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Commodity risk assessment of grafted plants of *Malus domestica* from Moldova

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Abstract

The European Commission requested the EFSA Panel on Plant Health to prepare and deliver risk assessments for commodities listed in Commission Implementing Regulation (EU) 2018/2019 as 'High risk plants, plant products and other objects'. This Scientific Opinion covers plant health risks posed by defoliated and in dormant phase, grafted bare rooted plants for planting of *Malus domestica* imported from Moldova, taking into account the available scientific information, including the technical information provided by the applicant country. A list of 1,118 pests potentially associated with the commodity species was compiled. The relevance of these pests was assessed following defined criteria and based on evidence. The EU-quarantine pest *Xiphinema rivesi* non-EU populations fulfilled these criteria and was selected for further evaluation. For this pest, the risk mitigation measures proposed in the technical dossier from Moldova were evaluated taking into account the possible limiting factors. For this pest, an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on it, including uncertainties associated with the assessment. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,991 and 10,000 plants per 10,000 would be free of *X. rivesi*.

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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) 2016/2031¹, on the protective measures against pests of plants, has been applied from 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 in Regulation (EU) 2018/2019². 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 178/2002³, 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 listed in the relevant Implementing Act 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 Moldova taking into account the available scientific information, including the technical dossier provided by Moldova.

1.2. Interpretation of the Terms of Reference

The EFSA Panel on Plant Health (hereafter referred to as 'the Panel') was requested to conduct a commodity risk assessment of *M. domestica* from Moldova following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019a).

The EU quarantine pests that are regulated as a group in the Commission Implementing Regulation (EU) 2019/2072 were considered and evaluated separately at species level.

Annex II of Implementing Regulation (EU) 2019/2072 lists certain pests as non-European populations or isolates or species. These pests are considered regulated quarantine pests. Consequently, the respective European populations, or isolates, or species are non-regulated pests.

Annex VII of the same Regulation, in certain cases (e.g. point 32) makes reference to the following countries that are excluded from the obligation to comply with specific import requirements for those non-European populations, or isolates, or species: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova,

¹ Regulation (EU) 2016/2031 of the European Parliament and 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.

Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug), San Marino, Serbia, Switzerland, Turkey, Ukraine and United Kingdom (except Northern Ireland⁴). Those countries are historically linked to the reference to 'non-European countries' existing in the previous legal framework, Directive 2000/29/EC.

Consequently, for those countries,

- i) any pests identified, which are listed as non-European species in Annex II of Implementing Regulation (EU) 2019/2072 should be investigated as any other non-regulated pest.
- ii) any pest found in a European country that belongs to the same denomination as the pests listed as non-European populations or isolates in Annex II of Implementing Regulation (EU) 2019/2072, should be considered as European populations or isolates and should not be considered in the assessment of those countries.

Pests listed as 'Regulated Non-Quarantine Pest (RNQP)' in Annex IV of the Commission Implementing Regulation (EU) 2019/2072, and deregulated pests (i.e. pest which were listed as quarantine pests in the Council Directive 2000/29/EC and were deregulated by Commission Implementing Regulation (EU) 2019/2072) were not considered for further evaluation.

In its evaluation, the Panel:

- Checked whether the information provided by the applicant (Plant Protection Department of the National Food Safety Agency, ANSA) in the technical dossier (hereafter referred to as 'the Dossier') was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested to the applicant.
- Selected the relevant union EU-regulated quarantine pests and protected zone quarantine pests [as specified in Commission Implementing Regulation (EU) 2019/2072⁵, hereafter referred to as 'EU quarantine pests'] and other relevant pests present in Moldova and associated with the commodity.
- Assessed whether or not the applicant country implements specific measures for Union quarantine pests for which specific measures are in place for the import of the commodity from the specific country in the relevant legislative texts for emergency measures (https://ec.europa.eu/food/plant/plant_health_biosecurity/legislation/emergency_measures_en); the assessment was restricted to whether or not the applicant country applies those measures. The effectiveness of those measures was not assessed.
- Assessed whether or not the applicant country implements the special requirements specified in Annex VII (points 1–101) of the Commission Implementing Regulation (EU) 2019/2072 targeting Union quarantine pests for the commodity in question from the specific country.
- Assessed the effectiveness of the measures described in the dossier for those Union quarantine pests for which no specific measures are in place for the import of the commodity from the specific applicant country and other relevant pests present in applicant country and associated with the commodity.

Risk management decisions are not within EFSA's remit. Therefore, the Panel provided a rating based on expert judgement regarding the likelihood of pest freedom for each relevant pest given the risk mitigation measures implemented by Moldova.

⁴ In accordance with the Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, and in particular Article 5(4) of the Protocol on Ireland/Northern Ireland in conjunction with Annex 2 to that Protocol, for the purposes of this Annex, references to Member States include the United Kingdom in respect of Northern Ireland.

⁵ 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.

2. Data and methodologies

2.1. Data provided by Moldova

The Panel considered all the data and information (hereafter called 'the Dossier') provided by ANSA of Moldova in 22/07/2020, and the additional information provided on 13/05/2021, after EFSA's request. The Dossier is managed by EFSA.

The structure and overview of the Dossier is shown in Table 1. The number of the relevant section is indicated in the opinion when referring to a specific part of the Dossier.

Table 1: Structure and overview of the Dossier

Dossier section	Overview of contents	Filename
1.	Dossier with description of the commodities and risk reduction options	Annex 3 (English).pdf
2.	References and sources of information used by Moldova to prepare the dossier	Annex 4.pdf
3.	Additional information provided by ANSA after EFSA's request for clarification	ANSA answers.en Final. Docx
4.	Additional information on <i>Xiphinema rivesi</i> provided by ANSA after EFSA's request for clarification	To Mr.Kriz - Additional info (ANSA from the RM).pdf

The data and supporting information provided by the Moldova formed the basis of the commodity risk assessment.

Table 2 shows the main data sources used by the Moldova to compile the Dossier (details on literature searches can be found in the Dossier Section 2):

Table 2: Database sources used in the literature searches by Moldova

Acronym/ short title	Database name and service provider	URL of database	Justification for choosing database
Wikipedia		https://pomicol.wordpress.com	Information on certification on plant material
		https://www.weatheronline.co.uk/reports/climate/Moldova.htm	Database with climatic data
		https://en.wikipedia.org/wiki/Codlinamoth	Wikipedia entry for a pest
		https://www.aqroAtlas.ru/ru/content/pests/Quadrastpidiotusperniciosus/index.html	Pest information
		https://wikivisualv.com/wiki/Lepidosaphesulmi	Wikipedia entry for a pest
EPPO	EPPO database	https://en.wikipedia.org/wiki/Archipsrosana	Wikipedia entry for a pest
		https://gd.eppo.int	Database on pest-specific information collected and updated by the EPPO Secretariat
		http://www.pesticide.md/registru-de-stat/	Phytosanitary products registered in Moldova

2.2. Literature searches performed by EFSA

Literature searches in different databases were undertaken by EFSA to complete a list of pests potentially associated with *Malus domestica*. The searches were run between 24 January 2021 and 22 April 2021. No language, date or document type restrictions were applied in the search strategy.

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.

As for Web of Science, the literature search was performed using a specific, ad hoc established search string (see Appendix B). The string was run in 'All Databases' with no range limits for time or language filters. This is further explained in Section 2.3.2.

Table 3: Databases used by EFSA for the compilation of the pest list associated with *Malus domestica*

Database	Platform/Link
Aphids on World Plants	https://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
Database of Insects and their Food Plants	https://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/
EUROPHYT	https://webgate.ec.europa.eu/europhyt/
Leaf-miners	https://www.leafmines.co.uk/html/plants.htm
Nemaplex	https://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx
Plant Viruses Online	https://bio-mirror.im.ac.cn/mirrors/pvo/vide/famindex.htm
Scalenet	https://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php
USDA ARS Fungal Database	https://nt.ars-grin.gov/fungalatabases/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
World Agroforestry	https://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749
GBIF	https://www.gbif.org/
Fauna Europaea	https://fauna-eu.org/
EFSA List of Non-EU viruses and viroids of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L..	https://www.efsa.europa.eu/it/efsajournal/pub/5501

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 data sheets in Appendix A) and the relevant literature and legislation (e.g. Regulation (EU) 2016/2031; Commission Implementing Regulations (EU) 2018/2019; (EU) 2018/2018 and (EU) 2019/2072) was taken into account.

2.3. Methodology

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, 2019a).

In the first step, pests potentially associated with the commodity in the country of origin (EU-quarantine pests and other pests) that may require risk mitigation measures are identified. The EU non-quarantine pests not known to occur in the EU are selected based on evidence of their potential impact in the EU. After the first step, all the relevant pests that may need risk mitigation measures are identified.

Based on the assessment of the information provided in the dossier, the current pests present in Moldova and in the EU and the type of commodity, one pest species was retained for further evaluation.

In a second step, the general risk mitigation measures put in place in Moldova and described in the dossier were listed, evaluated and if necessary, the efficacy or compliance with EU was assessed.

2.3.1. Commodity data

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

2.3.2. Identification of pests potentially associated with the commodity

To evaluate the pest risk associated with the importation of *M. domestica* from Moldova, a pest list was compiled. The pest list is a compilation of all identified plant pests associated with *M. domestica* based on information provided in the Dossier Section 1–3 and on searches performed by the Panel.

The scientific names of the host plants (i.e. *M. domestica*) were used when searching in the EPPO Global database and CABI Crop Protection Compendium.

EUROPHYT was consulted by searching for the interceptions associated with commodities imported from Moldova from 1994 to May 2020 and TRACES for interceptions from May 2020 to present.

The search strategy used for 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 the pests already retrieved using the other databases were removed from the search terms in order to be able to reduce the number of records to be screened.

The established search string is detailed in Appendix B and was run on 12 April 2021.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *M. domestica* were included in the pest list. The pest list was eventually further compiled with other relevant information (e.g. EPPO code per pest, taxonomic information, categorisation, distribution) useful for the selection of the pests relevant for the purposes of this opinion.

The compiled pest list (see Microsoft Excel® in Appendix B) includes all identified pests that use *M. domestica* as a host. The evaluation of the compiled pest list was done in two steps: first, the relevance of the EU-quarantine pests was evaluated (Section 4.1); second, the relevance of any other plant pest was evaluated (Section 4.2).

2.3.3. Listing and evaluation of risk mitigation measures

All implemented risk mitigation measures were listed and evaluated. When evaluating the likelihood of pest freedom at origin, the following types of potential infection sources for *Malus domestica* in nurseries 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 communicated by the ANSA, Moldova) were evaluated according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).

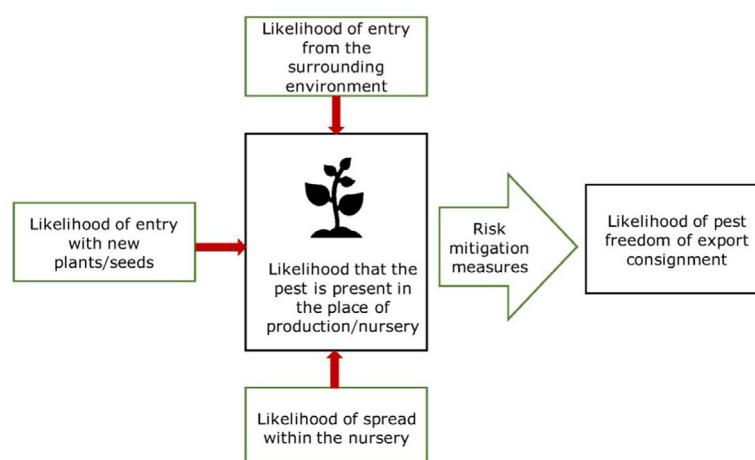


Figure 1: Conceptual framework to assess likelihood that plants are exported free from relevant pests. Source: EFSA PLH Panel (2019b)

2.3.4. Expert Knowledge Elicitation

To estimate the pest freedom of the commodities, an Expert Knowledge Elicitation (EKE) was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific question for EKE was defined as follows: 'Taking into account (i) the risk mitigation measures listed in the Dossier, and (ii) other relevant information, how many of 10,000 bundles of *Malus domestica* grafted dormant bare rooted plants will be infested with the relevant pest/pathogen when arriving in the EU?'. The risk assessment uses bundles of 10 bare-rooted plants as the most suitable unit. The following reasoning is given:

- i) There is no quantitative information available regarding clustering of plants during production;
- ii) Plants are grouped in bundles of 10 after sorting;
- iii) For the pests under consideration, a cross contamination during transport is possible;

The uncertainties associated with the EKE 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 5th percentile of the uncertainty distribution reflects the opinion that pest freedom is with 95% certainty above this limit.

Based on the pests known to occur in Moldova, the type of commodity, the description of the risk mitigation measures described in the dossier and the criteria for the selection of regulated and non-regulated pests, only one pest was retained for further evaluation in Moldova.

3. Commodity data

3.1. Description of the commodity

The commodities to be imported are grafted bare-rooted plants of *Malus domestica* (common name: apple tree; family: Rosaceae). The dossier refers to six rootstocks (i.e. M4, M7, M9, M26, M106 and BUD 62-396) that can be grafted with 79 different varieties (dossier 1 for details). The material for export is rooted plants, 1- to 3-year-old after grafting. Rootstocks can be 1- or 2-year-old when grafted. Material 1-year-old after grafting is 110–130 cm high including the crown. The diameter of the material was not specified. The material for export is either certified or regular i.e. equivalent to *Conformitas Agrarias Communitatis*. The material is exported defoliated and in a dormant phase.

The assessment performed assumes that the characteristics of the commodity are as described above.

According to ISPM 36 (FAO, 2019), the commodity can be classified as bare-rooted plants for planting.

3.2. Description of the production areas

The production nurseries in Moldova are spread throughout the country; however, most of the production is concentrated in the Northern and Central parts of the country, although there is also commercial production in the South (based on the production figures from 2014 to 2018 provided in the dossier).

The climate of Moldova is classified mainly as Dfb (cold, no dry season, warm summer) and some areas as Dfa (cold, no dry season, hot summer) and Bsk (Arid, steppe, cold), according to Kottek et al. (2006).

3.3. Production and handling processes

3.3.1. Growing conditions

The plant material intended for export is cultivated outdoors in soil but in registered production sites/nurseries. All the nurseries are authorised in the manner established by the provision of law 68 of 5/4/2013 (Dossier section 3.0). The soil of production sites is checked for the presence of virus-transmitting nematodes before planting and if necessary treated or discarded for production if nematode densities/presence cannot be managed (threshold for intervention was not mentioned in the dossier). Additional details regarding soil monitoring for nematodes and soil treatments were not specified. The typical cultivation cycle takes at least 2 years, which includes 1 year of growth after grafting, yielding a plant classified as 1 year old. Rootstocks are produced in stool-beds and grafting

takes place in the first or second year. Details were not provided but based on the information of the dossier (section 3) it is assumed that after this first year, grafted rootstocks also remain in the same field and are managed as in the first year.

3.3.2. Source of planting material

According to the dossier, planting material falling within the phytosanitary categories 'pre-basic', 'basic' and 'certified' is classified as virus-free, i.e. material free of viruses, phytoplasmas or other diseases and it is tested using international standards (not specified in the dossier). Regular material is not analysed as being virus-free.

Nurseries producing regular planting material usually have mother plantations for rootstocks and scions that have not been tested for viruses (dossier section 1).

Most of the nurseries for production in Moldova cultivate grafted trees that fall under regular category, and only a few producers (not specified in the dossier) are able to produce material in the certified category.

3.3.3. Production cycle

The interpretation of the information provided in the dossier suggests that 1- or 2-year-old rootstocks are grafted with scion varieties and grown for additional 1–3 years.

3.3.4. Pest monitoring during production

The cultivation cycle for certified and regular material is the same; in both cases, there is a field inspection prior to grafting. However, the 'regular' material category can originate from mother plantations (or solitary mother plants) that have been virus-tested or retested or planting material originating from untested mother plantations (or mother plants).

Mother plantations for rootstocks and scions are inspected in the field at least three times a year. After grafting, production fields are inspected twice a year.

Field inspectors also visually inspect the plant material after harvest.

3.3.5. Post-harvest processes and export procedure

Plants are uprooted manually. Trees are lifted with a VPN-2 suspended plough. The VPN-2 plough is fitted with a vibrator that loosens the soil from the roots. After cutting the roots with the plough at a depth of 30–35 cm, the trees are lifted mechanically between end of October and beginning of November.

After uprooting, plants are manually or chemically defoliated (i.e. chemical defoliant not specified on the dossier).

Roots are washed with water before export; however, no details are provided on the procedure. Uprooted plants may be treated with pesticides if necessary; however, details on the procedure are not specified in the dossier.

Material for export may be stored outside in the field or protected in a warehouse (in a controlled atmosphere at temperatures of 1–20°C and air humidity of 95–97%). Material for export is covered with a water-proof canvass to prevent exposure to the environment. Bareroots may be also covered to protect them from the environment during storage.

Plants for export are bundled in groups of 10 and then packaged for export and labelled with an indication of the rootstock and the grafted varieties.

4. Identification of pests potentially associated with the commodity

The search for potential pests associated with *M. domestica* rendered 1,118 species (see Microsoft Excel® file in Appendix C).

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) is based on assessments concluding that the pests can enter, establish, spread and have potential impact in the EU.

Forty-two EU-quarantine species that are reported to use *M. domestica* as a host plant were evaluated (Table 4) for their relevance of being included in this opinion.

The relevance of an EU-quarantine pest for this opinion was based on evidence that:

- a) the pest is present in Moldova;
- 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.

Of these 42 EU quarantine pests evaluated, one nematode, *Xiphinema rivesi*, was found to be present in Moldova based on peer-reviewed publications (Poiras, 2012; Poiras et al., 2013, 2014, 2015), although the NPPO did not find this nematode during official surveys carried out between 2019 and 2021 (Dossier section 3, letter dated 14 December 2021). Since there was uncertainty about the presence of this pest in Moldova, it was selected for further evaluation.

Table 4: Overview of the evaluation of the EU-quarantine pest species known to use *Malus domestica* as a host plant for their relevance for this opinion

No.	Pest name according to EU legislation ^(a)	EPPO code	Group	Pest present in Moldova	<i>Malus domestica</i> confirmed as a host (reference)	Pest relevant for the opinion
1	<i>Acleris minuta</i>	ACLRMI	INS	No	Yes (CABI, online)	No
2	<i>Anastrepha fraterculus</i>	ANSTFR	INS	No	Yes (CABI, online)	No
3	<i>Anastrepha ludens</i>	ANSTLU	INS	No	Yes (CABI, online)	No
4	<i>Anastrepha suspensa</i>	ANSTSU	INS	No	Yes (CABI, online)	No
5	<i>Anoplophora chinensis</i>	ANOLCN	INS	No	Yes (CABI, online)	No
6	<i>Anoplophora glabripennis</i>	ANOLGL	INS	No	Yes (EPPO, online)	No
7	<i>Anthonomus quadrigibbus</i>	TACYQU	INS	No	Yes (EPPO, online)	No
8	<i>Apple fruit crinkle viroid</i>	AFCVDO	VIR	No	Yes (EPPO, online)	No
9	<i>Apple necrotic mosaic virus</i>	APNMVO	VIR	No	Yes (EPPO, online)	No
10	<i>Apriona cinerea</i>	APRICI	INS	No	Yes (EPPO, online)	No
11	<i>Apriona germari</i>	APRIGE	INS	No	Yes (EPPO, online)	No
12	<i>Bactrocera dorsalis</i>	DACUDO	INS	No	Yes (CABI, online)	No
13	<i>Bactrocera tryoni</i>	DACUTR	INS	No	Yes (CABI, online)	No
14	<i>Bactrocera zonata</i>	DACUZO	INS	No	Yes (EPPO, online)	No
15	<i>Bactrocera cucurbitae</i>	DACUCU	INS	No	WOS Follet et al 2019	No
16	<i>Botryosphaeria kuwatsukai</i>	PHYOPI	FUN	No	Yes (EPPO, online)	No
17	<i>Candidatus Phytoplasma aurantifolia</i>	PHYPAF	BAC	No	Yes (CABI, online)	No
18	<i>Carposina sasakii</i>	CARSSA	INS	No	Yes (CABI, online)	No
19	<i>Cherry rasp leaf virus</i>	CRLV00	VIR	No	Yes (EPPO, online)	No
20	<i>Choristoneura rosaceana</i>	CHONRO	INS	No	Yes (EPPO, online)	No
21	<i>Conotrachelus nenuphar</i>	CONHNE	INS	No	Yes (EPPO, online)	No
22	<i>Erwinia amylovora</i>	ERWIAM	BAC	No	Yes (EPPO, online)	No
23	<i>Grapholita inopinata</i>	CYDIIN	INS	No	Yes (EPPO, online)	No
24	<i>Grapholita packardii</i>	LASPPA	INS	No	Yes (EPPO, online)	No
25	<i>Grapholita prunivora</i>	LASPPR	INS	No	Yes (EPPO, online)	No
26	<i>Gymnosporangium juniperi</i>	GYMNJU	FUN	No	CABI CPC, online	No
27	<i>Lopholeucaspis japonica</i>	LOPLIA	INS	No	Yes (EPPO, online)	No
28	<i>Oemona hirta</i>	OEMOHI	INS	No	Yes (EPPO, online)	No
29	<i>Phyllosticta solitaria</i>	PHYSSL	FUN	No	Yes (PC https://doi.org/10.2903/j.efsa.2018.5510)	No

No.	Pest name according to EU legislation ^(a)	EPPO code	Group	Pest present in Moldova	<i>Malus domestica</i> confirmed as a host (reference)	Pest relevant for the opinion
30	<i>Popillia japonica</i>	POPIJA	INS	No	Yes (EPPO, online)	No
31	<i>Rhagoletis pomonella</i>	RHAGPO	INS	No	Yes (EPPO, online)	No
32	<i>Saperda candida</i>	SAPECN	INS	No	Yes (EPPO, online)	No
33	<i>Spodoptera eridania</i>	PRODER	INS	No	Yes (CABI, online)	No
34	<i>Spodoptera frugiperda</i>	LAPHFR	INS	No	Yes (CABI, online)	No
35	<i>Spodoptera litura</i>	PRODLI	INS	No	Yes (CABI, online)	No
36	<i>Temperate fruit decay-associated virus</i>	TFDAV0	VIR	No	Yes (Basso et al., 2015)	No
37	<i>Tobacco ringspot virus</i>	TRSV00	VIR	No	Yes (CABI, online)	No
38	<i>Tomato ringspot virus</i>	TORSV0	VIR	No	Yes (CABI, online)	No
39	<i>Xiphinema americanum sensu stricto</i>	XIPHAA	Nem	No	Yes (CABI, online)	No
40	<i>Xiphinema bricolense</i>	XIPHBC	Nem	No	Yes (Xu and Zhao, 2019)	No
41	<i>Xiphinema californicum</i>	XIPHCA	Nem	No	Yes (Xu and Zhao, 2019)	No
42	<i>Xiphinema rivesi</i> (non-EU populations)	XIPHRI	NEM	Uncertainties	Yes (Xu and Zhao, 2019)	Yes

(a): Commission Implementing Regulation EU 2019/2072.

4.2. Selection of other relevant pests (non-regulated in the EU) associated with the commodity

The information provided by ANSA, integrated with the search performed by EFSA, was evaluated in order to assess whether there are other potentially relevant pests of *M. domestica* present in this country of export. For these potential pests that are non-regulated in the EU, pest risk assessment information on the probability of entry, establishment, spread and impact is usually lacking. Therefore, these pests were also evaluated to determine their relevance for this opinion based on evidence that:

- a) the pest is present in Moldova;
- b) the pest is (i) absent or (ii) has a limited distribution in the EU;
- c) *M. domestica* is a host of the pest;
- d) one or more life stages of the pest can be associated with the specified commodity;
- e) the pest may have an impact in the EU.

Pests that fulfilled the above listed criteria were selected for further evaluation.

Based on the information collected, 1,118 potential pests known to be associated with *M. domestica* were evaluated for their relevance to this opinion. Species were excluded from further evaluation when at least one of the conditions listed above (a-e) was not met. Details can be found in Appendix C (Microsoft Excel® file). Of the evaluated pests, one pest *X. rivesi* was selected for further evaluation because it met all the selection criteria. More information on *X. rivesi* can be found in the pest data sheet (Appendix A).

4.3. Overview of interceptions

Data on interception of harmful organisms from the export country on plants of *M. domestica* (or other hosts) can provide information about the presence of pests on this commodity despite the current measures taken. According to EUROPHYT online 14/3/2022 and TRACES online (accessed on 14/3/2022), there were no interceptions of plants for planting of *M. domestica* from Moldova destined to the EU Member States due to the presence of harmful organisms between the years 1994 and 2021.

4.4. Summary of pests selected for further evaluation

One pest was reported to be present in Moldova, based on peer-reviewed publications, though surveys carried out by the NPPO of Moldova did not confirm it is present. Thus, the presence of this pest was considered uncertain. This nematode has the potential for association with *M. domestica* plants destined for export and is listed in Table 5. The effectiveness of the risk mitigation measures applied to the commodity was evaluated for the selected pest (*Xiphinema rivesi*).

Table 5: List of relevant pests selected for further evaluation

Number	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
1	<i>Xiphinema rivesi</i> (non-EU populations)	XIPHRI	<i>Xiphinema rivesi</i>	Dorylaimida Xiphinematidae	Nematode	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072

5. Risk mitigation measures applied in applicant country

For the selected pest (Table 5), the Panel assessed the possibility that it could be present in a *Malus domestica* nursery and assessed the probability that pest freedom of a consignment is achieved by the proposed risk mitigation measures acting on the pest under evaluation.

The information used in the evaluation of the effectiveness of the risk mitigation measures is summarised in a pest data sheet (see Appendix A).

5.1. Possibility of pest presence in the export nurseries

For the pest (Table 5), the Panel evaluated the likelihood that it could be present in a *Malus domestica* nursery by evaluating the possibility that *Malus domestica* in the export nursery is infested either by:

- introduction of the pest from the environment surrounding the nursery;
- introduction of the pest with new plants/seeds;
- spread of the pest within the nursery.

5.2. Risk mitigation measures applied in Moldova

With the information provided by ANSA (Dossier sections 1–4), the Panel summarised the risk mitigation measures (Table 6) that are implemented in the production nurseries.

Table 6: Overview of implemented risk mitigation measures for *M. domestica* plants designated for export to the EU from Moldova

Number	Risk mitigation measure	Implementation in Moldova
1	Registration of production sites	Nurseries producing material for export are registered following the Moldovan legislation
2	Certification of propagation material	Nurseries produce material under different certification schemes. Plants for planting under the certified category are virus-free and accordingly tested for the presence of virus, viroids and other pathogens.
3	Sanitation and inspection of field sites for virus-vector nematodes	Cultivation occurs in registered sites, the field sites hosting mother material is inspected prior cultivation for the presence of virus vectoring nematodes. Sanitation may be applied if nematodes are detected, but no detailed information is provided on inspections, sanitation and soil disinfection
4	Surveillance, monitoring and sampling	'Regular' material category originates from: (1) mother plantations (or solitary mother plants) that have not been virus-tested or retested; (2) mother plantations (or solitary mother plants) that have been virus-tested or retested. Mother plantations for rootstocks and scions are inspected in the field at least three times. After grafting, production fields are inspected twice a year. Field inspectors also perform a visual inspection of the plant material after harvest. Diagnosis protocols are following ISPM standards; however, no details on these were provided in the dossier.
5	Forecasting of pest and diseases incidence and warning	ANSA monitors and communicates information regarding pest outbreaks, but no specific details are provided as to how this affects production of plants for planting.
6	Application of phytosanitary products (pesticides)	Several pesticides are registered in Moldova to deal with insects, mites and fungi but details on specific target pests, application frequency and dosage were not provided. Details on application procedure are very general.
7	Field sanitation	Removal, cutting and destruction of symptomatic or infested/infected material (shoots, leaves, fruits)
8	Post-harvest treatments	Defoliation of plant material. Root washing and application of pesticides during the washing
9	Sorting and storage	Material for export is sorted, labelled and packed before export

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

For the evaluated pest, the relevant risk mitigation measures acting on it 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 data sheet provided in Appendix A.

Based on this information, an expert judgement is given for the likelihood of pest freedom taking into consideration the risk mitigation measures and their combination acting on the pest.

An overview of the evaluation of the relevant pest is given in the sections below (section 5.3.1). The outcome of the EKE regarding pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.3.2.

5.3.1. Overview of the evaluation of *Xiphinema rivesi*

Rating of the likelihood of pest freedom	Pest free with some exceptional cases (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest free	9,991 out of 10,000 bundles	9,994 out of 10,000 bundles	9,997 out of 10,000 bundles	9,998 out of 10,000 bundles	9,999 out of 10,000 bundles
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infested bundles	1 out of 10,000 bundles	2 out of 10,000 bundles	3 out of 10,000 bundles	6 out of 10,000 bundles	9 out of 10,000 bundles
Summary of the information used for the evaluation	Possibility that the pest/pathogen could enter exporting nurseries <i>Xiphinema rivesi</i> is a polyphagous, free-living ectoparasite that occurs in the soil in association with a number of plant species. It has a worldwide distribution and has been reported from several continents. The nematode transmits several economically important nepoviruses that are included in the EU and EPPO lists of quarantine organisms (TRSV, ToRSV, PRMV and CRLV). The introduction into the EU of non-EU populations of <i>X. rivesi</i> from third countries may lead to the introduction of viruses that can be transmitted by nematode species already present in the EU (e.g. <i>X. rivesi</i> EU populations). In Moldova, <i>Xiphinema rivesi</i> has been reported from several fruit crops (apple, raspberry, strawberry, currant) (Poiras, 2012; Poiras et al., 2013, 2014, 2015). So far, no TRSV, ToRSV, PRMV and CRLV and no virus transmission by <i>X. rivesi</i> have been reported in Moldova, but uncertainties exist due to lack of data from official monitoring surveys and reports of problems caused by this nematode in Moldovan apple production areas. The main pathways of this nematode are plants for planting with infested soil, contaminated water, soil and growing media as such or attached to plants, agricultural machinery, tools and shoes. This nematode can occur in the rhizosphere of host plants and infest the commodity mainly due to human activities. Measures taken against the pest/pathogen and their efficacy The relevant proposed measures are: (i) certification of propagation material, (ii) sanitation and inspection of field sites for virus-vector nematodes, (iii) surveillance, monitoring and sampling and (iv) removal of soil from roots (root washing). Interception records There are no records of interceptions from Moldova. Shortcomings of current measures/procedures Nurseries shall be inspected for the presence of virus transmitted nematodes prior to planting and, if necessary, treated or discarded for production if nematode density or presence cannot be controlled. However, details of this measures and the threshold for intervention were not provided. Pre-export root washing reduces the risk of nematode infestation in plants intended for planting but it is uncertain how precise root washing is carried out in Moldovan nurseries. Main uncertainties • Symptoms caused by <i>X. rivesi</i> can be misidentified and may be overlooked; • The detection of the presence of <i>X. rivesi</i> is difficult and depends on incidence, distribution and analysis methods. Root washing may not completely reduce the risk of nematode infestation in plants intended for planting.				

5.3.2. Outcome of Expert Knowledge Elicitation

Table 7 and Figure 2 show the outcome of the EKE regarding pest freedom after the evaluation of the proposed risk mitigation measures for the evaluated pest.

Figure 3 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the proposed risk mitigation measures for *Malus domestica* trees designated for export to the EU for *Xiphinema rivesi* – non-EU populations.

Table 7: Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against *Xiphinema rivesi* non-EU populations on *Malus domestica* plants designated for export to the EU. In panel A, the median value for the assessed level of pest freedom 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	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
1		<i>Xiphinema rivesi</i> – non-EU populations							L	MU

	Pest freedom category	Pest-free bundles out of 10,000
	Sometimes pest free	≤ 5,000
	More often than not pest free	5,000–≤ 9,000
	Frequently pest free	9,000–≤ 9,500
	Very frequently pest free	9,500–≤ 9,900
	Extremely frequently pest free	9,900–≤ 9,950
	Pest free with some exceptional cases	9,950–≤ 9,990
	Pest free with few exceptional cases	9,990–≤ 9,995
	Almost always pest free	9,995–≤ 10,000

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

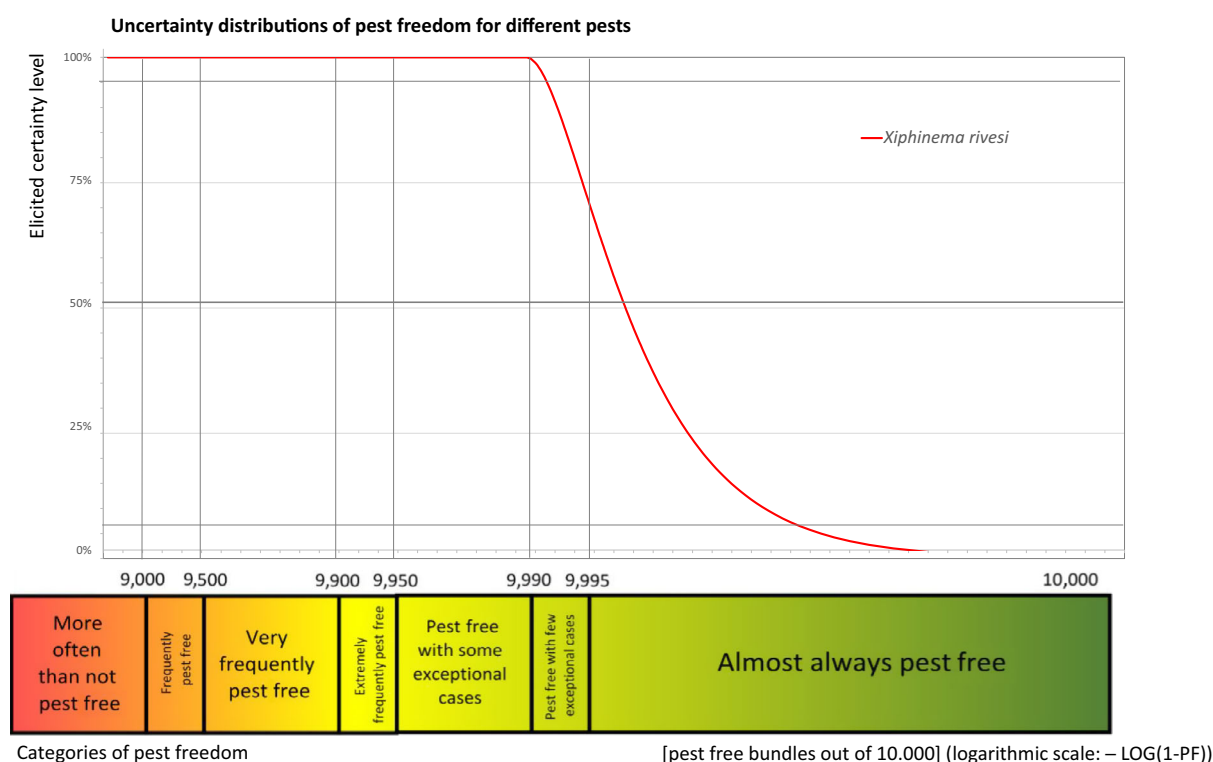


Figure 2: Elicited certainty (y-axis) of the number of pest-free *Malus domestica* bundles (x-axis; log-scaled) out of 10,000 plants designated for export to the EU from Moldova for the evaluated pest visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%). The Panel is 95% confident that 9,991 or more bundles per 10,000 will be free from *Xiphinema rivesi* – non-EU populations

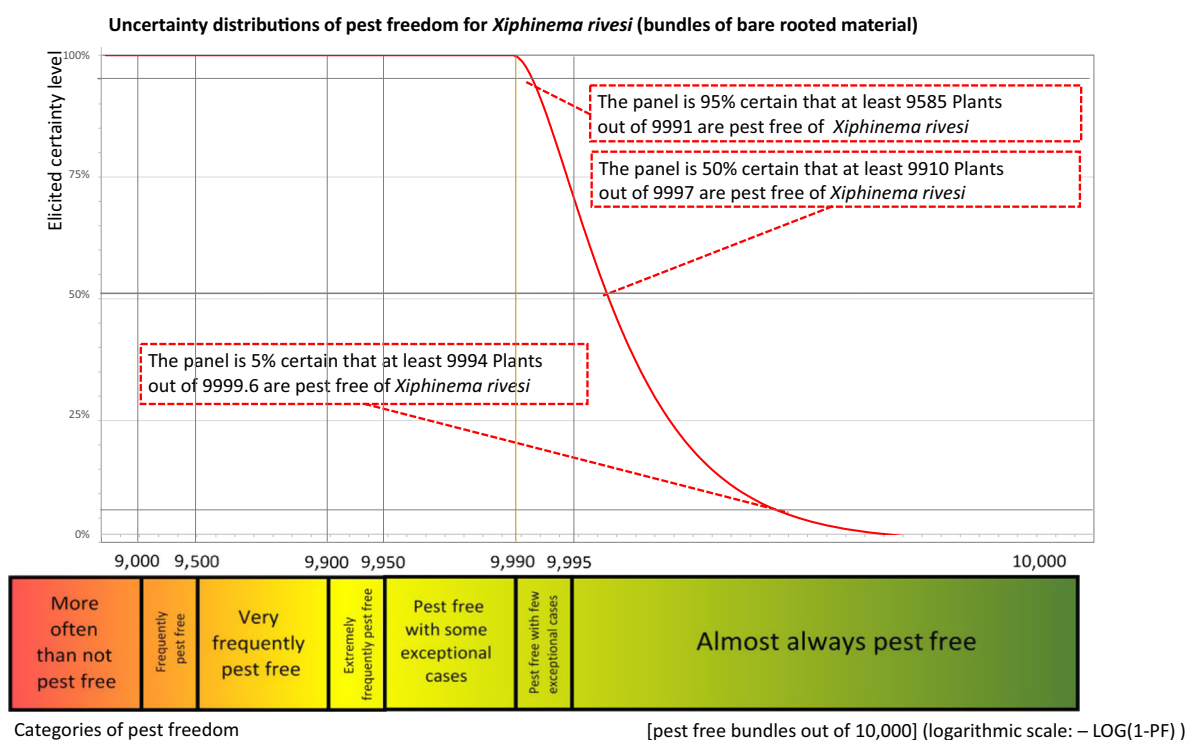


Figure 3: Explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the proposed risk mitigation measures for plants designated for export to the EU based on the example of *Xiphinema rivesi* – non-EU populations

6. Conclusions

There is one pest whose presence in Moldova is uncertain, and considered to be potentially associated with defoliated and dormant bare-rooted plants of *Malus domestica* imported from Moldova and relevant for the EU. While the official status of *X. rivesi* is 'absent', there are peer-reviewed publications that indicate that it may be present in apple production areas.

For *Xiphinema rivesi*, the likelihood of pest freedom following evaluation of current risk mitigation measures was estimated as 'Pest free with some exceptional cases' with the 90% uncertainty range reaching from 'Pest free with some exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,991 and 10,000 units per 10,000 will be free from *Xiphinema rivesi*.

References

- Basso MF, da Silva JCF, Fajardo TVM, Fontes EPB and Zerbini FM, 2015. A novel, highly divergent ssDNA virus identified in Brazil infecting apple, pear and grapevine. *Virus Research*, 210, 27–33.
- CABI (Centre for Agriculture and Bioscience International), online. CABI Crop Protection Compendium. Available online: <https://www.csbi.org/cpc/> [Accessed: 23 November 2021].
- EFSA PLH Panel (EFSA Panel on Plant Health), 2018. Guidance on quantitative pest risk assessment. *EFSA Journal* 2018;16(8):5350, 86 pp. <https://doi.org/10.2903/j.efsa.2018.5350>
- EFSA PLH Panel (EFSA Panel on Plant Health), 2019a. Guidance on commodity risk assessment for the evaluation of high risk plants dossiers. *EFSA Journal* 2019;17(4):5668, 20 pp. <https://doi.org/10.2903/j.efsa.2019.5668>
- EFSA PLH Panel (EFSA Panel on Plant Health), 2019b. Commodity risk assessment of black pine (*Pinus thunbergii* Parl.) bonsai from Japan. *EFSA Journal* 2019;17(5):5667, 184 pp. <https://doi.org/10.2903/j.efsa.2019.5668>
- EFSA Scientific Committee, 2018. Scientific Opinion on the principles and methods behind EFSA's Guidance on Uncertainty Analysis in Scientific Assessment. *EFSA Journal* 2018;16(1):5122, 235 pp. <https://doi.org/10.2903/j.efsa.2018.5122> ISSN:1831-4732
- EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: <https://www.eppo.int/> [Accessed: 23 November 2021].
- EUROPHYT, online. European Union Notification System for Plant Health Interceptions – EUROPHYT. Available online: https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm
- FAO (Food and Agriculture Organization of the United Nations), 1995. ISPM (International standards for phytosanitary measures) No 4. Requirements for the establishment of pest free areas. Available online: <https://www.ippc.int/en/publications/614/>
- FAO (Food and Agriculture Organization of the United Nations), 2017. ISPM (International standards for phytosanitary measures) No. 5. Glossary of phytosanitary terms. FAO, Rome. Available online: <https://www.ippc.int/en/publications/622/>
- FAO (Food and Agriculture Organization of the United Nations), 2019. ISPM (International standards for phytosanitary measures) No. 36, Integrated measures for plants for planting. FAO, Rome. Available online: <https://www.fao.org/3/k8114e/K8114E.pdf>
- Follett PA, Pineiro J, Sauder S, Jamieson L, Waddell B and Wall M, 2019. Host status of 'Scifresh' apples to the invasive fruit fly species *Bactrocera dorsalis*, *Zeugodacus cucurbitae*, and *Ceratitis capitata* (Diptera: Tephritidae). *Journal of Asia-Pacific Entomology*, 22, 458–470.
- Index Fungorum, online. Index fungorum. Available online: www.indexfungorum.org [Accessed: 20 March 2019].
- Kottek M, Grieser J, Beck C, Rudolf B and Rubel F, 2006. World Map of the Köppen-Geiger climate classification updated. *Meteorologische Zeitschrift*, 15, 259–263. <https://doi.org/10.1127/0941-2948/2006/0130>
- Poiras L, 2012. Species diversity and distribution of free-living and plant parasitic nematodes from order Dorylaimida (Nematoda) in different habitats of the Republic of Moldova. *Oltenia-studii Si Comunicari Stiintele Naturii*, 28, 35–42.
- Poiras L, Cerneț A, Bivol A, Poiras N and Iurcu-Străistaru E, 2014. Preliminary analysis of plant parasitic nematodes associated with strawberry and raspberry crops in the Republic of Moldova. *Oltenia-studii Si Comunicari Stiintele Naturii*, 30, 98–104.
- Poiras L, Iurcu-Străistaru E, Poiras N, Bivol A and Cerneț A, 2013. Plant parasitic and free-living nematodes of some orchards (peach, apple) in the Republic of Moldova. *Oltenia-studii Si Comunicari Stiintele Naturii*, 29, 166–171.
- Poiras L, Iurcu-Străistaru E, Poiras N, Bivol A and Cerneț A, 2015. Phytoparasitic nematode fauna of perennial fruit crops in Republic of Moldova. In: *Lucrări științifice, Univ. Agrară de Stat din Moldova*. 2015, vol. 42(2): Horticultură, viticultură și vinificație, silvicultură și grădini publice, protecția plantelor, pp. 376–382.
- TRACES, online. TRAdE Control and Expert System. Available online: <https://webgate.ec.europa.eu/tracesnt> [Accessed: 13 January 2022].
- Xu YM and Zhao ZQ, 2019. Longidoridae and Trichodoridae (Nematoda: Dorylaimida and Triplonchida). *Fauna of New Zealand*, 79.

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
PRA	Pest Risk Assessment
RNQPs	Regulated Non-Quarantine Pests

Glossary

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)
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 mitigation measures 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	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. A risk mitigation measure 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)

Appendix A – Data sheets of pests selected for further evaluation via Expert Knowledge Elicitation

A.1. *Xiphinema rivesi*

A.1.1. Organism information

Taxonomic information	Current valid scientific name: <i>Xiphinema rivesi</i> Dalmasso, 1969 Synonyms: – Name used in the EU legislation: <i>Xiphinema rivesi</i> (non-EU populations) Name used in the Dossier: Not mentioned in the dossier Order: Dorylaimida Family: Xiphinematidae
Group	Nematoda
EPPO code	XIPHRI
Regulated status	EU status: Quarantine pest (Annex II A) – <i>X. rivesi</i> (non-EU populations) Non- EU: Africa: Egypt (A1 list, 2018); Morocco (Quarantine pest; 2018) America: Brazil (A1 list, 2018); Mexico (Quarantine pest, 2018) Europe: Georgia (A1 list, 2018); Turkey (A1 list, 2016) EPPO (A2 list, 1981, 1993)
Pest status in Moldova	Officially absent; however, there is uncertainty according to the literature listed (Poiras, 2012; Poiras et al., 2013, 2014, 2015)
Pest status in the EU	Absent as non-EU populations. (EU populations of <i>X. rivesi</i> are reported in Croatia, France, Germany, Italy, Portugal, Slovenia, Spain, Slovakia) (EPPO, online; CABI online).
Host status on <i>Malus domestica</i>	In CABI – Plantwise Knowledge Bank (online) and Nemaplex (on line), apple, <i>Malus domestica</i> , is recorded as a host of <i>Xiphinema rivesi</i> .
PRA information	<i>Xiphinema rivesi</i> belongs to the <i>X. americanum</i> species complex, a group of morphologically very similar nematode species. The nematode is polyphagous, free-living ectoparasite that occurs in the soil in association with a number of plant species. The ectoparasitic feeding mode allows the nematode to move freely through its life cycle in search of a suitable host. <i>X. rivesi</i> attacks roots externally and feeds by puncturing plant cells with its odontostyle. During penetration, the nematode secretes enzymes that cause hypertrophy and thickening of the cells. The feeding process on a particular part of the plant root may take several hours to several days. During feeding, juveniles and adults can acquire and transmit viruses that can persist for several months and up to 2 years (Bitterlin and Gonsalves, 1987; EFSA, 2018). <i>X. rivesi</i> feeds on the roots of host plants causing swelling, stunting and destruction of root tips (Nemaplex, online). However, the greatest damage caused by this species is transmission of viruses. <i>X. rivesi</i> is known to transmit several economically important nepoviruses listed in the EU and EPPO lists of quarantine organisms, including tobacco ringspot virus (TRSV), tomato ringspot virus (ToRSV), peach rosette mosaic virus (PRMV) and cherry rasp leaf virus (CRLV) (EFSA, 2018). This nematode is widespread worldwide and has been reported from several continents, including Africa, Asia, Europe, North and South America and Oceania (EPPO, online). The introduction of non-EU populations of <i>X. rivesi</i> from third countries into the EU may lead to the introduction of viruses that can be transmitted by <i>X. rivesi</i> populations already present in the EU (<i>X. rivesi</i> EU populations). In Moldova, <i>X. rivesi</i> has been observed on several fruit crops (apple, grape, raspberry, strawberry, currant) (Poiras, 2012; Poiras et al., 2013, 2014, 2015), but according to Moldovan Food Safety Agency, it has not been detected in the last 3 years despite <i>Xiphinema</i> spp., including <i>X. rivesi</i>, were officially monitored.

	Apple plants for planting are produced in Moldova in registered production nurseries under different certification schemes. Production nurseries are inspected for the presence of virus-transmitted nematodes prior to planting; however, no details on the inspections are provided. If nematodes are detected, a sanitation measure can be implemented, but detailed information on sanitation measures and soil decontamination is not provided.	
Other relevant information for the assessment		
Symptoms	Main type of symptoms	Above-ground symptoms of <i>X. rivesi</i> infestation are not very clear and are manifested by a general reduction in growth, which is easily confused with other plant stresses caused by water or nutrient deficiencies. Direct damage may occur only at high population densities, indicated by characteristic depressed growth patches that correspond to the highest concentration of nematodes (CABI, online). Swelling, stunting and destroyed tips can be observed on the roots. The most commonly recognised symptoms due to this pest are those resulting from the transmission of the associated plant viruses.
	Presence of asymptomatic plants	In general, symptoms caused by <i>X. rivesi</i> on plants are inconspicuous and can be easily overlooked. <i>X. rivesi</i> may also go undetected when nematode infestation in the roots of host plants is low. The nematode may therefore not be detected by existing phytosanitary procedures and export controls, including laboratory tests.
	Confusion with other pathogens/pests	<i>X. rivesi</i> may be confused with other species in the group of <i>X. americanum sensu lato</i>. Differentiation of species from the <i>X. americanum sensu lato</i> group is based on morphological and morphometric analyses, but species differentiation is extremely difficult due to only minor differences (EFSA, 2018). Identification of <i>X. rivesi</i> is only possible for experienced nematologists. Due to the difficulties in distinguishing the species of <i>X. americanum sensu lato</i> based on their morphology, the use of molecular approaches is recommended (Brown et al., 1995; Lamberti et al., 2000, EFSA, 2018). However, there is currently no reliable molecular test for routine diagnosis. Such a molecular diagnostic method is available on the Q-Bank website but has not yet been included in the relevant IPPC and EPPO diagnostic protocols (FAO, 2016; EPPO, 2017; EFSA, 2018). It is not possible to distinguish EU populations of <i>X. rivesi</i> from non-EU populations.
Host plant range	<i>X. rivesi</i> is a highly polyphagous nematode species that has been found associated with a wide range of herbaceous and woody host plants, including citrus trees, grape, apple, peach, raspberry, walnut, oak, hackberry, alfalfa, corn, cottonwood, potato, garlic, cucumber, mango and sorghum (Nemaplex, online).	
Pathways	– Plants, plants for planting with attached soil – Soil and growing media as such from areas where the nematode occurs – Soil and growing media attached to machinery, tools, packing materials, etc.	
Surveillance information	Knowledge of the spatial distribution of this nematode, both horizontally and vertically, is essential for detection and efficient control of this pest. According to Moldovan Food Safety Agency, <i>Xiphinema</i> spp. are officially monitored; however, these nematodes, including <i>X. rivesi</i>, have not been detected between 2019 and 2021. Sites for production in Moldova are inspected for the presence of virus-transmitting nematodes prior to planting and, if necessary, treated or removed from the production process if the nematode density or presence cannot be controlled (threshold for intervention was not mentioned in the dossier). Details of this measure were not provided.	

A.1.2. Possibility of pest presence in the nursery

A.1.2.1. Possibility of entry from the surrounding environment

When *X. rivesi* is present in the environment, it can enter *Malus* production sites with soil attached to planting materials, agricultural machinery, tools, shoes and run-off water.

X. rivesi can actively move from plant to plant, but only over short (< 1 m) distances. Transmission from the surrounding area to the production field is mainly passive through the spread of contaminated soil (attached to roots of planting material, agricultural machinery, tools, shoes,) and run-off rain water.

Uncertainties

According to Poiras (2012) and Poiras et al. (2013, 2014, 2015), *Xiphinema rivesi* occurs in Moldova, but there is no information on its distribution and abundance in the *Malus domestica* growing area. According to the Moldovan NPPO, the pest has not been found during the official monitoring activities.

The limited data from official monitoring surveys and reports on problems caused by this nematode in apple production in Moldova lead to uncertainties. This is related to the fact that the nematode is either absent or has not been detected in apple orchards.

It is uncertain how many orchards in apple production areas in Moldova are infested with *X. rivesi*. There is uncertainty about the possible infestation of other plants of *X. rivesi* in the vicinity, which are also considered hosts for this nematode.

Given the above evidence and uncertainties, the Panel considers it possible that the nematode is present in the environment and could invade *Malus domestica* nurseries with soil and growing media, new plants for planting with soil attached or other human activities.

A.1.2.2. Possibility of entry with new plants/seeds

Plants without soil are not a pathway. Only plants with soil (even small amounts of soil) attached to the roots are important for nematode transmission.

Uncertainties

Uncertainties exist regarding the lack of data to monitor the presence of *X. rivesi* in nurseries from which *M. domestica* is sourced for planting.

Plants for planting with soil attached, originating from production sites where the nematode is present may be infested. However, infestation of such plants may be easily overlooked.

Symptoms caused by *X. rivesi* may be overlooked because symptoms are not very pronounced. Aboveground symptoms are similar to those caused by water and nutrient deficiencies. Therefore, the presence of *X. rivesi* in apple roots cannot be detected by visual inspection.

Considering the above evidence and uncertainties, the Panel considers it is possible that the infestation could be overlooked and that the nematode could be introduced into apple nurseries/orchards with new plants.

A.1.2.3. Possibility of spread within the nursery

X. rivesi actively moves only short (< 1 m) distances (EFSA, 2018). The nematode never penetrates plant tissue (except by piercing root cells with its stylet). The main route of spread of this nematode within the nursery or production field is usually human-assisted. The nematode can be spread with moist soil or growing media (soil as such or soil attached to plants, machinery, tools, shoes, animals, packing material) or run-off water, but not through plants without soil.

Uncertainties

If present, it is very likely that the nematode will spread within the production field.

In view of the above evidence and uncertainties, the Panel considers that the nematode, if present in the field, can be transmitted from one host plant to another.

A.1.3. Information from interceptions

No interceptions of *Xiphinema rivesi* from Moldova to the EU have been reported so far.

A.1.4. Evaluation of the risk reduction options

No.	Risk mitigation measure (name)	Description	Effect on the pest	Evaluation and uncertainties
1	Registration of production sites	Nurseries producing material for export are registered following the Moldovan legislation	No	–
2	Certification of propagation material	Nurseries produce material under different certification schemes. Plant for planting under the 'certified' category are virus-free and accordingly tested for the presence of virus, viroids and other plant pathogens, but this does not apply to plants in the category Regular	Yes	<u>Evaluation:</u> The presence of virus transmitted nematodes in nurseries is checked before planting. <u>Uncertainties:</u> • Details of the inspection and monitoring have not been described.
3	Sanitation and inspection of field sites for virus-vector nematodes	Cultivation occurs in registered sites, the field sites hosting mother material is inspected prior cultivation for the presence of virus vectored by nematodes. Sanitation may be applied if nematodes are detected, but no detailed information is provided on sanitation and soil disinfestation.	Yes	<u>Evaluation:</u> Nurseries are checked for the presence of nematode known as virus vectors before planting and if necessary treated or discarded for production if nematode densities/presence cannot be managed. <u>Uncertainties:</u> • Details of this measure were not provided. • Threshold for intervention was not mentioned in the dossier.
4	Surveillance, monitoring and sampling	'Regular' material category originates from: 1) mother plantations (or solitary mother plants) that have not been virus-tested or retested; 2) planting material originating from mother plantations (or mother plants). Mother plantations for rootstocks and scions are inspected in the field at least three times. After grafting, production fields are inspected twice a year. Field inspectors also perform a visual inspection of the plant material after harvest. Diagnosis protocols are following ISPM standards, however no details on these were provided in the dossier.	Yes	<u>Evaluation:</u> The presence of nematode known as virus vectors in nurseries is checked before planting. However, there is no information on how sampling and laboratory testing are carried out in Moldova. There is also no information on whether nematode-transmitted viruses are systematically monitored in Moldova. <u>Uncertainties:</u> • The details of inspection, monitoring and sampling, and laboratory testing have not been described.
5	Forecasting of pest and diseases incidence and warning	ANSA seems to monitor and communicate pest outbreaks but no specific details are provided as to how this affects production of plants for planting.	No	–

No.	Risk mitigation measure (name)	Description	Effect on the pest	Evaluation and uncertainties
6	Application of phytosanitary products (pesticides)	Several pesticides are registered in Moldova to manage insects, mites and fungi but details on specific target pests, application frequency and dosage were not provided. Details on application procedure are very general. Application may follow a calendar basis, but exact details were not provided.	No	
7	Field sanitation	Removal, cutting and destruction of symptomatic or infested/infected material (shoots, leaves, fruits)	No	–
8	Postharvest treatments	Defoliation of plant material. Root washing and application of pesticides during the washing	Yes	<u>Evaluation:</u> Root washing can effectively reduce the risk of nematode infestation in plants intended for planting. <u>Uncertainties:</u> It is uncertain how effectively root washing is carried out in Moldovan nurseries.
9	Sorting and storage	Material for export is sorted, labelled and packed before export	No	–

A.1.5. Overall likelihood of pest freedom

A.1.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

- Apple is considered an insignificant host and its growing areas are mainly in that part of the country where *X. rivesi* has not been reported.
- Regular inspections by phytosanitary authorities are effective and help to reduce the infestation pressure of this nematode.
- Root washing is effective against this nematode.

A.1.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

- Apple is considered the main host of this nematode.
- A similar pest pressure exists throughout the country.
- The nematode is widespread in apple-growing areas and its infestation is homogeneous.
- It can be assumed that most apple plants are infested with nematodes.
- Visual selection of apple plants for planting and visual inspections before export without laboratory test are not effective and result in high infestation.
- Washing the roots after harvest is only partially effective against this pest.

A.1.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments

- Uncertainties about the occurrence of the pest in Moldova.
- The information on infestation of *X. rivesi* on apple plants in Moldova is lacking.

- The absence of reports of problems related to viruses that can be transmitted with this nematode within the apple growing area in Moldova.
- The likelihood of introduction into apple growing areas through human activities.

A.1.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

- The main uncertainty is the absence of nematode-induced symptoms, so that the presence of the nematode in the apple roots can be overlooked; cannot be detected by visual inspection.

A.1.5.5. Elicitation outcomes of the assessment of the pest freedom for *Xiphinema rivesi* on Malus

The following Tables show the elicited and fitted values for pest infestation (Table A.1) and pest freedom (Table A.2).

Table A.1: Elicited and fitted values of the uncertainty distribution of pest infestation by *Xiphinema rivesi* per 10,000 bundles

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					2		3		6					10
EKE	0.078	0.183	0.352	0.680	1.12	1.67	2.24	3.47	4.91	5.75	6.73	7.73	8.72	9.41	10.0

The EKE results is the *BetaGeneral*(1.0765, 2.012, 0, 11.1) distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infested bundles the pest freedom was calculated (i.e. = 10,000 – number of infested plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.2 (Figure A.1).

Table A.2: The uncertainty distribution of plants free of *Xiphinema rivesi* per 10,000 bundles calculated by Table A.1

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,990					9,994		9,997		9,998					10,000
EKE results	9,990	9,991	9,991	9,992	9,993	9,994	9,995	9,997	9,998	9,998	9,999	9,999.3	9,999.6	9,999.8	9,999.9

The EKE results are the fitted values.

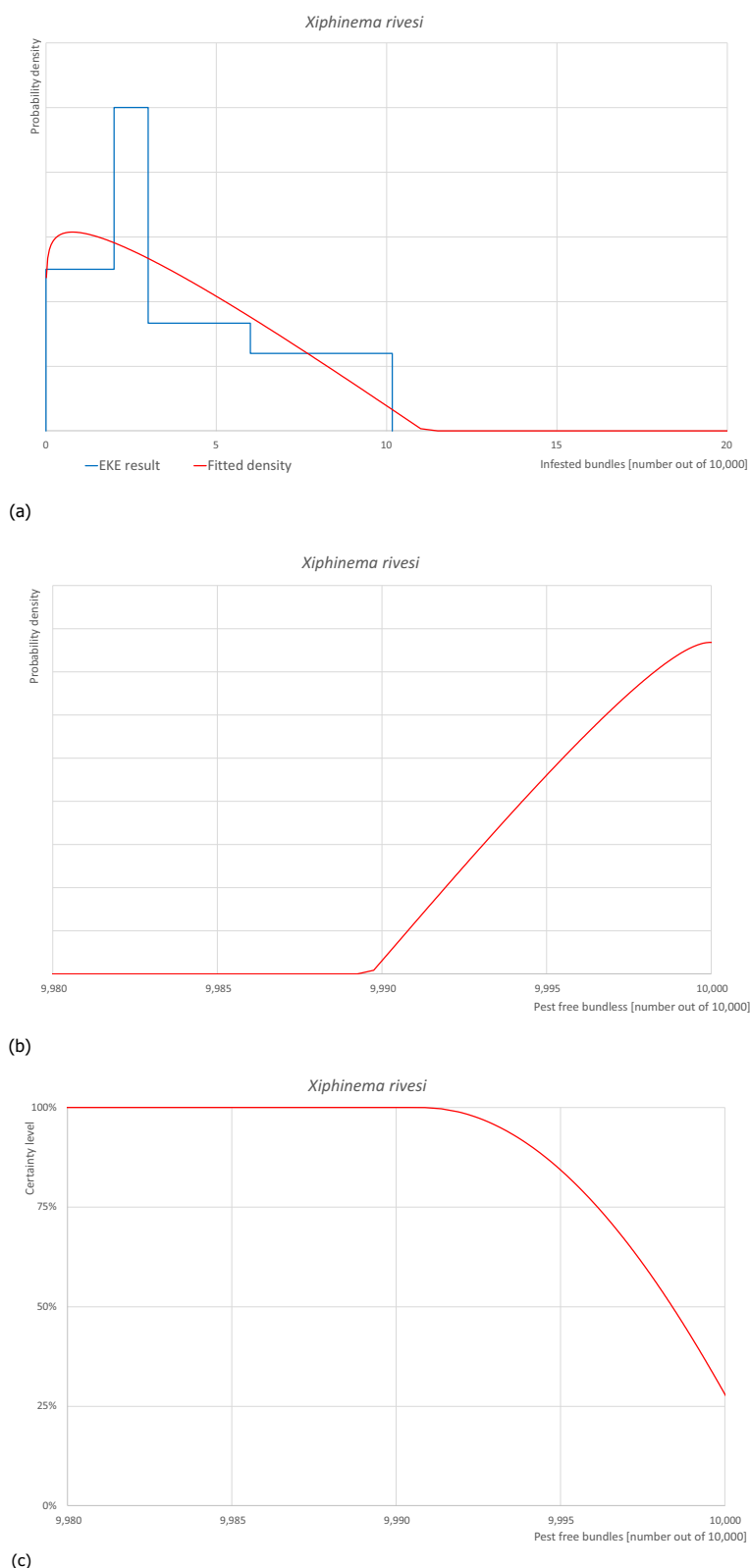


Figure A.1: (a) Elicited uncertainty of pest infestation per 10,000 bundles (histogram in blue– vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000 (i.e.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

A.1.6. Reference list

- Bitterlin MW, Gonsalves D, 1987. Spatial distribution of *Xiphinema rivesi* and persistence of tomato ringspot virus and its vector in soil. *Plant Disease*, 71, 408–411.
- Brown DJF, Roberston WM and Trudgill DL, 1995. Transmission of viruses by plant nematodes. *Annual Review of Phytopathology*, 33, 223–249.
- CABI (Centre for Agriculture and Bioscience International), online. CABI Crop Protection Compendium. Available online: <https://www.cabi.org/cpc/> [Accessed: 23 November 2021].
- EFSA PLH Panel (EFSA Panel on Plant Health), Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K, Gilioli G, Gregoire J-C, Jaques Miret JA, MacLeod A, Navajas Navarro M, Parnell S, Pottting R, Rafoss T, Rossi V, Urek G, Van Bruggen A, Van der Werf W, West J, Winter S, Kaluski T and Niere B, 2018. Scientific Opinion on the pest categorisation of *Xiphinema americanum* sensu lato. *EFSA Journal* 2018;16(7):5298, 43 pp. <https://doi.org/10.2903/j.efsa.2018.5298>
- EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: <https://www.eppo.int/> [Accessed: 23 November 2021].
- FAO, 2016. DP 11: *Xiphinema americanum* sensu lato. 26.
- Lamberti F, Molinari S, Moens M and Brown DJF, 2000. The *Xiphinema americanum* group. I. Putative species, their geographical occurrence and distribution, and regional polytomous identification keys for the group. *Russian Journal of Nematology*, 8, 65–84.
- Nemaplex, online. Available online: <http://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx> [Accessed: 23 November 2021].
- Poiras L, 2012. Species diversity and distribution of free-living and plant parasitic nematodes from order Dorylaimida (Nematoda) in different habitats of the Republic of Moldova. *Oltenia-studii si comunicari stiintele naturii*, 28, 35–42.
- Poiras L, Iurcu-Străistaru E, Poiras N, Bivol A, & Cerneț A, 2013. Plant parasitic and free-living nematodes of some orchards (peach, apple) in the Republic of Moldova. *Oltenia-studii si comunicari stiintele naturii*, 29/2, 166–171.
- Poiras L, Cerneț A, Bivol A, Poiras N, Iurcu-Străistaru E, 2014. "Preliminary analysis of plant parasitic nematodes associated with strawberry and raspberry crops in the Republic of Moldova." *Oltenia-studii si comunicari stiintele naturii*, 30, 98–104.
- Poiras L, Iurcu-Străistaru E, Poiras N, Bivol A, Cerneț A, 2015. Phytoparasitic nematode fauna of perennial fruit crops in Republic of Moldova. In: *Lucrări științifice, Univ. Agrară de Stat din Moldova*. 2015, vol. 42: Horticultură, viticultură și vinificație, silvicultură și grădini publice, protecția plantelor, pp. 37–382.

Appendix B – Web of Science All Databases Search String

In the table below the search string used in Web of Science is reported. In total, 184 papers were retrieved. Titles and abstracts were screened, and 13 pests were added to the list of pests (see Appendix C).

<i>Web of Science All databases</i>	TOPIC: ("Malus domestica" OR "M. domestica" OR "apple tree\$") AND TOPIC: (pathogen* OR pathogenic bacteria OR mycoplasma* OR bacteri* OR phytoplasma* OR disease\$ OR infecti* OR damag* OR symptom* OR pest\$ OR host plant\$ OR host-plant\$ OR host OR decline\$ OR dieback* OR die back* OR die-back* OR wilt\$ OR wilted OR canker OR witch* OR yellowing OR leafroll OR bacterial gall OR crown gall OR spot OR blast OR nematod* OR vector OR "root knot" OR "root-knot" OR root tip OR cyst\$ OR "dagger" OR "plant parasitic" OR "root feeding" OR "root\$ feeding" OR "plant\$parasitic" OR "root lesion\$" OR damage\$ OR infestation\$ OR virus* OR viroid* OR disease\$ OR infecti* OR infestation\$ OR damage\$ OR virosis OR canker OR blister\$ OR mosaic OR "leaf curl" OR "latent" OR "fung*" OR "oomycet*" OR "myce*" OR "root lesion\$" OR "scab\$" OR "rot" OR "rots" OR "rotten" OR "damping off" OR "damping-off" OR "smut" OR "mould" OR "mold" OR insect\$ OR mite\$ 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 "root feeder\$") NOT 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\$") NOT TOPIC: (" OR "Abortiporus biennis" OR "Acetobacter aceti" OR "Acetobacter pasteurianus" OR "Acetobacter persici" OR "Acleris comariana" OR "Acleris fimbriana" OR "Acleris minuta" OR "Acleris rhombana" OR "Acleris sparsana" OR "Acremonium mali" OR "Acremonium sclerotigenum" OR "Acremonium sp." OR "Acronicta psi" OR "Acronicta rumicis" OR "Aculus malivagrans" OR "Aculus malus" OR "Aculus schlechtendali" OR "Adoretus versutus" OR "Adoxophyes orana" OR "Adoxophyes orana fasciata" OR "Aenetus virescens" OR "Aeolesthes holosericea" OR "Aeolesthes sarta" OR "Agapeta hamana" OR "Agrilus mali" OR "Agriopsis bajaran" OR "Agrobacterium rhizogenes" OR "Agrobacterium sp." OR "Agrobacterium tumefaciens" OR "Agrotis ipsilon" OR "Agrotis ipsilon aneituma" OR "Allocotaphis quaestionis" OR "Alternaria alternata" OR "Alternaria alternata f. sp. mali" OR "Alternaria arborescens" OR "Alternaria dumosa" OR "Alternaria eureka" OR "Alternaria frumenti" OR "Alternaria infectoria" OR "Alternaria kordkuyana" OR "Alternaria mali" OR "Alternaria malicola" OR "Alternaria sp." OR "Alternaria tenuis" OR "Alternaria tenuissima" OR "Amara eurynota" OR "Amblyseius andersoni" OR "American plum line pattern virus" OR "Ametastegia" OR "Amitermes wahrmani" OR "Amphipyra pyramidea" OR "Amphitetranychus viennensis" OR "Amylostereum sacratum" OR "Anagyrus fusciventris" OR "Anarsia lineatella" OR "Anastrepha fraterculus" OR "Anastrepha ludens" OR "Anastrepha serpentina" OR "Anastrepha sp." OR "Anastrepha suspensa" OR "Anoplophora chinensis" OR "Anoplophora glabripennis" OR "Anthonomus piri" OR "Anthonomus pomorum" OR "Anthonomus pyri" OR "Anthonomus quadrigibbus" OR "Antrodia serialis" OR "Anuraphis farfarae" OR "Anytis baccarum" OR "Aonidiella aurantii" OR "Apatte monachus" OR "Aphelinus mali" OR "Aphidunguis mali" OR "Aphis craccivora" OR "Aphis eugeniae" OR "Aphis fabae" OR "Aphis gossypii" OR "Aphis odinae" OR "Aphis pomi" OR "Aphis spiraecola" OR "Aphis spiraephaga" OR "Aphis aurantii" OR
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"Aploneura ampelina" OR "Apocheima cinerarium" OR "Apocheima pilosaria" OR "Aporia crataegi" OR "Apple associated luteovirus" OR "Apple chat fruit agent" OR "Apple chat fruit disease" OR "Apple chlorotic leaf spot virus" OR "Apple chlorotic leafspot virus" OR "Apple dimple fruit viroid" OR "Apple fruit crinkle viroid" OR "Apple geminivirus" OR "Apple green crinkle agent" OR "Apple green crinkle associated virus" OR "Apple green crinkle disease" OR "Apple hammerhead viroid RNA" OR "Apple latent spherical virus" OR "Apple mosaic ilarvirus" OR "Apple mosaic virus" OR "Apple necrotic mosaic virus" OR "Apple proliferation phytoplasma" OR "Apple ringspot agent" OR "Apple ringspot disease" OR "Apple rough skin agent" OR "Apple rubbery wood agent" OR "Apple rubbery wood phytoplasma" OR "Apple rubbery wood-associated virus 1" OR "Apple rubbery wood-associated virus 2" OR "Apple scar skin viroid" OR "Apple sessile leaf phytoplasma" OR "Apple star crack agent" OR "Apple stem grooving virus" OR "Apple stem pitting virus" OR "Apriona cinerea" OR "Apriona germari" OR "Apterygothrips collyerae" OR "Archips argyrosipilus" OR "Archips breviplicanus" OR "Archips crataegana" OR "Archips crataeganus" OR "Archips fuscocupreanus" OR "Archips podana" OR "Archips podanus" OR "Archips rosana" OR "Archips rosanus" OR "Archips subsidiaria" OR "Archips termias" OR "Archips xylosteanus" OR "Arcyria oerstedtii" OR "Argolamprotes micella" OR "Argyresthia conjugella" OR "Argyresthia cornella" OR "Argyroploce umbrosana" OR "Argyrotaenia citrana" OR "Argyrotaenia ljungiana" OR "Argyrotaenia velutinana" OR "Aridius nodifer" OR "Armillaria limonea" OR "Armillaria luteobubalina" OR "Armillaria mellea" OR "Armillaria novae-zelandiae" OR "Armillaria sp." OR "Armillaria tabescens" OR "Arrenoseius wainstein" OR "Ascochyta piricola" OR "Ascochyta pirina" OR "Ascochyta pyricola" OR "Aspergillus clavatus" OR "Aspergillus flavus" OR "Aspergillus niger" OR "Aspergillus ustus" OR "Aspergillus versicolor" OR "Asteromella mali" OR "Asymmetrasca decedens" OR "Asynonychus cervinus" OR "Athelia bombacina" OR "Athelia rolfsii" OR "Atractotomus mali" OR "Atrichatus aeneicollis" OR "Aulacorthum solani" OR "Aureobasidium pullulans" OR "Auriculariopsis ampla" OR "Automeris io" OR "Automeris zephyria" OR "Bacchisa fortunei" OR "Bacillus cereus" OR "Bacillus subtilis" OR "Bactrocera aquilonis" OR "Bactrocera dorsalis" OR "Bactrocera tryoni" OR "Bactrocera zonata" OR "Bdellodes sp." OR "Bionectria ochroleuca" OR "Bispora antennata" OR "Bituberculate scale" OR "Bjerkandera adusta" OR "Blackberry chlorotic ringspot virus" OR "Blastobasis decolorata" OR "Blastobasis sp. nr. tarda" OR "Blattella germanica" OR "Boeremia exigua var. exigua" OR "Bohemannia pulverosella" OR "Bonagota cranaodes" OR "Bonagota salubricola" OR "Botryodiplodia malorum" OR "Botryodiplodia theobromae" OR "Botryosphaeria berengeriana" OR "Botryosphaeria berengeriana f. sp. pyricola" OR "Botryosphaeria dothidea" OR "Botryosphaeria kuwatsukai" OR "Botryosphaeria lutea" OR "Botryosphaeria obtusa" OR "Botryosphaeria parva" OR "Botryosphaeria quercuum" OR "Botryosphaeria ribis" OR "Botryosphaeria sinensis" OR "Botryosphaeria sp." OR "Botryosphaeria stevensii" OR "Botryotinia fuckeliana" OR "Botrytis cinerea" OR "Botrytis mali" OR "Brachycaudus cardui" OR "Brachycaudus helichrysi" OR "Brahmina coriacea" OR "Brevipalpus noranae" OR "Brevipalpus obovatus" OR "Brevipalpus phoenicis" OR "Bryobia cristata" OR "Bryobia giannitsensis" OR "Bryobia graminum" OR "Bryobia macedonica" OR "Bryobia piliensis" OR "Bryobia praetiosa" OR "Bryobia rubrioculus" OR "Bryobia vasiljevi" OR "Burkholderia cepacia" OR "Byturus tomentosus" OR "Cacoecimorpha pronubana" OR "Cacopsylla costalis" OR "Cacopsylla mali" OR "Cacopsylla melanoneura" OR "Cacopsylla picta" OR "Cacopsylla pulchella" OR "Cacopsylla pulchra" OR "Cactodera chaubattia" OR "Caecilius flavus" OR "Caenorhabditis briggsae" OR "Caenorhabditis elegans" OR "Caenorhabditis remanei" OR "Calepitrimerus aphrastus" OR "Calepitrimerus baileyi" OR "Caliroa cerasi" OR "Callisto coffeella" OR "Calliteara horsfieldii" OR "Calocoris norvegicus" OR "Calonectria kyotensis" OR "Calosphaeria sp." OR "Camarosporium karstenii" OR "Camarosporium multiforme" OR "Campylomma verbasci" OR "Candidatus Phytoplasma asteris" OR "Candidatus Phytoplasma aurantifolia" OR "Candidatus phytoplasma mali" OR "Candidatus Phytoplasma pruni" OR "Candidatus Phytoplasma solani" OR "Candidatus Phytoplasma mali" OR "Candidatus Phytoplasma pruni" OR "Candidatus Phytoplasma solani" OR "Candidatus Phytoplasma ziziphi" OR "Candidula intersecta" OR "Capnodium citri" OR "Capua semiferana" OR "Carabidae sp." OR "Carcina quercana" OR "Carnation ringspot virus" OR "Carpophilus gaveni" OR "Carpophilus mutilatus" OR "Carpocapsa sasakii" OR "Catoptes coronatus" OR "Cecidophyes malifoliae" OR "Cenopalpus irani" OR "Cenopalpus pulcher" OR "Cerambyx dux" OR "Ceratitis capitata" OR "Ceratitis

quilicii" OR "Ceratitis rosa" OR "Ceratostomella mali" OR "Ceresa alta" OR "Ceroplastes ceriferus" OR "Ceroplastes sinensis" OR "Chaetocnema confinis" OR "Chaetomium sp." OR "Chalastospora gossypii" OR "Cheiroseius samani" OR "Cherry leaf roll virus" OR "Cherry necrotic rusty mottle virus" OR "Cherry rasp leaf virus" OR "Chinavia hilaris" OR "Chlorocystis v-ata" OR "Chondrostereum purpureum" OR "Choreutis pariana" OR "Choristoneura diversana" OR "Choristoneura hebenstreitella" OR "Choristoneura rosaceana" OR "Chrysobothris mali" OR "Chrysomphalus aonidum" OR "Chymomyza amoena" OR "Cicadatra persica" OR "Cicinobolus humuli" OR "Cilix glaucata" OR "Cirsium arvense" OR "Citrus concave gum-associated virus" OR "Cladophialophora sp." OR "Cladosporium cladosporioides" OR "Cladosporium fumago" OR "Cladosporium herbarum" OR "Cladosporium sp." OR "Clarkeulia bourquini" OR "Clavibacter michiganensis" OR "Clepsia spectrana" OR "Clonostachys rosea" OR "Clover yellow mosaic virus" OR "Cnephasia asseclana" OR "Cnephasia stephensiana" OR "Cochlicopa lubrica" OR "Cochliobolus cynodontis" OR "Colaspis brunnea" OR "Coleophora prunifoliae" OR "Coleophora serratella" OR "Colletogloeum sp." OR "Colletotrichum acerbum" OR "Colletotrichum acutatum" OR "Colletotrichum aenigma" OR "Colletotrichum alienum" OR "Colletotrichum clavatum" OR "Colletotrichum fioriniae" OR "Colletotrichum fragariae" OR "Colletotrichum fructicola" OR "Colletotrichum gloeosporioides" OR "Colletotrichum godetiae" OR "Colletotrichum kahawae" OR "Colletotrichum kahawae subsp. ciggare" OR "Colletotrichum karsti" OR "Colletotrichum karstii" OR "Colletotrichum limetticola" OR "Colletotrichum melonis" OR "Colletotrichum noveboracense" OR "Colletotrichum nymphaeae" OR "Colletotrichum paranaense" OR "Colletotrichum rhombiforme" OR "Colletotrichum salicis" OR "Colletotrichum siamense" OR "Colletotrichum sp." OR "Colletotrichum theobromicola" OR "Colletotrichum tropicale" OR "Colletotrichum gloeosporioides" OR "Collybia drucei" OR "Colocasias coryli" OR "Comstockaspis perniciosus" OR "Coniothecium chomatosporum" OR "Coniothyrium armeniacae" OR "Coniothyrium sp." OR "Conistra rubiginosa" OR "Conogethes punctiferalis" OR "Conotrachelus nenuphar" OR "Conyza bonariensis" OR "Conyza canadensis" OR "Coprinus" OR "Coprinus atramentarius" OR "Cordana musae" OR "Coriolus velutinus" OR "Coriolus versicolor" OR "Coriolus zonatus" OR "Cornu aspersum" OR "Corticium centrifugum" OR "Corticium koleroga" OR "Corticium salmonicolor" OR "Corticium utriculicum" OR "Coryneum foliicola" OR "Corynoptera sp." OR "Cosmia trapezina" OR "Cossus" OR "Cossus insularis" OR "Costelytra zealandica" OR "Cotinis nitida" OR "Croesia holmiana" OR "Cryphonectria parasitica" OR "Cryptocoryneum condensatum" OR "Cryptosporiopsis curvispora" OR "Cryptosporiopsis malicorticis" OR "Cryptosporiopsis perennans" OR "Ctenopseustis obliquana" OR "Cucumber mosaic virus" OR "Cydia funebrana" OR "Cydia inopinata" OR "Cydia janthinana" OR "Cydia lobarzewskii" OR "Cydia molesta" OR "Cydia packardii" OR "Cydia pomonella" OR "Cydia prunivora" OR "Cydia pyrivora" OR "Cylindrocarpon candidum" OR "Cylindrocarpon destructans" OR "Cylindrocarpon didymum" OR "Cylindrocarpon heteronemum" OR "Cylindrocarpon liriodendri" OR "Cylindrocarpon macrodidymum" OR "Cylindrocarpon mali" OR "Cylindrocarpon obtusiusculum" OR "Cylindrocarpon pauciseptatum" OR "Cylindrocarpon sp." OR "Cylindrocladium floridanum" OR "Cyphellophora sessilis" OR "Cytospora calvillae" OR "Cytospora carphosperma" OR "Cytospora chrysosperma" 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 concentrica" OR "Daldinia vernicosa" OR "Dasineura mali" OR "Deltinea bourquini" OR "Dematophora sp." OR "Dendrothele tetracornis" OR "Dendryphiella vinosa" OR "Dermestes lanarius" OR "Devriesia pseudoamericana" OR "Diabrotica speciosa" OR "Diaphora mendica" OR "Diaporthe actinidiae" OR "Diaporthe ambigua" OR "Diaporthe cotoneastri" OR "Diaporthe dothidea" OR "Diaporthe eres" OR "Diaporthe foeniculina" OR "Diaporthe infecunda" OR "Diaporthe malorum" OR "Diaporthe oxae" OR "Diaporthe perniciosus" OR "Diaporthe serafinae" OR "Diaporthe sp." OR "Diaspidiotus ancylus" OR "Diaspidiotus perniciosus" OR "Diatrype sp." OR "Dickeya dadantii" OR "Dictyosporium toruloides" OR "Diderma asteroides" OR "Didymella aliena" OR "Diloba caeruleocephala" 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 "Diptacus sp." OR "Discotylenchus" OR "Dissoconium aciculare" OR "Dissoconium eucalypti" OR
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	"Dissoconium proteae" OR "Dissoconium sp." OR "Diurnea fagella" OR "Dorysthenes huegeli" OR "Dothiorella sarmentorum" OR "Drosophila immigrans" OR "Drosophila lativittata" OR "Drosophila simulans" OR "Drosophila suzukii" OR "Dysaphis affinis" OR "Dysaphis anthrisci" OR "Dysaphis anthrisci majkopica" OR "Dysaphis armeniaca" OR "Dysaphis brachycycla" OR "Dysaphis brancoi" OR "Dysaphis brancoi spp. malina" OR "Dysaphis brancoi spp. rogersoni" OR "Dysaphis brunii" OR "Dysaphis chaerophylli" OR "Dysaphis chaerophyllina" OR "Dysaphis devector" OR "Dysaphis gallica" OR "Dysaphis malidauci" OR "Dysaphis meridialis" OR "Dysaphis mordvilkoii" OR "Dysaphis orientalis" OR "Dysaphis physocaulis" OR "Dysaphis plantaginea" OR "Dysaphis pyri" OR "Dysaphis radicola" OR "Dysaphis sibirica" OR "Dysaphis zini" OR "Dysaphys flava" OR "Dysmicoccus brevipes" OR "Eccopisa effractella" OR "Edwardsiana crataegi" OR "Edwardsiana lamellaris" OR "Edwardsiana rosae" OR "Elsinoe piri" OR "Elsinoe pyri" OR "Ematurga atomaria" OR "Emex australis" OR "Emex spinosa" OR "Empoasca decipiens" OR "Empoasca fabae" OR "Enarmonia formosana" OR "Eotetranychus ancora" OR "Eotetranychus carpini" OR "Eotetranychus clitus" OR "Eotetranychus frosti" OR "Eotetranychus pruni" OR "Eotetranychus prunicola" OR "Eotetranychus sexmaculatus" OR "Eotetranychus smithi" OR "Eotetranychus uncatus" OR "Eotetranychus willamettei" OR "Epiblema foenella" OR "Epicoccum nigrum" OR "Epicoccum sp." OR "Epidiaspis leperii" OR "Epiphyas postvittana" OR "Epitrimerus pyri" OR "Epuraea imperialis" OR "Erannis defoliaria" OR "Eriococcus coccineus" OR "Eriogaster lanestris" OR "Eriophyes mali" OR "Eriophyes pyri" OR "Eriophyoidea sp." OR "Eriosoma lanigerum" OR "Eriosoma lanuginosum" OR "Erwinia amylovora" OR "Erysiphe heraclei" OR "Erythriscium salmonicolor" OR "Eucolaspis brunnea" OR "Eucolaspis sp." OR "Eulecanium mali" OR "Eulecanium tiliae" OR "Eupalopsis vandergeesti" 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 "Euzophera bigella" OR "Euzophera pinguis" OR "Exophiala sp." OR "Falagria sp." OR "Fibulorhizoctonia psychrophila" OR "Fieberiella florii" OR "Flammulina velutipes" OR "Fomitopsis pinicola" OR "Forficula auricularia" OR "Fracchiata sp." OR "Frankliniella" OR "Frankliniella occidentalis" OR "Fusarium acuminatum" OR "Fusarium apiogenum" OR "Fusarium avenaceum" OR "Fusarium compactum" OR "Fusarium crookwellense" OR "Fusarium culmorum" OR "Fusarium equiseti" OR "Fusarium lateritium" OR "Fusarium oxysporum" OR "Fusarium proliferatum" OR "Fusarium pseudograminearum" OR "Fusarium semitectum" OR "Fusarium solani" OR "Fusarium stilboides" OR "Fusarium tricinctum" OR "Fusicladium dendriticum" OR "Fusicladium pomi" OR "Fusicladium pyrorum" OR "Fusicoccum luteum" OR "Fusicoccum parvum" OR "Galinsoga parviflora" OR "Galinsoga quadriradiata" OR "Ganoderma applanatum" OR "Geastrum polystigmatis" OR "Gelechia rhombella" OR "Geniculosporium sp." OR "Geosmithia sp." OR "Geotrichum candidum" OR "Gibberella acuminata" OR "Gibberella avenacea" OR "Gibberella baccata" OR "Gibberella intricans" OR "Gibberella tricineta" OR "Globisporangium echinulatum" OR "Globisporangium heterothallicum" OR "Globisporangium irregulare" OR "Globisporangium parocandrum" OR "Globisporangium rostratum" OR "Globisporangium ultimum" OR "Globodera pallida" OR "Globodera rostochiensis" OR "Gloeocystidiellum sacratum" OR "Gloeodes pomigena" OR "Gloeopeniophorella sacrata" OR "Gloeosporium album" OR "Gloeosporium fructigenum" OR "Gloeosporium perennans" OR "Gloeosporium sp." 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 "Glonium parvulum" OR "Gluconobacter oxydans" OR "Goniapterus scutellatus" OR "Gracilacus peperpotti" OR "Graphania mutans" OR "Graphiphora augur" OR "Grapholita dimorpha" OR "Grapholita funebrana" OR "Grapholita inopinata" OR "Grapholita molesta" OR "Grapholita packardii" OR "Grapholita prunivora" OR "Gryllotalpa gryllotalpa" OR "Gymnobathra parca" OR "Gymnosporangium clavipes" OR "Gymnosporangium confusum" OR "Gymnosporangium globosum" OR "Gymnosporangium juniperi" OR "Gymnosporangium juniperi-virginiae" OR "Gymnosporangium juniperi-virginianae" OR "Gymnosporangium tremelloides" OR "Gymnosporangium yamadae" OR "Gypsonoma minutana" OR "Hadrotrichum populi" OR "Halyomorpha halys" OR "Halyomorpha mista" OR "Haplothrips kurdjumovi" OR "Haplothrips niger" OR "Haptoncus luteolus" OR "Harmonia axyridis" OR "Harpalus calceatus" OR "Harpalus distinguendus" OR "Hedya
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dimidioalba OR "*Hedya nubiferana*" OR "*Helicobasidium mompa*" OR "*Helicotylenchus dihystra*" OR "*Helicoverpa armigera*" OR "*Heliethrips haemorrhoidalis*" OR "*Hemiberlesia cyanophylli*" OR "*Hemiberlesia lataniae*" OR "*Hemiberlesia rapax*" OR "*Hemicyclophora theinmanni*" OR "*Hendersonia lignicola*" OR "*Hendersonia mali*" OR "*Hendersonia piricola*" OR "*Hesperophanes sericeus*" OR "*Heteroporus biennis*" OR "*Heterorhabditis indica*" 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 "*Hop stut viroid*" OR "*Hoplocampa*" OR "*Hoplocampa minuta*" OR "*Hoplocampa testudinea*" OR "*Houjia sp.*" OR "*Houjia yanglingensis*" OR "*Hyalomyzus eriobotryae*" OR "*Hyalophora cecropia*" OR "*Hyalopterus pruni*" OR "*Hylastes ater*" OR "*Hymenobacter marinus*" OR "*Hymenobacter metalli*" OR "*Hymenobacter pomorum*" OR "*Hyphantria cunea*" OR "*Hyphodontia gossypina*" OR "*Hypholoma incertum*" OR "*Hypoaspis myrmophila*" OR "*Hypocrea sp.*" OR "*Hypoxylon serpens*" OR "*Hypsicera femoralis*" OR "*Icerya aegyptiaca*" OR "*Icerya purchasi*" OR "*Ilyonectria liriiodendri*" OR "*Ilyonectria radicola*" OR "*Janus compressus*" OR "*Lacanobia oleracea*" OR "*Lacanobia subjuncta*" OR "*Lachnella anomala*" OR "*Lambertella corni-marit*" OR "*Lasiodiplodia brasiliense*" OR "*Lasiodiplodia brasiliensis*" OR "*Lasiodiplodia theobromae*" OR "*Lepidium draba*" OR "*Lepidosaphes ulmi*" OR "*Lepidosaphes ussuriensis*" OR "*Lepiota naucina*" OR "*Leptodontidium elatius*" OR "*Leptodontium elatius*" OR "*Leptosphaeria coniothyrium*" OR "*Leptothyrium pomi*" OR "*Leucoptera malifoliella*" OR "*Leucostoma cinctum*" OR "*Leucostoma personii*" OR "*Leucostoma persoonii*" OR "*Leucothyreus marginicollis*" OR "*Liberibacter europaeus*" OR "*Libertella blepharis*" OR "*Libertella sp.*" OR "*Limothrips cerealium*" OR "*Liothula omnivora*" OR "*Little cherry virus 2*" OR "*Longidorus caespiticola*" OR "*Longidorus danuvii*" OR "*Longidorus elongatus*" OR "*Longidorus euonymus*" OR "*Longidorus iranica*" OR "*Longidorus leptoccephalus*" OR "*Longidorus nanus*" OR "*Longidorus pisi*" OR "*Longidorus profundorum*" OR "*Longidorus rubi*" OR "*Longidorus sturhani*" OR "*Longistigma xizangensis*" OR "*Longitarsus fuliginosus*" OR "*Lonicera japonica*" OR "*Lophiostoma compressum*" OR "*Lophiostoma holmiorum*" OR "*Lophiostoma subcorticale*" OR "*Lophiostoma vicinum*" OR "*Lophium mytilinum*" OR "*Lopholeucaspis japonica*" OR "*Lorryia cristata*" OR "*Lorryia palpsetosa*" OR "*Lycorma delicatula*" OR "*Lygocoris communis*" OR "*Lygocoris pabulinus*" OR "*Lygus lineolaris*" OR "*Lymantria dispar*" OR "*Lymantria mathura*" OR "*Lymantria monacha*" OR "*Lymantria obfuscata*" OR "*Lyonetia clerkella*" OR "*Lyonetia prunifoliella*" OR "*Lyonetia prunifoliella malinella*" OR "*Lyonetia speculella*" OR "*Maconellicoccus hirsutus*" OR "*Macrodactylus subspinosus*" OR "*Macrolabis mali*" OR "*Macrophthalthothrips argus*" OR "*Macrosiphum chukotense*" OR "*Macrosiphum euphorbiae*" OR "*Macrosiphum rosae*" OR "*Macrosporium sp.*" OR "*Macrothylacia rubi*" OR "*Malacosoma americana*" OR "*Malacosoma americanum*" OR "*Malacosoma distria*" OR "*Malacosoma indicum*" OR "*Malacosoma neustria*" OR "*Malacosoma parallela*" OR "*Mamestra brassicae*" OR "*Margarodes vitis*" OR "*Marssonina coronaria*" OR "*Marssonina sp.*" OR "*Medicago lupulina*" OR "*Megalometis chilensis*" OR "*Megaplatypus mutatus*" OR "*Megaselia sp.*" OR "*Melanopsamma pomiformis*" OR "*Meloidogyne arenaria*" OR "*Meloidogyne ethiopica*" OR "*Meloidogyne incognita*" OR "*Meloidogyne javanica*" OR "*Meloidogyne mali*" OR "*Meloidogyne nataliei*" OR "*Melolontha*" OR "*Merothrips brunneus*" OR "*Merulius sp.*" OR "*Metaseiulus muma*" OR "*Metaseiulus occidentalis*" OR "*Metcalfa pruinosa*" OR "*Meyernychus emeticae*" OR "*Micrambina rutila*" OR "*Microcerotermes diversus*" OR "*Microcyclospora malicola*" OR "*Microcyclospora pomicola*" OR "*Microcyclospora sp.*" OR "*Microcyclospora tardicrescens*" OR "*Microcyclosporella mali*" OR "*Microcyclosporella sp.*" OR "*Microdiplodia microsporella*" OR "*Micromus tasmaniae*" OR "*Microsphaeropsis ochracea*" OR "*Microthyriella rubi*" OR "*Monilia fructigena*" OR "*Monilia polystroma*" OR "*Monilia yunnanensis*" OR "*Monilinia fructicola*" OR "*Monilinia fructigena*" OR "*Monilinia laxa*" OR "*Monilinia laxa f.sp. mali*" OR "*Monilinia mali*" OR "*Monilinia mumeicola*" OR "*Monilinia polystroma*" OR "*Monilinia yunnanensis*" OR "*Mucor piriformis*" OR "*Mycosphaerella pomi*" OR "*Mycosphaerella punctiformis*" OR "*Mycosphaerella sentina*" OR "*Mycosphaerella tassiana*" OR "*Myzus ornatus*" OR "*Myzus persicae*" OR "*Nanidorus minor*" OR "*Natrassia mangiferae*" OR "*Naupactus xanthographus*" OR "*Nearctaphis bakeri*" OR "*Nectria cinnabarina*" OR "*Nectria discophora*" OR "*Nectria ditissima*" OR "*Nectria galligena*" OR "*Nectria haematococca*" OR "*Nectria ochroleuca*" OR "*Nectria peziza*" OR "*Nectria pseudotrichia*" OR "*Nectria radicola*" OR "*Nectria sp.*" OR "*Nectriaceae*" OR "*Nematoloma fasciculare*" OR

Neodelphax fuscoterminalis OR *Neofabraea actinidiae* OR *Neofabraea alba* OR *Neofabraea brasiliensis* OR *Neofabraea kienholzii* 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 *Neonectria ditissima* OR *Neonectria galligena* OR *Neonectria macrodidyma* OR *Neonectria radicola* OR *Nesothrips propinquus* OR *Nezara viridula* OR *Niesslia sp.* OR *Nigrospora sp.* OR *Nippolachnus piri* OR *Nitschkia parasitans* OR *Nyctemera annulata* OR *Nysius huttoni* OR *Ochroporus ossatus* 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 *Opatrum sabulosum* OR *Operophtera bruceata* OR *Operophtera brumata* OR *Ophiostoma quercus* OR *Ophiostoma roboris* OR *Opodiphthera eucalypti* OR *Opogona omoscopia* OR *Orchestes fagi* 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 *Orthosia stabilis* OR *Orthotydeus californicus* OR *Orthotylus marginalis* OR *Osmia cornifrons* OR *Osmoderma eremita* OR *Ostrinia nubilalis* OR *Otiorynchus cribricollis* OR *Otiorynchus meridionalis* OR *Otthia spiraeae* OR *Ovatus crataegarius* OR *Ovatus insitus* OR *Ovatus malisuctus* OR *Oxalis latifolia* OR *Oxalis pes-caprae* OR *Pachyseius humeralis* OR *Pachysphinx modesta* OR *Paecilomyces niveus* OR *Paecilomyces sp.* OR *Palaeolecanium bituberculatum* OR *Pammene argyrana* OR *Pammene rhediella* OR *Panaeolus* OR *Pandemis cerasana* OR *Pandemis cinnamomeana* OR *Pandemis heparana* OR *Pandemis pyrusana* OR *Panonychus citri* OR *Panonychus inca* OR *Panonychus lishanensis* OR *Panonychus ulmi* OR *Pantoea agglomerans* OR *Pantomorus cervinus* OR *Pappia fissilis* OR *Paracoccus marginatus* OR *Paradevriesia pseudoamericana* OR *Paraphloeostiba gayndahensis* OR *Paratrachodorus allius* OR *Paratrachodorus porosus* OR *Paratrachodorus tunisiensis* OR *Paratylenchus* OR *Paratylenchus curvatus* OR *Parlatoria crypta* OR *Parlatoria oleae* OR *Parlatoria pergandii* OR *Parlatoria pittospori* OR *Paropsis charybdis* OR *Parornix geminatella* OR *Parthenolecanium corni* OR *Parthenolecanium persicae* OR *Pasiphila rectangulata* OR *Paspalum urvillei* OR *Patellaria atrata* OR *Peach latent mosaic viroid* 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 brevicompactum* OR *Penicillium carneum* OR *Penicillium chrysogenum* OR *Penicillium commune* OR *Penicillium crustosum* OR *Penicillium digitatum* OR *Penicillium expansum* OR *Penicillium glabrum* OR *Penicillium glaucum* 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 *Peniophora lycii* OR *Pennisetum clandestinum* OR *Pentatoma rufipes* OR *Perichaena corticalis* OR *Perichaena depressa* OR *Peridroma saucia* OR *Peritelus sphaeroides* OR *Pestalotia hartigii* OR *Pestalotia sp.* OR *Pestalotiopsis maculans* OR *Pestalotiopsis sp.* OR *Petiveria alliacea* OR *Petrobia harti* OR *Petrobia latens* OR *Petunia asteroid mosaic virus* OR *Pezicula alba* OR *Pezicula corticola* OR *Pezicula malicorticis* OR *Phacidiopycnis washingtonensis* OR *Phacidium lacerum* OR *Phaeoacremonium aleophilum* OR *Phaeoacremonium australiense* OR *Phaeoacremonium fraxinopennsylvanicum* OR *Phaeoacremonium geminum* OR *Phaeoacremonium inflatipes* OR *Phaeoacremonium iraniamum* 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 *Phigalia pilosaria* OR *Phlyctema vagabunda* OR *Phlyctinus callosus* OR *Pholiota aurivella* OR *Pholiota squarrosa* OR *Phoma cava* OR *Phoma enteroleuca* OR *Phoma exigua* var. *exigua* OR *Phoma glomerata* OR *Phoma herbarum* OR *Phoma macrostoma* OR *Phoma macrostoma* var. *macrostoma* OR *Phoma pirinia* OR *Phoma pomorum* OR *Phoma pomorum* var. *pomorum* OR *Phoma pyrina* OR *Phoma sp.* OR *Phomopsis* OR *Phomopsis cotoneastri* OR *Phomopsis mali* OR *Phomopsis oblonga* OR *Phomopsis perniciosus* OR *Phomopsis*

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crocea OR "*Sarocladium liquanensis*" OR "*Sarocladium mali*" OR "*Saturnia pavonia*" OR "*Saturnia pyri*" OR "*Scelodonta strigiculis*" OR "*Schizoneurella indica*" OR "*Schizophyllum alneum*" OR "*Schizophyllum commune*" OR "*Schizotetranychus smirnovi*" OR "*Schizothyrium pomi*" OR "*Scleroramularia abundans*" OR "*Sclerotinia fruticola*" OR "*Sclerotinia sclerotiorum*" OR "*Sclerotium delphinii*" OR "*Sclerotium rolfsii*" OR "*Sclerotium rolfsii* var. *delphinii*" OR "*Scolypopa australis*" OR "*Scolytus amygdali*" OR "*Scolytus mali*" OR "*Scolytus nitidus*" OR "*Scolytus rugulosus*" OR "*Scutellospora pellucida*" OR "*Seimatosporium fusisporum*" OR "*Seimatosporium lichenicola*" OR "*Selenosporella*" OR "*Senecio vulgaris*" OR "*Septocylindrium aderholdii*" OR "*Septocylindrium radicola*" OR "*Septoria* sp." OR "*Sigmothrips aotearoana*" OR "*Siphanta acuta*" OR "*Sitobion avenae*" OR "*Solanum carolinense*" OR "*Somena scintillans*" OR "*Spenceriartinsia plurivora*" OR "*Sperchia intractata*" OR "*Sphaeria microtheca*" OR "*Sphaeropsis mali*" OR "*Sphaeropsis malorum*" OR "*Sphaeropsis pyripitrescens*" 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 "*Sporobolomyces roseus*" OR "*Sporormiella* sp." OR "*Stellaria media*" OR "*Stemphylium botryosum*" OR "*Stemphylium ilicis*" OR "*Stemphylium vesicarium*" OR "*Stenostola ferrea*" OR "*Stenotrophomonas maltophilia*" OR "*Stereum hirsutum*" OR "*Stethorus bifidus*" OR "*Stigmella magdalenae*" OR "*Stigmella malella*" OR "*Stigmella sorbi*" OR "*Stigmella carpophila*" OR "*Stomiopeltis* sp." OR "*Streptoziana mali*" OR "*Strickeria kochii*" OR "*Strickeria obducens*" OR "*Swammerdamia pyrella*" OR "*Synanthedon hector*" OR "*Synanthedon myopaeformis*" OR "*Synanthedon scitula*" OR "*Syndemis musculana*" OR "*Tachypterellus quadrigibbus*" OR "*Tapinoma nigerrimum*" OR "*Tarsonemus nodosus*" OR "*Tatianaerhynchites aequatus*" OR "*Tebenna micalis*" OR "*Technomyrmex albipes*" OR "*Teichospora cruentula*" OR "*Teichospora seminuda*" OR "*Teleiodes vulgella*" OR "*Temperate fruit decay associated virus*" OR "*Tetranychus arabicus*" OR "*Tetranychus canadensis*" OR "*Tetranychus cinnabarinus*" OR "*Tetranychus desertorum*" OR "*Tetranychus frater*" OR "*Tetranychus kanzawai*" OR "*Tetranychus lambi*" OR "*Tetranychus ludeni*" OR "*Tetranychus mcdanieli*" OR "*Tetranychus mexicanus*" OR "*Tetranychus neocaledonicus*" OR "*Tetranychus pacificus*" OR "*Tetranychus schoenei*" OR "*Tetranychus turkestanii*" OR "*Tetranychus urticae*" OR "*Tetranychus viennensis*" OR "*Theloneotria lucida*" OR "*Theocolax formiciformis*" OR "*Thielavia* sp." OR "*Thrips australis*" OR "*Thrips hawaiiensis*" OR "*Thrips imaginis*" OR "*Thrips italicus*" OR "*Thrips obscuratus*" OR "*Thrips tabaci*" OR "*Tilletiopsis pallescens*" OR "*Tiracola grandirena*" OR "*Tischeria malifoliella*" OR "*Tobacco bushy stunt virus*" OR "*Tobacco mosaic virus*" OR "*Tobacco necrosis virus*" OR "*Tobacco ringspot virus*" OR "*Tomato bushy stunt virus*" OR "*Tomato ringspot virus*" OR "*Torula herbarum*" OR "*Torymus druparum*" OR "*Toxoptera aurantii*" OR "*Trametes hispida*" OR "*Trametes pubescens*" OR "*Trametes* sp." OR "*Trametes versicolor*" OR "*Trametes zonata*" OR "*Trematosphaeria communis*" OR "*Trichia botrytis*" OR "*Trichoderma*" OR "*Trichoderma harzianum*" OR "*Trichoderma* sp." OR "*Trichodorus*" OR "*Trichodorus cedarus*" OR "*Trichodorus nanjingensis*" OR "*Trichodorus persicus*" OR "*Trichodorus similis*" OR "*Trichodorus viruliferus*" OR "*Trichoforus campestris*" OR "*Trichoseptoria fructigena*" OR "*Trichothecium roseum*" OR "*Trioza urticae*" OR "*Tripodermum acerinum*" OR "*Tripodermum camelopardus*" OR "*Tripodermum myrti*" OR "*Tropinota hirta*" OR "*Tropinota squalida*" OR "*Truncatella angustata*" OR "*Trybliella rufula*" OR "*Trypodendron signatum*" OR "*Tubercularia vulgaris*" OR "*Tulare apple mosaic virus*" OR "*Tumularia*" OR "*Turanoclytus namanganensis*" OR "*Tydeus ancorarius*" OR "*Tydeus dorotheae*" OR "*Tydeus magnanus*" OR "*Tydeus plumosus*" OR "*Tydeus shabestariensis*" OR "*Tydeus unguis*" OR "*Tylenchorhynchus mashhood*" OR "*Typhlocyba pomaria*" OR "*Typhlodromus khosrovensis*" OR "*Typhlodromus pyri*" OR "*Typhlodromus vulgaris*" OR "*Tyrophagus curvipenis*" OR "*Urophorus humeralis*" OR "*Uwebraunia commune*" OR "*Uwebraunia dekkeri*" OR "*Valsa ambiens*" OR "*Valsa amphibola*" OR "*Valsa ceratosperma*" OR "*Valsa cincta*" OR "*Valsa leucostoma*" OR "*Valsa mali*" OR "*Valsa mali* var. *mali*" OR "*Valsa mali* var. *pyri*" OR "*Valsa malicola*" OR "*Valsa nivea*" OR "*Valsa persoonii*" OR "*Valsaria insitiva*" OR "*Valsella melastoma*" OR "*Venturia asperata*" OR "*Venturia inaequalis*" OR "*Venturia pyrina*" OR "*Verticillium albo-atrum*" OR "*Verticillium dahliae*" OR "*Watabura nishiyae*" OR "*Xenotemna pallorana*" OR "*Xestia c-nigrum*" OR "*Xiphinema americanum*" OR "*Xiphinema belmontense*" OR "*Xiphinema bricolense*" OR "*Xiphinema browni*" OR "*Xiphinema californicum*" OR "*Xiphinema diversicaudatum*" OR

"Xiphinema index" OR "Xiphinema mali" OR "Xiphinema meridianum" OR "Xiphinema mluci" OR "Xiphinema paramonovi" OR "Xiphinema parvistilus" OR "Xiphinema radicola" OR "Xiphinema rivesi" OR "Xiphinema vuittenezi" OR "Xylaria sp." OR "Xyleborinus saxesenii" OR "Xyleborus dispar" OR "Xylinothorus strigifrons" OR "Xylosandrus crassiusculus" OR "Xylosandrus germanus" OR "Xylotoles laetus" OR "Xylotrechus namanganensis" OR "Yponomeuta malinella" OR "Yponomeuta malinellus" OR "Zasmidium angulare" OR "Zetiasplozina thuenenii" OR "Zeugodacus cucurbitae" OR "Zeuzera coffeae" OR "Zeuzera pyrina" OR "Zygina zealandica" OR "Zygophiala cryptogama" OR "Zygophiala cylindrica" OR "Zygophiala imperatorae" OR "Zygophiala qianensis" OR "Zygophiala sp." OR "Zygophiala tardicrescens" OR "Zygophiala jamaicensis" OR "Zygophiala wisconsinensis")

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

Appendix C can be found in the online version of this output (in the 'Supporting information' section): <https://doi.org/10.2903/j.efsa.2022.7201>