

Technical Working Party for Vegetables

TWV/59/3

**Fifty-Ninth Session
Virtual meeting, May 5 to 8, 2025**

Original: English
Date: March 31, 2025

PARTIAL REVISION OF THE TEST GUIDELINES FOR TOMATO ROOTSTOCKS

Document prepared by an expert from the Netherlands (Kingdom of)

Disclaimer: this document does not represent UPOV policies or guidance

1. The purpose of this document is to present a proposal for a partial revision of the Test Guidelines for Tomato Rootstocks (document TG/294/1 Rev. 5).
2. The Technical Working Party for Vegetables (TWV), at its fifty-eighth session¹, agreed that the Test Guidelines for Tomato rootstocks be partially revised (see document TWV/58/11 “Report”, Annex II).
3. The following changes are proposed:
 - (a) Revision of characteristic 22 “*Meloidogyne incognita* (Mi)”: states of expression to read the same as in the Test Guidelines for Tomato
 - (b) Revision of explanation Ad. 22 “*Meloidogyne incognita* (Mi)”
4. The proposed changes are presented below in highlight and underline (insertion) and ~~strike through~~ (deletion).

Proposed revision of characteristic 22 “*Meloidogyne incognita* (Mi): states of expression to read the same as in the Test Guidelines for Tomato

Current wording

22. (* (+)	VG	Resistance to <i>Meloidogyne incognita</i> (Mi)	Résistance à <i>Meloidogyne incognita</i> (Mi)	Resistenz gegen <i>Meloidogyne incognita</i> (Mi)	Resistencia a <i>Meloidogyne incognita</i> (Mi)		
QN		susceptible	sensible	anfällig	susceptible	Bruce	1
		moderately resistant	moyennement résistant	mäßig resistent	moderadamente resistente		2
		highly resistant	hautement résistant	hoch resistent	muy resistente	Emperador	3

Proposed new wording

22. (* (+)	VG	Resistance to <i>Meloidogyne incognita</i> (Mi)	Résistance à <i>Meloidogyne incognita</i> (Mi)	Resistenz gegen <i>Meloidogyne incognita</i> (Mi)	Resistencia a <i>Meloidogyne incognita</i> (Mi)		
QN		susceptible <u>absent or low</u>	sensible <u>absente ou faible</u>	anfällig <u>fehlend oder gering</u>	susceptible <u>ausente o baja</u>	Bruce	1
		moderately resistant <u>medium</u>	moyennement résistant <u>moyenne</u>	mäßig resistent <u>mittel</u>	moderadamente resistente <u>resistente media</u>		2
		highly resistant <u>high</u>	hautement résistant <u>élevée</u>	hoch resistent <u>hoch</u>	muy resistente <u>alta</u>	Emperador	3

¹ held via electronic means, from April 22 to 25, 2024.

Revision of explanation Ad. 22 “*Meloidogyne incognita* (Mi): control varieties*Current wording*Ad. 22: Resistance to *Meloidogyne incognita* (Mi)

1.	Pathogen	<i>Meloidogyne incognita</i>
2.	Quarantine status	-
3.	Host species	Tomato - <i>Solanum lycopersicum</i>
4.	Source of inoculum	GEVES ² (FR) or INIA – CSIC (ES) ³ or Naktuinbouw (NL ⁴)
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	2 nd leaf stage
8.5	Inoculation method	deposit of piece of inoculated roots in soil (around 5-10g near each plant, to adapt depending on 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	Shelf life/viability inoculum	1 day
9.	Format of the test	
9.1	Number of plants per genotype	30 plants Remark: knowing that germination in rootstocks might be low and/or irregular it is recommended to sow more seeds to be sure to get at least 30 plants. It is recommended to include in the test, 10 non-inoculated plants, to be able to identify a possible lack of germination or a delay in plant growth, due to the material.
9.2	Number of replicates	at least 2, preferably 3 to allow statistical analysis
9.3	Control varieties	Susceptible: Bruce and (<i>Solanum lycopersicum</i>) Casaque Rouge Intermediate resistant: (<i>Solanum lycopersicum</i>) Campeon, Tynic Highly resistant: Emperador
9.4	Test design	3 replicates of 10 plants in different trays by variety
9.5	Test facility	greenhouse or climate room
9.6	Temperature	20-26°C, the temperature should be adapted, depending on the aggressiveness of the test, to obtain the expected response of the controls, but should not exceed 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	Quantity of inoculum depends on aggressiveness of test and growing conditions (e.g. between 30g to 60g of inoculated 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 are sown in non-inoculated soil and inoculation of soil and inoculation of soil is done after sowing when plantlets are at cotyledon stage.
10.7	End of test	28 to 45 days after inoculation depending on test conditions (temperature, season)

² GEVES; matref@geves.fr³ INIA; resistencias@inia.es⁴ Naktuinbouw; resistentie@naktuinbouw.nl

11.	Observations											
11.1	Method	root inspection per plant										
11.2	Observation scale											
	<table border="1"> <thead> <tr> <th>Class 0: healthy plant, no galls</th> <th>Class 1: few and little galls which are difficult to find (for example less than 5)</th> <th>Class 2: few galls, easy to observe but on few roots, still a lot of roots without galls</th> <th>Class 3: many individual galls on most but not all roots</th> <th>Class 4: many galls on all roots, sometimes in chains, can lead to dead plants and /or may suppress emergence</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Class 0: healthy plant, no galls	Class 1: few and little galls which are difficult to find (for example less than 5)	Class 2: few galls, easy to observe but on few roots, still a lot of roots without galls	Class 3: many individual galls on most but not all roots	Class 4: many galls on all roots, sometimes in chains, can lead to dead plants and /or may suppress emergence						
Class 0: healthy plant, no galls	Class 1: few and little galls which are difficult to find (for example less than 5)	Class 2: few galls, easy to observe but on few roots, still a lot of roots without galls	Class 3: many individual galls on most but not all roots	Class 4: many galls on all roots, sometimes in chains, can lead to dead plants and /or may suppress emergence								
												
11.3	Validation of test	<p>Validation on controls. Expected reactions of controls:</p> <p>Susceptible control: most plants at classes 3 and 4.</p> <p>Highly resistant: most plants at classes 0 and 1.</p> <p>Intermediate resistant: clearly different from other controls with majority of plants around class 2.</p>										
12.	Interpretation of data in terms of UPOV characteristic states	<p>[1] Susceptible: variety very similar to susceptible control</p> <p>[2] Intermediate resistant: variety very similar to intermediate resistant control</p> <p>[3] Highly resistant: variety very similar to highly resistant control</p> <p>If results are not clear, statistical analysis is advised.</p> <p>If significantly different from the controls, a retest is advised to check if the result is stable.</p>										
13.	Critical control points	<p>Avoid overwatering. This may result in rotting of roots.</p> <p>In case of aggressive test, decrease the quantity of inoculum.</p>										

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

1.	Pathogen	<i>Meloidogyne incognita</i>
2.	Quarantine status	-
3.	Host species	Tomato - <i>Solanum lycopersicum</i>
4.	Source of inoculum	GEVES ⁵ (FR) or INIA – CSIC (ES) ⁶ or Naktuinbouw (NL) ⁷
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	2 nd leaf stage
8.5	Inoculation method	deposit of piece of inoculated roots in soil (around 5-10g near each plant, to adapt depending on 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	Shelf life/viability inoculum	1 day
9.	Format of the test	
9.1	Number of plants per genotype	30 plants Remark: knowing that germination in rootstocks might be low and/or irregular it is recommended to sow more seeds to be sure to get at least 30 plants. It is recommended to include in the test, 10 non-inoculated plants, to be able to identify a possible lack of germination or a delay in plant growth, due to the material.
9.2	Number of replicates	at least 2, preferably 3 to allow statistical analysis
9.3	Control varieties	ISF definitions: ⁸
	Susceptible	Bruce and (<i>Solanum lycopersicum</i>) Casaque Rouge
	Intermediate resistant	(<i>Solanum lycopersicum</i>) Campeon, Tyonix
	Highly resistant	Emperador and (<i>Solanum lycopersicum</i>) Arletta, Anahu, Anahu x Casaque Rouge
9.4	Test design	3 replicates of 10 plants in different trays by variety
9.5	Test facility	greenhouse or climate room
9.6	Temperature	20-26°C, the temperature should be adapted, depending on the aggressiveness of the test, to obtain the expected response of the controls, but should not exceed 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	Quantity of inoculum depends on aggressiveness of test and growing conditions (e.g. between 30g to 60g of inoculated 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 are sown in non-inoculated soil and inoculation of soil and inoculation of soil is done after sowing when plantlets are at cotyledon stage.
10.7	End of test	28 to 45 days after inoculation depending on test conditions (temperature, season)

⁵ GEVES; matref@geves.fr⁶ INIA; resistencias@inia.es⁷ Naktuinbouw; resistentie@naktuinbouw.nl⁸ ISF, <https://www.worldseed.org>

11.	Observations											
11.1	Method	root inspection per plant										
11.2	Observation scale											
	<table border="1"> <thead> <tr> <th>Class 0: healthy plant, no galls</th> <th>Class 1: few and little galls which are difficult to find (for example less than 5)</th> <th>Class 2: few galls, easy to observe but on few roots, still a lot of roots without galls</th> <th>Class 3: many individual galls on most but not all roots</th> <th>Class 4: many galls on all roots, sometimes in chains, can lead to dead plants and /or may suppress emergence</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Class 0: healthy plant, no galls	Class 1: few and little galls which are difficult to find (for example less than 5)	Class 2: few galls, easy to observe but on few roots, still a lot of roots without galls	Class 3: many individual galls on most but not all roots	Class 4: many galls on all roots, sometimes in chains, can lead to dead plants and /or may suppress emergence						
Class 0: healthy plant, no galls	Class 1: few and little galls which are difficult to find (for example less than 5)	Class 2: few galls, easy to observe but on few roots, still a lot of roots without galls	Class 3: many individual galls on most but not all roots	Class 4: many galls on all roots, sometimes in chains, can lead to dead plants and /or may suppress emergence								
												
11.3	Validation of test	<p>Validation on controls. Expected reactions of controls: Susceptible control: most plants at classes 3 and 4. Highly resistant: most plants at classes 0 and 1. Intermediate resistant: clearly different from other controls with majority of plants around class 2.</p>										
12.	Interpretation of data in terms of UPOV characteristic states	<p>[1] Susceptible absent or low: variety very similar to susceptible control. [2] Intermediate resistant medium: variety very similar to intermediate resistant control. [3] Highly resistant high: variety very similar to highly resistant control.</p> <p>If results are not clear, statistical analysis is advised.</p> <p>If significantly different from the controls, a retest is advised to check if the result is stable.</p>										
13.	Critical control points	<p>Avoid overwatering. This may result in rotting of roots. In case of aggressive test, decrease the quantity of inoculum.</p>										

[End of document]