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TG/44/12(proj.3)
ORIGINAL: English
DATE: 2023-03-16

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

Geneva

DRAFT

TOMATO *

UPOV Code(s): SOLAN_LYC; SOLAN_LCH; SOLAN_LPI

Solanum lycopersicum L.;
Solanum lycopersicum L. x *Solanum cheesmaniae* (L. Ridley) Fosberg;
Solanum lycopersicum L. x *Solanum pimpinellifolium* L.

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by experts from the Netherlands
to be considered by the
Technical Working Party for Vegetables
at its fifty-seventh session, to be held in Antalya, Türkiye,
from 2023-05-01 to 2023-05-05

Disclaimer: this document does not represent UPOV policies or guidance

* 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.]

Alternative names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Solanum lycopersicum L., Lycopersicon esculentum Mill.	Cherry tomato; Tomato; tomato	Tomate; tomate; tomato cerise	Kirschtomate; Tomate	Tomate; tomate; tomatera; tomatillo
Solanum lycopersicum L. x *Solanum cheesmaniae* (L. Ridley) Fosberg				
Solanum lycopersicum L. x *Solanum pimpinellifolium* L., *Lycopersicon esculentum* Mill. x *Lycopersicon pimpinellifolium* L.				

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.

Other associated UPOV documents: TG/294/1

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1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Solanum lycopersicum* L., *Solanum lycopersicum* L. x *Solanum cheesmaniae* (L. Ridley) Fosber and *Solanum lycopersicum* L. x *Solanum pimpinellifolium* L. (including rootstocks of these species).
For tomato rootstock varieties belonging to other species TG/294 applies.

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:	2,500 seeds
(b) vegetatively propagated varieties:	25 non-grafted young plants without fruit. For disease resistance testing, additional plant material may be requested.

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

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

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

3.1.3 The testing of a variety may be concluded when the competent authority can determine with certainty the outcome of the test.

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 2 replicates.

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

3.4.3 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.

In case of vegetatively propagated varieties, when resistance characteristics are used for the assessment of Distinctness, Uniformity and Stability, records must be taken on at least 10 plants.

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 or 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 of plants 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 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 These Test Guidelines have been developed for the examination of seed-propagated and vegetatively propagated varieties. For varieties with other types of propagation, the recommendations in the General Introduction and document TGP/13 "Guidance for new types and species" Section 4.5 "Testing Uniformity" should be followed.

4.2.3 For the assessment of uniformity of self-pollinated varieties, single cross hybrids and vegetatively propagated varieties, 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) Plant: growth type (characteristic 2)
(b) Leaf: type of blade (characteristic 10)
(c) Peduncle: abscission layer (characteristic 19)
(d) Immature fruit: green shoulder (characteristic 21)
(e) Immature fruit: green stripes (characteristic 25)
(f) Immature fruit: anthocyanin coloration (characteristic 26)
(g) Fruit: size (characteristic 28)
(h) Fruit: shape in longitudinal section (characteristic 30)
(i) Fruit: number of locules (characteristic 38)
(j) Fruit: gel in locules (characteristic 39)
(k) Fruit: color (characteristic 40)
(l) Resistance to *Meloidogyne incognita* (Mi) (characteristic 45)
(m) Resistance to *Verticillium* sp. (Va and Vd) - Race 0 (characteristic 46)
(n) Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 0EU/1US (Fol: 0EU/1US) (characteristic 47)
(o) Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 1EU/2US (Fol: 1EU/2US) (characteristic 48)
(p) Resistance to *Tomato mosaic virus* - Strain 0 (ToMV: 0) (characteristic 59)
(q) Resistance to *Tomato spotted wilt virus* - Pathotype 0 (TSWV: 0) (characteristic 68)

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 All relevant states of expression are presented in the characteristic.

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

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1 2	**3 4**	**5 6**	**7**			
	Name of characteristics in English	**Nom du caractère en français**	**Name des Merkmals auf Deutsch**	**Nombre del carácter en español**		
	states of expression	types d’expression	Ausprägungsstufen	tipos de expresión		

1 Characteristic number

2 (*) Asterisked characteristic – see Chapter 6.1.2

3 Type of expression
QL Qualitative characteristic – see Chapter 6.3
QN Quantitative characteristic – see Chapter 6.3
PQ Pseudo-qualitative characteristic – see Chapter 6.3

4 Method of observation (and type of plot, if applicable)
MG, MS, VG, VS – see Chapter 4.1.5

5 (+) See Explanations on the Table of Characteristics in Chapter 8.2

6 (a)-(c) See Explanations on the Table of Characteristics in Chapter 8.1

7 Not applicable

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

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1. (*)	**QN VS**	**(+)**				
	Seed-propagated varieties only: Seedling: anthocyanin coloration of hypocotyl					
	absent				Colt, VTM215	1
	partially present					2
	totally present				Daniela, Marmande VR	3
2. (*)	**QL VG**	**(+)**				
	Plant: growth type					
	determinate				Rio Grande, Siluet	1
	indeterminate				Daniela, Florenteen, Marmande VR, Saint- Pierre	2
3. (*)	**QN MS/VG**	**(+)**				
	Only varieties with plant growth type determinate: Plant: number of inflorescences on main stem					
	very few				Cherry Falls	1
	very few to few				Monty	2
	few				Simplex	3
	few to medium					4
	medium				Miceno	5
	medium to many					6
	many				Malkonet	7
	many to very many				Grownet	8
	very many					9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
4.	**QN VG**	**(+)**				
	Stem: anthocyanin coloration					
	absent or very weak				Rebelski	1
	very weak to weak					2
	weak				Montfavet 63-5	3
	weak to medium					4
	medium				Miniprio, Philovita	5
	medium to strong					6
	strong				Grinta	7
	strong to very strong					8
	very strong				Villax	9
5.	**QN MS/VG**	**(+)**				
	Only varieties with plant growth type indeterminate: Stem: length of internode					
	very short					1
	very short to short					2
	short				Primioso	3
	short to medium					4
	medium				Campari, Montfavet 63-5	5
	medium to long					6
	long				Rebelski, Tomawak	7
	long to very long					8
	very long					9

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
6.	**(*)** **QN** **MS/VG**		**(+)**				
		Only varieties with plant growth type indeterminate: Plant: height					
		very short				Garderner's Delight, Maresme, Zadenna	1
		very short to short					2
		short				Delfine, Despina	3
		short to medium					4
		medium				Brooklyn, Campari	5
		medium to tall					6
		tall				Climberley, Pitenza	7
		tall to very tall					8
		very tall				Goldwin, Romindo	9
7.	**(*)** **QN** **VG**		**(+)** **(a)**				
		Leaf: attitude					
		erect					1
		erect to semi-erect					2
		semi-erect				Zadenna	3
		semi-erect to horizontal					4
		horizontal				Brioso, Geronimo	5
		horizontal to semi-drooping					6
		semi-drooping				Leonce, Montfavet 63-5, Upper	7
		semi-drooping to drooping					8
		drooping				Caboverde	9
8.	**QN** **MS/VG**		**(a)**				
		Leaf: length					
		very short					1
		very short to short					2
		short				Red Robin	3
		short to medium					4
		medium				Mezcal, Rio Grande	5
		medium to long					6
		long				Geronimo, Montfavet 63-5	7
		long to very long					8
		very long					9

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
9.		**QN MS/VG**	**(a)**				
		Leaf: width					
		very narrow					1
		very narrow to narrow					2
		narrow				Red Robin	3
		narrow to medium					4
		medium				Rio Grande	5
		medium to broad					6
		broad				Brioso, Saint- Pierre	7
		broad to very broad					8
		very broad					9
10.	**(*)**	**QL VG**	**(+)** **(a)**				
		Leaf: type of blade					
		pinnate				Matina	1
		bipinnate				Daniela, Saint- Pierre	2
11.		**QN VG**	**(+)** **(a)**				
		Leaf: size of leaflets					
		very small				Microtom	1
		very small to small					2
		small				Tiny Tim	3
		small to medium					4
		medium				Geronimo, Marmande VR	5
		medium to large					6
		large				Daniela	7
		large to very large					8
		very large					9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
12. (*)	**QN VG**	**(a)**				
	Leaf: intensity of green color					
	very light					1
	very light to light					2
	light				Rossol	3
	light to medium					4
	medium				Rebelski	5
	medium to dark					6
	dark				Daniela, Red Robin	7
	dark to very dark					8
	very dark					9
13.	**QN VG**	**(+) (a)**				
	Leaf: glossiness					
	very weak				Speedax	1
	very weak to weak					2
	weak				Daniela, Losna	3
	weak to medium					4
	medium				Marmande VR	5
	medium to strong					6
	strong				Albis, Dulcemiel, Lutecia	7
	strong to very strong				Wasino	8
	very strong					9
14.	**QN VG**	**(+) (a)**				
	Leaf: blistering					
	very weak					1
	very weak to weak					2
	weak				Daniela	3
	weak to medium					4
	medium				Marmande VR, Octavio, Syrio	5
	medium to strong					6
	strong				Albis, Delfine, Paronset, Red Robin	7
	strong to very strong					8
	very strong					9

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
15.		**QN VG**	**(+) (a)**				
		Leaf: attitude of petiole of leaflet in relation to main axis					
		erect				Volantis	1
		erect to semi-erect					2
		semi-erect				Geronimo, Marmande VR	3
		semi-erect to horizontal					4
		horizontal				Delisher	5
16.		**QN MG/MS**	**(+)**				
		Time of flowering					
		very early				Pyremello, Trambellino	1
		very early to early				Creativo, Tropical	2
		early				Delizia, Lemonade, Zorayda	3
		early to medium				Cindel, Goldwin, Organza	4
		medium				Delisher, Losna, Montfavet 63-5, Sonico	5
		medium to late				Orama, Soltyno	6
		late				Octydia, Raymos, Saint- Pierre, Sylvana	7
		late to very late				Nissos, Paronset	8
		very late				Atago, Brito, Wafira	9
17.		**PQ MS/VG**	**(+)**				
		Inflorescence: type					
		mainly uniparous				Geronimo, Red Robin	1
		equally uniparous and multiparous				Harzfeuer	2
		mainly multiparous				Karelya	3
		multiflora				Mini Star, Sweedor	4
18.	**(*)**	**QL VG**					
		Flower: color					
		yellow				Marmande VR, Santorange	1
		orange				Mountain Vineyard, Orama	2

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
19. (*) QL VG		**(+)**				
	Peduncle: abscission layer					
	absent				Merlice, Rio Grande	1
	present				Daniela, Grownet, Montfavet 63-5	9
20. (*) QN MS/VG		**(+)**				
	<u>Only varieties with peduncle abscission layer present</u>: Peduncle: length					
	very short					1
	very short to short					2
	short				Cerise, Ferline	3
	short to medium					4
	medium				Caboverde, Grownet	5
	medium to long					6
	long				Sir Elyan	7
	long to very long					8
	very long					9
21. (*) QL VG		**(+)**	**(b)**			
	Immature fruit: green shoulder					
	absent				Geronimo	1
	present				Daniela, Montfavet 63-5	9
22. QN VG		**(+)**	**(b)**			
	Immature fruit: extent of green shoulder					
	very small				Daniela	1
	very small to small					2
	small				Shiren, Siluet	3
	small to medium					4
	medium				Marmalindo, Montfavet 63-5, Red Robin	5
	medium to large					6
	large				Cobra, Dulcemiel	7
	large to very large					8
	very large					9

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
23.		**QN VG**	**(+) (b)**				
		Immature fruit: intensity of green color of shoulder					
		very light					1
		very light to light					2
		light				Daniela, Soltyno	3
		light to medium					4
		medium				Montfavet 63-5, Santonio, Sunita	5
		medium to dark					6
		dark				Brito, Nugget	7
		dark to very dark					8
		very dark					9
24.	**(*)**	**QN VG**	**(+) (b)**				
		Immature fruit: intensity of green color excluding shoulder					
		very light				Claree	1
		very light to light					2
		light				Daniela, Durinta, Trust	3
		light to medium					4
		medium				Sunita, Tropical	5
		medium to dark					6
		dark				Centella, Chocomate, Uragano	7
		dark to very dark					8
		very dark				Momi, Verdi	9
25.	**(*)**	**QL VG**	**(+) (b)**				
		Immature fruit: green stripes					
		absent				Daniela, Guanche, Jasminia	1
		present				Green Zebra, Tigerella	9
26.	**(*)**	**QL VG**	**(b)**				
		Immature fruit: anthocyanin coloration					
		absent				Durinta	1
		present				HN5003	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
27. (*)	**QN MG**	**(+)**				
	Time of maturity					
	very early				Goldwin, Pyremello, Sweet Baby, Trambellino	1
	very early to early				Delisher	2
	early				Lemonade, Shiren, Zorayda	3
	early to medium					4
	medium				Delizia, Losna, Sonico	5
	medium to late					6
	late				Mariana, Saneh	7
	late to very late					8
	very late				Atago, Brito, Daniela, Raymos, Wafira	9
28. (*)	**QN MS/VG**		**(c)**			
	Fruit: size					
	very small				Cerise, Sweet 100	1
	very small to small				Dolcetini, Genio	2
	small				Brioso, Tankini	3
	small to medium				Larimar, Progress	4
	medium				Mezcal, Oceano	5
	medium to large				Luminance, Rio Grande	6
	large				Carmello, Floradade	7
	large to very large				Florenteen, Grownet	8
	very large				Cupidissimo, Marsilia	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
29. (*)	**QN MS/VG**	**(+) (c)**				
	Fruit: ratio length/diameter					
	very compressed				Margold, Marmande VR	1
	very compressed to moderately compressed				Lutecia, Shourouq	2
	moderately compressed				Cupidissimo, Motto	3
	moderately compressed to medium				Kaponet, Laureen, Merlice	4
	medium				Chocostar, Mezcal, Red Robin	5
	medium to moderately elongated				Dulcini, Ibix	6
	moderately elongated				Oceano, Oribustar, Rio Grande	7
	moderately elongated to very elongated				Ibrax, Sir Elyan	8
	very elongated				Bellandine, Capriccio, Elko	9
30. (*)	**PQ VG**	**(+) (c)**				
	Fruit: shape in longitudinal section					
	flattened				Margold, Marmande VR	1
	oblate				Cartesio, Gloriette, Merlice, Montfavet 63-5	2
	circular				Cerise, Soussia	3
	oblong				Landolino, Red Sky	4
	cylindric				Hypeel 244, Sir Elyan	5
	elliptic				Obock	6
	cordate				Cuor di Bue, Cupidissimo, Laureen, Valenciano	7
	ovate				Dualrow, Soto	8
	obovate				Duquesa, Estelle, Mezcal	9
	pyriform				Oceano, Olivenza, Operino	10
	obcordate				Cuore del Ponente, Ingrid	11

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
31. (*)	**QN VG**	**(+) (c)**				
	Fruit: ribbing					
	absent or very weak				Cerise, Conchita	1
	very weak to weak					2
	weak				Baikonur, Guanche	3
	weak to medium					4
	medium				Montfavet 63-5, Shourouq	5
	medium to strong					6
	strong				Marmalindo, Marmande VR, Marsilia	7
	strong to very strong					8
	very strong				Ingrid, Marsalato	9
32.	**QN VG**	**(+) (c)**				
	Fruit: depression at peduncle end					
	absent or very weak				Mirante, Sweet Baby	1
	very weak to weak					2
	weak				Bodega, Lebron, Melody	3
	weak to medium					4
	medium				Fandango, Hibisco, Jasminia, Saint- Pierre	5
	medium to strong					6
	strong				Igido, Losna, Marmande VR	7
	strong to very strong					8
	very strong					9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
33.	**QN MS/VG**	**(+) (c)**				
	Fruit: size of peduncle scar					
	very small				Cerise, Sweet Baby	1
	very small to small					2
	small				Cherrubino, Tukami	3
	small to medium					4
	medium				Bodega, Hibisco, Montfavet 63-5	5
	medium to large					6
	large				Fandango, Gloriette, Jasminia	7
	large to very large					8
	very large				Baikonur, Ensemble, Marmande VR	9
34.	**QN MS/VG**	**(+) (c)**				
	Fruit: size of blossom scar					
	very small				Cerise, Conchita, Mirante	1
	very small to small					2
	small				Ensemble, Lilos, Montfavet 63-5	3
	small to medium					4
	medium				Pink Bisou	5
	medium to large					6
	large				Esmira, Marinda, Marmande VR, Saint- Pierre	7
	large to very large					8
	very large				Marsalato, Marsilia	9
35.	**QN VG**	**(+) (c)**				
	Fruit: shape at blossom end					
	indented				Marmande VR	1
	indented to flat				Framboo, Linnea	2
	flat				Montfavet 63-5, Realeza, Viniccio	3
	flat to pointed				Batistuta	4
	pointed				Roma VF, Talentum	5

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
36.	**QN MS/VG**	**(+) (c)**				
	Fruit: diameter of core in cross section in relation to total diameter					
	very small				Cerise	1
	very small to small					2
	small				Dolcevita, Takumi	3
	small to medium					4
	medium				Losna, Montfavet 63-5, Tastery	5
	medium to large					6
	large				Commodo, Paradigma	7
	large to very large					8
	very large				Baikonur, Marmande VR, Valenciano	9
37.	**QN VG**	**(+) (c)**				
	Fruit: thickness of pericarp					
	very thin				Cerise	1
	very thin to thin					2
	thin				Astuto, Conchita, Marmande VR	3
	thin to medium					4
	medium				Jayran, Montfavet 63-5, Refosco	5
	medium to thick					6
	thick				Losna, Reconquista	7
	thick to very thick					8
	very thick				Delibes, Floyd, Myriade, Orinade	9
38. **(*)**	**QN MS/VG**	**(+) (c)**				
	Fruit: number of locules					
	only two				Creativo, San Marzano 2, Tropical	1
	two and three				Bomfado, Orinade	2
	three and four				Durinta, Montfavet 63-5	3
	four, five or six				Rovente, Tosmar, Tradiro	4
	more than six				Bronson, Chocostar, Marmande VR	5

		English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
39.	**(*)**	**QL VG**	**(+) (c)**				
		Fruit: gel in locules					
		absent				Allflesh 1120, Nun 03560	1
		present				Daniela, Rio Grande	9
40.	**(*)**	**PQ VG**	**(+) (c)**				
		Fruit: color					
		yellowish white				Cream Sausage	1
		yellow				Babylor, Mimosa	2
		orange				Operino, Oranjestar	3
		pink				Framboo, Pink Wand, Tomimaru Muchoo	4
		red				Daniela, Ferline, Montfavet 63-5, Saint- Pierre, Umaca	5
		brown				Chocostar, Marbruni	6
		green				Green Grape, Green Zebra	7
41.		**PQ VG**	**(+) (c)**				
		Fruit: color of flesh					
		yellowish white				Cream Sausage	1
		yellow				Babylor, Mimosa	2
		orange				Operino, Oranjestar	3
		pink				Framboo, Pink Wand	4
		red				Daniela, Ferline, Montfavet 63-5, Saint- Pierre, Tomimaru Muchoo, Umaca	5
		brown				Chocostar, Marbruni	6
		green				Green Grape, Green Zebra	7
42.		**QN VG**	**(+) (c)**				
		Fruit: glossiness of skin					
		weak				Focale, Josefina, Sylvana	1
		medium				Ventero	2
		strong				Daltoma, Mecano	3

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
43.	**(*)**	**QL**	**VG**	**(+)**	**(c)**				
		Fruit: color of epidermis							
		colorless						Black Opal, Fruits, House Momotaro, Marvori	1
		yellow						Brown Berry, Daniela	2
44.	**(*)**	**QN**	**VG**	**(+)**	**(c)**				
		Fruit: firmness							
		very soft						Marmande VR	1
		very soft to soft							2
		soft						Marinda, Marsalato	3
		soft to medium							4
		medium						Rosannita, Sunita	5
		medium to firm							6
		firm						Losna, Octavio, Tradiro	7
		fim to very firm							8
		very firm						Brito, Daniela, Larimar, Lolek	9
45.		**QN**	**MS/VS**	**(+)**					
		Resistance to *Meloidogyne incognita* (Mi)							
		absent or low						Casaque Rouge	1
		medium						Campeon, Tyonic	2
		high						Anahu, Anahu x Casaque Rouge	3
46.		**QL**	**VG**	**(+)**					
		Resistance to *Verticillium* sp. (Va and Vd) - Race 0							
		absent						Marmande verte, Moneymaker	1
		present						Marmande VR, Monalbo	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
47.	**QL VG**	**(+)**				
	Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 0EU/1US (Fol: 0EU/1US)					
	absent				Marmande verte, Moneymaker	1
	present				Anabel, Marporum, Marsol	9
48.	**QL VG**	**(+)**				
	Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 1EU/2US (Fol: 1EU/2US)					
	absent				Marmande verte, Moneymaker	1
	present				Motelle	9
49.	**QL VG**	**(+)**				
	Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 2EU/3US (Fol: 2EU/3US)					
	absent				Marmande verte, Motelle	1
	present				Alliance, Ivanhoé	9
50.	**QL VG**	**(+)**				
	Resistance to *Fusarium oxysporum* f. sp. *radicis-lycopersici* (For)					
	absent				Moneymaker, Motelle	1
	present				Momor	9
51.	**QL VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Race 0					
	absent				Monalbo, Moneymaker	1
	present				Antique, Pink Treat, Retinto, Sprigel, Triatlon	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
52.	**QL VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Group A					
	absent				Monalbo, Moneymaker, Retinto	1
	present				Antique, Pink Treat, Sprigel, Triatlon	9
53.	**QL VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Group B					
	absent				Monalbo, Moneymaker, Pink Treat	1
	present				Antique, Retinto, Sprigel, Triatlon	9
54.	**QL VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Group C					
	absent				Monalbo, Moneymaker, Pink Treat, Retinto	1
	present				Antique, Sprigel, Triatlon	9
55.	**QL VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Group D					
	absent				Monalbo, Moneymaker, Triatlon	1
	present				Antique, Pink Treat, Retinto, Sprigel	9
56.	**QL VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Group E					
	absent				Monalbo, Moneymaker	1
	present				Antique, Sprigel	9
57.	**QL VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Group F					
	absent				Monalbo, Moneymaker	1
	present				Chelino, Completo	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
58.	**QL** **VG**	**(+)**				
	Resistance to *Passalora fulva* (Pf) - Group J					
	absent				Chelino, Completo	1
	present				Mogami	9
59.	**QL** **VG**	**(+)**				
	Resistance to *Tomato mosaic virus* - Strain 0 (ToMV: 0)					
	absent				Monalbo, Moneymaker	1
	present				Mobaci, Mocimor, Momor, Moperou	9
60.	**QL** **VG**	**(+)**				
	Resistance to *Tomato mosaic virus* - Strain 1 (ToMV: 1)					
	absent				Mobaci, Monalbo, Moneymaker	1
	present				Mocimor, Momor, Moperou	9
61.	**QL** **VG**	**(+)**				
	Resistance to *Tomato mosaic virus* - Strain 2 (ToMV: 2)					
	absent				Monalbo, Moneymaker, Moperou	1
	present				Mobaci, Mocimor, Momor	9
62.	**QL** **VG**	**(+)**				
	Resistance to *Phytophthora infestans* (Pi)					
	absent				Moneymaker, Saint- Pierre	1
	present				Phantasia, Sixtina	9
63.	**QL** **VG**	**(+)**				
	Resistance to *Pseudopyrenochaeta lycopersici (ex Pyrenochaeta lycopersici* (Pl)					
	absent				Marmande verte	1
	present				Garance	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
64.	**QL VG**	**(+)**				
	Resistance to *Stemphylium* spp. (Ss)					
	absent				Monalbo	1
	present				Motelle	9
65.	**QL VG**	**(+)**				
	Resistance to *Pseudomonas syringae* pv. *tomato* (Pst)					
	absent				Monalbo, Moneymaker	1
	present				Fuzzer	9
66.	**QL VG**	**(+)**				
	Resistance to *Ralstonia solanacearum* – Race 1 (Rs: 1)					
	absent				Floradel	1
	present				Caraïbo	9
67.	**QL VG**	**(+)**				
	Resistance to *Tomato yellow leaf curl virus* (TYLCV)					
	absent				Marmande, Moneymaker	1
	present				Delyca, Montenegro	9
68.	**QL VG**	**(+)**				
	Resistance to *Tomato spotted wilt virus* - Pathotype 0 (TSWV: 0)					
	absent				Moneymaker, Montfavet 63-5, Mountain Magic	1
	present				Bodar, Mospomor	9
69.	**QL VG**	**(+)**				
	Resistance to *Leveillula taurica* (Lt)					
	absent				Montfavet 63-5	1
	present				Radiance	9

	English	français	deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
70.	**QL** **VG**	**(+)**				
	Resistance to *Pseudoidium neolycopersici (ex Oidium neolycopersici)* (Pn (ex On))					
	absent				Montfavet 63-5	1
	present				Romiro	9
71.	**QL** **VG**	**(+)**				
	Resistance to *Tomato torrado virus* (ToTV)					
	absent				Daniela	1
	present				Matias	9

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

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

(a) In the case of indeterminate varieties, observations on the plant, stem and leaf should be done after a fruit set on at least five trusses and before ripening of the second truss. In the case of determinate varieties, all observations on the plant and leaves should be done after a fruit set on the second truss. Observations should be done in the middle third of the plant, before deterioration of the leaves.

(b) Observations should be made on fully developed immature fruits.

(c) Observations should be made on mature fruits from the second or higher truss, avoiding first and last mature fruit on the truss.

8.2 Explanations for individual characteristics

Ad. 1: Seed-propagated varieties only: Seedling: anthocyanin coloration of hypocotyl

Observations should be made on the hypocotyl, before development of the first leaves.

Partial presence of anthocyanin coloration of hypocotyl:
A variety (parent line) with partial presence of anthocyanin coloration of hypocotyl consists of 50% of plants without anthocyanin coloration and 50% of plants with anthocyanin coloration.
This segregation (ref. TG/1/3 and TGP/10 section 2.4) is a result of the method of propagation of the variety.
The heredity of this segregation is known, and behaves in the predicted manner.

Selfing and maintenance of a the variety (parent line):
Absence of anthocyanin on hypocotyl is recessive, only the *aa* genotypes will be without anthocyanin coloration while *Aa* and *AA* genotypes will cause presence of anthocyanin coloration of hypocotyl.
After selfing the offspring will be 50% Aa, 25% aa and 25% AA.
Absence of anthocyanin is linked with male sterility. Therefore for the maintenance of the line the cross aa x Aa is made. This results in 50% of plants without anthocyanin coloration of hypocotyl and 50% of plants with anthocyanin coloration of hypocotyl .

Ad. 2: Plant: growth type

Determinate (1):
This type produces a limited number of trusses. The number of trusses is different among varieties (Note: can be influenced by agro climatic conditions). In this type, the number of leaves or internodes between inflorescences is irregular within a plant and varies from one to three. The stem ends with an inflorescence and no lateral shoots are produced.
This type also includes some so-called “semi-determinate” varieties which do not have consistently three leaves or internodes between inflorescences, and show semi-determinate growth, for example, with the termination of the stem with the 9th inflorescence (e.g. ‘Prisca’ type) or higher than the 20th inflorescence (e.g. Early Pack type).

Indeterminate (2):
In this type, as a rule, three leaves or internodes are observed between inflorescences. After every group of three leaves, the plant produces three buds: the terminal bud is transformed into an inflorescence and one of the two lateral buds starts the prolongation of stem. Plants of this type grow with the continuous repetition of this growth pattern.
It should be noted that sometimes only two leaves or internodes might be observed between inflorescences in some parts of plants in a certain group of indeterminate variety types (e.g. varieties originating from ‘Daniela’). These varieties nevertheless are indeterminate.
This type includes ‘Marmande’ and ‘Costoluto Fiorentino’ types which might be considered to be categorized into an intermediate class between indeterminate and determinate, but they always have three leaves or internodes between inflorescences. They should therefore be categorized into the indeterminate type.

Ad. 3: Only varieties with plant growth type determinate: Plant: number of inflorescences on main stem

Remove side shoots during plant development.

Ad. 4: Stem: anthocyanin coloration

Indeterminate growth type varieties: observation should be made around flowering of 3rd or 4th truss, on the upper third of the plant.

Determinated growth type varieties: observation should be made before the main stem is ended in a truss/leaf division, on the upper third of the plant.

Ad. 5: Only varieties with plant growth type indeterminate: Stem: length of internode

Observation should be made 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 truss. When this observation/measure is divided by the number of internodes in between, an indication of the length of the internode is given.

Ad. 6: Only varieties with plant growth type indeterminate: Plant: height

Observation should be made at one time for the whole trial, e.g. 60 days after planting, or after a fruit set on approximately 5 nodes, or when the first variety in the trial has reached the wire in the green house or the top of the stake.

Ad. 7: Leaf: attitude

The attitude of the middle third part of the leaves in respect to the main stem should be observed. The line in the picture indicates the angle between the stem and leaf (middle third of leaf).

3
semi-erect

5
horizontal

7
semi-drooping

9
drooping

Ad. 10: Leaf: type of blade

Pinnate leaf: primary leaflets do not bear secondary leaflets
Bipinnate leaf: primary leaflets again are pinnate, so they bear secondary leaflets

1
pinnate

2
bipinnate

Ad. 11: Leaf: size of leaflets

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

Ad. 13: Leaf: glossiness

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

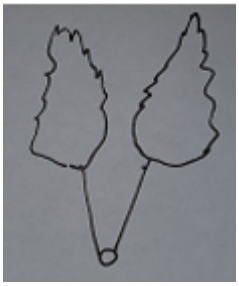
Ad. 14: Leaf: blistering

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.

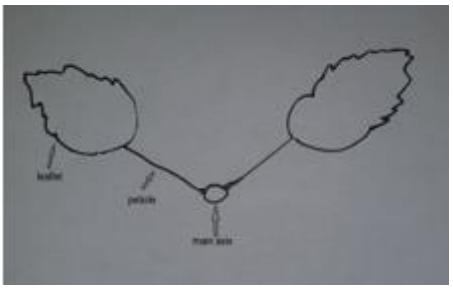
blistering

creasing

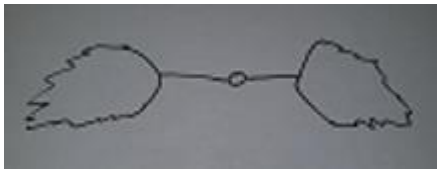
Ad. 15: Leaf: attitude of petiole of leaflet in relation to main axis



1
erect



3
semi-erect



5
horizontal

Ad. 16: Time of flowering

For staked varieties, this characteristic is assessed by observing the flowering date of the third flower on the second trusses, plant by plant. It is recommended not to record the time of flowering on the first truss, as the expression on the first truss is more influenced by the seed vigour and the plantation quality.

The date of flowering is reached when 50% of plants have the third flower on the second truss open.

For determinate non-staked varieties, it is recommended to grow them on pruned stakes on the main stem and to record the characteristics in the same way as those for 'staked varieties'. On non-staked crops, this characteristic cannot be observed easily due to the branching of the plant.

Ad. 17: Inflorescence: type

To be observed after fruit setting on the second and third trusses.
Observe the ratio of uniparous and multiparous trusses to decide for states 1, 2, 3.
State 4 is given to varieties showing multiflora inflorescences.
Pictures are for clarification of uniparous, multiparous and multiflora trusses.

(1) uniparous

(3) multiparous (biparous)

(3) multiparous (triparous)

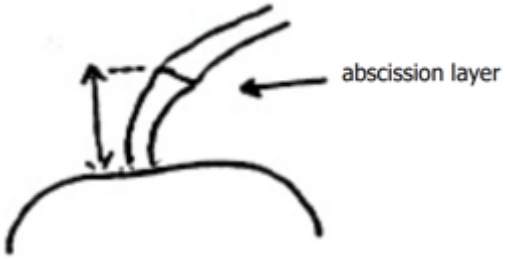
(4) multiflora

Ad. 19: Peduncle: abscission layer

1
absent

9
present

Ad. 20: Only varieties with peduncle abscission layer present: Peduncle: length



Observations should be made from the base until the abscission layer on harvested fruits.

Ad. 21: Immature fruit: green shoulder

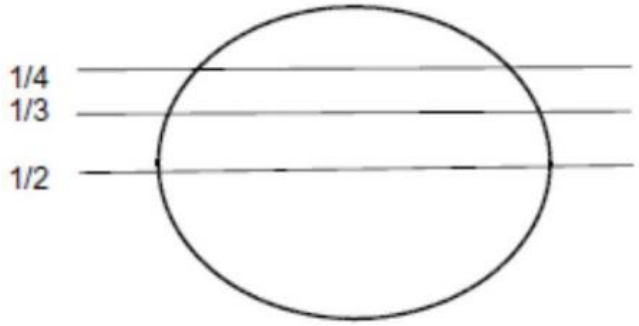
The gene for green shoulder might not be clearly expressed in some conditions, which is why it is important to have the example variety ‘Daniela’ to observe the expression of these characteristics.

1
absent

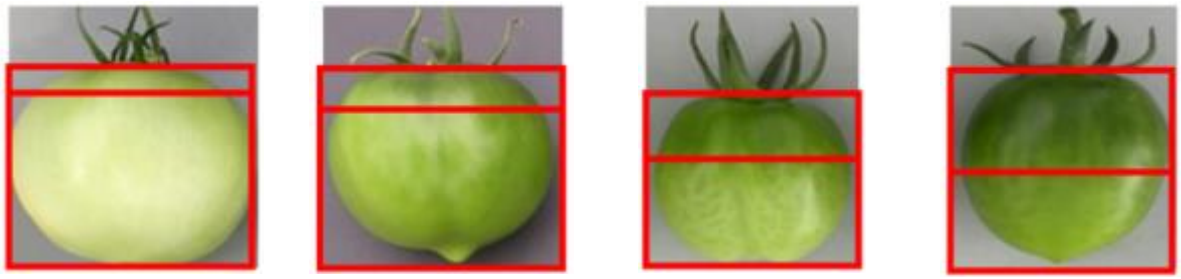
9
present

Ad. 22: Immature 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)



1
very small

3
small

5
medium

7
large

Ad. 23: Immature fruit: intensity of green color of shoulder

Intensity of green color of shoulder and intensity of green color excluding shoulder have to be observed on the same scale. This means that the note for intensity of green color of shoulder should be higher than the note for intensity of green color excluding shoulder, or in exceptional cases the same if the difference in intensity is very small. 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.

Ad. 24: Immature fruit: intensity of green color excluding shoulder

See Ad. 23

Ad. 25: Immature fruit: green stripes

1
absent

9
present

Ad. 27: Time of maturity

This characteristic is assessed by observing the date of maturity of the first fully ripe fruit on the second truss, plant by plant. It is recommended not to record the time of maturity on the first truss, as the expression on the first truss is more influenced by the seed vigor and the plantation quality.

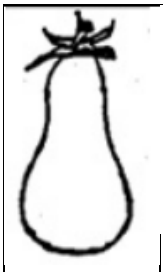
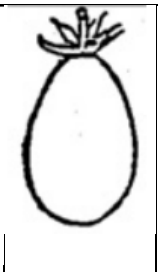
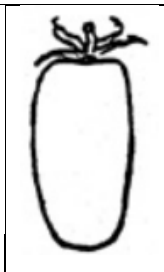
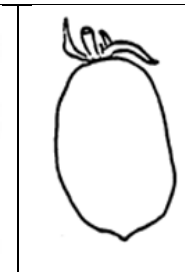
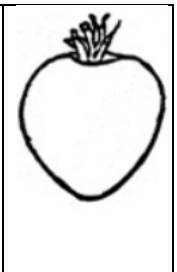
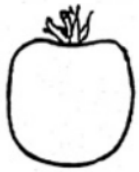
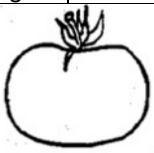
The date of maturity is recorded by the plot average, truss by truss.

Ad. 29: Fruit: ratio length/diameter

See Ad. 30

The more the fruits are compressed, the lower is the note of ratio L/D; the more the fruits are elongated, the higher is the note of ratio L/D, circular fruits have note 5 for ratio L/D.

Ad. 30: Fruit: shape in longitudinal section

	← broadest part →				
	below middle		at middle		above middle
width (ratio length/width)					
narrow (elongated)	 10 pyriform	 8 ovate	 (parallel) 5 cylindric	 (rounded) 6 elliptic	 9 obovate	 7 cordate
	 11 obcordate		 (parallel) 4 oblong	 (rounded) 3 circular		
			 2 oblate			
broad (compressed)			 1 flattened			

Ad. 31: Fruit: ribbing

Observations should be made at peduncle end after removal the peduncle and calyx. Each rib is between two grooves.

1
absent or very weak

3
weak

5
medium

7
strong

9
very strong

Ad. 32: Fruit: depression at peduncle end

1
absent or very weak

3
weak

5
medium

7
strong

Ad. 33: Fruit: size of peduncle scar

The size of the peduncle scar has to be observed as an absolute characteristic, i.e. irrespective of the size of the fruit. The peduncle should be removed and the green ring observed (not the full scar).

Ad. 34: Fruit: size of blossom scar

The size of the blossom scar has to be observed as an absolute characteristic, i.e. irrespective of the size of the fruit.

Ad. 35: Fruit: shape at blossom end

1
indented

2
indented to flat

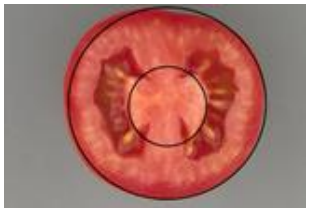
3
flat

4
flat to pointed

5
pointed

Ad. 36: Fruit: diameter of core in cross section in relation to total diameter

1
very small



3
small

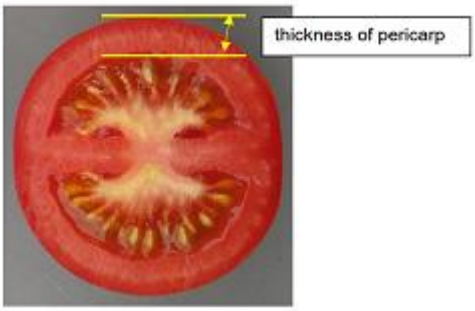
5
medium

7
large

9
very large

Ad. 37: Fruit: thickness of pericarp

The absolute thickness of the pericarp should be observed, i.e. irrespective of the size of the fruit.



Ad. 38: Fruit: number of locules

1	2	3	4	5
only two	two and three	three and four	four, five or six	more than six

Ad. 39: Fruit: gel in locules

Be aware of bad fruit set which may cause hollow fruits with lower amount of gel, also in normal fruit type.

1	9
absent	present

Ad. 40: Fruit: color

The color at maturity has to be observed after a full change of color, when placenta is found clearly in the cross section.

It should be noted that parent lines homozygous for the RIN or NOR gene do not ripen at all. In that case the fruits look green but are unripe and this characteristic is not applicable.

Ad. 41: Fruit: color of flesh

The color of flesh at maturity has to be observed at maturity.

It should be noted that parent lines homozygous for the RIN or NOR gene do not ripen at all. In that case the flesh looks green but the fruits are unripe and this characteristic is not applicable.

Ad. 42: Fruit: glossiness of skin

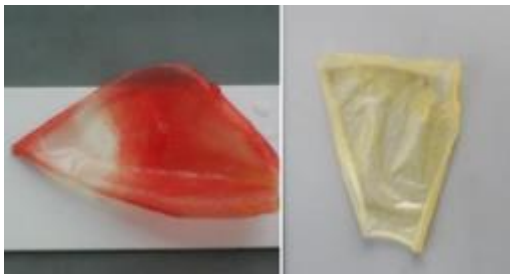
1
weak

2
medium

3
strong

Ad. 43: Fruit: color of epidermis

The color of the epidermis should be observed after the epidermis has been peeled off the fruit with a sharp knife. The fruit flesh may stick to the epidermis. The color of epidermis is visible when removing the fruit flesh by scratching it delicately.



1
colorless

2
yellow

Ad. 44: Fruit: firmness

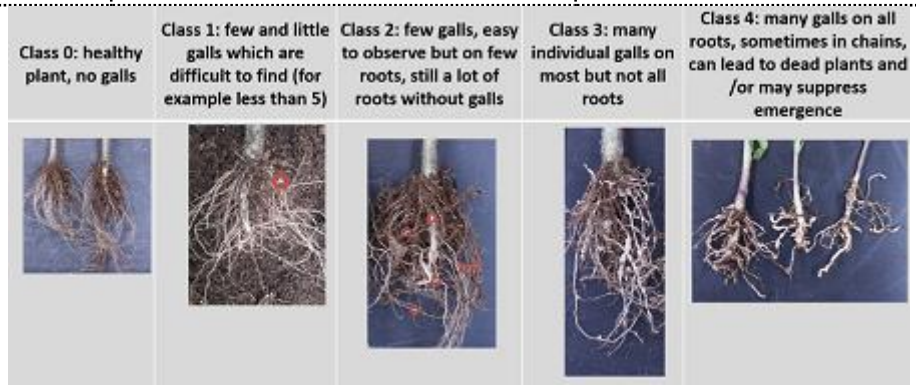
Method

Harvesting stage: fruits should be harvested when they are completely colored.

Determining firmness: determine by hand the firmness of the fruits compared to the standard varieties.

Ad. 45: Resistance to *Meloidogyne incognita* (Mi)

1.	Pathogen	*Meloidogyne incognita*
2.	Quarantine status	-
3.	Host species	Tomato - *Solanum lycopersicum*
4.	Source of inoculum	GEVES (FR)[1] or INIA - CSIC (ES)[2] or Naktuinbouw (NL)[3]
5.	Isolate	non-resistance breaking
6.	Establishment isolate identity	use tomato standards
7.	Establishment pathogenicity	use susceptible rootstock or tomato standard
8.	Multiplication inoculum	
8.1	Multiplication medium	living plant
8.2	Multiplication variety	susceptible variety, preferably resistant to powdery mildew
8.3	Plant stage at inoculation	2nd leaf stage
8.5	Inoculation method	deposit of piece of contaminated roots in soil (around 5-10g near each plant, to adapt depending of the population aggressivity)
8.6	Harvest of inoculum	6 to 10 weeks after inoculation, 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 and ripe egg masses
8.8	Shelflife/viability inoculum	1 day
9.	Format of the test	
9.1	Number of plants per genotype	30 plants, plus at least 10 non-inoculated plants to observe if a possible lack of germination is due to nematode or not It is recommended to sow more seeds to be sure to get enough plants.
9.2	Number of replicates	at least 2, preferably 3 replicates
9.3	Control varieties	ISF definitions:[4]
	Susceptible	Casaque Rouge
	Intermediate resistant (IR)	Campeon and Tyonic
	Highly resistant (HR)	Arletta, Anahu, Anahu x Casaque Rouge
9.4	Test design	3 replicates of 10 plants in different trays by variety, non-inoculated plants in a separate tray
9.5	Test facility	greenhouse or climate room
9.6	Temperature	20-26°C, the temperature must be adapted depending on the aggressivity of the test to obtain expected response of controls but should not be above 26°C. Higher temperatures will cause breakdown of resistance.
9.7	Light	at least 12 h per day
10.	Inoculation	
10.1	Preparation inoculum	small pieces of diseased roots mixed with soil
10.2	Quantification inoculum	the ratio is depending of aggressiveness of test and lab's conditions (e.g. between 30 g to 60 g of infested roots, for 100 plants in a tray of 45*30 cm containing approximately 5.5 kg of substrate), galls should be homogeneously mixed with soil.
10.3	Plant stage at inoculation	seed
10.4	Inoculation method	seeds sown in soil contaminated with galls
10.7	Final observations	28 to 45 days after inoculation depending on test conditions (temperature, season)
11.	Observations	
11.1	Method	root inspection

11.2	Observation scale	
	 The germination percentage of non-inoculated plants of the same seed lot in the same experiment should be used to calculate the number of seeds that did not produce a plant due to the presence of nematodes, and add these to plants in class 4.	
11.3	Validation of test	Validation on controls. Expected reactions of controls: Susceptible control: - most plants at classes 3 and 4, - at most 2 plants can be observed at class 2 Intermediate resistant control: - clearly different from other controls, - with majority of plants around class 2. Highly resistant control: - most plants at classes 0 and 1, - at most 2 plants can be observed at class 2
11.4	Off-types	Highly resistant varieties may have a few plants with a few galls
12.	Interpretation of data in terms of UPOV characteristic states	Resistance to *Meloidogyne incognita* (Mi): [1] absent or low: distribution of plants in the classes comparable with the susceptible controls. [2] medium: distribution of plants in the classes comparable with the intermediate resistant controls. [3] high: distribution of plants in the classes comparable with the highly resistant controls. If results are not clear, statistical analysis is advised.
13.	Critical control points	Avoid overwatering. This may result in rotting of roots. In case of aggressive test, put seeds in a layer of non-contaminated soil or decrease the quantity of inoculum.

[1] GEVES; matref@geves.fr
[2] INIA - CSIC; resistencias@inia.es
[3] Naktuinbouw; resistentie@naktuinbouw.nl
[4] ISF; https://www.worldseed.org

Ad. 46: Resistance to *Verticillium* sp. (Va and Vd) - Race 0

1.	Pathogen	*Verticillium* sp. (see note below)
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	Naktuinbouw[1] (NL) and GEVES[2] (FR)
5.	Isolate	Race 0 (e.g. isolate Toreilles 4-1-4-1)
6.	Establishment isolate identity	use differential varieties, see ISF website: https://www.worldseed.org
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 inoculum	spore count; adjust to 10^6 per ml
8.8	Shelf life/viability inoculum	1 day at 4°C
9.	Format of the test	
9.1	Number of plants per genotype	at least 20, and at least 2 non-inoculated plants
9.3	Control varieties	
	Susceptible	Flix, Marmande verte, Moneymaker, Santonio
	Resistant	Monalbo, Marmande VR, “Monalbo x Marmande verte”, Daniela, Elias
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 inoculum	aerated, liquid culture (8.4)
10.2	Quantification inoculum	count spores, adjust to 10^6 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 days after inoculation
10.7	Final observations	21 to 33 days 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 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 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.

[1] Naktuinbouw; resistentie@naktuinbouw.nl
[2] GEVES; matref@geves.fr

Ad. 47: Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 0EU/1US (Fol: 0EU/1US)

1.	Pathogen	*Fusarium oxysporum* f. sp. *lycopersici*
3.	Host species	*Solanum lycopersicum* L.
4.	Source of inoculum	GEVES[1] (FR), INIA - CSIC [2] (ES) or Naktuinbouw[3] (NL)
5.	Isolate	e.g. Reference strain validated in an interlaboratory test (*). Race 0EU/1US (e.g. isolate Orange 71 or PRI 20698 or Fol 071), race 1EU/2US (e.g. isolate 4152, PRI40698 or RAF 70) and race 2EU/3US
6.	Establishment isolate identity	use differential varieties, see ISF website: https://www.worldseed.org
7.	Establishment pathogenicity	on susceptible tomato varieties
8.	Multiplication inoculum	
8.1	Multiplication medium	Potato Dextrose Agar or Medium “S” of Messiaen or Czapek-Dox
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	see 10.2
8.8	Shelflife/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 plants plus at least 5 non-inoculated plants
9.2	Number of replicates	plants have to be divided into at least 2 replicates
9.3	Control varieties	
9.3.1	Control varieties for the test with race 0EU/1US	Susceptible: Marmande, Marmande verte, Resal, Moneymaker Resistant: Marporum, Larissa, “Marporum x Marmande verte”, Motelle, Gourmet; and Riesling as additional resistant control for medium level
9.3.2	Control varieties for the test with race 1EU/2US	Susceptible: Marmande verte, Cherry Belle, Roma, Marporum, Ranco, Moneymaker Resistant: Tradiro, Motelle, “Motelle x Marmande verte”; and Agostino as additional resistant control for medium level
9.3.3	Control varieties for the test with race 2EU/3US	Susceptible: Marmande verte, Motelle, Marporum Resistant: Alliance, Florida, Murdoch, “Marmande verte x Florida”
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
10.	Inoculation	
10.1	Preparation inoculum	3-5 days in aerated liquid cultures like PDB, Czapek Dox or S of Messiaen or scraping of plates of 10 days cultures on agar medium.
10.2	Quantification inoculum	spore count, adjust to 10^6 spores per ml, in case of very aggressive isolate inoculum concentration can be decreased
10.3	Plant stage at inoculation	10-18 d, cotyledon to first leaf
10.4	Inoculation method	plants at the inoculation stage are harvested carefully, roots and hypocotyls are immersed in spore suspension for 5-15 min; trimming of roots is an option, and transplanted in trays
10.7	Final observations	14-21 days after inoculation
11.	Observations	
11.1	Method	visual

11.2	Observation scale	

Class 0	Class 1	Class 2	Class 3
Healthy compared to the non-inoculated control.	Healthy compared to the non-inoculated control with brown vessel above the cotyledon (observed when plants are cut in case of variety with different levels of symptoms)	Higher than 50% of growth reduction and/or yellowing and/or wilting on cotyledons and/or leaves.	Nearly dead: strong reduction with plants look dwarf (there can be necrosis but not always) or dead
			
If all plants in class 0 or if all plants in classes 2 and 3, it is not necessary to cut the plants.			
In case of variety or control with different levels of symptoms, cut the plants to check presence or not of strong brown vessel above cotyledons. In case of no brown vessels or below cotyledons, the plant is note 0. In case of brown vessels above cotyledons, the plant is note 1.			

11.3	Validation of test	Validation on controls. Expected response of controls: Susceptible control: most plants in class 2 and 3, max.10% of plants class 0 and 1 Resistant control: most plants in class 0 and 1, max. 10% of plants class 2 and 3. Controls with medium level of resistance can show a higher number of plants in class 2 and 3.
12.	Interpretation of data in terms of UPOV characteristic states	[1] absent: Average symptom level higher than in the medium-resistant control [9] present: Average symptom level not different from the medium-resistant control or the high-resistant control If no clear results, statistics may be used.

[1] GEVES: matref@geves.fr
[2] INIA - CSIC: resistencias@inia.es
[3] Naktuinbouw: resistentie@naktuinbouw.nl
(*) Harmores 3 CPVO project:
https://cpvo.europa.eu/sites/default/files/documents/report_harmores_3_final_meeting_v0_0.pdf

Ad. 48: Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 1EU/2US (Fol: 1EU/2US)

See Ad. 47

Ad. 49: Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 2EU/3US (Fol: 2EU/3US)

See Ad. 47

Ad. 50: Resistance to *Fusarium oxysporum* f. sp. *radicis-lycopersici* (For)

1.	Pathogen	*Fusarium oxysporum* f. sp. *radicis-lycopersici*
2.	Quarantine status	
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	Naktuinbouw[1] (NL) and GEVES[2] (FR)
5.	Isolate	-
7.	Establishment pathogenicity	symptoms on susceptible tomato
8.	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	Shelflife/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	Motelle, Moneymaker
	Resistant	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
11.4	Off-types	
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. Isolates may lose pathogenicity after repeated subculturing. Isolates should not be subcultured more than two times.

[1] Naktuinbouw; resistentie@naktuinbouw.nl
[2] GEVES; matref@geves.fr

Ad. 51: Resistance to *Passalora fulva* (Pf) - Race 0

1.	Pathogen	*Passalora fulva*
2.	Quarantine status	-
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	Naktuinbouw[1] (NL) or GEVES[2] (FR)
5.	Isolate	Race group 0, A, B, C, D, E, F and J
6.	Establishment isolate identity	with genetically defined differentials A breaks Cf-2, B Cf-4, C Cf-2.4, D Cf-5, E Cf-2.4.5, F Cf-2.9, J Cf-2.6.9 https://www.worldseed.org
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	Shelflife/viability inoculum	4 hours, keep cool
9.	Format of the test	
9.1	Number of plants per genotype	At least 20
9.3	Control varieties	
	Susceptible	Monalbo, Moneymaker
	Resistant for race group A:	Purdue, IVT1154, IVT1149, Antique, Pink Treat, Sprigel, Triatlon
	Resistant for race group B:	Vétomold, IVT1154, IVT1149, Antique, Retinto, Sprigel, Triatlon
	Resistant for race group C:	IVT1154, IVT1149, Antique, Sprigel, Triatlon
	Resistant for race group D:	Vétomold, IVT1154, Antique, Pink Treat, Retinto, Sprigel
	Resistant for race group E:	IVT 1154, Antique, Sprigel
	Resistant for race group F:	Purdue 135, IVT1149, Ontario 7818, Chelino, Completo
	Resistant for race group J:	Purdue 135, IVT1149
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
9.8	Season	
9.9	Special measures	depending on facility and weather, there may be a need to raise the humidity, e.g. humidity tent fully closed 3-4 days after inoculation and after that partly closed (66% to 80%, 24 h per 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; when susceptible control does not show clear symptoms the test may be prolonged until for example 18 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
12.	Interpretation of data in terms of UPOV characteristic states	absent [1] symptoms present [9] no symptoms
13.	Critical control points	Pf spores have a variable size and morphology. Small spores are also viable. Fungal plates will gradually become sterile after 6-10 weeks and repeated subculturing. Do not subculture more often than strictly necessary for multiplication. Excessively high humidity may cause rugged brown spots on all leaves.

[1] Naktuinbouw; resistentie@naktuinbouw.nl
[2] GEVES; matref@geves.fr

Ad. 52: Resistance to *Passalora fulva* (Pf) - Group A

See Ad. 51

Ad. 53: Resistance to *Passalora fulva* (Pf) - Group B

See Ad. 51

Ad. 54: Resistance to *Passalora fulva* (Pf) - Group C

See Ad. 51

Ad. 55: Resistance to *Passalora fulva* (Pf) - Group D

See Ad. 51

Ad. 56: Resistance to *Passalora fulva* (Pf) - Group E

See Ad. 51

Ad. 57: Resistance to *Passalora fulva* (Pf) - Group F

See Ad. 51

Ad. 58: Resistance to Passalora fulva (Pf) - Group J

See Ad. 51

Ad. 59: Resistance to *Tomato mosaic virus* - Strain 0 (ToMV: 0)

Resistance to strain 0, 1 and 2 to be tested in a bio-assay (method i) or in a DNA marker test (method ii), if appropriate.

(i) bio-assay

1.	Pathogen	*Tomato mosaic virus*
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	Naktuinbouw[1] (NL) or GEVES[2] (FR) or INIA - CSIC [3] (ES, strain 0)
5.	Isolate	Strain 0, (e.g. isolate INRA Avignon 6-5-1-1), strain 1 and strain 2
6.	Establishment isolate identity	genetically defined tomato standards Mobaci (Tm1), Moperou (Tm2), Momor (Tm2^2) Use diffential varieties, see ISF website : https:// www.woldseed.org
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
9.3	Control varieties	
	Susceptible	Marmande, Monalbo, Moneymaker
	Resistant to ToMV: 0 and 2	Mobaci
	Resistant to ToMV: 0 and 1	Moperou
	Resistant to ToMV: 0, 1 and 2	“Monalbo x Momor” (with necrosis), Gourmet, Mocimor, Momor
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/30 ml)
10.4	Inoculation method	gentle rubbing
10.6	Second observation	cotyledons or 2 leaves
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

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[3] INIA - CSIC; resistencias@inia.es

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.

(ii) DNA marker test

Resistance to ToMV is often based on resistance gene Tm2 (allele Tm2 or Tm2^2). The presence of the allele for resistance Tm2 and Tm2^2 and/or susceptible allele tm2 can be detected by the co-dominant markers as described in Arens *et al* (2010). Two methods are available, conventional PCR and Taqman PCR. Specific aspects:

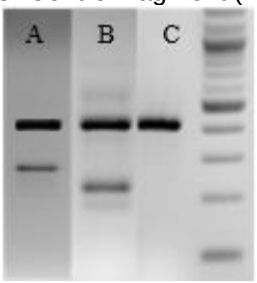
(a) Conventional PCR

1.	Pathogen	*Tomato mosaic virus*
2.	Functional gene	Tm2/2^2 (with two alleles for resistance Tm2 and Tm2^2 and one allele for susceptibility tm2)
3.	Primers	
3.1	Assay 1 to check resistant allele Tm2 or Tm2^2	Outer primer TMV-2286F: 5'GGGTATACTGGGAGTGTCCAATTC3' Outer primer TMV-2658R: 5'CCGTGCACGTTACTTCAGACAA3' Tm2^2 SNP2494F: 5'CTCATCAAGCTTACTCTAGCCTACTTTAGT3' Tm2 SNP2493R: 5'CTGCCAGTATATAACGGTCTACCG3'
3.2	Assay 2 to check susceptible or resistant allele	Outer primer TM2-748F:5'CGGTCTGGGGAAAACAACTCT3' Outer primer TM2-1256R:5'CTAGCGGTATACCTCCACATCTCC3' TM2-SNP901misR: 5'GCAGGTTGTCCTCCAAATTTTCCATC3' TM2-SNP901misF: 5'CAAATTGGACTGACGGAACAGAAAGTT3'
4.	Format of the test	
4.1	Number of plants per genotype	at least 20 plants
4.2	Control varieties	homozygous susceptible allele tm2 present: Mobaci [4], Monalbo, Moneymaker Homozygous resistant allele Tm2 present: Moperou Homozygous resistant allele Tm2^2 present: Mocimor, Momor
5.	Preparation of DNA	Harvest per individual plant a part of a young leaf. Isolate total DNA with a standard DNA isolation protocol. Pipette each DNA sample and the PCR mix (primers, dNTP's and Taq polymerase) into individual wells for assay 1 and assay 2.

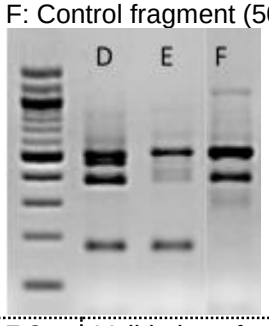
[4] Available at matref@geves.fr

6.	PCR conditions	1. Initial denaturation step at 94°C for 3 minutes 2. 35 cycles at 94°C for 1 minute, 56°C for 1 minute, 72°C for 2 minutes 3. Final extension step of 72°C for 10 minutes Visualize PCR product on 1-2% agarose gel.
7.	Observations	
7.1	Observation scale	

Assay 1
A: Control fragment (416bp) and Tm2 fragment (255bp)
B: Control fragment (416bp) and $Tm2^2$ fragment (214bp)
C: Control fragment (416bp)



Assay 2
D: Control fragment (509bp), tm2 fragment (S-allele; 381bp) and Tm2 or $Tm2^2$ fragment (R-allele; 185bp)
E: Control fragment (509bp) and Tm2 or $Tm2^2$ fragment (R-allele; 185bp)
F: Control fragment (509bp) and tm2 fragment (S-allele; 381bp)



7.2	Validation of test	Control varieties should give the expected results.
8.	Interpretation of data in terms of UPOV characteristic states	the presence of the alleles tm2, Tm2, $Tm2^2$ lead to different interpretation for characteristics 56, 57 and 58, see table. In case the DNA marker test result does not confirm the declaration in the TQ, a bio-assay should be performed to observe whether the resistance is absent or present for the variety (possibly based on another resistance gene, e.g. gene Tm1).

Test result DNA marker test	tm2/tm2	Tm2/tm2 or Tm2/Tm2	$Tm2^2$/tm2 or $Tm2^2$/$Tm2^2$ or $Tm2^2$/Tm2
		(less frequent)	(more frequent)
56 Strain 0	[1] absent	[9] resistant	[9] resistant
57 Strain 1	[1] absent	[9] resistant	[9] resistant
58 Strain 2	[1] absent	[1] absent	[9] resistant

(b) Taqman PCR

1.	Pathogen	*Tomato mosaic virus*
2.	Functional gene	Tm2/2^2 (with two alleles for resistance Tm2 and $Tm2^2$ and one allele for susceptibility tm2)
3.	Primers	TOMV RES Forward: 5'-CTCAATCATTTCCTCCAAATCTC-' TOMV RES Reverse: 5'-GGGAAATGTCTTAAGTACTGCCA-3' TOMV SUS Forward: 5'-GAAGCATTCCCTCCAAATATT-3' TOMV SUS Reverse: 5'-GGTAATGTCTTAAGCACTGCCAG-3' TOMV Probe Res $TM2^2$: 5'-Texas Red-CTACTTTAGTGTAGACCGT-BHQ2-3' TOMV Probe Res TM2: 5'-Atto 532-CAACTTTACGGTAGACC-BHQ1-3' TOMV Probe SUS: 5'-6FAM-TGCTTTATGGTAGACAGT-BHQ1-3' The probes are MGB probes or XS probes, designed with a temperature of 65°C.
4.	Format of the test	
4.1	Number of plants per genotype	at least 20 plants
4.2	Control varieties	homozygous susceptible allele tm2 present: Mobaci, Monalbo, Moneymaker Homozygous resistant allele Tm2 present: Moperou Homozygous resistant allele $Tm2^2$ present: Mocimor, Momor
5.	Preparation of DNA	Harvest per individual plant a part of a young leaf. Isolate total DNA with a standard DNA isolation protocol. Pipette each DNA sample and a commercial real-time PCR mastermix (primers, probes) into individual wells. Analyse the samples in a real-time PCR machine capable of reading the fluorophores of all the probes, with reaction conditions suitable for the mastermix used.
6.	PCR conditions	1. Initial denaturation step at 94°C for 2-10 minutes (mastermix dependent) 2. 40 cycles at 94°C for 15 sec, 60°C 1 min. Every cycle ends with plate reading
7.	Observations	
7.1	Observation scale	
7.2	Validation of test	Control varieties should give the expected results. In case of Ct/Cq 35-40: repeat the test.
8.	Interpretation of data in terms of UPOV characteristic states	the presence of the alleles tm2, Tm2, $Tm2^2$ lead to different interpretation for characteristics 56, 57 and 58, see table. In case the DNA marker test result does not confirm the declaration in the TQ, a bio-assay should be performed to observe whether the resistance is absent or present for the variety (possibly based on another resistance gene, e.g. gene Tm1).

Probe	Ct/Cq	Interpretation
TOMV Probe Res $TM2^2$	<35	resistance allele $Tm2^2$ present
	N/A	resistance allele $Tm2^2$ absent
TOMV Probe Res TM2	<35	resistance allele Tm2 present
	N/A	resistance allele Tm2 absent
TOMV Probe SUS	<35	Susceptible allele tm2 present
	N/A	Susceptible allele tm2 absent

Test result DNA marker test	tm2/tm2	Tm2/tm2 or Tm2/Tm2	$Tm2^2$/tm2 or $Tm2^2$/$Tm2^2$ or $Tm2^2$/Tm2
		(less frequent)	(more frequent)
56 Strain 0	[1] absent	[9] resistant	[9] resistant
57 Strain 1	[1] absent	[9] resistant	[9] resistant
58 Strain 2	[1] absent	[1] absent	[9] resistant

Ad. 60: Resistance to *Tomato mosaic virus* - Strain 1 (ToMV: 1)

See Ad. 59

Ad. 61: Resistance to *Tomato mosaic virus* - Strain 2 (ToMV: 2)

See Ad. 59

Ad. 62: Resistance to *Phytophthora infestans* (Pi)

1.	Pathogen	*Phytophthora infestans*
3.	Host species	*Solanum lycopersicum*
5.	Isolate	highly pathogenic on tomato
6.	Establishment isolate identity	biotest
7.	Establishment pathogenicity	biotest
8.	Multiplication inoculum	
8.1	Multiplication medium	V8 Agar or PDA or Malt Agar medium
8.2	Multiplication variety	susceptible tomato variety
8.3	Plant stage at inoculation	4 weeks
8.4	Inoculation medium	water
8.5	Inoculation method	spraying
8.6	Harvest of inoculum	wash spores from wetted plates
8.7	Check of harvested inoculum	count sporangiospores
8.8	Shelflife/viability inoculum	4 h after chilling at 8-10°C
9.	Format of the test	
9.1	Number of plants per genotype	20
9.3	Control varieties	
	Susceptible	Moneymaker, Saint-Pierre
	Resistant	Phantasia, Sixtina
9.5	Test facility	glasshouse
9.6	Temperature	18°C
9.7	Light	after inoculation darkness during 24 h, thereafter 10 h darkness per 24 h
9.9	Special measures	humidity tent during four days after inoculation
10.	Inoculation	
10.1	Preparation inoculum	wash spores from sporulating leaves, chill at 8-10°C chilling will induce zoospore release remark: Use fresh spores from repeated infection cycles on tomato plants during 3 weeks before inoculation
10.2	Quantification inoculum	count sporangiospores; adjust to 10^4 spores per ml
10.3	Plant stage at inoculation	10 leaves developed (6 to 7 weeks)
10.4	Inoculation method	spraying
10.7	Final observations	5-7 days after inoculation
11.	Observations	
11.1	Method	visual
11.2	Observation scale	Symptoms: water-soaked lesions, yellowing, and death
11.3	Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls heterozygous varieties may have a slightly lower level of expression of resistance
12.	Interpretation of data in terms of UPOV characteristic states	absent [1] severe symptoms present [9] no or mild symptoms
13.	Critical control points	resistance is only well-expressed in the adult plant

Ad. 63: Resistance to *Pseudopyrenochaeta lycopersici (ex Pyrenochaeta lycopersici* (Pl)

1.	Pathogen	*Pyrenochaeta lycopersici*
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	GEVES[1] (FR)
5.	Isolate	e.g. strain Pl 21
7.	Establishment pathogenicity	On susceptible plant
8.	Multiplication inoculum	
8.1	Multiplication medium	Messiaen agar or synthetic medium
8.4	Inoculation medium	Autoclaved grains (e.g. barley)
8.5	Inoculation method	Mix grains (e.g. 1 kg) with inoculum (e.g. medium from 2 Petri dishes with mycelium)
8.6	Harvest of inoculum	After 3 weeks
9.	Format of the test	
9.1	Number of plants per genotype	At least 20
9.3	Control varieties	
	Susceptible	Marmande verte, Montfavet H 63.5
	Resistant	Garance and (*S. lycopersicum* x S. *habrochaites*) Emperador
9.4	Test design	Add non-inoculated plants
9.5	Test facility	Greenhouse or climatic chamber
9.6	Temperature	20°C
9.7	Light	At least 12h
10.	Inoculation	
10.1	Preparation inoculum	Homogenize the contaminated grains and mix with soil (volume ratio of grains to soil ca. 1:5)
10.3	Plant stage at inoculation	3-4 leaf stage
10.4	Inoculation method	Transplanting of plantlets in the mixture of soil and contaminated grains
10.7	Final observations	40 days post inoculation
11.	Observations	
11.1	Method	Visual
11.2	Observation scale	Class 0: no necrotic lesions on roots Class 1: few small and uncoloured necrotic lesions Class 2: some brown necrotic lesions clearly visible (less than half the surface of the main root) Class 3: several brown necrotic lesions clearly visible (more than half the surface of the main root) Class 4: complete necrosis or destruction of the main root
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	Any variety judged to be of the same resistance level or higher than Garance is judged as resistant. Classes 0, 1 and 2 are commonly judged as resistant – Note 9 Classes 3 and 4 are commonly judged as susceptible – Note 1
13.	Critical control points	Pathogenicity maybe lost after 3 weeks growing on an agar medium.

[1] GEVES: matref@geves.fr

Ad. 64: 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[1] (FR)
7.	Establishment pathogenicity	biotest
8.1	Multiplication medium	PDA (12 hours per day under near-ultraviolet light to induce sporulation) or V8-Agar
9.	Format of the test	
9.1	Number of plants per genotype	20 at least
9.3	Control varieties	
	Susceptible	Monalbo
	Resistant	Motelle, “Motelle x Monalbo” (border)
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% RH 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 stirred for 30 min in a beaker with demineralized water, or sporulating plates are scraped with water with Tween20. The resulting 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	4-10 days after inoculation
11.	Observations	
11.1	Method	visual
11.2	Observation scale	0. no symptoms 1. some very rare lesions plus yellowing onleaves, and no symptoms on cotyledons 2. some lesions on leaves and cotyledons 3. many lesions on leaves, and cotyledons attached 4. coalescence of lesions, and cotyledons falling 5. total drying of the first two or the first three leaves, and cotyledons fallen
11.3	Validation of test	Symptoms on Motelle x Monalbo should be a little bit stronger than on Motelle. Symptoms on Monalbo should be much stronger than on Motelle.
12.	Interpretation of data in terms of UPOV characteristic states	Resisance absent [1] strong symptoms Resistance present [9] weak symptoms or no symptoms When the resistance level is just below the lower border of resistance, the test should be repeated one or two times before a final decision is taken
13.	Critical control points	Individuel isolates may differ stightly in pathogenicity. 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*.

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Ad. 65: Resistance to *Pseudomonas syringae* pv. *tomato* (Pst)

1.	Pathogen	*Pseudomonas syringae* pv. *tomato*
2.	Quarantine status	-
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	GEVES[1] (FR)
5.	Isolate	-
7.	Establishment pathogenicity	biotest
8.	Multiplication inoculum	
8.1	Multiplication medium	e.g. King's B agar medium, darkness
8.2	Multiplication variety	susceptible variety
8.4	Inoculation medium	water
8.8	Shelflife/viability inoculum	plates become old after 10 days
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	Monalbo, Moneymaker
	Resistant	Ontario 7710, "Monalbo x Ontario 7710", Fuzzer
9.5	Test facility	greenhouse or growth chamber
9.6	Temperature	day: 22° C, night: 16° C or 20°C
9.7	Light	12 hours
9.9	Special measures	humidity tent needed for 3 days or longer
10.	Inoculation	
10.1	Preparation inoculum	wash off spores from plate and addv a drop of surfactant to the bacterial suspension. Plate should be less than 2-4 days old.
10.2	Quantification inoculum	OD 0.1 or less, supported by dilution plating. Density 10^6 colony forming units per ml
10.3	Plant stage at inoculation	three leaves expanded (20-22 days)
10.4	Inoculation method	spraying a bacterial suspension on leaves
10.7	Final observations	8 days after inoculation or longer
11.	Observations	
11.1	Method	visual
11.2	Observation scale	bacterial speck, greasy in appearance with marginal chlorosis pinpoint lesions can be observed on resistant plants < 1.0 mm
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] bacterial speck present [9] no symptoms or pinpoint lesions
13.	Critical control points	Strains may lose virulence in storage

[1] GEVES: matref@geves.fr

Ad. 66: Resistance to *Ralstonia solanacearum* – Race 1 (Rs: 1)

1.	Pathogen	*Ralstonia solanacearum* – Race 1
2.	Regulatory status	See EPPO Global database: https://gd.eppo.int
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	-
5.	Isolate	Race 1 (Race 1 has a wide host range, including tomato. Race 3 has a narrow host range, also including tomato.)
8.	Multiplication inoculum	
8.1	Multiplication medium	Yeast Peptone Glucose (YPG) Agar or PYDAC Special conditions: 25-30°C (Race 3 usually needs 20-23°C)
8.5	Inoculation method	2 ml of inoculum placed at the foot of each plantlet prior to transplanting
8.8	Shelf life/viability inoculum	suspension in sterile distilled water at 15°C (<1 year)
9.	Format of the test	
9.1	Number of plants per genotype	20
9.3	Control varieties	
	Susceptible	Floradel
	Resistant	Caraïbo
9.5	Test facility	climate room
9.6	Temperature	day: 26-30°C; night: 25°C
9.7	Light	10 - 12 hours
9.9	Special measures	high humidity
10.	Inoculation	
10.2	Quantification inoculum	10^7 colony forming units per ml
10.3	Plant stage at inoculation	3 to 4 well-developed leaves (3 weeks)
10.7	Final observations	3 weeks after inoculation
11.	Observations	in intermediate resistant varieties, bacteria could be present in the lower part of the plant
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, or less than resistant standard

Ad. 67: Resistance to *Tomato yellow leaf curl virus* (TYLCV)

(i) agroinoculation method

1.	Pathogen	*Tomato yellow leaf curl virus* (TYLCV)
2.	Regulatory status	See EPPO Global Database: https://gd.eppo.int
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	Dr. Eduardo R. Bejarano, Plant Genetics Laboratory, HMS UMA-CSIC[1]
5.	Isolate	Alm:Pep:99, strain IL
8.	Multiplication inoculum	
8.1	Multiplication medium	YEP/Kanamycin.
8.3	Plant stage at inoculation	3-4 leaf
8.4	Inoculation medium	YEP
8.5	Inoculation method	Stem puncture agroinfiltration. Plant agroinoculation is carried out using *Agrobacterium tumefaciens* transformed with plasmids containing the infectious clones (Morilla, et al. 2005. Phytopathology 95: 1089-1097)
8.8	Shelf life/viability inoculum	*A. tumefaciens* stocks are maintained frozen at -80ºC in 15-20% glycerol for long term storage. Cultures to be stored are typically started from a single colony and grown in 5 ml YEP +2.5 µl kanamycin (100mg/ml) during 48 h at 28ºC.
9.	Format of the test	
9.1	Number of plants per genotype	20
9.2	Number of replicates	2
9.3	Control varieties	
	Susceptible	Moneymaker, Marmande
	Resistant	Delyca, Montenegro
9.5	Test facility	Glasshouse or climatic chamber with permission to confined use of use of LMO/GMO, confinement level 1 (N-1) (see 9.9)
9.6	Temperature	23-25°C
9.7	Light	16 h
9.9	Special measures	The transformed Agrobacterium tumefaciens is a living modified organism (LMO; or genetically modified organism (GMO)) and in many countries it requires to comply with Cartagena Protocol on Biosafety in case of transboundary movement, transit, handling and use that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health.
10.	Inoculation	
10.1	Preparation inoculum	Streak the surface of the frozen A. tumefaciens stock tube and submerge in 5ml YEP+2.5 µl kanamycin (100mg/ml) during 48 h at 28°C. Shaking is needed. Take 100 µl and place them into 100 ml YEP and 50 µl kanamycin (100mg/ml). Shake 48 h at 28ºC. Centrifuge the saturated culture for 20 min at 3500 rpm and discard supernatant
10.2	Quantification inoculum	Dissolve in sterile deionize water to a final OD_{600} of 1.
10.3	Plant stage at inoculation	3-4th leaf
10.4	Inoculation method	Take up into a 1 ml syringe with a 27-gauge needle and few drops (about 20 µl of the culture) were deposited on 10-15 puncture wounds made with the needle into the stem of test tomato plants. Maintain on ice while inoculating plants.
10.5	First observation	20 days post inoculation
10.6	Second observation	30 dpi
10.7	Final observations	45 dpi
11.	Observations	
11.1	Method	visual
11.2	Observation scale	Symptoms: leaf yellowing and curling

[1] Source of inoculum; HMS UMA (CSIC) edu_rodri@uma.es, INIA resistencias@inia.es
[2] Source of inoculum; IHSM, CSIC guillamon@eelm.csic.es, INIA resistencias@inia.es

11.3	Validation of test	evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
11.4	Off-types	
12.	Interpretation of data in terms of UPOV characteristic states	absent [1] severe symptoms present [9] no 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-IL is the strain most widely spread worldwide. With this strain, symptoms do not appear in varieties with Ty-1 and Ty-2. Some TYLCV resistant varieties may be susceptible to the closely related virus Tomato yellow leaf curl Sardinia virus (TYLCSV).

(ii) White fly inoculation method

1.	Pathogen	*Tomato yellow leaf curl virus* (TYLCV) IL strain
2.	Quarantine status	See EPPO Global Database: https://gd.eppo.int
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	Spain[2]
5.	Isolate	TYLCV-IL La Mayora
8.	Multiplication inoculum	White flies
8.1	Multiplication medium	
9.	Format of the test	
9.1	Number of plants per genotype	20
9.2	Number of replicates	Two replicates
9.3	Control varieties	
	Susceptible	Moneymaker, Marmande
	Resistant	Delyca, Montenegro
9.5	Test facility	Greenhouse/plastic tunnel
9.9	Special measures	prevent spread of white-flies
10.	Inoculation	
10.3	Plant stage at inoculation	2-4 weeks
10.4	Inoculation method	vector (*Bemisia* white-flies carrying TYLCV-IL)
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-IL is the strain most widely spread worldwide. With this strain, symptoms do not appear in varieties with Ty-1 and Ty-2. Some Some TYLCV resistant varieties may be susceptible to the closely related virus Tomato yellow leaf curl Sardinia virus (TYLCSV).

[2] Source of inoculum; IHSM, CSIC guillamon@eelm.csic.es, INIA resistencias@inia.es

Ad. 68: Resistance to *Tomato spotted wilt virus* - Pathotype 0 (TSWV: 0)

Resistance to strain 0 to be tested in a bio-assay (method i) or in a DNA marker test (method ii), if appropriate.

(i) bio-assay

1.	Pathogen	*Tomato spotted wilt virus*, Pathotype 0 (TSWV: 0)
2.	Regulatory status	See EPPO Global database: https://gd.eppo.int
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	Naktuinbouw[1] (NL), GEVES[2] (FR)
5.	Isolate	pathotype 0, preferably a thrips-transmission deficient variant
6.	Establishment isolate identity	symptomatic leaves may be stored below -70°C
7.	Establishment pathogenicity	Biotest
9.	Format of the test	
9.1	Number of plants per genotype	at least 20
9.2	Number of replicates	1 replicate
9.3	Control varieties	
	Susceptible	Monalbo, Momor, Montfavet 63-5, Moneymaker
	Resistant	Bodar, Mospomor
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 a suitable abrasive on cotyledons, inoculum suspension < 10°C
10.7	Final observations	7 -21 days after inoculation
11.	Observations	
11.1	Method	Visual, comparative
11.2	Observation scale	Symptoms: top mosaic, bronzing, various malformations, strong necrosis can be a sign of hypersensitivity
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 or symptoms of hypersensitivity
13.	Critical control points	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.

[1] Naktuinbouw; resistentie@naktuinbouw.nl
[2] GEVES; matref@geves.fr

(ii) DNA marker test

Resistance to TSWV pathotype 0 is often based on resistance gene Sw-5. The presence of allele for resistance and/or susceptible allele(s) can be detected by the co-dominant markers as described in Dianese *et al* (2010). Specific aspects:

<table>
<tr><td>1.</td><td>Pathogen</td><td>Tomato spotted wilt virus – pathotype 0</td></tr>
<tr><td>2.</td><td>Functional gene</td><td>Sw-5b</td></tr>
<tr><td>3.</td><td>Primers</td><td></td></tr>
<tr><td>3.1</td><td>Susceptible alleles</td><td>Sw5-Vat1-F: 5’-ACAACATCAAACAATGTTAGCC-3’
Sw5-Vat2-F: 5’-CATCAAACAATGCAGTTAGCC-3’</td></tr>
<tr><td>3.2</td><td>Resistant allele</td><td>Sw5-Res-F: 5’-ATCAACCAATACAGCCTAACC-3</td></tr>
<tr><td>3.3</td><td>Universal reverse</td><td>Sw5-universal-R: 5’-TTTCTCCCTGCAAGTTCACC-3’</td></tr>
<tr><td>3.3</td><td>Allele specific probes</td><td>Sw5-Sus1: 5’-VIC-TACATTATGAAGGGTTAACAAG-MGB-NFQ-3’
Sw5-Sus2: 5’-6FAM-ACAACAGAGGGTTAACAAGTTTAGG-BHQ1-3’
Sw5-Res: 5’-TEXAS RED-TGGGCGAAAATCCCAACAAG-BHQ2-3’</td></tr>
<tr><td>4.</td><td>Format of the test</td><td></td></tr>
<tr><td>4.1</td><td>Number of plants per genotype</td><td>at least 20 plants</td></tr>
<tr><td>4.2</td><td>Control varieties</td><td>homozygous susceptible allele 1 present:
Moneymaker
homozygous susceptible allele 2 present:
Mountain Magic
homozygous resistant allele present:
Montealto
Heterozygous 1 (allele for resistance and allele 1 for susceptibility present): Bodar
Heterozygous 2 (allele for resistance and allele 2 for susceptibility present): Sharmita</td></tr>
<tr><td>5.</td><td>Preparation of DNA</td><td>Harvest per individual plant a part of a young leaf. Isolate total DNA with a standard DNA isolation protocol. Pipette each DNA sample and a commercial real-time PCR mastermix into individual wells. Analyse the samples in a real-time PCR machine capable of reading the fluorophores of all the probes, with reaction conditions suitable for the mastermix used.</td></tr>
<tr><td>6.</td><td>PCR conditions</td><td>1. Initial denaturation step 10 min 95 °C
2. 40 cycles 15 sec 95 °C and 1 min 60°C. Every cycle ends with a plate reading.</td></tr>
<tr><td>7.</td><td>Observations</td><td></td></tr>
<tr><td>7.1</td><td>Observation scale</td><td>
<table>
<tr><th>probe</th><th>Ct/Cq</th><th>interpretation</th></tr>
<tr><td rowspan="2">Sw5-Sus1</td><td><35</td><td>susceptible allele sw5b-1 present</td></tr>
<tr><td>N/A</td><td>susceptible allele sw5b-1 absent</td></tr>
<tr><td rowspan="2">Sw5-Sus2</td><td><35</td><td>susceptible allele sw5b-2 present</td></tr>
<tr><td>N/A</td><td>susceptible allele sw5b-2 absent</td></tr>
<tr><td rowspan="2">Sw5-Res</td><td><35</td><td>resistance allele Sw-5b present</td></tr>
<tr><td>N/A</td><td>resistance allele Sw-5b absent</td></tr>
</table>
</td></tr>
<tr><td>7.2</td><td>Validation of the test</td><td>Control varieties should give the expected results. In case of Ct/Cq 35-40: repeat the test.</td></tr>
<tr><td>8.</td><td>Interpretation of data in terms of UPOV characteristic states</td><td>absent [1] susceptible allele(s) present and resistant allele absent
present [9] resistant allele present (homozygous or heterozygous)

In case the DNA marker test result does not confirm the declaration in the TQ, a bio-assay should be performed to observe whether the resistance is absent or present for the variety (on another mechanism).</td></tr>
</table>

Ad. 69: Resistance to *Leveillula taurica* (Lt)

1.	Pathogen	*Leveillula taurica*
2.	Quarantine status	-
3.	Host species	*Solanum lycopersicum*
4.	Source of inoculum	no long term storage method is available
8.1	Multiplication medium	detached leaves of a susceptible host plant
9.	Format of the test	
9.1	Number of plants per genotype	20
9.3	Control varieties	
	Susceptible	Monalbo, Montfavet 63-5
	Resistant	Radiance
10.	Inoculation	
10.3	Plant stage at inoculation	adult plants
10.4	Inoculation method	natural infection, mainly by wind dispersal of spores
10.7	Final observations	before maturity of fruits
11.	Observations	
11.1	Method	visual
11.2	Observation scale	Symptoms: Yellow chlorotic spots on upper side of leaves, mycelium on abaxial side 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 present [9] no symptoms, or same level as the resistant control.
13.	Critical control points	Check cleistothecia under microscope to confirm presence of *Leveillula* and not another powdery mildew. Plant stage dependent action of resistance can cause difficulties in the interpretation

Ad. 70: Resistance to *Pseudoidium neolycopersici (ex Oidium neolycopersici)* (Pn (ex On))

1.	Pathogen	*Oidium neolycopersici*
2.	Quarantine status	-
3.	Host species	*Solanum lycopersicum*
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	Momor, Montfavet 63-5
	Resistant	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.

Ad. 71: Resistance to *Tomato torrado virus* (ToTV)

1.	Pathogen	*Tomato torrado virus*
2.	Quarantine status	in regions with temperate climate
3.	Host species	*Solanum lycopersicum*
7.	Establishment pathogenicity	biotest
8.	Multiplication inoculum	
8.1	Multiplication medium	*Nicotiana tabacum* 'Xanthi'
8.3	Plant stage at inoculation	cotyledon to first leaf
8.5	Inoculation method	see 10.4
8.6	Harvest of inoculum	after 3 weeks
8.7	Check of harvested inoculum	plants yellow, systemic infection
8.8	Shelf life/viability inoculum	instable at room temperature
9.	Format of the test	
9.1	Number of plants per genotype	20
9.3	Control varieties	
	Susceptible	Daniela
	Resistant	Matias
9.5	Test facility	glasshouse
9.6	Temperature	23°C during the day; 21°C during the night
9.7	Light	16 hours
10.	Inoculation	
10.3	Plant stage at inoculation	14 days
10.4	Inoculation method	with ice-cold 0,01 M PBS pH 7 and carborundum
10.5	First observation	7 days after inoculation
10.6	Second observation	14 days after inoculation
10.7	Final observations	18 days after inoculation
11.	Observations	
11.1	Method	visual
11.2	Observation scale	necrotic spots on the top 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] necrotic spots present present [9] No symptoms
13.	Critical control points	ToTV is transmitted by white fly (*Bemisia tabaci*). Produce inoculum with ice-cold mortar and pestle. During inoculation the temperature should be below 25°C.

9. Literature

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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

1.1.1	Botanical name	*Solanum lycopersicum* L.	[ ]
1.1.2	Common name	Cherry tomato; Tomato; tomato	
1.2.1	Botanical name	*Solanum lycopersicum* L. x *Solanum cheesmaniae* (L. Ridley) Fosberg	[ ]
1.2.2	Common name		
1.3.1	Botanical name	*Solanum lycopersicum* L. x *Solanum pimpinellifolium* L.	[ ]
1.3.2	Common name		

2. Applicant

Name	
Address	
Telephone No.	
Fax No.	
E-mail address	
Breeder (if different from applicant)	

3. Proposed denomination and breeder's reference

Proposed denomination (if available)	
Breeder's reference	

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

#4. Information on the breeding scheme and propagation of the variety

4.1 Breeding scheme

Variety resulting from:

4.1.1 Crossing

4.1.2 Mutation [ ]
(please state parent variety)

4.1.3 Discovery and development [ ]
(please state where and when discovered and how developed)

4.1.4 Other [ ]
(Please provide details)

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:

4.2 Method of propagating the variety

4.2.1 Seed-propagated varieties

(a) Self-pollination [ ]
(b) Hybrid [ ]
(c) Inbred line [ ]
(d) Other (please provide details) [ ]

4.2.2 Vegetative propagation

(a) Cuttings [ ]
(b) *In vitro* propagation [ ]
(c) Other (state method) [ ]

4.2.3 Other [ ]
(Please provide details)

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 (2)	**Plant: growth type**		
	determinate	Rio Grande, Siluet	1 [ ]
	indeterminate	Daniela, Florenteen, Marmande VR, Saint- Pierre	2 [ ]
5.2 (6)	**Only varieties with plant growth type indeterminate: Plant: height**		
	very short	Garderner's Delight, Maresme, Zadenna	1 [ ]
	very short to short		2 [ ]
	short	Delfine, Despina	3 [ ]
	short to medium		4 [ ]
	medium	Brooklyn, Campari	5 [ ]
	medium to tall		6 [ ]
	tall	Climberley, Pitenza	7 [ ]
	tall to very tall		8 [ ]
	very tall	Goldwin, Romindo	9 [ ]
	not applicable		[ ]
5.3 (10)	**Leaf: type of blade**		
	pinnate	Matina	1 [ ]
	bipinnate	Daniela, Saint- Pierre	2 [ ]
5.4 (12)	**Leaf: intensity of green color**		
	very light		1 [ ]
	very light to light		2 [ ]
	light	Rossol	3 [ ]
	light to medium		4 [ ]
	medium	Rebelski	5 [ ]
	medium to dark		6 [ ]
	dark	Daniela, Red Robin	7 [ ]
	dark to very dark		8 [ ]
	very dark		9 [ ]

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

	Characteristics	Example Varieties	Note
5.5 (19)	**Peduncle: abscission layer**		
	absent	Merlice, Rio Grande	1 [ ]
	present	Daniela, Grownet, Montfavet 63-5	9 [ ]
5.6 (21)	**Immature fruit: green shoulder**		
	absent	Geronimo	1 [ ]
	present	Daniela, Montfavet 63-5	9 [ ]
5.7 (25)	**Immature fruit: green stripes**		
	absent	Daniela, Guanche, Jasminia	1 [ ]
	present	Green Zebra, Tigerella	9 [ ]
5.8 (26)	**Immature fruit: anthocyanin coloration**		
	absent	Durinta	1 [ ]
	present	HN5003	9 [ ]
5.9 (27)	**Time of maturity**		
	very early	Goldwin, Pyremello, Sweet Baby, Trambellino	1 [ ]
	very early to early	Delisher	2 [ ]
	early	Lemonade, Shiren, Zorayda	3 [ ]
	early to medium		4 [ ]
	medium	Delizia, Losna, Sonico	5 [ ]
	medium to late		6 [ ]
	late	Mariana, Saneh	7 [ ]
	late to very late		8 [ ]
	very late	Atago, Brito, Daniela, Raymos, Wafira	9 [ ]
5.10 (28)	**Fruit: size**		
	very small	Cerise, Sweet 100	1 [ ]
	very small to small	Dolcetini, Genio	2 [ ]
	small	Brioso, Tankini	3 [ ]
	small to medium	Larimar, Progress	4 [ ]
	medium	Mezcal, Oceano	5 [ ]
	medium to large	Luminance, Rio Grande	6 [ ]
	large	Carmello, Floradade	7 [ ]
	large to very large	Florenteen, Grownet	8 [ ]
	very large	Cupidissimo, Marsilia	9 [ ]

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

	Characteristics	Example Varieties	Note
5.11 (30)	**Fruit: shape in longitudinal section**		
	flattened	Margold, Marmande VR	1 [ ]
	oblate	Cartesio, Gloriette, Merlice, Montfavet 63-5	2 [ ]
	circular	Cerise, Soussia	3 [ ]
	oblong	Landolino, Red Sky	4 [ ]
	cylindric	Hypeel 244, Sir Elyan	5 [ ]
	elliptic	Obock	6 [ ]
	cordate	Cuor di Bue, Cupidissimo, Laureen, Valenciano	7 [ ]
	ovate	Dualrow, Soto	8 [ ]
	obovate	Duquesa, Estelle, Mezcal	9 [ ]
	pyriform	Oceano, Olivenza, Operino	10 [ ]
	obcordate	Cuore del Ponente, Ingrid	11 [ ]
5.12 (31)	**Fruit: ribbing**		
	absent or very weak	Cerise, Conchita	1 [ ]
	very weak to weak		2 [ ]
	weak	Baikonur, Guanche	3 [ ]
	weak to medium		4 [ ]
	medium	Montfavet 63-5, Shourouq	5 [ ]
	medium to strong		6 [ ]
	strong	Marmalindo, Marmande VR, Marsilia	7 [ ]
	strong to very strong		8 [ ]
	very strong	Ingrid, Marsalato	9 [ ]
5.13 (38)	**Fruit: number of locules**		
	only two	Creativo, San Marzano 2, Tropical	1 [ ]
	two and three	Bomfado, Orinade	2 [ ]
	three and four	Durinta, Montfavet 63-5	3 [ ]
	four, five or six	Rovente, Tosmar, Tradiro	4 [ ]
	more than six	Bronson, Chocostar, Marmande VR	5 [ ]
5.14 (39)	**Fruit: gel in locules**		
	absent	Allflesh 1120, Nun 03560	1 [ ]
	present	Daniela, Rio Grande	9 [ ]

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

	Characteristics	Example Varieties	Note
5.15 (40)	**Fruit: color**		
	yellowish white	Cream Sausage	1 [ ]
	yellow	Babylor, Mimosa	2 [ ]
	orange	Operino, Oranjestar	3 [ ]
	pink	Framboo, Pink Wand, Tomimaru Muchoo	4 [ ]
	red	Daniela, Ferline, Montfavet 63-5, Saint- Pierre, Umaca	5 [ ]
	brown	Chocostar, Marbruni	6 [ ]
	green	Green Grape, Green Zebra	7 [ ]
5.16 (44)	**Fruit: firmness**		
	very soft	Marmande VR	1 [ ]
	very soft to soft		2 [ ]
	soft	Marinda, Marsalato	3 [ ]
	soft to medium		4 [ ]
	medium	Rosannita, Sunita	5 [ ]
	medium to firm		6 [ ]
	firm	Losna, Octavio, Tradiro	7 [ ]
	fim to very firm		8 [ ]
	very firm	Brito, Daniela, Larimar, Lolek	9 [ ]
5.17 (45)	**Resistance to *Meloidogyne incognita* (Mi)**		
	absent or low	Casaque Rouge	1 [ ]
	medium	Campeon, Tyonic	2 [ ]
	high	Anahu, Anahu x Casaque Rouge	3 [ ]
	not tested		[ ]
5.18 (46)	**Resistance to *Verticillium* sp. (Va and Vd) - Race 0**		
	absent	Marmande verte, Moneymaker	1 [ ]
	present	Marmande VR, Monalbo	9 [ ]
	not tested		[ ]
5.19 (47)	**Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 0EU/1US (Fol: 0EU/1US)**		
	absent	Marmande verte, Moneymaker	1 [ ]
	present	Anabel, Marporum, Marsol	9 [ ]
	not tested		[ ]

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

	Characteristics	Example Varieties	Note
5.20 (48)	**Resistance to *Fusarium oxysporum* f. sp. *lycopersici* - Race 1EU/2US (Fol: 1EU/2US)**		
	absent	Marmande verte, Moneymaker	1 [ ]
	present	Motelle	9 [ ]
	not tested		[ ]
5.21 (59)	**Resistance to *Tomato mosaic virus* - Strain 0 (ToMV: 0)**		
	absent	Monalbo, Moneymaker	1 [ ]
	present	Mobaci, Mocimor, Momor, Moperou	9 [ ]
	not tested		[ ]
5.22 (68)	**Resistance to *Tomato spotted wilt virus* - Pathotype 0 (TSWV: 0)**		
	absent	Moneymaker, Montfavet 63-5, Mountain Magic	1 [ ]
	present	Bodar, Mospomor	9 [ ]
	not tested		[ ]

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
Example			

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

7.3.1 Other characteristics

(a) Fruits of the variety reach maturity yes [ ] / no [ ]
(b) LSL gene present yes [ ] / no [ ]

(c) LSL genetics homozygous RIN [ ] / heterozygous RIN [ ]
homozygous NOR [ ] / heterozygous NOR [ ] /
not known [ ] / other (please specify) [ ]

7.3.2 Resistance to:

	absent	present	not tested
(a) *Fusarium oxysporum f. sp. lycopersici (*Fol) race 2EU/ 3US (char. 49)	[ ]	[ ]	[ ]
(b) *Fusarium oxysporum f. sp. radicis-lycopersici* (For) (char. 50)	[ ]	[ ]	[ ]
(c) *Passalora fulva* (Pf)			
(i) Race 0 (char. 51)	[ ]	[ ]	[ ]
(ii) group A (char. 52)	[ ]	[ ]	[ ]
(iii) group B (char. 53)	[ ]	[ ]	[ ]
(iv) group C (char. 54)	[ ]	[ ]	[ ]
(v) group D (char. 55)	[ ]	[ ]	[ ]
(vi) group E (char. 56)	[ ]	[ ]	[ ]
(vii) group F (char. 57)	[ ]	[ ]	[ ]
(viii) group J (char. 58)	[ ]	[ ]	[ ]
(d) *Tomato mosaic virus* (ToMV)			
(i) Strain 1 (char. 60)	[ ]	[ ]	[ ]
(ii) Strain 2 (char. 61)	[ ]	[ ]	[ ]
(e) *Phytophthora infestans* (Pi) (char. 62)	[ ]	[ ]	[ ]
(f) *Pyrenochaeta lycopersici* (Pl) (char. 63)	[ ]	[ ]	[ ]
(g) *Stemphylium spp.* (Ss) (char. 64)	[ ]	[ ]	[ ]
(h) *Pseudomonas syringae* pv. *tomato* (Pst) (char. 65)	[ ]	[ ]	[ ]
(i) *Ralstonia solanacearum* (Rs) Race 1 (char. 66)	[ ]	[ ]	[ ]
(j) *Tomato yellow leaf curl virus* (TYLCV) (char. 67)	[ ]	[ ]	[ ]
(k) *Tomato spotted wilt virus* - Pathotype 0 (TSWV: 0) (char. 68)			
(l) *Leveillula taurica* (Lt) (char. 69)	[ ]	[ ]	[ ]
(m) *Pseudoidium neolycopersici* (Pn) (char. 70)	[ ]	[ ]	[ ]

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

(n) *Tomato torrado virus (*ToTV) (char. 71) [ ] [ ] [ ]

(o) Other (please specify, including races and strains)

7.3.3. Special conditions for the examination of the variety

(a) Type of culture:
- under glass [ ]

- in the open [ ]

(b) Main use:
-fresh market or garden [ ]

-industrial processing [ ]
- peel [ ]
- paste [ ]
- other [ ]

- pot plant [ ]

- rootstock [ ]

- other [ ]

It is strongly recommended to add a representative colour image of the fruits of the variety to the TQ.

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:

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.

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]