protocols with asterisked characteristics (only for certain vegetable species)
In the case of disease resistance characteristics, only those resistances marked with an asterisk (*) in the CPVO column are compulsory.

States of expression and corresponding notes
In the case of qualitative and pseudo-qualitative characteristics, 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 Example Varieties

Where appropriate, example varieties are provided to clarify the states of expression of each characteristic.

6.3 Legend

G	Grouping characteristic	– see Chapter 5
(*)	Asterisked characteristic	– see Chapter 6.1.2
MG, MS, VG, VS	– see Chapter 4.1.5	
QL	Qualitative characteristic	
QN	Quantitative characteristic	
PQ	Pseudo-qualitative characteristic	

Legend: Explanations covering several characteristics

(a)-(d)	See Explanations on the Table of Characteristics in Chapter 8.1
(+)	See Explanations on the Table of Characteristics in Chapter 8.

7. TABLE OF CHARACTERISTICS

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
1.	**1.**	**VG**	**Plant: anthocyanin coloration of hypocotyl**		
QL			absent	Tuf (D)	1
			present	Delinel (D), Vilbel (D)	9
2.	**3.**	**VG**	**Plant: growth type**		
QL			dwarf	Callide (D), Capitole (D)	1
G			climbing	Phenomene (C), Bacle (C)	2
3.	**4.**	**VG**	**Climbing beans only: Plant: architecture**		
PQ			pyramidal	Haricot maïs	1
			rectangular	Hilda	2
4.	**5.**	**VG**	**Dwarf beans only: Plant: dwarf type**		
PQ			non-vining	Callide, Capitole	1
			vining	Great Northern, Felspar, Spinel	2
5.	**6.**	**MG/ MS/VG**	**Dwarf beans only: Plant: height**		
QN			low	Goldfish	3
			medium	Fori	5
			high	Nerina, Rote von Paris	7
6.	**7.**	**MG/ MS/VG**	**Climbing beans only: Plant: start of climbing (80% of plants)**		
(+)			early	Perle von Marbach	3
QN			medium	Trebona	5
			late	Record	7
7.	**8.**	**VG**	**Climbing beans only: Plant: speed of climbing**		
(+)			slow		3
QN			medium	Meicy	5
			rapid	Perle von Marbach	7

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
8.	**9.**	**VG**	**Leaf: intensity of green colour**		
QN		**(a)**	very light		1
			light	Rote von Paris (D), Goldelfe (C)	3
			medium	Fori (D), Valja (D)	5
			dark	Dubra (D), Goldfish (D), Silvia (C)	7
			very dark	Diva (D)	9
9.	**10.**	**VG**	**Leaf: rugosity**		
QN		**(a)**	absent or very weak	IPR Gruana (C), IPR Uirapuru (C)	1
			weak	Goldfish (D), Groffy (D), Valja (D), Record (C)	3
			medium	Butterzart (D), Fillety (D), Fiori (D), Neckarkönigin (C)	5
			strong	Loma (D)	7
			very strong	Brede Z.dr (D)	9
10.	**11.**	**VG**	**Terminal leaflet: size**		
QN		**(a)**	small	Goldfish (D)	3
			medium	Prelude (D)	5
			large	Facta (D), Longking (D), Rote von Paris (D)	7
11.	**12.**	**VG**	**Terminal leaflet: shape**		
(+)		**(a)**	triangular	Aber (D), Candide (D)	1
PQ			triangular to circular	Facta (D)	2
			circular	Acarli (D), Felix (D), Niver (D)	3
			circular to quadrangular	Calas (D), Capitole (D), Dorabel (D)	4
			quadrangular	Ace (D), Carlyn (D), Madrigal (D)	5

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
12.	**13.**	**VG**	**Terminal leaflet: apex**		
(+)		**(a)**	short acuminate		3
QN			medium acuminate	Goldfish (D), Tuf (D)	5
			long acuminate	Flo (D), Nerina (D), Prelude (D)	7
13.	**14.**	**VG**	**Dwarf beans only: Inflorescences: location (at full flowering)**		
QN			in foliage	Ryco	1
			partly in foliage	Valja, Tuf	2
			above foliage	Daisy, Goldetta	3
14.	**15.**	**VG**	**Flower: size of bract**		
QN			small	Fanion (D), Nerina (D), Ryco (D), Fidel (C), Markant (C)	3
			medium	Torrina (D), Meicy (C)	5
			large	Label (D), Pfälzer Juni (D), Toplong (C)	7
15.	**16.**	**VG**	**Flower: colour of standard**		
PQ			white	Tuf (D)	1
			pinkish white		2
			pink	Maxi (D), Vilbel (D)	3
G			violet	Delinel (D), Purple Teepee (D)	4
16.	**17.**	**VG**	**Flower: colour of wing**		
PQ			white	Tuf (D)	1
			pinkish white	Signal (D)	2
			pink	Maxi (D), Vilbel (D)	3
			violet	Delinel (D), Purple Teepee (D)	4

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
17.1	**18.**	**MS**	**<u>Dwarf beans only</u>: Pod: length (excluding beak)**		
QN		**(b)**	very short		1
			short	Prelude, Tuf	3
			medium	Amity, Lusia	5
			long	Dubra, Loma	7
			very long	Daisy, Longking, Maja	9
17.2	**19.**	**MS**	**<u>Climbing beans only</u>: Pod: length (excluding beak)**		
QN		**(b)**	very short		1
			short	Juwagold	3
			medium		5
			long	Fidel	7
			very long	Toplong	9
18.	**20.**	**MS**	**Pod: width at maximum point**		
(+)		**(b)**	narrow	Cabri (D), Tuf, (D) Necores (C)	3
QN			medium	Regulex (D), Meicy (C)	5
			broad	Pfälzer Juni (D), Perle von Marbach (C)	7
19.	**21.**	**MS/VG**	**Pod: transversal width**		
(+)		**(b)**	very narrow	Booster (D)	1
QN			narrow	Bergamo (D), Rentegevers (C)	3
			medium	Impact (D), Flagrano (D), Donna (C)	5
			broad	Maxidor (D), Mondiam (D), Emerite (C)	7
			very broad	Kerprim (D), Neckarkönigin (C)	9

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
20.	**23.**	**MS/VG**	**Pod: ratio transversal width/width at maximum point**		
(+)		**(b)**	small	Pascal (D), Pfälzer Juni (D), Regulex (D)	3
QN			medium	Tuf (D)	5
			large	Tendercrop White Seeded (D)	7
21.	**22.**	**VG**	**Pod: shape of cross section (through seed)**		
(+)		**(b)**	narrow elliptic		1
PQ			elliptic to ovate	Pascal (D), Pfälzer Juni (D), Regulex (D)	2
			cordate	Daisy (D)	3
			circular	Tuf (D)	4
G			eight shaped	Tendercrop White Seeded (D)	5
22.	**24.**	**VG**	**Pod: ground colour**		
(+)		**(b)**	yellow	Goldfish (D), Golddukat (D), Goldmarie (C)	1
QL			green	Diva (D), Filetty (D), Fortissima (C)	2
G			violet	Purpiat (D), Purple Teepee (D)	3
23.	**25.**	**VG**	**Pod: intensity of ground colour**		
(+)		**(b)**	light	Erato (D), Fortissima (C)	3
QN			medium	Gabriella (D), Filetty (D), Prelude (D)	5
			dark	Decibel (D), Golddukat (D), Purpiat (D)	7
24.	**26.**	**VG**	**Pod: secondary colour**		
QL	**QL**	**(c)**	absent	Tuf (D)	1
			present	Marbel (D)	9
25.	**27.**	**VG**	**Pod: hue of secondary colour**		
QL		**(c)**	pink	IPR Juriti (C)	1
			red	Borlotto lingua di fuoco 2 (C)	2
			violet	Marbel (D)	3

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
26.	**28.**	**VG**	**Pod: density of flecks of secondary colour**		
QN		**(c)**	sparse		3
			medium		5
			dense		7
27. (+)	**29.**	**VG**	**Pod: stringiness on ventral suture**		
QL		**(b)**	absent	Cabri (D), Tuf (D)	1
G			present	Facta (D), Marbel (D)	9
28.	**30.**	**VG**	**Pod: degree of curvature**		
(+)		**(b)**	absent or very weak		1
QN			weak	Nerina (D)	3
			medium		5
			strong	Goldfish (D), Groffy (D), Ryco (D)	7
			very strong		9
29.	**31.**	**VG**	**Pod: shape of curvature**		
(+)		**(b)**	concave	Admires (D)	1
PQ			s-shaped	Ideaal (D)	2
			convex	Calima (D)	3
30.	**32.**	**VG**	**Pod: shape of distal part (excluding beak)**		
(+)		**(b)**	acute	Aiguillon (D), Calas (D), Cesar (D)	1
PQ			acute to truncate	Aiguille vert (D), Faria (D)	2
			truncate	Afrio (D), Alcade (D), Divel (D)	3
31.	**33.**	**MS/VG**	**Pod: length of beak**		
QN		**(b)**	short	Amity (D), Ryco (D)	3
			medium	Goldfish (D), Optimus (D)	5
			long	Facta (D), Golddukat (D), Vilbel (D)	7

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
32.	**34.**	**VG**	**Pod: curvature of beak**		
QN		**(b)**	absent or very weak		1
			weak	Nerina (D)	3
			medium		5
			strong	Goldfish (C), Groffy (D), Ryco (D)	7
			very strong		9
33.	**35.**	**VG**	**Pod: texture of surface**		
QN		**(b)**	smooth	Prelude (D), Tuf (D)	3
			moderately rough	Daisy (D), Longking (D), Blauhilde (C)	5
			very rough		7
34.	**36.**	**VS/VG**	**Pod: constrictions (at dry stage)**		
QN		**(b)**	absent or very weak	Pascal (D), Regulex (D)	1
			moderate		2
			strong	Mechelse Tros (C)	3
35.	**37.**	**MS/MG**	**Seed: weight**		
(+)		**(d)**	very low	Cabri (D), Decibel (D), Label (D)	1
QN			low	Belfin (D), Ingo (D)	3
			medium	Duplika (D), Konservenstolz (D), Juwagold (C)	5
			high	Regulex (D), Fidel (C)	7
			very high	Facta (D), Rote von Paris (D), Precores (C)	9

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
36.	**38.**	**VG**	**Seed: shape of median longitudinal section**		
(+)		**(d)**	circular	Coblan (D), Coco nain blanc précoce (D), Rapsani (D)	1
PQ			circular to elliptic	Coco noir (D)	2
			elliptic	Nerina (D), Pros (D), Tuf (D)	3
			kidney-shaped	Orex (D), Palmares (D), Re Mida (D), Rubico (D)	4
			rectangular	Polanka (D)	5
37.	**39.**	**VG**	**<u>Varieties with kidney-shaped seed only</u>: Seed: degree of curvature**		
QN		**(d)**	weak	Farcybel (D), Janus (D), Jakar (D)	3
			medium	Faria (D), Farno (D), Niver (D)	5
			strong	Chevrier vert (D), Hador (D)	7
38.	**40.**	**VG**	**Seed: shape of median cross-section**		
(+)		**(d)**	flat	Soisson nain hatif (D)	1
PQ			narrow elliptic	Roi de Belges (D), Samurai (D)	2
			medium elliptic	Orlinel (D), Pluto (D), Rachel (D)	3
			broad elliptic	Obélique (D), Odessa (D), Primanor (D)	4
			circular	Pactol (D), Romulus (D), Starnel (D)	5
39.	**41.**	**MS/VG**	**Seed: width in cross-section**		
(+)		**(d)**	narrow	Cabri (D), Golddukat (D)	3
QN			medium		5
			broad	Pfälzer Juni (D), Rote von Paris (D)	7
40.	**42.**	**MS/VG**	**Seed: length**		
(+)		**(d)**	short	Raba (D)	3
QN			medium	Igolomska (D)	5
			long	Nigeria (D)	7

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
41.	**43.**	**VG**	**Seed: number of colours**		
QL		**(d)**	one		1
			two		2
G			more than two		3
42.	**44.**	**VG**	**Seed: main colour (largest area)**		
PQ		**(d)**	white	Goldfish (D), Tuf (D)	1
			green or greenish	Muriel (D), Pascal (D)	2
			grey		3
			yellow	Gele Citroen (D)	4
			beige	Purple Teepee (D), Blauhilde (C)	5
			brown	Primel (D), Sunray (D)	6
			red	Flageolet rouge (D)	7
			violet		8
G			black	Delinel (D), Vilbel (D)	9
43.	**45.**	**VG**	**Seed: predominant secondary colour**		
(+)		**(d)**	grey		1
PQ			yellow		2
			beige		3
			brown		4
			red	Fiori (D)	5
			violet	Marbel (D)	6
G			black	Brittle Wax (D)	7
44.	**46.**	**VG**	**Seed: distribution of secondary colour**		
(+)		**(d)**	around hilum	Brittle Wax (D)	1
QL			on half of grain		2
			on entire grain		3

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
45.	**47.**	**VG**	**Seed: veining**		
QN		**(d)**	weak	Prelude (D), Ryco (D)	3
			medium	Loma (D)	5
			strong	Daisy (D), Flo (D)	7
46.	**48.**	**VS/VG**	**Time of flowering (50% of the plants with at least one flower)**		
QN			very early	Pfälzer Juni (D)	1
			early	Prelude (D), Fortissima (C), Perle von Marbach (C)	3
			medium	Fanion (D), Groffy (D), Hilda (C), Precores (C)	5
			late	Necores (C)	7
			very late		9
47. (+)	**49.**	**VS/VG**	**Resistance to Bean anthracnose (*Colletotrichum lindemuthianum*)**		
47.1 (*)		**VS/VG**	**Race 6**		
QL			absent	Goldrush, Masai (D), Michelet (D)	1
G			present	Booster (D), Pastoral	9
47.2	**49.2**	**VS/VG**	**Race Kappa**		
QL			absent	Goldrush, Masai (D), Michelet (D)	1
			present	Booster (D), Pastoral	9
48. (*)	**50.**	**VS/VG**	**Resistance to Bean Common Mosaic Necrosis Virus (BCMNV)**		
(+)			absent	Dufrix, Flandria	1
QL			present with necrosis	Booster, Odessa	2
G			present without symptoms	Bizet	3

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
49.	**51.**	**VS/VG**	**Resistance to Halo Blight (*Pseudomonas savastanoi* pv. *phaseolicola*), Race 6**		
(+)			absent	Michelet(D)	1
QL			present	Masai (D), Vaillant	9
50.	**52.**	**VS/VG**	**Resistance to Common Blight (*Xanthomonas axonopodis* pv. *phaseoli*) (Xap), Isolate 422**		
(+)	**QL**		absent	Echo (D), Keygold (D)	1
QL			present	Walley (US line) (D)	9

8. EXPLANATIONS ON THE TABLE OF CHARACTERISTICS

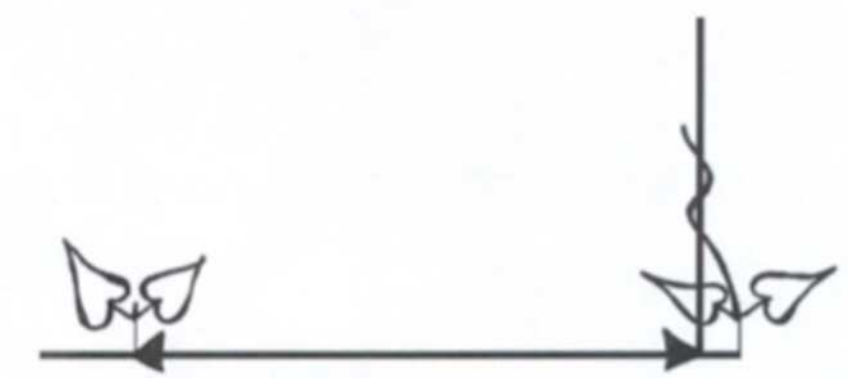
8.1 Explanations covering several characteristics

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

(a) All observation on the leaf should be made at the time of full flowering (all plants with flowers in bloom;
(b) All observation on the pod should be made at the time of fresh market maturity;
(c) All observations on the secondary colour of the pod should be made at maturity;
(d) All observations on the seed should be made on dry seed harvested from the plots.

8.2 Explanations for individual characteristics

Ad 6: Climbing beans only: Plant: start of climbing (80% of plants)



Number of days

Ad 7: Climbing beans only: Plant: speed of climbing

Number of days between the cotyledon leaf stage and reaching a height of 1.5 meters.

Ad 11: Terminal leaflet: shape

1
triangular

3
circular

5
quadrangular

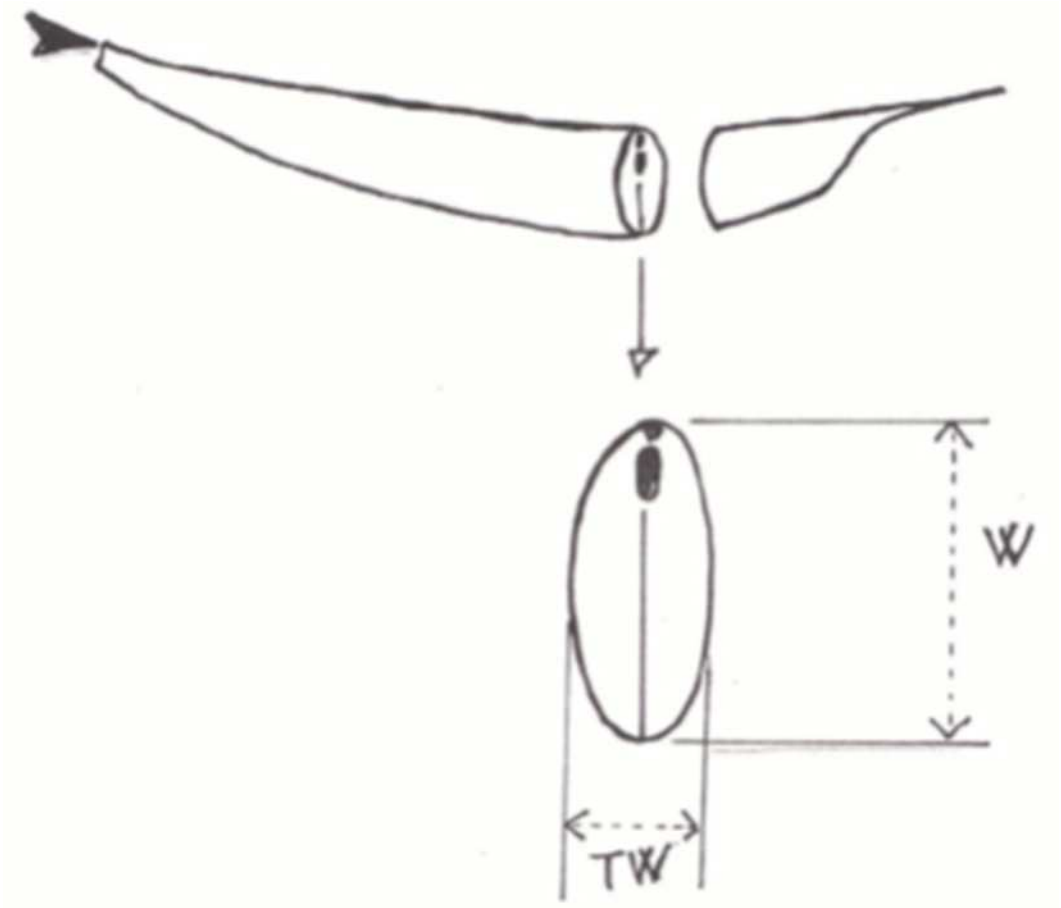
Ad 12: Terminal leaflet: apex

3
short acuminate

5
medium acuminate

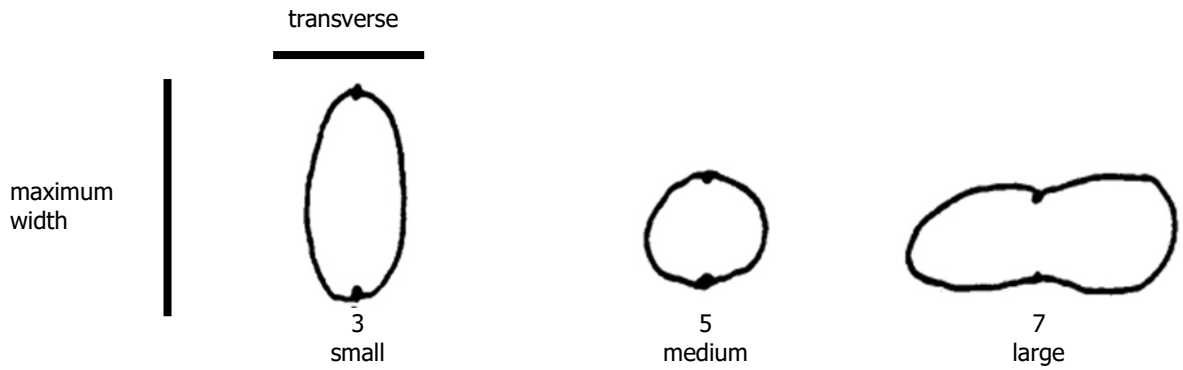
7
long acuminate

Ad 18, 19: Pod: width at maximum point
Pod: transversal width

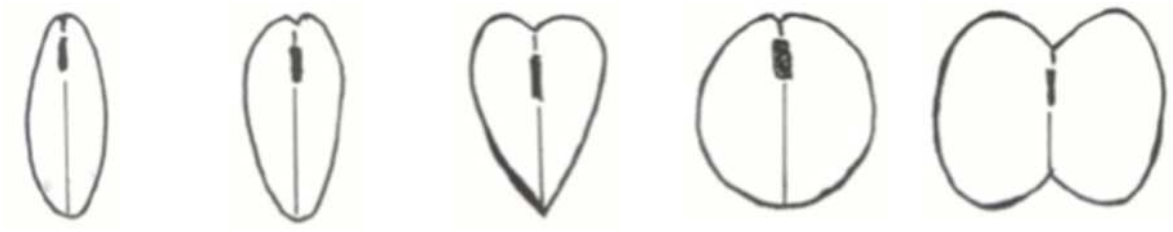


W = width at maximum point (characteristic 18)
TW = transversal width (characteristic 19)

Ad 20: Pod: ratio transversal width/width at maximum point



Ad 21: Pod: shape of cross section (through seed)



Ad 22, 23: Pod: ground colour
Pod: intensity of ground colour

	Characteristic 22: Pod: ground colour		
Characteristic 23: Pod: intensity of ground colour	**yellow (1)**	**green (2)**	**violet (3)**
light (3)	Erato (D), Frühe dickfleischige Wachs (D), Goldmarie (C)	Rabl (D), Ragalla (D), Ryco (D), Fortissima (C)	
medium (5)	Gabriella(D), Goldfish (D), Goldelfe (C)	Filetty (D), Prelude (D), Tuf (D)	
dark (7)	Golddukat (D)	Decibel (D), Diva (D), Verona (D), Vilbel (D)	Purpiat (D), Purple Teepee (D), Blauhilde (C)

Ad 27: Pod: stringiness on ventral suture

This characteristic should be observed just after the fresh market stage, by breaking the beak and pulling it from the pod. The stringiness emerges from the ventral suture of the pod.

The string is very strong and should not be confused with the oakum, for example, which has a weaker structure.

Ad 28: Pod: degree of curvature

1
absent or very slight

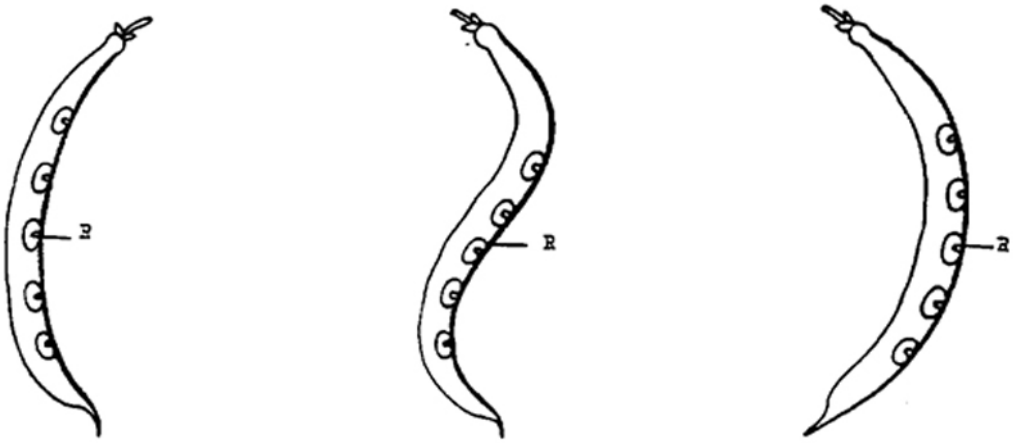
3
weak

5
medium

7
strong

9
very strong

Ad 29: Pod: shape of curvature



1
concave

2
s-shaped
R - dorsal suture

3
convex

Ad 30: Pod: shape of distal part (excluding beak)

3
acute

5
acute to truncate

7
truncate

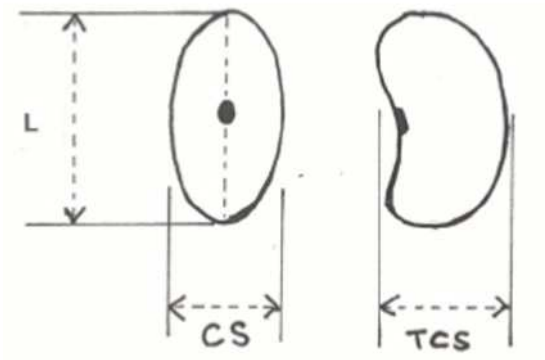
Ad 35: Seed: weight

The seed weight should be measured on four samples of 100 seeds.

Ad 36: Seed: shape of median longitudinal section

1	2	3	4	5
circular	circular to elliptic	elliptic	kidney-shaped	rectangular

Ad 38, 39, 40: Seed: shape of median cross section
Seed: width in cross section
Seed: length



CS = shape of median cross section (38)
TCS = width in longitudinal cross section (39)
L = length (40)

Ad 43: Seed: predominant secondary colour

The predominant secondary colour is the colour with the second largest area. If several secondary colours exist, the competent authorities will add one or more characteristics as necessary.

Ad 44: Seed: distribution of secondary colour

1	2	3
around hilum	on half of grain	on entire grain

Ad 47: Resistance to Bean anthracnose (Colletotrichum lindemuthianum)

Maintenance of strains

Long term storage of strains: at -80°C in 20% glycerol
A strain that does not break the Are gene, for example strain Cl.6.A from SERIDA (Spain), belonging to race 6 is used.
Strains can be subcultured on PDA or Mathur media.

Explanation of differences between races

Colletotrichum lindemuthianum is a pathogen with highly variable virulence characteristics. Races are defined with a set of differential lines coded A-L (Table 1). Some races have been denominated with a Greek letter (e.g. Lambda, Kappa). More recently, all races have been defined by binary race names (the sum of the binary values of susceptible differentials).

Resistance against *Colletotrichum lindemuthianum* is also genetically diverse. For example race 31 (kappa) breaks the resistance in differential D and E and race 55 (lambda) breaks the resistance in differential E and F. Race 6 does not break the resistance in D, E and F.

Race 6, 31 and 55 do not break the resistances in differentials G-L and resistances based on combinations of resistance genes.

There are many more races than the three mentioned here. The importance of races may vary between regions.

Old race name Binary race name				-	Lambda	Kappa
				6	55	31
Letter code	Binary value	Gene	Differential			
A	1		Michelite	R	S	S
B	2	Co-1	Michigan Dark Red Kidney	S	S	S
C	4	Co-1-3	Perry Marrow	S	S	S
D	8	Co-2 (Are)	Cornell 49242	R	R	S
E	16	Co-1-2	Widusa	R	S	S
F	32	Co-3	Kaboon	R	S	R
G	64		Mexico 222	R	R	R
H	128		PI 207262	R	R	R
I	256	Co-4	TO	R	R	R
J	512	Co-5	TU	R	R	R
K	1024	Co-6	AB 136	R	R	R
L	2048	Co-4-2/5/7	G 2333	R	R	R

Execution of test

Growth stage of plants
For inoculation by soaking seeds:
Pregermination of seeds in Petri dishes with moistured filter paper or on vermiculite for 4-5 days.

For inoculation by spraying cotyledons:
Seeds are sown on vermiculite or blotter for 2 days and transplanted in soil for 3 days.

The following varieties are used as controls. Each line will be represented by at least one variety which can be chosen in the varieties indicated. Pastoral can be added as resistant control as it has a weaker resistance and can give an indication on aggressiveness of the test

Variety	Resistance phenotype
Goldrush, Michelet à longue cosse, Masai	S
Booster	R

S = resistance absent; deeply sunken lesions or plant death
R = resistance present; superficial lesions or no symptoms

Temperature:
Test performed in climatic chambers or greenhouse at 20 -22°C. A high humidity is important for symptoms development.

Inoculum:
Colletotrichum lindemuthianum is grown on PDA or Mathur media for 7-20 days at 20 to 25°C. Spores are harvested with a scraper and suspension is adjusted to 10^6sp/ml.

Method of inoculation

Two methods can be used for inoculation:

By soaking seeds:
Pre-germinated seeds are soaked in the inoculum suspension for 2 min. Seeds are transplanted in soil after inoculation.

By spraying cotyledons:
5 days after sowing cotyledons are sprayed with inoculum suspension.

Duration of test
12-14 days from sowing to notation.

Number of plants tested:
At least 20 plants.

Notation:
When symptoms are well developed on S control (usually after 7 to 14 days post inoculation).

Notation scale:

For soaking seeds: 4 qualitative classes
0: no symptoms
1: weak reaction with small superficial necrosis (dots or stripes)
2: deeply sunken necrotic flecks on hypocotyl or stem and /or strong reaction with necrosis larger than 3 mm sunk deeply into the tissue
3: dying plants

For spraying cotyledons:
No symptoms
Necrosis observed on plants (hypocotyls, stems, veins)

Analysis of results:

For soaking seeds:
R: classes 0: no symptoms and 1: superficial lesions
S: classes 2: deeply sunken lesions and 3: plant death

For spraying cotyledons:
R: no symptoms, some flecks of necrosis can occur in the stem and some necrosis in the cotyledons.
S: deep necrosis observed on plants

Ad 48: Resistance to Bean Common Mosaic Necrosis Virus (BCMNV)

Preliminary note on the BCMV/BCMNV complex of virus species

Bean common mosaic (BCM) symptoms may be caused by two distinct virus species (BCMNV and BCMV) corresponding with serotype A (BCMNV) and B (BCMV) (Mink 1992, 1994; McKern 1992). These two viruses have been classified into seven pathogenicity groups based on their virulence pattern on a differential set of 11 varieties. Pathogenicity group PG-6 comprises the BCMNV strains NL3 and NL5. NL3 and NL5 have the ability to induce necrosis on bean varieties with gene I. Some strains have this ability only at high temperatures. The extent of necrosis may vary from local vein necrosis to top necrosis or in extreme cases whole plant necrosis (commonly called blackroot). Higher temperatures (26-32°C) generally enhance necrosis and mosaic symptom expression compared with lower temperatures (20-25°C) (Drijfhout, 1978; Mavric and Sustar-Vozlic, 2004).
"In response to NL3 strain, the I+bc12 restricts necrosis to the veins of the inoculated leaves, a symptom referred to as localized vein necrosis; I+bc22 restricts necrosis to small lesions on the inoculated leaf, a symptom referred to as local lesion necrosis" (Miklas et al, 2000).

Maintenance of BCMNV strains

Strains are long term stored as desiccated leaves below 10°C (BOS). The Pathogenicity group PG-06 represented by strains NL5 or NL3 are used. Strains should be multiplied on the susceptible control before being used for inoculation of the test.

Execution of test

Growth stage of plants
Plants are grown in greenhouse or growth chamber until the first expanded leaf stage.

The following varieties are used as controls for NL3 and NL5 strains. Each line will be represented by at least one variety which can be chosen in the varieties indicated. Within each class there may be considerable variation in the phenotypic expression of the symptoms.

Variety	Resistance phenotype NL3 or NL5
Dufrix, Flandria	S
Booster, Odessa	RN
Bizet	R

R = resistance present; no symptoms
RN = resistance present with vein or top necrosis
S = resistance absent; mosaic; leaf rolling

Temperature:
Test performed in climatic chambers or greenhouse at 25°C with an optional 5-7 days period at 30°C just after inoculation.

Method of inoculation
Mechanical inoculation by rubbing first expanded leaves with an inoculum solution consisting of symptomatic leaves grinded in a buffer with carborundum added. Leaves can be rinsed after inoculation.

Duration of test
At least 21 days from sowing to notation.

Number of plants tested:
At least 20 plants.

Notation:
When mosaic symptoms are well developed on S control (usually after 13-21 days)
Notation scale: 3 qualitative classes
1: mosaics and/or leaf rolling
2: top necrosis, or vein necrosis and/or small necrotic lesions in the leaf. Top necrosis is a systemic necrosis beginning at the apex of the plant whereas vein necrosis is a brown necrotic netting localized on veins.
3: without symptoms

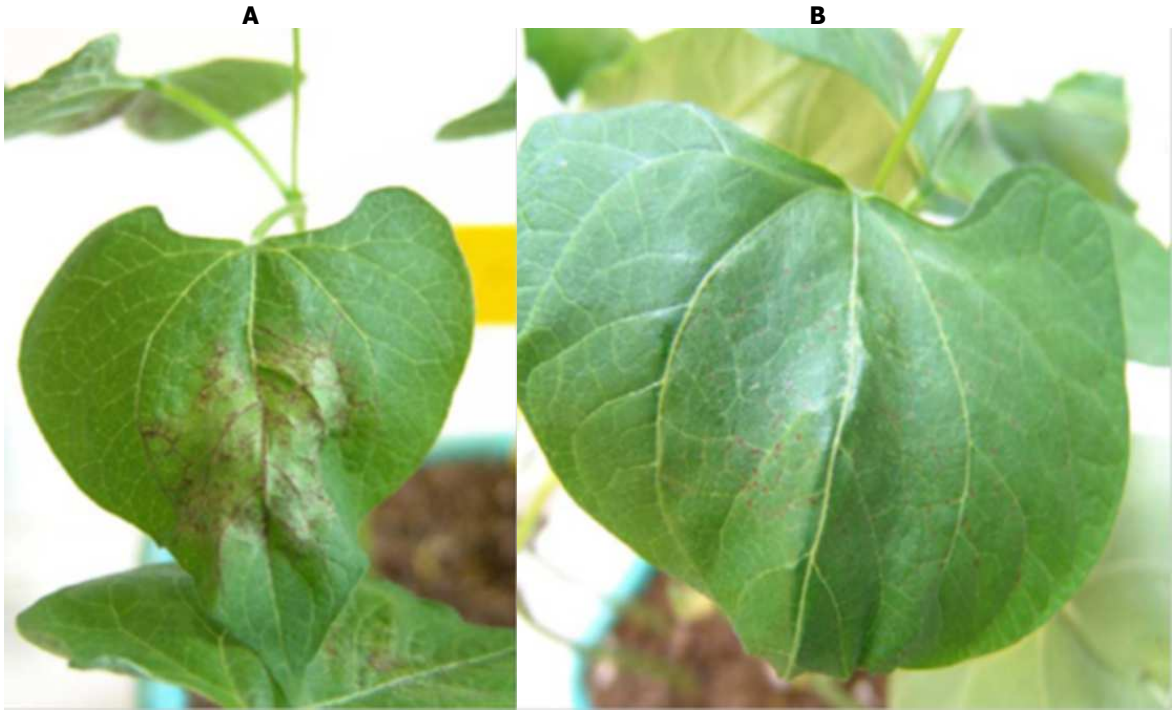
Analysis of results:
S: 1: mosaics or leaf deformation
R: 2: top or vein necrosis. Top necrosis is a systemic necrosis whereas vein necrosis is a brow necrotic netting localized on veins.
R: 3: without symptoms

Genetic background
One dominant and several recessive resistance genes have been described. The dominant gene I is responsible for the necrotic response to specific virus strains and absence of symptoms to other strains. Several recessive bc genes may cause resistance without necrotic response.
These bc genes need to be combined with one or more other bc genes for being effective. The presence of bc genes or gene combinations may suppress the necrotic response of the I gene partially or completely. In that case the I gene is said to be "protected" by the action of the bc gene or genes (Strausbaugh et al, 2003; Vandemark and Miklas, 2005).

BCMNV Pathogenicity Group VI resistance (example strains: NL3 and NL5)

	Phenotype	Resistance Genes
1	resistance present	healthy I gene + bc gene(s) or only bc genes
2	resistance present	necrosisI gene + bc gene(s) or only I gene
3	resistance absent	mosaic; leafroll

Picture 1: BCMNV: Symptoms of vein necrosis (A) and small necrotic lesions (B)



Ad 49: Resistance to Halo Blight (*Pseudomonas savastanoi* pv. *phaseolicola*)

Maintenance of strains

Isolates are long term stored at -80°C in glycerol (20%) or cryovial.
Race 6 represented by isolates PRI113, 7722a or HRI1299A is used.
Race 6 is the most frequent in Europe. Breeders use a broad (race-nonspecific) specific resistance. The use of an isolate of race 6 confirms broad resistance.
Isolates can be multiplied on King's B or YBC media.

Address of the following laboratories are able to provide isolates:
PRI113,: Naktuinbouw, NL
7722a : GEVES, FR
HRI1299A: HRI Warwick, UK INIA, ES (maintenance lab)

Execution of test

Growth stage of plants
Plants are grown in climatic chamber (or in glasshouse) for 7 to 15 days (first leaves stage just expanded).

The following standard varieties are used as controls. At least one resistant and one susceptible standard variety is necessary.

Standard variety	Phenotype
Michelet à longue cosse	Susceptible
Masaï, Vaillant	Resistant

S = resistance absent; water-soaked lesions, with or without halo and with or without systemic chlorosis.
R = resistance present; necrotic spots without water-soaked lesions or no symptom.

Temperature
Test performed in climatic chambers or in glasshouse at 18 to 20°C which represent the best conditions for symptom development. If temperatures are lower, symptoms will take longer time to develop. If temperatures are higher, less symptoms or necrotic symptoms will be obtained. A 100% relative humidity is important for symptoms development, especially in the first 24 hours after inoculation.

Inoculum
Pseudomonas savastanoi pv. *phaseolicola* is grown on King B or YBC medium for 1-4 days at 27°C.
A bacterial suspension with a concentration of 10^8 cfu/mL is used.

Method of inoculation
An inoculation by spraying leaves with pressure (2 bars) until runoff will be preferred. For this purpose several equipments may be used: atomizer, paint brush, with a pressure supplier (compressor, bottles with propane/isobutene). Otherwise rubbing leaves with carborundum and sponge is possible.

Duration of test
2 to 4 weeks from sowing to notation.

Number of plants tested
At least 20 plants.

Notation
7-14 days after inoculation when symptoms are well developed on susceptible control. If symptoms are recorded later, wrong interpretation could occur.

Notation scale
Results observed on susceptible (resistance absent) and resistant (resistance present):

Resistant:
- no symptoms,
- necrotic pinpoints.

Susceptible:
- halo,
- water-soaked (looking oily) lesions,
  - few
  - many
- water-soaked lesions becoming necrotic in time (larger than pinpoints),
- deformation and chlorosis on first trifoliate leaves (phaseolotoxine),
- necrosis on stems,
- plants dying.

Inoculation may produce some damage on susceptible and resistant plants.

Analysis of results
Analysis of results should be calibrated with results on R and S controls.

Ad 50: Resistance to Common Blight (*Xanthomonas axonopodis* pv. *phaseoli*) (Xap), Isolate 422

Method

Maintenance of races

Type of medium: ..... Infected, dry leaves

Execution of test

Growth stage of plants: ..... The first and second trifoliate leaves of 2 to 3 cm length

Temperature: ..... Day: 26°C; night: 20°C

Humidity: ..... 100% relative humidity during and 1 to 2 days after inoculation, thereafter normal relative humidity

Growing method: ..... In the glasshouse

Inoculum: ..... Bacterial suspension with a concentration of 10^8 bacterial cells/ml.

Method of inoculation ..... Mechanical, using a camel-hair brush

Duration of test

- from inoculation to reading: ..... Until infected leaves are fully developed

Number of plants tested: ..... 10-20 plants

Multiplication/propagation of bacteria: ..... 20 g extract of yeast powder, 20 g glucose, 20 g $CaCO_3$, 20 g agar-agar/1000 ml distilled water)

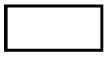
Remarks: ..... - Isolate 422 can be obtained from the Vegetable Research Institute, 1775 Budapest, P.O.Box 95, Hungary.

- The reaction of pods to *X. phaseoli* is not yet clear enough today

Legend of illustration following hereafter:

 healthy tissue

 (2) dying tissues

 (1) chlorotic tissue

 (3) some cell-size brownish red hypersentive necrotic spots

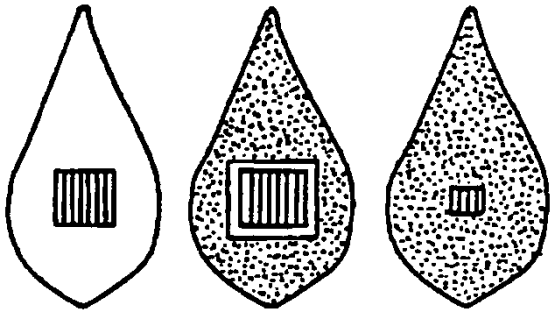
Scheme of observation

If chlorotic tissues (1) and/or dying tissue (2) are observed, the variety should be regarded as non-resistant.

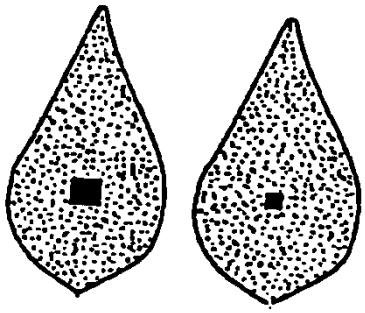
If only some cell-size brownish red hypersensitive necrotic spots (3) are observed, the variety should be regarded as resistant.

Possible combinations of symptoms

Resistance absent



Resistance present



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10. TECHNICAL QUESTIONNAIRE

The Technical Questionnaire is available on the CPVO website under the following reference: CPVO-TQ/012/4