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| International Union for the Protection of New Varieties of Plants |  |

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| Technical Committee  Fifty-Ninth Session  Geneva, October 23 and 24, 2023 | TC/59/20  Original: English  Date: September 29, 2023 |

Partial revision of the Test Guidelines for Melon

Document prepared by an expert from France

Disclaimer: this document does not represent UPOV policies or guidance

The purpose of this document is to present a proposal for a partial revision of the Test Guidelines for Melon (document TG/104/5 Rev. 2).

The Technical Working Party for Vegetables (TWV), at its fifty-seventh session[[1]](#footnote-2), considered a proposal for a partial revision of the Test Guidelines for Melon (*Cucumis melo* L.) on the basis of documents TG/104/5 Rev. 2 and TWV/57/22 “Partial revision of the Test Guidelines for Melon” and proposed the following changes (see document TWV/57/26 “Report”, paragraph 70):

1. Revision of Characteristics 69.1 to 69.4 “Resistances to *Fusarium oxysporum* f. sp. *melonis* (Fom) - races 0, 1, 2, and 1.2”;
2. Revision of explanation Ad. 69 “Resistances to *Fusarium oxysporum* f. sp. *melonis* (Fom) - races 0, 1, 2, and 1.2” in Chapter 8.2 “Explanations for individual characteristics”;
3. Revision of Characteristics 70.1 to 70.5 “Resistances to *Podosphaera xanthii* (Px) - races 1, 2, 3, 5, 3.5”;
4. Revision of explanation Ads. 70.1 to 70.3, 71 “Resistances to *Podosphaera xanthii* (Px), Resistance to *Golovinomyces cichoracearum* (*Erysiphe cichoracearum*), race 1 (Powdery mildew) Gc (Ec)” in Chapter 8.2 “Explanations for individual characteristics”;
5. Inclusion of characteristics from the Table of Characteristics in the Technical Questionnaire

The proposed new wording is presented below. The proposed changes are presented in highlight and underline (insertion) and ~~strikethrough~~ (deletion) in the Annex to this document (in English only).

## Proposed revision of Characteristics 69.1 to 69.4 “Resistances to *Fusarium oxysporum* f. sp. *melonis* (Fom) - races 0, 1, 2, and 1.2”

|  |  | English | français | deutsch | español | Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo | Note/ Nota |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 69. | VG | Resistance to *Fusarium oxysporum* f. sp. *melonis* (Fom) | Résistance à *Fusarium oxysporum* f. sp. *melonis* (Fom) | Resistenz gegen *Fusarium oxysporum* f. sp. *melonis* (Fom) | Resistencia al *Fusarium oxysporum* f. sp. *melonis* (Fom) |  |  |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| 69.1   (+) |  | **Race 0 (Fom: 0)** | **Race 0 (Fom: 0)** | **Pathotyp 0 (Fom: 0)** | **Raza 0 (Fom: 0)** |  |  |
| **QL** |  | absent | absente | fehlend | ausente | Atos, Charentais T | 1 |
|  |  | present | présente | vorhanden | presente | Cadence,  Charentais Fom-2, Dibango, Jubilo, Karakal, Védrantais | 9 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| 69.2   (+) |  | Race 1 (Fom: 1) | Race 1 (Fom: 1) | Pathotyp 1 (Fom: 1) | Raza 1 (Fom: 1) |  |  |
| **QL** |  | absent | absente | fehlend | ausente | Atos, Charentais T,  Védrantais | 1 |
|  |  | present | présente | vorhanden | presente | Cadence,  Charentais Fom-2, Dibango, Jubilo, Karakal | 9 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| 69.3   (+) |  | Race 2 (Fom: 2) | Race 2 (Fom: 2) | Pathotyp 2 (Fom: 2) | Raza 2 (Fom: 2) |  |  |
| **QL** |  | absent | absente | fehlend | ausente | Atos, Charentais Fom-2, Charentais T, Dibango, Marianna | 1 |
|  |  | present | présente | vorhanden | presente | Cadence,  Charentais Fom-1, Jubilo, Karakal, Perlita, Védrantais | 9 |
| **69.4  (+)** | **VG** | Resistance to *Fusarium oxysporum* f. sp. *melonis*  Race 1.2 (Fom: 1.2) | **Résistance à *Fusarium oxysporum* f. sp. *melonis*****Race 1.2 (Fom: 1.2)** | **Resistenz gegen *Fusarium oxysporum* f. sp. *melonis* Pathotyp 1.2 (Fom: 1.2)** | **Resistencia al *Fusarium oxysporum* f. sp. *melonis* Raza 1.2 (Fom: 1.2)** |  |  |
| **QL** |  | absent | absente | fehlend | ausente | Graffio, Prity, Virgos | 1 |
|  |  | present | présente | vorhanden | presente | Isabelle, Kyriel, Lunasol, Meliance, Piboule | 9 |

## Proposed revision of explanation Ad. 69 “Resistances to *Fusarium oxysporum* f. sp. *melonis* (Fom) - races 0, 1, 2, and 1.2” in Chapter 8.2 “Explanations for individual characteristics”

Ads. 69: 69.1 - 69.3: Resistance to *Fusarium oxysporum* f. sp. *melonis,* races 0, 1 and 2 (Fom: 0, Fom: 1, Fom: 2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. | | Pathogen | | | | *Fusarium oxysporum* f. sp. *melonis* races 0, 1, and 2 |
| 2. | | Quarantine status | | | | No |
| 3. | | Host species | | | | Melon - *Cucumis melo* |
| 4. | | Source of inoculum | | | | e.g. GEVES (FR)[[2]](#footnote-3) |
| 5. | | Isolate | | | | e.g., Reference strain validated in an inter-laboratory test[[3]](#footnote-4), [[4]](#footnote-5)  Fom:0   * Strain MLZ   = MAT/REF/04-07-01-03-02 2  Fom: 1   * Strain FOM 26   = MAT/REF/04-07-01-01 2  Fom: 2   * Strain F185 |
| 6. | | Establishment isolate identity | | | | The most recent table is available through ISF at  <https://www.worldseed.org/our-work/plant-health/differential-hosts/>  *Situation July 2019* |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Differential host** | **Gene present** | **Fom: 0\*** | **Fom: 1\*** | **Fom: 2\*** | **Fom: 1.2\*** | | Charantais T\* | - | S | S | S | S | | Védrantais\*, Doublon\* | *Fom-1* | HR | S | HR | S | | Charantais Fom-2\*, CM17187\* | *Fom-2* | HR | HR | S | S | | Isabelle\* | *Polygenic?* | HR | HR | HR | IR |   S = susceptible; HR = highly resistant; IR = intermediate  \*differential hosts and isolates that are used by the seed sector  Courtesy of Worldseed.org website | | | | | | |
| 7. | Establishment pathogenicity | | | | use susceptible melon varieties | |
| 8. | Multiplication inoculum | | | |  | |
| 8.1 | Multiplication medium | | | | on agar medium – e.g., Potato Dextrose Agar, Malt agar at 20°C to 25°C | |
| 8.2 | Multiplication variety | | | | - | |
| 8.3 | Plant stage at inoculation | | | | - | |
| 8.5 | Inoculation method | | | | - | |
| 8.6 | Harvest of inoculum | | | | 7–10-day-old culture | |
| 8.7 | Check of harvested inoculum | | | | - | |
| 8.8 | Shelf life /viability inoculum | | | | Between 4 to 8 h or keep cool to prevent spore germination | |
| 9. | Format of the test | | | |  | |
| 9.1 | Number of plants per genotype | | | | at least 30 plants, it is important to have at least 5 non-inoculated plants per genotype to be able to judge growth reduction | |
| 9.2 | Number of replicates | | | | At least e.g. 3 replicates (3 x10) | |
| 9.3 | | | Control varieties |  | | |
| 9.3.1 | | | Control varieties for race 0 | Resistance absent: Charentais T  Resistance present: Charentais Fom-2, Védrantais | | |
| 9.3.2 | | | Control varieties for race 1 | Resistance absent: Charentais T, Védrantais  Resistance present: Charentais Fom-2 | | |
| 9.3.3 | | | Control varieties race 2 | Resistance absent: Marianna  Resistance present: Perlita, Charentais Fom-1, Védrantais | | |
| 9.4 | | | Test design | 3 replicates of 10 plants to allow statistical analysis (in different trays) and at least 5 non-inoculated plants per genotype. | | |
| 9.5 | | | Test facility | glasshouse or climatic room | | |
| 9.6 | | | Temperature | - Fom: 0 and Fom: 1: 18 - 24°C  - Fom: 2: 24°C | | |
| 9.7 | | | Light | - Fom: 0 and Fom: 1: At least 12h  - Fom: 2: 16h | | |
| 9.9 | | | Special measures | - Fom: 0 and Fom: 1: Recommend having really 18°C at night and not above 24°C during the day. | | |
| 10. | | | Inoculation |  | | |
| 10.1 | | | Preparation inoculum | Scrape spore cultures with water from agar medium (see 8.1) or optional multiplication on liquid medium (e.g., Messiaen (1991) synthetic liquid medium, sucrose 50g/L, on permanent agitator-shaker or aerated Czapek-Dox culture medium for 5-7 days at room temperature).  *Remark*: Beware of toxin productions by some isolates (see remark under 13.) | | |
| 10.2 | | | Quantification inoculum | 4x105 to 1x106 sp /mL | | |
| 10.3 | | | Plant stage at inoculation | cotyledon expanded | | |
| 10.4 | | | Inoculation method | Plant at the inoculation stage are harvested carefully, roots and hypocotyls are immersed in spore suspension for 2-15 min; trimming of roots is an option; transplant in trays. | | |
| 10.5 | | | First observation | 1st notation: symptoms on Resistance absent (susceptible) control at classes 2 and 3 with a strong proportion at class 3 | | |
| 10.6 | | | Second observation | A second notation can be necessary to re-evaluate some unclear varieties | | |
| 11. | | | Observations |  | | |
| 11.1 | | | Method | Visual observation | | |

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| --- | --- | --- |
| 11.2 | Observation scale |  |

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| --- | --- | --- |
| non-inoculated plant | Class 0 | Class 1 |
| At least 5 plants | Healthy plant: no symptoms of yellowing and wilting, could be some growth reduction due to inoculation stress compared to mock. Sometimes in the mock we can observe some yellowing, different from the symptoms of *Fusarium* | Light symptoms of yellowing/wilting |
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| --- | --- | --- |
| Class 2 | Class 3 |  |
| typical symptoms: yellowing, wilting and necrosis, stunting (growth stopped) | Death of plant (Dead) |  |
|  | | Other symptoms of vein clearing could be difficult to judge.  It is advised to make a later notation to observe the evolution of these symptoms over the time. |

Courtesy of GEVES-SNES in the framework of CPVO Harmores project.

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| 11.3 | Validation of test | Validation on controls.  In case of the Fom: 0 and Fom:1 tests:  Controls expected response:  Resistance absent: most of the plants at classes 2 and 3  Resistance present: most of the plants at classes 0 and 1, sometimes very few plants at classes 2 or 3.  In case of the Fom: 2 test  Controls expected response:   * Susceptible controls, with UPOV characteristic state ‘Resistance absent’, should have most of the plants in observation classes 2 or 3, and few or no plants in observation classes 0 or 1.   + Marianna, the susceptible control is less susceptible than Charentais Fom‑2, Charentais T * Resistant controls should have most of the plants in observation classes 0 or 1, and few or no plant in observation classes 2 or 3.   Perlita, the lower threshold resistance control, should have at least some plants in observation class 1, 2, or 3. It has to be less resistant than Charentais Fom-1, Védrantais. |
| 11.4 | Off-types | - |
| 12. | Interpretation of data in terms of UPOV characteristic states | In case of varieties with a response between the susceptible (resistance absent) and the resistant control, repeat the test~~.~~  In case of confirmation of the result, the variety will be judged heterogeneous.  In case of unclear results, retest or test in another lab. |

Resistance to Fom: 0 and Fom: 1

**Not different** from the **resistance absent** control

**Not different** from the **resistance present** control

Une image contenant diagramme

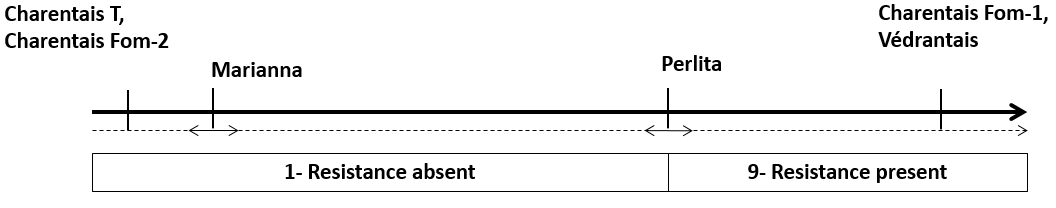
Description générée automatiquement

*Inconclusive result*

*retest*

**9 – Resistance present**

**1 – Resistance absent**



**9 – Resistance present**

**1 – Resistance absent**

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| 13. | Critical control points | For race 2, the control Perlita, with the *Fom-3* gene, allows to validate the capacity of the isolate to partially attack this variety.  In the case of inoculum increased in e.g. Messiaen (1991) synthetic liquid medium, on permanent agitator-shaker, inoculum can be used after 5 to 7 days.  For race 0 and 1, dilution 1/12 is recommended, while it must not be less than 1/20 for race 2. At a lower dilution (higher concentration of the medium), it has been observed that toxins released in the medium by the race 2 can cause some yellowing of melon plants, even if they are resistant. Alternatively, spores can be “washed” by resuspending a mass of spores collected on a Millipore filter with vacuum force. |

Ad 69.4: Resistance to *Fusarium oxysporum* f. sp. *melonis* race 1.2 (Fom: 1.2)

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| --- | --- | --- |
| 1. | Pathogen | *Fusarium oxysporum* f. sp. *melonis* race 1.2 (Fom: 1.2) |
| 2. | Quarantine status | No |
| 3. | Host species | Melon - *Cucumis melo* L. |
| 4. | Source of inoculum | GEVES (FR)[[5]](#footnote-6) |
| 5. | Isolate | e.g., Reference strain validated in an inter-laboratory test[[6]](#footnote-7)  Fom: 1.2   * Strain TST   = MAT/REF/04-07-01-04 2 |
| 6. | Establishment isolate identity | The most recent table is available through ISF at  <https://www.worldseed.org/our-work/plant-health/differential-hosts/>  *Situation July 2019* |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Differential host** | **Gene present** | **Fom: 0\*** | **Fom: 1\*** | **Fom: 2\*** | **Fom: 1.2\*** | | Charantais T\* | - | S | S | S | S | | Védrantais\*, Doublon\* | *Fom-1* | HR | S | HR | S | | Charantais Fom-2\*, CM17187\* | *Fom-2* | HR | HR | S | S | | Isabelle\* | *Polygenic?* | HR | HR | HR | IR |   S = susceptible; HR = highly resistant; IR = intermediate  \*differential hosts and isolates that are used by the seed sector  Courtesy of Worldseed.org website | | |
| 7. | Establishment pathogenicity | use susceptible melon varieties |
| 8. | Multiplication inoculum |  |
| 8.1 | Multiplication medium | on agar medium e.g., Potato Dextrose Agar, Sabouraud, at 20°C to 25°C |
| 8.2 | Multiplication variety | - |
| 8.3 | Plant stage at inoculation | - |
| 8.5 | Inoculation method | - |
| 8.6 | Harvest of inoculum | 4-10 day-old culture |
| 8.7 | Check of harvested inoculum | - |
| 8.8 | Shelf life/viability inoculum | - |
| 9. | Format of the test |  |
| 9.1 | Number of plants per genotype | 30 plants per variety plus 5 non-inoculated controls |
| 9.2 | Number of replicates | At least 3 x 10 plants, in different trays |
| 9.3 | Control varieties | Resistance absent: Virgos  Resistance present: Piboule and Lunasol and Isabelle (Isabelle is expected to have a lower disease index (DI) (= higher resistance than Piboule and Lunasol).  Piboule and Lunasol are both needed to illustrate the lower level of resistance. Their resistance is based on other genetics and may have different levels in different labs. |
| 9.4 | Test design | 3 replicates of 10 plants to allow statistical analysis (in different trays) and at least 5 non-inoculated plants per genotype. |
| 9.5 | Test facility | glasshouse or climatic room |
| 9.6 | Temperature | 18-24°C |
| 9.7 | Light | at least 12h |
| 10. | Inoculation |  |
| 10.1 | Preparation inoculum | Scrape cultures with water on agar medium (see 8.1) or optional multiplication on liquid medium (e.g., Potato Dextrose Broth (PDB), Czapek-Dox culture medium for 7 days at room temperature and darkness or Messiaen (1991) synthetic liquid medium, sucrose 50 g/L, on permanent agitator-shaker, at room-temperature, inoculum can be used after 5 to 7 days) |
| 10.2 | Quantification inoculum | 1x105-1x106 sp/mL, depending on inoculation method (see 10.4) and lab conditions |
| 10.3 | Plant stage at inoculation | cotyledons expanded, first leaf emerging |
| 10.4 | Inoculation method | One of two methods can be used for inoculation.   * Absorption:   Absorption of a suspension of spores, e.g., 700mL of a suspension at 1.105 sp/mL for 50 plants in a tray 30 cm\*30 cm.   * Injection:   Injection of a suspension of spores into the soil at the base of the plant, e.g., 5mL at 106 sp /mL per plant. |
| 10.7 | Final observations | 1st notation: symptoms on susceptible control at least at class 3 [generally 10-21 dpi]. A 2nd notation can be necessary to reevaluate some unclear varieties. |
| 11. | Observations |  |
| 11.1 | Method | Visual observation |
| 11.2 | Observation scale |  |

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| --- | --- | --- |
| Non-inoculated plants | Class 0 | Class 1 |
| Varieties must be compared to the non-inoculated plants. | Healthy plant, the whole plant is green or at the same level than the mock. Just a light yellowing can be accepted on the mock | Light level of symptoms, light yellowing on cotyledons and/or leaves without necrosis |
|  | | |

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| --- | --- | --- |
| Class 2 | Class 3 | Class 4 |
| Moderate level of symptoms, yellowing on cotyledon and/or leaves, starting of necrosis and wilting but not extended | Severe symptoms of yellowing and/or wilting on cotyledons and/or leaves with extended necrosis | Dead plant, no green leaf part or hypocotyl is dry |
|  | | |

Courtesy of GEVES-SNES in the framework of CPVO Harmores project.

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| 11.3 | Validation of test | Validation on controls. Controls expected response:   * Resistance present:   Most plants in classes 0 and 1, in some cases with few plants in 2, 3, 4.  Low level of disease index (DI) generally below 40%. A difference of disease index is generally observed between Piboule and Lunasol compared to Isabelle   * Resistance absent:   Most plants in classes 3 and 4, in some cases with few plants at class 0, 1, or 2. Very high disease index (DI) above 80%. |
| 11.4 | Off-types | ~~-~~ |
| 12. | Interpretation of data in terms of UPOV characteristic states | Interpretation of varieties depending on controls (figure 1)  Note 1 = Resistance absent  Note 9 = Resistance present  Quantitative analysis is based on the disease index (DI) AND the distribution of plants per class compared to the controls  The varieties statistically similar to the resistant controls or with a lower disease index (DI) have to be judged as resistant.  The varieties between the susceptible and the resistant controls have to be judged as susceptible.  If not clear, the use of statistics is highly recommended. |
| Resistance to Fom:1-2:    **9 – Resistance present**  **1 – Resistance absent**  Nx : number of plants at class x  *Figure 1: disease index (DI) formula* | | |

## Proposed revision of Characteristics 70.1 to 70.5 “Resistances to *Podosphaera xanthii* (Px) - races 1, 2, 3, 5, 3.5”

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 70. | VG | Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) | Résistance à *Podosphaera xanthii* (Px)(ex *Sphaerotheca fuliginea)* (oïdium) | Resistenz gegen *Podosphaera xanthii* (Px)(ex *Sphaerotheca fuliginea)* (Echter Mehltau) | Resistencia a *Podosphaera xanthii* (Px)(ex *Sphaerotheca fuliginea)* (Oidio) |  |  |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.1  (+)** |  | **Race 1 (Px: 1)** | **Race 1 (Px: 1)** | **Pathotyp 1 (Px: 1)** | **Raza 1 (Px: 1)** |  |  |
| **QN** |  | absent or low | absente ou faible | fehlend oder gering | ausente o baja | Védrantais | 1 |
|  |  | medium | moyenne | mittel | media | Escrito | 2 |
|  |  | high | élevée | hoch | alta | Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.2  (+)** |  | **Race 2 (Px: 2)** | **Race 2 (Px: 2)** | **Pathotyp 2 (Px: 2)** | **Raza 2 (Px: 2)** |  |  |
| **QN** |  | absent or low | absente ou faible | fehlend oder gering | ausente o baja | Védrantais | 1 |
|  |  | medium | moyenne | mittel | media | Escrito, Pendragon | 2 |
|  |  | high | élevée | hoch | alta | Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.3  (+)** |  | **Race 3 (Px: 3)** | **Race 3 (Px: 3)** | **Pathotyp 3 (Px: 3)** | **Raza 3 (Px: 3)** |  |  |
| **QN** |  | absent or low | absente ou faible | fehlend oder gering | ausente o baja | Védrantais | 1 |
|  |  | medium | moyenne | mittel | media | Arago, Durango | 2 |
|  |  | high | élevée | hoch | alta | Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.4  (+)** |  | **Race 5 (Px: 5)** | **Race 5 (Px: 5)** | **Pathotyp 5 (Px: 5)** | **Raza 5 (Px: 5)** |  |  |
| **QN** |  | absent or low | absente ou faible | fehlend oder gering | ausente o baja | Védrantais | 1 |
|  |  | medium | moyenne | mittel | media | Arago, Durango | 2 |
|  |  | high | élevée | hoch | alta | Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.5  (+)** |  | **Race 3-5 (Px: 3.5)** | **Race 3-5 (Px: 3.5)** | **Pathotyp 3-5 (Px: 3.5)** | **Raza 3-5 (Px: 3.5)** |  |  |
| **QN** |  | absent or low | absente ou faible | fehlend oder gering | ausente o baja | Védrantais | 1 |
|  |  | medium | moyenne | mittel | media | Arago, Durango | 2 |
|  |  | high | élevée | hoch | alta | Arum | 3 |

## Revision of explanation Ads. 70.1 to 70.3, 71 “Resistances to *Podosphaera xanthii* (Px), Resistance to *Golovinomyces cichoracearum* *(Gc)* (Powdery mildew)” in Chapter 8.2 “Explanations for individual characteristics”

Ads. 70.1 to 70.5: Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea*) (Powdery mildew)races 1, 2, 3, 5, 3.5 (Px: 1, 2, 3, 5, 3.5)

Ad. 71: Resistance to *Golovinomyces cichoracearum* (Gc) *(Erysiphe cichoracearum)* (Powdery mildew), race 1 (Gc: 1)

|  |  |  |
| --- | --- | --- |
| 1. | Pathogen | Powdery mildew:*Podosphaera xanthii* (ex *Spaerotheca fuliginea*) races 1, 2, 3, 5 and 3.5  *Golovinomyces cichoracearum* (ex *Erysiphe cichoracearum*) race 1 |
| 2. | Quarantine status | No |
| 3. | Host species | Melon - *Cucumis melo* L. |
| 4. | Source of inoculum | GEVES (FR)[[7]](#footnote-8) |
| 5. | Isolate | e.g., Reference strain validated in an inter-laboratory test[[8]](#footnote-9)  Px: 1   * Strain Sm 3   = MAT/REF/04-07-03-01 7  Px: 2   * Strain S87-7   = MAT/REF/04-07-03-02 7  Px: 3   * Strain 00Sm39   = MAT/REF/04-07-03-04-02 7  Px: 5   * Strain 98Sm65   = MAT/REF/04-07-03-03-01-02 7  Px: 3.5   * Strain 04Sm2   = MAT/REF/04-07-03-05-01 7  Gc: 1   * Strain GEVES   = MAT/REF/04-07-02-01)[3](mailto:contact@geves.fr) |
| 6. | Establishment isolate identity | on differentials (table 1) |

Table 1:

Races of *Podosphaera xanthii* (Px) and *Golovinomyces cichoracearum* (Gc), J. McCreight and M. Pitrat

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | *Podosphaera xanthii* | | | | | | *Golovinomyces cichoracearum* | |
|  | Race 0 | Race 1 | Race 2 | Race 3 | Race 4 | Race 5 | Race 3.5 | Race 0 | Race 1 |
| Iran H | S | S | S | S | S | S | S | S | S |
| Védrantais | R | S | S | S | S | S | S | R | S |
| PMR45 | R | R | S | S | S | S | S | R | S |
| WMR29 | R | R | R | R | S | S | S | R | S |
| Edisto 47 | R | R | R | R | R | S | S | R | S |
| MR-1, PI124112 | R | R | R | R | R | R | R | R | R |
| PMR5 | R | R | R | S | S | R | S | R | R |
| Nantais Oblong | R | S | S | S | S | S | S | R | R |

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| --- | --- | --- | --- |
| 7. | | Establishment pathogenicity | use susceptible melon varieties |
| 8. | | Multiplication inoculum |  |
| 8.1 | | Multiplication medium | Melon plantlets |
| 8.2 | | Multiplication variety | Susceptible variety, for example Védrantais.  For higher isolates like 3.5 or 5, a variety with broken resistance is recommended to keep the isolate pure. |
| 8.3 | | Plant stage at inoculation | Cotyledon |
| 8.5 | | Inoculation method | Sowing in substrate, for example soil or disinfected peat inside a closed mini glasshouse. When the cotyledons have expanded, remove them from the plant. Disinfect the cotyledons by soaking them for 3 minutes in a mercuric chloride solution (0.05%) or in sodium hypochlorite solution. Rinse them with sterilized water. Dry the cotyledons with sterile paper towel, then place them in Petri dishes with the following medium:  Sucrose 10g  Mannitol 20g  Agar 5g  Distilled water 1 liter  Scatter conidia on the cotyledons and blow them or deposit conidia at the surface of cotyledons. Incubate the inoculated cotyledons in Petri dishes for example at 23°C during 14 hours in the light and at 18°C during 10 hours in the dark or 17°C permanently under very low light intensity. 9 to 11 days after the inoculation, the cotyledons will be covered with conidia and can be used as an inoculum. |
| 8.6 | | Harvest of inoculum | Sporulation on cotyledons |
| 8.8 | | Shelf life /viability inoculum | Maximum 1 to 1.5 months after the inoculation. |
| 9. | | Format of the test |  |
| 9.1 | | Number of plants per genotype | At least 20 plants per variety and controls, 5 plants for other differentials. |
| 9.2 | | Number of replicates | - |
| 9.3 | | Control varieties |  |
|  |  | | For *Podosphaera xanthii* (Px) race 1, resistance   * absent or low: Védrantais * medium: Escrito * high: Arum   For *Podosphaera xanthii* (Px) race 2, resistance:   * absent or low: Védrantais * medium: Escrito, Pendragon * high: Arum   For *Podosphaera xanthii* (Px) races 3, 5, 3.5, resistance:   * absent or low: Védrantais * medium: Arago, Durango * high: Arum   For *Golovinomyces cichoracearum* (Gc) race 1, resistance:   * absent or low: Védrantais * medium: Anasta * high: Cézanne | |
| 9.4 | Test design | | Include differentials to validate the race (at least 5 plants per differentials) and compare the level of sporulation. | |
| 9.5 | Test facility | | Climatic chamber or greenhouse | |
| 9.6 | Temperature | | 20-24°C | |
| 9.7 | Light | | At least 12 hours | |
| 10. | Inoculation | |  | |
| 10.1 | Preparation inoculum | | - | |
| 10.2 | Quantification inoculum | | - | |
| 10.3 | Plant stage at inoculation | | Whole plants at 3-4 true leaf fully expanded stage. Inoculation on the leaves 2 and 3 indicated on the diagram below.    Courtesy of GEVES-SNES in the framework of CPVO Harmores project. | |
| 10.4 | Inoculation method | | Take spores from a cotyledon already covered with conidia and deposit them on a leaf. Different isolates can be tested on the same plant (or the same leaf) if the local deposit is well separated from each other and if a mark indicates the place of the deposit. | |
| 10.7 | Final observations | | The date of notation should be chosen based on expected symptoms on the three controls. Sporulation should be well expressed on the susceptible control. | |
| 11. | Observations | |  | |
| 11.1 | Method | | Visual observation of sporulation | |
| 11.2 | Observation scale | |  | |

|  |  |  |  |
| --- | --- | --- | --- |
| Class 1: No development of the fungus (no mycelium or dead mycelium) or no sporulation | Class 3: weak sporulation | Class 5: moderate sporulation | Class 9: strong sporulation |
| Example of contamination by environment on the susceptible control, test not validated | | | | |

Courtesy of GEVES-SNES in the framework of CPVO Harmores project.

|  |  |  |
| --- | --- | --- |
| 11.3 | Validation of test | Validation on controls.  Additional information for expected responses of *Podosphaera xanthii* controls  Resistance absent or low   * Plants at class 9, or most of the plants at class 9 and few plants at class 5 (high disease index). * Few plants at class 3 but in this case the resistant controls should be all at class 1 and the intermediate resistant control at classes 3 and 1. * No plants at class 1.   Resistance medium   * Between the resistant and the susceptible control. * Generally, plants at classes 3 and 5.   Resistance hiqh   * Plants at class 1, or most of the plants at class 1 and few plants at class 3 (very low disease index). * Plants at class 3 but in this case the susceptible control should be all at class 9. * No plants at classes 5 or 9. |
| 11.4 | Off-types | - |
| 12. | Interpretation of data in terms of UPOV characteristic states | Interpretation of varieties depending on controls (figure 1)  Resistance  Note 1 = absent or low  Note 2 = medium  Note 3 = high  Quantitative analysis is based on the disease index AND the distribution of plants per class compared to the controls.  Additional information for *Podosphaera xanthii* controls:  The varieties between the intermediate resistant and the resistant control have to be judged as intermediate resistant (because they are not resistant enough to be considered resistant).  The varieties between the susceptible and the intermediate resistant control have to be judged as susceptible (because they are not resistant enough to be considered intermediate resistant). |
| Resistance to Px:    **3 – high resistance**  **2 – medium resistance**  **1 – absent or low resistance**  ***Not different*** *from the  high resistant control 🡪* ***judged high resistant***  ***Not different*** *from the  absent or low resistant control 🡪* ***judged absent or low resistant***  ***Not different*** *from the  medium resistant control 🡪* ***judged medium resistant***  **Between** the absent or low and the medium resistant controls 🡪  **judged absent or low resistant**  **Between** the medium resistant and high resistant controls 🡪  **judged medium resistant**    NX: Number of plants at class X  Figure 1: disease index formula | | |
| 13. | Critical control points | To avoid cross contamination, it is advised to not produce inoculum of different races in the same room. |

Inclusion of characteristics from the Table of Characteristics in the Technical Questionnaire

The TWV is invited to consider the inclusion of the following characteristics in the TQ (characteristics for inclusion indicated in highlight and underline):

|  |  |  |
| --- | --- | --- |
| **Char. No.** | **(\*)** | **Characteristic Name** |
| 12 | (\*) | Inflorescence: sex expression (at full flowering) |
| 13 |  | Young fruit: hue of green color of skin |
| 14 | (\*) | Young fruit: intensity of green color of skin |
| 24 | (\*) | Fruit: length |
| 25 | (\*) | Fruit: diameter |
| 28 | (\*) | Fruit: shape in longitudinal section |
| 29 | (\*) | Fruit: ground color of skin |
| 31 |  | Fruit: hue of ground color of skin |
| 32 |  | Fruit: density of dots |
| 36 | (\*) | Fruit: density of patches |
| 38 | (\*) | Fruit: warts |
| 43 | (\*) | Fruit: grooves |
| 45 |  | Fruit: depth of grooves |
| 47 | (\*) | Fruit: creasing of surface |
| 48 | (\*) | Fruit: cork formation |
| 49 | (\*) | Fruit: thickness of cork layer |
| 50 | (\*) | Fruit: pattern of cork formation |
| 51 | (\*) | Fruit: density of pattern of cork formation |
| 54 | (\*) | Fruit: main color of flesh |
| 60 | (\*) | Seed: length |
| 62 |  | Seed: shape |
| 63 | (\*) | Seed: color |
| 68 | (\*) | Shelf life of fruit |
| 69.1 | (\*) | Resistance to *Fusarium oxysporum* f. sp. *melonis* Race 0 (Fom: 0) |
| 69.2 | (\*) | Resistance to *Fusarium oxysporum* f. sp. *melonis* Race 1 (Fom: 1) |
| 69.3 | (\*) | Resistance to *Fusarium oxysporum* f. sp. *melonis* Race 2 (Fom: 2) |
| 69.4 |  | Resistance to *Fusarium oxysporum* f. sp. *melonis* Race 1.2 (Fom: 1.2) |
| 70.1 |  | Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) (Px: 1) |
| 70.2 |  | Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew)Race 2 (Px: 2) |
| 70.3 |  | Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew)Race 3 (Px: 3) |
| 70.4 |  | Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) Race 5 (Px: 5) |
| 70.5 |  | Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) Race 3-5 (Px: 3.5) |
| 71 |  | Resistance to *Golovinomyces cichoracearum* (*Erysiphe cichoracearum*) (Powdery mildew) Race 1 (Gc: 1) |
| 72 |  | Resistance to colonization by *Aphis gossypii* |
| 73 |  | Resistance to *Zucchini yellow mosaic virus* (ZYMV) |
| 74.1 |  | Resistance to *Papaya ringspot virus* (PRSV) Guadeloupe strain |
| 74.2 |  | Resistance to *Papaya ringspot virus* (PRSV) E2 strain |
| 75 |  | Resistance to *Melon necrotic spot virus* (MNSV) Strain 0 (MNSV: 0) |
| 76 |  | Resistance to *Cucumber mosaic virus* (CMV) |

The detailed changes to the TQ are presented in highlight and underline (insertion) and ~~strikethrough~~ (deletion) in the Annex to this document (in English only).

[Annex follows]

PROPOSED CHANGES PRESENTED IN HIGHLIGHT  
(in English only)

## Proposed revision of Characteristics 69.1 to 69.4 “Resistances to *Fusarium oxysporum* f. sp. *melonis* (Fom) - races 0, 1, 2, and 1.2”

|  |  | English | français | deutsch | español | Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo | Note/ Nota |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 69. ~~A~~ | VG | Resistance to *Fusarium oxysporum* f. sp. *melonis* (Fom) | Résistance à *Fusarium oxysporum* f. sp. *melonis* (Fom) | Resistenz gegen *Fusarium oxysporum* f. sp. *melonis* (Fom) | Resistencia al *Fusarium oxysporum* f. sp. *melonis* (Fom) |  |  |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| 69.1  ~~(\*)~~ (+) |  | **Race 0 (Fom: 0)** | **Race 0 (Fom: 0)** | **Pathotyp 0 (Fom: 0)** | **Raza 0 (Fom: 0)** |  |  |
| **QL** |  | absent | absente | fehlend | ausente | ~~Jaune Canari 2~~ Atos, Charentais T | 1 |
|  |  | present | présente | vorhanden | presente | Cadence,  Charentais Fom-2, Dibango, ~~Jador,~~ Jubilo, Karakal, Védrantais | 9 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| 69.2  ~~(\*)~~ (+) |  | Race 1 (Fom: 1) | Race 1 (Fom: 1) | Pathotyp 1 (Fom: 1) | Raza 1 (Fom: 1) |  |  |
| **QL** |  | absent | absente | fehlend | ausente | ~~Jaune Canari 2~~  Atos, Charentais T,  Védrantais | 1 |
|  |  | present | présente | vorhanden | presente | ~~Arapaho, Jador, Rubbens~~ Cadence,  Charentais Fom-2, Dibango, Jubilo, Karakal | 9 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| 69.3  ~~(\*)~~ (+) |  | Race 2 (Fom: 2) | Race 2 (Fom: 2) | Pathotyp 2 (Fom: 2) | Raza 2 (Fom: 2) |  |  |
| **QL** |  | absent | absente | fehlend | ausente | ~~Arapaho, Jaune Canari 2, Rubbens~~ Atos, Charentais Fom-2, Charentais T, Dibango, Marianna | 1 |
|  |  | present | présente | vorhanden | presente | ~~Anasta, Cléo, Jador,~~ Cadence, Charentais Fom-1, Jubilo, Karakal, Perlita, Védrantais | 9 |
| **69.4 ~~B~~  (+)** | **VG** | Resistance to *Fusarium oxysporum* f. sp. *melonis*  Race 1.2 (Fom: 1.2) | **Résistance à *Fusarium oxysporum* f. sp. *melonis*****Race 1.2 (Fom: 1.2)** | **Resistenz gegen *Fusarium oxysporum* f. sp. *melonis* Pathotyp 1.2 (Fom: 1.2)** | **Resistencia al *Fusarium oxysporum* f. sp. *melonis* Raza 1.2 (Fom: 1.2)** |  |  |
| **~~QN~~ QL** |  | absent | absente | fehlend | ausente | Graffio, Prity, Virgos | 1 |
|  |  | present | présente | vorhanden | presente | Isabelle, Kyriel, Lunasol, Meliance, Piboule | 9 |
|  |  | ~~moderately resistant~~ | ~~moyennement résistant~~ | ~~mäßig resistent~~ | ~~moderadamente resistente~~ | ~~Lunasol~~ | ~~2~~ |
|  |  | ~~highly resistant~~ | ~~hautement résistant~~ | ~~hochresistent~~ | ~~altamente resistente~~ | ~~Dinero, Isabelle~~ | ~~3~~ |

## Proposed revision of explanation Ad. 69 “Resistances to *Fusarium oxysporum* f. sp. *melonis* (Fom) - races 0, 1, 2, and 1.2” in Chapter 8.2 “Explanations for individual characteristics”

Ads. 69 ~~A~~: 69.1 - 69.3: Resistance to *Fusarium oxysporum* f. sp. *melonis,* races 0, 1 and 2 (Fom: 0, Fom: 1, Fom: 2)

|  |  |  |
| --- | --- | --- |
| 1. | Pathogen | *Fusarium oxysporum* f. sp. *melonis* races 0, 1, and 2 |
| 2. | Quarantine status | No |
| 3. | Host species | Melon - *Cucumis melo* |
| 4. | Source of inoculum | e.g. GEVES (FR)[[9]](#footnote-10) |
| 5. | Isolate | ~~Fom: 0, Fom: 1, Fom: 2~~  e.g., Reference strain validated in an inter-laboratory test[[10]](#footnote-11), [[11]](#footnote-12)  Fom:0   * Strain MLZ   = MAT/REF/04-07-01-03-02 2  Fom: 1   * Strain FOM 26   = MAT/REF/04-07-01-01 2  Fom: 2   * Strain F185 |
| 6. | Establishment isolate identity | ~~use differential varieties~~:  ~~Test on differential hosts (potentially including Durango, see 13.).~~ The most recent table is available through ISF at  <https://www.worldseed.org/our-work/plant-health/differential-hosts/>  *Situation July 2019* |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Differential host** | **Gene present** | **Fom: 0\*** | **Fom: 1\*** | **Fom: 2\*** | **Fom: 1.2\*** | | Charantais T\* | - | S | S | S | S | | Védrantais\*, Doublon\* | *Fom-1* | HR | S | HR | S | | Charantais Fom-2\*, CM17187\* | *Fom-2* | HR | HR | S | S | | Isabelle\* | *Polygenic?* | HR | HR | HR | IR |   S = susceptible; HR = highly resistant; IR = intermediate  \*differential hosts and isolates that are used by the seed sector  Courtesy of Worldseed.org website | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *~~Gene~~* | ~~Race 0~~ | ~~Race 1~~ | ~~Race 2~~ |
| ~~Charentais T~~ |  | ~~S~~ | ~~S~~ | ~~S~~ |
| ~~Védrantais~~ | *~~Fom-1~~* | ~~R~~ | ~~S~~ | ~~R~~ |
| ~~Charentais Fom-2~~ | *~~Fom-2~~* | ~~R~~ | ~~R~~ | ~~S~~ |
| ~~Isabelle, Jador~~ |  | ~~R~~ | ~~R~~ | ~~R~~ |

|  |  |  |
| --- | --- | --- |
| 7. | Establishment pathogenicity | use susceptible melon varieties |
| 8. | Multiplication inoculum |  |
| 8.1 | Multiplication medium | on agar medium – e.g., Potato Dextrose Agar, Malt agar at 20°C to 25°C |
| 8.2 | Multiplication variety | - |
| 8.3 | Plant stage at inoculation | - |
| ~~8.4~~ | ~~Inoculation medium~~ | ~~on liquid medium~~ |
| 8.5 | Inoculation method | - |
| 8.6 | Harvest of inoculum | 7–10-day-old culture |
| 8.7 | Check of harvested inoculum | - |
| 8.8 | Shelf life /viability inoculum | Between 4 to 8 h or keep cool to prevent spore germination |
| 9. | Format of the test |  |
| 9.1 | Number of plants per genotype | ~~at least 20~~  at least 30 plants, it is important to have at least 5 non-inoculated plants per genotype to be able to judge growth reduction |
| 9.2 | Number of replicates | At least e.g. 3 replicates (3 x10) |
| 9.3 | Control varieties | ~~Jaune Canari 2 (susceptible)  Vedrantais, Arapaho, Rubbens, Anasta, Cleo (resistant, depending on the considered race)~~ |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *~~Gene~~* | ~~Race 0~~ | ~~Race 1~~ | ~~Race 2~~ |
| ~~Jaune Canari 2~~ |  | ~~S~~ | ~~S~~ | ~~S~~ |
| ~~Védrantais~~ | *~~Fom-1~~* | ~~R~~ | ~~S~~ | ~~R~~ |
| ~~Arapaho, Rubbens~~ | *~~Fom-2~~* | ~~R~~ | ~~R~~ | ~~S~~ |
| ~~Anasta, Cleo~~ |  | ~~R~~ | ~~R~~ | ~~R~~ |

|  |  |  |
| --- | --- | --- |
| 9.3.1 | Control varieties for race 0 | Resistance absent: Charentais T  Resistance present: Charentais Fom-2, Védrantais |
| 9.3.2 | Control varieties for race 1 | Resistance absent: Charentais T, Védrantais  Resistance present: Charentais Fom-2 |
| 9.3.3 | Control varieties race 2 | Resistance absent: Marianna  Resistance present: Perlita, Charentais Fom-1, Védrantais |
| 9.4 | Test design | 3 replicates of 10 plants to allow statistical analysis (in different trays) and at least 5 non-inoculated plants per genotype. |
| 9.5 | Test facility | glasshouse or climatic room |
| 9.6 | Temperature | - Fom: 0 and Fom: 1: 18-~~25~~ 24°C  - Fom: 2: 24°C |
| 9.7 | Light | - Fom: 0 and Fom: 1: At least 12h  - Fom: 2: 16h |
| ~~9.8~~ | ~~Season~~ | ~~all seasons~~ |
| 9.9 | Special measures | ~~optional: shading (no direct sunlight during 12 h after inoculation~~  - Fom: 0 and Fom: 1: Recommend having really 18°C at night and not above 24°C during the day. |
| 10. | Inoculation |  |
| 10.1 | Preparation inoculum | ~~aerated culture 7-10 days, e.g., Czapek Dox broth~~  ~~some isolates need filtration or centrifugation~~  ~~resuspend the pelleted spores in demineralized water~~  Scrape spore cultures with water from agar medium (see 8.1) or optional multiplication on liquid medium (e.g., Messiaen (1991) synthetic liquid medium, sucrose 50g/L, on permanent agitator-shaker or aerated Czapek-Dox culture medium for 5-7 days at room temperature).  *Remark*: Beware of toxin productions by some isolates (see remark under 13.) |
| 10.2 | Quantification inoculum | ~~spore count; adjust to 10~~~~6~~ ~~-10~~~~7~~ ~~per mL~~  4x105 to 1x106 sp /mL |
| 10.3 | Plant stage at inoculation | cotyledon expanded |
| 10.4 | Inoculation method | ~~soaking of the root system in a suspension of liquid medium of fungus~~  ~~at least 30 sec - 5 min~~  Plant at the inoculation stage are harvested carefully, roots and hypocotyls are immersed in spore suspension for 2-15 min; trimming of roots is an option; transplant in trays. |
| 10.5 | First observation | ~~7 days post inoculation~~  1st notation: symptoms on Resistance absent (susceptible) control at classes 2 and 3 with a strong proportion at class 3 |
| 10.6 | Second observation | ~~14 -20 days post inoculation~~  A second notation can be necessary to re-evaluate some unclear varieties |
| ~~10.7~~ | ~~Final observations~~ | ~~20 days post inoculation~~ |
| 11. | Observations |  |
| 11.1 | Method | Visual observation, ~~comparative~~ |
| 11.2 | Observation scale |  |
|  | ~~[1] absent~~ | ~~Growth retardation in combination with yellowing or wilting cotyledons (useful for judging the severity of the attack), possible internal vessel browning, death of plant.~~ |
|  | ~~[9] present~~ | ~~no symptoms~~ |

|  |  |  |
| --- | --- | --- |
| non-inoculated plant | Class 0 | Class 1 |
| At least 5 plants | Healthy plant: no symptoms of yellowing and wilting, could be some growth reduction due to inoculation stress compared to mock. Sometimes in the mock we can observe some yellowing, different from the symptoms of *Fusarium* | Light symptoms of yellowing/wilting |
|  | | |

|  |  |  |
| --- | --- | --- |
| Class 2 | Class 3 |  |
| typical symptoms: yellowing, wilting and necrosis, stunting (growth stopped) | Death of plant (Dead) |  |
|  | | Other symptoms of vein clearing could be difficult to judge.  It is advised to make a later notation to observe the evolution of these symptoms over the time. |

Courtesy of GEVES-SNES in the framework of CPVO Harmores project.

|  |  |  |
| --- | --- | --- |
| 11.3 | Validation of test | ~~on standards~~  Validation on controls.  In case of the Fom: 0 and Fom:1 tests:  Controls expected response:  Resistance absent: most of the plants at classes 2 and 3  Resistance present: most of the plants at classes 0 and 1, sometimes very few plants at classes 2 or 3.  In case of the Fom: 2 test  Controls expected response:   * Susceptible controls, with UPOV characteristic state ‘Resistance absent’, should have most of the plants in observation classes 2 or 3, and few or no plants in observation classes 0 or 1.   + Marianna, the susceptible control is less susceptible than Charentais Fom‑2, Charentais T * Resistant controls should have most of the plants in observation classes 0 or 1, and few or no plant in observation classes 2 or 3.   Perlita, the lower threshold resistance control, should have at least some plants in observation class 1, 2, or 3. It has to be less resistant than Charentais Fom-1, Védrantais. |
| 11.4 | Off-types | - |
| 12. | Interpretation of data in terms of UPOV characteristic states | ~~QL~~  In case of varieties with a response between the susceptible (resistance absent) and the resistant control, repeat the test~~.~~  In case of confirmation of the result, the variety will be judged heterogeneous.  In case of unclear results, retest or test in another lab. |

Resistance to Fom: 0 and Fom: 1

**Not different** from the **resistance absent** control

**Not different** from the **resistance present** control

Une image contenant diagramme

Description générée automatiquement

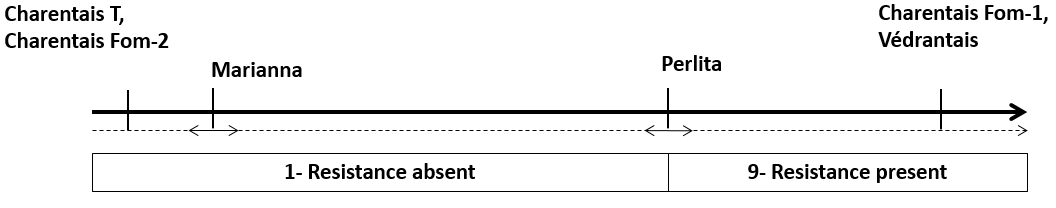
*Inconclusive result*

*retest*

**9 – Resistance present**

**1 – Resistance absent**

Resistance to Fom: 2



**9 – Resistance present**

**1 – Resistance absent**

|  |  |  |
| --- | --- | --- |
| 13. | Critical control points | ~~For Race 1.2 the modified protocol on the next page should be used.~~  For race 2, the control Perlita, with the *Fom-3* gene, allows to validate the capacity of the isolate to partially attack this variety.  In the case of inoculum increased in e.g. Messiaen (1991) synthetic liquid medium, on permanent agitator-shaker, inoculum can be used after 5 to 7 days.  For race 0 and 1, dilution 1/12 is recommended, while it must not be less than 1/20 for race 2. At a lower dilution (higher concentration of the medium), it has been observed that toxins released in the medium by the race 2 can cause some yellowing of melon plants, even if they are resistant. Alternatively, spores can be “washed” by resuspending a mass of spores collected on a Millipore filter with vacuum force. |

Ad ~~69 B~~ 69.4: Resistance to *Fusarium oxysporum* f. sp. *melonis* race 1.2 (Fom: 1.2)

|  |  |  |
| --- | --- | --- |
| 1. | Pathogen | *Fusarium oxysporum* f. sp. *melonis* race 1.2 (Fom: 1.2) |
| 2. | Quarantine status | No |
| 3. | Host species | Melon - *Cucumis melo* L. |
| 4. | Source of inoculum | GEVES (FR)[[12]](#footnote-13) ~~, Naktuinbouw (NL)~~ |
| 5. | Isolate | ~~Fom: 1.2 (moderately aggressive): TST strain~~  e.g., Reference strain validated in an inter-laboratory test 3  Fom: 1.2   * Strain TST   = MAT/REF/04-07-01-04 2 |
| 6. | Establishment isolate identity | ~~use differential varieties:  Védrantais, Virgos (susceptible)  Lunasol (moderately resistant) Dinero, Isabelle (highly resistant)~~  The most recent table is available through ISF at  <https://www.worldseed.org/our-work/plant-health/differential-hosts/>  *Situation July 2019* |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Differential host** | **Gene present** | **Fom: 0\*** | **Fom: 1\*** | **Fom: 2\*** | **Fom: 1.2\*** | | Charantais T\* | - | S | S | S | S | | Védrantais\*, Doublon\* | *Fom-1* | HR | S | HR | S | | Charantais Fom-2\*, CM17187\* | *Fom-2* | HR | HR | S | S | | Isabelle\* | *Polygenic?* | HR | HR | HR | IR |   S = susceptible; HR = highly resistant; IR = intermediate  \*differential hosts and isolates that are used by the seed sector  Courtesy of Worldseed.org website | | |
| 7. | Establishment pathogenicity | use susceptible melon varieties |
| 8. | Multiplication inoculum |  |
| 8.1 | Multiplication medium | on agar medium e.g., Potato Dextrose Agar, Sabouraud, at 20°C to 25°C |
| 8.2 | Multiplication variety | - |
| 8.3 | Plant stage at inoculation | - |
| ~~8.4~~ | ~~Inoculation medium~~ | ~~on liquid medium~~ |
| 8.5 | Inoculation method | - |
| 8.6 | Harvest of inoculum | 4-10 day-old culture |
| 8.7 | Check of harvested inoculum | - |
| 8.8 | Shelf life/viability inoculum | - |
| 9. | Format of the test |  |
| 9.1 | Number of plants per genotype | ~~at least 30~~  30 plants per variety plus 5 non-inoculated controls |
| 9.2 | Number of replicates | ~~e.g.,~~ At least 3 x 10 plants, in different trays |
| 9.3 | Control varieties | ~~R~~esistance absent: Virgos  Resistance present: Piboule and Lunasol and Isabelle (Isabelle is expected to have a lower disease index (DI) (= higher resistance than Piboule and Lunasol).  Piboule and Lunasol are both needed to illustrate the lower level ~~to intermediate resistance~~ of resistance. Their resistance is based on other genetics and may have different levels in different labs. |
|  | ~~[1] susceptible~~ | ~~Védrantais, Virgos~~ |
|  | ~~[2] moderately resistant~~ | ~~Lunasol (the lowest accepted level)~~ |
|  | ~~[3] highly resistant~~ | ~~Dinero, Isabelle, Jador~~ |
| 9.4 | Test design | 3 replicates of 10 plants to allow statistical analysis (in different trays) and at least 5 non-inoculated plants per genotype. |
| 9.5 | Test facility | glasshouse or climatic room |
| 9.6 | Temperature | 18-~~25~~ 24°C |
| 9.7 | Light | at least 12h |
| ~~9.8~~ | ~~Season~~ | ~~All seasons in a climatic room / in a greenhouse be aware of the strong environmental effect: winter could be too severe and summer could be too mild.~~ |
| ~~9.9~~ | ~~Special measures~~ | ~~optional shading (no direct sunlight during 12 h after inoculation)~~ |
| 10. | Inoculation |  |
| 10.1 | Preparation inoculum | ~~aerated culture 7-10 d old – e.g.: Czapek Dox broth~~  Scrape cultures with water on agar medium (see 8.1) or optional multiplication on liquid medium (e.g., Potato Dextrose Broth (PDB), Czapek-Dox culture medium for 7 days at room temperature and darkness or Messiaen (1991) synthetic liquid medium, sucrose 50 g/L, on permanent agitator-shaker, at room-temperature, inoculum can be used after 5 to 7 days) |
| 10.2 | Quantification inoculum | ~~spore count; adjust to 2.10~~~~4~~ ~~- 10~~~~5~~ ~~per ml~~  1x105-1x106 sp/mL, depending on inoculation method (see 10.4) and lab conditions |
| 10.3 | Plant stage at inoculation | cotyledons expanded, first leaf emerging |
| 10.4 | Inoculation method | ~~soaking of the trays in spore suspension; 700 ml for a tray with 25 - 30 plants, plants are not uprooted~~  One of two methods can be used for inoculation.   * Absorption:   Absorption of a suspension of spores, e.g., 700mL of a suspension at 1.105 sp/mL for 50 plants in a tray 30 cm\*30 cm.   * Injection:   Injection of a suspension of spores into the soil at the base of the plant, e.g., 5mL at 106 sp /mL per plant. |
| ~~10.5~~ | ~~First observation~~ | ~~7 - 14 days post inoculation~~ |
| ~~10.6~~ | ~~Second observation~~ | ~~14 - 21 days post inoculation~~ |
| 10.7 | Final observations | ~~21- 28 days post inoculation~~  1st notation: symptoms on susceptible control at least at class 3 [generally 10-21 dpi]. A 2nd notation can be necessary to reevaluate some unclear varieties. |
| 11. | Observations |  |
| 11.1 | Method | Visual observation~~, comparative~~ |
| 11.2 | Observation scale | ~~symptoms:~~ |
|  | ~~[1] susceptible~~ | ~~Védrantais: growth retardation, yellow cotyledons, drying, possible internal vessel browning, death of the plant~~ |
|  | ~~[2] moderately resistant~~ | ~~Symptoms may be present, but the level of expression must be distinctly lower than the susceptible control variety.~~  ~~= the lowest level of resistance is defined by the behavior of Lunasol~~ |
|  | ~~[3] highly resistant~~ | ~~Symptoms may be present, but the level of expression must be lower than the moderately control variety Lunasol.~~ |

|  |  |  |
| --- | --- | --- |
| Non-inoculated plants | Class 0 | Class 1 |
| Varieties must be compared to the non-inoculated plants. | Healthy plant, the whole plant is green or at the same level than the mock. Just a light yellowing can be accepted on the mock | Light level of symptoms, light yellowing on cotyledons and/or leaves without necrosis |
|  | | |

|  |  |  |
| --- | --- | --- |
| Class 2 | Class 3 | Class 4 |
| Moderate level of symptoms, yellowing on cotyledon and/or leaves, starting of necrosis and wilting but not extended | Severe symptoms of yellowing and/or wilting on cotyledons and/or leaves with extended necrosis | Dead plant, no green leaf part or hypocotyl is dry |
|  | | |

Courtesy of GEVES-SNES in the framework of CPVO Harmores project.

|  |  |  |
| --- | --- | --- |
| 11.3 | Validation of test | Validation on controls. Controls expected response:   * Resistance present ~~Intermediate Resistant:~~   Most plants in classes 0 and 1, in some cases with few plants in 2, 3, 4.  Low level of disease index (DI) generally below 40%. A difference of disease index is generally observed between Piboule and Lunasol compared to Isabelle   * Resistance absent ~~Susceptible~~:   Most plants in classes 3 and 4, in some cases with few plants at class 0, 1, or 2. Very high disease index (DI) above 80%. |
| 11.4 | Off-types | ~~calibrate with Lunasol~~  ~~-~~ |
| 12. | Interpretation of data in terms of UPOV characteristic states | ~~QN~~  Interpretation of varieties depending on controls (figure 1)  Note 1 = Resistance absent ~~Intermediate resistance absent = susceptibility~~  Note 9 = Resistance present ~~Intermediate resistance present~~  Quantitative analysis is based on the disease index (DI) AND the distribution of plants per class compared to the controls  The varieties statistically similar to the ~~intermediate~~ resistant controls or with a lower disease index (DI) have to be judged as ~~intermediate~~ resistant.  The varieties between the susceptible and the ~~intermediate~~ resistant controls have to be judged as susceptible. (~~not resistant enough to be considered)~~  If n~~ot clear results~~ are not clear, the use of statistics is highly recommended ~~suggested.~~ |
| Resistance to Fom:1-2:    **9 – Resistance present**  **1 – Resistance absent**  Nx : number of plants at class x  *Figure 1: disease index (DI) formula* | | |
| 13. | Critical control points | ~~A moderately aggressive type of Fom: 1.2 should be used as this is likely to show the difference between the presence and absence of resistance most clearly.~~  ~~There are two types of~~ *~~Fusarium oxysporum~~* ~~f. sp.~~ *~~melonis,~~* ~~Fom:1.2, viz. Fom: 1.2y which is a yellowing type with yellowing symptoms on leaves and another type and Fom: 1.2w which is a wilt type with wilting symptoms on leaves.~~ |

## Proposed revision of Characteristics 70.1 to 70.5 “Resistances to *Podosphaera xanthii* (Px) - races 1, 2, 3, 5, 3.5”

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 70. | VG | Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) | Résistance à *Podosphaera xanthii* (Px)(ex *Sphaerotheca fuliginea)* (oïdium) | Resistenz gegen *Podosphaera xanthii* (Px)(ex *Sphaerotheca fuliginea)* (Echter Mehltau) | Resistencia a *Podosphaera xanthii* (Px)(ex *Sphaerotheca fuliginea)* (Oidio) |  |  |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.1  (+)** |  | **Race 1 (Px: 1)** | **Race 1 (Px: 1)** | **Pathotyp 1 (Px: 1)** | **Raza 1 (Px: 1)** |  |  |
| **QN** |  | ~~susceptible~~ absent or low | ~~sensible~~ absente ou faible | ~~anfällig~~ fehlend oder gering | ~~susceptible~~ ausente o baja | ~~Jaune Canari 2,~~ Védrantais | 1 |
|  |  | ~~moderately resistant~~ medium | ~~moyennement résistant~~ moyenne | ~~mäßig resistent~~ mittel | ~~moderadamente resistente~~ media | Escrito | 2 |
|  |  | ~~highly resistant~~ high | ~~hautement résistant~~ élevée | ~~hochresistent~~ hoch | ~~altamente resistente~~ alta | ~~Anasta, Cézanne~~ Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.2  (+)** |  | **Race 2 (Px: 2)** | **Race 2 (Px: 2)** | **Pathotyp 2 (Px: 2)** | **Raza 2 (Px: 2)** |  |  |
| **QN** |  | ~~susceptible~~ absent or low | ~~sensible~~ absente ou faible | ~~anfällig~~ fehlend oder gering | ~~susceptible~~ ausente o baja | ~~Galoubet,~~ Védrantais | 1 |
|  |  | ~~moderately resistant~~ medium | ~~moyennement résistant~~ moyenne | ~~mäßig resistent~~ mittel | ~~moderadamente resistente~~ media | Escrito, Pendragon | 2 |
|  |  | ~~highly resistant~~ high | ~~hautement résistant~~ élevée | ~~hochresistent~~ hoch | ~~altamente resistente~~ alta | ~~Anasta, Cézanne~~ Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.3  (+)** |  | **Race 3 (Px: 3)** | **Race 3 (Px: 3)** | **Pathotyp 3 (Px: 3)** | **Raza 3 (Px: 3)** |  |  |
| **QN** |  | ~~susceptible~~ absent or low | ~~sensible~~ absente ou faible | ~~anfällig~~ fehlend oder gering | ~~susceptible~~ ausente o baja | Védrantais | 1 |
|  |  | ~~moderately resistant~~ medium | ~~moyennement résistant~~ moyenne | ~~mäßig resistent~~ mittel | ~~moderadamente resistente~~ media | ~~Nettuno~~ Arago, Durango | 2 |
|  |  | ~~highly resistant~~ high | ~~hautement résistant~~ élevée | ~~hochresistent~~ hoch | ~~altamente resistente~~ alta | ~~Batista, Godiva~~ Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.4  (+)** |  | **Race 5 (Px: 5)** | **Race 5 (Px: 5)** | **Pathotyp 5 (Px: 5)** | **Raza 5 (Px: 5)** |  |  |
| **QN** |  | ~~susceptible~~ absent or low | ~~sensible~~ absente ou faible | ~~anfällig~~ fehlend oder gering | ~~susceptible~~ ausente o baja | Védrantais | 1 |
|  |  | ~~moderately resistant~~ medium | ~~moyennement résistant~~ moyenne | ~~mäßig resistent~~ mittel | ~~moderadamente resistente~~ media | ~~Hugo, Pendragon~~ Arago, Durango | 2 |
|  |  | ~~highly resistant~~ high | ~~hautement résistant~~ élevée | ~~hochresistent~~ hoch | ~~altamente resistente~~ alta | ~~Arapaho~~ Arum | 3 |
|  |  | ------------------------ | -------------------------- | -------------------------- | ------------------------ | --------------------------- | ------- |
| **70.5  (+)** |  | **Race 3-5 (Px: 3.5)** | **Race 3-5 (Px: 3.5)** | **Pathotyp 3-5 (Px: 3.5)** | **Raza 3-5 (Px: 3.5)** |  |  |
| **QN** |  | ~~susceptible~~ absent or low | ~~sensible~~ absente ou faible | ~~anfällig~~ fehlend oder gering | ~~susceptible~~ ausente o baja | Védrantais | 1 |
|  |  | ~~moderately resistant~~ medium | ~~moyennement résistant~~ moyenne | ~~mäßig resistent~~ mittel | ~~moderadamente resistente~~ media | ~~Cisco~~ Arago, Durango | 2 |
|  |  | ~~highly resistant~~ high | ~~hautement résistant~~ élevée | ~~hochresistent~~ hoch | ~~altamente resistente~~ alta | ~~90625~~ Arum | 3 |

## Revision of explanation Ads. 70.1 to 70.3, 71 “Resistances to *Podosphaera xanthii* (Px), Resistance to *Golovinomyces cichoracearum* *(Gc)* (Powdery mildew)” in Chapter 8.2 “Explanations for individual characteristics”

Ads. 70.1 to 70.~~3~~ 5: Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea*) (Powdery mildew)~~Px (Sf)~~ races 1, 2, 3, 5, 3.5 (Px: 1, 2, 3, 5, 3.5)

Ad. 71: Resistance to *Golovinomyces cichoracearum* (Gc) *(Erysiphe cichoracearum)* (Powdery mildew), race 1 (Gc: 1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | Pathogen | | Powdery mildew:*Podosphaera xanthii* (ex *Spaerotheca fuliginea*) races 1, 2, 3, 5 and 3.5  *Golovinomyces cichoracearum* (ex *Erysiphe cichoracearum*) race 1  *~~Only~~**~~Podosphaera xanthii~~* ~~was validated in Harmores 3 project.~~ | |
| 2. | Quarantine status | | No | |
| 3. | Host species | | Melon - *Cucumis melo* L. | |
| 4. | Source of inoculum | | GEVES (FR)[[13]](#footnote-14) | |
| 5. | Isolate | | ~~Px: races 1, 2, 3, 5 and 3-5;~~  e.g., Reference strain validated in an inter-laboratory test 6  Px: 1   * Strain Sm 3   = MAT/REF/04-07-03-01 7  Px: 2   * Strain S87-7   = MAT/REF/04-07-03-02 7  Px: 3   * Strain 00Sm39   = MAT/REF/04-07-03-04-02 7  Px: 5   * Strain 98Sm65   = MAT/REF/04-07-03-03-01-02 7  Px: 3.5   * Strain 04Sm2   = MAT/REF/04-07-03-05-01 7  Gc: 1   * Strain GEVES   = MAT/REF/04-07-02-01)[3](mailto:contact@geves.fr) | |
| 6. | Establishment isolate identity | on differentials (table 1) | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ~~Powdery Mildew~~ | | | | | |
|  | *~~Podosphaera xanthii~~*  ~~(~~*~~Sphaerotheca fuliginea)~~* | | | | | *~~Golovinomyces cichoracearum (Erysiphe cichoracearum)~~* |
|  | ~~race~~  ~~1~~ | ~~race~~  ~~2~~ | ~~race 3~~ | ~~race 5~~ | ~~race~~  ~~3-5~~ | ~~race 1~~ |
| ~~Védrantais~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~S~~ |
| ~~Nantais Oblong~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~R~~ |
| ~~PMR 45~~ | ~~R~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~S~~ | ~~S~~ |
| ~~Edisto 47, WMR 29~~ | ~~R~~ | ~~R~~ | ~~R~~ | ~~S~~ | ~~S~~ | ~~S~~ |
| ~~PI 124112, 90625~~ | ~~R~~ | ~~R~~ | ~~R~~ | ~~R~~ | ~~R~~ | ~~R~~ |
| ~~PMR 5~~ | ~~R~~ | ~~R~~ | ~~S~~ | ~~R~~ | ~~S~~ | ~~R~~ |
| ~~PI 414723~~ | ~~R~~ | ~~R~~ | ~~IR~~ | ~~R~~ | ~~R/ IR~~ | ~~R~~ |

~~Legend: S susceptible (high sporulation); R resistant (low sporulation), IR (moderately resistant)~~

Table 1:

Races of *Podosphaera xanthii* (Px) and *Golovinomyces cichoracearum* (Gc), J. McCreight and M. Pitrat

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | *Podosphaera xanthii* | | | | | | *Golovinomyces cichoracearum* | |
|  | Race 0 | Race 1 | Race 2 | Race 3 | Race 4 | Race 5 | Race 3.5 | Race 0 | Race 1 |
| Iran H | S | S | S | S | S | S | S | S | S |
| Védrantais | R | S | S | S | S | S | S | R | S |
| PMR45 | R | R | S | S | S | S | S | R | S |
| WMR29 | R | R | R | R | S | S | S | R | S |
| Edisto 47 | R | R | R | R | R | S | S | R | S |
| MR-1, PI124112 | R | R | R | R | R | R | R | R | R |
| PMR5 | R | R | R | S | S | R | S | R | R |
| Nantais Oblong | R | S | S | S | S | S | S | R | R |

|  |  |  |
| --- | --- | --- |
| 7. | Establishment pathogenicity | use susceptible melon varieties |
| 8. | Multiplication inoculum |  |
| 8.1 | Multiplication medium | ~~detached cotyledon in Petri-dish on 0.35 – 0.5% Agar, 1‑2% mannitol, possible add of 1% sucrose~~  Melon plantlets |
| 8.2 | Multiplication variety | ~~susceptible varieties~~  Susceptible variety, for example Védrantais.  For higher isolates like 3.5 or 5, a variety with broken resistance is recommended to keep the isolate pure. |
| 8.3 | Plant stage at inoculation | ~~young, unfolded cotyledon; decontaminated with e.g., 0.05% mercuric chloride or 3 to 5% bleach (NaClO + NaCl)~~  Cotyledon |
| ~~8.4~~ | ~~Inoculation medium~~ | ~~Air~~ |
| 8.5 | Inoculation method | ~~scatter conidia on the cotyledons transferred by blowing~~  Sowing in substrate, for example soil or disinfected peat inside a closed mini glasshouse. When the cotyledons have expanded, remove them from the plant. Disinfect the cotyledons by soaking them for 3 minutes in a mercuric chloride solution (0.05%) or in sodium hypochlorite solution. Rinse them with sterilized water. Dry the cotyledons with sterile paper towel, then place them in Petri dishes with the following medium:  Sucrose 10g  Mannitol 20g  Agar 5g  Distilled water 1 liter  Scatter conidia on the cotyledons and blow them or deposit conidia at the surface of cotyledons. Incubate the inoculated cotyledons in Petri dishes for example at 23°C during 14 hours in the light and at 18°C during 10 hours in the dark or 17°C permanently under very low light intensity. 9 to 11 days after the inoculation, the cotyledons will be covered with conidia and can be used as an inoculum. |
| 8.6 | Harvest of inoculum | ~~use cotyledons with strong sporulation~~  Sporulation on cotyledons |
| 8.7 | Check of harvested inoculum | ~~check presence of spores~~ |
| 8.8 | Shelf life /viability inoculum | ~~on cotyledon, 17-23~~~~o~~~~C, under very low light intensity; maximum storage time is 15 days, after the inoculation~~  ~~Remark: In case of longer-term preservation, inoculate locally with a few spores, store at 14°C/12h low light per day~~  Maximum 1 to 1.5 months after the inoculation. |
| 9. | Format of the test |  |
| 9.1 | Number of plants per genotype | ~~at least 16 plants~~  At least 20 plants per variety and controls, 5 plants for other differentials. |
| 9.2 | Number of replicates | ~~e.g., 3~~  - |
| 9.3 | Control varieties |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ~~Powdery Mildew~~ | | | | | |
|  | *~~Podosphaera xanthii~~* | | | | | *~~Golovinomyces cichoracearum~~* |
|  | ~~race 1~~ | ~~race 2~~ | ~~race 3~~ | ~~race 5~~ | ~~race 3-5~~ | ~~race 1~~ |
| ~~Susceptible~~ | ~~Jaune Canari 2, Védrantais~~ | ~~Galoubet, Védrantais~~ | ~~Védrantais~~ | ~~Védrantais~~ | ~~Védrantais~~ | ~~Védrantais~~ |
| ~~moderately resistant~~ | ~~Escrito~~ | ~~Escrito, Pendragon~~ | ~~Nettuno~~ | ~~Hugo, Pendragon~~ | ~~Cisco~~ | ~~Anasta~~ |
| ~~highly resistant~~ | ~~Anasta, Cézanne~~ | ~~Anasta, Cézanne~~ | ~~Batista, Godiva~~ | ~~Arapaho~~ | ~~90625~~ | ~~Heliobel~~ |

|  |  |  |
| --- | --- | --- |
|  |  | For *Podosphaera xanthii* (Px) race 1, resistance   * absent or low ~~Susceptible~~: Védrantais * medium ~~Intermediate resistant~~: Escrito * high ~~Resistant~~: Arum   For *Podosphaera xanthii* (Px) race 2, resistance:   * absent or low ~~Susceptible~~: Védrantais * medium ~~Intermediate resistant~~: Escrito, Pendragon * high ~~Resistant~~: Arum   For *Podosphaera xanthii* (Px) races 3, 5, 3.5, resistance:   * absent or low ~~Susceptible~~: Védrantais * medium ~~Intermediate resistant~~: Arago, Durango * high ~~Resistant~~: Arum   For *Golovinomyces cichoracearum* (Gc) race 1, resistance:   * absent or low ~~Susceptible~~: ~~Escrito, Score,~~ Védrantais * medium ~~Intermediate resistant~~: ~~Flores,~~ Anasta * high ~~Resistant~~: Cézanne, ~~Heliobel, Théo~~ |
| 9.4 | Test design | ~~leaf discs placed on 0.4% agar with 1- 4% mannitol and possible add of 0.003% benzimidazole~~  Include differentials to validate the race (at least 5 plants per differentials) and compare the level of sporulation. |
| 9.5 | Test facility | ~~climatic room~~  Climatic chamber or greenhouse |
| 9.6 | Temperature | 20-24°C |
| 9.7 | Light | ~~12 to 24h darkness after inoculation~~  At least 12 hours |
| ~~9.8~~ | ~~Season~~ | ~~-~~ |
| ~~9.9~~ | ~~Special measures~~ | ~~Inoculation tower needed for even distribution of dry spores.~~ |
| 10. | Inoculation |  |
| 10.1 | Preparation inoculum | - |
| 10.2 | Quantification inoculum | - |
| 10.3 | Plant stage at inoculation | ~~Routine method: leaf disks, 2 cm in diameter, from young plants.~~  ~~Complementary method, if necessary: young plants~~  Whole plants at 3-4 true leaf fully expanded stage. Inoculation on the leaves 2 and 3 indicated on the diagram below.    Courtesy of GEVES-SNES in the framework of CPVO Harmores project. |
| 10.4 | Inoculation method | ~~Routine method: on leaf disks: inoculation tower needed for even distribution of dry spores.~~  ~~Complementary method: take spores from a cotyledon covered with conidia and deposit them on a leaf or blow the spores from a cotyledon~~.  Take spores from a cotyledon already covered with conidia and deposit them on a leaf. Different isolates can be tested on the same plant (or the same leaf) if the local deposit is well separated from each other and if a mark indicates the place of the deposit. |
| ~~10.5~~ | ~~First observation~~ | ~~8-10 days post inoculation~~ |
| ~~10.6~~ | ~~Second observation~~ | ~~-~~ |
| 10.7 | Final observations | ~~11-12 days post inoculation~~  The date of notation should be chosen based on expected symptoms on the three controls. Sporulation should be well expressed on the susceptible control. |
| 11. | Observations |  |
| 11.1 | Method | Visual observation of sporulation |
| 11.2 | Observation scale |  |
|  | ~~[1] susceptible~~ | ~~medium or intense sporulation all over the leaf disc surface~~ |
|  | ~~[2] intermediate~~ | ~~weak sporulation all over the surface or isolated colonies on more than 10% of the surface~~ |
|  | ~~[3] resistant~~ | ~~isolated colonies on less than 10% of the surface or no sporulation~~ |
| |  |  |  |  | | --- | --- | --- | --- | | Class 1: No development of the fungus (no mycelium or dead mycelium) or no sporulation | Class 3: weak sporulation | Class 5: moderate sporulation | Class 9: strong sporulation | | Example of contamination by environment on the susceptible control, test not validated | | | | |   Courtesy of GEVES-SNES in the framework of CPVO Harmores project. | | |
| 11.3 | Validation of test | ~~on controls~~  Validation on controls.  Additional information for expected responses of *Podosphaera xanthii* controls  Resistance absent or low   * Plants at class 9, or most of the plants at class 9 and few plants at class 5 (high disease index). * Few plants at class 3 but in this case the resistant controls should be all at class 1 and the intermediate resistant control at classes 3 and 1. * No plants at class 1.   Resistance medium   * Between the resistant and the susceptible control. * Generally, plants at classes 3 and 5.   Resistance hiqh   * Plants at class 1, or most of the plants at class 1 and few plants at class 3 (very low disease index). * Plants at class 3 but in this case the susceptible control should be all at class 9. * No plants at classes 5 or 9. |
| 11.4 | Off-types | - |
| 12. | Interpretation of data in terms of UPOV characteristic states | ~~QN~~  Interpretation of varieties depending on controls (figure 1)  Resistance  Note 1 = ~~Resistance~~ absent or low~~= susceptibility~~  Note 2 = medium ~~Intermediate resistance present~~  Note 3 = high ~~Resistance present~~  Quantitative analysis is based on the disease index AND the distribution of plants per class compared to the controls.  Additional information for *Podosphaera xanthii* controls:  The varieties between the intermediate resistant and the resistant control have to be judged as intermediate resistant (because they are not resistant enough to be considered resistant).  The varieties between the susceptible and the intermediate resistant control have to be judged as susceptible (because they are not resistant enough to be considered intermediate resistant). |
| Resistance to Px:    **3 – high resistance**  **2 – medium resistance**  **1 – absent or low resistance**  ***Not different*** *from the  high resistant control 🡪* ***judged high resistant***  ***Not different*** *from the  absent or low resistant control 🡪* ***judged absent or low resistant***  ***Not different*** *from the  medium resistant control 🡪* ***judged medium resistant***  **Between** the absent or low and the medium resistant controls 🡪  **judged absent or low resistant**  **Between** the medium resistant and high resistant controls 🡪  **judged medium resistant**    NX: Number of plants at class X  Figure 1: disease index formula | | |
| 13. | Critical control points | To avoid cross contamination, it is advised to not produce inoculum of different races in the same room. |

Inclusion of characteristics from the Table of Characteristics in the Technical Questionnaire

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

|  |  |  |  |
| --- | --- | --- | --- |
| 5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds). | | | |
|  | Characteristics | Example Varieties | Note |
| **5.1 (12)** | **Inflorescence: sex expression (at full flowering)** |  |  |
|  | monoecious | Alpha, Categoría | 1[ ] |
|  | andromonoecious | Piel de Sapo | 2[ ] |
| **5.2 (13)** | **Young fruit: hue of green color of skin** |  |  |
|  | whitish green | Geasol | 1[ ] |
|  | yellowish green | Fimel | 2[ ] |
|  | green | Lucas | 3[ ] |
|  | greyish green | Spanglia | 4[ ] |
| **5.3 (14)** | **Young fruit: intensity of green color of skin** |  |  |
|  | very light | Solarking | 1[ ] |
|  | very light to light |  | 2[ ] |
|  | light | Fimel | 3[ ] |
|  | light to medium |  | 4[ ] |
|  | medium | Eros | 5[ ] |
|  | medium to dark |  | 6[ ] |
|  | dark | Galia | 7[ ] |
|  | dark to very dark |  | 8[ ] |
|  | very dark | Edén | 9[ ] |

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

|  |  |  |  |
| --- | --- | --- | --- |
|  | Characteristics | Example Varieties | Note |
| **5.4 (24)** | Fruit: length |  |  |
|  | very short | Doublon, Golden Crispy | 1[ ] |
|  | very short to short |  | 2[ ] |
|  | short | Topper, Védrantais | 3[ ] |
|  | short to medium |  | 4[ ] |
|  | medium | Marina, Spanglia | 5[ ] |
|  | medium to long |  | 6[ ] |
|  | long | Categoría, Toledo | 7[ ] |
|  | long to very long |  | 8[ ] |
|  | very long | Katsura Giant, Valdivia | 9[ ] |
| **5.5 (25)** | **Fruit: diameter** |  |  |
|  | very narrow | Banana, Golden Crispy | 1[ ] |
|  | very narrow to narrow |  | 2[ ] |
|  | narrow | Alpha, Maestro | 3[ ] |
|  | narrow to medium |  | 4[ ] |
|  | medium | Categoría, Galia | 5[ ] |
|  | medium to broad |  | 6[ ] |
|  | broad | Albino, Kinka | 7[ ] |
|  | broad to very broad |  | 8[ ] |
|  | very broad | Noir des Carmes | 9[ ] |

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|  | Characteristics | Example Varieties | Note |
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| **5.~~2~~ 6 (28)** | **Fruit: shape in longitudinal section** |  |  |
|  | ovate | De Cavaillon, Piolín | 1[ ] |
|  | medium elliptic | Piel de Sapo | 2[ ] |
|  | broad elliptic | Corin, Sardo | 3[ ] |
|  | circular | Alpha, Galia | 4[ ] |
|  | quadrangular | Zatta | 5[ ] |
|  | oblate | Jívaro, Noir de Carmes | 6[ ] |
|  | obovate | Cganchi | 7[ ] |
|  | elongated | Alficoz, Banana | 8[ ] |
| **5.~~3~~ 7 (29)** | **Fruit: ground color of skin** |  |  |
|  | white | Albino, Honey Dew | 1[ ] |
|  | yellow | Amarillo-Canario, Edén, Galia, Passport, Solarking | 2[ ] |
|  | green | Gohyang, Piel de Sapo | 3[ ] |
|  | grey | Geaprince, Geamar, Romeo, Sirio, Supporter, Védrantais | 4[ ] |
| **5.8 (31)** | **Fruit: hue of ground color of skin** |  |  |
|  | absent or very weak | Amarillo-Canario, Albino, Piel de Sapo, Sirio | 1[ ] |
|  | whitish | Romeo | 2[ ] |
|  | yellowish | Geaprince, Supporter | 3[ ] |
|  | orange | Edén | 4[ ] |
|  | ochre | Passport | 5[ ] |
|  | greenish | Geamar, Honey Dew, Solarking | 6[ ] |
|  | greyish | Gohyang | 7[ ] |

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|  | Characteristics | Example Varieties | Note |
| **5.9 (32)** | **Fruit: density of dots** |  |  |
|  | absent or very sparse | Charentais | 1[ ] |
|  | very sparse |  | 2[ ] |
|  | sparse |  | 3[ ] |
|  | sparse to medium |  | 4[ ] |
|  | medium | Petit Gris de Rennes | 5[ ] |
|  | medium to dense |  | 6[ ] |
|  | dense | Piel de Sapo | 7[ ] |
|  | dense to very dense |  | 8[ ] |
|  | very dense | Albino | 9[ ] |
| **5.~~4~~ 10 (36)** | **Fruit: density of patches** |  |  |
|  | absent or very sparse | Rochet | 1[ ] |
|  | very sparse to sparse |  | 2[ ] |
|  | sparse |  | 3[ ] |
|  | sparse to medium |  | 4[ ] |
|  | medium | Braco | 5[ ] |
|  | medium to dense |  | 6[ ] |
|  | dense | Piel de Sapo | 7[ ] |
|  | dense to very dense |  | 8[ ] |
|  | very dense | Oranje Ananas | 9[ ] |
| **5.~~5~~ 11 (38)** | **Fruit: warts** |  |  |
|  | absent | Piel de Sapo | 1[ ] |
|  | present | Zatta | 9[ ] |

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|  | Characteristics | Example Varieties | Note |
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| **5.~~6~~ 12 (43)** | **Fruit: grooves** |  |  |
|  | absent or very weakly expressed | Piel de Sapo, Arava | 1[ ] |
|  | weakly expressed | Total, Hobby | 2[ ] |
|  | strongly expressed | Védrantais, Galia | 3[ ] |
| **5.13 (45)** | **Fruit: depth of grooves** |  |  |
|  | very shallow | Amber | 1[ ] |
|  | very shallow to shallow |  | 2[ ] |
|  | shallow | Galia | 3[ ] |
|  | shallow to medium |  | 4[ ] |
|  | medium | Alpha | 5[ ] |
|  | medium to deep |  | 6[ ] |
|  | deep | Panamá, Supermarket | 7[ ] |
|  | deep to very deep |  | 8[ ] |
|  | very deep | Noir des Carmes,  Sucrin de Tours | 9[ ] |
| **5.14 (47)** | **Fruit: creasing of surface** |  |  |
|  | absent or very weak | Védrantais | 1[ ] |
|  | very weak to weak |  | 2[ ] |
|  | weak | Melchor, Sirocco | 3[ ] |
|  | weak to medium |  | 4[ ] |
|  | medium | Costa, Piolín | 5[ ] |
|  | medium to strong |  | 6[ ] |
|  | strong | Tendral Negro | 7[ ] |
|  | strong to very strong |  | 8[ ] |
|  | very strong | Balbey, Kirkagac | 9[ ] |
| **5.~~7~~ 15 (48)** | **Fruit: cork formation** |  |  |
|  | absent | Alpha | 1[ ] |
|  | present | Dalton | 9[ ] |

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|  | Characteristics | Example Varieties | Note |
| **5.16 (49)** | **Fruit: thickness of cork layer** |  |  |
|  | very thin | Amarillo Oro | 1[ ] |
|  | very thin to thin |  | 2[ ] |
|  | thin | Riosol, Védrantais | 3[ ] |
|  | thin to medium |  | 4[ ] |
|  | medium | Marina | 5[ ] |
|  | medium to thick |  | 6[ ] |
|  | thick | Geamar, PMR 45 | 7[ ] |
|  | thick to very thick |  | 8[ ] |
|  | very thick | Honey Rock, Perlita | 9[ ] |
| **5.~~8~~ 17 (50)** | **Fruit: pattern of cork formation** |  |  |
|  | dots only | Hermes, Védrantais | 1[ ] |
|  | dots and linear | Jivaro, Topper | 2[ ] |
|  | linear only | Futuro, Riosol | 3[ ] |
|  | linear and netted | Anatol, Chantal | 4[ ] |
|  | netted only | Galia, Perlita | 5[ ] |
| **5.~~9~~ 18 (51)** | **Fruit: density of pattern of cork formation** |  |  |
|  | very sparse | Alpha, Amarillo Oro | 1[ ] |
|  | very sparse to sparse |  | 2[ ] |
|  | sparse | Védrantais | 3[ ] |
|  | sparse to medium |  | 4[ ] |
|  | medium | Regal, Vital | 5[ ] |
|  | medium to dense |  | 6[ ] |
|  | dense | Galia, Geamar | 7[ ] |
|  | dense to very dense |  | 8[ ] |
|  | very dense | Honey Rock, Perlita | 9[ ] |

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|  | Characteristics | Example Varieties | Note |
| **5.~~10~~ 19 (54)** | Fruit: main color of flesh |  |  |
|  | white | Piel de Sapo | 1[ ] |
|  | greenish white | Galia | 2[ ] |
|  | green | Radical | 3[ ] |
|  | yellowish white | Guaraní | 4[ ] |
|  | orange | Védrantais | 5[ ] |
|  | reddish orange | Magenta | 6[ ] |
| **5.~~11~~ 20 (60)** | **Seed: length** |  |  |
|  | very short | Geumssaraki, Golden Crispi | 1[ ] |
|  | very short to short |  | 2[ ] |
|  | short | Elario, Katsura Giant | 3[ ] |
|  | short to medium |  | 4[ ] |
|  | medium | Arava, Sancho | 5[ ] |
|  | medium to long |  | 6[ ] |
|  | long | Amarillo Oro, Toledo | 7[ ] |
|  | long to very long |  | 8[ ] |
|  | very long | Albino | 9[ ] |
| **5.21 (62)** | **Seed: shape** |  |  |
|  | not pine-nut shape | Toledo | 1[ ] |
|  | pine-nut shape | Piel de Sapo | 2[ ] |
| **5.~~12~~ 22 (63)** | **Seed: color** |  |  |
|  | whitish | Amarillo Oro s.b. | 1[ ] |
|  | cream yellow | Galia, Piel de Sapo | 2[ ] |

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|  | Characteristics | Example Varieties | Note |
| **5.~~13~~ 23 (68)** | **Shelf life of fruit** |  |  |
|  | very short | Charentais | 1[ ] |
|  | very short to short |  | 2[ ] |
|  | short | Galia | 3[ ] |
|  | short to medium |  | 4[ ] |
|  | medium | Clipper | 5[ ] |
|  | medium to long |  | 6[ ] |
|  | long | Piel de Sapo | 7[ ] |
|  | long to very long |  | 8[ ] |
|  | very long | Tendral Negro | 9[ ] |
| **5.~~14~~ 24 (69.1)** | **Resistance to *Fusarium oxysporum* f. sp. *melonis* (Fom) *–* Race 0  (Fom: 0)** |  |  |
|  | absent | ~~Jaune Canari 2~~ Atos, Charentais T | 1[ ] |
|  | present | Cadence, Charentais Fom-2, Dibango, ~~Jador,~~ Jubilo, Karakal, Védrantais | 9[ ] |
| **5.~~15~~ 25 (69.2)** | **Resistance to *Fusarium oxysporum* f. sp. *melonis* (Fom)** ***-* Race 1 (Fom: 1)** |  |  |
|  | absent | ~~Jaune Canari 2~~  Atos, Charentais T, Védrantais | 1[ ] |
|  | present | ~~Arapaho, Jador, Rubbens~~ Cadence, Charentais Fom-2, Dibango, Jubilo, Karakal | 9[ ] |
| **5.~~16~~ 26 (69.3)** | **Resistance to *Fusarium oxysporum* f. sp. *melonis* (Fom) *-* Race 2 (Fom: 2)** |  |  |
|  | absent | ~~Arapaho, Jaune Canari 2, Rubbens~~ Atos,  Charentais Fom-2, Charentais T, Dibango, Marianna | 1[ ] |
|  | present | ~~Anasta, Cléo, Jador,~~ Cadence,  Charentais Fom-1, Jubilo, Karakal, Perlita, Védrantais | 9[ ] |
| **5.27 (69.4)** | **Resistance to *Fusarium oxysporum* f. sp. *melonis -* Race 1.2 (Fom: 1.2)** |  |  |
|  | ~~susceptible~~ | ~~Jaune Canari 2,  Védrantais, Virgos~~ | ~~1[ ]~~ |
|  | ~~moderately resistant~~ | ~~Lunasol~~ | ~~2[ ]~~ |
|  | ~~highly resistant~~ | ~~Dinero, Isabelle~~ | ~~3[ ]~~ |
|  | absent | Graffio, Prity, Virgos | 1[ ] |
|  | present | Isabelle, Kyriel, Lunasol, Meliance, Piboule | 9[ ] |
|  | not tested |  | [ ] |

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|  | Characteristics | Example Varieties | Note |
| **5.28 (70.1)** | **Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) - Race 1 (Px: 1)** |  |  |
|  | ~~susceptible~~ absent or low | ~~Jaune Canari 2,~~ Védrantais | 1[ ] |
|  | ~~moderately resistant~~ medium | Escrito | 2[ ] |
|  | ~~highly resistant~~ high | ~~Anasta, Cézanne~~ Arum | 3[ ] |
|  | not tested |  | [ ] |
| **5.29 (70.2)** | **Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) - Race 2 (Px: 2)** |  |  |
|  | ~~susceptible~~ absent or low | ~~Galoubet,~~ Védrantais | 1[ ] |
|  | ~~moderately resistant~~ medium | Escrito, Pendragon | 2[ ] |
|  | ~~highly resistant~~ high | ~~Anasta, Cézanne~~ Arum | 3[ ] |
|  | not tested |  | [ ] |
| **5.30 (70.3)** | **Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) - Race 3 (Px: 3)** |  |  |
|  | ~~susceptible~~ absent or low | Védrantais | 1[ ] |
|  | ~~moderately resistant~~ medium | ~~Nettuno~~ Arago, Durango | 2[ ] |
|  | ~~highly resistant~~ high | ~~Batista, Godiva~~ Arum | 3[ ] |
|  | not tested |  | [ ] |
| **5.31 (70.4)** | **Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) - Race 5 (Px: 5)** |  |  |
|  | ~~susceptible~~ absent or low | Védrantais | 1[ ] |
|  | ~~moderately resistant~~ medium | ~~Hugo, Pendragon~~ Arago, Durango | 2[ ] |
|  | ~~highly resistant~~ high | ~~Arapaho~~ Arum | 3[ ] |
|  | not tested |  | [ ] |
| **5.32 (70.5)** | **Resistance to *Podosphaera xanthii* (Px) (ex *Sphaerotheca fuliginea)* (Powdery mildew) - Race 3-5 (Px: 3.5)** |  |  |
|  | ~~susceptible~~ absent or low | Védrantais | 1[ ] |
|  | ~~moderately resistant~~ medium | ~~Cisco~~ Arago, Durango | 2[ ] |
|  | ~~highly resistant~~ high | ~~90625~~ Arum | 3[ ] |
|  | not tested |  | [ ] |

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|  | Characteristics | Example Varieties | Note |
| **5.33 (71)** | Resistance to *Golovinomyces cichoracearum* (*Erysiphe cichoracearum*) (Powdery mildew) Race 1 (Gc: 1) |  |  |
|  | susceptible | Escrito, Score, Védrantais | 1[ ] |
|  | moderately resistant | Flores, Anasta | 2[ ] |
|  | highly resistant | Cézanne, Heliobel, Théo | 3[ ] |
|  | not tested |  | [ ] |
| **5.34 (72)** | **Resistance to colonization by *Aphis gossypii*** |  |  |
|  | absent | Védrantais | 1[ ] |
|  | present | AR Hale’s Best Jumbo,  AR Top Mark, Godiva, Heliobel, Virgos | 9[ ] |
|  | not tested |  | [ ] |
| **5.35 (73)** | **Resistance to *Zucchini yellow mosaic virus* (ZYMV)** |  |  |
|  | absent | Cardillo, Généris, Jador, Védrantais | 1[ ] |
|  | present | Hannah’s Choice, Lunaduke | 9[ ] |
|  | not tested |  | [ ] |
| **5.36 (74.1)** | **Resistance to *Papaya ringspot virus* (PRSV) - Guadeloupe strain** |  |  |
|  | absent | Védrantais | 1[ ] |
|  | present | Hannah’s Choice | 9[ ] |
|  | not tested |  | [ ] |
| **5.37 (74.2)** | **Resistance to *Papaya ringspot virus* (PRSV) - E2 strain** |  |  |
|  | absent | Hannah’s Choice, Védrantais | 1[ ] |
|  | present | WMR29 | 9[ ] |
|  | not tested |  | [ ] |
| **5.38 (75)** | **Resistance to *Melon necrotic spot virus* (MNSV) Strain 0 (MNSV: 0)** |  |  |
|  | absent | Védrantais | 1[ ] |
|  | present | Cyro, Primal, Virgos, Yellow Fun | 9[ ] |
|  | not tested |  | [ ] |

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|  | Characteristics | Example Varieties | Note |
| **5.39 (76)** | **Resistance to *Cucumber mosaic virus* (CMV)** |  |  |
|  | absent | Cézanne, Dalton | 1[ ] |
|  | present | Lunaduke, Virgos | 9[ ] |
|  | not tested |  | [ ] |

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1. held in Antalya, Türkiye, from May 1 to 5, 2023, in hybrid format [↑](#footnote-ref-2)
2. [matref@geves.fr](mailto:matref@geves.fr) [↑](#footnote-ref-3)
3. Harmores 3 CPVO project (<https://cpvo.europa.eu/sites/default/files/documents/report_harmores_3_final_meeting_v0_0.pdf> [↑](#footnote-ref-4)
4. ISF EG DRT Fom: 2 resistance in Melon – Link to include – *not yet available* [↑](#footnote-ref-5)
5. [matref@geves.fr](mailto:matref@geves.fr) [↑](#footnote-ref-6)
6. Harmores 3 CPVO project (<https://cpvo.europa.eu/sites/default/files/documents/report_harmores_3_final_meeting_v0_0.pdf>) [↑](#footnote-ref-7)
7. [matref@geves.fr](mailto:matref@geves.fr) [↑](#footnote-ref-8)
8. Harmores 3 CPVO project (<https://cpvo.europa.eu/sites/default/files/documents/report_harmores_3_final_meeting_v0_0.pdf>) [↑](#footnote-ref-9)
9. [matref@geves.fr](mailto:matref@geves.fr) [↑](#footnote-ref-10)
10. Harmores 3 CPVO project (<https://cpvo.europa.eu/sites/default/files/documents/report_harmores_3_final_meeting_v0_0.pdf> [↑](#footnote-ref-11)
11. ISF EG DRT Fom: 2 resistance in Melon – Link to include – *not yet available* [↑](#footnote-ref-12)
12. [matref@geves.fr](mailto:matref@geves.fr)

    3 Harmores 3 CPVO project (<https://cpvo.europa.eu/sites/default/files/documents/report_harmores_3_final_meeting_v0_0.pdf>) [↑](#footnote-ref-13)
13. 3 [matref@geves.fr](mailto:matref@geves.fr)

    6 Harmores 3 CPVO project (<https://cpvo.europa.eu/sites/default/files/documents/report_harmores_3_final_meeting_v0_0.pdf>) [↑](#footnote-ref-14)