NAME OF THE ORGANISM: Tomato apical stunt viroid (TASVD0)

GENERAL INFORMATION ON THE PEST

Name as submitted in the project specification (if different to the preferred name):

Pest category:

Viruses and viroids **1- Identity of the pest/Level of taxonomic listing:**
Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?

Yes
Is the pest defined at the species level or lower?:

Yes
Can listing of the pest at a taxonomic level higher than species be supported by scientific reasons or can species be identified within the taxonomic rank which are the (main) pests of concern?

* Not relevant: Vegetable seed sector, Vegetable propagating and planting material (other than seeds) sector

Is it justified that the pest is listed at a taxonomic rank below species level?

Not relevant
Conclusion:

* Candidate: Vegetable seed sector, Vegetable propagating and planting material (other than seeds) sector

Justification (if necessary):

Species discrimination is based on sequence similarity level (less than 90% sequence identity of the total viroid genome) and on distinctive biological properties. Pospiviroid detection is done by using RT-PCR with generic primers for broad but specific amplification of pospiviroids. In addition other molecular
methods, including (i) Northern blot hybridisation assays using species-specific probes that to a lower extent also show cross-hybridization with other members of the genus, (ii) RT-PCR and (iii) real-time RT-PCR, allow reliable detection of pospiviroids. Sequence analysis of RT-PCR products permits identification of pospiviroid species. Overall, methods for reliable detection and identification/discrimination of pospiviroids are available, although their high sensitivity implies the risk of false-positive reactions because of cross-contamination. These techniques are already widely used by EU MS as indicated by the answers received to the questionnaire sent by EFSA (EFSA PLH, 2011). **2 – Status in the EU:**

Is this pest already a quarantine pest for the whole EU?

No
Presence in the EU:

Yes
Conclusion:

candidate
Justification (if necessary):

The pest is present in Austria (transient, under eradication), Belgium, Croatia (transient, under eradication), Germany (transient, under eradication), Italy (transient, under eradication), Netherlands, Poland (transient, under eradication) and Slovenia (EFSA PLH, 2011; EPPO, 2016).

HOST PLANT N°1: Solanum lycopersicum (LYPES) for the Vegetable seed sector.

Origin of the listing:

EFSA PRA (EFSA PLH, 2011)
Plants for planting:

Seeds **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**

No
Conclusion:

Evaluation continues **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**

Yes
Conclusion:

Candidate

Justification:

Transmission of TASVd through seed has been experimentally demonstrated in tomato with a transmission rate up to 80% (EFSA-PLH, 2011). The spread can occur over long distances with plants for planting (including seeds). There is experimental and circumstantial evidence that TASVd can be spread between crops by mechanical transmission in tomato and bumblebee and aphid transmission (EFSA-PLH, 2011; EPPO, 2016), thus any infection arising from seed will likely spread to neighbouring susceptible plant species in the nursery. Therefore seeds as plants for planting are considered a significant pathway for this pest/host/intended use combination. **5 - Economic impact:**
Are there documented reports of any economic impact on the host?

Yes
Justification:

All pospiviroids cause similar symptoms in tomato, independent of the viroid species. Symptoms are most conspicuous when plants become infected at early stages of development and when grown at high temperatures and light intensity. The first symptoms are growth reduction and chlorosis in the upper leaves, subsequently, this may develop into permanent stunting and bunchy growth, occasionally, plants may either die or partially recover. Usually, symptoms are observed along rows in the fields and greenhouses, indicating that the viroid spreads mechanically during crop handling.
Fruit production generally stops on infected plants, yield loss is strongly dependent on the age at which plants become infected. Early infection, before fruit setting, will result in close to 100% loss, while losses associated with later infections are more variable (EFSA-PLH, 2011). For TASVd, a delay in the ripening of the fruit and a reduction in their storage life from 3 weeks to 1 week is reported.
The pest has been found in tomato glasshouses in Israel causing severe losses (Antignus et al., 2007). The outbreak of TASVd in a commercial glasshouse in the Netherlands in May 2011 resulted in heavy damage on plants. Moreover TASVd can readily spread within a tomato crop as a result of routine crop handling and maintenance, even if there is only one initial infection event, and it is likely to result in tens to hundreds of additional infections in the tomato crop (MAF, 2012).
What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)

Major
Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?

No
Conclusion:

Candidate
Justification:

Overall there is ample evidence that significant yield losses may result from pospiviroid infections in tomato and the impact is therefore expected to be major, with low uncertainty (EFSA-PLH, 2011). The economic impact is evaluated as unacceptable on Tomato. **6 - Are there feasible and effective measures available to prevent the presence of the pest on the plants for planting at an incidence above a certain threshold (including zero) to avoid an unacceptable economic impact as regards the relevant host plants?**

Yes

Conclusion:

candidate
Justification:

There is no management option that can prevent infestation other than exclusion and avoiding the use of infected plants (EFSA-PLH, 2011). Visual examination and testing in case of symptoms should be an effective measures. This position is reinforced by risk management measures set up for PSTVd that significantly reduced the incidence of this pathogen. TASVd is able to contaminate the embryonic tissues of the seed (Antignus et al, 2007), this is why seed treatment will not eliminate or inactivate the viroid. **7- Is the quality of the data sufficient to recommend the pest to be listed as a RNQP?**

Yes

Conclusion:

Candidate
Justification:

 **CONCLUSION ON THE STATUS:**

Recommended for listing as an RNQP, based on data. **8 - Tolerance level:**
Is there a need to change the Tolerance level:

Yes
Proposed Tolerance levels:

Zero tolerance approach, based on the following risk management measures. **9 - Risk management measures:**
Is there a need to change the Risk management measure:

Yes
Proposed Risk management measure:

Seeds:
(a) The seeds have been produced from mother plants which have been maintained in isolation from other potential sources of infection, including host plants which may be latently infected;
and
(b) No symptoms of Tomato apical stunt viroid have been observed on mother plants at the site of production since the beginning of the last complete cycle of vegetation, or if symptoms have been seen, then the symptomatic plants have been tested and found free from Tomato apical stunt viroid.
Justification (if necessary):

Experts considered that the Pest free area option is not reliable because of the risk linked to ornamentals constantly marketed in the area. They also commented that available data do not justify testing of seed lots for pospiviroids: only very few outbreaks of solanaceous pospiviroids have been reported that may be related to infested/contaminated seed while various outbreaks could be related to pospiviroid infestations in ornamentals. In addition, no seed transmission was found in recent experiments carried out in the Netherlands with ca 100.000 seeds from commercial seed lots infested with various solanaceous pospiviroids. However very low initial infestation rates lead in some cases to an unacceptable economic impact. Isolation from ornamentals (for CEVd, CLVd, TASVd and TCDVd) and aubergine (for CEVd) is necessary for the production of reproductive material. **REFERENCES:**

* Antignus Y, Lachman O & Pearlsman M (2007) Spread of TASVd in greenhouse tomato crops is associated with seed transmission and bumble bee activity. The American Phytopathological Society. Plant Disease 91, 47-50. Available at: <http://apsjournals.apsnet.org/doi/pdf/10.1094/PD-91-0047>;
* EFSA Panel on Plant Health (PLH) (2011) Scientific Opinion on the assessment of the risk of solanaceous pospiviroids for the EU territory and the identification and evaluation of risk management options. EFSA Journal 2011;9(8):2330 [132 pp.]. doi:10.2903/j.efsa.2011. 2330; www.efsa.europa.eu/efsajournal;
* EPPO (2016) Report of a Pest Risk Analysis for Tomato apical stunt viroid;
* MAF (2012) Import Risk Analysis: Tomato and Capsicum seed for sowing from all countries. Ministry of Agriculture and Forestry of New-Zealand, Information Bureau. Available at: <http://www.mpi.govt.nz/document-vault/2887>;

HOST PLANT N°2: Solanum lycopersicum (LYPES) for the Vegetable propagating and planting material (other than seeds) sector.

Origin of the listing:

EFSA PRA (EFSA PLH, 2011)
Plants for planting:

Plants intended for planting, other than seeds **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**

No
Conclusion:

Evaluation continues **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**

Yes
Conclusion:

Candidate

Justification:

Transmission of TASVd through seed has been experimentally demonstrated in tomato with a transmission rate up to 80% (EFSA-PLH, 2011). The spread can occur over long distances with plants for planting (including seeds). There is experimental and circumstantial evidence that TASVd can be spread between crops by mechanical transmission in tomato and bumblebee and aphid transmission (EFSA-PLH, 2011; EPPO, 2016), thus any infection arising from seed will likely spread to neighbouring susceptible plant species in the nursery. Therefore plants for planting (arising from infected seed, or mechanical means from other hosts), are considered a significant pathway for this pest/host/intended use combination. **5 - Economic impact:**
Are there documented reports of any economic impact on the host?

Yes
Justification:

All pospiviroids cause similar symptoms in tomato, independent of the viroid species. Symptoms are most conspicuous when plants become infected at early stages of development and when grown at high temperatures and light intensity. The first symptoms are growth reduction and chlorosis in the upper leaves, subsequently, this may develop into permanent stunting and bunchy growth, occasionally, plants may either die or partially recover. Usually, symptoms are observed along rows in the fields and greenhouses, indicating that the viroid spreads mechanically during crop handling.
Fruit production generally stops on infected plants, yield loss is strongly dependent on the age at which plants become infected. Early infection, before fruit setting, will result in close to 100% loss, while losses associated with later infections are more variable (EFSA-PLH, 2011). For TASVd, a delay in the ripening of the fruit and a reduction in their storage life from 3 weeks to 1 week is reported.
The pest has been found in tomato glasshouses in Israel causing severe losses (Antignus et al., 2007). The outbreak of TASVd in a commercial glasshouse in the Netherlands in May 2011 resulted in heavy damage on plants. Moreover TASVd can readily spread within a tomato crop as a result of routine crop handling and maintenance, even if there is only one initial infection event, and it is likely to result in tens to hundreds of additional infections in the tomato crop (MAF, 2012).
What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)

Major
Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?

No
Conclusion:

Candidate
Justification:

Overall there is ample evidence that significant yield losses may result from pospiviroid infections in tomato and the impact is therefore expected to be major, with low uncertainty (EFSA-PLH, 2011). The economic impact is evaluated as unacceptable on Tomato. **6 - Are there feasible and effective measures available to prevent the presence of the pest on the plants for planting at an incidence above a certain threshold (including zero) to avoid an unacceptable economic impact as regards the relevant host plants?**

Yes

Conclusion:

candidate
Justification:

There is no management option that can prevent infestation other than exclusion and avoiding the use of infected plants (EFSA-PLH, 2011). Visual examination and testing in case of symptoms should be an effective measures. This position is reinforced by risk management measures set up for PSTVd that significantly reduced the incidence of this pathogen. **7- Is the quality of the data sufficient to recommend the pest to be listed as a RNQP?**

Yes

Conclusion:

Candidate
Justification:

 **CONCLUSION ON THE STATUS:**

Recommended for listing as an RNQP, based on data. **8 - Tolerance level:**
Is there a need to change the Tolerance level:

Yes
Proposed Tolerance levels:

Zero tolerance approach, based on the following risk management measures. **9 - Risk management measures:**
Is there a need to change the Risk management measure:

Yes
Proposed Risk management measure:

Plants:
(a) The plants have been grown from seed that meet the requirements laid down; and have been maintained in isolation from other potential sources of infection, including host plants which may be latently infected;
and
(b) No symptoms of Tomato apical stunt viroid have been observed on plants at the site of production since the beginning of the last complete cycle of vegetation.
Justification (if necessary):

Experts considered that the Pest free area option is not reliable because of the risk linked to ornamentals constantly marketed in the area. They also commented that available data do not justify testing of seed lots for pospiviroids: only very few outbreaks of solanaceous pospiviroids have been reported that may be related to infested/contaminated seed while various outbreaks could be related to pospiviroid infestations in ornamentals. In addition, no seed transmission was found in recent experiments carried out in the Netherlands with ca 100.000 seeds from commercial seed lots infested with various solanaceous pospiviroids. However very low initial infestation rates lead in some cases to an unacceptable economic impact. Isolation from ornamentals (for CEVd, CLVd, TASVd and TCDVd) and aubergine (for CEVd) is necessary for the production of reproductive material. **REFERENCES:**

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* EFSA Panel on Plant Health (PLH) (2011) Scientific Opinion on the assessment of the risk of solanaceous pospiviroids for the EU territory and the identification and evaluation of risk management options. EFSA Journal 2011;9(8):2330 [132 pp.]. doi:10.2903/j.efsa.2011. 2330; www.efsa.europa.eu/efsajournal;
* EPPO (2016) Report of a Pest Risk Analysis for Tomato apical stunt viroid;
* MAF (2012) Import Risk Analysis: Tomato and Capsicum seed for sowing from all countries. Ministry of Agriculture and Forestry of New-Zealand, Information Bureau. Available at: <http://www.mpi.govt.nz/document-vault/2887>;