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# Commodity risk assessment of *Malus domestica* plants from Serbia

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## Abstract

The EFSA Panel on Plant health was requested to prepare and deliver risk assessments for commodities listed in the relevant Implementing Acts as 'High risk plants, plant products and other objects' (Commission Implementing Regulation (EU) 2018/2019 establishing a provisional list of high-risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031). The current scientific opinion covers all plant health risks posed by dormant bare rooted plants for planting of *Malus domestica* (1–2 years old) imported from Serbia, considering the available scientific information, including the technical information provided by the Plant Protection Directorate from Serbia on 27 December 2019. The relevance of an EU-quarantine pest for this opinion was based on evidence that: (a) the pest is present in Serbia; (b) the pest uses *M. domestica* as a host; (c) one or more life stages of the pest can be associated with the specified commodity. The relevance for this opinion of pests not regulated in the EU was based on the following criteria: (i) the pest is present in Serbia; (ii) the pest is not present in the EU; (iii) *M. domestica* is a host of the pest; (iv) the pest can be associated with the commodity and (v) the pest may have an impact and can pose potential risk for the EU territory. After the assessment of 1191 potential pests, one bacterium, *Erwinia amylovora,* fulfilled all criteria and accordingly, was selected for further evaluation. For this bacterium, the risk mitigation measures proposed in the technical dossier were evaluated. Limiting factors on the effectiveness of the measures were also considered. For the selected species, an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on *E. amylovora*, including any uncertainties. Based on the outcomes of an Expert Knowledge Elicitation, the Panel is considering a pallet as a unit; and taking into account the uncertainties associated with the assessment, the panel is 95% sure that 9,934 or more pallets out of 10,000 will be pest free.



**Keywords:** *Malus domestica*, apple trees, Serbia, European Union, commodity risk assessment, plant health, phytosanitary import requirements, bacteria, *Erwinia amylovora*, fireblight

**Requestor:** European Commission

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# 1. Introduction

## 1.1. Background and Terms of Reference as provided by European Commission

### 1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031[1], on the protective measures against pests of plants, has been applied since December 2019. Provisions within the above Regulation are in place for the listing of 'high risk plants, plant products and other objects' (Article 42) on the basis of a preliminary assessment, and to be followed by a commodity risk assessment. A list of 'high risk plants, plant products and other objects' has been published (EU) 2018/2019[2]. Scientific opinions are therefore needed to support the European Commission and the Member States in the work connected to Article 42 of Regulation (EU) 2016/2031, as stipulated in the terms of reference.

### 1.1.2. Terms of Reference

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002[3], the Commission asks EFSA to provide scientific opinions in the field of plant health.

In particular, EFSA is expected to prepare and deliver risk assessments for commodities that shall be listed in the relevant Implementing Acts as "High risk plants, plant products and other objects". Article 42, paragraphs 4 and 5, establishes that a risk assessment is needed as a follow-up to evaluate whether the commodities will remain prohibited, removed from the list and additional measures will be applied or removed from the list without any additional measures. This task is expected to be on-going, with a regular flow of dossiers being sent by the applicant required for the risk assessment.

Therefore, to facilitate the correct handling of the dossiers and the acquisition of the required data for the commodity risk assessment, a format for the submission of the required data for each dossier is needed.

Furthermore, a standard methodology for the performance of "commodity risk assessment" based on the work already done by Member States and other international organizations needs to be set.

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002, the Commission asks EFSA to provide scientific opinion in the field of plant health for *M. domestica* from Serbia taking into account the available scientific information, including the technical dossier provided by Serbia.

## 1.2. Interpretation of the Terms of Reference

The European Food Safety Authority (EFSA) Panel on Plant Health (hereafter referred to as 'the Panel') was requested to conduct a commodity risk assessment of specified plants for planting of *Malus domestica* Borkh from Serbia (RS) based on the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019).

In its evaluation the Panel:

- Checked whether the information in the technical dossier (hereafter referred to as 'the Dossier') provided by the Serbian Authority (Ministry of Agriculture, Forestry and Water Management, Plant Protection Directorate – PPD) was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested from the applicant,
- Selected the relevant EU-regulated quarantine pests and protected zone quarantine pests (Regulation (EU) 2019/2072), hereafter referred to as 'EU quarantine pests') and other relevant pests present in the applicant country and associated with the commodity. Pests listed

[1] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) 228/2013, (EU) 652/2014 and (EU) 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC. OJ L 317, 23.11.2016, pp. 4–104.

[2] Commission Implementing Regulation (EU) 2018/2019 of 18 December 2018 establishing a provisional list of high risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031 and a list of plants for which phytosanitary certificates are not required for introduction into the Union, within the meaning of Article 73 of that Regulation C/2018/8877. OJ L 323, 19.12.2018, pp. 10–15.

[3] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, pp. 1–24.

as union regulated non-quarantine pests (RNQPs) in Regulation (EU) 2019/2072 were not considered for further evaluation,
- Evaluated the effectiveness of the proposed measures (as specified by the applicant country) for the selected relevant organisms on the commodity in the applicant country.

Risk management decisions are not within EFSA's remit. Therefore, the Panel will provide a rating for the likelihood of pest freedom for each relevant pest given the risk mitigation measures proposed by the PPD.

# 2. Data and methodologies

## 2.1. Data

The Panel considered all the data and information (hereafter called 'the Dossier') provided by the PPD of Serbia on *M. domestica* on 8 August 2019, including the additional information provided by the PPD of Serbia on 27th of December and on 14th of February, after EFSA's request. The Dossier is managed by EFSA.

The structure and overview of the Dossier and the additional material are shown in Table 1. The number of the relevant section will be indicated in the opinion when referring to a specific part of the Dossier.

**Table 1:** Structure and overview of the Dossier and additional material provided by the PPD of Serbia

| Section | Overview of contents | Filename |
|---|---|---|
| 1.0 | Initial request by Serbia | Cover_letter_Serbia_COM-19-08-08-ARES 5140394_Letter.pdf |
| 2.0 | Technical dossier on *Malus domestica* Borkh. (complete document) | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| **3.0** | **COMMODITY DATA** | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.1 | Taxonomic information | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.2 | Plants for planting specification (ISPM 36 – FAO, 2012) | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.7 | Production period | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.8 | Phytosanitary status and management | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.9 | Intended use | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.10 | Production area | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.11 | Separation of production areas | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.12 | Climatic classification | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 3.13 | Pictures and description | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| **4** | **PEST LIST** | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 4.1 | List of all the pests potentially associated with the commodity plant species or genus in the exporting country | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 4.2 | List of EU-regulated pests (Table D.1) | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 4.3 | List of non-regulated pests (Table D.2) | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 4.4 | Summary table of relevant pests associated with the commodity (Table D.3) | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 4.5 | Details of the literature search according to Appendix B | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 4.6 | OPTIONAL– Additional information or evidence (e) | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |

| Section | Overview of contents | Filename |
|---|---|---|
| **5.0** | **DATA ON PHYTOSANITARY MITIGATION MEASURES** | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.1 | Description of phytosanitary mitigation measures | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.2 | Description of phytosanitary regulations | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.3 | Description of surveillance and monitoring | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.4 | Trade volumes and frequencies | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.5 | Description of post-harvest procedures | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.6 | E1 Details of pesticide treatment | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.7 | E2 Details of other treatments/ measures | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.8 | E3 Calendar including relevant crop phenology data, pest presence in the crop and timing of treatment | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.9 | E4 Assessment of the overall efficacy of phytosanitary mitigation measures | EFSA-Dossier_Q-2019-00532_0003-Serbia-Malus_domestica.pdf |
| 5.10 | List of production nurseries in Serbia producing plant material included in this dossier | ANNEX III Table 3 Rasinski district.pdf |
| 5.11 | Summary of sampling efforts (inspections) in apple production areas in Serbia | ANNEX IV Summary report 2018 eng.pdf |
| 5.12 | Maps showing the ubication of nurseries producing mother plants and production nurseries | MapOfAllPlaceOFProduction_2019_Print.jpg |
| 6.0 | **RESPONSE FOR CLARIFICATION ON THE INFORMATION PROVIDED IN THE DOSSIER SUBMITTED BY THE PLANT PROTECTION DIRECTORATE OF SERBIA ON PLANTS FOR PLANTING OF MALUS DOMESTICA AND ANNEXES WITH ADDITIONAL INFORMATION** | Response to EFSA Question number EFSA Q-2019-00532-0003 SERBIA.pdf |
| 6.1 | Inspection protocols and surveillance in Serbia | ANNEX I Inspection Protocol Malus Serbia.pdf |
| 6.2 | Sampling protocol for *Erwinia amylovora* | ANNEX II Sampling Protocol E.a.pdf |
| 6.3 | Sampling protocol for *Candidatus Phytoplasma mali* | ANNEX II Sampling Protocol C.p.mali.pdf |
| 6.4 | List of mother plantations (nurseries) in Serbia producing plant material included in this dossier | ANNEX III Table 1 Mother Plantation 2019.pdf |
| 6.5 | List of production nurseries in Serbia producing plant material included in this dossier | ANNEX III Table 2 Nurseries 2019.pdf |
| 6.6 | List of production nurseries in Serbia producing plant material included in this dossier | ANNEX III Table 3 Rasinski district.pdf |

| Section | Overview of contents | Filename |
|---|---|---|
| 6.7 | Summary of sampling efforts (inspections) in apple production areas in Serbia | ANNEX IV Summary report 2018 eng.pdf, |
| 6.8 | Maps showing the ubication of nurseries producing mother plants and production nurseries | MapOfAllPlaceOFProduction_2019_Print.jpg |
| 7.0 | **RESPONSE PLANT PROTECTION DIRECTORATE MAFWM OF SERBIA TO THE REQUEST FOR CLARIFICATION ON THE INFORMATION PROVIDED IN THE DOSSIER SUBMITTED BY THE PLANT PROTECTION DIRECTORATE OF SERBIA ON PLANTS FOR PLANTING OF MALUS DOMESTICA EFSA Question number: EFSA-Q-2019-00532-0003-SERBIA** | Letter of NPPO Serbia.pdf |
| 7.1 | ANNEX I – Response of Plant Protection Directorate for clarification on the information provided in the dossier submitted by the Plant Protection Directorate of Serbia on plants for planting of Malus domestica (Question number: EFSA-Q-2019-00532-0003-SERBIA) | ANNEX I Response to the Questions related to the content of the dossier (EFSA-Q-2019-00532_0003).pdf |
| 7.2 | ANNEX II – Rulebook on lists of harmful organisms and lists of plants, plant products and regulated objects ('OG RS', No. 7/2010, 22/2012 and 57/2015) | ANNEX II Serbian Quarantine Rulebook.pdf |
| 7.3 | ANNEX III – Folder references and reports (ToRSV) | Attach 1_ MijatovicActa Physiol. Plant_TomatoViroses in Serbia.pdf<br>Attach 2_Nikolic_Eur J Plant Pathol_Tomato viruses.pdf<br>Attach 3 Jordovic_Rankovic_Dimitrijevic_1973.pdf<br>Attach 4 Jevremovic_Paunovic_Leposavic_2016.pdf<br>Attach 5 Report PPD blueberry 2014.pdf<br>Attach 6 Report PPD blueberry 2015.pdf<br>Attach 7 Report PPD blueberry 2016.pdf<br>Attach 8 Report PPD blueberry 2017.pdf<br>Attach 9 Report PPD blueberry 2018.pdf<br>Attach 10 Paunovic et al._2007-vinova loza.pdf<br>Attach 11 Dulic-Markovic_izvod disertacija_1999.pdf |
| 7.4 | ANNEX IV Folder References (TRSV) | Attach 1_Mickovski_TSWV not TRSV.pdf<br>Attach 1A Buzancic and Juretic 1978<br>Attach 2_Dukic_Pestic.Phytomed._tobacco viruses.pdf<br>Attach 3_Stankovic_Acta Virologica_tobacco viruses.pdf<br>Attach 4_Jevremovic_Pestic.Phytomed._TRSV.pdf |

The data and supporting information provided by the PPD formed the basis of the commodity risk assessment. Table 2 shows the main data sources used by the PPD to compile the dossier and provide the requested information.

**Table 2:** Scientific references and technical databases consulted by the PPD of Serbia as provided in the submitted dossier

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| Zlatibor and Almasi R et al., 2004. Harmful and beneficial organisms of pome fruits. pp. 43–46. | |
| **Databases** | |
| Centre for Agriculture and Bioscience International (CABI), CABI Invasive Species Compendium | https://www.cabi.org/ISC |
| Data base for leaf miner | https://bladmineerders.nl/ |
| European and Mediterranean Plant Protection Organization, EPPO Global Database | https://gd.eppo.int/ |
| Fauna Europaea | https://fauna-eu.org/ |
| PESI<br>Pan-European Species directories Infrastructure | http://www.eu-nomen.eu/portal/ |
| Plantwise Knowledge Bank | https://www.plantwise.org/ |
| Scindex Serbian citation Index (national database) | http://scindeks.ceon.rs/ |
| Scopus | https://www.scopus.com/search/form.uri?display=basic |
| Web of Science (WoS) | https://apps.webofknowledge.com/ |
| **Other sources *internal reports** | |
| Summary Report Insitute Tamiš (Folder Reference) | Summary report of results of laboratory analysis of soil samples from seed potato, ware potato and plant propagation material fields on presence of *Globodera rostochiensis* in plant nematology laboratory of institute Tamiš in the period 2011–2018 |
| Reports on national surveys Apple Serbia (Folder Reference) | – Report PM-A. mali, 2017.serb.pdf<br>– Report PM-A. mali, 2016.serb.pdf<br>– Report to NPPO on Alternaria mali survey.pdf |

## 2.2. Methodologies

To have a comprehensive list of the pests potentially associated with *M. domestica* in Serbia, a literature search was undertaken by EFSA, in which it was combined: (i) a general search to identify pests of *M. domestica* in different databases and (ii) a tailored search to identify whether these pests were present or not in Serbia. The searches were run between 28 September and 10 November 2019. No language, date or document type restrictions were applied in the search strategy.

The Panel used the following databases (Table 3) to compile the list of pests associated with *M. domestica*:

- **European and Mediterranean Plant Protection Organization Global Database**

*EPPO (online)*

The European and Mediterranean Plant Protection Organization (EPPO) Global Database is maintained by the EPPO Secretariat. The aim of the database is to provide all pest-specific information that has been produced or collected by EPPO. It includes host range data, distribution ranges and pest status information.

- **CABI Crop Protection Compendium**

*CABI (online)*

The Crop Protection Compendium is an encyclopaedic resource that brings together a wide range of different types of science-based information on all aspects of crop protection. It comprises detailed datasheets on pests, diseases, weeds, host crops and natural enemies that have been sourced from experts, edited by an independent scientific organisation and enhanced with data from specialist organisations, images, maps, a bibliographic database and full-text articles. New datasheets and data sets continue to be added, datasheets are reviewed and updated and search and analysis tools are being built.

- **Other databases**

In addition to CABI and EPPO, other databases were used to compile the list of potential pests of *M. domestica*. The databases used for compiling the pest list are reported in Table 3. As for Web of Science, the literature search was performed using a specific and ad hoc established search string. The string was run in 'All Databases' with no range limits for time or language filters. This will be further discussed in Paragraph 2.2.1.

- **Other sources**

Additional searches, limited to retrieve documents, were run when developing the opinion. The available scientific information, including previous EFSA opinions on the relevant pests and diseases (see pest sheets in Appendix A) and the relevant literature and legislation (e.g. Regulation (EU) 2016/2031[4], Commission implementing regulation (EU) 2018/2018[5], Commission implementing regulation (EU) 2018/2019[6]) were taken into account.

**Table 3:** Databases used for the compilation of the pest list associated with *M. domestica*

| Database | Platform/Link |
|---|---|
| Aphids on World Plants | http://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm |
| CABI Crop Protection Compendium | https://www.cabi.org/cpc/ |
| Database of Insects and their Food Plants | http://www.brc.ac.uk/dbif/hosts.aspx |
| Database of the World's Lepidopteran Hostplants | https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml |
| EPPO Global Database | https://gd.eppo.int/ |
| Fauna Europaea | https://fauna-eu.org/ |
| Google Scholar | https://scholar.google.com/ |
| Leaf-miners | http://www.leafmines.co.uk/html/plants.htm |
| Nemaplex | http://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx |
| Plant Viruses Online | http://bio-mirror.im.ac.cn/mirrors/pvo/vide/famindex.htm |
| Scalenet | http://scalenet.info/associates/ |
| Spider Mites Web | https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php |
| USDA ARS Fungi Database | https://nt.ars-grin.gov/fungaldatabases/fungushost/fungushost.cfm |
| Web of Science: All Databases (Web of Science Core Collection, CABI: CAB Abstracts, BIOSIS Citation Index, Chinese Science Citation Database, Current Contents Connect, Data Citation Index FSTA, KCI-Korean Journal Database, Russian Science Citation Index, MEDLINE SciELO Citation Index, Zoological Record) | Web of Science https://www.webofknowledge.com |
| Index Fungorum | http://www.indexfungorum.org/Names/Names.asp |

When developing the opinion, the Panel followed the EFSA Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019).

Firstly, pests associated with the commodity in the country of origin (EU-regulated pests and other pests) that may require risk mitigation measures were identified. In this opinion, relevant pests not

[4] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) No 228/2013, (EU) No 652/2014 and (EU) No 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC.

[5] Commission Implementing Regulation (EU) 2018/2018 of 18 December 2018 laying down specific rules concerning the procedure to be followed in order to carry out the risk assessment of high-risk plants, plant products and other objects within the meaning of Article 42(1) of Regulation (EU) 2016/2031 of the European Parliament and of the Council.

[6] Commission Implementing Regulation (EU) 2018/2019 of 18 December 2018 establishing a provisional list of high-risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031 and a list of plants for which phytosanitary certificates are not required for introduction into the Union, within the meaning of Article 73 of that Regulation.

regulated in the EU were selected based on evidence for their potential impact for the EU. After the first step, all the relevant pests that may need risk mitigation measures were identified.

Secondly, the overall efficacy of the proposed risk mitigation measures for each pest was evaluated. A conclusion on the pest freedom status of the commodity for each of the relevant pests was achieved and uncertainties were identified.

### 2.2.1. Commodity data

Based on the information provided by the PPD of Serbia, the characteristics of the commodity were summarised.

### 2.2.2. Identification of pests potentially associated with the commodity

To evaluate the pest risk associated with the importation of *M. domestica* from Serbia, a pest list was compiled. The pest list is based on the information provided in the Dossier Section 4 and on the additional searches performed by the Panel. The search strategy and search syntax were adapted to each of the databases listed in Table 3, according to the options and functionalities of the different databases and CABI keyword thesaurus.

The scientific name of the host plant (i.e. *Malus domestica*) was used when searching in the EPPO Global database and CABI Crop Protection Compendium. The same strategy was applied to the other databases excluding Web of Science.

The search strategy used for the Web of Science Databases was designed combining common names for pests and diseases, terms describing symptoms of plant diseases and the scientific and common names of the commodity. All of the pests already retrieved using the other databases were removed from the search terms to reduce the number of records to be screened. The established search string is detailed in Appendix B and was run on 24 September 2019.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *M. domestica* were included in the pest list.

All the pests retrieved using the different databases are included in an Excel file including relevant information for the shortlisting of the pests relevant for this Opinion (i.e. EPPO code per pest, taxonomic information, categorisation, distribution, etc.). The pest list (see Microsoft Excel® file in Appendix C) is a document that includes all the pests potentially associated with *Malus domestica* retrieved from EPPO GD, CABI CPD and other databases. An overview of the consulted sources is listed in Table 3.

### 2.2.3. Listing and evaluation of risk mitigation measures

All currently used risk mitigation measures were listed and evaluated. When evaluating the potential pest freedom of the commodity, the following types of potential infection sources for *M. domestica* plants in export nurseries and relevant risk mitigation measures=risk reduction options (see glossary) were considered (see also Figure 1):

- pest entry from surrounding areas,
- pest entry with new plants/seeds,
- pest spread within the nursery.

The risk mitigation measures adopted in the plant nurseries (as stated by the PPD) were evaluated by means of an Expert Knowledge Elicitation (EKE) according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).

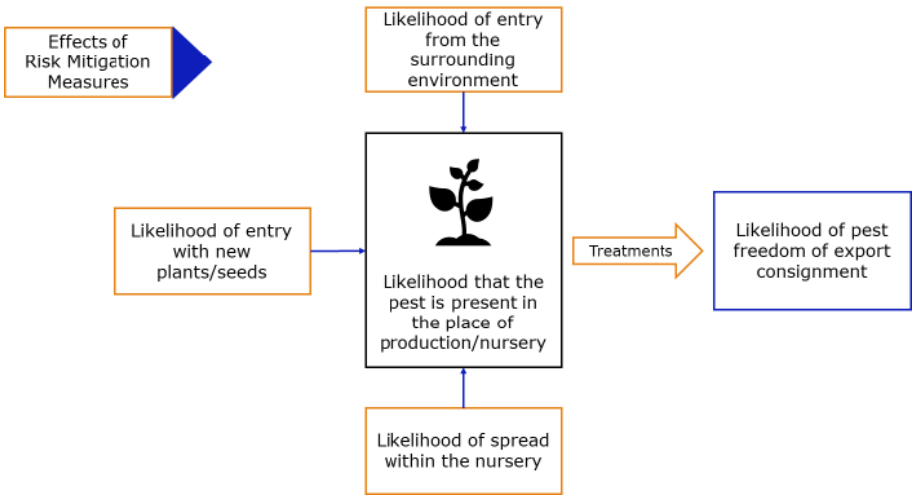


**Figure 1:** Conceptual framework to assess likelihood that plants are exported free from relevant pests Source: EFSA PLH Panel (2019)

Information on the biology, estimates of likelihood of entry of the pest to the export nursery and the effect of the measures on the specific pest were summarised in pest datasheets compiled for each pest selected for further evaluation (see Appendix A).

To estimate the pest freedom of the commodity, a semi-formal EKE was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific question for the semi-formal EKE was defined as follows: Taking into account (i) the risk mitigation measures in place in the export nurseries, and (ii) other relevant information, how many out of 10,000 pallets with *Malus domestica* plants will be infested with the relevant pest when arriving in the EU? Given the information provided on production and packaging, it was decided that a pallet would be used as the unit of assessment in the expert knowledge elicitation because during transportation plants can be in contact within a pallet and in consequence, the infection/infestation of a single plant would compromise the pest freedom of the whole pallet. As detailed in the submitted dossier by Serbia, each pallet contains 600–900 individual plants of *M. domestica*, packaged in net bags containing 10–20 plants. The uncertainties associated with the EKE (expert judgements) on the pest freedom of the commodity for the pest were taken into account and quantified in the probability distribution applying the semi-formal method described in Section 3.5.2 of the EFSA-PLH Guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Finally, the results were reported in terms of the likelihood of pest freedom. The lower 5% percentile of the uncertainty distribution reflects the opinion that pest freedom is with 95% certainty above this limit.

# 3. Commodity data

## 3.1. Description of the commodity

The commodity to be imported is *M. domestica* (common name: Apple; family: Rosaceae) plants. The planting material considered to be imported into the EU from Serbia corresponds to 1- to 2-year-old grafted (see Section 3.3.3 for details) bare root plants *sensu* ISPM 36[7] (FAO 2012 Annex1).

The apple planting material is commercialised in a dormant phenological phase. The intended use of the commodity is the distribution to final consumers (Dossier Section 3.9). Both types of plant material i.e. 1- and 2-year-old plants are marketable from October to May (Dossier Section 3.13).

Although the phytosanitary management undertaken is different among the producers – the sanitary status of the plants reflects the standard required by the national legislation of the Republic of

[7] Regarding specific measures from ISPM 36 the following measures are applied:
– Production within a specified certification scheme
– Derivation from mother plants that have been tested and found free from the relevant hub
– Isolation from sources of infestation
– Pre-planting soil testing for freedom from or to meet a tolerance for soil-borne pests or their vectors
– Growing season inspection of the mother plants
– Growing season inspection of the nurseries
– Pesticide treatments.

Serbia. The sanitary status of the production is controlled by the producers as well via official inspection controls. The plants produced for export are certified plants according to the legislation listed in Section 5 of the Dossier. The volume of the production of plants was 28.622.000 plants per three production seasons and certified plants are representing over 80% of this volume (Dossier Section 3.8). All plants are produced only in registered nurseries under official inspections. Different surveillance schemes are conducted to reduce the risks of pest outbreaks at the place of production. The measures are described and contribute to guarantee of the absence of the specific pests.

## 3.2. Description of the production areas

The whole territory of Serbia is production area for apple planting material. The nurseries producing apple plants for export are concentrated in two main regions in Serbia – the Vojvodina region (including the Macva (Sabac)), located in northern Serbia, and the Rasina district located in central Serbia. The map (Figure 2A) is presenting the location of the 15 major exporters of apple planting material (Dossier Section 3.10–3.11).


**Figure 2:** (A) Map of Serbia marking the areas where nurseries designated for the export are situated (Dossier Section 3.10–3.11; Source: MAFWM). (B) Map of all the apple planting material production places (nurseries and mother plantations) in Serbia (Annex V, Response Letter)

Based on the global Köppen–Geiger climate zone classification (Kottek et al., 2006), the climate of the production areas of *M. domestica* in Serbia is Cfa i.e. main climate (C): warm temperate; precipitation (f): fully humid; temperature (a): hot summer.

## 3.3. Production and handling processes

### 3.3.1. Growing conditions

The growing media used for the production are soil (according to the ISPM 40, FAO 2017). Soil tests to determine phytosanitary risks are an obligatory prerequisite for establishment of production nurseries in Serbia.

### 3.3.2. Source of planting material

The source rootstocks and scions can be either:

- import from the EU (from the Netherlands, for T3 production model, see Section 3.3.3);
- nursery own mother plantation (Dossier Section 3.7).

### 3.3.3. Production cycle

Three different production models (i.e. T1, T2 and T3 as designanted in the Serbian dossier) are used in Serbia (Figure 3). All plant production is done in open fields; however, grafting for T2 and T3 occurs indoors.

The production cycle for the three prevailing technologies performed in Serbia over 1- and 2-year vegetation period of apple tree production is presented below (points 1–3, Dossier Section 3.7). The production of 2-year-old plants (T3) is the dominant production method in nurseries in Vojvodina and production models T2 and T3 are dominant in central Serbia (Rasina District).

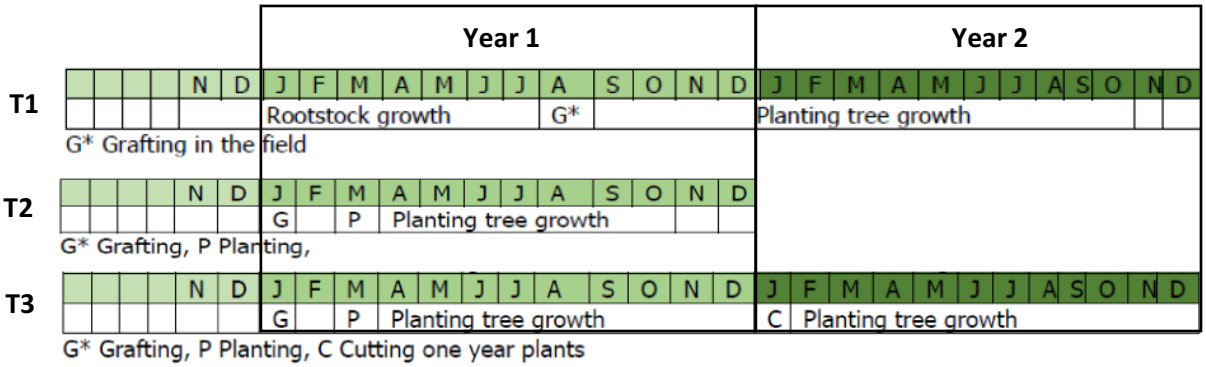


**Figure 3:** Apple planting material production process for the three different production models as explained in the submitted dossier (T1, T2, T3)

1) T1- Apple planting material production process (over a 2-year period, grafting in the field):
   - Previous year: plot selection, soil analysis, soil cultivation. November year 1: planting the rootstocks on site.
   - November to August year 1: irrigation, cultivation, fertigation, pest protection of the rootstocks.
   - August year 1: grafting on site (grafting in the field).
   - August year 1 until September year 2: Irrigation, cultivation, fertigation, pest protection of the plants; official inspection controls in June and August.
   - September year 2: defoliation treatment.
   - October to December year 2: removal of the plants from soil, packaging, delivery or storage in a cold storage.
2) T2 – Apple planting material production process (1-year period, grafting indoors):
   - Previous year: plot selection, soil analysis, soil cultivation. Rotation is done.
   - January and February year 1: grafting and storage in cold storage until planting.

- March to April year 1: irrigation system installation; planting the nursery trees; fertigation, pest control.
- May to July year 1: tying plants at fibreglass rods; stripping tape removal, fertigation; first official inspection control in June.
- August year 1: second official inspection control.
- September year 1: defoliation treatment.
- October to December year 1: taking out the plants from soil, packaging, delivery or storage in cold storage.

3) T3 – Apple planting material production process (over a 2-year period, grafting indoors):

- Previous year: plot selection, soil analysis, soil cultivation. Rotation is done.
- January to February year 1: import of scions and rootstocks from the Netherlands; grafting; storage in cold storage until planting.
- March and April year 1: irrigation system installation; planting the nursery trees; fertigation Pest control.
- May to July year 1: tying plants at fibreglass rods; stripping tape removal, fertigation; first official inspection control in June.
- August year 1: optional re-grafting according to cultivar request; second official inspection control.
- January year 2: cutting the 1-year-old plants.
- April to July year 2: tying plants at fibreglass rods, fertigation, pest and weed control; first official inspection control.
- August year 2: second official inspection control.
- September year 2: defoliation treatment.
- October to December year 2: taking out the plants from soil, packaging, delivery or storage in a cold storage.

### 3.3.4. Export procedure

The following information was provided by the PPD (Dossier Section 5).

In accordance with the Council Directive 2000/29 after at least two on-site inspections carried out in that year during the vegetative period in registered nurseries, prior the export, additional export inspection is carried out at the place of loading of propagating material of *M. domestica* intended for export to the EU.

The PPD provides technical information to the staff involved in official plant health controls and certification for export on plant health status of harmful organisms and new findings and risks, measures, notifications, specific phytosanitary requirements and additional declarations for import/ export, acting in specific cases in international trade pursuant to relevant International Standards for Phytosanitary Measures (ISPM), as well as communication with NPPOs of other countries.

Before uprooting the plants, two defoliation treatments are performed with copper chelate at a dose of 10 kg/ha and 1,000 L water/ha in total. The treatments are not sufficient to remove all the leaves, so manual defoliation is also required. The planting material is taken from the soil from October onwards. During uprooting, plants are mechanically shaken to remove soil from roots. Additionally, the remaining soil is removed by washing the plant individually with clean high-pressure water, without any added chemicals. Once the plants are uprooted and washed, they are immediately sorted and placed in bundles. Plant bundles are directly placed, washed, repacked and stored (2°C). Plants are classified based on the quality of adherence at the joint site, the development of the root system and the above-ground part and the age of the plants. The grafting site should be well matched. The plants need to be straight, smooth, unharmed with completely overgrown side branches. The thickness of the plants is not as significant as the development of root system.

Plants for export are sorted into two classes. The first class includes plants with well-developed root systems, normally developed and a well-developed graft connection site. This takes into account the standards set by the national Rulebook on standards of quality, packaging, sealing and marking of propagating material of agricultural plants (OG SFRY No 45/75 and 26/79) which determines that 1-year-old fruit trees for the market should have a root system with at least five base roots 20 cm long. The length of the aboveground part should be at least 1 m, the diameter of the plant directly above the root gate must not be smaller than 10 mm.

The labelling occurs after the quality check per each plant or by a package of 10 plants.

The planting material is stored under a controlled regime of temperature and humidity until the delivery for export. Before export, the producer is obliged to announce to PPD the shipment. Then, an official inspection is conducted including a documentation check and a visual inspection of the material for export. The export inspection is carried out at the place of loading of propagating material of *M. domestica* intended for export to EU. The Phyto certificate for export is issued after official inspection.

The certified and standard materials are the ones to be exported to EU. On each label at each plant – the category (grade) is specified as well as nursery register number, name of the producer and the headquarter place, number of certificate, name of the grafted cultivar and rootstock, botanical name, plant passport number and label serial number.

The plants are packed on EU heat treated wooden or metal pallets.

The 7+ class (plants have seven or more branches circularly spaced, minimum length of branches 25 cm): 600–800 plants per pallet. The number varies depending on the apple variety.

The 5+ class: 800–900 plants per pallet.

The 3+ or spurred (plants with three or more branches shorter than 25 cm): 1,100–1,200 plants can fit per pallet.

The 'unfeather' class (plants with two, one or no branches): 1,500 plants can fit per pallet.

The plants are packed exclusively in nets. Ten plants are packed as a bundle in a net, except for the 'unfeather' class, that allows a tighter bundling with 20 plants packed together. The bundles therefore consist of 10 (or up to 20) plants. After the pallet is packed, an additional paper label is added describing what is on the pallet (e.g. variety name, pallet number, plant class and total number of plants per pallet). Usually the paper labels are on both sides of the pallet. The number of plants per pallet depends on planting material quality class. The consignment consisted of 6,000–9,000 plants per truck.

The export of planting material to the EU occurs between October and March/April. The export volumes to the EU in 2018 and 2019 (between January and March) amounted to approximately 2,308.000 and 607.000 apple plants, respectively. The planned volumes in 2020 and in following years were based on market requirements although the operators were expecting a positive trend.

## 3.4. Surveillance system in Serbia

According to Dossier Section 5.3 and the additional information provided to EFSA, apple planting material is under permanent surveillance and monitoring. The process is under official control and there are official records of the production surveillance in all registered nurseries. The procedures and protocols for the commodity – Apple planting material are in line with EPPO Standards PM 4/27 (1) Certification scheme on pathogen-tested material of *Malus*, *Pyrus* and *Cydonia*, PM 3/76 (1) Trees of *Malus*, *Pyrus*, *Cydonia* and *Prunus* spp. – inspection of places of production and PM 3/72 (1) Elements common to inspection of places of production, area-wide surveillance, inspection of consignments and lot identification.

- Registration
  - Planting material production can be performed only by a legal person and entrepreneur registered in Register of propagating material producers.
  - This Register is maintained by the PPD (112 active registered apple producers, total number of all registered producers of planting material is 400).
  - Producers have to annually report the production of propagating material.
  - Producers keep all records of production and marketing of propagating material.
  - The PPD issues a decision by which the producer of planting material is registered in this Register and assigns a unique registration number.
- Application
  - The registered producer of the planting material in the approval process must submit a production application as well as an application for plant health inspections on the prescribed forms and within the prescribed deadlines.
  - The application shall be accompanied by appropriate documentation. Applications are submitted for each location where production is made, separately. There is a check on the origin of the used propagating material (species, variety and category).

- The producer is obliged to submit the detailed production plan.
- The application shall be accompanied by the proof of the origin of the planting material.
- The producer of planting material is obliged to provide the certificates of the health inspection of soil and substrates, as well as the certificates of health status of the rootstocks and scions (buds) for planting material within the prescribed deadlines.
- Health inspection of the soil and substrate for the presence of nematodes is carried out once a year, 30 days before the beginning of the production – the establishment of planting, and every fourth year in the mother plantation, before the vegetation starts.
- Applications are submitted on the prescribed forms in two copies.

○ Official control inspection (mandatory)

Control inspections are conducted on the basis of the application by the producer. It is conducted by categories and by plant species at least twice per vegetation type. Documentary check is performed to determine the origin of used propagating material, species, variety and category.
Plant health checks in objects/areas for production of propagating material are carried out during the growing season to determine the presence of pests and diseases. If the propagating material meets the prescribed requirements, Certificates are issued on the origin of the propagating material and on plant health condition
Health checks apply to:

- Apple planting material;
- Soil and substrate;
- Plants that are potential host of harmful organisms, as well as plants located in the immediate environment of plantings or facilities.

At least two visual inspections are mandatory, first when the plants' characteristics of species and cultivars are the most pronounced and therefore, symptoms of plant diseases and pests can be best seen; second, when plants express a uniform development and it is possible to estimate yield.
If forecasted environmental conditions (e.g. moisture, temperature) could favour the establishment of a pathogen, and outbreaks are suspected, plant health checks are performed more than twice per year.
Plant health checks of crops and facilities are performed in the presence of producers. On each control, a report is written, signed by the responsible person from the producer side and authorised persons.
Plant health checks of soil and substrates for the presence of nematodes is performed once a year, 30 days before starting the production – establishment of crops, 30 days before establishment of facilities and every fourth year in mother plantations, before the starting of vegetation.
Report on the results of completed testing on the presence of nematodes, as well as tests for viruses, is an integral part of the records.
If the control determines that the propagating material does not meet the conditions specified by law and its implementing regulations, plant material must be destroyed in the presence of phytosanitary inspectors.
If the control determines that the planting material meets all the requirements prescribed, authorised Agricultural Service issues Certificate on plant health condition, and Plant Protection Directorate, Certificate on propagating material production.

○ Plant passport and labelling

After obtaining the Certificate on production, the producer is filling application to phytosanitary inspection for printing labels for all categories of propagating material. Label has a unique serial number and it is labelling the propagating material in the market. Plant passport is part of label. Traceability is ensured to the place of production. Printing labels are carried out by the authorised organisation. Colour of label is prescribed for each category of plant material. Authorised organisation shall keep record of issued labels.
When marketing, propagating material must match the declared variety, the prescribed standards of quality, health, originally packaged and labelled (individually or in a group).

Categories of plant material are:

- Pre-basic: Pre-basic propagating material is reproductive material produced under the responsibility of the breeder or his/her agents, used for the production of basic plant material, and it has been tested according to the latest international standards for the presence of diseases and pests. It is held in strict conditions with no possibility for infection.
- Basic: The basic planting material is reproductive material derived from pre-basic propagating material used for production of certified planting material, produced in mother plantations under the control of an authorised organisation. It is marked with a white label.
- Certified: Certified planting material is propagating material created from the basic planting materials intended for the production of certified plants or production of standard plant material. It is marked with a blue label.
- Standard: Standard planting material is reproductive planting material originated by reproduction of certified material and is intended for the production of standard plants. It is marked with orange certificate.
- Standard marked with the label S-A in distribution. Standard planting material originated by reproduction of standard plants, or from mother plants approved in accordance with the Law on Seeds and Propagating Material (Official Gazette of RS No. 54/93), or for species that do not have a certification scheme, it is marked in distribution with certificate of orange colour and with special label S-A.

○ National surveys

Every year the PPD prepares and organises activities for conducting two programmes:

1) Program of Measures for Plant Health.
2) Program of monitoring, forecasting and reporting of pests, as part of support to producers and exporters related to improve the plant health status.

The Program of Measures for Plant Health aims at the prevention, early detection, monitoring, suppression and eradication of harmful organisms on plants. This Program defines the actual measures, time limits, manner of implementing those measures, the entities that will implement them, sources of funds and manner of provision and use of the funds, as well as the manner of controlling the implementation of the measures.
In accordance with this Program of Measures for Plant Health, every year there are surveys to determine the status regarding a number of pests i.e. *Alternaria mali, Apple proliferation phytoplasma, Erwinia amylovora, Globodera pallida, Globodera rostochiensis, Clavibacter michiganensins subsp. sepedonicus, Synchitrium endobioticum.*
For new emerged phytosanitary problems, PPD organises standing expert committees in order to solve the problem.

# 4. Identification of pests potentially associated with the commodity

In total the search for potential pests associated with *M. domestica* rendered 1191 species. From these 1,191 pests, there were 22 parasitic plant species, 2 gastropods, 537 fungi and oomycetes, 527 insects and mites, 21 bacteria, 32 nematodes and 50 viruses, viroids and phytoplasmas; 93 species were EU-regulated (i.e. 48 were Union quarantine pests or Protected Zones Union Quarantine Pests and 45 were RNQPs).

## 4.1. Selection of relevant EU-quarantine pests associated with the commodity

The EU listing of Union quarantine pests and protected zone quarantine pests (Commission Implementing Regulation EU/2019/2072[8]) is based on assessments concluding that the pest can enter, establish, spread and have potential impact in the EU.

[8] Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019. OJ L 319, 10.12.2019, p. 1–279.

For the 48 EU-quarantine species reported to use *M. domestica* as a host plant, the relevance for this opinion was based on evidence that:

a) the pest is present in Serbia;
b) *M. domestica* is a host of the pest;
c) one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all criteria were selected for further evaluation (Table 4).

Table 4 gives an overview of the evaluation of the 48 EU-quarantine pest species that are reported to use *M. domestica* as a host in regards of their relevance for this opinion. For more information, see also Appendix C (Microsoft Excel file).

Of the 93 EU-regulated species evaluated, 38 pests were present in Serbia, and of these, one species was relevant for further assessment.

**Table 4:** Overview of EU-quarantine pest species considered for this opinion

| Pest name according to the EU legislation[(a)] | EPPO code | Taxa[(b)] | Presence in Serbia | *Malus domestica* confirmed as a host (reference) | Pest can be associated with the commodity[(c)] | Pest relevant for the opinion | Additional remarks[(d)] |
|---|---|---|---|---|---|---|---|
| *Erwinia amylovora* | ERWIAM | BAC | Yes | Yes (CABI CPC Online) | Yes | **Yes** | *Note 1* |
| *Botryosphaeria kuwatsukai* | PHYOPI | FUN | No | Yes (EPPO Online) | Not applicable (N/A) | **No** | |
| *Cryphonectria parasitica* | ENDOPA | FUN | Yes | No (Shear et al., 1917, Baird, 1991) | N/A | **No** | *Note 2* |
| *Gymnosporangium clavipes* | GYMNCL | FUN | No | Yes (EPPO Online) | N/A | **No** | |
| *Gymnosporangium globosum* | GYMNGL | FUN | No | Yes (EPPO Online) | N/A | **No** | |
| *Gymnosporangium yamadae* | GYMNYA | FUN | No | Yes (EPPO Online) | N/A | **No** | |
| *Phyllosticta solitaria* | PHYSSL | FUN | No | Yes (EPPO Online) | N/A | **No** | |
| *Phymatotrichopsis omnivora* | PHMPOM | FUN | No | Yes (EPPO Online) | N/A | **No** | |
| *Anastrepha fraterculus* | ANSTFR | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Anastrepha ludens* | ANSTLU | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Anastrepha suspensa* | ANSTSU | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Anoplophora chinensis* | ANOLCN | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Anoplophora glabripennis* | ANOLGL | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Anthonomus quadrigibbus* | TACYQU | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Bactrocera dorsalis* | DACUDO | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Bactrocera tryoni* | DACUTR | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Bactrocera zonata* | DACUZO | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Carposina sasakii* | CARSSA | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Ceratitis rosa* | CERTRO | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Choristoneura rosaceana* | CHONRO | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Conotrachelus nenuphar* | CONHNE | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Cydia inopinata* | CYDIIN | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Cydia packardi* | LASPPA | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Cydia prunivora* | LASPPR | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Gonipterus scutellatus* | GONPSC | INS | No | No (EPPO Online) | N/A | **No** | |
| *Grapholita inopinata* | CYDIIN | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Grapholita packardi* | LASPPA | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Grapholita prunivora* | LASPPR | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Lopholeucaspis japonica* | LOPLJA | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Margarodes vitis* | MARGVI | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Oemona hirta* | OEMOHI | INS | No | Yes (EPPO Online) | N/A | **No** | |

| Pest name according to the EU legislation[a] | EPPO code | Taxa[b] | Presence in Serbia | *Malus domestica* confirmed as a host (reference) | Pest can be associated with the commodity[c] | Pest relevant for the opinion | Additional remarks[d] |
|---|---|---|---|---|---|---|---|
| *Popillia japonica* | POPIJA | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Rhagoletis pomonella* | RHAGPO | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Saperda candida* | SAPECN | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Spodoptera eridania* | PRODER | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Spodoptera frugiperda* | LAPHFR | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Spodoptera littoralis* | SPODLI | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Spodoptera litura* | PRODLI | INS | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Tachypterellus quadrigibbus* | TACYQU | INS | No | Yes (EPPO Online) | N/A | **No** | |
| *Zeugodacus cucurbitae* | DACUCU | INS | No | Yes (WoS) | N/A | **No** | |
| *Globodera pallida* | HETDPA | NEM | Yes | No (EPPO Online) | N/A | **No** | *Note 3* |
| *Globodera rostochiensis* | HETDRO | NEM | Yes | No (EPPO Online) | N/A | **No** | *Note 3* |
| *Xiphinema americanum sensu stricto* | XIPHAA | NEM | No | Yes (CABI CPC Online) | N/A | **No** | |
| *Xiphinema rivesi (non European populations)* | XIPHRI | NEM | No | No (EPPO Online) | N/A | **No** | |
| *Tobacco ringspot virus* | TRSV00 | VIR | No | Yes (EPPO Online) | N/A | **No** | *Note 4* |
| *Tomato ringspot virus* | TORSV0 | VIR | No | Yes (EPPO Online) | N/A | **No** | *Note 4* |
| *American plum line pattern virus* | APLPV0 | VIR | No | Yes (EPPO Online) | N/A | **No** | |
| *Cherry rasp leaf virus* | CRLV00 | VIR | No | Yes (EPPO Online) | N/A | **No** | |

(a): Commission Implementing Regulation (EU) 2019/2072.
(b): BAC: Bacteria; FUN: Fungi and oomycetes; INS: Insects and mites; NEM: Nematodes; VIR: Viruses, viroids and phytoplasmas.
(c): Association with the commodity is evaluated only if the pest is present in Serbia and uses *Malus domestica* as a host.
(d): Additional remarks.

| Additional Remarks | |
|---|---|
| **Note 1** | *Erwinia amylovora is included in Annex III: List of protected zones and the respective protected zone quarantine pests and their respective codes but also, in Annex IV: List of Union regulated non-quarantine pests ('RNQPs') and specific plants for planting, with categories and thresholds as referred to in Article 5, Part J: RNQPs concerning fruit propagating material and fruit plants intended for fruit production* |
| **Note 2** | *After review of the literature available (see Shear* et al.*, 1917 and Baird, 1991), it was concluded that* Malus domestica *is not naturally infected by this fungus, so M. domestica is not a host* |
| **Note 3** | *Not considered relevant for the opinion because: 1)* Malus domestica *is not a host and 2) Serbia conducts special phytosanitary inspections to prevent agricultural production in areas potentially infested with cysts nematodes* |
| **Note 4** | *Additional information provided by the Serbian NPPO, after EFSA's request for clarification, indicates that both viruses are absent in the Serbian territory* |

## 4.2. Selection of other relevant pests (not regulated in the EU) associated with the commodity

The information provided by the PPD of Serbia was evaluated to assess whether there are other relevant pests of *M. domestica* present in the country of export. For these potential pests that are not regulated in the EU, pest risk assessment information on the probability of entry, establishment, spread and impact is usually lacking. Therefore, these non-regulated pests that are potentially associated with *M. domestica* in Serbia were also evaluated to determine whether they were absent from the EU and whether there was evidence for potential impact in the EU.

Thus, the relevance of other pests (not regulated in the EU) for this opinion was based on evidence that:

i) the pest is present in Serbia;
ii) the pest is absent or has limited distribution in the EU;
iii) the pest uses *Malus domestica* as a host;
iv) one or more life stages of the pest can be associated with the specified commodity;
v) the pest may have an impact and can pose a potential risk for the EU territory.

Pests that fulfilled all criteria were selected for further evaluation.

Species were excluded from further evaluation when at least one of the conditions listed above (i–v) was not met. Details can be found in the Appendix C (Microsoft Excel file). Of the 1,099 non-EU-regulated species evaluated, 242 species are absent or have limited distribution in the EU. None of the non-regulated pests were selected for further evaluation because they did not meet all the selection criteria.

## 4.3. Overview of interceptions

Based on the information provided by the applicant, the number of plants of *M. domestica* exported to the EU from Serbia in 2018 and 2019 (between January and March) was approximately 2,308.000 and 607,000, respectively.

Data on the interception of harmful organisms on plants of *M. domestica* can provide information on some of the organisms that can be present on the exported plants despite the current measures taken. Based on the information available in the EUROPHYT database, no interceptions of pests have been detected on plants of *M. domestica* imported in the EU from Serbia between 1995 and 2019.

## 4.4. List of potential pests not further assessed

From the list of pests not selected for further evaluation, the Panel raised questions on two species i.e. *Tomato Ringspot Virus* (TORSV0) and *Tobacco Ringspot Virus* (TRSV00) (listed in Table D.1 in Appendix D), after the revision of additional information provided by the Serbian NPPO, the currently available evidence confirms the absence of these two species in the Serbian territory and hence, provides no reason to select these species for further evaluation in this opinion. The status of these two viruses on the EPPO region is uncertain.

## 4.5. Summary of pests selected for further evaluation

One pathogen identified to be present in Serbia and considered to be reasonably likely to be associated with *M. domestica* is listed in Table 5. For this selected pathogen, the currently applied risk mitigation measures applied for the commodity were evaluated.

**Table 5:** Pest selected for further evaluation

| Number | Current scientific name | Name used in the EU legislation | Taxonomic information | Group* | Regulatory status |
|---|---|---|---|---|---|
| 1 | *Erwinia amylovora* | *Erwinia amylovora (Burrill) Winslow* et al. | Enterobacteriales, Enterobacteriaceae | BAC | Regulated in the EU (Annex III, Annex IV-Part J, Annex V-Part C, Annex X-9) |

*BAC: bacteria.

# 5. Risk mitigation measures

For *Erwinia amylovora*, the Panel assessed the possibility that it could be present in a *M. domestica* export nursery and assessed the probability that pest freedom of a consignment is achieved by the proposed risk mitigation measures (i.e. RROs) acting on the pest under consideration.

All the information used in the evaluation of the pest presence and risk mitigation measures for the pest is summarised in a pest datasheet (see Appendix A).

## 5.1. Possibility of pest presence in the export nurseries

For *E. amylovora*, the Panel evaluated the possibility that the pathogen could be present in a *M. domestica* nursery by evaluating the possibility that *M. domestica* in the export nursery are infected either by:

- Introduction of the pathogen (e.g. insects, propagules) from the environment surrounding the nursery.
- Introduction of the pathogen with new plants/seeds.
- Spread of the pathogen within the nursery.

## 5.2. Risk mitigation measures applied in Serbia

The Dossier Section 5.1 contains information on the phytosanitary mitigation measures related to the plant of interest (*M. domestica*) where it has been reported:

- Certification scheme established in 2005 by the Regulation (Law on propagating material of fruits, vine and hops) and harmonised with EPPO.
- Spatial isolation is part of the regulation for the certified apple planting material and it is regulated as defined by the Rulebook on health checks of crops and facilities for the production of seeds, planting material and health status of seed and planting material ((‘Official Gazette SRY’, No 66/99 i 13/2002, ‘Official Gazette SCG’, No 10/2003 i 13/2003 i ‘Official Gazette RS’, No 39/2006, 59/2006, 115/2006, 119/2007 i 107/2008).
- For the commodity export in EU, soil control is an obligatory step in the process of establishment of nurseries for production and each year and soil analyses are mandatory in the process of application for the production each year.
- The nurseries are performing chemical (pesticide) treatments.
- Plant passport system and labelling.
- Inspection prior to export.

With the information provided by the PPD of Serbia (Dossier Section 3 and 5), the Panel summarised the risk mitigation measures (Table 6) that are currently applied in the production nurseries. It was noted that the applicant country implements measures for *E. amylovora* that are consistent with the requirements for plants of *Malus* that are detailed in Annex X of 2019/2072 (Item 9).

**Table 6:** Overview of the currently applied risk mitigation measures for *M. domestica* plants designated for export to the EU from Serbia described as reported in the PPD declaration and classified according to the type of Risk Reduction Options (RROs) listed in EFSA PLH Panel (2018)

| Number of the RRO | Risk reduction options | Current measures in Serbia |
|---|---|---|
| RRO1 | Surveillance and monitoring | Apple planting material is under permanent surveillance and monitoring. The process is under official controls and there are official records of the production surveillance in all registered nurseries. The procedures and protocols for the commodity are in line with EPPO Standards PM 4/27 (1) Certification scheme on pathogen-tested material of Malus, Pyrus and Cydonia, PM 3/76 (1) Trees of Malus, Pyrus, Cydonia and Prunus spp. – inspection of places of production and PM 3/72 (1) Elements common to inspection of places of production, area-wide surveillance, inspection of consignments and lot identification |

| Number of the RRO | Risk reduction options | Current measures in Serbia |
|---|---|---|
| RRO2 | Copper treatment | Copper is used as defoliation agent; two treatments are performed with copper chelate |
| RRO3 | Root treatment | Uprooting, removal of soil and root washing. |
| RRO4 | Storage treatment | Cold storage at 2°C |
| RRO5 | Pesticide treatment | Several pesticides are used against targeted pest species (i.e.: apple scab, green aphid, powdery mildew, apple leaf-curling midge and European red spider mite). Details on pesticide treatment can be found on Table 9 of the Dossier (pp. 67–69) |

## 5.3. Evaluation of the current measures for the selected relevant pests including uncertainties

For the pathogen, *E. amylovora*, the effective risk mitigation measures were identified. Any limiting factors on the effectiveness of the measures were documented. All the relevant information including the related uncertainties deriving from the limiting factors used in the evaluation are summarised in a pest datasheet provided in Appendix A.

Based on this information, an expert judgement has been given for the likelihood of pathogen freedom taking into consideration the risk mitigation measures acting on the pest and their combination (Table 7).

An overview of the evaluation of the pest is given in the section below (Section 5.3.1).

### 5.3.1. Summary of *Erwinia amylovora* pest datasheet

| **Rating of the likelihood of pest freedom** | **Pest free with some exceptional cases (99.5–99.9%) (between 9,950 and 9,990 of 10,000 pallets) (EFSA PLH Panel, 2019)** | | | | |
|---|---|---|---|---|---|
| **Percentile of the distribution** | 5% | 25% | 50% | 75% | 95% |
| **Number of pest-free pallets out of 10,000** | **9,997** | **9,993** | **9,986** | **9,975** | **9,934** |
| **Summary of the information used for the evaluation** | **Possibility that the pest/pathogen could enter exporting nurseries**<br>*E. amylovora* is officially present in Serbia since 1989. There are reports of severe epiphytotic outbreaks by the bacterium in 2000. In 2016, E. amylovora was also reported but, mainly on pears.<br>Natural spread is likely through wind, water, rain, insects (especially pollinators) and birds. Human activities (i.e. pruning, machineries, equipment, etc.) facilitate the spread of the pest. Also, it can survive for several weeks in pollen, nectar, honey. There is a possibility to enter through infected planting material (from the EU or from local Serbian mother plantations)<br>**Measures taken against the pest/pathogen and their efficacy**<br>Surveillance and monitoring are conducted in production areas and in demarcated belts. When *E. amylovora* is detected, trade is suspended. If symptoms of *E. amylovora* are detected in mother plants, infected plants are removed immediately. Copper is applied during defoliation (copper chelate) which can have a toxic effect on *E. amylovora*. During storage and delivery, plants are kept at 2°C which can affect the multiplication of E. amylovora<br>**Interception records**<br>There are no records of interceptions of plant material from Serbia | | | | |

| | |
|---|---|
| **Rating of the likelihood of pest freedom** | **Pest free with some exceptional cases (99.5–99.9%) (between 9,950 and 9,990 of 10,000 pallets) (EFSA PLH Panel, 2019)** |
| | **Shortcomings of current measures/procedures**<br>The effectiveness of inspections is uncertain, particularly when applying visual inspections and in the case of latent infections. Given that data on the phenology of apple plants in production areas are not provided, it is unclear whether the periods of inspection might be optimised to match the flowering period of the plant and therefore, inspections might fail to detect the symptoms. Copper chelate might not affect directly *E. amylovora*. Cold storage might prevent the multiplication of the bacteria, but it does not kill it<br><br>***Main uncertainties***<br>Several sizes of surveillance belts around nurseries production areas are stated and thus not clearly defined. It is uncertain to what extent the visual inspection is effective. References to the diagnostic protocol PM 7/20 and the sampling protocol (in Annex II, Response Letter) miss specific details. There is still a possibility of pest entrance through infected material (imported from NL, or from Serbian mother plantations). There are uncertainties on to what extent common management practices in the cultivation of apple could favour the spread of the disease. It is not certain to what extent common management practices in the cultivation of apple could favour the spread of the disease. Also, the effect of chemical treatments on insects and the management of pollinators affecting the dispersal of *E. amylovora* is unknown |

**Table 7:** Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against *Erwinia amylovora* on *M. domestica* designated for export to the EU. In panel A, the median value for the assessed level of pest freedom for each pest is indicated by 'M', the 5% percentile is indicated by L and the 95% percentile is indicated by U. The percentiles together span the 90% uncertainty range regarding pest freedom. The pest freedom categories are defined in panel B of the table

| Number | Group* | Pest species | Pest Freedom (PF) category | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sometimes pest free | More often than not pest free | Frequently pest free | Very frequently pest free | Extreme frequently pest free | Pest free with some expectational cases | Pest free with few expectational cases | Almost always pest free |
| 1 | BAC | *Erwinia amylovora* | | | | | L | M | | U |

*: BAC: bacteria.

Panel A

| | Pest freedom category | Pest fee pallets out of 10000 |
|---|---|---|
| | Sometimes pest free | ≤ 5000 |
| | More often than not pest free | 5000 - ≤ 9000 |
| | Frequently pest free | 9000 - ≤ 9500 |
| | Very frequently pest free | 9500 - ≤ 9900 |
| | Extremely frequently pest free | 9900 - ≤ 9950 |
| | Pest free with some exceptional cases | 9950 - ≤ 9990 |
| | Pest free with few exceptional cases | 9990 - ≤ 9995 |
| | Almost always pest free | 9995 - ≤ 10000 |

| Legend of pest freedom categories | |
|---|---|
| **L** | Pest freedom category includes the elicited lower bound of the 90% uncertainty range |
| **M** | Pest freedom category includes the elicited median |
| **U** | Pest freedom category includes the elicited upper bound of the 90% uncertainty range |

**Figure 4.**

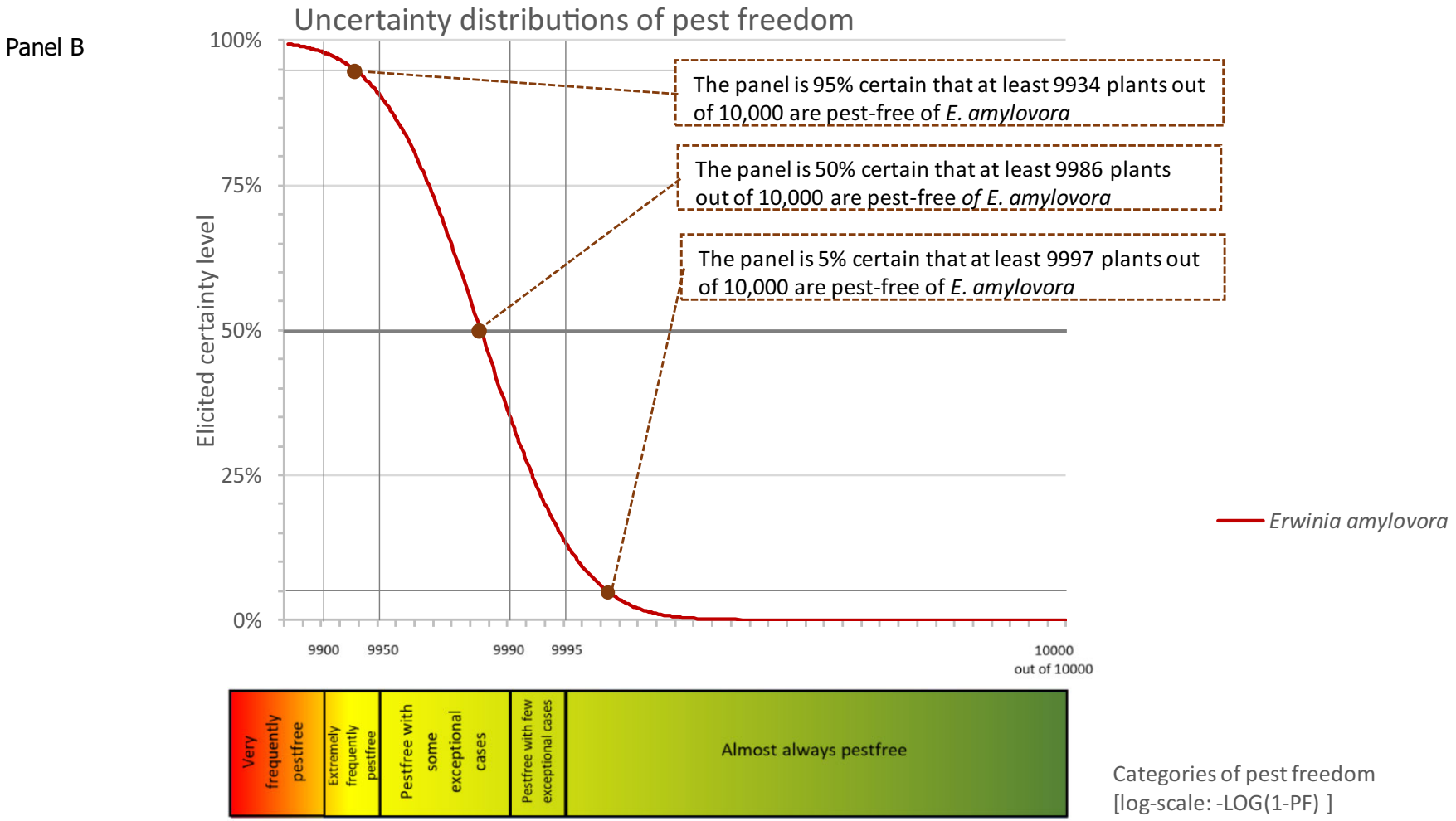


**Figure 4:** Comparison of the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures of *M. domestica* designated for export to the EU for all evaluated pests visualised as descending distribution function

## 6. Conclusions

There is one pest, *E. amylovora,* identified to be present in Serbia and considered to be potentially associated with *M. domestica* plants and relevant for the EU. For this pathogen, the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures applied on *M. domestica* destined for export to the EU was estimated. Considering a pallet as a unit and taking into account the uncertainties associated with the assessment, the Panel is 95% sure that 9,934 or more pallets out of 10,000 will be pest free.

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## Glossary

| | |
|---|---|
| Containment (of a pest) | Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017) |
| Control (of a pest) | Suppression, containment or eradication of a pest population (FAO, 1995, 2017) |
| Entry (of a pest) | Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017) |
| Eradication (of a pest) | Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017) |
| Establishment (of a pest) | Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017) |
| Impact (of a pest) | The impact of the pest on the crop output and quality and on the environment in the occupied spatial units |
| Introduction (of a pest) | The entry of a pest resulting in its establishment (FAO, 2017) |
| Measures | Control (of a pest) is defined in ISPM 5 (FAO 2017) as 'Suppression, containment or eradication of a pest population' (FAO, 1995). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance |
| Pathway | Any means that allows the entry or spread of a pest (FAO, 2017) |

| | |
|---|---|
| Phytosanitary measures | Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017) |
| Protected zone | A protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union |
| Quarantine pest | A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017) |
| Regulated non-quarantine pest | A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017) |
| Risk mitigation measure = Risk reduction option (RRO) | A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. An RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager |
| Spread (of a pest) | Expansion of the geographical distribution of a pest within an area (FAO, 2017) |

## Abbreviations

| | |
|---|---|
| CABI | Centre for Agriculture and Bioscience International |
| EKE | Expert knowledge elicitation |
| EPPO | European and Mediterranean Plant Protection Organization |
| FAO | Food and Agriculture Organization |
| FUN | Fungi |
| INS | Insect |
| ISPM | International Standards for Phytosanitary Measures |
| NEM | Nematode |
| PLH | Plant Health |
| PPD | Plant Protection Directorate |
| PRA | Pest Risk Assessment |
| RNQP | regulated non-quarantine pest |
| RRO | Risk Reduction Option = Risk Mitigation Measures |

# Appendix A – Datasheets of pests selected for further evaluation

***Erwinia amylovora (fireblight)***

## A.1. Organism information

| | |
|---|---|
| **Taxonomic information** | Current valid scientific name: *Erwinia amylovora (Burrill 1882) Winslow* et al. *(1920)*<br>Synonyms: *Bacillus amylovorus* (Burrill) Trevisan, 1889, *Bacterium amylovorum* Chester, 1901, *Erwinia amylovora* f.sp. rubi Starr et al. (1951), *Micrococcus amylovorus* Burrill, 1882<br>Name used in the EU legislation: *Erwinia amylovora (Burrill) Winslow* et al.<br>Name used in the Dossier: *Erwinia amylovora*<br>Order: Enterobacteriales<br>Family: Enterobacteriaceae |
| **Group** | Bacteria |
| **EPPO code** | ERWIAM |
| **Regulated status** | **EU status:**<br>Annex III Protected zones quarantine pests Commission Implementing Regulation 2019/2072<br>(a) **Estonia**;<br>(b) **Spain** (except the autonomous communities of Andalucía, Aragón, Castilla la Mancha, Castilla y León, Extremadura, the autonomous community of Madrid, Murcia, Navarra and La Rioja, the province of Guipuzcoa (Basque Country), the comarcas of Garrigues, Noguera, Pla d'Urgell, Segrià and Urgell in the province of Lleida (Comunidad autonoma de Catalunya); and the municipalities of Alborache and Turís in the province of Valencia and the Comarcas de L'Alt Vinalopó and El Vinalopó Mitjà in the province of Alicante (Comunidad Valenciana));<br>(c) **France** (Corsica);<br>(d) **Italy** (Abruzzo, Basilicata, Calabria, Campania, Lazio, Liguria, Marche, Molise, Piedmont (except the communes of Busca, Centallo, Scarnafigi, Tarantasca and Villafalleto in the province of Cuneo), Sardinia, Sicily (except the municipalities of Cesarò (Messina Province), Maniace, Bronte, Adrano (Catania Province) and Centuripe, Regalbuto and Troina (Enna Province)), Tuscany, Umbria, Valle d'Aosta);<br>(e) **Latvia**;<br>(f) **Finland**;<br>(g) **United Kingdom** (Isle of Man; Channel Islands);<br>(h) until 30 April 2020: **Ireland** (except Galway city);<br>(i) until 30 April 2020: **Italy** (Apúlia, Lombardy (except the provinces of Milan, Mantua, Sondrio and Varese, and the communes of Bovisio Masciago, Cesano Maderno, Desio, Limbiate, Nova Milanese and Varedo in Monza Brianza Province), Veneto (except the provinces of Rovigo and Venice, the communes Barbona, Boara Pisani, Castelbaldo, Masi, Piacenza d'Adige, S. Urbano and Vescovana in the province of Padova and the area situated to the South of the motorway A4 in the province of Verona));<br>(j) until 30 April 2020: **Lithuania** (except the municipalities of Babtai and Kėdainiai (region of Kaunas));<br>(k) until 30 April 2020: **Slovenia** (except the regions of Gorenjska, Koroška, Maribor and Notranjska, and the communes of Lendava and Renče-Vogrsko (south of the motorway H4) and Velika Polana, and the settlements Fužina, Gabrovčec, Glogovica, Gorenja vas, Gradiček, Grintovec, Ivančna Gorica, Krka, Krška vas, Male Lese, Malo Črnelo, Malo Globoko, Marinča vas, Mleščevo, Mrzlo Polje, Muljava, Podbukovje, Potok pri Muljavi, Šentvid pri Stični, Škrjanče, Trebnja Gorica, Velike Lese, Veliko Črnelo, Veliko Globoko, Vir pri Stični, Vrhpolje pri Šentvidu, Zagradec and Znojile pri Krki in the commune Ivančna Gorica);<br>(l) until 30 April 2020: **Slovakia** (except the county of Dunajská Streda, Hronovce and Hronské Kľačany (Levice County), Dvory nad Žitavou (Nové Zámky County), Málinec (Poltár County), Hrhov (Rožňava County), Veľké Ripňany (Topoľčany County), Kazimír, Luhyňa, Malý Horeš, Svätuše and Zatín (Trebišov County)) |

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| | **Annex IV, Part J: RNQPs**, plants for planting (Malus Mill.) RNQPs concerning propagating material of ornamental plants and other plants for planting intended for ornamental purposes, whereby a threshold of 0% for the fruit propagating material and fruit plants is established<br><br>**Annex V, Part C**, Measures to prevent the presence of *E. amylovora* on plants for planting where the following requirements specify that:<br><br>(a) the plants have been produced in areas known to be free from *E. amylovora* (Burrill) Winslow et al.; or (b) the plants have been grown in a production site that has been visually inspected at an appropriate time to detect the pest during the last growing season for the detection of that pest and plants showing symptoms of that pest, and any surrounding host plants, have been immediately rogued out and destroyed<br><br>**Non-EU:**<br><br>A1 list: Azerbaijan (2007), Georgia (2018), Moldova (2006)<br><br>A2 list: Russia (2014), Turkey (2016), Ukraine (2010)<br><br>Quarantine pest: Belarus (1994), Norway (2012) (EPPO) |
| **Pest status in Serbia** | Present: restricted distribution (CABI/EPPO, 2013; EPPO, 2014)<br>Present: subject of official control in specific area of production of plant propagation material (Dossier) |
| **Pest status in the EU** | Present, widespread: Bulgaria, Cyprus, Greece, Netherlands, Romania, England and Wales<br><br>Present, restricted distribution: Belgium, Croatia, Czech Republic, Denmark, France, Germany, Greece (Crete), Hungary, Italy, Lithuania, Luxembourg, Norway, Poland, Portugal, Slovenia, Spain, Sweden, UK, Northern Ireland, Scotland<br><br>Present, no details: Finland<br><br>Present, few occurrences: Austria, Ireland, Italy (Sicily), Latvia, Slovakia<br><br>Transient: under eradication: Estonia (CABI, EPPO) |
| **Host status on *Malus domestica*** | *M. domestica* is reported as a major host plant for *E. amylovora* in the EPPO Global Database (EPPO, online) and CABI Crop Protection Compendium (CABI CPC Online) |
| **PRA information** | Based on the EFSA Scientific Opinion on pest categorisation of *E. amylovora* published in 2014, the introduction of infected nursery material in pathogen-free areas may lead to outbreaks and losses in horticulture. Apple production areas provide suitable ecological and climatic conditions for fireblight, thus it is highly likely that the pathogen can spread and establish into new areas where pome fruits are cultivated. There is high potential for the disease to cause severe impact on commercial horticulture (especially on apple, pear, quince) and on nursery trade<br><br>According to the Norwegian Scientific Committee for Food Safety (VMK, 2007), taking into consideration that the phytosanitary regulations and practices for fireblight remain the same, the probability of introduction into commercial fruit production areas and nurseries is low<br><br>Since no relaxation of the phytosanitary regulations and practices will occur, import of apple trees and apple tree propagation material from countries where the fireblight is already present will not increase the risk of fireblight introduction |

| **Other relevant information for the assessment** | | |
|---|---|---|
| **Symptoms** | **Main type of symptoms** | The basic symptom of fireblight is the necrosis or death of tissues. An important symptom is droplets of ooze on infected tissues (CABI CPC Online)<br><br>Flowers (the most susceptible organ to *E. amylovora*)<br>– Water-soaked, darker green<br>– Spurs start collapsing and turning brown to black (within 5–30 days) *(Scientific Opinion, EFSA, 2014)* |

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| | | Shoots<br>– Turn brown to black from the tip, 'shepherd-crook' shape<br>Leaves & Fruits<br>– Discoloration and consequently collapse<br>– Necrotic areas and wilting<br>– Exudation of milky, sticky liquid or ooze containing bacteria (during wet, humid weather)<br>– Mummification (on fruits)<br>Twigs, larger branches, trunk<br>– Darker colour than usual<br>– Inner tissues water-soaked, in some cases with reddish streaks and later tissues turn dark brown to black<br>– Canker (usually appear in summer or autumn)<br>Trees with rootstock<br>– Liquid bleeding from the crown or below the graft union<br>– Yellow to red foliage, a month before normal autumn coloration<br>– Dieback after the first year of infection (CABI CPC Online) |
| | **Presence of asymptomatic plants** | *Erwinia amylovora* can be present in asymptomatic plants and its detection has been proved to be difficult, due to low bacterial population levels For the analysis of the asymptomatic samples, enrichment-isolation, enrichment-DASI-ELISA and PCR can be used (*OEPP/EPPO, 2013)* |
| | **Confusion with other pathogens/pests** | Symptoms of fireblight can be confused with: *Pseudomonas syringae pv. Syringae* (blister spot of apple), *E. pyrifoliae*, *E. piriflorinigrans, E. uzenensis, Nectria cinnabarina* (fungi) causing Nectria twig blight*, Nectria galligena* (fungi) causing European canker, *Phomopsis tanakae* (fungi) causing European pear dieback, *Phomopsis mali* or *Sphaeropsis malorum* causing fungal cankers, *Polycaon confertus,* twig borer beetle, causing *Polycaon confertus* (Roberts R. G. et al., 2008), *Jasnus compresus* and *Zeuzera pyrina* (insects) *(Scientific Opinion, EFSA, 2014)* |
| **Host plant range** | *E. amylovora* occurs in members of the Rosaceae family (CABI CPC Online). According to the list published in the CABI website, main hosts are: *Cotoneaster, Crataegus* (hawthorns), *Cydonia oblonga* (quince), *Eriobotrya, Eriobotrya japonica* (loquat), *Malus* (ornamental species apple), *Malus domestica* (apple), *Prunus salicina* (Japanese plum), *Pyracantha* (Firethorn), *Pyrus* (pears), *Pyrus communis* (European pear)<br>Other hosts are: *Amelanchier* (serviceberries), *Amelanchier alnifolia* (saskatoon serviceberry), *Amelanchier canadensis* (thicket serviceberry), *Cotoneaster horizontalis* (wall-spray), *Chaenomeles sinensis*, *Fragaria* (strawberry), *Malus floribunda*, *Mespilus* (medlar), *Photinia davidiana* (chinese stranvaesia), *Prunus armeniaca* (apricot), *Prunus cerasifera* (myrobalan plum), *Pyrus communis var. pyraster* (poirier sauvage), *Pyrus pyrifolia* (Oriental pear tree), *Rosa canina* (Dog rose), *Rosa rugosa* (rugosa rose), *Rubus* (blackberry, raspberry), *Rubus fruticosus* (blackberry), *Sorbus* (rowan), *Spiraea prunifolia* | |
| **Pathways** | – Plants, plants for planting<br>– Plant trade: bark, flowers/Inflorescences/cones/calyx, fruits (inc. pods), leaves, seedlings/micropropagated plants, stems (above ground)/shoots/trunks/branches, wood (CABI CPC)<br>– Human factor (clothing, footwear, machineries, equipment)<br>– Containers and packaging, non-wood (on some plastics) and wood<br>– Honeybees and the movement of beehives<br>– Insects<br>– Birds (Keil et al., 1972)<br>– Water, rain and wind (CABI CPC) | |

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| **Surveillance information** | *E. amylovora* is present in Serbia. Apple planting material is under permanent surveillance and monitoring (Section 5.3 of the Technical Dossier). The pathogen is regulated according to Serbian regulation (Guidelines on Plant Health checks of crops and facilities for the production of seeds, planting material and health status of seed and planting material i.e. 'Official Gazette SRY', No. 66/99 i 13/2002, 'Official Gazette SCG', No. 10/2003 i 13/2003 i 'Official Gazette RS', No. 39/2006, 59/2006, 115/2006, 119/2007 i 107/2008). The inspection procedures conducted in Serbia are provided in the dossier and in the supplementary material provided by Serbia (see Table 8, page 63, Dossier and Question C, page 5-6, Response). There are officially controlled zones where nurseries and mother plantations are surveilled and controls are performed in accordance to the Serbian regulation, following the EPPO Standard PM 3/72 (2) (Dossier, page 38) and aligned with the current EU Plant Health Law (Annex V, part C). For *E. amylovora*, surveys aim to detect by visual inspection an infection level of 0.1% or more with a confidence level of at least 99%. All plants in production are inspected. The whole place of production and susceptible plants in their immediate vicinity are also inspected. All host plants are examined and if the symptoms are recorded, orders the removal of plants (if they are individual) are issued (Dossier, page 54). Visual inspection of trees around production areas occur within a radius of 1000 m around nurseries producing mother plants; however, this distance can be reduced to 250 m when parcels around mother nurseries are cultivated with other Pomoidae fruit crops. The areas around production nurseries are inspected in a radius of 500 m. In the Vojvodina region (northern Serbia), where five exporting nurseries and mother plantations are located, the surveilled belt is defined by a 5 km radius given the homogeneity of the landscape composed mainly by field crops which do not host *E. amylovora.* An overlap of inspection belts between mother plantations and production nurseries may occur (see Annex V Rasina District)<br><br>In apple production areas, two inspections are done, in May–June and August–September. Plant health checks of apple production facilities can be performed more than two times per year if environmental conditions for production of propagating material would favour harmful organisms (Dossier, page 54–55).<br><br>Inspections occur by means of regulated protocols where inspectors:<br><br>– identify production parcels (cadastral municipality, parcel number, the area and GPS coordinates);<br>– conduct visual inspections around belts for surveillance of all host plants for *E. amylovora* (Burr.) Winsl and *Candidatus Phytoplasma mali*. Large trees are inspected individually for symptoms in the canopy or in internal crown branches where the foliage may be denser or growing under more humid conditions. In all cases, symptoms are confirmed by laboratory testing (Response Letter from Serbia, Question C1 and C2, page 5–6).<br><br>Additionally, for *E. amylovora* by means of the *Program of monitoring, forecasting and reporting of pests, the Plant Protection Directorate (PPD)* establishes the gathering of biological, meteorological and other type of data to forecast the occurrence and spread of harmful organisms (Dossier, page 56–57). |

## A.2. Possibility of pest presence in the nursery

### A.2.1. Possibility of entry from the surrounding environment

Natural spread is very likely through wind, water, rain, insects (especially pollinating insects), birds, aerosols and aerial strands (Keil et al., 1972). Infection takes place through flowers and later in the season, through small wounds (by winds, hail, insects) in young leaves and at the tips of growing shoots (CABI CPC, Online). *Erwinia amylovora* also can survive on other healthy plant surfaces, such as leaves and branches, for limited periods (weeks), but colony establishment and epiphytic growth on these surfaces does not occur. Cells of *E. amylovora* excrete large amounts of an extracellular polysaccharide (a major component of bacterial ooze), which creates a matrix that protects the pathogen on plant surfaces (Johnson, 2000). Once established, the transport of inoculum is possible through rain and wind. *E. amylovora* can survive for several weeks in pollen, nectar, honey and fruit flies (EFSA Scientific Opinion, 2014).

Additionally, human factors pose a high risk in *E. amylovora* dispersion through machines, equipment, pruning, spraying tools, shoes, clothes, etc. (VKM, 2007).

In Serbia, *E. amylovora* was first detected in 1989 near Šabac (where Fleunerra nursery is located) and continued spreading in the West, Southern and Central part of Serbia until the end of 1992. Until the end of 1996, *E. amylovora* was found in Vojvodina region (where five exporting nurseries are

located), mainly on apple trees. In 1997, an infected individual of *Pyracantha coccinea* (firethorn) was found to be hosting the bacteria in Serbia; in 2000, it was found on apple and quince seedlings in the Southern part of Serbia. The same year, there was a severe epiphytotic outbreak during the first half of May where fire blight was registered in Vojvodina's Southern Bačka region on apple plantations (Jedinstvo and Irmovo) on an area of 400 ha. Two new hosts were found in Vojvodina Province: *Cotoneaster horizontalis* and *Chaenomeles japonica*. In 2008, in the Southern part of Bačka County (where some apple nurseries are located), asymptomatic samples from plantations (mainly apples) were found positive in the bacteria, analysed by molecular methods. Eradication has been conducted mainly in apple orchards in Vojvodina region (2008) and in Rasina district (2007). However, asymptomatic samples from apple nurseries were found negative (Balaž et al., 2013). In 2016, there was an occurrence of *Erwinia amylovora* (exact location is not mentioned) but not an epiphytic outbreak on apple (Response Letter, D4 a).

Visual inspections around (mother) nurseries and production areas are conducted on regular bases as explained above. In the Vojvodina region, nurseries are surrounded by field crops (wheat, maize, sugar beet, oil crops like sunflowers, soybean, oil rape, etc.) which do not host *E. amylovora*. In the Rasina district, apple plant production areas are grouped and the isolation belts of 500 and 1,000 m around mother and production nurseries overlap.

Uncertainties:

- Distances of surveillance belts around nurseries production areas are not clearly defined, taking into consideration the overlap between mother and production nurseries.
- Assisted dispersal of the bacteria by animals and abiotic factors can bridge the distances
- If dispersal from infected hosts surrounding production nurseries occurs after inspection in the two defined periods, the plant/tree may carry the disease asymptomatically.
- Based on the information we have from the Dossier and the reply from Serbia, it is uncertain to what extent the visual inspection is effective. Based on the months defined and the lack of information on phenology, it is possible that the inspections might be occurring late in the flowering season. Therefore, inspections may not be 100% effective.
- There is a possibility for latent infections that remain unnoticed even after visual inspections.
- Concerning the epiphytic/endophytic growth, survival is still likely at very low temperatures, so cold treatment might not be effective treatment to eliminate or prevent the bacteria.
- The EPPO Standards and Diagnostic Protocols for regulated pests PM 7/20 that are followed (Table 8, p. 63, Dossier) can be effective at high bacterial population levels but the effectiveness is uncertain at low population levels.
- In case diagnostics of symptomatic samples are carried out, it is not clear how the sampling is done, and which diagnostic protocol is used. Referring only to the diagnostic protocol PM 7/20, is too general. Also, the sampling protocol provided in Annex II, are too general information, but details are lacking.
- According to the additional information provided by Serbia in Annex IV, two samples showing symptoms of *E. amylovora* were tested but gave a negative result, given that details on the sensitivity of the diagnostic tests are lacking, there is uncertainty on the sensitivity level of the used methods and therefore on the reliability of the obtained results.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nursery from the surrounding area. Pathogen is present in Serbia and in the past, it has been detected in areas surrounding or near apple producing areas i.e. mother nurseries and production nurseries. Although there are thorough inspections in production areas and there are demarcated belts around (mother and production) nurseries that are also inspected, the pathogen, if present and the environmental conditions (temperature and humidity) allow it, could infect plants for planting. Also, the assisted dispersal via insects, birds and/or in-farm orchard management may allow the spread of the pathogen.

### A.2.2. Possibility of entry with new plants/seeds

There are two possible pathways for introduction of the pathogen, introductions from other countries via infected material and reintroductions and spread within the country. The main long-distance pathway is mainly the import of infected nursery stock and propagative material (Roberts et al., 2008) since the pathogen can live as an epiphyte or an endophyte in buds and shoots (*EFSA Scientific Opinion, 2014*).

According to the Dossier (page 6), the main production models in Serbian nurseries are T2 plants (1-year old) and T3 plants (2-year old). Concerning the production model T3, scions and rootstocks are imported from the Netherlands. Regarding the production model T2, origin of scions and rootstocks is not specified (it could be either import from EU or Serbian mother plantation).

Uncertainties:

- The production of T3 plants relies on plant material imported from the Netherlands. Given that *E. amylovora* is present in the Netherlands and that details on the phytosanitary status of that material is not provided in the dossier, there is a theoretical level of uncertainty (although unlikely in practicality) regarding the potential infection of that plant material.
- There is uncertainty on whether mother nurseries are importing plant material from other EU or non-EU countries, as done with the Dutch material and therefore, there is a theoretical possibility of entrance through other planting material.

Taking into consideration the above evidence and uncertainties, the Panel considers that although technically unlikely, it is possible that the pathogen could enter the nursery with new plants/seeds or soil growing media. *Erwinia amylovora* is present and widespread although at low prevalence in the Netherlands (EPPO), given the fact that part of the material is coming from the Netherlands it cannot be excluded that the pathogen may also be introduced via this material. The Plants for planting specified in the dossier are also produced by grafting from material produced in other local nurseries, again, it cannot be excluded the introduction of the pathogen with plant material grown in Serbia.

### A.2.3. Possibility of spread within the nursery

High level of soil moisture (by rain or irrigation), wind and temperature between 18°C and 30°C can lead to rapid disease development (VKM, 2007). *E. amylovora* can retain its pathogenic potential at temperatures ranging from 4°C (sometimes even lower) to 37°C (Santander et al., 2017). Movement of machineries/equipment and even pruning is a significant pathway. (VKM, 2007).

Concerning the apple planting material production process in Serbia, the main treatments are: grafting, fertigation, pest control, soil cultivation, defoliation (two treatments with copper chelate and manually), uprooting and root shaking and washing, packaging, delivery or cold storage (2°C) until spring, if not sold in November. Plant roots are washed individually with water under pressure, without any added chemicals. (Response Letter, B10).

Grafting could be a possible pathway since in propagation nurseries, cells of *E. amylovora* surviving on woody surfaces can initiate disease when scions and rootstocks are wounded during grafting. *E. amylovora* also, can reside as an endophyte within apparently healthy plant tissue, such as branches, limbs and budwood. Migration of the pathogen through xylem is one mechanism by which floral infections of apple can lead to rootstock infections near the graft union (Johnson, 2000). Moreover, dispersion is highly likely through insects (especially pollinating), birds (Keil et al., 1972) and human factors (CABI CPC, Online).

Uncertainties:

- Undetected latent infections in hosting trees in the buffer zones may be the source for spread to mother and production areas.
- Although the steps in production of the different plant material are explained in the dossier, the specific management of plants in the nursery is not detailed and therefore, there are uncertainties on to what extent common management practices in the cultivation of apple could favour the spread of the disease.
- There are uncertainties on the effectiveness of chemical and other treatments to deal with insect pests. As we do not know population sizes of phytophagous or pollinating insects going from tree to tree in the nurseries, there are uncertainties on likelihood of spread via insects within the nursery.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pathogen within the nursery is possible. As explained above, *E. amylovora* can be spread by means of abiotic factors (water, wind) and also by insects (especially pollinators), and given the fact that the bacterium is present in Serbia and the close proximity among the nurseries in the production areas, spread of the bacterium can occur easily under favourable environmental conditions. Also, in farm management, e.g. the use of beehives and pollinators in apple production areas, or the use of machinery and tools can also spread the disease and therefore, there is a theoretical risk of spread within apple production areas that cannot be neglected.

## A.3. Information from interceptions

Considering imports of *M. domestica* plants from Serbia to the EU, between 1995 and 2019 (until November), there are no records of interceptions of *E. amylovora* (EUROPHYT, online).

## A.4. Evaluation of the risk reduction options

In the table below, all the RROs currently applied in Serbia are summarised and an indication of their effectiveness on ERWIAM is provided.

| Number of the RRO | Risk reduction options | Effect on pest | Current measures in Serbia | Evaluation and uncertainties |
|---|---|---|---|---|
| RRO1 | Surveillance and monitoring | Yes | There are inspection/detection surveillances in the places of production and inspection of consignments<br>Detection surveillances focus on the visual inspection of production areas and nurseries to detect an infection level of 0.1% or more with a confidence level of at least 99%<br>All plants are inspected. The whole place of production and susceptible plants in their vicinity are inspected<br>For mother plantation, isolation belt is set with a 1000 m radius where plants of the subfamily Pomoidae must not be present, however, this distance can be reduced (to 250 m) if plantations and nurseries cultivate Pomoidae | Uncertainties:<br>The buffer and the isolation zones are not clearly defined. The easiest time to detect is during flowering<br>It is unclear to what extent the two inspections occurring in production areas are optimised for detection according to the crop phenology<br>They conduct two inspections (before and after the summer). The first period is a bit late, probably after flowering. It is unclear, given that they do not provide information on the phenology, whether they are performing the survey in the right moment<br>The effectiveness of the visual inspection is uncertain. If asymptomatic plants are not sampled for bacteria and the visual inspection does not occur in the right time period, the bacteria may not be detected even if present |
| RRO2 | Suspension of trade | Yes | If *E. amylovora* is detected, marketing is allowed only if the absence of the harmful organism has been documented by analysis of the epiphytic population. Additionally, mother plantation is to be suspended for at least one year. (Response Letter from Serbia, ANNEX I, page 2) | |
| RRO3 | Removal of infested trees | Yes | If symptoms of *Erwinia amylovora* are observed in mother plants, destruction of the infected plants is ordered (Dossier, page 66) | |
| RRO4 | Fungicide treatment | Yes | Used to deal with apple scab | Copper oxychloride is used in fruit production to deal with fungal diseases. It is uncertain to what extent this treatment is affecting *E. amylovora* |
| RRO5 | Insecticide treatment that may affect the volume of the bacterial infection | Yes | In the dossier, it is mentioned the application of pesticides to treat local infestations of phytophagous insects | Other animal vectors are not reduced by insecticide treatment e.g. birds |

| Number of the RRO | Risk reduction options | Effect on pest | Current measures in Serbia | Evaluation and uncertainties |
|---|---|---|---|---|
| RRO6 | Storage treatment | Yes | Cold storage at 2°C | Uncertainties:<br>This will prevent multiplication of the bacteria, but it may survive in latent state |

## A.5. Overall likelihood of pest freedom

| **Rating of the likelihood of pest freedom** | Pest free with some exceptional cases (99.5%–99.9%) (between 9,950 and 9,990 of 10,000 pallets) (EFSA PLH Panel, 2019) | | | | |
|---|---|---|---|---|---|
| **Percentiles of the distribution** | 1% | 25% | 50% | 75% | 99% |
| **Number of infested units (pallets) out of 10.000** | **1** | **7** | **15** | **25** | **100** |
| **Summary of the information used for the evaluation** | **Possibility that the pest/pathogen could enter exporting nurseries**<br>*E. amylovora* is officially present in Serbia since 1989. There are reports of severe epiphytotic outbreaks by the bacterium (in 2000). In 2016, *E. amylovora* was also reported but, mainly on pears<br>Natural spread is likely through wind, water, rain, insects (especially pollinators) and birds. Human activities (i.e. pruning, machineries, equipment, etc.) facilitate the spread of the pest. Also, it can survive for several weeks in pollen, nectar, honey and on the fruit fly. There is a possibility to enter through infected planting material (from the EU, especially Netherlands, or from local Serbian mother plantations)<br>**Measures taken against the pest/pathogen and their efficacy**<br>Surveillance and monitoring are conducted in production areas and in demarcated belts. When *E. amylovora* is detected, trade is suspended. If symptoms of *E. amylovora* are detected in mother plants, infected plants are removed immediately. Copper is applied during defoliation (copper chelate) which can have an effect on *E. amylovora*. During storage and delivery, plants are kept under 2°C which can affect the multiplication of *E. amylovora*<br>**Interception records**<br>There are no records of interceptions<br>**Shortcomings of current measures/procedures**<br>The effectiveness of the visual inspection at border control is uncertain, let alone if is the case of latent infections. Given that data on the phenology of apple plants in production areas are not provided, it is unclear whether the periods of inspection might be optimised to match the flowering period of the plant and therefore, inspections might fail to detect the symptoms. Copper sulfate might not affect directly *E. amylovora*. Cold storage might prevent the multiplication of the bacterium but it will not kill it<br>***Main uncertainties***<br>Distances of surveillance belts around nurseries production areas are not clearly defined. It is uncertain to what extent the visual inspection is effective. Referring to the diagnostic protocol PM 7/20 and the sampling protocol (see Annex II, Response Letter) is too general as details on the specific samplings in Serbia are not provided. There is still a possibility of pest entrance through infected material (imported from NL, or from Serbian mother plantations). There are uncertainties on to what extent common management practices in the cultivation of apple could favour the spread of the disease. It is not certain on to what extent common management practices in the cultivation of apple could favour the spread of the disease. Also, the effectiveness of chemical and other treatments to deal with insect pests is unknown | | | | |

## A.6. Eicitation outcomes of the assessment of the pest freedom for *Erwinia amylovora*

To perform the EKE, the WG put forward the following scenarios

### A.6.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

The surveillance scheme conducted by Serbia is complete. Serbia follows EPPO standards, using the best techniques available. Surveillances in production areas and demarcated belts are working effectively and taking place during the most suitable periods for the detection of the pest symptoms. Few latent infections occur and are in any case detected. Given the proximity of production nurseries to mother nurseries, production nurseries benefit from the strict monitoring occurring in mother nurseries. In the production areas (in the Vojvodina region in particular), nurseries and mother plantations are surrounded by field crops where no hosts of *E. amylovora* are present. Planting material is healthy and mother plants are under protected conditions that prevent infection. Management practices are adapted to reduce infections and vectors are controlled sufficiently. Infected material will not leave the production nursery and will not be exported. Cold storage (2°C) is effective in preventing the spread of the disease.

### A.6.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Inspections and surveillance schemes are not effective, and protocols used for the detection of the pathogen are not sensitive enough. Inspection periods might miss the right moment for the detection of the bacterium. Detection in the surveillances is not effective due to lack of clear symptoms and/or wrong timing. Also, latent infections are not detected. Surveillance of other potential hosts is difficult to perform (e.g. private gardens).

Surveillance belts around production areas are not properly demarcated and/or too small allowing the spread and/or preventing pathogen confinement. Mother plantations and nurseries are surrounded by orchards (other host plants) where the pathogen may be present. Climatic conditions and vector populations could favour the emergence and spread of the disease. High prevalence of vectors carrying the pathogen (e.g. infected bee-hives). Material imported from the Netherlands may be infected and mother nurseries import infested material from other areas where the bacteria is present. Management practices (e.g. pruning) may spread latent infections or enable introduction.

### A.6.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (median)

The experts agreed on the fact that the median value i.e. a value separating the higher half from the lower half of the data sample was skewed to the left, as the most likely scenario under the production conditions presented in the dossier are those of pest freedom with very low bacteria prevalence, which would result in a relatively low number of infested consignments. In other words, a scenario where visual inspections are effective in detecting symptoms of infection in nurseries, production areas and demarcated belts. At the same time, production and management in farm follows general phytosanitary standards.

### A.6.4. Reasoning for the precision of the judgement describing the remaining uncertainties (first and third quartile/interquartile range)

The experts agreed that first quartile value (7 infested of 10 000) represented a between the 1% and the 50% values (1 and 15). For the third quartile value, the experts agreed that most likely value (25 infested of 10 000) was closer to the median value, reflecting the production conditions presented in the dossier which would result in a relatively low number of infested consignments.

Elicited and fitted values for *E. amylovora* agreed by the Panel are shown in Tables A.1 and A.2 and in the Figure A.1.

**Table A.1:** Elicited and fitted values of the uncertainty distribution of pest infestation by *E. amylovora* per 10,000 pallets

| Percentile | 1% | 2.5% | 5% | 10% | 17% | 25% | 33% | 50% | 67% | 75% | 83% | 90% | 95% | 97.5% | 99% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elicited values** | 1 | | | | | 7 | | 15 | | 25 | | | | | 100 |
| **EKE** | 1.54 | 2.18 | 2.94 | 4.14 | 5.59 | 7.37 | 9.27 | 14.0 | 21.0 | 26.5 | 34.9 | 47.1 | 66.4 | 89.5 | 127 |

*The EKE results is the Lognormal distribution* (21.886, 26.42) fitted to the elicited values with @Risk version 7.5.

Based on the numbers of estimated infected pallets, the likelihood of estimated pest freedom was calculated. The fitted values of the uncertainty distribution of the likelihood of pest freedom are shown in table.

**Table A.2:** The uncertainty distribution of pallets free of *E. amylovora* per 10,000 pallets calculated by Table A.1

| Percentile | 1% | 2.5% | 5% | 10% | 17% | 25% | 33% | 50% | 67% | 75% | 83% | 90% | 95% | 97.5% | 99% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Values** | 9,900 | | | | | 9,975 | | 9,985 | | 9,993 | | | | | 9,999 |
| **EKE results** | 9,873 | 9,910 | 9,934 | 9,953 | 9,965 | 9,974 | 9,979 | 9,986 | 9,991 | 9,993 | 9,994 | 9,996 | 9,997 | 9,998 | 9,998 |

*The EKE results are the* fitted values.

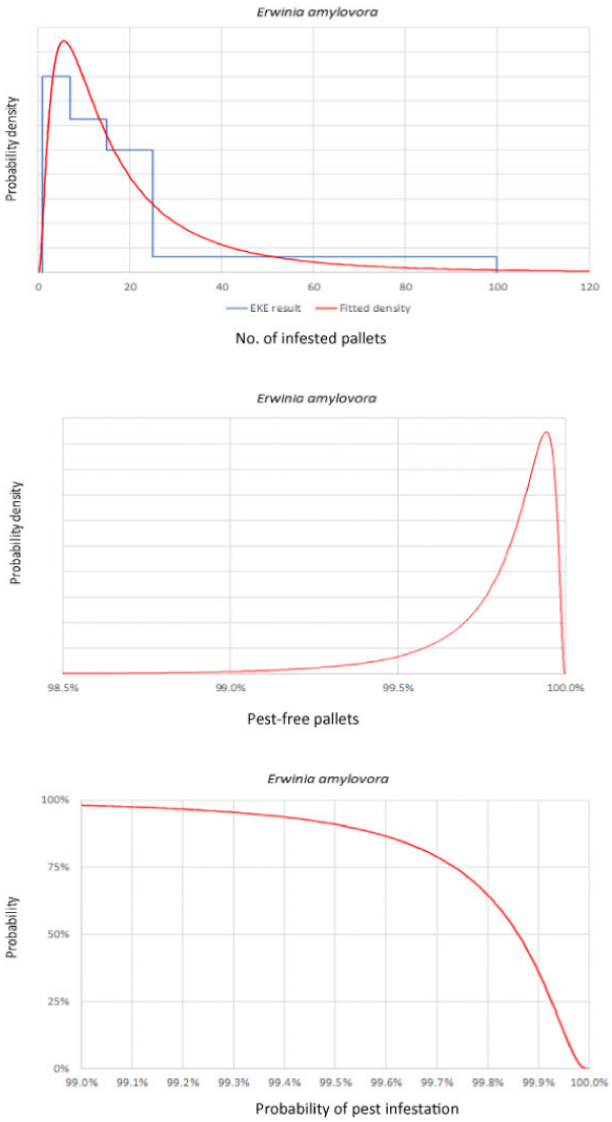


**Figure A.1:** (a) Elicited uncertainty of pest infestation per 10,000 pallets (histogram in blue vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free pallets per 10,000 (i.e. 1-pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 pallets

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# Appendix B – Search strategies

## Web of Science all databases search string

In the table below, the search string used in Web of Science is reported. Totally, 1,209 papers were retrieved. Titles and abstracts were screened, and 89 pests were added to the Excel list.

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| Web of Science All databases | **TOPIC:** ("Malus domestica" OR "M. domestica")<br>**AND**<br>**TOPIC:** (pathogen* OR pathogenic bacteria OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect$ OR mite$ OR phytoplasm* OR arthropod* OR nematod* OR disease$ OR infecti* OR damag* OR symptom* OR pest$ OR vector OR hostplant$ OR "host plant$" OR host OR "root lesion$" OR decline$ OR infestation$ OR damage$ OR symptom$ OR dieback* OR "die back*" OR malaise OR aphid$ OR curculio OR thrip$ OR cicad$ OR miner$ OR borer$ OR weevil$ OR "plant bug$" OR spittlebug$ OR moth$ OR mealybug$ OR cutworm$ OR pillbug$ OR "root feeder$" OR caterpillar$ OR "foliar feeder$" OR virosis OR viruses OR blight$ OR wilt$ OR wilted OR canker OR scab$ OR rot OR rots OR rotten" OR "damping off" OR "damping-off" OR blister$ OR smut OR "mould" OR "mold" OR "damping syndrome$" OR mildew OR scald$ OR "root knot" OR "root-knot" OR rootkit OR cyst$ OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant$parasitic" OR "root feeding" OR "root$feeding")<br>**NOT**<br>**TOPIC:** ("heavy metal$" OR "pollut*" OR "weather" OR "propert*" OR probes OR "spectr*" OR "antioxidant$" OR "transformation" OR musca OR RNA OR "musca domestica" OR peel OR resistance OR gene OR DNA OR "Secondary plant metabolite$" OR metabolite$ OR Catechin OR "Epicatechin" OR "Rutin" OR "Phloridzin" OR "Chlorogenic acid" OR "Caffeic acid" OR "Phenolic compounds" OR "Quality" OR "Appearance" OR Postharvest OR Antibacterial OR Abiotic OR Storage OR Pollin* OR Ethylene OR Thinning OR fertil* OR Mulching OR Nutrient$ OR Pruning OR "human virus" OR "animal disease$" OR "plant extracts" OR "immunological" OR "purified fraction" OR "traditional medicine" OR "medicine" OR mammal$ OR bird$ OR "human disease$")<br>**NOT**<br>**TOPIC:** ("Aphidounguis mali" OR "Aphis aurantii" OR "Acetobacter aceti" OR "Acetobacter pasteurianus" OR "Acleris fimbriana" OR "Acleris minuta" OR "Acleris rhombana" OR "Acremonium mali" OR "Acremonium sclerotigenum" OR "Acremonium sp." OR "Acronicta psi" OR "Acronicta rumicis" OR "Aculus schlechtendali" OR "Adoretus versutus" OR "Adoxophyes orana" OR "Adoxophyes orana" OR "Adoxophyes orana fasciata" OR "Aeolesthes sarta" OR "Aeolesthes sarta" OR "Aeolesthes sarta" OR "Agrilus mali" OR "Agrilus mali" OR "Agriopis bajaria" OR "Agrotis ipsilon" OR "Allocotaphis quaestionis" OR "Alternaria alternata" OR "Alternaria alternata" OR "Alternaria arborescens" OR "Alternaria dumosa" OR "Alternaria eureka" OR "Alternaria frumenti" OR "Alternaria infectoria" OR "Alternaria kordkuyana" OR "Alternaria mali" OR "Alternaria mali" OR "Alternaria mali" OR "Alternaria mali" OR "Alternaria malicola" OR "Alternaria sp." OR "Alternaria tenuis" OR "Alternaria tenuissima" OR "Alternaria tenuissima" OR "American plum line pattern virus" OR "Ametastegia" OR "Amphipyra pyramidea" OR "Amphitetranychus viennensis" OR "Amphitetranychus viennensis "OR "Amylostereum sacratum" OR "Anarsia lineatella" OR "Anarsia lineatella" OR "Anastrepha fraterculus" OR "Anastrepha fraterculus" OR "Anastrepha fraterculus" OR "Anastrepha ludens" OR "Anastrepha serpentina" OR "Anastrepha serpentina" OR "Anastrepha suspensa" OR "Anoplophora chinensis" OR "Anoplophora chinensis" OR "Anoplophora glabripennis" OR "Anoplophora glabripennis" OR "Anthonomus piri" OR "Anthonomus pomorum" OR "Anthonomus pomorum" OR "Anthonomus pomorum" OR "Anthonomus quadrigibbus" OR "Anthonomus quadrigibbus" OR "Anthonomus quadrigibbus" OR "Antrodia serialis" OR "Anuraphis farfarae" OR "Apate monachus" OR "Aphis craccivora"OR "Aphis eugeniae" OR "Aphis fabae" OR "Aphis gossypii" OR "Aphis gossypii" OR "Aphis odinae" OR "Aphis pomi" OR "Aphis pomi" OR "Aphis spiraecola" OR "Aphis spiraecola" OR "Aphis spiraephaga" OR "Aploneura ampelina" OR "Apocheima cinerarium" OR "Apocheima pilosaria" OR "Aporia crataegi" OR "Apple chat fruit agent" OR "Apple chat fruit disease" OR "Apple chlorotic leaf spot virus" OR "Apple chlorotic leaf spot virus" OR "Apple dimple fruit viroid" OR "Apple green crinkle agent" OR "Apple green crinkle disease" OR "Apple mosaic ilarvirus" OR "Apple mosaic virus" OR "Apple mosaic virus" OR "Apple ringspot agent" OR "Apple ringspot disease" |

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| | OR "Apple rough skin agent" OR "Apple rubbery wood agent" OR "Apple rubbery wood phytoplasma" OR "Apple scar skin viroid" OR "Apple star crack agent" OR "Apple stem grooving virus" OR "Apple stem grooving virus" OR "Apple stem pitting virus" OR "Apple stem pitting virus" OR "Apriona cinerea" OR "Apriona germari" OR "Apriona germari" OR "Archips argyrospilus" OR "Archips breviplicanus" OR "Archips crataeganus" OR "Archips fuscocupreanus" OR "Archips podanus" OR "Archips rosana" OR "Archips subsidiaria" OR "Archips termias" OR "Archips xylosteanus" OR "Argyresthia conjugella" OR "Argyrotaenia citrana" OR "Argyrotaenia ljungiana" OR "Argyrotaenia velutinana" OR "Armillaria limonea" OR "Armillaria luteobubalina" OR "Armillaria mellea" OR "Armillaria novae-zelandiae" OR "Armillaria sp." OR "Armillaria tabescens" OR "Ascochyta piricola" OR "Ascochyta pirina" OR "Ascochyta pyricola" OR "Aspergillus clavatus" OR "Aspergillus flavus" OR "Aspergillus ustus" OR "Aspergillus versicolor" OR "Asteromella mali" OR "Asymmetrasca decedens" OR "Athelia bombacina" OR "Athelia rolfsii" OR "Athelia rolfsii" OR "Atractotomus mali" OR "Aulacorthum solani" OR "Aureobasidium pullulans" OR "Aureobasidium pullulans" OR "Automeris io" OR "Automeris zephyria" OR "Bacchisa fortunei" OR "Bacillus cereus" OR "Bacillus subtilis" OR "Bactrocera aquilonis" OR "Bactrocera dorsalis" OR "Bactrocera dorsalis" OR "Bactrocera dorsalis" OR "Bactrocera tryoni" OR "Bactrocera tryoni" OR "Bactrocera tryoni" OR "Bactrocera zonata" OR "Bionectria ochroleuca" OR "Bispora antennata" OR "Bjerkandera adusta" OR "Blastobasis decolorella" OR "Boeremia exigua var. exigua" OR "Bonagota cranaodes/salubr." OR "Bonagota cranaodes/salubricol" OR "Botryodiplodia malorum" OR "Botryodiplodia theobromae" OR "Botryosphaeria berengeriana" OR "Botryosphaeria berengeriana f.sp. pyricola" OR "Botryosphaeria dothidea" OR "Botryosphaeria dothidea" OR "Botryosphaeria kuwatsukai" OR "Botryosphaeria kuwatsukai" OR "Botryosphaeria kuwatsukai" OR "Botryosphaeria lutea" OR "Botryosphaeria obtusa" OR "Botryosphaeria obtusa" OR "Botryosphaeria parva" OR "Botryosphaeria ribis" OR "Botryosphaeria ribis" OR "Botryosphaeria sinensis" OR "Botryosphaeria sp." OR "Botryosphaeria stevensii" OR "Botryosphaeria stevensii" OR "Botryotinia fuckeliana" OR "Botrytis cinerea" OR "Botrytis mali" OR "Brachycaudus cardui" OR "Brachycaudus helichrysi" OR "Brahmina coriacea" OR "Brevipalpus obovatus" OR "Brevipalpus phoenicis" OR "Bryobia giannitsensis" OR "Bryobia graminum "OR "Bryobia macedonica" OR "Bryobia piliensis" OR "Bryobia praetiosa" OR "Bryobia rubrioculus" OR "Bryobia rubrioculus "OR "Bryobia vasiljevi" OR "Burkholderia cepacia" OR "Byturus tomentosus" OR "Cacoecimorpha pronubana" OR "Cacopsylla mali" OR "Cacopsylla melanoneura" OR "Cacopsylla picta" OR "Cactodera chaubattia" OR "Caliroa cerasi" OR "Callisto coffeella" OR "Calliteara horsfieldii" OR "Calonectria kyotensis" OR "Camarosporium karstenii" OR "Camarosporium multiforme" OR "Campylomma verbasci" OR "Candidatus Phytoplasma asteris" OR "Candidatus Phytoplasma pruni" OR "Candidatus Phytoplasma solani" OR "Candidula intersecta" OR "Capnodium citri" OR "Carpophilus mutilatus" OR "Carposina sasakii" OR "Carposina sasakii" OR "Carposina sasakii" OR "Cenopalpus pulcher" OR "Ceratitis capitata" OR "Ceratitis capitata" OR "Ceratitis quilicii" OR "Ceratitis rosa" OR "Ceratitis rosa" OR "Ceratitis rosa" OR "Ceratostomella mali" OR "Ceresa alta" OR "Ceroplastes ceriferus" OR "Chaetocnema confinis" OR "Chaetomium sp." OR "Chalastospora gossypii" OR "Cherry leaf roll virus" OR "Cherry leaf roll virus" OR "Cherry rasp leaf virus" OR "Cherry rasp leaf virus" OR "Cherry rasp leaf virus" OR "Chinavia hilaris" OR "Chloroclystis v-ata" OR "Chondrostereum purpureum" OR "Choreutis pariana" OR "Choristoneura rosaceana" OR "Choristoneura rosaceana" OR "Chrysomphalus aonidum" OR "Chrysomphalus aonidum" OR "Chymomyza amoena" OR "Cicinobolus humuli" OR "Cilix glaucata" OR "Cirsium arvense" OR "Cladophialophora sp." OR "Cladosporium cladosporioides" OR "Cladosporium fumago" OR "Cladosporium herbarum" OR "Cladosporium sp." OR "Clarkeulia bourquini" OR "Clepsis spectrana" OR "Clonostachys rosea" OR "Clover yellow mosaic virus" OR "Cochliobolus cynodontis" OR "Colaspis brunnea" OR "Coleophora prunifoliae" OR "Coleophora serratella" OR "Colletogloeum sp." OR "Colletotrichum acerbum" OR "Colletotrichum acutatum" OR "Colletotrichum acutatum" OR "Colletotrichum acutatum" OR "Colletotrichum aenigma" OR "Colletotrichum alienum" OR "Colletotrichum clavatum" OR "Colletotrichum fioriniae" OR "Colletotrichum fioriniae" OR "Colletotrichum fragariae" OR "Colletotrichum fructicola" OR "Colletotrichum fructicola" OR "Colletotrichum gloeosporioides" OR "Colletotrichum godetiae" OR "Colletotrichum kahawae" OR "Colletotrichum kahawae subsp. ciggaro" OR "Colletotrichum karsti" OR "Colletotrichum karstii" OR "Colletotrichum limeticola" OR "Colletotrichum melonis" OR "Colletotrichum nymphaeae" OR "Colletotrichum nymphaeae" OR "Colletotrichum paranaense" OR "Colletotrichum rhombiforme" OR "Colletotrichum salicis" OR "Colletotrichum siamense" OR "Colletotrichum siamense" OR "Colletotrichum sp." OR "Colletotrichum theobromicola" OR "Collybia drucei" OR "Comstockaspis perniciosa" OR "Comstockaspis perniciosa" OR "Coniothecium chomatosporum" OR "Coniothyrium armeniacae" OR "Coniothyrium sp." OR "Conogethes punctiferalis" OR "Conotrachelus nenuphar" OR "Conotrachelus nenuphar" |

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| | OR "Conotrachelus nenuphar" OR "Conyza bonariensis" OR "Conyza canadensis" OR "Cordana musae" OR "Coriolus velutinus" OR "Coriolus versicolor" OR "Coriolus zonatus" OR "Cornu aspersum" OR "Corticium koleroga" OR "Corticium utriculicum" OR "Coryneum foliicola" OR "Cosmia trapezina" OR "Cossus cossus" OR "Cotinis nitida" OR "Cryphonectria parasitica" OR "Cryptocoryneum condensatum" OR "Cryptosporiopsis curvispora" OR "Cryptosporiopsis malicorticis" OR "Cryptosporiopsis perennans" OR "Ctenopseustis obliquana" OR "Cucumber mosaic virus" OR "Cydia janthinana" OR "Cydia lobarzewskii" OR "Cydia pomonella" OR "Cydia pomonella" OR "Cylindrocarpon candidum" OR "Cylindrocarpon destructans" OR "Cylindrocarpon didymum" OR "Cylindrocarpon didymum" OR "Cylindrocarpon heteronemum" OR "Cylindrocarpon liriodendri" OR "Cylindrocarpon liriodendri" OR "Cylindrocarpon macrodidymum" OR "Cylindrocarpon mali" OR "Cylindrocarpon obtusiusculum" OR "Cylindrocarpon pauciseptatum" OR "Cylindrocladium floridanum" OR "Cyphellophora sessilis" OR "Cytospora calvillae" OR "Cytospora carphosperma" OR "Cytospora cincta" OR "Cytospora leucostoma" OR "Cytospora mali" OR "Cytospora melnikii" OR "Cytospora nivea" OR "Cytospora parasitica" OR "Cytospora rubescens" OR "Cytospora schulzeri" OR "Cytospora sp." OR "Dactylonectria pauciseptata" OR "Daldinia vernicosa" OR "Dasineura mali" OR "Deltinea bourquini" OR "Dendrothele tetracornis" OR "Devriesia pseudoamericana" OR "Diabrotica speciosa" OR "Diaporthe actinidiae" OR "Diaporthe ambigua" OR "Diaporthe ambigua" OR "Diaporthe eres" OR "Diaporthe eres" OR "Diaporthe eres" OR "Diaporthe foeniculina" OR "Diaporthe malorum" OR "Diaporthe perniciosa" OR "Diaporthe serafiniae" OR "Diaporthe sp." OR "Diaspidiotus ancylus" OR "Diaspidiotus perniciosus" OR "Didymella aliena" OR "Diplocarpon mali" OR "Diplocarpon mali" OR "Diplocarpon mali" OR "Diplocarpon mespili" OR "Diplococcium asperum" OR "Diplodia bulgarica" OR "Diplodia intermedia" OR "Diplodia mutila" OR "Diplodia pseudoseriata" OR "Diplodia seriata" OR "Diplodia sp." OR "Diptacus gigantorhynchus" OR "Dissoconium aciculare" OR "Dissoconium eucalypti" OR "Dissoconium proteae" OR "Dissoconium sp." OR "Dothiorella sarmentorum" OR "Drosophila immigrans" OR "Drosophila lativittata" OR "Drosophila simulans" OR "Drosophila suzukii" OR "Drosophila suzukii" OR "Dysaphis affinis" OR "Dysaphis anthrisci" OR "Dysaphis anthrisci majkopica" OR "Dysaphis armeniaca" OR "Dysaphis brachycyclica" OR "Dysaphis brancoi" OR "Dysaphis brancoi spp. malina" OR "Dysaphis brancoi spp. rogersoni" OR "Dysaphis brunii" OR "Dysaphis chaerophylli" OR "Dysaphis chaerophyllina" OR "Dysaphis devecta" OR "Dysaphis devecta" OR "Dysaphis gallica" OR "Dysaphis malidauci" OR "Dysaphis meridialis" OR "Dysaphis mordvilkoi" OR "Dysaphis orientalis" OR "Dysaphis physocaulis" OR "Dysaphis plantaginea" OR "Dysaphis plantaginea" OR "Dysaphis pyri" OR "Dysaphis radicola" OR "Dysaphis sibirica" OR "Dysaphis zini" OR "Dysaphys flava" OR "Dysmicoccus brevipes" OR "Edwardsiana crataegi" OR "Edwardsiana rosae" OR "Elsinoe piri" OR "Elsinoe pyri" OR "Emex australis" OR "Emex spinosa" OR "Empoasca fabae" OR "Enarmonia formosana" OR "Eotetranychus ancora" OR "Eotetranychus carpini "OR "Eotetranychus clitus" OR "Eotetranychus frosti "OR "Eotetranychus pruni" OR "Eotetranychus pruni "OR "Eotetranychus prunicola" OR "Eotetranychus sexmaculatus "OR "Eotetranychus smithi" OR "Eotetranychus uncatus" OR "Eotetranychus uncatus" OR "Eotetranychus willamettei "OR "Epicoccum nigrum" OR "Epicoccum sp." OR "Epidiaspis leperii" OR "Epiphyas postvittana" OR "Epiphyas postvittana" OR "Epitrimerus pyri" OR "Erannis defoliaria" OR "Eriophyes mali" OR "Eriosoma lanigerum" OR "Eriosoma lanigerum" OR "Eriosoma lanuginosum" OR "Erwinia amylovora" OR "Erwinia amylovora" OR "Erwinia amylovora" OR "Erysiphe heraclei" OR "Erythricium salmonicolor" OR "Eulecanium tiliae" OR "Eupithecia insigniata" OR "Euproctis chrysorrhoea" OR "Eurhizococcus brasiliensis" OR "Eurytetranychus ulmi" OR "Eurytoma schreineri" OR "Eutetranychus africanus "OR "Eutetranychus orientalis "OR "Eutypa lata" OR "Eutypa lata" OR "Euzophera pinguis" OR "Exophiala sp." OR "Fibulorhizoctonia psychrophila" OR "Fieberiella florii" OR "Flammulina velutipes" OR "Fomitopsis pinicola" OR "Fomitopsis pinicola" OR "Forficula auricularia" OR "Frankliniella" OR "Frankliniella occidentalis" OR "Fusarium acuminatum" OR "Fusarium apiogenum" OR "Fusarium avenaceum" OR "Fusarium compactum" OR "Fusarium crookwellense" OR "Fusarium lateritium" OR "Fusarium oxysporum" OR "Fusarium oxysporum" OR "Fusarium proliferatum" OR "Fusarium pseudograminearum" OR "Fusarium semitectum" OR "Fusarium solani" OR "Fusarium sp." OR "Fusarium tricinctum" OR "Fusicladium dendriticum" OR "Fusicladium pomi" OR "Fusicladium pyrorum" OR "Fusicoccum luteum" OR "Galinsoga parviflora" OR "Galinsoga quadriradiata" OR "Ganoderma applanatum" OR "Geastrumia polystigmatis" OR "Geosmithia sp." OR "Geotrichum candidum" OR "Gibberella acuminata" OR "Gibberella avenacea" OR "Gibberella avenacea" OR "Gibberella baccata" OR "Gibberella tricincta" OR "Globisporangium irregulare" OR "Globodera pallida" OR "Globodera rostochiensis" OR "Gloeocystidiellum sacratum" OR "Gloeodes pomigena" OR "Gloeosporium album" OR "Gloeosporium fructigenum" OR "Gloeosporium sp." OR "Glomerella cingulata" OR "Glomerella cingulata" OR "Glomerella miyabeana" OR "Glomus constrictum" OR "Glomus deserticola" OR "Glomus etunicatum" OR "Glomus fasciculatum" OR "Glomus geosporum" OR "Glomus mosseae" OR "Gluconobacter oxydans" OR "Graphiphora augur" |

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| | OR "Grapholita funebrana" OR "Grapholita funebrana" OR "Grapholita inopinata" OR "Grapholita inopinata" OR "Grapholita inopinata" OR "Grapholita molesta" OR "Grapholita molesta" OR "Grapholita molesta" OR "Grapholita packardi" OR "Grapholita packardi" OR "Grapholita packardi" OR "Grapholita prunivora" OR "Grapholita prunivora" OR "Grapholita prunivora" OR "Gryllotalpa gryllotalpa" OR "Gymnosporangium clavipes" OR "Gymnosporangium clavipes" OR "Gymnosporangium clavipes" OR "Gymnosporangium confusum" OR "Gymnosporangium globosum" OR "Gymnosporangium globosum" OR "Gymnosporangium globosum" OR "Gymnosporangium juniperi" OR "Gymnosporangium juniperi-virginiae" OR "Gymnosporangium juniperi-virginianae" OR "Gymnosporangium juniperi-virginianae" OR "Gymnosporangium juniperi-virginianae" OR "Gymnosporangium tremelloides" OR "Gymnosporangium yamadae" OR "Gymnosporangium yamadae" OR "Gymnosporangium yamadae" OR "Gymnosporangium yamadae" OR "Gypsonoma minutana" OR "Hadrotrichum populi" OR "Halyomorpha halys" OR "Halyomorpha halys" OR "Halyomorpha mista" OR "Haptoncus luteolus" OR "Harmonia axyridis" OR "Hedya nubiferana" OR "Helicobasidium mompa" OR "Helicotylenchus dihystera" OR "Hemicycliophora theinemanni" OR "Hendersonia lignicola" OR "Hendersonia mali" OR "Hendersonia piricola" OR "Heteroporus biennis" OR "Hirneola auricula-judae" OR "Holcocerus arenicolus" OR "Holotrichia longipennis" OR "Homeopronematus cf. staercki" OR "Homona coffearia" OR "Homona magnanima" OR "Hop stunt viroid" OR "Hoplocampa" OR "Hoplocampa testudinea" OR "Houjia sp." OR "Houjia yanglingensis" OR "Hyalomyzus eriobotryae" OR "Hyalophora cecropia" OR "Hyalophora cecropia" OR "Hyalopterus pruni" OR "Hyphantria cunea" OR "Hyphantria cunea" OR "Hyphantria cunea" OR "Hyphodontia gossypina" OR "Hypholoma incertum" OR "Hypoxylon serpens" OR "Icerya aegyptiaca" OR "Ilyonectria liriodendri" OR "Janus compressus" OR "Lacanobia oleracea" OR "Lacanobia subjuncta" OR "Lambertella corni-maris" OR "Lasiodiplodia brasiliense" OR "Lasiodiplodia brasiliensis" OR "Lasiodiplodia theobromae" OR "Lepidium draba" OR "Lepidosaphes ulmi" OR "Lepidosaphes ussuriensis" OR "Leptodontidium elatius" OR "Leptosphaeria coniothyrium" OR "Leptothyrium pomi" OR "Leucoptera malifoliella" OR "Leucoptera malifoliella" OR "Leucostoma cinctum" OR "Leucostoma personii" OR "Leucostoma persoonii" OR "Liberibacter europaeus" OR "Longidorus elongatus" OR "Longidorus pisi" OR "Longistigma xizangensis" OR "Lonicera japonica" OR "Lophiostoma compressum" OR "Lophiostoma holmiorum" OR "Lophiostoma subcorticale" OR "Lophiostoma vicinum" OR "Lopholeucaspis japonica" OR "Lopholeucaspis japonica" OR "Lycorma delicatula" OR "Lygocoris communis" OR "Lygocoris pabulinus" OR "Lymantria dispar" OR "Lymantria dispar" OR "Lymantria mathura" OR "Lymantria monacha" OR "Lyonetia clerkella" OR "Lyonetia prunifoliella" OR "Lyonetia prunifoliella malinella" OR "Lyonetia speculella" OR "Macrodactylus subspinosus" OR "Macrosiphum chukotense" OR "Macrosiphum euphorbiae" OR "Macrosiphum rosae" OR "Macrosporium sp." OR "Macrothylacia rubi" OR "Magicicada septendecim" OR "Malacosoma americana" OR "Malacosoma americanum" OR "Malacosoma americanum" OR "Malacosoma americanum" OR "Malacosoma disstria" OR "Malacosoma indicum" OR "Malacosoma neustria" OR "Malacosoma parallela" OR "Malacosoma parallela" OR "Malacosoma parallela" OR "Mamestra brassicae" OR "Margarodes vitis" OR "Marssonina coronaria" OR "Marssonina sp." OR "Medicago lupulina" OR "Megaplatypus mutatus" OR "Megaplatypus mutatus" OR "Melanopsamma pomiformis" OR "Meloidogyne arenaria" OR "Meloidogyne ethiopica" OR "Meloidogyne javanica" OR "Meloidogyne mali" OR "Meloidogyne nataliei" OR "Melolontha melolontha" OR "Merulius sp." OR "Metaseiulus occidentalis" OR "Metcalfa pruinosa" OR "Meyernychus emeticae "OR "Microcyclospora malicola" OR "Microcyclospora pomicola" OR "Microcyclospora sp." OR "Microcyclospora tardicrescens" OR "Microcyclosporella mali" OR "Microcyclosporella sp." OR "Microdiplodia microsporella" OR "Microsphaeropsis ochracea" OR "Microthyriella rubi" OR "Monilia fructigena" OR "Monilia polystroma" OR "Monilia polystroma" OR "Monilia yunnanensis" OR "Monilinia fructicola" OR "Monilinia fructicola" OR "Monilinia fructicola" OR "Monilinia fructicola" OR "Monilinia fructigena" OR "Monilinia fructigena" OR "Monilinia fructigena" OR "Monilinia laxa" OR "Monilinia laxa" OR "Monilinia laxa f.sp. mali" OR "Monilinia mali" OR "Monilinia polystroma" OR "Monilinia polystroma" OR "Monilinia polystroma" OR "Mucor piriformis" OR "Mucor piriformis" OR "Mucor pyriformis" OR "Mycosphaerella pomi" OR "Mycosphaerella pomi" OR "Mycosphaerella punctiformis" OR "Mycosphaerella sentina" OR "Myzus ornatus" OR "Myzus persicae" OR "Myzus persicae" OR "Nattrassia mangiferae" OR "Naupactus xanthographus" OR "Naupactus xanthographus" OR "Nearctaphis bakeri" OR "Nectria cinnabarina" OR "Nectria cinnabarina" OR "Nectria ditissima" OR "Nectria galligena" OR "Nectria ochroleuca" OR "Nectria peziza" OR "Nectria sp." OR "Nematoloma fasciculare" OR "Neofabraea actinidiae" OR "Neofabraea alba" OR "Neofabraea brasiliensis" |

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| | OR "Neofabraea kienholzii" OR "Neofabraea malicorticis" OR "Neofabraea malicorticis" OR "Neofabraea perennans" OR "Neofabraea sp." OR "Neofabraea vagabunda" OR "Neofusicoccum algeriense" OR "Neofusicoccum australe" OR "Neofusicoccum italicum" OR "Neofusicoccum luteum" OR "Neofusicoccum nonquaesitum" OR "Neofusicoccum parvum" OR "Neofusicoccum ribis" OR "Neofusicoccum ribis" OR "Neonectria ditissima" OR "Neonectria ditissima" OR "Neonectria galligena" OR "Neonectria macrodidyma" OR "Neonectria radicicola" OR "Nigrospora sp." OR "Nippolachnus piri" OR "Nitschkia parasitans" OR "Ochroporus ossatus" OR "Oemona hirta" OR "Oemona hirta" OR "Oidium farinosum" OR "Oligonychus biharensis "OR "Oligonychus litchii" OR "Oligonychus newcomeri "OR "Oligonychus sayedi" OR "Oligonychus yothersi "OR "Oncopodiella robusta" OR "Operophtera bruceata" OR "Operophtera brumata" OR "Operophtera brumata" OR "Ophiostoma quercus" OR "Ophiostoma roboris" OR "Orgyia antiqua" OR "Orgyia leucostigma" OR "Orgyia recens" OR "Oribius destructor" OR "Oribius inimicus" OR "Orthosia cerasi" OR "Orthosia cruda" OR "Orthosia hibisci" OR "Orthosia incerta" OR "Orthotydeus californicus" OR "Orthotylus marginalis" OR "Osmia cornifrons" OR "Ostrinia nubilalis" OR "Otiorhynchus cribricollis" OR "Otthia spiraeae" OR "Ovatus crataegarius" OR "Ovatus insitus" OR "Ovatus malisuctus" OR "Ovatus malisuctus" OR "Oxalis latifolia" OR "Oxalis pes-caprae" OR "Pachysphinx modesta" OR "Paecilomyces niveus" OR "Palaeolecanium bituberculatum" OR "Pammene rhediella" OR "Pandemis cerasana" OR "Pandemis heparana" OR "Pandemis pyrusana" OR "Panonychus citri" OR "Panonychus citri "OR "Panonychus inca" OR "Panonychus lishanensis" OR "Panonychus ulmi" OR "Panonychus ulmi "OR "Pantoea agglomerans" OR "Pantomorus cervinus" OR "Paradevriesia pseudoamericana" OR "Paratrichodorus porosus" OR "Parlatoria crypta" OR "Parlatoria oleae" OR "Parlatoria pergandii" OR "Parornix geminatella" OR "Parthenolecanium corni" OR "Parthenolecanium persicae" OR "Pasiphila rectangulata" OR "Paspalum urvillei" OR "Patellaria atrata" OR "Pear blister canker viroid" OR "Pellicularia koleroga" OR "Peltaster cerophilus" OR "Peltaster fructicola" OR "Peltaster gemmifer" OR "Peltaster sp." OR "Peltosphaeria pustulans" OR "Penicillium aurantiogriseum" OR "Penicillium biourgeianum" OR "Penicillium carneum" OR "Penicillium chrysogenum" OR "Penicillium commune" OR "Penicillium crustosum" OR "Penicillium digitatum" OR "Penicillium digitatum" OR "Penicillium expansum" OR "Penicillium expansum" OR "Penicillium glabrum" OR "Penicillium glaucum" OR "Penicillium griseofulvum" OR "Penicillium griseofulvum" OR "Penicillium novae-zelandiae" OR "Penicillium paneum" OR "Penicillium polonicum" OR "Penicillium ramulosum" OR "Penicillium rugulosum" OR "Penicillium solitum" OR "Penicillium sp." OR "Penicillium viridicatum" OR "Pennisetum clandestinum" OR "Peridroma saucia" OR "Pestalotia hartigii" OR "Pestalotia sp." OR "Pestalotiopsis sp." OR "Petiveria alliacea" OR "Petrobia harti" OR "Petrobia latens" OR "Petrobia latens" OR "Pezicula alba" OR "Pezicula alba" OR "Pezicula malicorticis" OR "Pezicula malicorticis" OR "Phacidiopycnis washingtonensis" OR "Phacidiopycnis washingtonensis" OR "Phacidium lacerum" OR "Phaeoacremonium aleophilum" OR "Phaeoacremonium australiense" OR "Phaeoacremonium fraxinopennsylvanicum" OR "Phaeoacremonium geminum" OR "Phaeoacremonium inflatipes" OR "Phaeoacremonium iranianum" OR "Phaeoacremonium italicum" OR "Phaeoacremonium minimum" OR "Phaeoacremonium mortoniae" OR "Phaeoacremonium parasiticum" OR "Phaeoacremonium proliferatum" OR "Phaeoacremonium scolyti" OR "Phaeoacremonium subulatum" OR "Phanerochaete salmonicolor" OR "Phellinus alni" OR "Phellinus igniarius" OR "Phenacoccus aceris" OR "Phialophora sessilis" OR "Phlyctema vagabunda" OR "Phlyctinus callosus" OR "Phlyctinus callosus" OR "Pholiota aurivella" OR "Pholiota squarrosa" OR "Phoma enteroleuca" OR "Phoma glomerata" OR "Phoma herbarum" OR "Phoma macrostoma" OR "Phoma pomorum" OR "Phoma pomorum var. pomorum" OR "Phoma pyrina" OR "Phoma sp." OR "Phomopsis cotoneastri" OR "Phomopsis mali" OR "Phomopsis oblonga" OR "Phomopsis perniciosa" OR "Phomopsis sp." OR "Phorodon humuli" OR "Phyllachora pomigena" OR "Phyllactinia mali" OR "Phyllactinia mali" OR "Phyllonorycter blancardella" OR "Phyllonorycter blancardella" OR "Phyllonorycter corylifoliella" OR "Phyllonorycter crataegella" OR "Phyllonorycter cydoniella" OR "Phyllonorycter elmaella" OR "Phyllonorycter gerasimowi" OR "Phyllonorycter hostis" OR "Phyllonorycter mespilella" OR "Phyllonorycter ringoniella" OR "Phyllosticta briardi" OR "Phyllosticta briardii" OR "Phyllosticta solitaria" OR "Phyllosticta solitaria" OR "Phyllosticta solitaria" OR "Phyllosticta solitaria" OR "Phyllosticta sp." OR "Phyllotreta nigripes" OR "Phymatotrichopsis omnivora" OR "Phymatotrichopsis omnivora" OR "Physalospora malorum" OR "Phytomyza heringiana" OR "Phytophthora cactorum" OR "Phytophthora cactorum" OR "Phytophthora cactorum" OR "Phytophthora cambivora" OR "Phytophthora cambivora" OR "Phytophthora cryptogea" OR "Phytophthora cryptogea" OR "Phytophthora drechsleri" OR "Phytophthora drechsleri" OR "Phytophthora fragariae" OR "Phytophthora gonapodyides" OR "Phytophthora megasperma" OR "Phytophthora megasperma" OR "Phytophthora megasperma var. megasperma" OR "Phytophthora plurivora" OR "Phytophthora rosacearum" OR "Phytophthora sp." OR "Phytophthora syringae" |

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| | OR "Phytophthora syringae" OR "Phytoplasma aurantifolia" OR "Phytoplasma mali" OR "Phytoplasma mali" OR "Phytoplasma mali" OR "Phytoplasma pruni" OR "Phytoplasma pyri" OR "Planococcus citri" OR "Planotortrix excessana" OR "Platynota flavedana" OR "Platynota idaeusalis" OR "Platynota stultana" OR "Pleochaeta mali" OR "Pleomassaria mali" OR "Pleospora herbarum" OR "Pleospora herbarum" OR "Pleospora mali" OR "Pleospora scrophulariae" OR "Pleospora sp." OR "Plesiocoris rugicollis" OR "Pleurophoma cava" OR "Pleurotus sp." OR "Plocamaphis gyirongensis" OR "Plum pox potyvirus" OR "Poa annua" OR "Podosphaera leucotricha" OR "Podosphaera leucotricha" OR "Polygonum aviculare" OR "Polyopeus pomi" OR "Polyphylla fullo" OR "Polyporus badius" OR "Polyporus ciliatus" OR "Polyporus leptocephalus" OR "Popillia japonica" OR "Popillia japonica" OR "Poria ferruginosa" OR "Pratylenchus loosi" OR "Pratylenchus neglectus" OR "Pratylenchus neglectus" OR "Pratylenchus penetrans" OR "Pratylenchus penetrans" OR "Pratylenchus scribneri" OR "Pratylenchus thornei" OR "Pratylenchus vulnus" OR "Prociphilus caryae ssp. Fitchii" OR "Prociphilus kuwanai" OR "Prociphilus oriens" OR "Prociphilus pini" OR "Prociphilus sasakii" OR "Prodiplosis longifila" OR "Proeulia auraria" OR "Proeulia auraria" OR "Proeulia chrysopteris" OR "Proeulia chrysopteris" OR "Prunus necrotic ringspot virus" OR "Psallus ambiguus" OR "Pseudexentera mali" OR "Pseudocamarosporium sp." OR "Pseudocercospora mali" OR "Pseudocercospora sp." OR "Pseudocercosporella sp." OR "Pseudococcus calceolariae" OR "Pseudococcus calceolariae" OR "Pseudococcus comstocki" OR "Pseudococcus comstocki" OR "Pseudococcus comstocki" OR "Pseudococcus longispinus" OR "Pseudococcus maritimus" OR "Pseudococcus viburni" OR "Pseudomonas cichorii" OR "Pseudomonas fluorescens" OR "Pseudomonas syringae" OR "Pseudomonas syringae pv. papulans" OR "Pseudomonas syringae pv. syringae" OR "Pseudomonas viridiflava" OR "Pseudoveronaea ellipsoidea" OR "Pseudoveronaea obclavata" OR "Psylla melanoneura" OR "Pterochloroides persicae" OR "Pterochloroides persicae" OR "Ptycholoma lecheanum" OR "Pycnoporus cinnabarinus" OR "Pyrenochaeta furfuracea" OR "Pyrolachnus pyri" OR "Pythium abappressorium" OR "Pythium arrhenomanes" OR "Pythium debaryanum" OR "Pythium echinulatum" OR "Pythium irregulare" OR "Pythium paroecandrum" OR "Pythium rostratum" OR "Pythium sp." OR "Pythium ultimum" OR "Pythium ultimum" OR "Pythium vexans" OR "Ramichloridium apiculatum" OR "Ramichloridium luteum" OR "Ramichloridium sp." OR "Ramularia eucalypti" OR "Ramularia mali" OR "Ramularia sp." OR "Recurvaria nanella" OR "Retithrips syriacus" OR "Rhagoletis pomonella" OR "Rhagoletis pomonella" OR "Rhagoletis pomonella" OR "Rhagoletis tabellaria" OR "Rhizobium radiobacter" OR "Rhizobium rhizogenes" OR "Rhizoctonia solani" OR "Rhizopus sp." OR "Rhizopus stolonifer" OR "Rhizopus stolonifer" OR "Rhopalosiphum insertum" OR "Rhopalosiphum oxyacanthae" OR "Rhopalosiphum padi" OR "Rhopobota unipunctana" OR "Ricania speculum" OR "Richardia brasiliensis" OR "Rosellinia necatrix" OR "Rosellinia necatrix" OR "Rosellinia sp." OR "Rubus ellipticus" OR "Saperda candida" OR "Sarcodontia crocea" OR "Sarocladium liquanensis" OR "Sarocladium mali" OR "Saturnia pavonia" OR "Saturnia pyri" OR "Schizoneurella indica" OR "Schizophyllum alneum" OR "Schizophyllum commune" OR "Schizotetranychus smirnovi" OR "Schizothyrium pomi" OR "Schizothyrium pomi" OR "Scleroramularia abundans" OR "Sclerotinia fruticola" OR "Sclerotinia sclerotiorum" OR "Sclerotinia sclerotiorum" OR "Sclerotium delphinii" OR "Sclerotium rolfsii" OR "Sclerotium rolfsii var. delphinii" OR "Scolytus amygdali" OR "Scolytus mali" OR "Scolytus rugulosus" OR "Scutellospora pellucida" OR "Senecio vulgaris" OR "Septocylindrium aderholdii" OR "Septocylindrium radicola" OR "Septoria sp." OR "Solanum carolinense" OR "Spencermartinsia plurivora" OR "Sphaeria microtheca" OR "Sphaeropsis mali" OR "Sphaeropsis malorum" OR "Sphaeropsis pyriputrescens" OR "Sphaeropsis sapinea" OR "Sphaerotheca pannosa" OR "Sphinx perelegans" OR "Spilocaea pomi" OR "Spilonota ocellana" OR "Spodoptera eridania" OR "Spodoptera frugiperda" OR "Spodoptera littoralis" OR "Spodoptera litura" OR "Sporidesmajora pennsylvaniensis" OR "Sporidesmium asperum" OR "Sporidesmium sp." OR "Sporormiella sp." OR "Stellaria media" OR "Stemphylium vesicarium" OR "Stereum hirsutum" OR "Stigmella malella" OR "Stigmina carpophila" OR "Stomiopeltis sp." OR "Strelitziana mali" OR "Strickeria kochii" OR "Strickeria obducens" OR "Swammerdamia pyrella" OR "Sybren sp." OR "Synanthedon hector" OR "Synanthedon myopaeformis" OR "Synanthedon scitula" OR "Syndemis musculana" OR "Tapinoma nigerrimum" OR "Taraxacum officinale complex" OR "Teichospora cruentula" OR "Teichospora seminuda" OR "Tetranychus arabicus" OR "Tetranychus canadensis "OR "Tetranychus cinnabarinus" OR "Tetranychus desertorum" OR "Tetranychus frater" OR "Tetranychus kanzawai" OR "Tetranychus kanzawai" OR "Tetranychus lambi" OR "Tetranychus ludeni" OR "Tetranychus mcdanieli" OR "Tetranychus mcdanieli" OR "Tetranychus mexicanus "OR "Tetranychus neocaledonicus" OR "Tetranychus pacificus" OR "Tetranychus schoenei" OR "Tetranychus turkestani "OR "Tetranychus urticae" OR "Tetranychus urticae" OR "Thelonectria lucida" OR "Thielavia sp." OR "Thrips hawaiiensis" OR "Thrips imaginis" OR "Thrips imaginis" |

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| | OR "Tilletiopsis pallescens" OR "Tischeria malifoliella" OR "Tobacco mosaic virus" OR "Tobacco necrosis virus" OR "Tobacco ringspot virus" OR "Tomato ringspot virus" OR "Tomato ringspot virus" OR "Torula herbarum" OR "Trametes hispida" OR "Trametes sp." OR "Trametes versicolor" OR "Trematosphaeria communis" OR "Trichoderma harzianum" OR "Trichoderma sp." OR "Trichodorus" OR "Trichodorus viruliferus" OR "Trichodorus viruliferus" OR "Trichoferus campestris" OR "Trichoferus campestris" OR "Trichoseptoria fructigena" OR "Trichothecium roseum" OR "Trichothecium roseum" OR "Tripospermum acerinum" OR "Tripospermum camelopardus" OR "Tripospermum myrti" OR "Tropinota hirta" OR "Truncatella angustata" OR "Truncatella angustata" OR "Tryblidiella rufula" OR "Trypodendron signatum" OR "Tubercularia vulgaris" OR "Turanoclytus namanganensis" OR "Turanoclytus namanganensis" OR "Typhlocyba pomaria" OR "Typhlodromus khosrovensis" OR "Urophorus humeralis" OR "Uwebraunia commune" OR "Uwebraunia dekkeri" OR "Valsa ambiens" OR "Valsa ceratosperma" OR "Valsa ceratosperma" OR "Valsa ceratosperma" OR "Valsa cincta" OR "Valsa leucostoma" OR "Valsa leucostoma" OR "Valsa mali" OR "Valsa mali" OR "Valsa mali" OR "Valsa mali var. mali" OR "Valsa mali var. pyri" OR "Valsa malicola" OR "Valsa malicola" OR "Valsa nivea" OR "Valsa persoonii" OR "Valsaria insitiva" OR "Valsella melastoma" OR "Venturia asperata" OR "Venturia asperata" OR "Venturia inaequalis" OR "Venturia inaequalis" OR "Venturia pyrina" OR "Verticillium albo-atrum" OR "Verticillium dahliae" OR "Watabura nishiyae" OR "Xestia c-nigrum" OR "Xiphinema americanum" OR "Xiphinema index" OR "Xiphinema rivesi" OR "Xylaria sp." OR "Xyleborinus saxesenii" OR "Xyleborus dispar" OR "Xylosandrus crassiusculus" OR "Xylosandrus germanus" OR "Xylotrechus namanganensis" OR "Yponomeuta malinellus" OR "Zasmidium angulare" OR "Zeuzera coffeae" OR "Zeuzera pyrina" OR "Zygophiala cryptogama" OR "Zygophiala cylindrica" OR "Zygophiala emperorae" OR "Zygophiala qianensis" OR "Zygophiala sp." OR "Zygophiala tardicrescens" OR "Zygophiala wisconsinensis") |

## Appendix C – Excel file with the pest list of Malus domestica

Excel file with all EU and non-EU regulated pests.

https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2020.6109#support-information-section

# Appendix D – List of pests that can potentially cause an effect not further assessed

**Table D.1:** List of pests which can potentially cause an impact not further assessed

| Group | Pest species of Malus domestica | Taxonomic information | Reasoning for inclusion and uncertainties |
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| VIR | *Tomato Ringspot Virus* | *Riboviria, Secoviridae* | The currently available evidence confirms the absence of these two species in the Serbian territory and hence, provides no reason to select these species for further evaluation in this opinion. The status of these two viruses on the EPPO region is uncertain |
| VIR | *Tobacco Ringspot Virus* | *Riboviria, Secoviridae* | |