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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

GUIDELINES**FOR THE CONDUCT OF TESTS****FOR DISTINCTNESS, UNIFORMITY AND STABILITY**

prepared by an expert from the Netherlands

to be considered by the

*Enlarged Editorial Committee at its meeting
to be held in Geneva, on January 11 and 12, 2012*

*Alternative Names:**

<i>Botanical name</i>	<i>English</i>	<i>French</i>	<i>German</i>	<i>Spanish</i>
<i>Solanum lycopersicum</i> L. x, <i>Solanum habroichaites</i> S. Knapp & D.M. Spooner, <i>Solanum lycopersicum</i> x <i>Solanum peruvianum</i> , <i>Solanum lycopersicum</i> x <i>Solanum chesmanii</i>	Tomato rootstocks belonging to <i>Solanum lycopersicum</i> x <i>Solanum habroichaites</i>	Porte-greffe de tomate appartenant à <i>Solanum lycopersicum</i> x <i>Solanum habroichaites</i>	Tomate Unterlagen gehörend zu <i>Solanum lycopersicum</i> x <i>Solanum habroichaites</i>	Portainjertos de tomate pertenecientes a <i>Solanum lycopersicum</i> x <i>Solanum habroichaites</i>

* 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.]

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.

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1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Solanum lycopersicum* L. x, *Solanum habrochaites* 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.)). 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/44/10.

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
- b) vegetatively propagated varieties: 25 plants plus the number required for disease resistance tests.

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. For disease resistance testing, additional plant material may be requested.

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 The assessment of uniformity should be according to the recommendations for cross-pollinated varieties in the General Introduction.

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) Sensitivity to 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	Pflanze: 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 (between 1st and 4th inflorescence)	Tige : longueur de l'entre-nœud (entre la 1^{re} et la 4^e inflorescence)	Stengel: Internodienlänge (zwischen dem 1. und dem 4. Blütenstand)	Tallo: longitud del entrenudo (entre la 1^a y 4^a inflorescencia)		
QN	(a) short	court	kurz	corta	Big Force	3
	medium	moyen	mittel	media	Maxifort	5
	long	long	lang	larga	Beaufort	7
5. VG/ MG (*)	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

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
6. VG/ (*) MG	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
7. VG (+)	Leaf: size of leaflets (in middle of leaf)	Feuille : taille des folioles (au centre de la feuille)	Blatt: Größe der Blattfiedern (in der Blattmitte)	Hoja: tamaño de los folíolos (en el medio de la hoja)		
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 (as for 7)	Feuille : brillance (comme pour 7)	Blatt: Glanz (wie unter 7)	Hoja: brillo (como para 7)		
QN (a)	weak	faible	gering	débil		3
	medium	moyenne	mittel	medio	Titron	5
	strong	forte	stark	fuerte		7
10. VG	Leaf: blistering (as for 7)	Feuille : cloqure (comme pour 7)	Blatt: Blasigkeit (wie unter 7)	Hoja: abullonado (como para 7)		
QN (a)	weak	faible	gering	débil		3
	medium	moyenne	mittel	medio	Emperador	5
	strong	forte	stark	fuerte		7

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota	
11.	VG/ MS (+)	Pedicel: length (from abscission layer to calyx)	Pédoncule : longueur (du point d'abscission au calice)	Blütenstandstiel: Länge (von der Bruchstelle bis zum Kelch)	Pedúnculo: longitud (desde la zona de abscisión hasta el cáliz)		
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
13.	VG (* (+)	Fruit: shape in longitudinal section	Fruit : forme en section longitudinale	Frucht: Form im Längsschnitt	Fruto: forma en sección longitudinal		
PQ	(b)	flattened	aplatie	abgeflacht	aplanada	He-Wolf	1
		slightly flattened	légèrement aplatie	leicht abgeflacht	ligeramente aplanada	Gladiator	2
		circular	arrondie	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 or three	deux ou trois	zwei oder drei	dos o tres		2
15.	VG (* (+)	Fruit: green shoulder (before maturity)	Fruit : collet vert (avant maturité)	Frucht: Flammung (vor der Reife)	Fruto: hombro verde (antes de la madurez)		
QL	(c)	absent	absent	fehlend	ausente		1
		present	présent	vorhanden	presente	Maxifort	9
16.	VG (* (+)	Fruit: extent of green shoulder (before maturity)	Fruit : taille du collet vert (comme pour 34)	Frucht: Größe der Flammung (wie unter 34)	Fruto: tamaño del hombro verde (como para 34)		
QN	(c)	small	petit	klein	pequeño	Big Force	3
		medium	moyen	mittel	medio		5
		large	grand	groß	grande	He-man	7

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
17. VG (*)	Fruit: intensity of green color of shoulder (before maturity)	Fruit : intensité de la couleur verte du collet (comme pour 34)	Frucht: Intensität der Grünfärbung der Flammung (wie unter 34)	Fruto: intensidad del color verde del hombro (como para 34)		
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 (before maturity)	Fruit : netteté des stries méridiennes (avant maturité)	Frucht: Ausprägung des Mittelstreifens (vor der Reife)	Fruto: visibilidad de las franjas meridianas (antes de la madurez)		
QN	weak	faible	schwach	débil	Popeye	3
	medium	moyenne	mittel	media	Body	5
	strong	forte	stark	fuerte	Vigomax	7
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	rougeâtre	rötlich	rojizo	Brigeor	4
20. MG	Time of flowering	Époque de la floraison	Zeitpunkt der Blüte	Época de floración		
QN	early	précoce	früh	precoz	He-Man	3
	medium	moyenne	mittel	media	Body	5
	late	tardive	spät	tardía	Popeye	7
21. VG (*) (+)	Sensitivity to autonecrosis	Sensibilité à l'autonécrose	Empfindlichkeit gegen Autonekrose	Sensibilidad a la autonecrosis		
QL	insensitive	insensible	fehlend	insensible	Maxifort	1
	moderately sensitive	modérément sensible	moderat empfindlich	moderadamente sensible	Beaufort	2
	very sensitive	très sensible	sehr empfindlich	muy sensible	Body	3

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
22. (*)(+)	VG Resistance to <i>Meloidogyne incognita</i>	Résistance à <i>Meloidogyne incognita</i>	Resistenz gegen <i>Meloidogyne incognita</i>	Resistencia a <i>Meloidogyne incognita</i>		
QL	absent	absente	fehlend	ausente	Bruce	1
	intermediate	moyenne	mittel	intermedia		2
	present	présente	vorhanden	presente	Emperador	3
23. (*)(+)	VG Resistance to <i>Verticillium sp.</i> – Race 0	Résistance à <i>Verticillium sp.</i> – Pathotype 0	Resistenz gegen <i>Verticillium sp.</i> – Pathotyp 0	Resistencia a <i>Verticillium sp.</i> – Raza 0		
QL	absent	absente	fehlend	ausente		1
	present	présente	vorhanden	presente	Big Power	9
24. (+)	Resistance to <i>Fusarium oxysporum f. sp. lycopersici</i>	Résistance à <i>Fusarium oxysporum f. sp. lycopersici</i>	Resistenz gegen <i>Fusarium oxysporum f. sp. lycopersici</i>	Resistencia a <i>Fusarium oxysporum f. sp. lycopersici</i>		
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 <i>Fusarium oxysporum f. sp. radicis-lycopersici</i>	Résistance à <i>Fusarium oxysporum f. sp. radicis-lycopersici</i>	Resistenz gegen <i>Fusarium oxysporum f. sp. radicis-lycopersici</i>	Resistencia a <i>Fusarium oxysporum f. sp. radicis-lycopersici</i>		
QL	absent	absente	fehlend	ausente	Kemerit	1
	present	présente	vorhanden	presente	Emperador	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
26.	Resistance to <i>Fulvia fulva</i> (Ff) (ex <i>Cladosporium fulvum</i>)	Résistance à <i>Fulvia fulva</i> (Ff) (ex <i>Cladosporium fulvum</i>)	Resistenz gegen <i>Fulvia fulva</i> (Ff) (ex <i>Cladosporium fulvum</i>)	Resistencia a <i>Fulvia fulva</i> (Ff) (ex <i>Cladosporium fulvum</i>)		
(+)						
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
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

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
27.	Resistance to Tomato Mosaic Virus (ToMV)	Résistance au virus de la mosaïque de la tomate (ToMV)	Resistenz gegen das Tomatenmosaik- virus (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 (*) (+) <i>Pyrenochaeta lycopersici</i>	Résistance à <i>Pyrenochaeta lycopersici</i>	Resistenz gegen <i>Pyrenochaeta lycopersici</i>	Resistencia a <i>Pyrenochaeta lycopersici</i>		
QL	absent	absente	fehlend	ausente	Zaralto	1
	present	présente	vorhanden	presente	Emperador	9
29.	VG Resistance to (+) <i>Stemphylium</i> spp.	Résistance à <i>Stemphylium</i> spp.	Resistenz gegen <i>Stemphylium</i> spp.	Resistencia a <i>Stemphylium</i> 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 virus des feuilles jaunes en cuillère (TYLCV)	Resistenz gegen gelbes Tomatenblattroll- virus (TYLCV)	Resistencia al 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 virus de la tache bronzée de la tomate (TSWV)	Resistenz gegen das gefleckte Tomaten- welkevirus (TSWV)	Resistencia al virus del bronceado del tomate (TSWV)		
(+)						
QL	absent	absente	fehlend	ausente	Big Power	1
	present	présente	vorhanden	presente	Enpower	9
32. VG	Resistance to <i>Oidium</i> <i>neolycopersici</i>	Résistance à <i>Oidium</i> <i>neolycopersici</i>	Resistenz gegen <i>Oidium</i> <i>neolycopersici</i>	Resistencia a <i>Oidium</i> <i>neolycopersici</i>		
(+)						
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 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, except for varieties with Tm2 allele which is linked to anthocyanin of the stem (especially at the internode).



3
weak



5
medium



7
strong

Ad. 4: Stem: length of internode (between 1st and 4th inflorescence)

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. When this observation/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 (in middle of leaf)

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

Ad. 11: Pedicel: length (from abscission layer to calyx)



Ad. 13: Fruit: shape in longitudinal section



1
flattened



2
slightly flattened

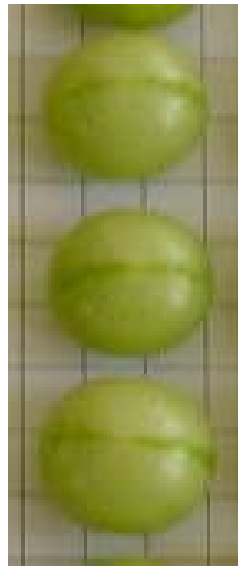


3
circular

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



3
weak



5
medium



7
strong

Ad. 21: Sensitivity to 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 Naktuinbouw¹ (NL) or GEVES² (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
 - 8.1 Multiplication medium living plant
 - 8.2 Multiplication variety Delito (resistant to powdery mildew)
 - 8.3 Plant stage at inoculation..... 10.3
 - 8.5 Inoculation method..... 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
 - 9.3 Control varieties
Absent (Susceptible): Bruce and (*Solanum lycopersicum*) Clairvil, Casaque Rouge
Intermediate :..... (*Solanum lycopersicum*) Madyta, "Anahu x Monalbo"
Present (Resistant): Emperador and (*Solanum lycopersicum*) Anabel, Anahu
 - 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

¹ Naktuinbouw; resistentie@naktuinbouw.nl

² GEVES; Valerie.GRIMAULT@geves.fr

- mix soil and infested root pieces
- 10.2 Quantification inoculum..... soil: root ratio = 8:1
- 10.3 Plant stage at inoculation seed
- 10.4 Inoculation method plants are sown in infested soil
- 10.7 End of test 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
..... 1-10 galls per root system may be counted
- 11.3 Validation of test 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
[1] Absent; growth strongly reduced, high gall count
[2] Intermediate; medium growth reduction, medium gall count
[3] Present; no growth reduction, no galls
13. Critical control points:
Avoid rotting of roots; high temperature causes breakdown of resistance

Literature references

Laterrot, H., 1973: Sélection de variétés de Tomate résistantes aux Meloidogyne, OEPP/EPPO Bulletin 3(1): 89.92.

Ad. 23: Resistance to *Verticillium* sp.

1. Pathogen *Verticillium dahliae* or *Verticillium albo-atrum* (see note below)
3. Host species..... *Solanum lycopersicum*
4. Source of inoculum Naktuinbouw³(NL) and GEVES⁴ (F)
5. Isolate Race 0
8. Multiplication inoculum
- 8.1 Multiplication medium..... Potato Dextrose Agar, Medium "S" of Messiaen
- 8.4 Inoculation medium..... Czapek Dox broth, 20-25°C, in darkness
- 8.6 Harvest of inoculum 3-7 d-old aerated culture
..... filter through double muslin cloth
- 8.7 Check of harvested inoculum... spore count; adjust to 10⁶ per ml
- 8.8 Shelf life/viability inoculum..... 1 d at 4°C
9. Format of the test
- 9.1 Number of plants per genotype 35 seed for 24 plants
- 9.3 Control varieties
- Susceptible (*Solanum lycopersicum*) Marmande, Flix, Planet
- Resistant Big Power and (*Solanum lycopersicum*) Monalbo, Elias
- 9.4 Test design..... 22 plants inoculated, 2 blanks

³ Naktuinbouw; resistentie@naktuinbouw.nl

⁴ GEVES; Valerie.GRIMAULT@geves.fr

- 9.5 Test facility..... greenhouse or climate room
9.6 Temperature 25°C for germination, 20-22°C after inoculation
9.7 Light 16 h or longer
10. Inoculation
10.1 Preparation inoculum aerated, liquid culture (8.4)
10.2 Quantification inoculum..... 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.
10.5 First observation 14 d after inoculation
10.6 Second observation 21 d after inoculation
10.7 End of test..... 21-33 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 compare
12. Interpretation of data in terms of UPOV characteristic states
[1] severe symptoms
[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 than 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 a relatively weak resistance 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.

Literature references Denby, L. G., Wooliams, G. E., 1962: The Development of Verticillium Resistant Strains of Established Tomato Varieties, Canadian Journal Plant Science 42,681-685.

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

- | | |
|--|--|
| 1. Pathogen | <i>Fusarium oxysporum</i> f. sp. <i>lycopersici</i> |
| 3. Host species..... | <i>Solanum lycopersicum</i> |
| 4. Source of inoculum | Naktuinbouw ⁵ (NL) and GEVES ⁶ (F) |
| 5. Isolate | Race 0 (ex 1), 1 (ex 2) and 2 (ex 3) |
| | Individual strains may vary in pathogenicity |
| | Long term storage:-80°C in 20% glycerol |
| 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..... | Czapek-Dox culture |
| 8.5 Inoculation method..... | immersion of roots in spore suspension, 5-15 min |
| 8.6 Harvest of inoculum | 7 d-old aerated culture |
| | 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 |
| 9.3 Control varieties for the test with <u>race 0 (ex 1)</u> | |
| Susceptible | (<i>Solanum lycopersicum</i>) Marmande, Marmande verte, |
| | Resal |
| Resistant for race 0 only..... | (<i>Solanum lycopersicum</i>) Marporum, Larissa, |
| | “Marporum x Marmande verte” |
| Resistant for race 0 and 1 | (<i>Solanum lycopersicum</i>) Motelle, Gourmet, Mohawk |
| Control varieties for the test with <u>race 1 (ex 2)</u> | |
| Susceptible | (<i>Solanum lycopersicum</i>) Marmande verte, Cherry Belle, |
| | Roma |
| Resistant for race 0 only | (<i>Solanum lycopersicum</i>) Marporum, Ranco |
| Resistant for race 0 and 1 | (<i>Solanum lycopersicum</i>) Tradiro, Odisea |
| Remark | (<i>Solanum lycopersicum</i>) Ranco is slightly less resistant
than Tradiro |
| Control varieties for the test with <u>race 2 (ex 3)</u> | |
| Susceptible for race 0, 1 and 2 | Emperador |
| Resistant for race 0, 1 and 2 | Colosus |
| 9.4 Test design..... | 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 | at least 16 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 7-10 days |
| 10.2 Quantification inoculum..... | spore count, adjust to 10 ⁶ spores per ml |

⁵ Naktuinbouw: resistantie@naktuinbouw.nl

⁶ GEVES; Valerie.GRIMAULT@geves.fr

- 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
 10.5 First observation..... 14 days after inoculation
 10.7 End of test..... 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 on standards
 12. Interpretation of data in terms of UPOV characteristic states
 [1] severe symptoms
 [9] mild or no symptoms

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 are essential to compare between labs.

Literature references

Laterrot, H., 1972: Sélection de tomates résistantes à *Fusarium oxysporum* f. sp. *lycopersici*, *Phytopathologia Mediterranea*, Volume XI, No. 3, p. 154-158.

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

1. Pathogen *Fusarium oxysporum* f. sp. *radicis-lycopersici*
 3. Host species..... *Solanum lycopersicum*
 4. Source of inoculum Naktuinbouw⁷ (NL) and GEVES⁸ (F)
 5. Isolate -
 7. Establishment pathogenicity symptoms on susceptible tomato
 Multiplication inoculum
 8.1 Multiplication medium..... Potato Dextrose Agar, Medium “S” of Messiaen
 8.4 Inoculation medium..... Czapek-Dox culture
 8.5 Inoculation method..... immersion of roots in spore suspension, 5-15 min
 8.6 Harvest of inoculum 7 d-old aerated culture
 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
 9.3 Control varieties
 Susceptible: Kemerit and (*Solanum lycopersicum*) Motelle,
 Moneymaker
 Resistant: Emperador and (*Solanum lycopersicum*) Momor,
 “Momor x Motelle”

⁷ Naktuinbouw: resistentie@naktuinbouw.nl

⁸ GEVES: Valerie.GRIMAULT@geves.fr

- Remark: “Momor x Motelle” has slightly weaker resistance than Momor
- 9.4 Test design..... 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 at least 16 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 7-10 days
- 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 min; trimming of roots is an option
- 10.5 First observation..... 14 days after inoculation
- 10.7 End of test..... 14-21 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
12. Interpretation of data in terms of UPOV characteristic states
[1] symptoms
[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

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

1. Pathogen	<i>Fulvia fulva</i> (ex <i>Cladosporium fulvum</i>)
3. Host species.....	<i>Lycopersicum esculentum</i>
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
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
9.3 Control varieties	
Susceptible:	King Kong and (<i>Solanum lycopersicum</i>) Monalbo, Money maker
Resistant for race 0:.....	Bruce and (<i>Solanum lycopersicum</i>) Angela, Estrella, Sonatine, Sonato, Vemone
Resistant for race group A:	Big Power and (<i>Solanum lycopersicum</i>) Angela, Estrella, Sonatine, Sonato
Resistant for race group B:	Bruce and (<i>Solanum lycopersicum</i>) Angela, Estrella, Sonatine, Sonato, Vemone
Resistant for race group C:	Big power and (<i>Solanum lycopersicum</i>) Angela, Estrella, Sonatine
Resistant for race group D:	Bruce and (<i>Solanum lycopersicum</i>) Estrella, Sonatine, Vemone
Resistant for race group E:	Big Power and (<i>Solanum lycopersicum</i>) Sonatine
9.4 Test design.....	2 plants per pot
9.5 Test facility.....	glasshouse or climate room
9.6 Temperature	day: 22° C, night: 20°
9.7 Light	more than 12 hours
9.9 Special measures	humidity tent closed 3 days after inoculation
.....	After this, 66% closed during day, until end
10. Inoculation	
10.1 Preparation inoculum	prepare evenly colonized plates, 1 for 36 plants; remove spores from plate by scraping 2-3 times with 1 ml
.....	demi water with 0,01% Tween20;
.....	filter through double muslin cloth
10.2 Quantification inoculum.....	count spores; adjust to 5.10 ⁵ spores per ml
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 End of test.....	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

⁹ Naktuinbouw: resistentie@naktuinbouw.nl

¹⁰ GEVES: Valerie.GRIMAULT@geves.fr

- 11.3 Validation of test on standard varieties
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
[1] symptoms
[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.

Literature references

Hubbeling, N., 1978. Breakdown of resistance to the Cf-5 gene in tomato by another new race of *Fulvia fulva*. Mededelingen van de Faculteit Landbouwwetenschappen Universiteit Gent 42/2

Laterrot, H., 1981. La lutte génétique contre la Cladosporiose de la Tomate en France, P.H.M. Revue Horticole, No. 214, February 1981.

Ad. 27: Resistance to Tomato Mosaic Virus (ToMV)

1. Pathogen Tomato mosaic virus
3. Host species..... *Lycopersicon esculentum*
4. Source of inoculum Naktuinbouw¹¹ (NL) or GEVES¹² (F)
5. Isolate Strain 0, 1 and 2
6. Establishment isolate identity..... genetically defined tomato standards
..... Mobaci (Tm1) , Moperou (Tm2), Momor (Tm2²)
7. Establishment pathogenicity on susceptible plant
8. Multiplication inoculum
8.1 Multiplication medium..... living plant
8.2 Multiplication variety Moneymaker, Marmande
8.7 Check of harvested inoculum... 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
9.3 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
9.5 Test facility..... Glasshouse or climate room
9.6 Temperature 25°C day, 23°C night
9.7 Light 16 hours

¹¹ Naktuinbouw: resistentie@naktuinbouw.nl

¹² GEVES: Valerie.GRIMAULT@geves.fr

9.8 Season..... symptoms are more pronounced in summer

10. Inoculation

10.1 Preparation inoculum 1 g leaf with symptoms with 10 ml PBS
..... Homogenize, add carborundum to PBS (1 g/30ml)

10.3 Plant stage at inoculation..... 2 leaves

10.4 Inoculation method..... gentle rubbing with sponge wetted with inoculum

10.5 First observation..... 11 days after inoculation

10.7 End of test..... 19 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

Remark: in some 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

[1] symptoms of susceptibility

[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.

Resistant 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. This Strain causes a striking yellow Aucuba mosaic

Literature references

Laterrot, H., 1973: Résistance de la Tomate au virus de la Mosaïque du Tabac. Difficultés rencontrées pour la sélection de variétés résistantes, Ann.Amelior.Plantes, 1973, 23(4), 287-313.

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

1. Pathogen	<i>Pyrenochaeta lycopersici</i>
3. Host species.....	<i>Solanum lycopersicum</i>
4. Source of inoculum	-
5. Isolate	-
7. Establishment pathogenicity	biotest
8. Multiplication inoculum	
8.1 Multiplication medium.....	V8A
8.2 Multiplication variety	susceptible tomato variety
8.3 Plant stage at inoculation.....	seed
8.4 Inoculation medium.....	mixture of soil (70%), sand (20%) and inoculum (10.1)
.....	(10%)
.....	or soil mixed with diseased roots cut to small pieces
8.5 Inoculation method.....	sowing
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 loose its pathogenicity within a week after isolation on an agar medium
9. Format of the test	
9.1 Number of plants per genotype	20
9.3 Control varieties	
susceptible:	Zaralto and (<i>Solanum lycopersicum</i>) Montfavet H 63.5
resistant:	Emperador and (<i>Solanum lycopersicum</i>) 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	double-autoclaved mixture of soil with 10% oatmeal added
.....	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
10.5 First observation	6 weeks after transplanting
10.7 End of test.....	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	on standard varieties
12. Interpretation of data in terms of	UPOV characteristic states
`	[1] symptoms
	[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.

Literature references

Laterrot, H., 1983: La lutte génétique contre la maladie des racines liégeuses de la Tomate, P.H.M. Revue Horticole, No. 238, June-July 1983.

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

1. Pathogen	<i>Stemphylium solani</i> (see note below)
3. Host species.....	<i>Solanum lycopersicum</i>
4. Source of inoculum	-
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)
9. Format of the test	
9.1 Number of plants per genotype	20
9.3 Control varieties	
Susceptible:	Big Power and (<i>Solanum lycopersicum</i>) Monalbo
Resistant:	Body and (<i>Solanum lycopersicum</i>) 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
.....	
10. Inoculation	
10.1 Preparation inoculum	sporulating plates (8.1) are scraped and air-dried overnight
.....	The next day plates are soaked and stirred for 30 min in a beaker with demineralized water.
.....	The spore suspension is sieved through a double layer of muslin.
10.2 Quantification inoculum.....	$5 \cdot 10^3 - 10^5$ spores per ml
10.3 Plant stage at inoculation.....	20-22 days (three expanded leaves)
10.4 Inoculation method.....	spraying
10.5 First observation.....	4 days after inoculation
10.6 Second observation	5 days after inoculation
10.7 End of test.....	6 days 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.....	on standard varieties
12. Interpretation of data in terms of UPOV characteristic states	

- [1] symptoms (11.2)
- [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*.

Literature references

Laterrot, H. and Blancard, D., 1983: Criblage d'une série de lignées et d'hybrides F1 de Tomate pour la résistance à la Stemphyliose, *Phytopath. medit.* 1983, 22, 188-193.

Laterrot, H. and Blancard, D., 1986: Les Stemphyliia rencontrés sur la Tomate, *Phytopath. medit.* 1986, 25, 140-144.

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
- 9.3 Control varieties
- Susceptible: local varieties
- 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 End of test 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 on standard varieties
- 12. Interpretation of data in terms of UPOV characteristic states
 - [1] severe symptoms
 - [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).\

Literature references

Barbieri, M., et al., 2010. Introgressions of resistance to two Mediterranean virus species causing tomato yellow leaf curl into a valuable traditional tomato variety. *Journal of Plant Pathology* 92(2):485-493

Garcia, S., et al., 2009. Resistance driven selection of begomoviruses associated with the TYLCV. *Virus research* 146: 66-72

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 Naktuinbouw¹³ (NL)
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
- 9.3 Control varieties
- Susceptible: Big Power and (*Solanum lycopersicum*) Monalbo
- Resistant: Enpower and (*Solanum lycopersicum*) Tsunami, Bodar,
..... Lisboa
- 9.5 Test facility glasshouse
- 9.6 Temperature 20°C
- 9.7 Light 16 hours
- 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
..... 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
- 10.5 First observation 7 days after inoculation
- 10.6 Second observation 14 days after inoculation
- 10.7 End of test 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 on standard varieties
12. Interpretation of data in terms of UPOV characteristic states
[1] symptoms
[9] no symptoms
13. Critical control points:

¹³ Naktuinbouw: resistentie@naktuinbouw.nl

TSWV has a quarantine status in some countries. TSWV is transmitted by *Thrips tabaci* 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. TSWV resistance based on Sw-5 may be detected without using the pathogen.

Literature references

Garland, S., Sharman, M., Persley, D. and McGrath, D. (2005) The development of an improved PCR-based marker system for Sw-5, an important TSWV resistance gene of tomato. Australian Journal of Agricultural Research, 56 (3): 285-289.

Gordillo, L.F. and M. R. Stevens (2008) Screening two *Lycopersicon peruvianum* collections for resistance to Tomato spotted wilt virus. Plant Disease 92(5): 694-704

Smilde, W.D. and D. Peters (2007) Pathotyping TSWV in pepper and tomato. In: Niemorowicz-Szczytt, K. (Ed.), Progress in Research on Capsicum and Eggplant, Eucarpia conference proceedings, Warsaw, pp. 231-236

Ad 32: Resistance to *Oidium neolycopersici* (OI)

1. Pathogen	<i>Oidium neolycopersici</i> (Powdery mildew)
3. Host species.....	<i>Solanum lycopersicum</i>
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
9.3 Control varieties	
Susceptible:	(<i>Solanum lycopersicum</i>) Momor
Resistant tomato:	Multifort and (<i>Solanum lycopersicum</i>) Atlanta
9.5 Test facility.....	glasshouse
9.6 Temperature	24°C during the day; 18°C during the night
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
10.5 First observation.....	7 days after inoculation
10.6 Second observation	14 days after inoculation
10.7 End of test.....	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 on standard varieties

12. Interpretation of data in terms of UPOV characteristic states

..... [1] Moderate or abundant sporulation

..... [9] No or restricted sporulation

13. Critical control points:

Resistance-breaking isolates should be avoided. Resistance to *O. neolyopersici* 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. neolyopersici* exist.

Literature references

Bai, Y. 2004. The genetics and mechanisms of resistance to tomato powdery mildew (*Oidium neolyopersici*) in *Lycopersicon* species. Thesis Wageningen University, The Netherlands.

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'argentine 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	<input type="text" value="Solanum lycopersicum L. x Solanum habroichaites S. Knapp & D.M. Spooner"/>	
1.2 Common name	<input type="text" value="Tomato rootstocks"/>	
2. Applicant		
Name	<input type="text"/>	
Address	<input type="text"/>	
Telephone No.	<input type="text"/>	
Fax No.	<input type="text"/>	
E-mail address	<input type="text"/>	
Breeder (if different from applicant)	<input type="text"/>	
3. Proposed denomination and breeder's reference		
Proposed denomination (if available)	<input type="text"/>	
Breeder's reference	<input type="text"/>	

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:
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#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) | |

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4.1.2 Vegetative propagation

- | | |
|---------------------------------|-----|
| (a) cuttings | [] |
| (b) <i>in vitro</i> propagation | [] |
| (c) other (state method) | [] |

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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:
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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 Fruit: shape in longitudinal section (13)		
flattened	He-Wolf	1[]
slightly flattened	Gladiator	2[]
circular	Maxifort	3[]
5.2 Fruit: number of locules (14)		
only two	Maxifort	1[]
two or three		2[]
5.3 Fruit: green shoulder (before maturity) (15)		
absent		1[]
present	Maxifort	9[]
5.4 Fruit: color at maturity (19)		
green	Big Force	1[]
yellowish	Vigomax	2[]
orangish	Titron	3[]
reddish	Brigeor	4[]
5.5 Resistance to <i>Meloidogyne incognita</i> (22)		
absent	Bruce	1[]
intermediate		2[]
present	Emperador	3[]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:
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Characteristics	Example Varieties	Note
5.6 Resistance to <i>Verticillium e</i> sp. - Race 0 (23)		
absent		1[]
present	Big Power	9[]
5.7 Resistance to <i>Fusarium oxysporum</i> f.sp. <i>lycopersici</i> (24)		
5.8 Race 0 (ex 1) (24.1)		
absent		1[]
present	Emperador	9[]
5.9 Race 1 (ex 2) (24.2)		
absent		1[]
present	Emperador	9[]
5.10 Race 2 (ex 3) (24.3)		
absent	Emperador	1[]
present	Colosus	9[]
5.11 Resistance to <i>Fusarium oxysporum</i> f.sp.<i>radicis- lycopersici</i> (25)		
absent	Kemerit	1[]
present	Emperador	9[]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:
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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:
<p>#7. Additional information which may help in the examination of the variety</p> <p>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?</p> <p>Yes [] No []</p> <p>(If yes, please provide details)</p> <p>7.2 Are there any special conditions for growing the variety or conducting the examination?</p> <p>Yes [] No []</p> <p>(If yes, please provide details)</p> <p>7.3 Other information</p>		
<p>8. Authorization for release</p> <p>(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?</p> <p>Yes [] No []</p> <p>(b) Has such authorization been obtained?</p> <p>Yes [] No []</p> <p>If the answer to (b) is yes, please attach a copy of the authorization.</p>		

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:
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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]