These Test Guidelines have been superseded by a later version. The latest adopted version of Test Guidelines can be found at http://www.upov.int/test_guidelines/en/list.jsp

This publication has been scanned from a paper copy and may have some discrepancies from the original document.

Ces principes directeurs d’examen ont été remplacés par une version ultérieure. La version adoptée la plus récente des principes directeurs d’examen figure à l’adresse suivante : http://www.upov.int/test_guidelines/fr/list.jsp

Cette publication a été numérisée à partir d’une copie papier et peut contenir des différences avec le document original.


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Las presentes directrices de examen han sido reemplazadas por una versión posterior. La versión de las directrices de examen de más reciente aprobación está disponible en http://www.upov.int/test_guidelines/es/list.jsp.

Este documento ha sido escaneado a partir de una copia en papel y puede que existan divergencias en relación con el documento original.
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/44: Tomato (Solanum lycopersicum L.)

These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website (www.upov.int), for the latest information.]
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1. **Subject of these Test Guidelines**

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

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

2. **Material Required**

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

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

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

10 g or 2,500 seeds.

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

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

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

3. **Method of Examination**

3.1 *Number of Growing Cycles*

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

3.2 *Testing Place*

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

3.3 *Conditions for Conducting the Examination*

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

3.4 *Test Design*

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

3.4.2 When resistance characteristics are used for assessing distinctness, uniformity and stability, records must be taken under conditions of controlled infection and, unless otherwise specified, on at least 20 plants.
3.4.3 The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.

3.5 Additional Tests

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

4. Assessment of Distinctness, Uniformity and Stability

4.1 Distinctness

4.1.1 General Recommendations

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

4.1.2 Consistent Differences

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a single growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent. One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic in at least two independent growing cycles.

4.1.3 Clear Differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness.

4.1.4 Number of Plants / Parts of Plants to be Examined

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

4.1.5 Method of Observation

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

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

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

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

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

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

4.2 Uniformity

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

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

4.3 Stability

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

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

5. Grouping of Varieties and Organization of the Growing Trial

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

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

5.3 The following have been agreed as useful grouping characteristics:

(a) Fruit: green shoulder (characteristic 11)
(b) Autonecrosis (characteristic 21)
(c) Resistance to Meloidogyne incognita (characteristic 22)
(d) Resistance to Verticillium sp. – Race 0 (characteristic 23)
(e) Resistance to Fusarium oxysporum f. sp. lycopersici – Race 0 (ex 1) (characteristic 24.1)
(f) Resistance to Fusarium oxysporum f. sp. lycopersici – Race 1 (ex 2) (characteristic 24.2)
(g) Resistance to Fusarium oxysporum f. sp. lycopersici – Race 2 (ex 3) (characteristic 24.3)
(h) Resistance to Pyrenochaeta lycopersici (characteristic 28)

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction and document TGP/9 “Examining Distinctness”.
6. **Introduction to the Table of Characteristics**

6.1 **Categories of Characteristics**

6.1.1 **Standard Test Guidelines Characteristics**

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

6.1.2 **Asterisked Characteristics**

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

6.2 **States of Expression and Corresponding Notes**

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

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

<table>
<thead>
<tr>
<th>State</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>small</td>
<td>3</td>
</tr>
<tr>
<td>medium</td>
<td>5</td>
</tr>
<tr>
<td>large</td>
<td>7</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>State</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>very small</td>
<td>1</td>
</tr>
<tr>
<td>very small to small</td>
<td>2</td>
</tr>
<tr>
<td>small</td>
<td>3</td>
</tr>
<tr>
<td>small to medium</td>
<td>4</td>
</tr>
<tr>
<td>medium</td>
<td>5</td>
</tr>
<tr>
<td>medium to large</td>
<td>6</td>
</tr>
<tr>
<td>large</td>
<td>7</td>
</tr>
<tr>
<td>large to very large</td>
<td>8</td>
</tr>
<tr>
<td>very large</td>
<td>9</td>
</tr>
</tbody>
</table>

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

6.3 **Types of Expression**

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

6.4 **Example Varieties**

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

(*) Asterisked characteristic – see Chapter 6.1.2

QL Qualitative characteristic – see Chapter 6.3
QN Quantitative characteristic – see Chapter 6.3
PQ Pseudo-qualitative characteristic – see Chapter 6.3

MG, MS, VG, VS – see Chapter 4.1.5

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

(+) See Explanations on the Table of Characteristics in Chapter 8.2.
### 7. Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de características

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>français</th>
<th>deutsch</th>
<th>español</th>
<th>Example Varieties</th>
<th>Note/Nota</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>VG ([*]) (+)</td>
<td>Seedling: anthocyanin coloration of hypocotyl</td>
<td>Plantule: pigmentation anthocyanique de l’hypocotyle</td>
<td>Sämling: Anthocyanfärbung des Hypocotyls</td>
<td>Plántula: pigmentación antocianica del hipocótilo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QL</td>
<td>absent</td>
<td>fehlend</td>
<td>ausente</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>present</td>
<td>présente</td>
<td>vorhanden</td>
<td>presente</td>
<td>Beaufort 9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QN</td>
<td>short</td>
<td>basse</td>
<td>niedrig</td>
<td>baja</td>
<td>Big Power 3</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>moyenne</td>
<td>mittel</td>
<td>media</td>
<td>Maxifort 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tall</td>
<td>haute</td>
<td>hoch</td>
<td>alta</td>
<td>Beaufort 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QN (a)</td>
<td>absent or very weak</td>
<td>fehlend oder sehr gering</td>
<td>ausente o muy débil</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>weak</td>
<td>faible</td>
<td>gering</td>
<td>débil</td>
<td>Arnold 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>moyenne</td>
<td>media</td>
<td>Beaufort 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>strong</td>
<td>forte</td>
<td>stark</td>
<td>Montezuma 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>VG/MS (+)</td>
<td>Stem: length of internode</td>
<td>Tige: longueur de l’entre-nœud</td>
<td>Stängel: Internodienlänge</td>
<td>Tallo: longitud del entrenudo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QN (a)</td>
<td>short</td>
<td>court</td>
<td>kurz</td>
<td>corta</td>
<td>Big Force 3</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>moyen</td>
<td>mittel</td>
<td>media</td>
<td>Maxifort 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>long</td>
<td>long</td>
<td>lang</td>
<td>larga</td>
<td>Beaufort 7</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>VG/MS ([*])</td>
<td>Leaf: length</td>
<td>Feuille: longueur</td>
<td>Blatt: Länge</td>
<td>Hoja: longitud</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QN (a)</td>
<td>short</td>
<td>courte</td>
<td>kurz</td>
<td>corta</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>moyenne</td>
<td>mittel</td>
<td>media</td>
<td>Body 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>long</td>
<td>longue</td>
<td>lang</td>
<td>larga</td>
<td>Maxifort 7</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>VG/MS ([*])</td>
<td>Leaf: width</td>
<td>Feuille: largeur</td>
<td>Blatt: Breite</td>
<td>Hoja: anchura</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QN (a)</td>
<td>narrow</td>
<td>étroite</td>
<td>schmal</td>
<td>estrecha</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>moyenne</td>
<td>mittel</td>
<td>media</td>
<td>Body 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>broad</td>
<td>large</td>
<td>breit</td>
<td>ancha</td>
<td>Emperador 7</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>VG (+)</td>
<td>Leaf: size of leaflets</td>
<td>Feuille: taille des folioles</td>
<td>Blatt: Größe der Blattfiedern</td>
<td>Hoja: tamaño de los foliolos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QN (a)</td>
<td>very small</td>
<td>très petites</td>
<td>sehr klein</td>
<td>muy pequeños</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>small</td>
<td>petites</td>
<td>klein</td>
<td>pequeños</td>
<td>Titron 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>moyennes</td>
<td>mittel</td>
<td>medios</td>
<td>Big Force 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>large</td>
<td>grandes</td>
<td>groß</td>
<td>grandes</td>
<td>Beaufort 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>very large</td>
<td>très grandes</td>
<td>sehr groß</td>
<td>muy grandes</td>
<td>Hires 1210 9</td>
<td></td>
</tr>
<tr>
<td>Example Varieties</td>
<td>Note/Nota</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 8. (* | VG Leaf: intensity of green color |
| QN (a) | light | claire | hell | claro | 3 |
| QN (a) | medium | moyenne | mittel | medio | 5 |
| QN (a) | dark | foncée | dunkel | oscuro | Maxifort | 7 |

| 9. (+ | VG Leaf: glossiness |
| QN (a) | weak | faible | gering | débil | Montezuma | 1 |
| QN (a) | medium | moyenne | mittel | medio | Titron | 2 |
| QN (a) | strong | forte | stark | fuerte | Maxifort | 3 |

| 10. (+ | VG Leaf: blistering |
| QN (a) | weak | faible | gering | débil | Montezuma | 1 |
| QN (a) | medium | moyenne | mittel | medio | Emperador | 2 |
| QN (a) | strong | forte | stark | fuerte | Body | 3 |

| 11. (*) | VG Fruit: green shoulder |
| QL (c) | absent | absent | fehlend | ausente | 1 |

| 12. (*) | VG Fruit: extent of green shoulder |
| QN (c) | small | petit | klein | pequeño | Big Force | 3 |
| QN (c) | medium | moyen | mittel | medio | 5 |
| QN (c) | large | grand | groß | grande | Maxifort | 7 |

| 13. (*) | VG Fruit: intensity of green color of shoulder |
| QN (c) | light | claire | hell | claro | 3 |
| QN (c) | medium | moyenne | mittel | medio | 5 |
| QN (c) | dark | foncée | dunkel | oscuro | He-man | 7 |

<p>| 14. (+ | VG Fruit: conspicuousness of meridian stripes |
| QN (c) | very weak | très faible | sehr gering | muy débil | He Wolf | 1 |
| QN (c) | weak | faible | gering | débil | Popeye | 2 |
| QN (c) | medium | moyenne | mittel | medio | Body | 3 |
| QN (c) | strong | forte | stark | fuerte | Vigomax | 4 |
| QN (c) | very strong | très forte | sehr stark | muy fuerte | 5 |</p>
<table>
<thead>
<tr>
<th>Example Varieties</th>
<th>Exemples</th>
<th>Beispielesorten</th>
<th>Variedades ejemplo</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>15.</strong> VG/MS</td>
<td>Pedicel: length</td>
<td>Pédicelle: longueur</td>
<td>Blütenstiel: Länge</td>
</tr>
<tr>
<td>(+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QN (b)</td>
<td>short</td>
<td>court</td>
<td>kurz</td>
</tr>
<tr>
<td>medium</td>
<td>moyen</td>
<td>mittel</td>
<td>media</td>
</tr>
<tr>
<td>long</td>
<td>long</td>
<td>lang</td>
<td>larga</td>
</tr>
<tr>
<td><strong>16.</strong> VG</td>
<td>Fruit: size</td>
<td>Fruit : taille</td>
<td>Frucht: Größe</td>
</tr>
<tr>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QN (b)</td>
<td>small</td>
<td>petit</td>
<td>klein</td>
</tr>
<tr>
<td>medium</td>
<td>moyen</td>
<td>mittel</td>
<td>medio</td>
</tr>
<tr>
<td>large</td>
<td>grand</td>
<td>groß</td>
<td>grande</td>
</tr>
<tr>
<td><strong>17.</strong> VG</td>
<td>Fruit: shape in longitudinal section</td>
<td>Fruit : forme en section longitudinale</td>
<td>Frucht: Form im Längsschnitt</td>
</tr>
<tr>
<td>(*) (+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PQ (b)</td>
<td>broad oblate</td>
<td>aplatie large</td>
<td>breit breit rund</td>
</tr>
<tr>
<td>narrow oblate</td>
<td>aplatie étroite</td>
<td>schmal breit rund</td>
<td>achatada estrecha</td>
</tr>
<tr>
<td>circular</td>
<td>circulaire</td>
<td>kreisförmig</td>
<td>circular</td>
</tr>
<tr>
<td>obovate</td>
<td>obovale</td>
<td>verkehrt eiförmig</td>
<td>obovado</td>
</tr>
<tr>
<td><strong>18.</strong> VG/MS</td>
<td>Fruit: number of locules</td>
<td>Fruit : nombre de loges</td>
<td>Frucht: Anzahl Kammern</td>
</tr>
<tr>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QN (b)</td>
<td>only two</td>
<td>seulement deux</td>
<td>nur zwei</td>
</tr>
<tr>
<td>two and three</td>
<td>deux et trois</td>
<td>zwei und drei</td>
<td>dos y tres</td>
</tr>
<tr>
<td><strong>19.</strong> VG</td>
<td>Fruit: color at maturity</td>
<td>Fruit : couleur à maturité</td>
<td>Frucht: Farbe bei der Reife</td>
</tr>
<tr>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PQ (b)</td>
<td>green</td>
<td>verte</td>
<td>grün</td>
</tr>
<tr>
<td>yellowish</td>
<td>jaunâtre</td>
<td>gelblich</td>
<td>amarillento</td>
</tr>
<tr>
<td>orangish</td>
<td>orangé</td>
<td>orangero</td>
<td>anaranjado</td>
</tr>
<tr>
<td>reddish</td>
<td>rougeâtre</td>
<td>rötlich</td>
<td>rojizo</td>
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<tr>
<td><strong>20.</strong> MG</td>
<td>Time of flowering</td>
<td>Époque de floraison</td>
<td>Zeitpunkt der Blüte</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QN</td>
<td>early</td>
<td>précoce</td>
<td>früh</td>
</tr>
<tr>
<td>medium</td>
<td>moyenne</td>
<td>mittel</td>
<td>medio</td>
</tr>
<tr>
<td>late</td>
<td>tardive</td>
<td>spät</td>
<td>tardia</td>
</tr>
<tr>
<td><strong>21.</strong> VG</td>
<td>Autonecrosis</td>
<td>Autonécrose</td>
<td>Autonekrose</td>
</tr>
<tr>
<td>(*) (+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QL</td>
<td>absent</td>
<td>absente</td>
<td>fehlend</td>
</tr>
<tr>
<td>present</td>
<td>présente</td>
<td>vorhanden</td>
<td>présente</td>
</tr>
<tr>
<td><strong>22.</strong> VG</td>
<td>Resistance to <em>Meloidogyne incognita</em> (Mi)</td>
<td>Résistance à <em>Meloidogyne incognita</em> (Mi)</td>
<td>Resistenzen gegen <em>Meloidogyne incognita</em> (Mi)</td>
</tr>
<tr>
<td>(*) (+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QN</td>
<td>susceptible</td>
<td>sensible</td>
<td>anfällig</td>
</tr>
<tr>
<td>moderately resistant</td>
<td>moyennement résistant</td>
<td>mäßig resistant</td>
<td>moderadamente resistente</td>
</tr>
<tr>
<td>highly resistant</td>
<td>hautement résistant</td>
<td>hoch resistant</td>
<td>muy resistente</td>
</tr>
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<td>français</td>
<td>deutsch</td>
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<tr>
<td>---</td>
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<tr>
<td>23.</td>
<td>VG</td>
<td>Resistance to <em>Verticillium</em> sp. (Va and Vd)</td>
<td>Résistance à <em>Verticillium</em> sp. (Va et Vd)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Race 0</td>
<td>– Pathotype 0</td>
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<td></td>
<td>QL</td>
<td>absent</td>
<td>absente</td>
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<td></td>
<td>present</td>
<td>présente</td>
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<tr>
<td>24.</td>
<td>VG</td>
<td>Resistance to <em>Fusarium oxysporum</em> f. sp. <em>lycopersici</em> (Fol)</td>
<td>Résistance à <em>Fusarium oxysporum</em> f. sp. <em>lycopersici</em> (Fol)</td>
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<td>24.1</td>
<td>(†)</td>
<td>Race 0 (ex 1)</td>
<td>Pathotype 0 (ex 1)</td>
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</tr>
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<td></td>
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<td>présente</td>
</tr>
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<td>24.2</td>
<td>VG</td>
<td>Race 1 (ex 2)</td>
<td>Pathotype 1 (ex 2)</td>
</tr>
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<td>présente</td>
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<td>VG</td>
<td>Race 2 (ex 3)</td>
<td>Pathotype 2 (ex 3)</td>
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<td></td>
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<tr>
<td>25.</td>
<td>VG</td>
<td>Resistance to <em>Fusarium oxysporum</em> f. sp. <em>radicis-lycopersici</em> (Forl)</td>
<td>Résistance à <em>Fusarium oxysporum</em> f. sp. <em>radicis-lycopersici</em> (Forl)</td>
</tr>
<tr>
<td></td>
<td>QL</td>
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<td>absente</td>
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<td></td>
<td></td>
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<td>présente</td>
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<tr>
<td>26.</td>
<td>VG</td>
<td>Resistance to <em>Fulvia fulva</em> (Ff) (ex <em>Cladosporium fulvum</em>)</td>
<td>Résistance à <em>Fulvia fulva</em> (Ff) (ex <em>Cladosporium fulvum</em>)</td>
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<td>26.1</td>
<td>VG</td>
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<td>Pathotype 0</td>
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<td>présente</td>
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<td>VG</td>
<td>Group A</td>
<td>– Groupe A</td>
</tr>
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<td>présente</td>
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<td>VG</td>
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<td>– Groupe B</td>
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<td>présente</td>
</tr>
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<td>26.4</td>
<td>VG</td>
<td>Group C</td>
<td>– Groupe C</td>
</tr>
<tr>
<td></td>
<td>QL</td>
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<td>absente</td>
</tr>
<tr>
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</tr>
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<td>deutsch</td>
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<td>---------</td>
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<tr>
<td>26.5 VG – Group D</td>
<td>– Groupe D</td>
<td>– Gruppe D</td>
<td>– Grupo D</td>
</tr>
<tr>
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<td>absente</td>
<td>fehlend</td>
</tr>
<tr>
<td>present</td>
<td>présente</td>
<td>vorhanden</td>
<td>presente</td>
</tr>
<tr>
<td>QL</td>
<td>absent</td>
<td>absente</td>
<td>fehlend</td>
</tr>
<tr>
<td>present</td>
<td>présente</td>
<td>vorhanden</td>
<td>presente</td>
</tr>
</tbody>
</table>

| Resistance to Tomato mosaic virus (ToMV) | Résistance au virus de la mosaïque de la tomate (ToMV) | Resistenz gegen das Tomatenmosaikvirus (ToMV) | Resistencia al virus del mosaico del tomate (ToMV) |
| 27.1 VG – Strain 0 | – Souche 0 | – Pathotyp 0 | – Cepa 0 |
| QL | absent | absente | fehlend | ausente 1 |
| present | présente | vorhanden | presente | Emperador 9 |
| 27.2 – Strain 1 | – Souche 1 | – Pathotyp 1 | – Cepa 1 |
| QL | absent | absente | fehlend | ausente 1 |
| present | présente | vorhanden | presente | Emperador 9 |
| 27.3 – Strain 2 | – Souche 2 | – Pathotyp 2 | – Cepa 2 |
| QL | absent | absente | fehlend | ausente 1 |
| present | présente | vorhanden | presente | Emperador 9 |

| Resistance to Pyrenochaeta lycopersici (Pl) | Résistance au Pyrenochaeta lycopersici (Pl) | Resistenz gegen Pyrenochaeta lycopersici (Pl) | Resistencia a Pyrenochaeta lycopersici (Pl) |
| 28. VG | | | |
| QL | absent | absente | fehlend | ausente Zaralto 1 |
| present | présente | vorhanden | presente | Emperador 9 |

| Resistance to Stemphylium spp. (Ss) | Résistance à Stemphylium spp. (Ss) | Resistenz gegen Stemphylium spp. (Ss) | Resistencia a Stemphylium spp. (Ss) |
| 29. VG | | | |
| QL | absent | absente | fehlend | ausente Big Power 1 |
| present | présente | vorhanden | presente | Body 9 |

| Resistance to Tomato yellow leaf curl virus (TYLCV) | Résistance au virus des feuilles jaunes en cuillère de la tomate (TYLCV) | Resistenz gegen gelbes Tomatenblattrollvirus (TYLCV) | Resistencia al virus del enrollamiento de la hoja (TYLCV) |
| 30. VG | | | |
| QL | absent | absente | fehlend | ausente Big Power 1 |
| present | présente | vorhanden | presente | Body 9 |

| Resistance to Tomato spotted wilt virus (TSWV) | Résistance au virus de la tache bronzée de la tomate (TSWV) | Resistenz gegen das gefleckte Tomatenbronzenfleckenvirus (TSWV) | Resistencia al virus del bronceado de tomate (TSWV) |
| 31. VG | | | |
| QL | absent | absente | fehlend | ausente Big Power 1 |
| present | présente | vorhanden | presente | Body 9 |

| Resistance to Oidium neolycopersici (On) | Résistance à Oidium neolycopersici (On) | Resistenz gegen Oidium neolycopersici (On) | Resistencia a Oidium neolycopersici (On) |
| 32. VG | | | |
| QL | absent | absente | fehlend | ausente Big Power 1 |
| present | présente | vorhanden | presente | Multifort 9 |
8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

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

(a) Observations on the plant, stem and leaves should be done after a fruit set on at least five trusses and before ripening of the second truss. Observations should be done before deterioration of the leaves.
(b) Observations on the fruit should be made on mature fruits from the second or higher truss.
(c) Observations on the green shoulder and meridian stripes of the fruit should be made on the plant before maturity.

8.2 Explanations for individual characteristics

Ad. 1: Seedling: anthocyanin coloration of hypocotyl

Ad. 2: Plant: height

To be observed after fruit set on 5 nodes.

Ad. 4: Stem: length of internode

The mean length of the internodes between the 1st and 4th trusses should be assessed.

Ad. 7: Leaf: size of leaflets

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

Ad. 9: Leaf: glossiness

The glossiness of the leaf should be observed in the middle of the plant.
Ad. 10: Leaf: blistering

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

Ad. 12: Fruit: extent of green shoulder

The gene for green shoulder might not be clearly expressed in some conditions.

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

Ad. 14: Fruit: conspicuousness of meridian stripes

2  weak
3  medium
4  strong
Ad. 15: Pedicel: length

Ad. 17: Fruit: shape in longitudinal section

The apex is considered to be the part that is furthest from the stalk attachment.

1 broad oblate
2 narrow oblate
3 circular
4 obovate

Ad. 21: Autonecrosis

Autonecrosis is a necrotic reaction to the presence of incompatible genomes causing older leaves to wither and die.
Ad. 22: Resistance to *Meloidogyne incognita* (Mi)

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

---
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\(^2\) GEVES; Valerie.GRI MAULT@geves.fr
Ad. 23: Resistance to *Verticillium* sp. (Va and Vd)

1. Pathogen ........................................... *Verticillium dahliae* or *Verticillium albo-atrum* (see note below)
2. Host species .................................... *Solanum lycopersicum*
3. Source of inoculum .......................... Naktuinbouw3 (NL) and GEVES4 (FR)
4. Isolate ............................................. Race 0 (e.g. strain Toreilles 4-1-4-1)
5. Multiplication inoculum
6. Multiplication medium .................... Potato Dextrose Agar, Agar Medium “S” of Messiaen
8. Inoculation medium........................  water (for scraping agar plates) or Czapek Dox broth (3-7 d-old aerated culture at 20-25°C, in darkness)
8.6 Harvest of inoculum ....................... filter through double muslin cloth
8.7 Check of harvested inoculums……  spore count; adjust to 10⁶ per ml
8.8 Shelf life/viability inoculums…………1 d at 4°C
9. Format of the test
9.1 Number of plants per genotype……   35 seeds for 24 plants
9.2 Number of replicates………………   1 replicate
9.3 Control varieties
   Susceptible ..................................... (Solanum lycopersicum) Flix, Marmande verte, Clarion, Santonio, Anabel
   Resistant ...................................... Big Power and (Solanum lycopersicum) Monalbo, Elias, Monalbo x Marmande verte, Daniela, Marmande VR
9.4 Test design .......................... 20 plants inoculated at least, 2 blanks at least
9.5 Test facility .......................... greenhouse or climate room
9.6 Temperature .......................... optimal 20-25°C, 20-22°C after inoculation
9.7 Light ........................................ 12 h or longer
9.8 Temperature ................................ optimal 20-25°C, 20-22°C after inoculation
10. Inoculation
10.1 Preparation inoculums…………… aerated, liquid culture (8.4)
10.2 Quantification inoculums………… count spores, adjust to 10⁶ per ml
10.3 Plant stage at inoculation……….. cotyledon to 3rd leaf
10.4 Inoculation method ............... roots are immersed for 4 to 15 min in spore suspension.
10.7 Final observations ............... 14-33 d after inoculation
11. Observations
11.1 Method .......................... visual
11.2 Observation scale ..................... growth retardation, wilting, chlorosis, and vessel browning
11.3 Validation of test ............ evaluation of variety resistance should be calibrated with results of resistant and susceptible controls. Standards near borderline R/S will help to compare between laboratories.
12. Interpretation of test results in comparison with control varieties
   absent ........................................... [1] severe symptoms
   present ........................................ [9] mild or no 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.

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4 GEVES; Valerie.GRIMAUT@geves.fr
Ad. 24: Resistance to *Fusarium oxysporum* f. sp. *lycopersici* (Fol)

1. Pathogen ............................... *Fusarium oxysporum* f. sp. *lycopersici*
2. Host species .............................. *Solanum lycopersicum*
4. Source of inoculum ..................... Naktuinbouw\(^5\) (NL) and GEVES\(^6\) (FR)
5. Isolate ................................. Race 0 (ex 1) (e.g. strains Orange 71 or PRI 20698 or Fol 071 1 (ex 2) (e.g. strains 4152 or PRI40698 or RAF 70 and 2 (ex 3) Individual strains may vary in pathogenicity
6. Establishment isolate identity........ use differential varieties (see 9.3)
7. Establishment pathogenicity .......... on susceptible tomato varieties
8. Multiplication inoculum
8.1 Multiplication medium……………. Potato Dextrose Agar, Medium “S” of Messiaen
8.2 Inoculation medium……………… water for scraping agar plates or Czapek-Dox culture medium (7 d-old aerated culture)
8.6 Harvest of inoculum ……………….. filter through double muslin cloth
8.7 Check of harvested inoculum spore count; adjust to 10^6 per ml
8.8 Shelf-life/viability inoculum ……… 4-8 h, keep cool to prevent spore germination
9. Format of the test
9.1 Number of plants per genotype... at least 20 plants
9.2 Number of replicates............... 1 replicate
9.3 Control varieties for the test with race 0 (ex 1) 
   Susceptible.............................. (Solanum lycopersicum) Marmande, Marmande verte, Resal
   Resistant for race 0 only .......... (Solanum lycopersicum) Marporum, Larissa, “Marporum x Marmande verte”, Marsol, Anabel
   Resistant for race 0 and 1 .......... (Solanum lycopersicum) Motelle, Gourmet, Mohawk
   Control varieties for the test with race 1 (ex 2)
   Susceptible.............................. (Solanum lycopersicum) Marmande verte, Cherry Belle, Roma
   Resistant for race 0 only .......... (Solanum lycopersicum) Marporum, Ranco
   Resistant for race 0 and 1 .......... (Solanum lycopersicum) Tradiro, Odisea
   Remark: Ranco is slightly less resistant than Tradiro
   Control varieties for the test with race 2 (ex 3)
   Susceptible for race 0, 1 and 2....... Emperador
   Resistant for race 0, 1 and 2......... Colosus
9.4 Test design ………………………… >20 plants; e.g. 35 seeds for 24 plants, including 2 blanks
9.5 Test facility ………………………… glasshouse or climate room
9.6 Temperature………………….. 24-28°C (severe test, with mild isolate)
   20-24°C (mild test, with severe isolate)
9.7 Light………………………………… 12 hours per day or longer
9.8 Season ………………………… all seasons
9.9 Special measures ........................... slightly acidic peat soil is optimal;
   keep soil humid but avoid water stress
10. Inoculation 
10.1 Preparation inoculums…………….. aerated Messiaen or PDA or Agar Medium S of Messiaen or Czapek Dox culture or scraping of plates
10.2 Quantification inoculums.......... spore count, adjust to 10^6 spores per ml,
   Lower concentration for a very aggressive isolate
10.3 Plant stage at inoculation......... 10-18 d, cotyledon to first leaf
10.4 Inoculation method…………………. roots and hypocotyls are immersed in spore suspension
   for 5-15 min; trimming of roots is an option
10.7 Final observations .................. 14-21 days after inoculation
11. Observations 
11.1 Method ………………………… visual
11.2 Observation scale ………………… Symptoms:
   growth retardation, wilting, yellowing,
   vessel browning extending above cotyledon
11.3 Validation of test………………… evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
12. Interpretation of test results in comparison with control varieties
   absent ………………………… [1] severe symptoms
   present ……………………….. [9] mild or no symptoms
13. Critical control points:
   Test results may vary slightly in inoculum pressure due to differences in isolate, spore concentration, soil humidity and temperature. Standards near borderline R/S will help to compare between labs.

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\(^6\) GEVES; Valerie.GRIMAULT@geves.fr
Ad. 25: Resistance to *Fusarium oxysporum* f. sp. *radicis-lycopersici* (Forl)

1. Pathogen ........................................... *Fusarium oxysporum* f. sp. *radicis-lycopersici*
2. Host species ................................. *Solanum lycopersicum*
3. Source of inoculum ......................... Naktuinbouw (NL) and GEVES (FR)
4. Isolate ............................................ -
5. Establishment pathogenicity .......... symptoms on susceptible tomato
6. Multiplication inoculum
   8. 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 10⁶ per ml
   8.8 Shelf life/viability inoculum .......... 4-8 h, keep cool to prevent spore germination
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 10⁶ per ml
   8.8 Shelf life/viability inoculum .......... 4-8 h, keep cool to prevent spore germination
9. Format of the test
10. Inoculation
    10.1 Preparation inoculum ................. aerated culture or scraping of plates
    10.2 Quantification inoculum .............. spore count, adjust to 10⁶ spores per ml
    10.3 Plant stage at inoculation .......... 12-18 d, cotyledon to third leaf
    10.4 Inoculation method ..................... roots and hypocotyls are immersed in spore suspension for 5-15 min
    10.7 Final observations ...................... 10-21 days after inoculation
11. Observations
    11.1 Method ..................................... visual; a few plants are lifted at the end of the test
    11.2 Observation scale ........................ Symptoms:
       Plant death, Growth retardation caused by root degradation
       Root degradation, Necrotic pinpoints and necrotic lesions on stems
    11.3 Validation of test ....................... evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
12. Interpretation of test results in comparison with control varieties
    absent ......................................... [1] symptoms
    present ....................................... [9] no symptoms
13. Critical control points:
    Temperature should never exceed 27°C during the test period; frequent renewal of races may be needed because of loss of pathogenicity

---

7 Naktuinbouw: resistentie@naktuinbouw.nl
8 GEVES: Valerie.GRIMAULT@geves.fr
Ad. 26: Resistance to *Fulvia fulva* (Ff) (ex *Cladosporium fulvum*)

1. Pathogen ........................................... *Fulvia fulva* (ex *Cladosporium fulvum*)
2. Host species ................................. *Solanum lycopersicum*
3. Source of inoculum ......................... Naktuinbouw\(^9\) (NL) or GEVES\(^10\) (FR)
4. Isolate .......................................... Race group 0, A, B, C, D, and E
5. Establishment isolate identity .......... with genetically defined differentials from GEVES (FR)
   A breaks Cf-2, B Cf-4, C Cf-2&4, D Cf-5, E Cf-2&4&5
6. Establishment pathogenicity ............ symptoms on susceptible tomato
7. Multiplication inoculum .................. Potato Dextrose Agar or Malt Agar or a synthetic medium
8. Multiplication medium .................... Potato Dextrose Agar or Malt Agar or a synthetic medium
9. Shelf life/viability inoculum .......... 4 hours, keep cool
10. Format of the test ..........................
9.1 Number of plants per genotype .... more than 20 plants
9.2 Number of replicates .................... 1 replicate
9.3 Control varieties
   Susceptible: .................................... King Kong and (*Solanum lycopersicum*) Monalbo, Moneymaker
   Resistant for race 0: ........................ Bruce and (*Solanum lycopersicum*) Angela, Estrella, Sonatine, Sonato, Vemone, Vagabond, IVT 1149, Vagabond × IVT 1149, IVT 1154
   Resistant for race group A: .............. Big Power and (*Solanum lycopersicum*) Angela, Estrella, Sonatine, Sonato
   Resistant for race group B: .............. Bruce and (*Solanum lycopersicum*) Angela, Estrella, Sonatine, Vemone
   Resistant for race group C: .............. Big Power and (*Solanum lycopersicum*) Angela, Estrella, Sonatine
   Resistant for race group D: .............. Bruce and (*Solanum lycopersicum*) Estrella, Sonatine, Vemone
   Resistant for race group E: .............. Big Power and (*Solanum lycopersicum*) Sonatine, Jadviga, Rhianna, IVT 1154
9.5 Test facility ................................. Glasshouse or climate room
9.6 Temperature ................................. Day: 22°C, night: 20°C or day: 25°C, night: 20°C
9.7 Light ........................................... 12 hours or longer
9.9 Special measures .......................... Depending on facility and weather, there may be a need to raise the humidity e.g. humidity tent closed 3-4 days after inoculation and after this, 66% until 80% closed during day, until end
10. Inoculation .................................
10.1 Preparation inoculum ................... Prepare evenly colonized plates, e.g. 1 for 36 plants; remove spores from plate by scraping with water with Tween20; filter through double muslin cloth
10.2 Quantification inoculum ............... Count spores; adjust to 10\(^5\) spores per ml or more
10.3 Plant stage at inoculation .......... 19-20 d (incl. 12 d at 24\(^\circ\)), 2-3 leaves
10.4 Inoculation method ...................... Spray on dry leaves
10.7 Final observations ....................... 14 days after inoculation
11. Observations .................................
11.1 Method ....................................... Visual inspection of abaxial side of inoculated leaves
11.2 Observation scale ........................... Symptom: velvety, white spots
11.3 Validation of test ....................... Evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
12. Interpretation of test results in comparison with control varieties
   Absent ........................................... [1] symptoms
   Present .......................................... [9] no symptoms
Excessively high humidity may cause rugged brown spots on all leaves. These are not to be considered as off-types.
13. Critical control points:
   Ff spores have a variable size and morphology. Small spores are also viable.
   Fungal plates will gradually become sterile after 6-10 weeks. Store good culture at -80°C.
   For practical purposes, it is not possible to keep plants longer than 14 days inside a tent.

---

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

1. Pathogen .............................................. Tomato mosaic virus
2. Host species ............................ Solanum lycopersicum
3. Source of inoculum .................. Naktuinbouw (NL) or GEVES (FR)
4. Isolate ................................. Strain 0 (e.g. isolate INRA Avignon 6-5-1-1) 1 and 2
5. Establishment isolate identity .... genetically defined tomato standards
   Mobaci (Tm1), Moperou (Tm2), Momor (Tm2)
6. Establishment pathogenicity ........ on susceptible plant
7. 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”,
6. 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 plants
9.2 Number of replicates……………… 1 replicate
9.3 Control varieties
   Susceptible ............................ (Solanum lycopersicum) Marmande, Monalbo
   Resistant for ToMV: 0 and 2 ......... (Solanum lycopersicum) Mobaci
   Resistant for ToMV: 0 and 1 ......... (Solanum lycopersicum) Moperou
   Resistant with necrosis .......... (Solanum lycopersicum) “Monalbo x Momor”
   Resistant ..................................... (Solanum lycopersicum) Gourmet
9.4 Test design .................................... blank treatment with PBS and carborundum or similar buffer
9.5 Test facility ..................................... Glasshouse or climate room
9.6 Temperature .................................. 24 to 26°C
9.7 Light ............................................... 12 hours or longer
9.8 Season............................................ symptoms are more pronounced in summer
9.10 Inoculation
   10.1 Preparation inoculum ............ 1 g leaf with symptoms with 10 ml PBS or similar buffer
   Homogenize, add carborundum to buffer (1 g/30ml)
   10.3 Plant stage at inoculation ........ cotyledons or 2 leaves
   10.4 Inoculation method ............... gentle rubbing
   10.7 Final observations................. 11-21 days after inoculation
11. Observations
11.1 Method ......................................... visual
11.2 Observation scale ........................ Symptoms of susceptibility:
   Mosaic in top, leaf malformation
   Symptoms of resistance (based on hypersensitivity):
   Local Necrosis, Top necrosis, Systemic Necrosis
11.3 Validation of test .......................... evaluation of variety resistance should be calibrated with results of
   resistant and susceptible controls
Remark: in some heterozygous varieties a variable proportion of plants may have severe systemic necrosis
or some necrotic spots while the other plants have no symptoms. This proportion may vary between
experiments
12. Interpretation of test results in comparison with control varieties
   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.

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

---

11 Naktuinbouw: resistantie@naktuinbouw.nl
12 GEVES: Valerie.GRIMAULT@geves.fr
Ad. 28: Resistance to *Pyrenochaeta lycopersici* (Pl)

1. Pathogen ........................................... *Pyrenochaeta lycopersici*
2. Host species ................................. *Solanum lycopersicum*
3. Source of inoculum ......................... -
4. Isolate ............................................. -
5. Establishment pathogenicity ............ biotest
6. Multiplication inoculum
7. Multiplication medium .................... V8 Agar
8. Multiplication variety ...................... susceptible tomato variety
9. Plant stage at inoculation ............... seed
10. Inoculation medium........................ mixture of soil, e.g. (70%), sand (20%) and inoculum (10.1) (10%)
11. Harvest of inoculum ....................... diseased roots are harvested after 2-4 months
12. Check of harvested inoculum ........... visual inspection of lesions on roots
13. Shelf-life/viability inoculum ........... the fungus will not die quickly, but may lose its pathogenicity
   within a week after isolation on an agar medium
14. Format of the test
15. Number of plants per genotype ..... 20 plants
16. Number of replicates……………… 1 replicate
17. Control varieties ............................
   susceptible: .......................................... Zaralto and (*Solanum lycopersicum*) Montfavet H 63.5
   resistant: .............................................. Emperador and (*Solanum lycopersicum*) Kyndia, Moboglan,
   Pyrella
18. Test facility ..................................... greenhouse or climate cell
19. Temperature .................................. day 24°C, night 14°C
20. Light ............................................... 12 h minimum
21. Inoculation
22. Preparation inoculum ................... e.g. double-autoclaved mixture of soil with 10% oatmeal added
23. Plant stage at inoculation ............. 6 weeks
24. Inoculation method ...................... transplanting into mixture of soil, sand and inoculum (8.4)
25. Final observations........................ 6-8 weeks after transplanting (flowering plant)
26. Observations
27. Method........................................... visual
28. Observation scale ........................... Symptoms: brown lesions on roots
29. Validation of test .......................... evaluation of variety resistance should be calibrated with results of
   resistant and susceptible controls
30. Interpretation of test results in comparison with control varieties
   absent .............................................. [1] symptoms
   present .......................................... [9] no symptoms
31. Critical control points:
The fungus loses its pathogenicity quickly after isolation on an agar medium. It is advisable to keep the isolate alive on living plants.
Ad. 29: Resistance to Stemphylium spp. (Ss)

1. Pathogen ........................................... Stemphylium spp. e.g. Stemphylium solani (see note below)
2. Host species .............................. Solanum lycopersicum
3. Source of inoculum .......................... GEVES13 (FR)
4. Isolate ............................................ -
5. Establishment pathogenicity .......... biotest
6. Multiplication inoculum
7. Multiplication medium .......... PDA (12 hours per day under near-ultraviolet light)

8. Multiplication inoculum
8.1 Multiplication medium .......... PDA (12 hours per day under near-ultraviolet light)

9. Format of the test
9.1 Number of plants per genotype .... at least 20 plants
9.2 Number of replicates ............. 1 replicate
9.3 Control varieties .................

Susceptible: ................................. Big Power and (Solanum lycopersicum) Monalbo
Resistant: ................................. Body and (Solanum lycopersicum) Motelle, F1 Motelle x Monalbo
9.5 Test facility .......................... greenhouse or climate cell
9.6 Temperature ............................. 24°C
9.7 Light ......................................... 12 hours minimum
9.9 Special measures ..................... incubation in tunnel with 100 % relative humidity or humidity tent

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 Tween

The spore suspension is sieved through a double layer of muslin.

10.2 Quantification inoculum .......... 5.10³ – 10⁵ 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 ............... Symptoms:
ross lesions on cotyledons and leaves;
yellowing of leaves
11.3 Validation of test .............. evaluation of variety resistance should be calibrated with results of

resistant and susceptible controls

12. Interpretation of test results in comparison with control varieties

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

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

Note: Some isolates of Stemphylium cannot be classified easily as either Stemphylium solani or a related

species. These Stemphylium isolates may still be useful for identifying resistance to Stemphylium solani.
Ad. 30: Resistance to Tomato yellow leaf curl virus (TYLCV)

1. Pathogen ........................................... Tomato yellow leaf curl virus (see note below)
2. Quarantine status ............................. yes
3. Host species .................................... Solanum lycopersicum
4. Source of inoculum .......................... -
5. Isolate ............................................. -
6. Harvest of inoculum ....................... symptomatic leaves may be stored at -70°C
7. Format of the test ............................. field with natural disease pressure
9.1 Number of plants per genotype ....... 20 plants
9.2 Number of replicates ..................... 1 replicate
9.3 Control varieties
   Susceptible: .................................. (Solanum lycopersicum) Montfavet H 63.5
   Resistant: .................................... (Solanum lycopersicum) TY 20, Anastasia, Mohawk
9.5 Test facility .................................. field with natural disease pressure
9.9 Special measures ......................... prevent spread of white-flies
10. Inoculation
   10.3 Plant stage at inoculation .......... 6-12 weeks (adult plants)
   10.4 Inoculation method .................... vector (Bemisia white-flies carrying TYLCV)
   10.7 Final observations ..................... 1-2 months after inoculation
11. Observations
   11.1 Method ...................................... visual
   11.2 Observation scale ...................... Symptoms: leaf yellowing and curling
   11.3 Validation of test ....................... evaluation of variety resistance should be calibrated with results of resistant and susceptible controls
12. Interpretation of test results in comparison with control varieties
    absent........................................ [1] severe symptoms
    present ..................................... [9] no or mild symptoms
13. Critical control points:
    TYLCV is endemic in many tropical and subtropical areas and has a quarantine status in many countries with a temperate climate. TYLCV is on the EPPO alert list. Some TYLCV resistant varieties may be susceptible to the closely related virus Tomato yellow leaf curl Sardinia virus (TYLCSV).
Ad. 31: Resistance to Tomato spotted wilt virus (TSWV)

1. Pathogen ............................................ Tomato spotted wilt virus (see note below)
2. Quarantine status ............................. yes (see note below)
3. Host species .............................. Solanum lycopersicum
4. Source of inoculum ..................... Naktuinbouw\textsuperscript{14} (NL), GEVES\textsuperscript{15} (FR)
5. Isolate .................................. race 0, preferably a thrips-transmission deficient variant
6. Establishment pathogenicity .......... biotest
7. Multiplication inoculum ............... symptomatic leaves may be stored at -70°C
8. Harvest of inoculum ..................... symptomatic leaves may be stored at -70°C
9. Number of plants per genotype ...... 20 plants
9.1 Number of replicates ................. 1 replicate
9.2 Format of the test ....................... glasshouse or climatic chamber
9.3 Temperature ............................. 20°C
9.4 Light .......................................... 12 hours or longer
9.5 Control varieties
   Susceptible: .............................. Big Power and (Solanum lycopersicum) Monalbo, Momor,
                                Montfavet H 63.5
   Resistant: ............................... Enpower and (Solanum lycopersicum) Tsunami, Bodar, Mospomor,
                                Lisboa
9.6 Test facility ............................... glasshouse or climatic chamber
9.7 Test facility ......................... glasshouse or climatic chamber
9.8 Test facility ............................... glasshouse or climatic chamber
9.9 Test facility ............................... glasshouse or climatic chamber
10. Inoculation
10.1 Preparation inoculum ............... press symptomatic leaves in ice-cold buffer
    Option: sieve the leaf sap through double muslin
10.2 Plant stage at inoculation ............ one or two expanded leaves
10.3 Inoculation method ................. mechanical, rubbing with carborundum on cotyledons, inoculum
    suspension < 10° C
10.4 Inoculation method ................. mechanical, rubbing with carborundum on cotyledons, inoculum
    suspension < 10° C
10.5 Inoculation method ................. mechanical, rubbing with carborundum on cotyledons, inoculum
    suspension < 10° C
10.6 Inoculation method ................. mechanical, rubbing with carborundum on cotyledons, inoculum
    suspension < 10° C
10.7 Final observations .................... 7-21 days after inoculation
11. Observations
11.1 Method .................................. visual
11.2 Observation scale .................... Symptoms: top mosaic, bronzing, various malformations, necrosis
11.3 Validation of test ..................... evaluation of variety resistance should be calibrated with results of
   resistant and susceptible controls
12. Interpretation of test results in comparison with control varieties
   absent............................................ [1] symptoms
   present......................................... [9] no symptoms
13. Critical control points:
    TSWV has a quarantine status in some countries. TSWV is transmitted by Thrips tabaci and Western flower
    thrips (Frankliniella occidentalis). Pathotype 0 is defined by its inability to break resistance in tomato varieties
    carrying the resistance gene Sw-5.

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\textsuperscript{15} GEVES; Valerie.GRIMAULT@geves.fr
Ad. 32: Resistance to *Oidium neolycopersici* (On)

1. Pathogen ........................................... *Oidium neolycopersici* (Powdery mildew)
2. Host species ................................. *Solanum lycopersicum*
3. Source of inoculum ..................... -
4. Isolate ........................................ see remark under 13
5. Establishment pathogenicity .......... biotest
6. Multiplication inoculum
7. Multiplication medium ... plant
8. Harvest of inoculum ................. by washing off
9. Check of harvested inoculum ....... check for contaminants under microscope
10. Shelf-life/viability inoculum ...... 1-2 hours
9. Format of the test
10. Number of plants per genotype ..... 20 plants
11. Number of replicates ............... 1 replicate
12. Control varieties
   Susceptible: ............................. *(Solanum lycopersicum)* Momor, Montfavet H 63.5
   Resistant: ............................... Multifort and *(Solanum lycopersicum)* Atlanta, Romiro, PI-247087
13. Test facility .............................. glasshouse
14. Temperature .............................. 20°C or 18/24°C
15. Light ........................................... 12 hours
16. Inoculation
17. Preparation inoculum .............. collect spores in water
18. Quantification inoculum ............ 10^4 conidia/ml
19. Plant stage at inoculation ............ 3 weeks
20. Inoculation method ................. by spraying on leaves or dredging of leaves
21. Final observations ...................... 7-18 days after inoculation
22. Observations
23. Method ........................................ visual
24. Observation scale ....................... 0. no sporulation
   1. necrotic points and sometimes locally restricted sporulation
   2. moderate sporulation
   3. abundant sporulation
25. Validation of test ....................... evaluation of variety resistance should be calibrated with results of
   resistant and susceptible controls
26. Interpretation of test results in comparison with control varieties
   absent .......................................... [1] moderate or abundant sporulation
   present ....................................... [9] no or restricted sporulation
27. Critical control points:
   Resistance-breaking isolates should be avoided. Resistance to *O. neolycopersici* is usually race-specific.
   However, as long as a differential series of tomato genotypes with well defined resistances is lacking, it will
   remain hard to conclude that different races of *O. neolycopersici* exist.
9. Literature


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


10. Technical Questionnaire

<table>
<thead>
<tr>
<th>TECHNICAL QUESTIONNAIRE</th>
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<th>Reference Number:</th>
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<tbody>
<tr>
<td></td>
<td>Application date:</td>
<td>(not to be filled in by the applicant)</td>
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<tr>
<td></td>
<td>TECHNICAL QUESTIONNAIRE</td>
<td>to be completed in connection with an application for plant breeders’ rights</td>
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</tbody>
</table>

1. Subject of the Technical Questionnaire
Tomato Rootstocks belonging to:

1.1 Botanical name: *Solanum lycopersicum* L. *x* *Solanum habrochaites* S. Knapp & D.M. Spooner

1.2 Botanical name: *Solanum lycopersicum* L. *x* *Solanum peruvianum* (L.) Mill.

1.3 Botanical name: *Solanum lycopersicum* L. *x* *Solanum cheesmaniae* (L. Ridley) Fosberg

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

4.1 Breeding scheme

(i) Inbred line
(ii) Hybrid
(iii) Open-pollinated variety
(iv) Other (please provide details)

Variety resulting from:

4.1.1 Crossing

(a) controlled cross

(please state parent varieties)

(…………………………..) x (…………………………..)
female parent male parent

(b) partially known cross

(please state known parent variety(ies))

(…………………………..) x (…………………………..)
female parent male parent

(c) unknown cross

4.1.2 Mutation

(please state parent variety)

4.1.3 Discovery and development

(please state where and when discovered and how developed)

4.1.4 Other

(please provide details)

* Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.
4.2 Method of propagating the variety

4.2.1 Seed-propagated varieties

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

4.2.2 Vegetatively propagated varieties

(a) cuttings  [   ]
(b) *in vitro* propagation  [   ]
(c) other (state method)  [   ]

4.2.3 Other  [   ]
   (please provide details)
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).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Example Varieties</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5.1 Fruit: green shoulder</strong> (11)</td>
<td></td>
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</tr>
<tr>
<td>absent</td>
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<td>1[ ]</td>
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<tr>
<td>present</td>
<td>Big Force, Maxifort</td>
<td>9[ ]</td>
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<td><strong>5.2 Fruit: shape in longitudinal section</strong> (17)</td>
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<tr>
<td>broad oblate</td>
<td>He-Wolf</td>
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<tr>
<td>narrow oblate</td>
<td>Gladiator</td>
<td>2[ ]</td>
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<td>circular</td>
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<td>3[ ]</td>
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<tr>
<td>obovate</td>
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<td>4[ ]</td>
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<td><strong>5.3 Fruit: number of locules</strong> (18)</td>
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<td>only two</td>
<td>Maxifort</td>
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<td>two and three</td>
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<td><strong>5.4 Fruit: color at maturity</strong> (19)</td>
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<td>susceptible</td>
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<td>highly resistant</td>
<td>Emperador</td>
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<td><strong>5.6 Resistance to Verticillium sp. (Va and Vd) - Race 0</strong> (23)</td>
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<tr>
<td>present</td>
<td>Big Power</td>
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</tr>
<tr>
<td>Characteristics</td>
<td>Example Varieties</td>
<td>Note</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------</td>
<td>------</td>
</tr>
<tr>
<td>5.7 (24) Resistance to <em>Fusarium oxysporum</em> f. sp. <em>lycopersici</em> (Fol)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.8 (24.1) Race 0 (ex 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td></td>
<td>1[ ]</td>
</tr>
<tr>
<td>present</td>
<td>Emperador</td>
<td>9[ ]</td>
</tr>
<tr>
<td>5.9 (24.2) Race 1 (ex 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td></td>
<td>1[ ]</td>
</tr>
<tr>
<td>present</td>
<td>Emperador</td>
<td>9[ ]</td>
</tr>
<tr>
<td>5.10 (24.3) Race 2 (ex 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td>Emperador</td>
<td>1[ ]</td>
</tr>
<tr>
<td>present</td>
<td>Colosus</td>
<td>9[ ]</td>
</tr>
<tr>
<td>5.11 (25) Resistance to <em>Fusarium oxysporum</em> f. sp. <em>radicis-lycopersici</em> (Forl)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td>Kemerit</td>
<td>1[ ]</td>
</tr>
<tr>
<td>present</td>
<td>Emperador</td>
<td>9[ ]</td>
</tr>
<tr>
<td>5.12 (28) Resistance to <em>Pyrenochaeta lycopersici</em> (Pl)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absent</td>
<td>Zaralto</td>
<td>1[ ]</td>
</tr>
<tr>
<td>present</td>
<td>Emperador</td>
<td>9[ ]</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Denomination(s) of variety(ies) similar to your candidate variety</th>
<th>Characteristic(s) in which your candidate variety differs from the similar variety(ies)</th>
<th>Describe the expression of the characteristic(s) for the similar variety(ies)</th>
<th>Describe the expression of the characteristic(s) for your candidate variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>Fruit: green shoulder</td>
<td>present</td>
<td>absent</td>
</tr>
</tbody>
</table>

Comments:
**TECHNICAL QUESTIONNAIRE**

<table>
<thead>
<tr>
<th>Page (x) of (y)</th>
<th>Reference Number:</th>
</tr>
</thead>
</table>

### #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?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

(If yes, please provide details)

#### 7.2 Are there any special conditions for growing the variety or conducting the examination?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

(If yes, please provide details)

#### 7.3 Other information

### 8. Authorization for release

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

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

(b) Has such authorization been obtained?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

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

---

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