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UPOV

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

DRAFT

PEA

UPOV code: PISUM_SAT

Pisum sativum L.

*

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by an expert from the United Kingdom

to be considered by the Technical Working Party for Vegetables (TWV)
at its fortieth session to be held in Guanajuato, Guanajuato State, Mexico,
from June 12 to 16, 2006
and
by the Technical Working Party for Agricultural Crops (TWA)
at its thirty-fifth session to be held in Beijing, China, from July 3 to 7, 2006

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Pisum sativum L.	Pea	Pois	Erbse	Guisante, Arvejo

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 *Pisum sativum* 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.

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

1,000 g or at least 12,000 seeds

2.4 The seed should meet the minimum requirements for germination, species and analytical purity, health and moisture content, specified by the competent authority. In cases where the seed is to be stored, the germination capacity should be as high as possible and should be stated by the applicant.

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

2.6 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

3. Method of Examination

3.1 Number of Growing Cycles

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

3.2 Testing Place

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

3.3 Conditions for Conducting the Examination

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.

3.3.2 The optimum stage of development for the assessment of each characteristic is indicated by a number in the second column of the Table of Characteristics. The stages of development denoted by each number are described at the end of Chapter 8.

3.3.3 The recommended method of observing the characteristic is indicated by the following key in the second column of the Table 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

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 100 plants, which should be divided between two or more 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 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, all observations should be made on 20 plants or parts taken from each of 20 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, a population standard of 1% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 100 plants, 3 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) Plant: anthocyanin coloration (characteristic 1)
(b) Leaf: leaflets (characteristic 10)
(c) Stipule: ‘rabbit-eared’ stipules (characteristic 18)
(d) Stipule: flecking (characteristic 25)
(e) Pod: parchment (characteristic 44)

(f) Varieties with no or partial parchment only: Pod: thickened wall (characteristic 45)
(g) Varieties without thickened pod wall only: Pod: shape of distal part (characteristic 46)
(h) Pod: color (characteristic 51)
(i) Immature seed: intensity of green color (characteristic 57)
(j) Seed: type of starch grain (characteristic 59)
(k) Seed: color of cotyledon (characteristic 63)
(l) Varieties with anthocyanin only: Seed: marbling of testa (characteristic 64)
(m) Varieties with anthocyanin only: Seed: violet or pink spots on testa (characteristic 65)
(n) Seed: hilum color (characteristic 66)

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 (Section 6.1.2)

(QL) Qualitative characteristic – see Chapter 6 (Section 6.3)
(QN) Quantitative characteristic – see Chapter 6 (Section 6.3)
(PQ) Pseudo-qualitative characteristic – see Chapter 6 (Section 6.3)

MG: single measurement of a group of plants or parts of plants – see Chapter 3.3.3
MS: measurement of a number of individual plants or parts of plants – see Chapter 3.3.3
VG: visual assessment by a single observation of a group of plants or parts of plants –see Chapter 3.3.3
VS: visual assessment by observation of individual plants or parts of plants – see Chapter 3.3.3

(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
TWA: Char.9 (now 1) Add asterisk							
1. (*) (+)	**30 – 240 VG**	**Plant: anthocyanin coloration**	**Plante: pigmentation anthocyanique**	**Pflanze: Anthocyan-färbung**			
QL		absent	absente	fehlend		Avola, Solara	1
		present	présente	vorhanden		Pidgin, Rosakrone	9
TWA: Char. 10 (now 2) to be indicated as MG/VG							
2. (*) (+)	**218 – 230 MG/ VG**	**Plant: height**	**Plante: hauteur**	**Pflanze: Höhe**			
QN		very short	très petite	sehr niedrig		Columbia	1
		short	petite	niedrig		Mini, Solara	3
		medium	moyenne	mittel		Lord Chancellor, Toskana	5
		tall	grande	hoch		Blauwschokker, Rhea	7
		very tall	très grande	sehr hoch		Livioletta	9
TWA: Char. 11 (now 3) Asterisk to be deleted. Explanation to be improved to make it clearer that the characteristic cannot be observed under short daylength conditions.							
3. (*) (+)	**30-199 VG**	**Stem: fasciation**	**Tige: fasciation**	**Stengel: Verbänderung**			
QL		absent	absente	fehlend		Avola, Solara	1
		present	présente	vorhanden		Bikini, Rosakrone	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
4. **(+)**	**242 – 250 MS**	**Stem: length**	**Tige: longueur**	**Stengel: Länge**			
QN		very short	très petite	sehr kurz		Elma	1
		short	petite	kurz		Birte, Mini	3
		medium	moyenne	mittel		Lord Chancellor, Minor	5
		long	grande	lang		Blauwschokker, Livia	7
		very long	très grande	sehr lang		Enka	9
5. **(*)** **(+)**	**210 – 240 MS**	**Stem: number of nodes up to and including first fertile node**	**Tige : nombre de nœuds jusqu'au premier nœud fertile inclus**	**Stengel: Anzahl Knoten bis einschliesslich des ersten Blütenstandes**			
QN		very few	très petit	sehr gering		Kelvil	1
		few	petit	gering		Miragreen, Waverking	3
		medium	moyen	mittel		Markana, Susan	5
		many	grand	gross		Cooper	7
		very many	très grand	sehr gross		Regina	9
6.	**30 – 240 VG**	**Stem: anthocyanin coloration of axil**	**Tige : pigmentation anthocyanique au point d'insertion du stipule**	**Stengel: Anthocyanfärbung der Achsel**			
QL		absent	absente	fehlend		Avola, Maro	1
		present	présente	vorhanden		Assas, Caroubel	9
7.	**30-240 VG**	**Only varieties with anthocyanin coloration of axil: Stem: type of anthocyanin coloration of axil**	**Tige : type de la pigmentation anthocyanique au point d'insertion du stipule**	**Stengel: Typ der Anthocyanfärbung der Achsel**			
QL		single ring	anneau simple	einfacher Ring		Assas, Tirabeque	1
		double ring	anneau double	doppelter Ring		Caroubel, Enka	2

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
8. (*)	**40-240 VG**	**Foliage: color**	**Feuillage: couleur**	**Laub: Farbe**			
PQ		yellow green	vert jaune	gelbgrün		Pilot	1
		green	vert	grün		Avola, Progreta	2
		blue green	vert bleu	blaugrün		Polar	3
9.	**40-240 VG**	**<u>Varieties with green foliage only</u>: Foliage: intensity of color**					
QN		light	claire	hell		Algera, Twinkle	3
		medium	moyenne	mittel		Lisa, Rondo	5
		dark	foncée	dunkel		Waverex	7
10. (*)	**20-240 VG**	**Leaf: leaflets**	**Feuille: folioles**	**Blatt: Blattfiedern**			
QL		absent	absentes	fehlend		Hawk, Solara	1
		present	présentes	vorhanden		Avola, Rhea	9
TWA: To read Leaf: waxiness of upper side of leaflet							
11.	**20-240 VG**	**Leaf: waxiness of upper surface of leaflet**	**Feuille : pruine sur la surface de la foliole supérieure**	**Blatt: Wachsschicht der Oberfläche der obersten Blattfieder**			
QL		absent	absente	fehlend		Citrina	1
		present	présente	vorhanden		Avola, Maro	9
12.	**30-240 MS or VG**	**Leaf: average maximum number of leaflets**	**Feuille :moyen des nombres maximaux de folioles**	**Blatt: durchschnittliche maximale Anzahl von Blattfiedern**			
QN		few	petit	gering		Jof	3
		medium	moyen	mittel		Dark Skin Perfection, Finale	5
		many	grand	gross		Ultimo	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
13.	**216-226 MS/ VG**	**Leaflet: size**	**Foliole : taille (la plus grand feuille au deuxième nœud florifère)**	**Blattfieder: Grösse (grösstes Blatt am zweiten blütentragenden Knote)**			
QN	**(a)**	very small	très petite	sehr klein		Payette	1
		small	petite	klein		Mini	3
		medium	moyenne	mittel		Finale	5
		large	grande	gross		Alderman	7
		very large	très grande	sehr gross		Mammoth Melting Sugar	9
14.	**216-226 MS/ VG**	**Leaflet: length**	**Foliole: longueur**	**Blattfieder: Länge**			
QN	**(a)**	short	courte	kurz		Eagle, Polar	3
		medium	moyenne	mittel		Bohatyr, Dakota	5
		long	longue	lang		Delikata, Mammoth Melting Sugar	7
15.	**216-226 MS/ VG**	**Leaflet: width**	**Foliole: largeur**	**Blattfieder: Breite**			
QN	**(a)**	narrow	étroite	schmal		Alouette, Grapis	3
		medium	moyenne	mittel		Dakota, Irina	5
		broad	large	breit		Adept, Tirabeque	7
16.	**216-226 MS/ VG**	**Leaflet: distance from widest point to base**	**Foliole : distance du point le plus large à la base**	**Blattfieder: Abstand zwischen der grössten Breite und der Basis**			
QN	**(a)**	short	petite	klein		Griffin, Progreta	3
		medium	moyenne	mittel		Columbia, Maro	5
		long	grande	gross		Nobel, Salome	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
17. **(+)**	**30 - 240 VG**	**Leaflet: dentation**					
QN	**(a)**	absent or very weak	très faible	sehr gering		Progreta	1
		weak	faible	gering		Snowflake	3
		medium	moyenne	mittel		Miracle	5
		strong	forte	stark		Amos	7
		very strong	très forte	sehr stark		Sugar Star	9

TWA: Ibiza and Progreta to be deleted. To check if there are any existing example varieties for states 2 and 3 and if not, delete.

18. **(*)** **(+)**	**30 - 240 VG**	**Stipule: 'rabbit-eared' habit**	**Stipule : stipules en forme d'oreilles de lapin**	**Nebenblatt: hasenohrartige Nebenblätter**			
QN	**(b)**	absent or weakly expressed	absentes ou très faibles	fehlend oder sehr schwach		Avola, Maro	1
		moderately expressed	moyennement expressés	mittelmäβig ausgeprägt		*France to provide example variety*	2
		strongly expressed	fortement expressés	stark ausgeprägt		Ibiza	3

TWA: characters 28-33 (now 19 – 24) To clarify which characteristics can be assessed manually and which can only be assessed by image analysis. Methods have to be clearly defined. The illustration does not show how to measure the characteristic: the fix-points are not clear; does not work for other leaf shapes.

19. **(+)**	**216-226 MS/ VG**	**Stipule: length**	**Stipule: longueur**	**Nebenblatt: Länge**			
QN	**(b)**	short	courte	kurz		Eagle, Steffi	3
		medium	moyenne	mittel		Timo, Twinkle	5
		long	longue	lang		Alderman, Rhea	7
20. **(+)**	**216-226 MS/ VG**	**Stipule: width**	**Stipule: largueur**	**Nebenblatt: Breite**			
QN	**(b)**	narrow	etroite	schmal		Eagle, Steffi	3
		medium	moyenne	mittel		Timo, Twinkle	5
		broad	large	breit		Nettuno	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
21.	**216-226 MS/ VG**	**Stipule: size**	**Stipule: taille**	**Nebenblatt: Grösse**			
QN	**(b)**	small	petite	klein		Alfetta, Dakota	3
		medium	moyenne	mittel		Jackpot, Misty	5
		large	grande	gross		Beetle, Manille	7
22. (+)	**216-226 MS**	**Stipule: length from axil to tip**	**Stipule : longueur du point d'insertion au stipule à l'extrémité**	**Nebenblatt: Länge zwischen der Achsel und der Spitze**			
QN	**(b)**	short	courte	kurz		Alfetta, Fortress	3
		medium	moyenne	mittel		Cabree, Orka	5
		long	longue	lang		Beetle, Manille	7
23. (+)	**216-226 MS**	**Stipule: length from axil to base**	**Stipule : longueur du point d'insertion au stipule à l'extrémité**	**Nebenblatt: Länge zwischen der Achsel und der Basis**			
QN	**(b)**	short	courte	kurz		Dakota, Toskana	3
		medium	moyenne	mittel		Eiffel, Misty	5
		long	longue	long		Manille, Quantum	7
24. (+)	**216-226 MS**	**Stipule: length of lobe below axil**					
QN	**(b)**	short				Dakota, Ramrod	3
		medium				Kahuna, Twinkle	5
		long				Eden, Quantum	7
25. (*) (+)	**20-240 VG**	**Stipule: flecking (on the whole plant)**	**Stipule: macules**	**Nebenblatt: Marmorierung**			
QL		absent	absentes	fehlend		Lisa, Tafila	1
		present	présentes	vorhanden		Avola, Maro	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
26. **(+)**	**20-240 VG**	**Stipule: maximum density of flecking (on the whole plant)**	**Stipule : densité maximale des macules**	**Nebenblatt: maximale Dichte der Marmorierung**			
QN		very sparse	très lâche	sehr locker		Progreta	1
		sparse	lâche	locker		Backgammon, Waxwing	3
		medium	moyenne	mittel		Accent, Ambassador	5
		dense	dense	dicht		Avola, Sephia	7
		very dense	très dense	sehr dicht		Oregon Sugar Pod	9
27. **(+)**	**216-226 MS/ VG**	**Petiole: length (from axil to the first leaflet or tendril)**					
QN		short	court	kurz		Hellas, Keo	3
		medium	moyen	mittel		Avola, Solara	5
		long	long	lang		Saskia, Tafila	7
28. **(+)**	**216-226 MS/ VG**	**<u>Varieties without leaflets only</u>: Petiole: total length (from axil to last tendril)**					
QN		short	court	kurz		Choucas, Fredrio	3
		medium	moyen	mittel		Alambo, Alezan	5
		long	long	lang		Arosa, Calao	7
29. **(*)** **(+)**	**214 MS/ VG**	**Time of flowering**	**Epoque de floraison**	**Zeitpunkt der Blüte**			
QN		very early	très précoce	sehr früh		Tempo	1
		early	précoce	früh		Smart, Sparkle	3
		medium	moyenne	mittel		Carlton, Waverex	5
		late	tardive	spät		Cooper, Purser	7
		very late	très tardive	sehr spät		Livioletta	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
30. (*)	**216-226 MS/ VG**	**Non-fasciated varieties only: Plant: maximum number of flowers per node**	**Variétés non-fasciées seulement : Plante : nombre maximal de fleurs par nœud**	**Nur nicht-verbänderte Sorten: Pflanze: maximale Anzahl Blüten pro Knoten**			
QL		one	une	eine		Progress No. 9, Tyla	1
		two	deux	zwei		Banff, Cooper	2
		three	trois	drei		Nettuno, Ultimo	3
		four or more	quatre ou plus	□ie roder mehr		*F to provide example*	4
31. (*)	**216-218 VG**	**Varieties with anthocyanin coloration only: Flower: color of wing**	**Variétés avec anthocyane seulement : Fleur : pigmentation anthocyanique de l'aile**	**Nur Sorten mit Anthocyan : Blüte : Anthocyanfärbung des Flügels**			
PQ	**(b)**	white with pink blush	rose pâle	blassrosa		Golf	1
		pink	rose	rosa		Rosakrone	2
		reddish purple	pourpre rougeâtre	rötlich purpur		Assas	3
32. (+)	**216-218 VG**	**Varieties without anthocyanin only: Flower: color of standard**	**Variétés sans anthocyane seulement : Fleur : couleur de l'étendard**	**Nur Sorten ohne Anthocyan: Blüte: Farbe der Fahne**			
PQ	**(b)**	white	blanc	weiss		Gloton, Record	1
		whitish cream	blanc à crème	weiss bis cremefarben		Maro, Cooper	2
		cream	crème	cremefarben		Cratos, Orcado	3
33. (+)	**216-218 MS/ VG**	**Flower: width of standard**	**Fleur : largeur de l'étendard**	**Blüte: Breite der Fahne**			
QN	**(b)**	narrow	étroite	schmal		Eagle, Progreta	3
		medium	moyenne	mittel		Bikini, Cooper	5
		broad	large	breit		Birdie, Pilot	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
34. (*) (+)	**216-218 VG**	**Flower: shape of base of standard**	**Fleur : forme de la base de l'étendard**	**Blüte: Form des Fahnengrunds**			
QN	**(b)**	strongly raised	fortement cunéiforme	stark keilförmig			1
		moderately raised	cunéiforme	keilförmig		Picar, Progreta	3
		level	droite	gerade		Markado, Solara	5
		moderately arched	arquée	zweilappig		Avola, Cooper	7
		strongly arched	fortement arquée	stark zweilappig		Bohatyr, Kennedy	9
35. (+)	**216-218 VG**	**Flower: undulation of standard**	**Fleur : intensité de l'ondulation de l'étendard**	**Blüte: Intensität der Wellung der Fahne**			
QN	**(b)**	absent or very weak	nulle ou très faible	fehlend oder sehr gering		Ultimo, Woody	1
		weak	faible	gering		Cooper, Dakota	3
		medium	moyenne	mittel		Alex, Kodiak	5
		strong	forte	stark		Koka, Reveille	7
		very strong	très forte	sehr stark		Téléphone nain, Télévision	9

TWA: Char 45, 46 (now 36 and 37) to be retained. Good differentiation in the collection, easy to observe. TWV had agreed to delete

36.	**216-218 VG**	**Flower: width of upper sepal**	**Fleur: largeur du sépale**	**Blüte: Breite des Kelchblatts**			
QN	**(b)**	narrow	étroite	schmal		Abador	3
		medium	moyenne	mittel		Conservor	5
		broad	large	breit		Kodiak	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
37.	**212-240 VG**	**Flower: shape of apex of upper sepal**	**Fleur: forme du sommet du sépale supérieur (au deuxième florifère)**	**Blüte: Form der Spitze des oberen Kelchblatts (am zweiten blütentragenden Knoten)**			
PQ	**(b)**	accuminate	acuminé	mit langer ausgezogener Spitze		Dawn	1
		pointed	pointu	zugespitzt		Kelvedon Wonder	2
		rounded	arrondi	abgerundet		Kodiak	3
38. **(+)**	**235-245 MS/ VG**	**Peduncle: length from stem to first pod**					
QN	**(b)**	short	court	kurz		Goblin, Orcado	3
		medium	moyen	mittel		Bohatyr, Maro	5
		long	long	lang		Kabuki, Reveille	7
39. **(+)**	**235 - 245 MS/ VS**	**Peduncle: length of between 1st and second pods**					
QN	**(b)**	short	court	kurz		Alize, Atila	3
		medium	moyen	mittel		Access, Kirio	5
		long	long	lang		Aladin, Alex	7
40. **(+)**	**MS/ VS**	**Peduncle: length of spur**					
QN	**(b)**	short	court	kurz		Cabro, Kirio	3
		medium	moyen	mittel		Metaxa, Rialto	5
		long	long	lang		Alezan, Calao	7

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
TWA: Char. 50 (now 41) To check if this is the frequency of bracts (normally there is a maximum of two bracts per pod). To check if the 1-9 scale is appropriate							
41.	**MS/ VS**	**Peduncle: number of bracts**					
QN	**(b)**	absent or very few				Fauvette, Kirio	1
		few				*France to provide example variety*	3
		medium				Delta, Duez	5
		many				Eiffel, Goelan	7
		very many				*France to provide example variety*	9
42. (*)	**240 MS/ VG**	**Pod: length**	**Gousse: longueur**	**Hülse: Länge**			
QN	**(c)**	very short	très courte	sehr kurz		Cepia, Vermio	1
		short	courte	kurz		Progreta, Solara	3
		medium	moyenne	mittel		Cooper, Jof	5
		long	longue	lang		Hurst Green Shaft, Protor	7
		very long	très longue	sehr lang		Roi de Carouby	9
43. (*) (+)	**240 MS/ VG**	**Pod: width**	**Gousse : largeur**	**Hülse: Breite**			
QN	**(c)**	very narrow	très étroite	sehr schmal		Disco	1
		narrow	étroite	schmal		Picar, Ultimo	3
		medium	moyenne	mittel		Progreta, Solara	5
		broad	large	breit		Finale, Kahuna	7
		very broad	très large	sehr breit		Kennedy	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
TWA: Char 53 (now 44) to have the states not entire (1) and entire (2)							
44. (*) (+)	**310 VG**	**Pod: parchment**	**Gousse: parchemin**	**Hülse: Pergamentschicht**			
QL	**(c)**	absent or partial	absent	fehlend		Sugar Ann	1
		entire	entièrement présent	vollständig vorhanden		Avola, Solara	2
TWA: Char. 54 (now 45) to read: Only varieties without entire parchment							
45. (*) (+)	**240 VG**	**<u>Varieties with no or partial parchment only</u>: Pod: thickened wall**	**<u>Variétés sans parchemin ou avec parchemin partiel seulement</u>: Gousse: paroi épaisse**	**<u>Nur Sorten mit fehlender oder teilweise vorhandener Pergamentschicht</u>: Hülse: verdickte Wand**			
QL	**(c)**	absent	absente	fehlend		Nofila, Reuzensuiker	1
		present	présente	vorhanden		Cygnet, Sugar Ann	9
46. (*) (+)	**240 VG**	**<u>Varieties without thickened pod wall only:</u> Pod: shape of distal part**	**<u>Variétés à gousse sans paroi épaisse seulement</u> : Gousse : forme de la partie distale**	**<u>Nur Sorten ohne verdickte Hülsenwand</u>: Hülse: Form des Hülsenendes**			
QL	(c)	pointed	pointue	zugespitzt		Jof, Oskar	1
		blunt	tronquée	stumpf		Avola, Solara	2
TWA: Chars 55, 56 (now 47, 48) Relationship between the two characteristics is unclear. What is the expression of char. 56if there is state 2 in Char. 55? Char. 55 cannot be QL, intermediate state is necessary.							
47 (+)	**235 – 240 VG**	**Pod: type of concave curvature**					
QL	**(c)**	curvature along the length of the pod				Edula	1
		curvature towards the pod apex only				Jof	2

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
48. (*) (+)	**240 VG**	**Pod: degree of curvature**	**Gousse : intensité de la courbure**	**Hülse: Stärke der Krümmung**			
QN	**(c)**	absent or very weak	absente ou très faible	fehlend oder sehr gering		Finale, Maro	1
		weak	faible	gering		Eagle, Span	3
		medium	moyenne	mittel		Carlton, Hurst Green Shaft,	5
		strong	forte	stark		Delikata, Jof	7
		very strong	très forte	sehr stark		Edula, Oskar	9

TWA: To be deleted. No additional information provided. Char. 59 (now 50) state 3 = convex; there are no example varieties for convex. States 1 and 2 are fully covered by Char. 56 (now 48).

49. (+)	**240 VS MS**	**Pod: position of the ovary compared to the midpoint of the pod**					
	(c)	above				Carlton, Edula	1
		level				Banff	2
		below				Avola, Hawk	3
50. (+)	**240 VS MS**	**Pod: postion of the apex compared to the midpoint of the seed-bearing suture**					
	(c)	above				Edula, Jof	1
		level				Milor, Pluton	2
		below					3
51. (*)	**230 - 240 VG**	**Pod: color**	**Gousse: couleur**	**Hülse: Farbe**			
PQ	**(c)**	yellow	jaune	gelb		Orlex	1
		green	verte	grün		Avola, Solara	2
		blue-green	vert bleu	blaugrün		Miracle, Miragreen	3
		purple	pourpre	purpur		Blauwschokker	4

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
52.	**230 - 240 VG**	**Pod: intensity of green color**	**Gousse : intensité de la couleur verte**	**Hülse: Intensität der grünen Farbe**			
QN	**(c)**	light	claire	hell		Solara, Ultimo	3
		medium	moyenne	mittel			5
		dark	foncée	dunkel		Dark Skin Perfection, Hawaii	7
53. (*) (+)	**240-245 VG**	**Varieties with no or partial parchment only: Pod: suture strings**	**Variétés sans parcheminou avec parchemin partiel seulement : Gousse : fils de la suture**	**Nur Sorten mit fehlender oder teilweise vorhandener Pergamentschicht: Hülse: Fäden der Naht**	**-**		
QL	**(c)**	absent or rudimentary	absents ou rudimentaires	fehlend oder rudimentär		Nofila, Sugar Lace	1
		present	présents	vorhanden		Crispi, Reuzensuiker	9
54. (+).	**240-255 VG**	**Varieties with anthocyanin only: Pod: anthocyanin coloration of suture**	**Variétés avec anthocyane seulement: Gousse: pigmentation anthocyanique de la suture**	**Nur Sorten mit Anthocyan: Hülse: Anthocyanfärbung der Naht**			
QL	**(c)**	absent	absente	fehlend		Desiree, Pidgin	1
		present	présente	vorhanden		Lisa, Super Delicia	9
55. (+)	**240-255 VG**	**Varieties with anthocyanin only: Pod: spots of anthocyanin color-ation on outer wall**	**Variétés avec anthocyane seulement: Gousse: pigmentation anthocyanique en taches sur la paroi externe**	**Nur Sorten mit Antho cyan: Hülse: Anthocyanflecke auf der Aussenwand**			
QL	**(c)**	absent	absente	fehlend		Lisa, Sirius	1
		present	présente	vorhanden		Caroubel, Pidgin	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
TWA: Char 65 (now56) Stage of development to be checked. Explanation necessary on whether aborted ovules are to be counted							
56. (*)	**230-240 MS**	**Pod: number of ovules**	**Gousse: nombre d'ovules**	**Hülse: Anzahl Samenanlagen**			
QN	**(c)**	few	faible	gering		De Grace, Pegas	3
		medium	moyen	mittel		Backgammon, Hawk	5
		many	élevé	gross		Karisma	7
57. (*)	**230-240 VG**	**Immature seed: intensity of green color**	**Gousse: intensité de la couleur verte de la graine immature**	**Hülse: Intensität der grünen Farbe des unreifen Samens**			
QN		light	claire	hell		Solara, Ultimo	3
		medium	moyenne	mittel			5
		dark	foncée	dunkel		Dark Skin Perfection, Hawaii	7
TW*A: Char. 1 (now 58) Differentiation of state 4, 5, 6 not clear. To combine these notes as irregular*							
58. (+)	**320 VG**	**Seed: shape**	**Graine: forme**	**Samen: Form**			
PQ		spherical	sphérique	kugelförmig		Goeland, Nofila	1
		ovoid	ovoïde	eiförmig		Solara	2
		cylindrical	cylindrique	zylindrisch		Span, Timo	3
		rhomboid	rhomboïde	rhomboid		Maro, Progreta	4
		triangular	triangulaire	dreieckig		Protor	5
		irregular	irrégulière	unregelmässig		Géant à fleur violette	6
59. (*) (+)	**320 VG**	**Seed: type of starch grains**	**Graine: forme du grain d'amidon**	**Samen: Form des Stärkekorns**			
QL		simple	lisse	einfach		Adagio, Maro, Solara	1
		compound	étoilé	zusammengesetzt		Avola, Polar	2

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
UK proposes to split Seed: wrinkling of cotyledon into absent /present and degree of wrinkling to make a clearer separation of cotyledon dimpling (61) and cotyledon wrinkling (62)							
TWA: Char. 69 (now split into 60 and 61) To check French and German.							
60. (*) (+)	**320 VG**	**Seed: wrinkling of cotyledon**	**Graine: forme du grain d'amidon**	**Samen: Form des Stärkekorns**			
QL		absent	absentes	fehlend		Maro, Solara	1
		present	présentes	vorhanden		Adagio, Avola, Polar	9
61. (*)	**320 VG**	**For varieties with wrinkled seed only: Seed: intensity of wrinkling of cotyledon**	**Graine: intensité des rides sur les cotylédons**	**Samen: Stärke der Schrumpfung des Keimblatts**		**Check Adagio and Zorba**	
QN		weak	faible	gerning		Jessy, Merle	3
		medium	moyenne	mittel		Zorba, Calama	5
		strong	forte	stark		Esprit, Sherwood	7
		very strong	très forte	sehr stark		Oskar, Sparkle	9
TWA : To be deleted. Classification is not clear because char 69 (now 62) is QL. Very difficult to be observed							
62. (*) (+)	**320 VG**	**Varieties with unwrinkled seed and simple starch grains only: Seed: dimpled cotyledons**	**Variétés avec graines sans rides et avec grains d'amidon lisses seulement: Graine: fossettes sur les cotylédons**	**Nur Sorten mit Samen ohne Schrumpfung und mit einfachen Stärkekörnern: Samen: Grübchen des Keimblatts**			
QL		absent	absentes	fehlend		Columbia, Solara	1
		present	présentes	vorhanden		Maro, Progreta	9
63. (*) (+)	**320 VG**	**Seed: color of cotyledon**	**Graine: couleur des cotylédons**	**Samen: Farbe des Keimblatts**			
QL		green	verts	grün		Avola, Solara	1
		yellow	jaunes	gelb		Caractacus, Hardy	2
		orange	orange	orange		Oliver	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
64. (*)	**320 VG**	**<u>Varieties with anthocyanin only</u>: Seed: marbling of testa**	**Variétés avec anthocyane seulement: Graine: marbrure des téguments**	**Nur Sorten mit Anthocyan: Samen: Marmorierung der Samenschale**			
QL		absent	absente	fehlend		Rhea, Rif	1
		present	présente	vorhanden		Assas, Birdie	9
65. (*)	**320 VG**	**<u>Varieties with anthocyanin only:</u> Seed: violet or pink spots on testa**	**<u>Variétés avec anthocyane seulement</u>: Graine: taches violettes ou roses sur les téguments**	**<u>Nur Sorten mit Anthocyan: Samen</u>: violette oder rosa Punktierung auf der Samenschale**			
QL		absent	absentes	fehlend		Birdie, Rif	1
		faint	faibles	gering		Assas, Susan	2
		intense	intenses	intensiv		Arvika, Rhea	3
66. (*)	**320 VG**	**Seed: hilum color**	**Graine: couleur du hile**	**Samen: Nabelfarbe**			
QL		not black	autre que noir	anders als schwarz		Avola, Birdie	1
		black	noir	schwarz		Nofila, Rif	2
67.	**320 VG**	**<u>Varieties with anthocyanin only:</u> Seed: color of testa**	**Variétés avec anthocyane seulement: Graine: couleur du tégument**	**Nur Sorten mit Anthocyan: Samen: Farbe der Samenschale**			
PQ		reddish brown	brun rougeâtre	rötlichbraun		Pidgin, Rosakrone	1
		brown	brun	braun		Poneka	2
		brownish green	vert brunâtre	bräunlichgrün		Lisa, Susan	3

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
68 (*) (+)	**320 MG**	**Seed: weight**	**Graine: poids de semences**	**Samen: Samengewicht**			
QN		very low				Ultimo	1
		low				Hawk, Iceberg	3
		medium				Mammoth Melting Sugar, Toskana	5
		high				Kennedy, Maro	7
		very high				Bamby, Cratos	9

TWA: Char 71 (now 69) Asterisk to be deleted because not useful for agroicultural peas and it has to be observed by a special test.

69. (+)	**VS**	**Resistance to Fusarium oxysporum f. sp. pisi**	**Résistance à Fusarium oxysporum f. sp. pisi**	**Resistenz gegen Fusarium oxysporum f. sp. pisi**			
QL		**Race 1**	**Race 1**	**Pathotyp 1**			
69.1		absent	absente	fehlend		JI 1365 ex 'Little Marvel'	1
		present	présente	vorhanden		JI 1362 ex 'Dark Skin Perfection'	9
69.2		**Race 2**	**Race 2**	**Pathotyp 2**			
		absent	absente	fehlend		JI 1363 ex WSU 28	1
		present	présente	vorhanden		JI 1364 ex WSU 23	9
69.3		**Race 5**	**Race 5**	**Pathotyp 5**			
		absent	absente	fehlend		JI 1365 ex 'Little Marvel'	1
		present	présente	vorhanden		JI 1364 ex WSU 23	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
69.4		**Race 6**	**Race 6**	**Pathotyp 6**			
		absent	absente	fehlend		JI 1365 ex 'Little Marvel'	1
		present	présente	vorhanden		JI 1363 ex WSU 28	9
70.	**VG**	**Resistance to <u>Erysiphe pisi</u> Syd**	**Résistance à <u>Erysiphe pisi</u> Syd.**	**Resistenz gegen <u>Erysiphe pisi</u> Syd.**			
(+)							
QL		absent	absente	fehlend		JI 502 ex 'Rondo'	1
		present	présente	vorhanden		JI 1559 ex Mexique 4	9
71.	**VS**	**Resistance to <u>Ascochyta pisi</u>, Race C**	**Résistance à <u>Ascochyta pisi</u>, race C**	**Resistenz gegen <u>Ascochyta pisi</u>, Pathotyp C**			
(+)							
QL		absent	absente	fehlend		JI 394 ex 'Kelvedon Wonder'	1
		present	présente	vorhanden		JI 502 ex 'Rondo'	9
72.	**VS**	**Resistance to <u>Pseudomonas syringae</u> pv. <u>pisi</u>**	**Résistance à <u>Pseudomonas syringae</u> pv. <u>pisi</u>**	**Resistenz gegen <u>Pseudomonas syringae</u> pv. <u>pisi</u>**			
(+)							
QL							
72.1		**Pathovar 2**	**Pathotype 2**	**Pathotyp 2**			
		absent	absente	fehlend		JI 2430 ex 'Kelvedon Wonder'	1
		present	présente	vorhanden		JI 2431 ex 'Early Onward'	9
72.2		**Pathovar 4**	**Pathotype 4**	**Pathotyp 4**			
		absent	absente	fehlend		JI 2431 ex 'Early Onward'	1
		present	présente	vorhanden		JI 2439 ex 'Fortune'	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
73. (+)	**VS**	**Resistance to Seed-borne Mosaic Virus (SbmV) Strain P1**	**Résistance au virus de la mosaïque transmis par les semences (SbmV) race P1**	**Resistenz gegen Saatgutübertragenes Blattrollmosaikvirus (SbmV) Pathotyp P1**			
QL		absent	absente	fehlend		JI 363 ex 'Lincoln'	1
		present	présente	vorhanden		JI 968 ex WBH 1779	9
74. (+)	**VS**	**Resistance to Bean Yellow Mosaic Virus (BYMV)**	**Résistance au virus de la mosaïque jaune du Haricot (BYMV)**	**Resistenz gegen Gelbes Bohnenmosaikvirus (BYMV)**			
QL		absent	absente	fehlend		JI 502 ex 'Rondo'	1
		present	présente	vorhanden		JI 394 ex 'Kelvedon Wonder'	9
75. (+)	**VS**	**Resistance to Pea Enation Mosaic Virus (PEMV)**	**Résistance au virus enation de la mosaïque du Pois (PEMV)**	**Resistenz gegen Scharfes Adernmosaik (PEMV)**			
QL		absent	absente	fehlend		ex 'Dark Skin Perfection'	1
		present	présente	vorhanden		ex 'Perfected Freezer 60'	9

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) Leaflet: Unless otherwise indicated, all observations should be made on the first leaflet at the second flowering node.

(b) Stipule, flower and peduncle: Unless otherwise indicated, all observations should be made at the second flowering node

(c) Pod: Unless otherwise indicated, all observations should be made at the second fertile node

8.2 Explanations for individual characteristics

Ad. 1: Plant: anthocyanin coloration

The anthocyanin coloration should be recorded as present if anthocyanin occurs in one or more of the following: seed, foliage, stem, axil, flower or pod.

Ad. 2: Plant: height

The observations should be made when at least 30% of the plants have one flower open.

Ad. 3: Stem: fasciation

The expression of fasciation varies considerably with environmental conditions, being more clearly expressed in longer daylengths. However, the presence or absence of fasciation in any environment is usually clear. Fasciated stems may be ribbed and flattened up to a width of 3 cm; several apical growing points often result in multiple flowers or pods at the top of the plant. Flower and pod counts should not be assessed on fascinated varieties.

Ad. 4: Stem: length

The observations should be made on harvested plants when seed is green and fully developed. The measurement should include the first two nodes with scale leaves.

Stem length may vary considerably with site and season due to different responses to daylength, temperature and soil moisture. However, within years, both characteristics are highly discriminating. Only the main stem should be recorded.

If there is sufficient soil moisture present, some varieties will continue to grow after flowering, while others will not. The differentiation of these varieties can be achieved by comparing plant height and stem length.

Ad. 5. Stem: number of nodes up to and including the first fertile node

The first two nodes, which have 'scale' leaves, should be included in all node counts.

Ad. 17: Leaflet: dentation

The maximum expression should be recorded; observations should only be made on the main stem (excluding aerial and basal branches), and above node six.

Still to be provided

1	3	5	7	9
very weak	weak	medium	strong	very strong

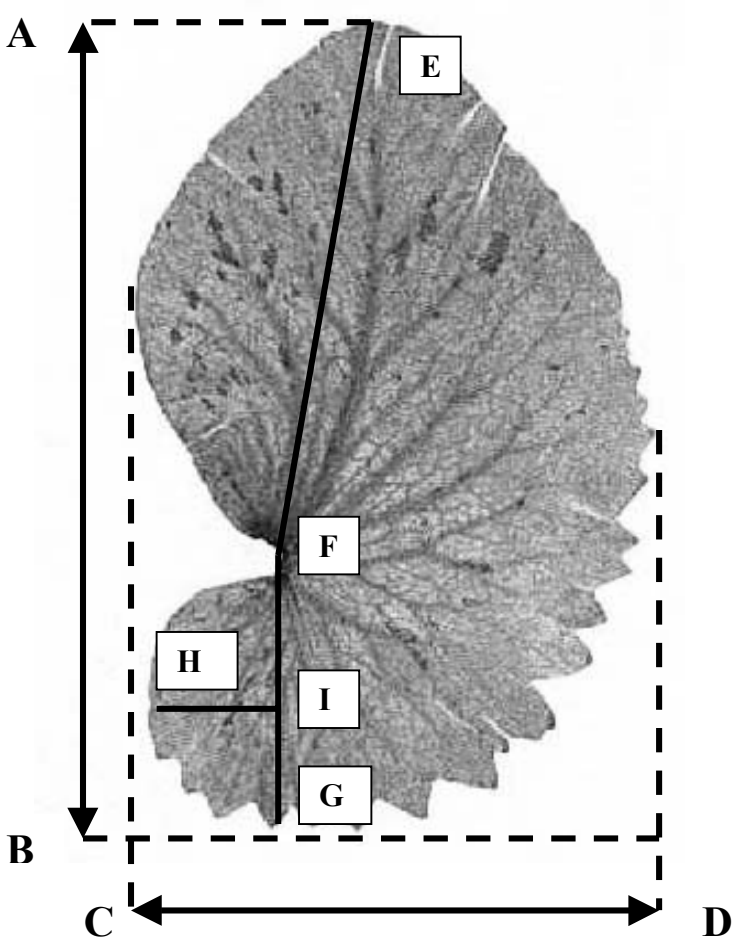
Ad. 18: Stipule: 'rabbit-eared' habit

'Rabbit-eared' stipules are parallel with pointed tips, rather than being divergent with rounded tips. The expression of 'rabbit-eared' stipule habit is part of a syndrome affecting flowers (flowers are reduced with raised standard base shape), foliage (leaflets and stipules are gracile, more pointed and reduced in area), and to a lesser extent stem habit.

If there is doubt about whether the stipules are 'rabbit-eared', then the occurrence of the syndrome in other parts of the plant will confirm its presence.

Ad. 19: Stipule: length
Ad. 20: Stipule: width
Ad. 22: Stipule: length from axil to tip
Ad. 23: Stipule: length from axil to base
Ad. 24: Stipule: length of lobe below axil

Observations should be made on stipules which have been detached from the plant and flattened.



Stipule: length (19)	A - B
Stipule: width (20)	C - D
Stipule: length from axil to tip (22)	E - F
Stipule: length from axil to base (23)	F - G
Stipule: length of lobe below axil (24)	H - I

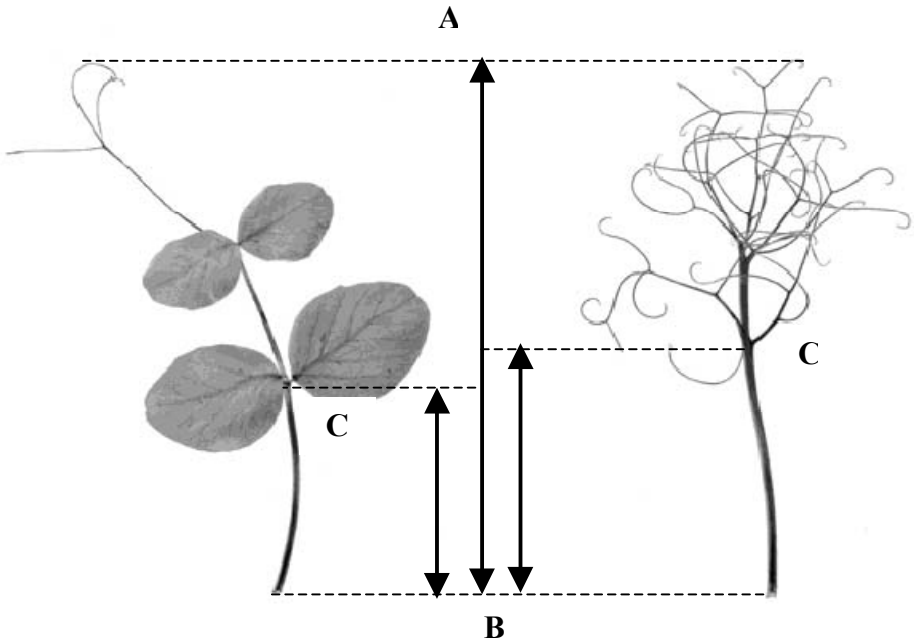
Ad. 25: Stipule: flecking
Ad. 26: Stipule: maximum density of flecking

The observations should be made over the whole plant. Care has to be taken to ensure that foliage at the lowest nodes has not senesced before assessment. The plant should have at least eight nodes, since flecking in some varieties may not be expressed at lower nodes. Assessment should be made on the main stem only.

Still to be provided

1	3	5	7	9
very sparse	sparse	medium	dense	very dense

Ad. 27: Petiole: length (from axil to the first leaflet or tendril)
Ad. 28: Varieties without leaflets only: Petiole: total length (from axil to last tendril)



Petiole length from axil to the first leaflet or tendril (27) B - C
Total length of petiole including tendrils (28) A - B

The length (B – C) should be recorded from the axil to the first leaflet or the first tendril.

Ad. 29: Time of flowering

TWA: The time of flowering is when 30% of plants have at least one flower open

The observations should not be made before 30% of the plants have at least one flower open.

Ad. 32: Varieties without anthocyanin only: Flower: color of standard

The color of standard should be recorded on flowers which are fully opened, and fresh.

Ad. 33: Flower: width of standard

The standard should be detached from the flower and flattened on a hard, flat surface.

Ad. 34: Flower: shape of base of standard

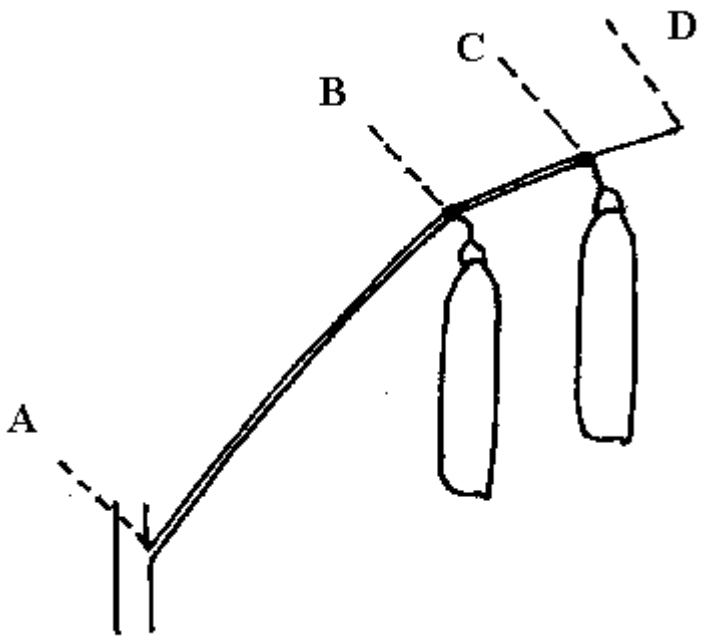
The standard should be detached and flattened on a hard, flat surface

1	3	5	7	9
strongly raised	moderately raised	level	moderately arched	strongly arched

Ad. 35. Flower: intensity of undulation of standard

The maximum expression on the plant should be recorded. Flowers recorded should be fully opened and not senescing.

Ad. 38: Peduncle: length from stem to first pod
Ad. 39: Peduncle: length between first and second pods
Ad. 40: Peduncle: length of spur



A – B = Peduncle: length from stem to first pod (38)

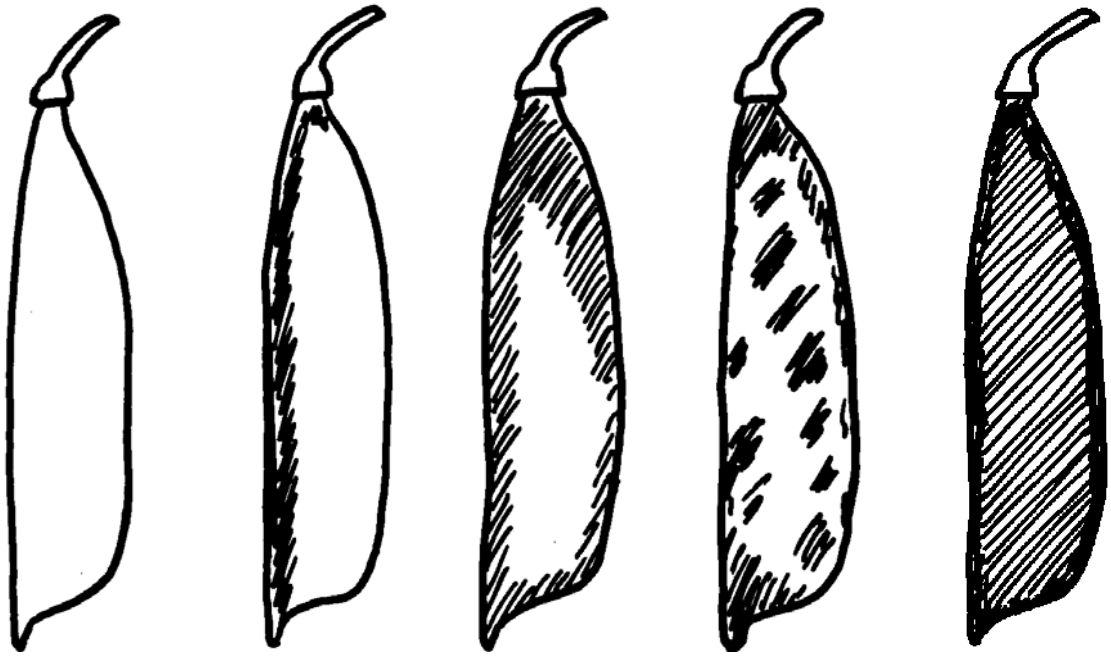
B – C = Peduncle: length between first and second pods (39)

C – D = Peduncle: length of spur (40)

Ad. 43: Pod: width

The observations should be made on well developed green pods; the width is assessed from suture to suture on unopened pods

Ad. 44: Pod: parchment



1	1	1	1	2
absent or partial	absent or partial	absent or partial	absent or partial	entire

TWA: To explain what 'Snap Peas' are. The term is not used elsewhere in the guidelines.

(l) The observations should be made on dry pods with the exception of 'Snap Peas'. *Snap Peas are Sugar Peas with* thickened pod walls and are best recorded when green, in order to minimize fungal infection which obscures assessment

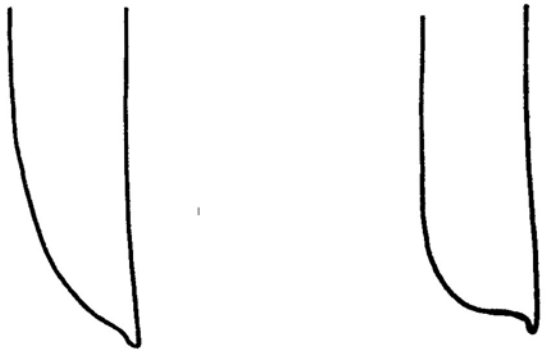
(2) The pod should be opened along the suture without damaging the edges of the two valves. The distribution of sclerenchyma, which makes up the parchment, may either be observed by staining with Phoroglucinol in Hydrochloric Acid, or by reflecting light (preferably daylight) on the inside of the pod wall

Ad. 45: Varieties with no or partial parchment only: Pod: thickened wall

The observations should be made on well developed pods not showing any signs of senescence. Unopened harvested pods should be cut in cross section to examine pod wall thickness.

Ad. 46. Pod: shape of distal part (varieties without thickened pod wall only)

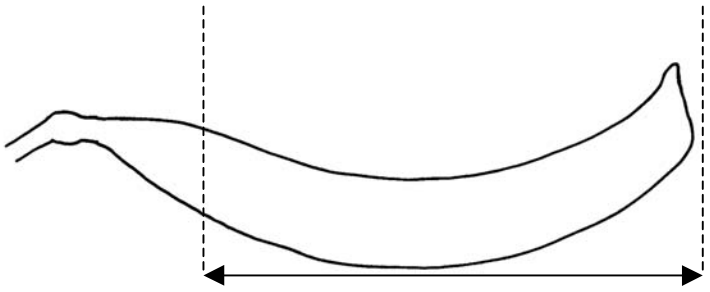
Observations should be made on several nodes of each plant when pods are fully developed, but before any senescence. Care should be taken when recording strongly curved pods, where the 'beak' is longer than the pod tip, or where parchment is not entire. Some varieties have a blunt tip which is rounded, with the 'beak' higher up the pod.



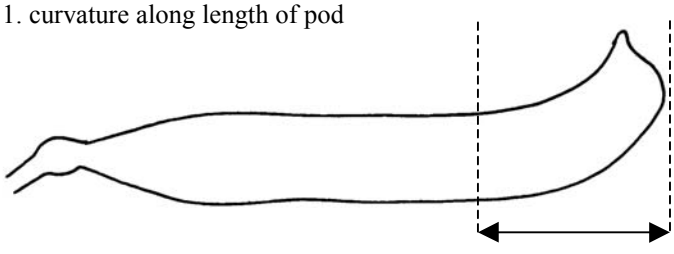
1
pointed

2
blunt

Ad. 47: Pod: type of concave curvature

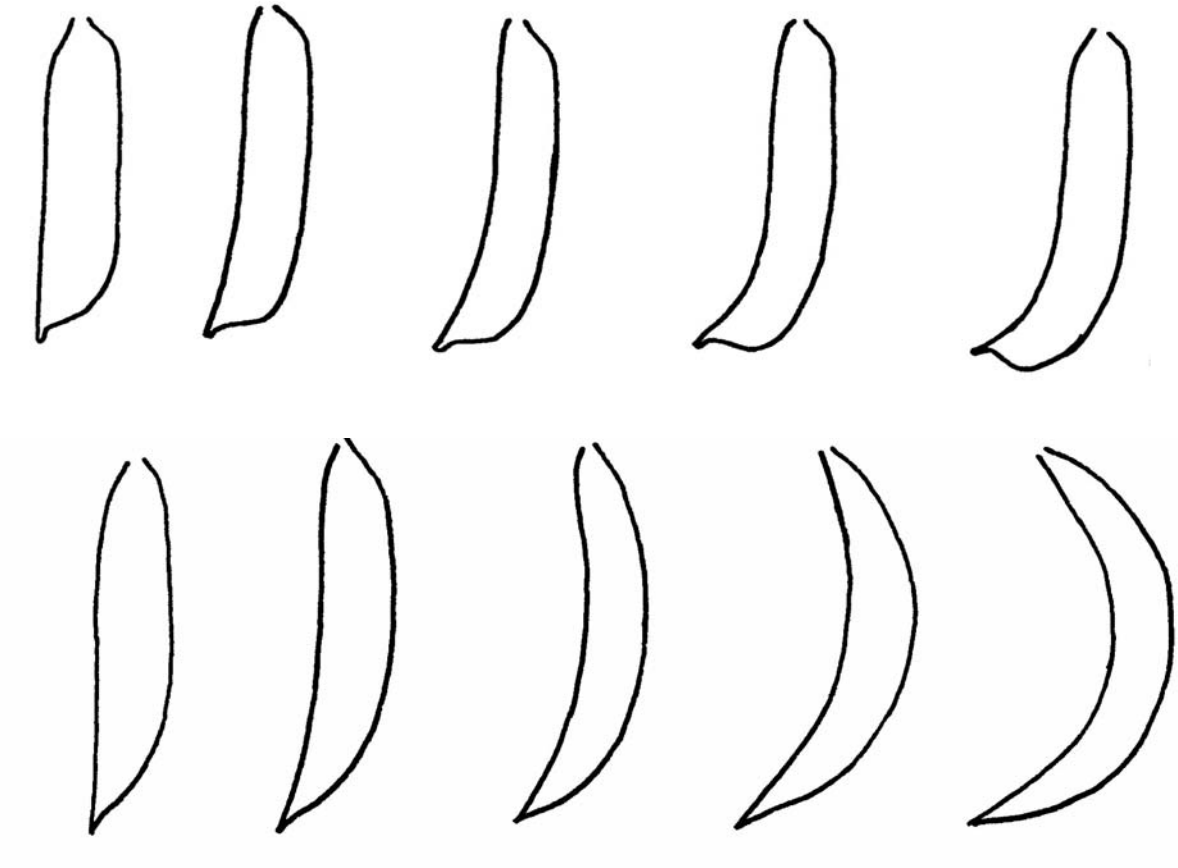


1. curvature along length of pod



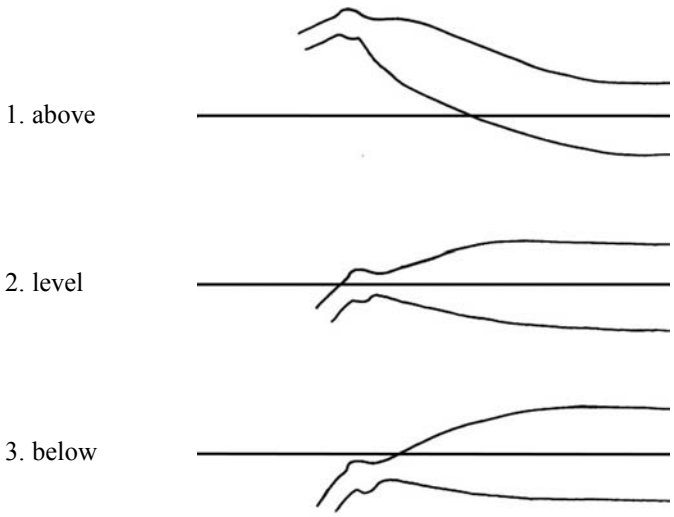
2. curvature towards the pod apex only

Ad. 48: Pod: degree of curvature

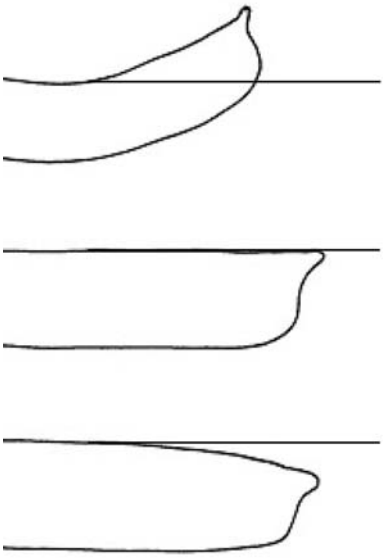


1	3	5	7	9
absent or very weak	weak	medium	strong	very strong

Ad. 49: Pod: position of ovary compared to the midpoint of the pod



Ad. 50: Pod: position of the apex compared to the midpoint of the seed-bearing suture



1. above

2. level

3. below

Ad. 53: Varieties with no or partial parchment only: Pod: suture strings

When temperatures exceed 20°C, the formation of suture strings is delayed, so observations should be made on fully developed pods.

Where suture strings are absent or partial and starch grains are compound, seed wrinkling in part of the population is much reduced; this expression is not considered to be a lack of uniformity; it may be affected by a penetrance factor and does not respond to selection.

Ad. 54: Varieties with anthocyanin only: Pod: anthocyanin coloration of suture
Ad. 55. Varieties with anthocyanin only: Pod: spots of anthocyanin coloration on outer wall

The observations should be made over the whole plant when pods are well developed and are beginning to dry out.

Assessment of dry seed characteristics

For best assessment, seed should be mature and preferably not severely bleached, and the recording should be carried out within nine months after harvest. For varieties with anthocyanin pigment, tannins in the testa often darken with age, (usually after nine months) obscuring many characteristics.

Assessment of some characteristics is difficult under artificial light, being easiest under conditions of bright natural daylight.

Character 58: Seed: shape

The shape can be influenced by environmental conditions, although it is generally consistent from year to year, provided the seed has reached its full development. The shape of seeds which grow next to the ovary or tip in the pod is influenced by the pod and should be excluded from assessment.

Seed of 'Marrowfat' types can identified by their rhomboid shape with cotyledon dimpling.

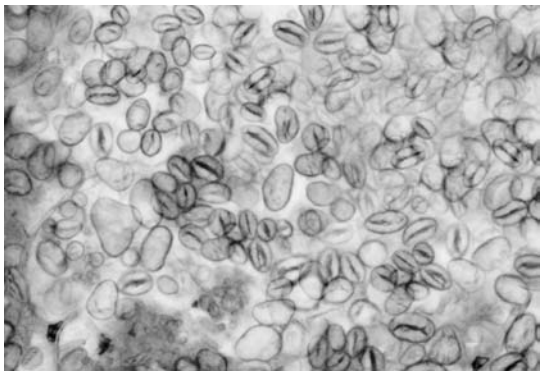
Ad. 59: Seed: type of starch grains

(l) Following the removal of the testa, fine fragments of tissue should be extracted from the cotyledon and placed on a microscope slide. A droplet of water is added to the extracted tissue and another microscope slide is placed on top. The tissue and water mixture is then squashed gently between the two slides. Too much pressure during squashing results in fragmentation of the grains, too little pressure will not provide a layer thin enough for examination.

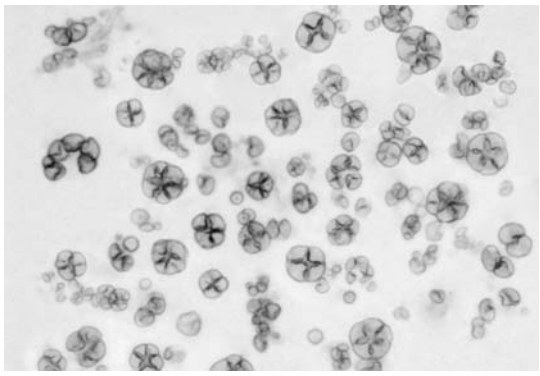
(2) A microscope with transmitted light, using X16 eye-pieces and either X10 or X40 objectives, is most suitable for examination. For examination of compound grains the larger objectives will be required.

(3) Simple grains resemble wheat seeds or coffee beans in shape, often with what looks like a suture line running along their length.

(4) Compound grains look irregularly star-shaped and appear to be made of a number of segments. The center of the grains may appear cross-shaped.



1
simple



2
compound

Ad. 60: Seed: wrinkling of cotyledon

'Golf ball' and large dimples are independent of wrinkling and should be ignored in the assessment of cotyledon wrinkling.

Ad. 62: Varieties with unwrinkled seed and simple starch grains only: Seed: dimpled cotyledons

Record on dry seed within 9 months of harvest. Seed should not be immature. Appears as irregular shallow dimpling of the cotyledon and is accompanied by a slight 'rippling' of the testa surface which should not be confused with wrinkling. The appearance of very fine dimpling, similar to that of a golf ball, should be ignored. This characteristic along with rhomboid seed shape typifies 'Marrowfat' varieties.

1
absent

2
present

Ad. 63: Seed: color of cotyledon

Following the removal of the testa, the seed is cut along the line of the cotyledon suture. Assessment of both external and internal surfaces are necessary. Dry immature seeds should be excluded from the assessment.

The expression varies with enviromental conditions:

- bleaching, caused by sunlight or chemical changes in the plant, can remove color from seeds making it difficult to determine cotyledon color; cutting the seed in half enables the assessment of the internal color which may be less affected.
- color becomes dull with age, even if seed is stored in cold, dark conditions.
- color can darken in the presence of high amounts of Tragacanth oil occurring on the underside of the testa. This fades as the seed ages.
- orange cotyledons can be difficult to determine without reference to an example variety.

Ad. 66. Seed: hilum color

The hilum color can be influenced by the presence of tannin in the testa. The hilum area should be lightly polished with a cloth before recording, to remove any loose tissue present.

Ad. 68: Seed: seed weight

Seed weight should be measured on at least two samples of 100 seeds. The observations should be made on harvest seed only. Immature and infected seeds should be excluded; the seed should be dry, (approximately 10-15% moisture content) at time of recording.

Ad. 69.1 – 69.4: Resistance to *Fusarium oxysporum* f. sp. *pisi* Races 1, 2, 5 and 6

Host Differential

A list of host differentials which may be used for testing these characteristics, addresses for obtaining recommended isolates, example varieties and host differentials, are provided in Annex I to these Test Guidelines.

Maintenance of isolates

Maintain in a refrigerator at 4°C as a soil culture (loam) and pass through a susceptible variety every 2-3 years. Isolate identity is determined by testing against a host differential set.

Preparation of inoculum

Cultures of the fungus are grown in liquid Czapek-Dox medium at 2°C in daylight conditions for 7 days. The liquid is continuously aerated by sterile air. The cultures are strained through muslin followed by centrifugation at 3,500 rpm for 10 minutes; the solution is diluted with distilled water to a concentration of 10^6 spores/ml

Inoculation and assessment of disease Test plants and controls are raised in 8 litres of 1:1 peat and sand mixture and adjusted to pH 5.0. 1 litre of spore suspension is used. Two replicates of 10 plants are grown for assessment; a third replicate is grown if any problems arise.

After 3 weeks, or 4 - 5 node stage, the basal third of the seedling roots can be cut and dipped into the inoculum for 3-5 seconds before being transplanted. Four weeks after inoculation, surviving seedlings are recorded as resistant.

Ad. 70: Resistance to *Erysiphe pisi* Syd.: Powdery Mildew

Host Differential

A list of host differentials which may be used for testing this characteristic, addresses for obtaining recommended isolates, example varieties and host differentials, are provided in Annex I to these Test Guidelines.

Maintenance of isolates

It is not necessary to maintain isolates; infection occurs from natural sources

Assessment of disease

Infected foliage surfaces are white and powdery. Tissue beneath the infected areas may turn purplish followed by the production of black fruiting structures. Badly infected tissue remains soft and fails to dry out naturally.

In resistant plants, infection is absent or localized in very small patches

Ad. 71: Resistance to Race C of *Ascochyta pisi* Lib. Ascochyta Leaf and Pod Spot

Host Differential

A list of host differentials which may be used for testing this characteristic, addresses for obtaining recommended isolates, example varieties and host differentials, are provided in Annex I to these Test Guidelines.

Maintenance of isolates

Maintain on Mathur medium at ambient temperature. Isolate identity is determined by testing against a host differential set.

Preparation of inoculum

Add 0.4% Tween 80 wetting agent to aid dispersal of spores. Remove hyphal fragments by straining solution through muslin. Concentration of 10^6 spores/ml

Inoculation and assessment of disease

Grow seedlings in glasshouse under natural daylength at 20°C and high humidity. Spray inoculum on young seedlings 10-15 days after emergence; mist spray 2 or 3 times per day for 15 minutes. Alternatively, inoculation can be made at the apex of enclosed leaves. This method does not require conditions of high humidity.

Plants are assessed about 5 days after inoculation. Infection is very clear when present: necrotic lesions are slightly sunken, brown and sharply delineated. Lesions are circular on pods and elongated on stems. Two replicates of 10 plants are grown; a third replicate is grown if any problems arise.

Ad. 72.1 and 72.2: Resistance to *Pseudomonas syringae* pv. *pisi* Races 2 and 4.

Host differential

A list of host differentials which may be used for testing these characteristics, addresses for obtaining recommended isolates, example varieties and host differentials, are provided in Annex I to these Test Guidelines.

Maintenance of isolates

Bacteria are stored either as lyophilized cultures in sealed vials at ambient temperature or as frozen suspensions at -80°C. Isolate identity is determined by serological reactions and by their pathogenicity to one or more host differential cultivars.

Preparation of the inoculum

Bacteria are grown on plates of King's Medium B for 24-48 hours at 25°C. Bacteria are scraped from the culture surface for inoculation

Inoculation and assessment of disease

10-14 day old seedlings, grown under glass at 20°C, are inoculated into young growing tissue of the stem at the axil with the stipule. The tip of a sterilized entomological mounting pin is scraped along the culture surface and stabbed into the plants at the two youngest nodes (2 inoculations / plant).

Plant reactions are recorded 5-10 days after inoculation as either resistant or susceptible. Susceptible response is expressed as water soaked tissue around the point of inoculation; resistant response is expressed as a localized necrotic reaction

Two replicates of 10 plants are inoculated for each race; a third replicate is grown if any problems arise.

Ad. 73: Resistance to Seed-borne Mosaic Virus Strain P1

Host differential

A list of host differentials which may be used for testing this characteristic, addresses for obtaining recommended isolates, example varieties and host differentials, are provided in Annex I to these Test Guidelines.

Maintenance of isolates

Symptomatic leaves or shoot tissue of infected seedlings are used to prepare inoculum, and are stored dry at -18°C.

Isolate identity is determined by reaction to antiserum in serological tests and by reaction with a set of host differential cultivars.

Preparation of inoculum

Infected dry plant tissue is ground in a phosphate buffer (pH 8.5, 0.005M).

Inoculation and assessment of disease

Inoculum is applied after a dark period (early morning), to Carborundum powder dusted leaves of 10-14 day old seedlings. Inoculated plants are maintained at 24°C and 14,000 Klux. Care is taken to avoid too much damage of the tissue to prevent necrosis. Two replicates of 10 plants are grown; a third replicate is grown if problems arise.

Susceptible plants are stunted and have rolling of the leaf margins, with or without leaf mosaic. The presence of infection in the plant is detected by ELISA test.

Ad. 74: Resistance to Bean Yellow Mosaic Virus

Host differential

A list of host differentials which may be used for testing this characteristic, addresses for obtaining recommended isolates, example varieties and host differentials, are provided in Annex I to these Test Guidelines.

Maintenance of isolates

Isolates are stored as infected dry tissue at +5°C or infected tissue at –18°C.

Preparation of inoculum

Infected dry tissue is ground in a phosphate buffer (pH 8.5, 0.005M).

Inoculation and assessment of disease

Plants are grown under glass at 20°C and supplementary lighting to provide a 14-16 hour daylength; (supplementary illumination 500 watts/m^2). At the 2-3 leaf stage the isolate is added to the plant following abrasion with Carborundum powder.

Assessment of disease

Ten days after the inoculation, whether or not symptoms exist. Two replicates of 10 plants are grown; a third replicate is grown if problems arise.

Ad. 75: Resistance to Pea Enation Mozaic Virus

Host differential

A list of host differentials which may be used for testing this characteristic, addresses for obtaining recommended isolates, example varieties and host differentials, are provided in an annex to this guideline.

Maintenance of Isolates

Symptomatic leaves or shoot tissue of infected seedlings are used to prepare inoculum; lyophilized infected tissue is stored at –20°C.

Preparation of inoculum

Grind desiccated infected tissue (1:50, w/vol) in phosphate buffer (pH 8.5 O.O5M), allow to re-hydrate for 5 minutes before grinding again. Crude extract is applied to carborundum-dusted young leaves.

Inoculation and assessment of disease

Apply inoculum to first fully-expanded true leaves, lightly dusted with 400-mesh carborundum. Maintain inoculated plants at 20 to 25°C and 11,000 Lux. (Use of plants after 2- to 3-1eaf stage produces unreliable results.)

Symptoms consisting of stunting, mosaic, and leaf-shape deformity typically develop 10 to 15 days after inoculation. Non-inoculated control plants are essential for establishing the effects of viral inoculation. For homozygous lines, 20 to 50 inoculated seedlings should accurately determine resistance or susceptibility of genotype.

KEY FOR THE GROWTH STAGES
CLE POUR LES STADES DE CROISSANCE
SCHLUESSEL FUER DIE ENTWICKLUNGSSTADIEN

Key Clé Schlüssel	General Description	Description générale	Allgemeine Beschreibung
0	Germination	Germination	Keimung
00	Dry seed	Graine sèche	Trockenkorn
10	Seedling growth	Croissance de la plantule	Wachstum des Keimlings
16	Young seedling with first scale leaf developed	Jeune plantule avec première feuille à écailles développée	Junger Keimling mit ersten entwickelten Schuppenblättern
18	Young seedling with second scale leaf developed	Jeune plantule avec deuxième feuille à écailles développée	Junger Keimling mit zweiten entwickelten Schuppenblättern
20	First pair of stipules at the third node fully opened	Première paire de stipules au niveau du troisième noeud complètement ouverte	Erstes Paar Nebenblätter am dritten Knoten voll geöffnet
22	Stipules at the fourth node fully opened	Stipules au niveau du quatrième noeud complètement ouverts	Nebenblätter am vierten Knoten voll geöffnet
25	Stipules at the fifth node fully opened	Stipules au niveau du cinquième noeud complètement ouverts	Nebenblätter am fünften Knoten voll geöffnet
28	Stipules at the sixth node fully opened	Stipules au niveau du sixième noeud complètement ouverts	Nebenblätter am sechsten Knoten voll geöffnet
30	Vegetative growth	Croissance végétative	Vegetatives Wachstum
31	Stipules at the seventh node fully opened	Stipules au niveau du septième noeud complètement ouverts	Nebenblätter am siebenten Knoten voll geöffnet
34	Stipules at the eighth node fully opened	Stipules au niveau du huitième noeud complètement ouverts	Nebenblätter am achten Knoten voll geöffnet
40	Stipules at the tenth node fully opened	Stipules au niveau du dixième noeud complètement ouverts	Nebenblätter am zehnten Knoten voll geöffnet
n	Stipules at the Nth node fully opened	Stipules au niveau du N-ième noeud complètement ouverts	Nebenblätter am N-ten Knoten voll geöffnet
200	Reproductive stage	Stade de reproduction	Generatives Stadium
200	Initiation of first flower	Apparition de la première fleur	Beginn der ersten Blüte
206	Development of first flower bud enclosed in stipules	Développement de la première fleur, mais à l'intérieur des stipules	Entwicklung der ersten in Nebenblätter eingeschlossenen Blütenknospe
208	Development and sometimes elongation of peduncle	Développement et parfois allongement du pédoncule	Entwicklung und manchmal Verlängerung des Blütenstandstiels

Key Clé Schlüssel	General Description	Description générale	Allgemeine Beschreibung
210	Emergence of first flower bud from stipules	Apparition du premier bourgeon à fleurs hors des stipules	Erscheinen der ersten Blütenknospe aus den Nebenblättern
212	Emergence of standards from the calyx	Apparition des étendards hors du calice	Erscheinen der Fahne aus dem Kelch
214	Opening of the standards and emergence of the wings	Ouverture des étendards et apparition des ailes	Oeffnen der Fahne und Erscheinen der Flügel
216	Slight opening of the wings to show the keel	Légère ouverture des ailes découvrant la carène	Leichtes Oeffnen der Flügel und Erscheinen des Kieles
218	Standards usually fully opened	Etendards généralement complètement ouverts	Fahnen normalerweise voll geöffnet
220	Standards beginning to crumple at the margins	Etendards commençant à se friper sur les bords	Fahnen beginnen am Rand zu kräuseln
222	Standards and wings showing signs of withering	Etendards et ailes présentant des signes de flétrissure	Fahnen und Flügel weisen Zeichen des Welkens auf
224	Emergence of the first flat pod	Apparition de la première gousse aplatie	Erscheinen der ersten flachen Hülse
226	Elongation of the flat pod with clearly visible ovules	Allongement de la gousse aplatie avec des ovules nettement visibles	Verlängerung der flachen Hülse mit deutlich sichtbaren Samenanlagen
230	Swelling of the ovules and slight swelling of the pod wall	Gonflement des ovules et léger renflement de la paroi de la gousse	Schwellen der Samenanlagen und leichtes Schwellen der Hülsenwand
235	Green seed rounded becoming slightly firm; pods almost fully swollen or developed	Graine verte arrondie devenant légèrement ferme; gousses presque entièrement formées ou développées	Grüner rundlicher Samen wird leicht fest; Hülse fast vollkommen geschwollen oder entwickelt
240	Green seed firm, becoming starchy; pods fully developed or swollen	Graine verte ferme, devenant amylacée; gousses pleinement développées ou gonflées	Grüner Samen fest; wird leicht stärkehaltig; Hülsen voll entwickelt oder geschwollen
245	Green seed becoming pale, testas tough; pod beginning to lose color	Graine verte devenant pâle, téguments épais; gousse commençant à se décolorer	Grüner Samen wird blass, Samenschale fest; Hülse beginnt Farbe zu verlieren
250	Stem and lower foliage becoming yellowish	Tige et feuillage inférieur devenant jaunâtre	Stengel und niedrige Blätter werden gelblich
255	Seed drying and becoming yellowish green; pod becoming wrinkled	Dessèchement de la graine devenant vert jaunâtre; gousse commençant à se rider	Samen trocknet und wird gelblichgrün; Hülse wird schrumpfig
260	Lower foliage becoming dry at margins	Feuillage inférieur devenant sec sur les bords	Untere Blätter werden am Rand trocken
265	Seed yellowish green; pods wrinkled, pale green	Graine vert jaunâtre; gousses ridées vert pâle	Samen gelblichgrün; Hülsen schrumpfig, blassgrün

Key Clé Schlüssel	General Description	Description générale	Allgemeine Beschreibung
270	Lower foliage becoming dry and papery	Feuillage inférieur devenant sec et semblable à du papier	Untere Blätter werden trocken und papierartig
275	Seed yellowish-white and rubbery; pods wrinkled and yellowish-green	Graine blanc jaunâtre et caoutchouteuse; gousse ridée et de couleur vert jaunâtre	Samen gelblichweiss und gummiartig; Hülsen schrumpfig und gelblichgrün
280	Stem drying out, becoming yellowish green	Dessèchement de la tige devenant vert jaunâtre	Stengel trocknet aus, wird gelblichgrün
285	Lowest pods yellowish-brown, dry and papery	Gousses inférieures de couleur brun jaunâtre, sèches et semblables à du papier	Unterste Hülsen gelblich-braun, trocken und papierartig
290	Stem becoming stiff and brittle and appearing yellowish-white	Tige devenant érigée et fragile, et de couleur blanc jaunâtre	Stengel wird steif und zerbrechlich und erscheint gelblichweiss
300	Lower and middle nodes with dry papery foliage; lower pods dry and papery	Feuillage sec et semblable à du papier sur tous les noeuds inférieurs et médians; gousses inférieures sèches et semblables à du papier	Untere und mittlere Knoten mit trockenen, papierartigen Blättern; untere Hülsen trocken und papierartig
305	All nodes with dry papery foliage; lower and middle pods dry and papery	Feuillage sec et semblable à du papier sur tous les noeuds; gousses inférieures et médianes sèches et semblables à du papier	Alle Knoten mit trockenen, papierartigen Blättern; untere und mittlere Hülsen trocken und papierartig
310	All nodes with dry papery foliage and pods; seed drying but not hard	Feuillage et gousses secs et semblables à du papier sur tous les noeuds; graine se desséchant, mais non dure	Alle Knoten mit trockenen, papierartigen Blättern und Hülsen; Samen trocknet, ist aber noch nicht hart
320	Hard dry seed	Graine dure et sèche	Harter trockener Samen

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Wellensiek, S.J., 1925*: "Genetic monograph on Pisum," Bibl. Genetica, 2, pp. 343-476

* General reference texts

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	*Pisum sativum* L.
1.2 Common Name	Peas

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

[#] 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 (1)	**Plant: anthocyanin coloration**		
	absent	Avola, Solara	1 [ ]
	present	Pidgin, Rosakrone	9 [ ]
5.2 (2)	**Plant: height (at flowering)**		
	very short	Columbia	1 [ ]
	short	Mini, Solara	3 [ ]
	medium	Lor Chancellor, Toskana	5 [ ]
	tall	Blauwschokker, Rhea	7 [ ]
	very tall	Livioletta	9 [ ]
5.3 (3)	**Stem: fasciation**		
	absent	Avola, Soalra	1 [ ]
	present	Bikini, Rosakrone	9 [ ]

TWA: delete 5.10 (now 5.4) no reliable information given by the applicant or not used for planning the trial

5.4 (5)	**Stem: number of nodes up to and including first fertile node**		
	very few	Kelvil	1 [ ]
	few	Miragreen, Waverking	3 [ ]
	medium	Markana, Susan	5 [ ]
	many	Cooper	7 [ ]
	very many	Regina	9 [ ]

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

	Characteristics	Example Varieties	Note
5.5 (8)	**Foliage: color**		
	yellow green	Pilot	1 [ ]
	green	Avola, Progreta	2 [ ]
	blue-green	Polar	3 [ ]
5.6 (10)	**Leaf: leaflets**		
	absent	Hawk, Solara	1 [ ]
	present	Avola, Rhea	9 [ ]
5.7 (18)	**Stipule: 'rabbit-eared' habit**		
	absent or very weak	Avola, Maro	1 [ ]
	moderately expressed		2 [ ]
	strongly expressed	Ibiza, Progreta	3 [ ]
5.8 (25)	**Stipule: flecking (on the whole plant)**		
	absent	Lisa, Tafila	1 [ ]
	present	Avola, Maro	9 [ ]

TWA: retain 5.18 (now 5.9) To keep Time of flowering. Very important for planning the growing trial; TWV agreed to delete from TQ

5.9 (29)	**Time of flowering**		
	very early	Tempo	1 [ ]
	early	Smart, Sparkle	3 [ ]
	medium	Carlton, Waverex	5 [ ]
	late	Cooper, Purser	7 [ ]
	very late	Livioletta	9 [ ]

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

	Characteristics	Example Varieties	Note
5.10 (30)	**<u>Non-fasciated varieties only</u>: Plant: maximum number of flowers per node**		
	one	Progress No. 9, Tyla	1 [ ]
	two	Banff, Cooper	2 [ ]
	three	Nettuno, Ultimo	3 [ ]
	four or more		4 [ ]
5.11 (31)	**<u>Varieties with anthocyanin only</u>: Flower: color of wing**		
	white with pink blush	Golf	1 [ ]
	pink	Rosakrone	2 [ ]
	reddish purple	Assas	3 [ ]
TWA: delete 5.21 (now 5.12) no reliable information given by the applicant or not used for planning the trial			
5.12 (34)	**Flower: shape of base of standard**		
	strongly raised		1 [ ]
	moderately raised	Picar, Progreta	3 [ ]
	medium	Markado, Solara	5 [ ]
	moderately arched	Avola, Copper	7 [ ]
	strongly arched	Boahtyr, Kennedy	9 [ ]
TWA: delete 5.22 (now 5.13) no reliable information given by the applicant or not used for planning the trial			
5.13 (42)	**Pod: length (at second fertile node)**		
	very short	Cepia, Vermio	1 [ ]
	short	Progreta, Solara	3 [ ]
	medium	Copper, Jof	5 [ ]
	long	Hurst Green Shaft, Protor	7 [ ]
	very long	Roi de Carouby	9 [ ]

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

	Characteristics	Example Varieties	Note
TWA: delete 5.23 (now 5.14) no reliable information given by the applicant or not used for planning the trial			
5.14 (43)	**Pod: width (at second fertile node)**		
	very narrow	Disco	1 [ ]
	narrow	Picar, Ultimo	3 [ ]
	medium	Progreta, Solara	5 [ ]
	broad	Final, Kahuna	7 [ ]
	very broad	Kennedy	9 [ ]
5.15 (44)	**Pod: parchment**		
	absent or partial	Sugar Ann	1 [ ]
	entire	Avola, Solara	2 [ ]
5.16 (45)	**<u>Varieties with no or partial parchment only</u>: Pod: thickened wall**		
	absent	Nofila, Reuzensuiker	1 [ ]
	present	Cygnet, Suggar Ann	9 [ ]
5.17 (46)	**<u>Varieties without thickened pod wall only</u>: Pod: shape of distal part**		
	pointed	Jof, Oskar	1 [ ]
	blunt	Avola, Solara	2 [ ]
5.18 (51)	**Pod: color**		
	yellow	Orlex	1 [ ]
	green	Avola	2 [ ]
	blue-green	Miracle, Miragreen	3 [ ]
	purple	Blauschokker	4 [ ]

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

	Characteristics	Example Varieties	Note
5.19 (53)	**<u>Varieties with no or partial pod parchment</u>: Pod: suture strings**		
	absent or rudimentary	Nofila, Sugar Lace	1 [ ]
	present	Reuzensuiker, Crispi	2 [ ]
5.20 (56)	**Pod: number of ovules**		
	few	Pegas, De Grace	3 [ ]
	medium	Hawk, Backgammon	5 [ ]
	many	Karisma	7 [ ]
5.21 (57)	**Immature seed: intensity of green color**		
	light	Ultimo, Solara	3 [ ]
	medium		5 [ ]
	dark	Dark Skin Perfection, Hawaii	7 [ ]
5.23 (59)	**Seed: type of starch grains**		
	simple	Adagio, Maro, Soalra	1 [ ]
	compound	Avola, Polar	2 [ ]

TWA: delete 5.6 (no reliable information given by the applicant or not used for planning the trial)

5.24 (62)	**<u>Varieties with unwrinkled seed and simple starch grains only</u>: Seed: dimpled cotyledons**		
	absent	Columbia, Solara	1 [ ]
	present	Maro, Progreta	9 [ ]
5.25 (63)	**Seed: color of cotyledon**		
	green	Avola, Solara	1 [ ]
	yellow	Caractacus, Hardy	2 [ ]
	orange	Oliver	3 [ ]

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

	Characteristics	Example Varieties	Note
5.26 (64)	**<u>Varieties with anthocyanin only</u>: Seed: marbling of testa**		
	absent	Rif, Rhea	1 [ ]
	present	Assas, Birdie	2 [ ]
5.27 (65)	**<u>Varieties with anthocyanin only</u>: Seed: violet or pink spots on testa**		
	absent	Rif, Birdie	1 [ ]
	faint	Assas, Susan	2 [ ]
	intense	Arvika, Rhea	3 [ ]
5.28 (66)	**Seed: hilum color**		
	not black	Avola, Birdie	1 [ ]
	black	Nofila, Rif	2 [ ]
5.22 (68)	**Seed: weight**		
	very low	Ultimo	1 [ ]
	low	Hawk, Iceberg	3 [ ]
	medium	Mammoth Melting Sugar, Toskana	5 [ ]
	high	Kennedy, Maro	7 [ ]
	very high	Bamby, Cratos	9 [ ]

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

6. Similar varieties and differences from these varieties

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

Denomination(s) of variety(ies) similar to your candidate variety	Characteristic(s) in which your candidate variety differs from the similar variety(ies)	Describe the expression of the characteristic(s) for the **similar** variety(ies)	Describe the expression of the characteristic(s) for **your** candidate variety
GN 33 *Example*	*[e.g. Flower color]*	*[e.g. orange]*	*[e.g. orange red]*

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

TWA: To check if 7.3 is useful for DUS purposes to differentiate so many types of use.

Use

fresh market	[ ]
canning	[ ]
freezing	[ ]
dry seed for human consumption	[ ]
dry protein	[ ]
forage	[ ]
other (please specify)	[ ]

……..

TWA: to add lines for each disease Resistant [ ], Susceptible [ ], Not tested [ ]

Resistance to disease

Fusarium Wilt (Race 1) (Common Wilt)	[ ]
Fusarium Wilt (Race 2) (Near Wilt)	[ ]
Fusarium Wilt (Race 5)	[ ]
Fusarium Wilt (Race 6)	[ ]
Powdery mildew	[ ]
Ascochyta (leaf and pod spot) Race C	[ ]
Pea Bacterial Wilt (Pseudomonas)	[ ]
(specify races/pathovars) ……	
Pea Seed-borne Mosaic Virus (P1 strain)	[ ]
Bean Yellow Mosaic Virus (BYMV)	[ ]
Pea Enation Mosaic Virus (PEMV)	[ ]

Resistance to other diseases
(please give details below) [ ]

……

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

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.

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 of where you have indicated "yes".

……

9.3 Has the plant material to be examined been tested for the presence of virus or other pathogens?

Yes [ ]

(please provide details as specified by the Authority)

No [ ]

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

Applicant's name

Signature Date

[Annex I follows]

ANNEX I TO THE UPOV TEST GUIDELINES FOR PEA (*PISUM SATIVUM* L.)

The information provided in this annex relates to the characters listed in the Table of Characteristics, and is additional to that given under Explanations on the Table of Characteristics. Much of this information indicates what is known of the genetics and lists key genetic references, for those who wish to investigate characteristics further or understand the inheritance of the genes involved.

The literature reference numbers refer to bibliography in this Annex

Availability of example varieties and lines

Where example varieties are no longer in commerce, or where genetic lines are used to provide examples, small quantities of seed are available from:

Scottish Agricultural Science Agency,
Herbage & Vegetable Crops
1 Roddinglaw Road,
Edinburgh
EH12 9FJ
U.K

For seed of Host Differential Lines for disease tests, see comments following characteristic 70.

Additional comments for characteristics in the guideline

Characteristic 1: Plant: anthocyanin coloration

The expression of anthocyanin is controlled by the gene a and modified by several genes; the most common modifier genes in cultivated material are am and b. There are a number of genes whose expression is dependent on the dominant allele of the gene a. Their expression is hidden in the presence of the recessive allele. Literature reference: 58, 76.

Characteristic 3: Stem: fasciation

Fasciation is controlled by two complimentary genes fa and fas. Literature reference: 30, 58, 76.

Characteristic 4: Stem: length.

A complex interaction between internode and flowering genes influence stem length, habit, branching and flowering. Literature reference: 58, 61.

Characteristic 5: Stem: number of nodes up to and including the first fertile node

The expression is controlled by the gene lf, which has four alleles which could be used for classification of cultivars;

Genotype	Phenotype
lf > a	very early (very low flowering nodes 5-7)
lf	early (low flowering nodes 8-12)
Lf	late (high flowering nodes 13-16/18)
Lf > d	very late (very high flowering nodes 16/18 and above)

However, accurate classification depends on night temperatures being above 17°C; if temperature falls below this critical threshold, the node of flowering will be lowered, resulting in misclassification. The effect is greatest with very late and late flowering types, and is smallest in early flowering types. Very early flowering types do not appear to be affected.

Where flower abortion occurs, the node of flower initiation will provide a more consistent measure of flowering node. Literature reference: 14, 59, 65, 76.

Characteristic 6: Stem: anthocyanin coloration of axil

The expression is controlled by the gene d which is dependent on the gene a. The color is usually reddish-purple, but can be pink when modified by the am or b genes. Literature reference: 69, 76.

Characteristic 7: Only varieties with anthocyanin coloration of axil: Stem: type of anthocyanin coloration of axil

The expression is controlled by the gene d which has five alleles:

Genotype	Phenotype
D>w	double axil ring
D>co	single axil ring
D>ma	incomplete ring - two spots in axil
D>tet	incomplete ring - four spots in axil
D	absence of pigment in axil

Only the first two phenotypes are included in the table of characteristics, being the most common in commercial material. The latter three phenotypes have occurred as variants in commercial varieties. All the phenotypes are dependent on the presence of anthocyanin gene a. Literature reference: 17, 26, 57, 67, 69, 76.

Characteristic 8: Foliage: color

The expression of foliage color is discontinuous and is controlled by 4 genes:

Genotype	Phenotype	Literature reference numbers
o	yellow-green foliage	76
pa Vim	green foliage	33, 78
Pa vim	green foliage	33, 78
cov	blue-green foliage	35

In some genetic backgrounds yellow-green foliage color is difficult to separate from the palest green foliage color without the use of example varieties. Literature reference: 33, 78

.

Another gene py causes the plant to turn yellowish rapidly with the approach of maturity, and senescing earlier than normal. py is independent of the other foliage color genes. Literature reference: 54.

Characteristic 10: Leaf: leaflets

The absence of leaflets is controlled by the gene af. There are at least three different sources of the af gene which have arisen by mutation. Literature reference: 07, 19, 22.

Characteristic 11: Leaf: waxiness of upper surface of leaflet

The expression is controlled by the gene wlo. There are several genes controlling the distribution and density of wax on the whole plant or on parts of the plant. Literature reference: 62.

Characteristic 17: Leaflet: dentation

The expression is controlled by the gene td. Plants which are recessive have no dentation, or have one, two or occasionally three teeth (or coarser notches) on the leaflet margin. Where dentation is very marked, it is likely that another gene int has intensified the expression of td.

In all cases assessment should be made on the main stem because expression of dentation on branches (both aerial and basal) can be the opposite of that on the main stem. One theory to explain this is that expression is affected by a switching mechanism, being positive for expression on the main stem and negative for branches.

Assessment should exclude the expression of dentation below node six as it differs from the expression at higher nodes.

Leaf serration and incision are unrelated and independently controlled by the genes Ser and Inci respectively. Literature reference: 44, 64, 73.

Characteristic 18: Stipule: 'rabbit-eared' habit

The expression of 'rabbit-eared' stipules is part of a syndrome affecting flowers (flowers reduced with raised standard base shape), foliage (leaflets and stipules more pointed and reduced in area), and to a lesser extent stem habit. The syndrome is not inherited in the usual Mendelian way and control of its expression is unknown.

Varieties selected for the syndrome have been known to revert to their original form. If there is doubt about whether the stipules are 'rabbit-eared', then the occurrence of the syndrome in other parts of the plant will confirm presence. Literature reference: 05.

Although plants with 'Rabbit-eared' stipules are reduced in size, they should not be confused with rudimentary stipules, which are lanceolate and have significantly reduced surface area (up to 80%). The expression of rudimentary stipules is controlled by the gene st. There is reported to be linkage between st and susceptibility to Downy Mildew. Literature reference: 63, 73.

Characteristic 25: Stipule: flecking

Characteristic 26: Stipule: maximum density of flecking (on the whole plant)

Flecking is a discontinuous pattern on the foliage caused by the raising of the surface cells from the underlying tissue and is best expressed on the stipules. Flecking is controlled by the gene fl which has four alleles:

Genotype	Phenotype
fl	Flecking absent or occasionally one or two flecks
Fl	Flecking sparse
Fl>v	Flecking intermediate
Fl>w	Flecking very dense, almost entirely covering the leaf surface

The guideline treats flecking in two ways; characteristic 25 differentiates between absent (represented by the allele fl) and present (represented by the alleles Fl and Fl>v). Characteristic 26 differentiates the degree of flecking within the alleles Fl and Fl>v.

The allele Fl>w is rarely observed in commercial material but occasionally occurs as a variant. Plants which are recessive either have no flecking, or have one or two flecks present.

Spontaneous Mutation
There is evidence to support mutation from flecked to non-flecked types, and also back mutation from non-flecked to flecked, but these occurrences are rare and can not be identified without assessment over at least three generations. Literature reference: 06, 50, 67.

Characteristic 29: Time of flowering

The expression is controlled by the interaction of several genes for flowering and internode length. For further information see notes for characteristic 5. Literature reference: 14, 60, 61.

Characteristic 30: Non-fasciated varieties only: Plant: maximum number of flowers per node

The observations should be made on non-fasciated varieties. The observations should be made when highest nodes produce flower buds which do not open. Flower number is mainly controlled by two genes fn and fna and results in three phenotypes:

Genotype	Phenotype
Fn Fna	Single flowered
Fn fna	Double flowered
fn Fna	Double flowered
fn fna	Triple, or more than triple, flowered

Literature reference: 28, 65, 76

Characteristic 31: Varieties with anthocyanin only: Flower: color of wing

There are several genes which influence flower color, but many are difficult to determine due to complex genetic and environmental interaction. Reddish-purple wing color is controlled by the gene a, the basic gene for anthocyanin expression. This color may be modified by other genes such as the am and b genes which produce flowers with pink wings or white wings with a very pale pink blush respectively: Literature reference: am 10; b 70, 76; a 58, 76.

Genotype	Phenotype
am	white wings with a pale pink blush
b	pink wings

Pigment in other parts of the plant (seed, axils, pods etc) can also be modified by these genes.

Characteristic 44: Pod: parchment.

The expression of parchment is controlled by two genes p and v and has four phenotypes:

Genotype	Phenotype
P V	Parchment occurring as a strong thick entire layer
p V	Parchment reduced to a strip along upper and/or lower sutures
P v	Parchment reduced to either patches, or a very thin entire layer
p v	Parchment absent

Literature reference: 58, 76.

Spontaneous mutation in pod parchment genes

The following rates are known to occur:

p to P	0.05 - 0.2%
v to V	0.3 - 3.0%

The effect of these spontaneous mutations will be to increase the levels of parchmented plants in parchment-free or partially parchmented types. Since both genes can mutate at the same time, this increase can occur within a few generations.

Characteristic 45: Varieties with no or partial parchment only: Pod: thickened wall

The expression is controlled by the gene n. Although the guideline characteristic concerns varieties with absent or partial parchment, thickened pod walls can occur in fully parchmented types. Literature reference: 74

Characteristic 46: Varieties without thickened pod wall only: Pod: shape of distal part

The expression is controlled by the gene bt. Literature reference: 01, 29, 76.

Characteristic 47: Pod: type of concave curvature
Characteristic 48: Pod: degree of curvature
Characteristic 49: Pod: position of ovary compared to the midpoint of the pod
Characteristic 50: Pod: position of the apex compared to the midpoint of the seed-bearing suture

The expression of pod curvature is controlled by three genes co, con and cp which result in a number of different phenotypic classes, which, with care, can be differentiated. The position of the ovary and the pod apex is related to the pod curvature genotype. Literature reference: 23, 32, 74, 77.

Characteristic 51: Pod: color

This is a discontinuous multi-state characteristic - the expression for each state being under independent genetic control.

The expression of yellow pods is controlled by the gene gp. Peduncles, sepals and upper stems can also appear a milky yellowish color. In the presence of anthocyanin coloration, the pods appear pale red. Literature reference: 58, 76.

The expression of green pods occurs when the genes for yellow, blue-green or purple pods are not being expressed.

The expression of blue-green pods is controlled by the gene dp. Pods are dark and slightly bluish, but not as blue as blue-green foliage (characteristic 8). The color develops with time, and may be more accentuated in hotter, drier conditions. Literature reference: 55.

Two genes, Pu and Pur, control the expression of purple pods. Occasionally expression can be unstable, appearing and disappearing on the same plant, but this is not a uniformity

problem. The gene Pur has four alleles which affect the presence and distribution of coloration:

Genotype	Phenotype
Pur	pods entirely purple
pur>a	major part of pods purple
pur>b	minor part of pods purple
pur	pods lacking anthocyanin

Literature reference numbers: 24, 32, 58.

Characteristic 52: Pod: intensity of green color
Characteristic 57: Immature seed: intensity of green color

The expression of these two characteristics is controlled by the genes pa and vim. It should be possible to classify all material into two categories pale and dark green, although it is possible to differentiate degrees of intensity within these groups; however, small changes in the stage of development can affect this intensity. Literature reference: 33, 78.

In varieties with blue-green pods (gene dp), immature seed color can be intensified/darker. Literature reference: 55.

Immature seed color in some varieties with green cotyledons may appear creamy white before the seed is fully developed; this may be the result of the recessive allele of the gene gla which causes the disappearance of chlorophyll from the testa. Literature reference: 39.

Characteristic 53: Varieties with no or partial parchment only: Pod: suture strings

Expression is controlled by the gene sin. Literature reference number: 24.

Characteristic 54: Varieties with anthocyanin only: Pod: anthocyanin coloration of suture

The observations should be made over the whole plant when pods are well developed and are beginning to dry out. The expression is controlled by two genes sru and srub. Literature reference: 46.

Characteristic 55: Varieties with anthocyanin only: Pod: spots of anthocyanin coloration on outer wall

They should be made over the whole plant when pods are well developed and are beginning to dry out. If present, several fine spots of anthocyanin appear on the pod wall - often in an area around, or on top of, the underlying seeds. The expression is controlled by two genes rup and rups. Literature reference: 46.

Character 58: Seed: shape

The expression of individual seed genes are difficult to separate due to the interaction of :
i) genes influencing shape of whole seed, radicle or hilum, and

ii) genes influencing the testa: 16(z), 21(rb), 29(z), 31(ar), 40(fov), 42(sul), 45(mifo), 47(Him),
49(foe), 58(r), 66(ar), 68(l), 71(l), 75(di), 76(r).
iii) genes indirectly affecting seed shape through influence on the pod: 42(com, pla, qua).

Characteristic 59: Seed: type of starch grains
Characteristic 60: Seed: wrinkling of cotyledon

The expression of both starch grains and cotyledon wrinkling are controlled by the genes R and Rb and are related in the following way:

Genotype	Phenotype
r rb	wrinkled cotyledons, compound starch grains
r Rb	smooth cotyledons, simple starch grains
R rb	wrinkled cotyledons, simple starch grains

Seeds which have wrinkled cotyledons and simple starch grains (R rb) have smaller, finer wrinkling. Very strongly wrinkled seed (r rb) is associated with higher sugar content.
Literature reference: 21, 58, 76.

Characteristic 62: Varieties with unwrinkled seed and simple starch grains only: Seed: dimpled cotyledons

Seed dimpling is controlled by the gene di. Literature reference: 75.

Characteristic 63: Seed: color of cotyledon

The expression of cotyledon color is controlled by two genes:

Genotype	Phenotype
I	yellow cotyledons
i	green cotyledons
orc	orange cotyledons

Literature reference: 58, 76, 103.

Characteristic 64: Varieties with anthocyanin only: Seed: marbling of testa

The expression of testa marbling is controlled by the gene M The marbling is most easily observed on seeds which have tannin in the testa; however, marbling can also occur in the absence of tannin, giving the seed a dirty grey appearance, which is known as ghost marbling.
Literature reference: 52, 76.

Characteristic 65: Varieties with anthocyanin only: Seed: violet or pink spots on testa

The expression of spotting is controlled by the complimentary genes F and Fs. There is no intermediate expression between faint spotting and intense spotting, the latter being caused by an allele of the Fs gene: Fs >ex. The expression occurs as clearly defined faint or intense spots which are usually violet due to the presence of anthocyanin. However, spot color can be pink due to modification by other genes. Literature reference: 25, 51, 76, 78.

Characteristic 66: Seed: hilum color

The expression is controlled by the gene Pl. Literature reference: 53, 76.

Spontaneous mutation: from melanin absent to melanin present has been reported in the literature, but has rarely been observed. The precise mutation rate is unknown. Spontaneous mutation has not been reported in white flowered types. Literature reference: 18.

Characteristic 67: Varieties with anthocyanin only: Seed: color of testa

The testa color can be modified in the same way as flower color: seeds with brown testas is a result of gene a without any modification, although varying intensity of tannin color with age is caused by the gene z. It is likely, therefore, that the greenish-brown testa color is caused by the lack of intensification of tannins in the testa. Seeds with pale reddish-brown or pinkish-brown testas have been modified by the am or the b gene.

CHARACTERISTICS USED FOR TESTING DISEASE RESISTANCE

It is recommended that disease resistance tests for the following characteristics make use of a standard set of host differentials which are available from the John Innes Centre, with a back-up set in Edinburgh:

John Innes Centre
Pea Gene Bank
Colney Lane
Norwich
NR4 7UH
U.K.

Scottish Agricultural Science Agency,
Herbage & Vegetable Crops,
1 Roddinglaw Road,
Edinburgh
EH 12 9FJ
U.K.

Host Differentials for Characteristics Listed in the UPOV Test Guidelines

Host Differential Line	**Charact-eristic**	**Disease**	**Race**	**Res/Susc**
JI 1360 ex 'Dark Skinned Perfection'	69	*Fusarium oxysporum* f. sp. *pisi*	1	Resistant
JI 1365 ex 'Little Marvel'	69	*Fusarium oxysporum* f. sp. *pisi*	1	Susceptible
JI 1364 ex WSU 23	69	*Fusarium oxysporum* f. sp. *pisi*	2	Resistant
JI 1363 ex WSU 28	69	*Fusarium oxysporum* f. sp. *pisi*	2	Susceptible
JI 1364 ex WSU 23	69	*Fusarium oxysporum* f. sp. *pisi*	5	Resistant
JI 1365 ex 'Little Marvel'	69	*Fusarium oxysporum* f. sp *pisi*	5	Susceptible
JI 1363 ex WSU 28	69	*Fusarium oxysporum* f. sp. *pisi*	6	Resistant
JI 1365 ex 'Little Marvel'	69	*Fusarium oxysporum* f. sp. *pisi*	6	Susceptible
JI 502 ex 'Rondo	70	*Erisyphe pisi* Syd.	-	Susceptible
JI 1599 ex WBH 1677 ('Mexique-4')	70	*Erisyphe pisi* Syd. -	-	Resistant
JI 502 ex 'Rondo'	71	*Ascochyta pisi* Lib	C	Resistant
JI 394 ex 'Kelvedon Wonder'	71	*Ascochyta pisi* Lib	C	Susceptible
JI 2430 ex 'Kelvedon Wonder'	72	*Pseudomonas syringae* pv. *pisi*	2	Susceptible
JI 2439 ex 'Fortune'	72	*Pseudomonas syringae* pv. *pisi*	2	Resistant
JI 2431 ex 'Early Onward'	72	*Pseudomonas syringae* pv. *pisi*	4	Susceptible
JI 2438 ex 'Partridge'	72	*Pseudomonas syringae* pv. *pisi*	4	Resistant
JI 363 ex 'Lincoln'	73	Seed-borne Mosaic Virus Strain	P1	Susceptible
JI 968 ex WL 1799 / PI 193835	73		P1	Resistant
JI 502 ex 'Rondo'	74	Bean Yellow Mosaic Virus	-	Susceptible
JI 394 ex 'Kelvedon Wonder'	74	Bean Yellow Mosaic Virus	-	Resistant
ex 'Dark Skinned Perfection'	75	Pea Enation Mosaic Virus	-	Susceptible
ex 'Perfected Freezer 60'	75	Pea Enation Mosaic Virus	-	Resistant

It should be emphasized that host differentials are pure lines and are more reliable than commercial varieties of the same name, since the latter may not have sufficiently uniform resistance or susceptibility to carry out accurate tests.

It is also recommended that isolates are obtained from the sources listed under each characteristic, so that the risk of differences arising due to multiple maintenance, are reduced.

Characteristics 69.1 - 69.4. Resistance to *Fusarium oxysporum* f. sp. p*isi*: Fusarium wilt Races 1, 2, 5 and 6.

Host differentials used for test:

Race 1: Line JI 1360 ex 'Dark Skinned Perfection' (resistant)
Line JI 1365 ex 'Little Marvel' (susceptible)

Race 2: Line JI 1364 ex WSU 23 (resistant)
Line JI 1363 ex WSU 28 (susceptible)

Race 5: Line JI 1364 ex WSU 23 (resistant)
Line JI 1365 ex 'Little Marvel' (susceptible)

Race 6: Line JI 1363 ex WSU 28 (resistant)
Line JI 1365 ex 'Little Marvel' (susceptible)

Isolates and isolate identity
Isolate identity is determined by testing against the host differential set described by Haglund and Kraft (1979). All isolates are derived from single spore cultures.

Isolates used in the test: Race 1: IPO culture collection no. 20379
Race 2: WSU culture type 2
Race 5: IPO culture collection no. 10279
Race 6: WSU culture type 6

Maintenance of isolates for:

Races 1 and 5:

Research Institute for Plant Protection (IPO)
PO Box 9060
NL-6700 GW Wageningen
The Netherlands

Races 2 and 6:

Washington State University,
Research and Extension Unit,
Mount Vernon, Washington 98273,
United States of America

Genetic background
The expression of resistance to race 1 is controlled by the gene Fw and to race 2 by the gene Fnw; races 5 and 6 are controlled by single dominant genes but no symbols have been allocated.

Composition of the Czapek-Dox liquid medium

2.0 g Sodium Nitrate
0.5 g Potassium Chloride
1.0 g Dipotassium Phosphate
0.5 g Magnesium Sulphate
0.01 g Ferrous Sulphate
30.0 g Saccharose

The above mixture is added to 1 litre of distilled water and poured into a flask; the solution is sterilized in an autoclave at 115°C for 20 minutes.

Literature reference:

Race 1: 11, 72, 80, 98; Race 2: 11, 80, 97, 98, 99; Race 5: 11, 81, 98; Race 6: 11, 82, 98

Characteristic 70: Resistance to *Erysiphe pisi* Syd.: Powdery Mildew

Host differentials used for test
Line JI 502 ex 'Rondo' (susceptible)
Line JI 1559 ex WBH 1677 = 'Mexique-4' (resistant)

Isolates and isolate identity
No isolates are maintained as infection is natural

Genetic background and symptoms of infection
Two recessive genes confer resistance: er1 and er2

'Rondo' is susceptible (Er1 Er2)
'Mexique-4' is resistant (er1 er2)

Literature reference: 11, 12, 56, 86, 102.

Characteristic 71: Resistance to Race C of *Ascochyta pisi* Lib.: Ascochyta Leaf and Pod Spot

Host differentials used for test:
Line JI 502 ex 'Rondo' (resistant)
Line JI 394 ex 'Kelvedon' Wonder (susceptible)

Isolates and isolate identity
Isolate used in the test: Tezier Strain
Isolate identity is determined by testing against a host differential set.

Isolates are maintained at:
GEVES SNES
Station Nationale d'Essais de Semences
Rue George Morel, B.P.24
49071 Beaucouzé Cedex France

Genetic background:

The expression of resistance to Race C (also known as BP2) is controlled by a single dominant gene Rap2. Five pathotypes and four resistance genes are known.
Literature reference: 11, 83, 100, 101.

Characteristics 72.1, 72.2 Resistance to *Pseudomonas syringae* pv. *pisi*: Bacterial blight Races 2 and 4.

Host differentials used for test

Race 2: Line JI 2430 ex 'Kelvedon Wonder' (susceptible)
Line JI 2438 ex 'Partridge' (susceptible)
Line JI 2431 ex 'Early Onward' (resistant)
Line JI 2439 ex 'Fortune' (resistant)

Race 4: Line JI 2430 ex 'Kelvedon Wonder' (susceptible)
Line JI 2431 ex 'Early Onward' (susceptible)
Line JI 2438 ex 'Partridge' (resistant)
Line JI 2439 ex 'Fortune' (resistant)

Since the method for testing all races is the same, the following Host Differentials are available

	RACE						
HOST DIFFERENTIAL	1	2	3	4	5	6	7
Line JI 2430 ex 'Kelvedon Wonder'	S	S	S	S	S	S	S
Line JI 2431 ex 'Early Onward'	S	R	S	S	R	S	R
Line JI 2432 ex 'Belinda'	R	S	R	S	S	S	R
Line JI 2435 ex 'Hurst Greenshaft'	R	S	S	R	R	S	R
Line JI 2436 ex 'Vinco'	R	R	R	S	R	S	R
Line JI 2437 ex 'Sleaford Triumph'	R	S	R	R	R	S	R
Line JI 2439 ex 'Fortune'	R	R	R	R	R	S	R

Isolates and isolate identity

The following isolates are used for testing:

RACE	ISOLATE
1	299A
2	202
3	870A
4	895A
5	974B
6	1704B
7	2491A

Isolate identity is determined by serological reactions (Taylor 1972; Taylor and Dye 1972) and by their pathogenicity to one or more host differential cultivars.

Isolates are maintained at:

Horticultural Research International
Wellesbourne
Warwick
CV35 9EF
United Kingdom

Genetic background

Races 2 and 4 are controlled by different single dominant genes. No gene symbols have been assigned. Resistance to Race 6 is known in accessions of *Pisum abyssinicum*. Literature reference: 11, 87, 88, 89, 90.

Characteristic 73: Resistance to Seed-borne Mosaic Virus: Strain P1

Host differentials used for test
Strain P1: Line JI 363 ex 'Lincoln' (susceptible)
Line JI 968 = WL 1779 = PI 193835 (resistant)

Isolates and isolate identity
Isolates used in the test: PSbm P1 Versailles Strain

Isolate identity is determined by reaction to antiserum in serological tests and by reaction with a set of host differential cultivars.

Isolates are maintained at:

GEVES SNES
Station Nationale d'Essais de Semences
Rue George Morel, B.P.24
49071 Beaucouzé Cedex France

Genetic background:

Resistance is pathotype specific, with single recessive genes for each pathotype. There are 4 known genes for resistance. The gene sbm-1 controls resistance to the P1 Strain. Literature reference: 11, 91, 93.

Characteristic 74: Resistance to Bean Yellow Mosaic Virus

Host differentials used for test

Line JI 502 ex 'Rondo' (susceptible)
Line JI 394 ex 'Kelvedon' Wonder (resistant)

Isolates:

Isolate used in the test: Versailles Strain

Isolate are maintained at:

GEVES SNES
Station Nationale d'Essais de Semences
Rue George Morel, B.P.24
49071 Beaucouzé Cedex France

Genetic background
Resistance is conferred by the gene *mo*.
Literature reference: 11, 79, 85, 92.

Characteristic 75: Resistance to Pea Enation Mozaic Virus

Host differentials used for test
'Dark Skinned Perfection' (susceptible)
'Perfected Freezer 60' (resistant)

Isolates
Lyophilized infected tissue is stored at -20°C. The virus remains viable for more than 5 years under these storage conditions.

Isolate PEM-3 is readily mechanically transmissible, is stable during long-term maintenance (i.e. has not produced variants), and is representative of PEMV occurring naturally in North America and Europe (i.e. glasshouse inoculations produce results agreeing with those obtained by natural field inoculations).

Isolates of PEMV tend to be monotypic; thus similar results should be possible with other isolates from North America or Europe.

Isolate (and other reference isolates) maintained at:

USDA ARS,
Dept. of Botany Plant Pathology,
Oregon State University,
Corvallis
Oregon 97331-2902
U.S.A.

Genetic background

A single dominant gene, En confers tolerance to PEMV infection (i.e. the gene enables plants to grow and produce well when virus-infected). Expression of PEM symptoms is dependent upon numerous factors, including inoculum concentration, plant age at infection, plant-growth environment, and perhaps gene interactions.

Literature reference: 11, 94, 95, 96.

[Annex II follows]

ANNEX II

ANNEX II. ASSESSMENT OF CHARACTERISTICS FOR UNIFORMITY: A CAUTIONARY NOTE ON VARIABLE PENETRANCE AND INCOMPLETE DOMINANCE.

The expression of several characteristics in a population may be partial due to low penetrance, or, modified due to incomplete dominance.

It is important therefore, to be aware of their expression, so that rejection on the grounds of apparently lacking uniformity, could be avoided in cases where there may in fact be genetic homogeneity.

Characteristics with low penetrance or incomplete dominance, could be used for Distinctness purposes (viz. two varieties could be separated if one always had the expression of a characteristic, and the other never expressed the characteristic). The following characteristics can be clearly observed, but have variable expression from 1-80 %:

1. Seed: grey median stripe	00	absent	Avola, Solara	1
		present	Valgreen	9

When present, a diffuse grey stripe about two millimetres wide occurs around the suture of the cotyledons. The stripe does not occur on the inside of the testa and is more easily observed on seeds which have simple starch grains. This characteristic is very difficult to observe on seeds with tannins or anthocyanins present. Expression is variable due to incomplete dominance and is controlled by the gene gri. Literature reference: 27.

2. Seed: violet color of testa	00	absent	Assas	1
		present	Arvika	9

Anthocyanin expression may vary from diffuse pale purple patches, often restricted to part of the testa, to very dark purple covering the entire testa. It is often more clearly expressed under glasshouse conditions. Expression is variable due to partial penetrance and is controlled by the gene Obs. Literature reference: 15, 37.

3. Seed: 'golf-ball' dimpling	00	absent	Paloma	1
		present	Birte, Solara	9

'Golf-ball' dimpling occurs as close-set small shallow impressions occurring on the testa and the underlying cotyledons. Expression is variable due to partial penetrance and is present on between 40 and 80 % of the seeds; it is controlled by the gene mifo. Literature reference: 45.

4. Seed: grey area over radicle	00	absent	-	1
		present		9

The area of the radicle is greyish colored and is only easily observed on simple starch grained varieties which lack anthocyanin. Expression is variable due to incomplete dominance and is controlled by the gene rag. Literature reference: 43.

5. Seed: broad impression over radicle	00	absent		1
		present		9

This characteristic is expressed as a broad, shallow impression in the area of the radicle. Heterozygous seeds have a shallower impression; Expression is controlled by the gene fov. Literature reference: 40.

6. Seed: narrow impression over radicle	00	absent	Alaska, Ascona	1
		present	Solara	9

This characteristic is expressed as a deep groove-like impression in the area of the radicle. Expression is variable due to incomplete penetrance and is controlled by the gene sul. If the genes fov and sul are expressed together, they cannot be reliably separated. Literature reference: 42.

7. Seed: degree of Tragacanth oil	00	absent or very slight		1
		slight	Record	3
		medium	Alaska	5
		much	Solara	7
		very much	Morehu	9

Tragacanth oil is present underneath the testa and may be observed as an oily spot from the outside. It is most easily observed on seeds with simple starch grains. Expression is variable due to incomplete dominance and is controlled by the gene Tra. Record on seed within nine months of harvest. Very high Tragacanth oil levels, as in the variety Morehu, may be the expression of an additional allele. Literature reference: 27, 34.

8. Stem: dichotomous branching	30-240	absent	1
		present	9

The division of the stem into two similarly developing parts usually occurs approximately half way up the stem. Expression is variable due to partial penetrance and is controlled by the gene bif. Literature reference: 08, 09.

9. Leaflet: incision of tip	216-226	absent	1
		present	9

The leaflet tip is incised with the main vein growing on free of the incision. Expression is variable due to partial penetrance and is controlled by the gene ins. Literature reference: 41.

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* = General texts

[End of Annex III and of document]