TG/TOM_ROOT(proj.3)
ORIGINAL: English
DATE: 2012-05-03

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

Geneva

DRAFT

TOMATO ROOTSTOCKS

UPOV Code: SOLAN_LHA

Solanum lycopersicum L. x *Solanum habroichaites* S. Knapp & D.M. Spooner
Solanum lycopersicum x *Solanum peruvianum,*
Solanum lycopersicum x *Solanum chesmanii*

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by an expert from the Netherlands

to be considered by the

Technical Working Party for Vegetables at its forty-sixth session,
to be held near the City of Venlo, Netherlands, from 11 to 15 June 2012

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Solanum lycopersicum L. x, Solanum habroichaites S. Knapp & D.M. Spooner, Solanum lycopersicum x Solanum peruvianum, Solanum lycopersicum x *Solanum chesmanii*	Tomato rootstocks belonging to *Solanum lycopersicum* x *Solanum habroichaites* or *Solanum lycopersicum x Solanu, peruvianum,* or *Solanum lycopersicum* x *Solanum chesmanii*	Porte-greffe de tomate appartenant à *Solanum lycopersicum* x *Solanum habroichaite* or *Solanum lycopersicum x Solanu, peruvianum,* or *Solanum lycopersicum* x *Solanum chesmanii s*	Tomate Unterlagen gehörend zu *Solanum lycopersicum* x *Solanum habroichaites* or *Solanum lycopersicum x Solanu, peruvianum,* or *Solanum lycopersicum* x *Solanum chesmanii*	de tomate pertenecientes a *Solanum lycopersicum* x *Solanum habroichaites* or *Solanum lycopersicum x Solanu, peruvianum,* or *Solanum lycopersicum* x *Solanum chesmanii*

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

1.1 These Test Guidelines apply to all varieties of *Solanum lycopersicum* L. x *Solanum habroichaites* S. Knapp & D.M. Spooner (*Lycopersicum esculentum* Mill. x *Lycopersicum hirsutum* Dunal.), *Solanum lycopersicum* x *Solanum peruvianum* and *Solanum lycopersicum* x *Solanum chesmanii.* Such varieties are generally used as rootstocks for tomato varieties (varieties of *Solanum lycopersicum* L (*Lycopersicum esculentum* Mill.)).

1.2 Rootstocks belonging to *Solanum lycopersicum* L (*Lycopersicum esculentum* Mill.) or to *Solanum lycopersicum* L x *Solanum pimpinellifolia* L. (*Lycopersicum esculentum* Mill. x *Lycopersicum pimpinellifolia* Mill.) should be covered by UPOV Test Guidelines TG/44/11.

2. Material Required

2.1 The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with.

2.2 The material is to be supplied in the form of seed or plants.

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

a) seed-propagated varieties: 10g or 2500 seeds

In the case of seed, the seed should meet the minimum requirements for germination, species and analytical purity, health and moisture content, specified by the competent authority.

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

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

3. Method of Examination

3.1 Number of Growing Cycles

The minimum duration of tests should normally be two independent 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

The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination.

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 20 plants, which should be divided between at least two replicates.

3.4.2 When resistance characteristics are used for assessing distinctness, uniformity and stability, records must be taken under conditions of controlled infection and, unless otherwise specified, on at least 20 plants.

3.4.3 The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

3.5 Additional Tests

Additional tests, for examining relevant characteristics, may be established.

4. Assessment of Distinctness, Uniformity and Stability

4.1 Distinctness

4.1.1 General Recommendations

It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines.

4.1.2 Consistent Differences

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a 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.

4.1.4 Number of Plants / Parts of Plants to be Examined

Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 10 plants or parts taken from each of 10 plants and any other observations made on all plants in the test disregarding any off-type plants.

4.1.5 Method of Observation

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

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

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

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

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

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

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

4.2 Uniformity

4.2.1 It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in these Test Guidelines:

4.2.2 For the assessment of uniformity, a population standard of 1% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 20 plants, 1 off-type is allowed.

4.3 Stability

4.3.1 In practice, it is not usual to perform tests of stability that produce results as certain as those of the testing of distinctness and uniformity. However, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable.

4.3.2 Where appropriate, or in cases of doubt, stability may be further examined by testing a new seed or plant stock to ensure that it exhibits the same characteristics as those shown by the initial material supplied.

5. Grouping of Varieties and Organization of the Growing Trial

5.1 The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness are aided by the use of grouping characteristics.

5.2 Grouping characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together.

5.3 The following have been agreed as useful grouping characteristics:

(a) Fruit: green shoulder (before maturity) (characteristic 15)
(b) Autonecrosis (characteristic 21)
(c) Resistance to *Meloidogyne incognita* (characteristic 22)
(d) Resistance to *Verticillium* sp. – Race 0 (characteristic 23)
(e) Resistance to *Fusarium oxysporum* f. sp. *lycopersici* – Race 0 (ex 1) (characteristic 24.1)
(f) Resistance to *Fusarium oxysporum* f. sp. *lycopersici* – Race 1 (ex 2) (characteristic 24.2)
(g) Resistance to *Fusarium oxysporum* f. sp. *lycopersici* – Race 2 (ex 3) (characteristic 24.3)
(h) Resistance to *Pyrenochaeta lycopersici* (characteristic 28)

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

6. Introduction to the Table of Characteristics

6.1 Categories of Characteristics

6.1.1 Standard Test Guidelines Characteristics

Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.

6.1.2 Asterisked Characteristics

Asterisked characteristics (denoted by *) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate.

6.2 States of Expression and Corresponding Notes

6.2.1 States of expression are given for each characteristic to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical note for ease of recording of data and for the production and exchange of the description.

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

State	Note
small	3
medium	5
large	7

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

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

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

6.3 Types of Expression

An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction.

6.4 Example Varieties

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

6.5 Legend

(*)	Asterisked characteristic	– see Chapter 6.1.2
QL	Qualitative characteristic	– see Chapter 6.3
QN	Quantitative characteristic	– see Chapter 6.3
PQ	Pseudo-qualitative characteristic	– see Chapter 6.3
MG, MS, VG, VS		– see Chapter 4.1.5
(a)-(c)	See Explanations on the Table of Characteristics in Chapter 8.1.	
(+)	See Explanations on the Table of Characteristics in Chapter 8.2.	

7. Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de caracteres

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1. **(*)** **(+)**	**VG**	**Seedling: anthocyanin coloration of hypocotyl**	**Plantule: pigmentation anthocyanique de l'hypocotyle**	**Keimpflanze: Anthocyanfärbung des Hypocotyls**	**Plántula: pigmentación antociánica del hipocótilo**		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente	Beaufort	9
2. **(+)**	**VG**	**Plant: height**	**Plante: hauteur**	**Pflantze: Höhe**	**Planta: altura**		
QN		short	basse	niedrig	baja	Big Power	3
		medium	moyenne	mittel	media	Maxifort	5
		tall	haute	hoch	alta	Beaufort	7
3. **(+)**	**VG**	**Stem: anthocyanin coloration of upper third**	**Tige: pigmentation anthocyanique du tiers supérieur**	**Stengel: Anthocyan-färbung des oberen Drittels**	**Tallo: pigmentación antociánica del tercio superior**		
QN	**(a)**	absent or very weak	absente ou très faible	fehlend oder sehr gering	ausente o muy débil		1
		weak	faible	gering	débil	Arnold	3
		medium	moyenne	mittel	media	Beaufort	5
		strong	forte	stark	fuerte	Montezuma	7
4. **(+)**	**VG/MS**	**Stem: length of internode**	**Tige: longueur de l'entrenœud**	**Stengel: Internodienlänge**	**Tallo: longitud del entrenudo**		
QN	**(a)**	short	court	kurz	corta	Big Force	3
		medium	moyen	mittel	media	Maxifort	5
		long	long	lang	larga	Beaufort	7
5. **(*)**	**VG/MS**	**Leaf: length**	**Feuille: longueur**	**Blatt: Länge**	**Hoja: longitud**		
QN	**(a)**	short	courte	kurz	corta		3
		medium	moyenne	mittel	media	Body	5
		long	longue	lang	larga	Maxifort	7
6. **(*)**	**VG/MS**	**Leaf: width**	**Feuille: largeur**	**Blatt: Breite**	**Hoja: anchura**		
QN	**(a)**	narrow	étroite	schmal	estrecha		3
		medium	moyenne	mittel	media	Body	5
		broad	large	breit	ancha	Emperador	7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
7. **(+)**	**VG**	**Leaf: size of leaflets**	**Feuille: taille des folioles**	**Blatt: Größe der Blattfiedern**	**Hoja: tamaño de los folíolos**		
QN	**(a)**	very small	très petites	sehr klein	muy pequeños		1
		small	petites	klein	pequeños	Titron	3
		medium	moyennes	mittel	medios	Big Force	5
		large	grandes	groß	grandes	Beaufort	7
		very large	très grandes	sehr groß	muy grandes	Hires 1210	9
8. **(*)**	**VG**	**Leaf: intensity of green color**	**Feuille: intensité de la couleur verte**	**Blatt: Intensität der Grünfärbung**	**Hoja: intensidad del color verde**		
QN	**(a)**	light	claire	hell	claro		3
		medium	moyenne	mittel	medio		5
		dark	foncée	dunkel	oscuro	Maxifort	7
9. **(+)**	**VG**	**Leaf: glossiness**	**Feuille: brillance**	**Blatt: Glanz**	**Hoja: brillo**		
QN	**(a)**	weak	faible	gering	débil	Montezuma	3
		medium	moyenne	mittel	medio	Titron	5
		strong	forte	stark	fuerte	Maxifort	7
10. **(+)**	**VG**	**Leaf: blistering**	**Feuille: cloqûre**	**Blatt: Blasigkeit**	**Hoja: abullonado**		
QN	**(a)**	weak	faible	gering	débil	Montezuma	3
		medium	moyenne	mittel	medio	Emperador	5
		strong	forte	stark	fuerte	Body	7
11. **(+)**	**VG/MS**	**Peduncle: length**	**Pédoncule: longueur**	**Blütenstandstiel: Länge**	**Pedúnculo: longitud**		
QN		short	court	kurz	corta	Titron	3
		medium	moyen	mittel	media	Multifort	5
		long	long	lang	larga	Beaufort	7
12. **(*)**	**VG**	**Fruit: size**	**Fruit: taille**	**Frucht: Größe**	**Fruto: tamaño**		
QN	**(b)**	small	petit	klein	pequeño	Body, Optifort	3
		medium	moyen	mittel	medio	Emperador	5
		large	grand	groß	grande	Titron	7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
13. (*) (+)	**VG**	**Fruit: shape in longitudinal section**	**Fruit: forme en section longitudinale**	**Frucht: Form im Längsschnitt**	**Fruto: forma en sección longitudinal**		
PQ	**(b)**	flattened	nettement aplatie	abgeflacht	aplanada	He-Wolf	1
		oblate	aplatie	breitrund	achatada	Gladiator	2
		circular	ronde	kreisförmig	circular	Maxifort	3
14. (*)	**MS**	**Fruit: number of locules**	**Fruit: nombre de loges**	**Frucht: Anzahl Kammern**	**Fruto: número de lóculos**		
QN	**(b)**	only two	seulement deux	nur zwei	sólo dos	Maxifort	1
		two and three	deux et trois	zwei und drei	dos y tres		2
15. (*)	**VG**	**Fruit: green shoulder**	**Fruit: collet vert**	**Frucht: Flammung**	**Fruto: hombro verde**		
QL	**(c)**	absent	absent	fehlend	ausente		1
		present	présent	vorhanden	presente	Big Force, Maxifort	9
16. (*)	**VG**	**Fruit: extent of green shoulder**	**Fruit: taille du collet vert**	**Frucht: Größe der Flammung**	**Fruto: tamaño del hombro verde**		
QN	**(c)**	small	petit	klein	pequeño	Big Force	3
		medium	moyen	mittel	medio		5
		large	grand	groß	grande	Maxifort	7
17. (*)	**VG**	**Fruit: intensity of green color of shoulder**	**Fruit: intensité de la couleur verte du collet**	**Frucht: Intensität der Grünfärbung der Flammung**	**Fruto: intensidad del color verde del hombro**		
QN	**(c)**	light	claire	hell	claro		3
		medium	moyenne	mittel	medio		5
		dark	foncée	dunkel	oscuro	He-man	7
18. (+)	**VG**	**Fruit: conspicuousness of meridian stripes**					
QN	**(c)**	weak				Popeye	3
		medium				Body	5
		strong				Vigomax	7

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
19. (*)	**VG**	**Fruit: color at maturity**	**Fruit: couleur à maturité**	**Frucht: Farbe bei der Reife**	**Fruto: color en la madurez**		
PQ	**(b)**	green	verte	grün	verde	Big Force	1
		yellowish	jaunâtre	gelblich	amarillento	Vigomax	2
		orangish	orangé	orangerot	anaranjado	Titron	3
		reddish				Brigeor	4
20.	**MG**	**Time of flowering**					
QN		early				He-Man	3
		medium				Body	5
		late				Popeye	7
21. (*) (+)	**VG**	**Autonecrosis**	**Autonécrose**				
QL		absent	absente	fehlend	ausente	Maxifort	1
		present	présente	vorhanden	presente	Body	9
22. (*) (+)	**VG**	**Resistance to *Meloidogyne incognita***	**Résistance au *Meloidogyne incognita***	**Resistenz gegen *Meloidogyne incognita***	**Resistencia a *Meloidogyne incognita***		
QL		susceptible				Bruce	1
		moderately resistant					2
		highly resistant				Emperador	3
23. (*) (+)	**VG**	**Resistance to *Verticillium* sp. (Va and Vd)** **– Race 0**	**Résistance au *Verticillium* sp.** **– Pathotype 0**	**Resistenz gegen *Verticillium* sp.** **– Pathotyp 0**	**Resistencia a *Verticillium* sp.** **– Raza 0**		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente	Big Power	9

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
24. **(+)**		**Resistance to *Fusarium oxysporum* f. sp. *Lycopersici* (Fol)**	**Résistance au *Fusarium oxysporum* f. sp. *lycopersici***	**Resistenz gegen *Fusarium oxysporum* f. sp. *lycopersici***	**Resistencia a *Fusarium oxysporum* f. sp. *lycopersici***		
24.1 **(*)**	**VG**	**– Race 0 (ex 1)**	**– Pathotype 0 (ex 1)**	**– Pathotyp 0 (ex 1)**	**– Raza 0 (ex 1)**		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente	Emperador	9
24.2 **(*)**	**VG**	**– Race 1 (ex 2)**	**– Pathotype 1 (ex 2)**	**– Pathotyp 1 (ex 2)**	**– Raza 1 (ex 2)**		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente	Emperador	9
24.3 **(*)**	**VG**	**– Race 2 (ex 3)**	**– Pathotype 2 (ex 3)**	**– Pathotyp 2 (ex 3)**	**– Raza 2 (ex 3)**		
QL		absent	absente	fehlend	ausente	Emperador	1
		present	présente	vorhanden	presente	Colosus	9
25. **(*)** **(+)**	**VG**	**Resistance to *Fusarium oxysporum* f. sp. *radicis-lycopersici* (Forl)**	**Résistance au *Fusarium oxysporum* f. sp. *radicis-lycopersici***	**Resistenz gegen *Fusarium oxysporum* f. sp. *radicis-lycopersici***	**Resistencia a *Fusarium oxysporum* f. sp. *radicis-lycopersici***		
QL		absent	absente	fehlend	ausente	Kemerit	1
		present	présente	vorhanden	presente	Emperador	9
26. **(+)**		**Resistance to *Fulvia fulva* (Ff) (ex *Cladosporium fulvum*)**	**Résistance au *Fulvia fulva* (Ff) (ex *Cladosporium fulvum)***	**Resistenz gegen *Fulvia fulva* (Ff) (ex *Cladosporium fulvum)***	**Resistencia a *Fulvia fulva* (Ff) (ex *Cladosporium fulvum)***		
26.1	**VG**	**– Race 0**	**– Pathotype 0**	**– Pathotyp 0**	**– Raza 0**		
QL		absent	absente	fehlend	ausente	King Kong	1
		present	présente	vorhanden	presente	Bruce	9
26.2	**VG**	**– Group A**	**– Groupe A**	**– Gruppe A**	**– Grupo A**		
QL		absent	absente	fehlend	ausente	King Kong	1
		present	présente	vorhanden	presente	Big Power	9
26.3	**VG**	**– Group B**	**– Groupe B**	**– Gruppe B**	**– Grupo B**		
QL		absent	absente	fehlend	ausente	King Kong	1
		present	présente	vorhanden	presente	Bruce	9
26.4	**VG**	**– Group C**	**– Groupe C**	**– Gruppe C**	**– Grupo C**		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente	Big Power	9

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
26.5	**VG**	**– Group D**	**– Groupe D**	**– Gruppe D**	**– Grupo D**		
QL		absent	absente	fehlend	ausente	King Kong	1
		present	présente	vorhanden	presente	Bruce	9
26.6	**VG**	**– Group E**	**– Groupe E**	**– Gruppe E**	**– Grupo E**		
QL		absent	absente	fehlend	ausente	Bruce, King Kong	1
		present	présente	vorhanden	presente	Big Power	9
27. **(+)**		**Resistance to Tomato mosaic virus (ToMV)**	**Résistance au virus de la mosaïque de la tomate (ToMV)**	**Resistenz gegen das Tomatenmosaikvirus (ToMV)**	**Resistencia al virus del mosaico del tomate (ToMV)**		
27.1	**VG**	**– Strain 0**	**– Souche 0**	**– Pathotyp 0**	**– Cepa 0**		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente	Emperador	9
27.2		**– Strain 1**	**– Souche 1**	**– Pathotyp 1**	**– Cepa 1**		
		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente		9
27.3		**– Strain 2**	**– Souche 2**	**– Pathotyp 2**	**– Cepa 2**		
		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente		9
28. **(*)** **(+)**	**VG**	**Resistance to *Pyrenochaeta lycopersici* (Pl)**	**Résistance au *Pyrenochaeta lycopersici***	**Resistenz gegen *Pyrenochaeta lycopersici***	**Resistencia a *Pyrenochaeta lycopersici***		
QL		absent	absente	fehlend	ausente	Zaralto	1
		present	présente	vorhanden	presente	Emperador	9
29. **(+)**	**VG**	**Resistance to *Stemphylium* spp.**	**Résistance au *Stemphylium* spp.**	**Resistenz gegen *Stemphylium* spp.**	**Resistencia a *Stemphylium* spp.**		
QL		absent	absente	fehlend	ausente	Big Power	1
		present	présente	vorhanden	presente	Body	9
30. **(+)**	**VG**	**Resistance to Tomato yellow leaf curl virus (TYLCV)**	**Résistance au *Tomato yellow leaf curl virus* (TYLCV)**	**Resistenz gegen gelbes Tomatenblattrollvirus (TYLCV)**	**Resistencia a virus de la hoja en cuchara (TYLCV)**		
QL		absent	absente	fehlend	ausente	Big Power	1
		present	présente	vorhanden	presente		9

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
31. **(+)**	**VG**	**Resistance to Tomato spotted wilt virus (TSWV)**	**Résistance au *Tomato spotted wilt virus* (TSWV)**	**Resistenz gegen das gefleckte Tomaten-welkevirus (TSWV)**	**Resistencia a *Tomato Spotted Wilt Virus* (TSWV)**		
QL		absent	absente	fehlend	ausente	Big Power	1
		present	présente	vorhanden	presente	Enpower	9
32. **(+)**	**VG**	**Resistance to *Oidium_neolycopersici* (On)**	**Résistance au *Oidium_neolycopersici***	**Resistenz gegen *Oidium neolycopersici***	**Resistencia a *Oidium neolycopersici***		
QL		absent	absente	fehlend	ausente		1
		present	présente	vorhanden	presente	Multifort	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) All observations on the plant, stem and leaves should be done after a fruit set on at least five trusses and before ripening of the second truss. Observations should be done before deterioration of the leaves.
(b) All observations on the fruit should be made on mature fruits from the second or higher truss.
(c) All observations on the green shoulder and meridian stripes of the fruit should be made on the plant before maturity.

8.2 Explanations for individual characteristics

Ad. 1: Seedling: anthocyanin coloration of hypocotyl

Ad. 2: Plant: height

To be observed after a fruit set on 5 nodes

Ad. 3: Stem: anthocyanin coloration of upper third

Most of the varieties are classed 1 to 5. Expression of anthocyanin is influenced by day temperature. Under greenhouse conditions, the variation is rather low.

Ad. 4: Stem: length of internode

The length of the internode should be observed/measured at one time for the whole trial, e.g after a fruit set on approximately 5 nodes. The total length of the stem should be observed/measured between the 1st and 4th trusses. In case of measurements, this measure is divided by the number of internodes in between, an indication of the length of the internode is given.

Ad. 7: Leaf: size of leaflets

The size of the leaflet should be observed in the middle of the leaf.

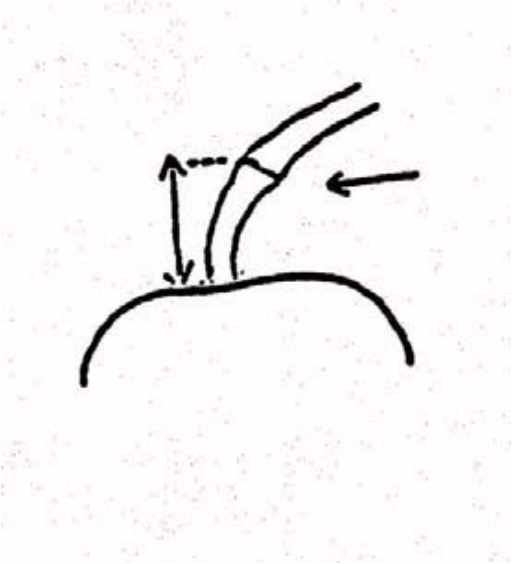
Ad. 9: Leaf: glossiness

The glossiness of the leaf should be observed in the middle of the plant.

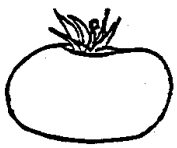
Ad. 10: Leaf: blistering

Caution is required for confusion between blistering and creasing.
Blistering is the difference in height of the surface of the leaf between the veins.
Creasing is independent form the veins. The blistering should be observed in the middle third of the plant.

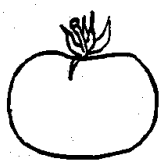
Ad. 11: Pedicel: length



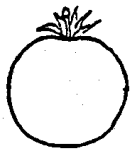
Ad. 13: Fruit: shape in longitudinal section



1
flattened



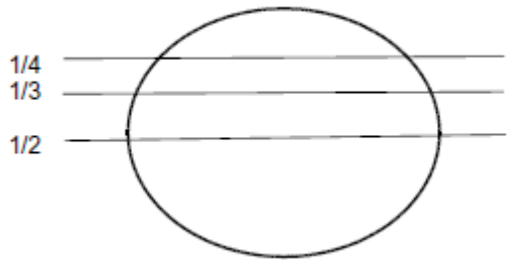
2
oblate



3
circular

Ad. 16: Fruit: extent of green shoulder

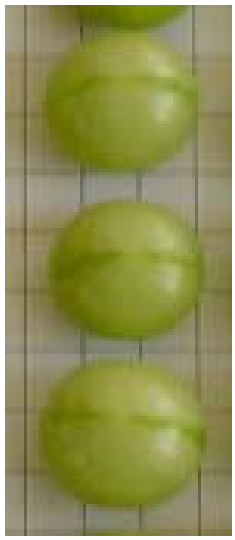
The gene for green shoulder might not be clearly expressed in some conditions, which is why it is important to have the example variety ‘Daniela’ to observe the expression of these characteristics.



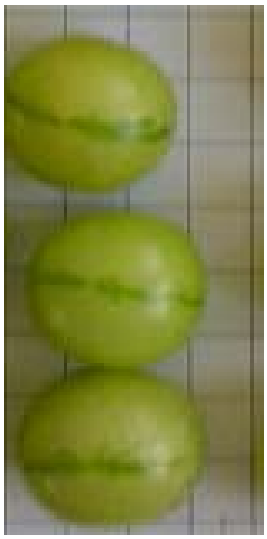
3: small (1/4)
5: medium (1/3)
7: large (1/2)

Ad. 18 Fruit: conspicuousness of meridian stripes (before maturity)

3
weak



5
medium



7
strong

Ad. 21: Autonecrosis

Method:

Evaluation:	evaluation is done on fully-grown plants
Execution of test:	autonecrosis can be observed under normal growing conditions.
Sowing:	normal trial conditions
Temperature:	normal trial temperatures
Light:	normal daylight
Growing method:	no special method necessary
Duration of test:	4 - 5 months
Number of plants tested:	minimum of 20

Observation of the expression: A visual survey has to be made on the presence of leaves that show signs of autonecrosis

Standard varieties:	insensitive:	Maxifort
	moderately sensitive:	Beaufort
	very sensitive:	Body

Ad. 22: Resistance to *Meloidogyne incognita* (Mi)

1. Pathogen	*Meloidogyne incognita*
3. Host species	*Solanum lycopersicum*
4. Source of inoculum	Naktuinbouw (NL[1]) or GEVES[2] (F)
5. Isolate	non-resistance breaking
6. Establishment isolate identity	use rootstock or tomato standards
7. Establishment pathogenicity	use susceptible rootstock or tomato standard
8. Multiplication inoculum	
8.2 Multiplication variety	preferably resistant to powdery mildew
8.3 Plant stage at inoculation	see 10.3
8.1 Multiplication medium	living plant
8.5 Inoculation method	see 10.4
8.6 Harvest of inoculum.....	root systems are cut with scissors into pieces
.....	of about 1 cm length
8.7 Check of harvested inoculum	visual check for presence of root knots
8.8 Shelf life/viability inoculum.....	1 day
9. Format of the test	
9.1 Number of plants per genotype	20 plants
9.2 Number of replicates…….	Not applicable
9.3 Control varieties.....	
Susceptible:	Bruce and (Solanum lycopersicum) Clairvil, Casaque Rouge
Moderately resistant :	(Solanum lycopersicum) Madyta, “Anahu x Monalbo”, Campeon,
.....	Madyta, Vinchy
Highly resistant:	Emperador and (Solanum lycopersicum) Anahu, Anabel
9.4 Test design	include standard varieties
9.5 Test facility	greenhouse or climate room
9.6 Temperature	not over 28° C
9.7 Light.....	at least 12 h per day
10. Inoculation	
10.1 Preparation inoculum.....	small pieces of diseased root mixed with soil
.....	mix soil and infested root pieces
10.2 Quantification inoculum	soil: root ratio = 8:1, or depending on experience
10.3 Plant stage at inoculation	seed, or cotyledons
10.4 Inoculation method	plants are sown in infested soil or contamination of soil after sowing when plantlets are at cotyledon stage
10.7 Final observations	28 to 45 days after inoculation
11. Observations	
11.1 Method.....	root inspection
11.2 Observation scale.....	Symptoms:
.....	Galling, root malformation,
.....	growth reduction, plant death
11.3 Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls on standards
11.4 Off-types	resistant varieties may have a few plants with a few galls
12. Interpretation of data in terms of UPOV characteristic states	
Absent (susceptible)	[1] growth strongly reduced, high gall count
Intermediate (moderately resistant).....	[2] medium growth reduction, medium gall count
Present (highly resistant).....	[3] present; no growth reduction, no galls
13. Critical control points: Avoid rotting of roots; high temperature causes breakdown of resistance	

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Ad. 23: Resistance to *Verticillium* sp. (Va and Vd)

1. Pathogen	*Verticillium dahliae* or *Verticillium albo-atrum* (see note below)
3. Host species	*Solanum lycopersicum*
4. Source of inoculum.....	Naktuinbouw[3] (NL) and GEVES[4] (*F*)
5. Isolate	Race 0 (e.g. strain Toreilles 4-1-4-1)
8. Multiplication inoculum	
8.1 Multiplication medium	Potato Dextrose Agar, Agar Medium "S" of Messiaen
8.4 Inoculation medium.....	water (for scraping agar plates) or Czapek Dox broth (3-7 d-old aerated culture at 20-25°C, in darkness)
8.6 Harvest of inoculum.....	filter through double muslin cloth
8.7 Check of harvested inoculums……	spore count; adjust to 106 per ml
8.8 Shelf life/viability inoculums……	1 d at 4°C
9. Format of the test	
9.1 Number of plants per genotype……	35 seed for 24 plants
9.2 Number of replicates……	Not applicable
9.3 Control varieties	
Susceptible ……	(Solanum lycopersicum) Flix, Marmande verte, Clarion, Santonio, Anabel
Resistant ……	Big Power and (Solanum lycopersicum) Monalbo, Elias, Monalbo x Marmande verte, Daniela, Marmande VR
9.4 Test design……	20 plants inoculated at least, 2 blanks at least
9.5 Test facility……	greenhouse or climate room
9.6 Temperature……	optimal 20-25°C, 20-22°C after inoculation
9.7 Light……	12 h or longer
10. Inoculation	
10.1 Preparation inoculums……	aerated, liquid culture (8.4)
10.2 Quantification inoculums……	count spores, adjust to 106 per ml
10.3 Plant stage at inoculation……	cotyledon to 3rd leaf
10.4 Inoculation method……	roots are immersed for 4 to 15 min in spore suspension.
10.7 Final observations……	14-33 d after inoculation
11. Observations	
11.1 Method……	visual
11.2 Observation scale……	growth retardation, wilting, chlorosis, and vessel browning
11.3 Validation of test……	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls

12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	severe symptoms
present	[9]	no or mild symptoms

13. Critical control points

All symptoms may be present in resistant varieties, but the severity will be distinctly less than in susceptible varieties. Usually resistant varieties will show significantly less growth retardation then susceptible varieties. Observation of vessel browning is important for diagnosis. Usually, vessel browning will not extend to the 1st leaf in resistant varieties. Many hybrid varieties are heterozygous and appear to have mild symptoms in the biotest.

Note: Resistance to V. dahliae based in the Ve gene is also effective to V. albo-atrum. Isolates of both fungal species may be used to evaluate the UPOV characteristic "Resistance to V. dahliae" or V. albo-atrum as long as the isolate belongs to the non-Ve breaking race 0. Resistance-breaking isolates have been described in both species.

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Ad. 24: Resistance to *Fusarium oxysporum* f. sp. *Lycopersici* (Fol)

1. Pathogen *Fusarium oxysporum* f. sp. *lycopersici*
3. Host species ..... *Solanum lycopersicum*
4. Source of inoculum..... Naktuinbouw[5] (NL) and GEVES[6] (*F*)
5. Isolate ..... Race 0 (ex 1) (e.g. strains Orange 71 or PRI 20698 or Fol 071 1 (ex 2) (e.g. strains 4152 or PRI40698 or RAF 70 and 2 (ex 3)
..... Individual strains may vary in pathogenicity
6. Establishment isolate identity ..... use differential varieties (see 9.3)
7. Establishment pathogenicity..... on susceptible tomato varieties
8. Multiplication inoculum
8.1 Multiplication medium…… Potato Dextrose Agar, Medium "S" of Messiaen
8.4 Inoculation medium ……water for scraping agar plates or Czapek-Dox culture medium (7 d-old aerated culture)
8.6 Harvest of inoculum……filter through double muslin cloth
8.7 Check of harvested inoculum spore count; adjust to 106 per ml
8.8 Shelf-life/viability inoculum …… 4-8 h, keep cool to prevent spore germination
9. Format of the test
9.1 Number of plants per genotype……at least 20
9.2 Number of replicates……Not applicable
9.3 Control varieties for the test with race 0 (ex 1)
Susceptible……(Solanum lycopersicum) Marmande, Marmande verte, Resal
Resistant for race 0 only ……(Solanum lycopersicum) Marporum, Larissa, "Marporum x Marmande verte", Marsol, Anabel
Resistant for race 0 and 1 ……(Solanum lycopersicum) Motelle, Gourmet, Mohawk
Control varieties for the test with race 1 (ex 2)
Susceptible ……(Solanum lycopersicum) Marmande verte, Cherry Belle, Roma
Resistant for race 0 only ……(Solanum lycopersicum) Marporum, Ranco
Resistant for race 0 and 1 ……(Solanum lycopersicum) Tradiro, Odisea
Remark: Ranco is slightly less resistant than Tradiro
Control varieties for the test with race 2 (ex 3)
Susceptible for race 0, 1 and 2……. Emperador
Resistant for race 0, 1 and 2……. Colosus
9.4 Test design ……>20 plants; e.g. 35 seeds for 24 plants, including 2 blanks
9.5 Test facility ……glasshouse or climate room
9.6 Temperature ……24-28°C (severe test, with mild isolate)
20-24°C (mild test, with severe isolate)
9.7 Light ……12 hours per day or longer
9.8 Season …… all seasons
9.9 Special measures ……slightly acidic peat soil is optimal;
keep soil humid but avoid water stress
10. Inoculation
10.1 Preparation inoculums……aerated Messiaen or PDA or Agar Medium S of Messiaen or Czapek Dox culture or scraping of plates
10.2 Quantification inoculums……spore count, adjust to 106 spores per ml, Lower concentration for a very aggressive isolate
10.3 Plant stage at inoculation…… 10-18 d, cotyledon to first leaf
10.4 Inoculation method ……roots and hypocotyls are immersed in spore suspension for 5-15 min; trimming of roots is an option
10.7 Final observations ……14-21 days after inoculation
11. Observations
11.1 Method ……visual
11.2 Observation scale ……Symptoms:
growth retardation, wilting, yellowing,
vessel browning extending above cotyledon
11.3 Validation of test……evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	severe symptoms
present	[9]	mild or no symptoms

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13. Critical control points

Test results may vary slightly in inoculum pressure due to differences in isolate, spore concentration, soil humidity and temperature. Standards near borderline R/S will help to compare between labs.

Ad. 25: Resistance to *Fusarium oxysporum* f. sp. *radicis-lycopersici* (Forl)

1. Pathogen	*Fusarium oxysporum* f. sp. *radicis-lycopersici*
3. Host species	*Solanum lycopersicum*
4. Source of inoculum.....	Naktuinbouw[7] (NL) and GEVES[8] (*F*)
5. Isolate	-
7. Establishment pathogenicity.....	symptoms on susceptible tomato
Multiplication inoculum	
8.1 Multiplication medium	Potato Dextrose Agar or Medium agar “S” of Messiaen
8.4 Inoculation medium.....	water for scraping agar plates or
.....	Czapek-Dox (7 d-old aerated culture)
8.6 Harvest of inoculum.....	filter through double muslin cloth
8.7 Check of harvested inoculum	spore count; adjust to 10^6 per ml
8.8 Shelf life/viability inoculum.....	4-8 h, keep cool to prevent spore germination
9. Format of the test	
9.1 Number of plants per genotype	at least 20
9.2 Number of replicates……	Not applicable
9.3 Control varieties	
Susceptible:	Kemerit and (Solanum lycopersicum) Motelle, Moneymaker
Resistant:	Emperador and (Solanum lycopersicum) Momor, “Momor x
.....	Motelle”
Remark:	“Momor x Motelle” has slightly weaker resistance than Momor
9.4 Test design	>20 plants; e.g. 35 seeds for 24 plants, including 2 blanks
9.5 Test facility.....	glasshouse or climate room
9.6 Temperature	24-28°C (severe test, with mild isolate)
.....	17-24°C (mild test, with severe isolate)
9.7 Light	at least 12 hours per day
9.8 Season.....	all seasons
9.9 Special measures	slightly acidic peat soil is optimal;
.....	keep soil humid but avoid water stress
10. Inoculation	
10.1 Preparation inoculum.....	aerated culture or scraping of plates
10.2 Quantification inoculum	spore count, adjust to 10^6 spores per ml
10.3 Plant stage at inoculation	12-18 d, cotyledon to third leaf
10.4 Inoculation method	roots and hypocotyls are immersed in spore suspension
.....	for 5-15 min
10.7 Final observations	10-21 days after inoculation
11. Observations	
11.1 Method.....	visual; a few plants are lifted at the end of the test
11.2 Observation scale.....	Symptoms:
.....	Plant death, Growth retardation caused by root degradation
.....	Root degradation, Necrotic pinpoints and necrotic lesions on stems
11.3 Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls

12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	symptoms
present	[9]	no symptoms

13. Critical control points Temperature should never exceed 27°C during the test period; frequent renewal of races may be needed because of loss of pathogenicity

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Ad. 26: Resistance to *Fulvia fulva* (Ff) (ex *Cladosporium fulvum*)

1. Pathogen	*Fulvia fulva* (ex *Cladosporium fulvum)*
3. Host species	*Solanum lycopersicum*
4. Source of inoculum	Naktuinbouw[9] (NL) or GEVES[10] (FR)
5. Isolate	Race group 0, A, B, C, D, and E
6. Establishment isolate identity	with genetically defined differentials from GEVES (FR)
.....	A breaks Cf-2, B Cf-4, C Cf-2&4, D Cf-5, E Cf-2&4&5
7. Establishment pathogenicity	symptoms on susceptible tomato
8. Multiplication inoculum	
8.1 Multiplication medium	Potato Dextrose Agar or Malt Agar or a synthetic medium
8.8 Shelf life/viability inoculum	4 hours, keep cool
9. Format of the test	
9.1 Number of plants per genotype	more than 20
9.2 Number of replicates……	Not applicable
9.3 Control varieties	
Susceptible:	King Kong and (Solanum lycopersicum) Monalbo, Moneymaker
Resistant for race 0:	Bruce and (Solanum lycopersicum) Angela, Estrella, Sonatine,
.....	Sonato, Vemone, Vagabond, IVT 1149, Vagabond × IVT 1149,
.....	IVT 1154
Resistant for race group A:	Big Power and (Solanum lycopersicum) Angela, Estrella, Sonatine,
.....	Sonato
Resistant for race group B:	Bruce and (Solanum lycopersicum) Angela, Estrella, Sonatine,
.....	Sonato, Vemone
Resistant for race group C:	Big Power and (Solanum lycopersicum) Angela, Estrella, Sonatine
Resistant for race group D:	Bruce and (Solanum lycopersicum) Estrella, Sonatine, Vemone
Resistant for race group E:	Big Power and (Solanum lycopersicum) Sonatine, Jadviga, Rhianna,
.....	IVT 1154
9.5 Test facility	glasshouse or climate room
9.6 Temperature	day: 22° C, night: 20° or day: 25°C, night 20°C
9.7 Light	12 hours or longer
9.9 Special measures	depending on facility and weather, there may be a need to
.....	raise the humidity
.....	e.g. humidity tent closed 3-4 days after inoculation
.....	and after this, 66% until 80% closed during day, until end
10. Inoculation	
10.1 Preparation inoculum	prepare evenly colonized plates, e.g. 1 for 36 plants;
.....	remove spores from plate by scraping with water with Tween20;
.....	filter through double muslin cloth
10.2 Quantification inoculum	count spores; adjust to 10^5 spores per ml or more
10.3 Plant stage at inoculation	19-20 d (incl. 12 d at 24°), 2-3 leaves
10.4 Inoculation method	spray on dry leaves
10.7 Final observations	14 days after inoculation
11. Observations	
11.1 Method	visual inspection of abaxial side of inoculated leaves
11.2 Observation scale	Symptom: velvety, white spots
11.3 Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
11.4 Off-types	excessively high humidity may cause rugged
.....	brown spots on all leaves

12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	symptoms
present	[9]	no symptoms

13. Critical control points:

Ff spores have a variable size and morphology. Small spores are also viable.
Fungal plates will gradually become sterile after 6-10 weeks. Store good culture at -80°C.
For practical purposes, it is not possible to keep plants longer than 14 days inside a tent.

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Ad. 27: Resistance to Tomato mosaic virus (ToMV)

1. Pathogen	Tomato mosaic virus
3. Host species	*Solanum lycopersicum*
4. Source of inoculum	Naktuinbouw[11] (NL) or GEVES[12] (F)
5. Isolate	Strain 0 (e.g. isolate INRA Avignon 6-5-1-1) 1 and 2
6. Establishment isolate identity	genetically defined tomato standards
.....	Mobaci (Tm1), Moperou (Tm2), Momor ($Tm2^2$)
7. Establishment pathogenicity	on susceptible plant
8. Multiplication inoculum	
8.1 Multiplication medium	living plant
8.2 Multiplication variety	e.g. Moneymaker, Marmande
8.7 Check of harvested inoculum	option: on *Nicotiana tabacum* "Xanthi",
.....	check lesions after 2 days
8.8 Shelf life/viability inoculum	fresh>1 day, desiccated>1year
9. Format of the test	
9.1 Number of plants per genotype	at least 20
9.2 Number of replicates……	Not applicable
9.3 Control varieties	
Susceptible	(Solanum lycopersicum) Marmande, Monalbo
Resistant for ToMV: 0 and 2	(Solanum lycopersicum) Mobaci
Resistant for ToMV: 0 and 1	(Solanum lycopersicum) Moperou
Resistant with necrosis	(Solanum lycopersicum) "Monalbo x Momor"
Resistant	(Solanum lycopersicum) Gourmet
9.4 Test design	blank treatment with PBS and carborundum or similar buffer
9.5 Test facility	Glasshouse or climate room
9.6 Temperature	24 to 26°C
9.7 Light	12 hours or longer
9.8 Season	symptoms are more pronounced in summer
10. Inoculation	
10.1 Preparation inoculum	1 g leaf with symptoms with 10 ml PBS or similar buffer
.....	Homogenize, add carborundum to buffer (1 g/30ml)
10.3 Plant stage at inoculation	cotyledons or 2 leaves
10.4 Inoculation method	gentle rubbing
10.7 Final observations	11-21 days after inoculation
11. Observations	
11.1 Method	visual
11.2 Observation scale	Symptoms of susceptibility:
.....	Mosaic in top, leaf malformation
.....	Symptoms of resistance (based on hypersensitivity):
.....	Local Necrosis, Top necrosis, Systemic Necrosis
11.3 Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls

Remark: in some heterozygous varieties a variable proportion of plants may have severe systemic necrosis or some necrotic spots while the other plants have no symptoms. This proportion may vary between experiments

12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	symptoms of susceptibility
present	[9]	no symptoms, or symptoms of hypersensitive resistance

13. Critical control points:

Temperature and light may influence the development of necrosis. More light means more necrosis. At temperatures above 26°C the resistance may break down.

Resistant heterozygous varieties may have symptomless plants and plants with severe necrosis; in spite of apparent segregation the sample may be evaluated as uniform for resistance

Remark ..... Strain INRA Avignon 6-5-1-1 is recommended for ToMV: 0. This strain causes a striking yellow Aucuba mosaic

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Ad. 28: Resistance to *Pyrenochaeta lycopersici* (Pl)

1. Pathogen	*Pyrenochaeta lycopersici*
3. Host species	*Solanum lycopersicum*
4. Source of inoculum.....	-
5. Isolate	-
7. Establishment pathogenicity.....	biotest
8. Multiplication inoculum	
8.1 Multiplication medium	V8 Agar
8.2 Multiplication variety	susceptible tomato variety
8.3 Plant stage at inoculation	seed
8.4 Inoculation medium.....	mixture of soil, e.g. (70%), sand (20%) and inoculum (10.1) (10%)
.....	or soil mixed with diseased roots cut to small pieces
8.5 Inoculation method	sowing, or transplanting at fruit maturity
8.6 Harvest of inoculum.....	diseased roots are harvested after 2-4 months
8.7 Check of harvested inoculum	visual inspection of lesions on roots
8.8 Shelf-life/viability inoculum	the fungus will not die quickly, but may lose its pathogenicity within a week after isolation on an agar medium
9. Format of the test	
9.1 Number of plants per genotype	20
9.2 Number of replicates……	Not applicable
9.3 Control varieties.....	
susceptible:.....	Zeralto and (Solanum lycopersicum) Montfavet H 63.5
resistant:	Emperador and (Solanum lycopersicum) Kyndia, Moboglan,
.....	Pyrella
9.5 Test facility.....	greenhouse or climate cell
9.6 Temperature	day 24°C, night 14°C
9.7 Light.....	12 h minimum
10. Inoculation	
10.1 Preparation inoculum.....	e.g. double-autoclaved mixture of soil with 10% oatmeal added
.....	e.g. Incubate for 10-14 d at 20°C with occasional, repeated turning
10.3 Plant stage at inoculation	6 weeks
10.4 Inoculation method	transplanting into mixture of soil, sand and inoculum (8.4)
.....	or soil mixed with diseased roots cut to small pieces
.....	or naturally infected soil
10.7 Final observations	6-8 weeks after transplanting (flowering plant)
11. Observations	
11.1 Method.....	visual
11.2 Observation scale.....	Symptoms: brown lesions on roots
11.3 Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls

12. Interpretation of data in terms of UPOV characteristic states

` absent	[1]	symptoms
present	[9]	no symptoms

13. Critical control points:

The fungus loses its pathogenicity quickly after isolation on an agar medium. It is advisable to keep the isolate alive on living plants.

Ad. 29: Resistance to *Stemphylium* spp. (Ss)

1. Pathogen *Stemphylium* spp. e.g. *Stemphylium solani* (see note below)
3. Host species ..... *Solanum lycopersicum*
4. Source of inoculum..... GEVES (Fr)
5. Isolate ..... -
7. Establishment pathogenicity..... biotest
8. Multiplication inoculum
8.1 Multiplication medium ..... PDA (12 hours per day under near-ultraviolet light
..... to induce sporulation) or V8
9. Format of the test
9.1 Number of plants per genotype ..... 20 at least
9.2 Number of replicates…… Not applicable
9.3 Control varieties.....
Susceptible: ..... Big Power and (Solanum lycopersicum) Monalbo
Resistant:..... Body and (Solanum lycopersicum) Motelle, F1 Motelle x Monalbo
9.5 Test facility..... greenhouse or climate cell
9.6 Temperature ..... 24°C
9.7 Light ..... 12 hours minimum
9.9 Special measures ..... incubation in tunnel with 100 % relative humidity or humidity tent closed 5 days after inoculation, after this, 80% until end
10. Inoculation
10.1 Preparation inoculum..... sporulating plates (8.1) are scraped and air-dried overnight
..... The next day plates are soaked and strirred for 30 min
..... in a beaker with demineralized water, or sporulating plates are scraped with water with Tween
..... The spore suspension is sieved through a double layer of muslin.
10.2 Quantification inoculum ..... $5.10^3 – 10^5$ spores per ml
10.3 Plant stage at inoculation ..... 20-22 days (three expanded leaves)
10.4 Inoculation method ..... spraying
10.7 Final observations ..... 4 -10days after inoculation
11. Observations
11.1 Method..... visual
11.2 Observation scale..... Symptoms:
..... necrotic lesions on cotyledons and leaves;
..... yellowing of leaves
11.3 Validation of test..... evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	symptoms (11.2)
present	[9]	no symptoms, or less than resistant standard

13. Critical control points: ..... 8.1 and 10.1

Note: Some isolates of *Stemphylium* cannot be classified easily as either *Stemphylium solani* or a related species. These *Stemphylium* isolates may still be useful for identifying resistance to *Stemphylium solani*.

Ad. 30: Resistance to Tomato yellow leaf curl virus (TYLCV)

1. Pathogen	Tomato yellow leaf curl virus (see note below)
2. Quarantine status	yes
3. Host species	*Solanum lycopersicum*
4. Source of inoculum.....	-
5. Isolate	-
8. Multiplication inoculum	
8.6 Harvest of inoculum.....	symptomatic leaves may be stored at -70°C
9. Format of the test	
9.1 Number of plants per genotype	20
9.2 Number of replicates……	Not applicable
9.3 Control varieties	
Susceptible:	(Solanum lycopersicum) Montfavet H 63.5
Resistant:	(Solanum lycopersicum) TY 20, Anastasia, Mohawk
9.5 Test facility.....	field with natural disease pressure
9.9 Special measures	prevent spread of white-flies
10. Inoculation	
10.3 Plant stage at inoculation	6-12 weeks (adult plants)
10.4 Inoculation method	vector (Bemisia white-flies carrying TYLCV)
10.7 Final observations	1-2 months after inoculation
11. Observations	
11.1 Method.....	visual
11.2 Observation scale.....	Symptoms: leaf yellowing and curling
11.3 Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls

12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	severe symptoms
present	[9]	no or mild symptoms

13. Critical control points:

TYLCV is endemic in many tropical and subtropical areas and has a quarantine status in many countries with a temperate climate. TYLCV is on the EPPO alert list. Some TYLCV resistant varieties may be susceptible to the closely related virus Tomato yellow leaf curl Sardinia virus (TYLCSV).

Ad. 31: Resistance to Tomato spotted wilt virus (TSWV)

1. Pathogen	Tomato spotted wilt virus (see note below)
2. Quarantine status	yes (see note below)
3. Host species	*Solanum lycopersicum*
4. Source of inoculum	Naktuinbouw [13] (NL), GEVES (FR)
5. Isolate	race 0, preferably a thrips-transmission deficient variant
7. Establishment pathogenicity	biotest
8. Multiplication inoculum	
6 Harvest of inoculum	symptomatic leaves may be stored at -70°C
9. Format of the test	
9.1 Number of plants per genotype	20
9.2 Number of replicates……	Not applicable
9.3 Control varieties	
Susceptible:	Big Power and (Solanum lycopersicum) Monalbo, Momor,
.....	Montfavet H 63.5
Resistant:	Enpower and (Solanum lycopersicum) Tsunami, Bodar, Mospomor,
.....	Lisboa
9.5 Test facility	glasshouse or climatic chamber
9.6 Temperature	20°C
9.7 Light	12 hours or longer
9.9 Special measures	prevent or combat thrips
10. Inoculation	
10.1 Preparation inoculum	press symptomatic leaves in ice-cold buffer
.....	0,01 M PBS, pH 7.4, with 0,01 M sodium sulfite or similar buffer
.....	Option: sieve the leaf sap through double muslin
10.3 Plant stage at inoculation	one or two expanded leaves
10.4 Inoculation method	mechanical, rubbing with carborundum on cotyledons, inoculum suspension < 10° C
10.7 Final observations	7-21 days after inoculation
11. Observations	
11.1 Method	visual
11.2 Observation scale	Symptoms: top mosaic, bronzing, various malformations, necrosis
11.3 Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls

12. Interpretation of data in terms of UPOV characteristic states

absent	[1]	symptoms
present	[9]	no symptoms

13. Critical control points:

TSWV has a quarantine status in some countries. TSWV is transmitted by *Thrips tabac*i and Western flower thrips (*Frankliniella occidentalis*). Pathotype 0 is defined by its inability to break resistance in tomato varieties carrying the resistance gene Sw-5.

[13] Naktuinbouw: resistentie@naktuinbouw.nl

Ad. 32: Resistance to *Oidium neolycopersici* (On)

1. Pathogen *Oidium neolycopersici* (Powdery mildew)
3. Host species ..... *Solanum lycopersicum*
4. Source of inoculum..... -
5. Isolate see remark under 13
7. Establishment pathogenicity..... biotest
8. Multiplication inoculum
8.1 Multiplication medium ..... plant
8.3 Plant stage at inoculation ..... 24°C during the day; 18°C during the night
8.4 Inoculation medium..... water
8.5 Inoculation method ..... see 10.4
8.6 Harvest of inoculum..... by washing off
8.7 Check of harvested inoculum ..... check for contaminants under microscope
8.8 Shelf-life/viability inoculum ..... 1-2 hours
9. Format of the test
9.1 Number of plants per genotype 20
9.2 Number of replicates…… Not applicable
9.3 Control varieties.....
Susceptible: ..... (Solanum lycopersicum) Momor, Montfavet H 63.5
Resistant tomato: ..... Multifort and (Solanum lycopersicum) Atlanta, Romiro, PI-247087
9.5 Test facility..... glasshouse
9.6 Temperature ..... 20°C or 18/24°C
9.7 Light..... 12 hours
10. Inoculation
10.1 Preparation inoculum..... collect spores in water
10.2 Quantification inoculum ..... 10^4 conidia/ml
10.3 Plant stage at inoculation ..... 3 weeks
10.4 Inoculation method ..... by spraying on leaves or dredging of leaves
10.7 Final observations ..... 7-18 days after inoculation
11. Observations
11.1 Method..... visual
11.2 Observation scale..... 0. no sporulation
..... 1. necrotic points and sometimes locally restricted sporulation
..... 2. moderate sporulation
..... 3. abundant sporulation
11.3 Validation of test..... evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
12. Interpretation of data in terms of UPOV characteristic states

Absent	....	[1]	Moderate or abundant sporulation
Present	..	[9]	No or restricted sporulation

13. Critical control points:
Resistance-breaking isolates should be avoided. Resistance to O. neolycopersici is usually race-specific. However, as long as a differential series of tomato genotypes with well defined resistances is lacking, it will remain hard to conclude that different races of O. neolycopersici exist.

9. Literature

Arens P., Mansilla C., Deinum D., Cavellini L., Moretti A., Rolland S., van der Schoot H., Calvache D., Ponz F., Collonnier C., Mathis R., Smilde D., Caranta C,; Vosman B., 2010. Development and evaluation of robust molecular markers linked to disease resistance in tomato for distinctness, uniformity and stability testing. Theoretical and applied genetics. 120(3): 655-64

Kjellberg, L., 1973: Sortundersökningar av tomat enligt UPOV, Swedish University of Agricultural Sciences, Research Information Centre, Alnarp Trädgaard 162, SE.

Laterrot, H., 1990: Situation de la lutte génétique contre les parasites de la Tomate dans les pays méditerranéens, P.H.M. Revue Horticole, No. 303, January 1990.

Laterrot, H., 1982: L'argenture de la Tomate, P.H.M. Revue Horticole, No. 225, March 1982.

http://www.worldseed.org/isf/pathogen_coding_3.html (International Seed Federation (ISF), Trade Issues, Phytosanitary Matters, Pathogen coding, Strain Denomination, Differential sets)

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	*Solanum lycopersicum* L. x *Solanum habroichaites* S. Knapp & D.M. Spooner
1.2 Common name	Tomato rootstocks

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 Method of propagating the variety

4.1.1 Seed-propagated varieties

(a) Self-pollination [ ]
(b) Cross-pollination
(i) population [ ]
(ii) synthetic variety [ ]
(c) Hybrid [ ]
(d) Other [ ]
(please provide details)

4.1.2 Vegetative propagation

(a) cuttings [ ]

(b) *in vitro* propagation [ ]

(c) other (state method) [ ]

[#] 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 (13)	**Fruit: shape in longitudinal section**		
	flattened	He-Wolf	1[ ]
	oblate	Gladiator	2[ ]
	circular	Maxifort	3[ ]
5.2 (14)	**Fruit: number of locules**		
	only two	Maxifort	1[ ]
	two and three		2[ ]
5.3 (15)	**Fruit: green shoulder**		
	absent		1[ ]
	present	Maxifort	9[ ]
5.4 (19)	**Fruit: color at maturity**		
	green	Big Force	1[ ]
	yellowish	Vigomax	2[ ]
	orangish	Titron	3[ ]
	reddish	Brigeor	4[ ]
5.5 (22)	**Resistance to *Meloidogyne incognita***		
	susceptible	Bruce	1[ ]
	moderately resistant		2[ ]
	highly resistant	Emperador	3[ ]
5.6 (23)	**Resistance to *Verticillium* sp. (VA and VD) - Race 0**		
	absent		1[ ]
	present	Big Power	9[ ]

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

	Characteristics	Example Varieties	Note
5.7 (24)	**Resistance to *Fusarium oxysporum* f.sp*. Lycopersici* (FOL)**		
5.8 (24.1)	**Race 0 (ex 1)**		
	absent		1[ ]
	present	Emperador	9[ ]
5.9 (24.2)	**Race 1 (ex 2)**		
	absent		1[ ]
	present	Emperador	9[ ]
5.10 (24.3)	**Race 2 (ex 3)**		
	absent	Emperador	1[ ]
	present	Colosus	9[ ]
5.11 (25)	**Resistance to *Fusarium oxysporum* f.sp.*radicis- lycopersici* (Forl)**		
	absent	Kemerit	1[ ]
	present	Emperador	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
He-Wolf	Fruit: shape in longitudinal section	slightly flattened	circular

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

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to (b) is yes, please attach a copy of the authorization.

[#] Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

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

9. Information on plant material to be examined or submitted for examination.

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

(a)	Microorganisms (e.g. virus, bacteria, phytoplasma)	Yes [ ]	No [ ]
(b)	Chemical treatment (e.g. growth retardant, pesticide)	Yes [ ]	No [ ]
(c)	Tissue culture	Yes [ ]	No [ ]
(d)	Other factors	Yes [ ]	No [ ]

Please provide details for where you have indicated “yes”.

……

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

Applicant’s name

Signature Date

[End of document]