**Commodity risk assessment of *Berberis thunbergii* potted plants from Turkey**

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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 the Commission Implementing Regulation (EU) 2018/2019 as ‘High-risk plants, plant products and other objects’. This Scientific Opinion covers plant health risks posed by potted plants (2–3 years old) of *Berberis thunbergii* produced in nurseries and imported into the EU from Turkey, taking into account the available scientific information, including the technical information provided by the NPPO of Turkey. The relevance of any pest for this Opinion was based on evidence following defined criteria. Two species, the EU-quarantine pest *Bemisia tabaci* and the non-regulated pest *Malacosoma parallela*, fulfilled the relevant criteria and were selected for further evaluation. For these pests, the risk mitigation measures proposed in the technical dossier from Turkey were evaluated taking into account the possible limiting factors. For these pests, an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on the pest, including uncertainties associated with the assessment. The estimated degree of pest freedom varies among the pests evaluated, with *B. tabaci* being the pest most frequently expected on the imported plants. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,928 and 10,000 plants per 10,000 would be free of *B. tabaci*. The role of *Berberis thunbergii* as possible host of *Puccinia* spp. is discussed in the body of the opinion.

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Figure 2: Provided by the NPPO of Turkey.
Commodity risk assessment of Berberis thunbergii plants from Turkey

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1. Introduction

1.1. Background and terms of reference as provided by European Commission

1.1.1. Background

The Plant Health Regulation (EU) 2016/2031, 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) 2018/2019. Scientific opinions are therefore needed to support the European Commission and the Member States in the work connected to Article 42 of Regulation (EU) 2016/2031, as stipulated in the terms of reference.

1.1.2. Terms of reference

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002, 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 organisations 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 Berberis thunbergii exported from Turkey in the EU taking into account the available scientific information, including the technical dossier provided by Turkey.

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 Berberis thunbergii from Turkey 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 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, Morocco, Namibia, Netherlands, Norway, Papua New Guinea, Portugal, Saint Vincent and the Grenadines, San Marino, Serbia, Sierra Leone, Spain, Swaziland, Switzerland, Tajikistan, Turks and Caicos Islands, United Kingdom, and USA.

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1 Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) 228/2013, (EU) 652/2014 and (EU) 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EC, 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.
Commodity risk assessment of Berberis thunbergii plants from Turkey

Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralsky federalny okrug), Northwestern Federal District (SeveroZapadny 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. pests 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 (Republic of Turkey, Ministry of Agriculture and Forestry, National Plant Protection Organization – NPPO of Turkey) 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 Turkey and associated with the commodity.

- Assessed whether 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 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 the 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 the NPPO of Turkey.

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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) 2016/231 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 the NPPO of Turkey

The Panel considered all the data and information (hereafter called ‘the Dossier’) provided by the NPPO of Turkey and received by EFSA on 9 January 2020 and 15 June 2020, including the additional information provided by the NPPO of Turkey on 17 December 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 |
|-----------------|----------------------|----------|
| 1.0             | Technical dossier on Berberis | BARBERY_Technical_Report-TR-27.11.2019.pdf |
| 2.0             | Technical dossier on Berberis (second submission) | Barberry_Tecnical_Report-TR-05.05.2020_V2 Commented.pdf |
| 3.0             | Additional information provided by NPPO of Turkey | Question_and_answer_on_Berberis_spp.pdf |

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

Table 2 shows the main data sources used by the NPPO of Turkey to compile the Dossier (details on literature searches can be found in the Dossier Section 2.1).

Table 2: Database sources used in the literature searches by the NPPO of Turkey

| Acronym/short title | Database name and service provider | URL of database | Justification for choosing database |
|---------------------|-----------------------------------|----------------|-----------------------------------|
| PPTI                | Name: Plant Protection Technical Instructions Provider: NPPO of Turkey | https://www.tarimorman.gov.tr/TAGEM/Bitki%20Zararl%C4%B1lar%C4%B1%20Ziraai%20M%C3%BCcadele%20Teknik%20Talimatlar%C4%B1.pdf | These instructions are prepared regarding pests in Turkey, which cause damages on their hosts economically. They cover total of 644 pests including bacteria, phytoplasmas, fungi, insects, viruses and viroids. |
| CABI ISC            | CABI Invasive Species Compendium Provider: CAB International | https://www.cabi.org/ISC | EFSA recommendation |
| EPPO GD             | EPPO Global Database Provider: European and Mediterranean Plant Protection Organization | https://gd.eppo.int/ | EFSA recommendation |
| Plant Protection Bulletin published by the Plant Protection Central Research Institute | https://dergipark.org.tr/en/pub/bitkorb | The journal is published four times a year with original research articles in English or Turkish languages on plant protection and health. |
2.2. Literature searches performed by EFSA

Literature searches were undertaken by EFSA to complete a list of pests potentially associated with Berberis spp. Two searches were combined: (i) a general search to identify pests of Berberis spp., in different databases; and (ii) a tailored search to identify whether these pests are present or not in Turkey. The searches were launched on 23 August 2021. No language, date or document type restrictions were applied in the search strategy.

The Panel used the databases indicated in Table 3 to compile the list of pests associated with Berberis spp. As for Web of Science, the literature search was performed using a specific, ad hoc established search string (see Appendix B). 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 English common names of the commodity. The following species, indicated in the dossier, were included in the search: Berberis thunbergii, Berberis spp.

All 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 string was run in ‘All Databases’ with no range limits for time or language filters.

Table 3: Databases used by EFSA for the compilation of the pest list associated with the species of genus Berberis spp. relevant for this Dossier
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) were 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 were 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 were identified.

In the second step, the implemented risk mitigation measures for each relevant pest were evaluated in terms of efficacy or compliance with EU requirements as explained in Section 1.2.

A conclusion on the likelihood of the commodity being free from each of the relevant pests was determined and uncertainties were identified using expert judgements.

Pest freedom was assessed by estimating the number of infested/infected potted plants out of 10,000 exported potted plants.

#### 2.3.1. Commodity data

Based on the information provided by the NPPO of Turkey, 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 *Berberis thunbergii* imported from Turkey, a pest list was compiled. The pest list is a compilation of all identified plant pests associated with *Berberis* spp. based on information provided in the Dossier Section 4 and on searches performed by the Panel.

The scientific names of the host plants (i.e. *Berberis* spp., *Berberis thunbergii*, etc.) were used when searching in the EPPO Global database (EPPO online) and CABI Crop Protection Compendium.

EUROPHYT was consulted by searching for the interceptions associated with commodities imported from Turkey, at species and genus level, from 1994 to May 2020 and TRACES for interceptions from May 2020 to present (April 2022). For the pests selected for further evaluation, a search in the EUROPHYT and/or TRACES was performed for the interceptions from the whole world, at species and genus level.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *Berberis* spp. 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® file in Appendix D) includes all identified pests that use *Berberis* spp. 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

The proposed risk mitigation measures were listed and evaluated. When evaluating the likelihood of pest freedom at origin, the following types of potential infection/infestation sources for *Berberis thunbergii* in nurseries and relevant risk mitigation measures were considered (see also Figure 1):

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

The effect of risk mitigation measures adopted in the plant nurseries (as communicated by the NPPO of Turkey) was evaluated with Expert Knowledge Elicitation (EKE) according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).

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

Information on the biology, estimates of likelihood of entry of the pest to the nursery and spread within the nursery and the effect of the measures on a specific pest is summarised in pest data sheets compiled for each pest selected for further evaluation (see Appendix A).

### 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 *Berberis thunbergii* potted plants will be infested with the relevant pest/pathogen when arriving in the EU?'

The risk assessment uses individual potted 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) For the pests under consideration, a cross-contamination during transport is not likely.

iii) Potted plants will be finally distributed to final consumers by wholesaler and retailers.

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

3. **Commodity data**

3.1. **Description of the commodity**

According to the information provided in the dossier and the additional information received, the species planned to be exported is *Berberis thunbergii* (family: Berberidaceae). The following varieties are planned to be exported: *B. thunbergii* var. atropurpureum, *B. thunbergii* var. green, *B. thunbergii* var. red rocket, *B. thunbergii* var. maria and *B. thunbergii* var. atropurpurea nana.

*B. thunbergii* is a deciduous species therefore, based on the period of export (see Table 4) these are expected to be dormant plants without leaves for most of this period. However, if exported in March, April or October, the plants may have leaves. The age of the plants at the time of export is between 2 and 3 years. The size of the commodity is between 20 and 40 cm tall. All *B. thunbergii* plants are exported as potted plants.

According to ISPM 36 (FAO, 2016), the commodity can be classified as ‘rooted plants in pots’.

3.2. **Description of the production areas**

*B. thunbergii* plants for export are grown and cultivated outdoors in containers (pots).

The main production areas of *B. thunbergii* plants for export are located in 14 provinces in Turkey (Figure 2). Forest nurseries located throughout Turkey may be providers of starting material (plantlets) for the ornamental production nurseries.

![Figure 2: Main production areas (indicated in green) in Turkey of Berberis plants for export (provided by the NPPO of Turkey)](image)

3.3. **Production and handling processes**

3.3.1. **Growing conditions**

*B. thunbergii* plants for export are produced in open field nurseries.

3.3.2. **Source of planting material**

Genetic material from registered forest nurseries (Technical dossier on *Berberis* -second submission-, Section 3) is the source of propagation material used by the production nurseries for the production of plants intended for export. There is no other available information on the reproductive material.
3.3.3. Production cycle

Exported plants are 2–3 years old.

Production starts with winter or summer cuttings taken from mother plants. The age of the mother plants, the size of the cuttings and the growing conditions were not specified in the dossier. All stages of the plants are grown in pots with turf on a jute black base without ground connection. However, based on the pictures included in the dossier, it seems that the pots are, at some stages, in contact with soil.

Limited information was provided on any chemical, physical or biological phytosanitary measures adopted during the cultivation period (Additional information provided by NPPO of Turkey, Section 19).

3.3.4. Pest monitoring during production

Forest nurseries affiliated with the General Directorate of Forestry (not directly exporting/importing nurseries) are stated to be inspected by forestry inspectors as a routine work (at least once a month). According to the dossier forest nurseries are inspected once a year for phytosanitary requirements by the Provincial Directorate of Agriculture.

Production nurseries are inspected at least once a year, regardless whether they are exporting or not. According to the dossier, for the identification of viruses, bacteria, fungi and nematodes in the plants to be exported, 1 kg sample is taken from growing media in pots as composite sample. Also, samples from leaves, stems, etc., are to be taken separately by the inspector and send to the laboratory for analysis. In the production nurseries of ornamentals, all plants are to be inspected visually, and samples are taken from symptomatic plants if necessary. There is no information on the frequency of these inspections and on pests identified during the inspections and laboratory testing.

Traded ornamental plants are required to be free from any kind of disease symptoms or pests. No information is provided on actions taken in case a harmful organism is identified in the nursery.

3.3.5. Post-harvest processes and export procedure

The planned production for export in the EU in 2020 was estimated to be 7,950 plants. The months on which the plants are to be exported to the EU are indicated in Table 4 (Dossier, Section 5.4).

Exportation may be done in mixed loads of Berberis spp. with other (not specified) species and it is mainly done from production sites in the provinces Adana, Antalya, İzmir and Sakarya.

Plants are loaded on refrigerated trucks for export. The relative humidity content of the loaded trailer is between 85% and 95% and temperature is between 2°C and 4°C. However, from the pictures provided, it is not clear if the trucks shown can ensure these conditions.

The size of the consignment varies according to the age of the plants, the size of the pots and the loading capacity of the trucks. The pots are stacked one by one in a row in the refrigerated trucks. If the plants are located in the production sites of different companies, the exporter company collects the plants to be shipped to its own production area.

| Table 4: Scheduling of *Berberis thunbergii* plants planned to be exported to the EU (indicated in grey) |
| February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|
| Berberis |  |  |  |  |  |  |  |  |  |  |

4. Identification of pests potentially associated with the commodity

The search for potential pests associated with *Berberis* spp. rendered 614 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.
The relevance of an EU-quarantine pest for this opinion was based on evidence that:

- a) the pest is present in Turkey;
- b) *Berberis* spp. is a host of the pest;
- c) one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all criteria were selected for further evaluation. Table 5 presents an overview of the evaluation of the four EU-quarantine pest species that are reported to use *Berberis* spp. as a host with regard to their relevance for this Opinion. Of these four EU-quarantine pest species evaluated, one is present in Turkey and was selected for further evaluation as it fulfils the criteria to be selected for further evaluation (*Bemisia tabaci*).

Table 5: Overview of the evaluation of the four EU-quarantine pest species reported in *Berberis* spp.

| No. | Pest name according to EU legislation(a) | EPPO code | Group | Pest present in Turkey | Berberis spp. confirmed as a host (reference) | Pest can be associated with the commodity | Pest relevant for the opinion |
|-----|----------------------------------------|-----------|-------|------------------------|-----------------------------------------------|---------------------------------------------|-----------------------------|
| 1   | *Phymatotrichopsis omnivora*           | PHMPOM    | Fungi | No                     | Yes                                           | Yes                                         | No                          |
| 2   | *Phytophthora ramorum*                 | PHYTRA    | Oomycete | No                     | Yes                                           | Yes                                         | No                          |
| 3   | *Bemisia tabaci*                       | BEMITA    | Insects | Yes                     | Yes                                           | Yes                                         | Yes                         |
| 4   | *Toxoptera citricida*                  | TOXOCI    | Insects | No                     | Yes                                           | Yes                                         | No                          |

(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 NPPO of Turkey, integrated with the search EFSA performed, was evaluated in order to assess whether there are other potentially relevant pests of *Berberis* spp. present in the 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 Turkey;
- b) the pest is (i) absent or (ii) has a limited distribution in the EU;
- c) *Berberis* spp. 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.

Based on the information collected, 605 potential pests not regulated in the EU, known to be associated with *Berberis* 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 D (Microsoft Excel® file). Of the evaluated pest species not regulated in the EU, one insect species (*Malacosoma parallela*) was selected for further evaluation, because it met all the selection criteria. More information on this pest species can be found in the pest datasheets (Appendix A).

Several *Puccinia* species, including *Puccinia graminis*, are present in the EU, and therefore, the Panel concluded not to select them for further evaluation. However, because of the importance of these cereal rust pathogens for the EU, the panel wants to report the following notes:

- *Berberis* is an alternate host for several rust species, including *P. graminis* and *P. striiformis*.
- *P. graminis* is present in Turkey and reported on *Berberis* species.
- *Berberis thunbergii* is not reported as a host for *P. graminis*.
- Interspecific hybrids of *B. thunbergii* can be a host of *Puccinia graminis* (e.g. Bartaula et al., 2019).
• *P. striiformis* is present in Turkey but not on *Berberis* species.
• It is important to avoid planting of *Berberis* species in proximity to cereal fields.
• New stem rust races could be introduced with the trade of *Berberis* plants.
• Genetic diversity and new virulence combinations can develop on introduced *Berberis* plants.
• Arrival of new stem rust races by wind to Europe can also happen and cannot be prevented.
• *P. graminis* is present in EU and has no quarantine status in EU, but has a quarantine status in Canada and USA.
• Import of and domestic movement of *Berberis* species (including *B. thunbergii*) is regulated in Canada (D-01-04: Plant Protection Import and Domestic Movement Requirements for Barberry (*Berberis*, *Mahoberberis* and spp.) under the Canadian Barberry Certification Program).

4.3. Overview of interceptions

Data on the interception of harmful organisms on plants of *Berberis* spp. can provide information on some of the organisms that can be present on *Berberis* spp. despite the current measures taken. In the EUROPHYT/TRACES database (assessed on April 2022) of interceptions in the EU, there is no record of interceptions on *Berberis* from Turkey (EUROPHYT and TRACES, online).

*Bemisia tabaci* is the most intercepted pest species on plants for planting in the EU. There were 72 interceptions of *B. tabaci* on different commodities imported into the EU from Turkey, mainly on fruits of *Capsicum annum*. Considering imports of *Berberis* plants from Turkey to the EU, between 1994 and 2022, there are no records of interceptions of *B. tabaci* (EUROPHYT and TRACES, online, [Accessed: 26 April 2022]).

4.4. List of potential pests not further assessed

From the pests not selected for further evaluation, the Panel highlighted two species that can potentially have an impact (see Appendix C) but for which the currently available evidence does not provide reasons for further evaluation in this opinion. The detailed reason is provided for each species in Appendix C.

4.5. Summary of pests selected for further evaluation

The two pests identified to be present in Turkey and can be associated with potted plants of *Berberis* spp. destined for export are listed in Table 6. The effectiveness of the risk mitigation measures applied to the commodity was evaluated for these selected pests.

**Table 6:** List of relevant pests selected for further evaluation

| Current scientific name | EPPO code | Name used in the EU legislation | Taxonomic information | Group | Regulatory status |
|-------------------------|-----------|---------------------------------|-----------------------|-------|------------------|
| *Bemisia tabaci*        | BEMITA    | *Bemisia tabaci* (European populations) | Aleyrodidae | Insect | EU protected zone quarantine pest according to Commission Implementing Regulation (EU) 2019/2072 |
| *Malacosoma paralela*   | MALAPA    | *Malacosoma paralela*            | Lasiocampidae | Insect | No quarantine status in the EU |

5. Risk mitigation measures

For each selected pest (Table 6), the Panel assessed the possibility that it could be present in a *Berberis* spp. nursery and assessed the probability that pest freedom of a consignment is achieved by the implemented 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 datasheet (see Appendix A).
5.1. Possibility of pest presence in the export nurseries

For each pest (Table 6), the Panel evaluated the likelihood that the pest could be present in a *Berberis* spp. nursery by evaluating the possibility that *Berberis* spp. in the export nursery are infested either by:

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

5.2. Risk mitigation measures applied in Turkey

- With the information provided by the NPPO of Turkey (Dossier sections 5.1, 5.2, and 5.3), the Panel summarised the risk mitigation measures (see Table 7) that are implemented in the production nurseries.

| Table 7: Overview of implemented risk mitigation measures for *Berberis* spp. plants designated for export to the EU from Turkey |
|---|
| **Number** | **Risk mitigation measure** | **Implementation in Turkey** |
| 1 | Registration of the nursery and Phytosanitary management | Turkey is a member of the International Plant Protection Convention (IPPC) and is obliged to implement the International Standards on Phytosanitary Measures (ISPM) published by the IPPC. All nurseries producing ornamental plants are required to be a member of the ornamental plant grower union in Turkey and inspected at least once a year. A plant passport or export certificate is issued. |
| 2 | Phytosanitary certificates and plant passport | Phytosanitary Certificates/Re-Export Phytosanitary Certificates are issued in exportation of plants and plant products with respect to plant health. Plant health inspectors are responsible from exportation and importation controls, sampling and issuing certificates. Nurseries are officially inspected at least once a year and for issuing the export certificate. |
| 3 | Growing media | Is composed entirely of peat or fibre of *Cocos nucifera* L. and has not been previously used for growing plants or for any other agricultural purposes. It is also stored and maintained under appropriate conditions to keep it free from quarantine pests. Appropriate measures are taken to ensure that the growing medium is kept free from Union quarantine pests, including at least: physical isolation of the growing medium from soil and other possible sources of contamination, hygiene measures and using water free from Union quarantine pests. |
| 4 | Pesticide application | There is a database for registered pesticides in Turkey. There are no products registered for *Berberis*. For all crops in Turkey, pesticides are applied according to the technical instructions for plant protection and according to the principles of integrated pest management. |
| 5 | Surveillance and monitoring | Both processes are conducted according to Turkish phytosanitary regulations. There are no targeted surveys for the actionable pests. |
| 6 | Sampling and laboratory testing | For the identification of viruses, bacteria, fungi and nematodes in the seedlings to be exported, 1 kg sample is taken from growing media in pots as composite sample. Samples from leaves, stems, are taken separately by the inspector and sent to the laboratory for analysis. |
| 7 | Refrigeration | Transportation is made with refrigerated trucks. The dispatch is made as pots and the pots are stacked one by one in a row in the truck. The moisture content is between 85% and 95%. Trailers temperature must be between 2°C and 4°C. |
| 8 | Preconsignment inspection | Prior to export, planting material for which a Phytosanitary Certificate is to be issued shall be subjected to phytosanitary inspection. Only certified plants for planting may be exported. Phytosanitary inspectors are responsible for export controls, sampling and issuing certificates. |
5.3. Evaluation of the current measures for the selected relevant pests including uncertainties

For each pest, the relevant risk mitigation measures acting on the pest were identified. Any limiting factors on the efficacy of the measures were documented. All the relevant information including the related uncertainties deriving from the limiting factors used in the evaluation are summarised in a pest datasheet provided in Appendix A.

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

An overview of the evaluation of each relevant pest is given in the sections below (Sections 5.3.1–5.3.2). The outcome of EKE on pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.3.3.

5.3.1. Overview of the evaluation of Bemisia tabaci

| 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 plants         | 9,928 out of 10,000 plants  9,950 out of 10,000 plants  9,969 out of 10,000 plants  9,885 out of 10,000 plants  9,997 out of 10,000 plants |
| Proportion of infested plants          | 3 out of 10,000 plants  15 out of 10,000 plants  31 out of 10,000 plants  50 out of 10,000 plants  72 out of 10,000 plants |

Summary of the information used for the evaluation

The whitefly B. tabaci is a polyphagous pest with a wide host range of more than 1,000 different plant species. B. tabaci is widespread in Turkey and Berberis spp. has been reported as a host of B. tabaci in Turkey. Due to its polyphagous nature the pest can be present in the surrounding environment of the nurseries producing Berberis thunbergii. Plants are mostly grown in the open field and the whitefly could enter the nursery by flight. All life stages of B. tabaci (eggs, larvae, and adults) can be present on the leaves of the plants.

There is no export of plants in the spring and summer period (indicated in dossier from April to September). B. thunbergii is a deciduous plant. In general, dormant deciduous plants without leaves are not considered a pathway for B. tabaci. However, it is uncertain if the export period of dormant plants indicated in the dossier excludes the presence of leaves of the exported B. thunbergii plants. B. thunbergii plants traded in March, April or October could have leaves and B. tabaci could be present.

Measures taken against the pest and their efficacy

The relevant applied measures are: (i) regular inspections in the nurseries (at least 1 inspection per year) (ii) export inspections. No information was provided on targeted treatments against Bemisia tabaci in nurseries producing Berberis plants for export.

Interception records

B. tabaci has been intercepted on plants from Turkey. There are no records of interceptions of B. tabaci on Berberis plants from Turkey.

Shortcomings of current measures/procedures

There is no clear indication of a targeted inspections and treatments for B. tabaci in ornamental nurseries producing Berberis.

Main uncertainties

There is high uncertainty on the exact trading season and the implementation of the risk mitigation measures targeting Bemisia in the nurseries.
5.3.2. Overview of the evaluation of *Malacosoma parallela*

| 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 bundles        | 9,956 | 9,971 | 9,982 | 9,991 | 9,998 |
| Proportion of infested bundles         | 2 | 9 | 18 | 29 | 44 |
|                                   | out of 10,000 plants | out of 10,000 plants | out of 10,000 plants | out of 10,000 plants | out of 10,000 plants |

Summary of the information used for the evaluation

Possibility that the pest could become associate with the commodity

The lepidopteran pest *M. parallela* is extremely polyphagous and causes most damage in its native range to *Quercus* spp., *Prunus* spp. and *Malus* spp. Significant damage also occurs on various other woody species, including *Berberis* and many native species of Central Asia. *Malacosoma parallela* is present in Turkey, with no further details on its distribution. *M. parallela* can spread by flights of adult moths. All stages of the life cycle can be transported on host plants moving in trade, particularly plants for planting and cut branches. Eggs, larvae and pupae (cocoons) may be associated with wood carrying bark and may be present as contaminants on other commodities.

Measures taken against the pest and their efficacy

The relevant applied measures are: (i) regular inspections in the nurseries (at least one inspection per year) (ii) export inspections. No information was provided on targeted treatments against *M. parallela* in nurseries producing *Berberis* plants for export.

Interception records

There are no records of interceptions of *Berberis* plants for planting from Turkey.

Shortcomings of current measures/procedures

Egg masses might be overlooked by non-trained personnel. Some of the pesticides listed in the dossier might be effective against the moth. However, no details are given on which pesticides are applied from those listed in the Dossier, Section 2.0, on the pesticide application schedule and on the application methods.

Main uncertainties

- The pest is reported in Turkey with no details on its distribution.
- Egg masses might be overlooked by non-trained personnel.
- The insecticide applications are not targeted to *M. parallela* and may not be effective.

5.3.3. Outcome of Expert Knowledge Elicitation

Table 8 and Figure 3 show the outcome of the EKE regarding pest freedom after the evaluation of the implemented risk mitigation measures for all the evaluated pests. Figure 4 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for *Berberis thunbergii* plants designated for export to the EU for *Bemisia tabaci*. 
Table 8: Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against *Bemisia tabaci* and *Malacosoma parallela* on *Berberis* spp. potted plants designated for export to the EU. In panel A, the median value for the assessed level of pest freedom for each pest is indicated by ‘M’, the 5% percentile is indicated by L and the 95% percentile is indicated by U. The percentiles together span the 90% uncertainty range regarding pest freedom. The pest freedom categories are defined in panel B of the table.

| Number | Group* | Pest species          | 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      | Insect | *Bemisia tabaci*      |                     |                               |                     | L                        | M                               | U                                  |                                   |                     |
| 2      | Insect | *Malacosoma parallela*|                     |                               |                     | L                        | LM                              | U                                  |                                   |                     |

**PANEL A**

| Pest freedom category                  | Pest-free plants out of 10,000 | Legend of pest freedom categories                                      |
|----------------------------------------|---------------------------------|------------------------------------------------------------------------|
| Sometimes pest free                    | ≤ 5,000                         | **L** Pest freedom category includes the elicited lower bound of the 90% uncertainty range |
| More often than not pest free          | 5,000 to ≤ 9,000                | **M** Pest freedom category includes the elicited median               |
| Frequently pest free                   | 9,000 to ≤ 9,500                | **U** Pest freedom category includes the elicited upper bound of the 90% uncertainty range |
| Very frequently pest free              | 9,500 to ≤ 9,900                |                                                                        |
| Extremely frequently pest free         | 9,900 to ≤ 9,950                |                                                                        |
| Pest free with some exceptional cases  | 9,950 to ≤ 9,990                |                                                                        |
| Pest free with few exceptional cases   | 9,990 to ≤ 9,995                |                                                                        |
| Almost always pest free                | 9,995 to ≤ 10,000               |                                                                        |

**PANEL B**
Figure 3: Elicited certainty (y-axis) of the number of pest-free *Berberis* spp. potted plants (x-axis; log-scaled) out of 10,000 plants designated for export to the EU from Turkey for all evaluated pests 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 9,928 and 9,956 or more plants per 10,000 will be free from *Bemisia tabaci* and *Malacosoma parallela*, respectively.
6. Conclusions

There are two pests identified to be present in Turkey and considered to be potentially associated with potted plants of 2–3 years old of *Berberis thunbergii* imported from Turkey and relevant for the EU.

The likelihood of the pest freedom after the evaluation of the implemented risk mitigation measures for potted plants of 2–3 years old of *B. thunbergii*. Designated for export to the EU was estimated.

For *Bemisia tabaci*, the likelihood of pest freedom following the evaluation of current risk mitigation measures, it was estimated as ‘Pest free with some exceptional cases’ with the 90% uncertainty range reaching from ‘Extremely frequently pest free’ and to ‘Almost always pest free’. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,928 and 10,000 plants per 10,000 will be free from *Bemisia tabaci*.

For *Malacosoma parallela*, 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 9,956 and 10,000 plants per 10,000 will be free from *Malacosoma parallela*.

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**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)
### Abbreviations

| Abbreviation | Full Form |
|--------------|-----------|
| 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 |
Appendix A – Data sheets of pests selected for further evaluation via expert knowledge elicitation

A.1. Bemisia tabaci

A.1.1. Organism information

| Taxonomic information | Current valid scientific name: Bemisia tabaci (Gennadius, 1889) |
|-----------------------|---------------------------------------------------------------|
|                       | Synonyms: Aleurodes inconspicua, Aleurodes tabaci, Bemisia achyranthes, Bemisia bahiana, Bemisia costa-limai, Bemisia emiliae, Bemisia goldenii, Bemisia gossypipera, Bemisia gossypipera mosaicivectura, Bemisia hibisci, Bemisia inconspicua, Bemisia longispina, Bemisia lonicerae, Bemisia manihotis, Bemisia minima, Bemisia minuscula, Bemisia nigeriensis, Bemisia rhodesiaensis, Bemisia signata, Bemisia vayssieri |
|                       | Name used in the EU legislation: Bemisia tabaci Genn. (non-European populations) known to be vector of viruses [BEMITA] |
|                       | Order: Hemiptera |
|                       | Family: Aleyrodidae |
|                       | Common name: tobacco whitefly |
|                       | Name used in the Dossier: Bemisia tabaci |

| Group | Insects |
|-------|---------|
| EPPO code | BEMITA |
| Regulated status | The pest is listed in Annex II/A of Regulation (EU) 2019/2072 as Bemisia tabaci Genn. (non-European populations) known to be vector of viruses [BEMITA], and in Annex III as protected zone quarantine pest (European populations). |
| Pest status in Turkey | Widespread (EPPO global database), the formerly defined Biotypes B and Q (now species considered as MEAM1 and MED) are present in Turkey (EFSA, 2013). |
| Host status on Berberis | Berberis species are reported as host plants for B. tabaci (Bayhan et al., 2006; EFSA, 2013; Li et al., 2011). In Turkey, it is also reported as a pest in cotton and vegetable crops (Bayhan et al., 2006). B. tabaci is highly polyphagous, and therefore, the panel assumes that B. thunbergii can be a host for B. tabaci. |
| PRA information | EFSA Scientific Opinion on the risks to plant health posed by Bemisia tabaci species complex and viruses it transmits for the EU territory (EFSA PLH Panel, 2013). B. tabaci was identified as an actionable pest for the commodity risk assessment of Lonicera plants from Turkey (EFSA, 2022). |

Other relevant information for the assessment

B. tabaci is a complex of at least 28 indistinguishable morphocryptic species. Twenty-six of them, endemic in countries around the world, are so far not reported in Europe (EFSA PLH Panel, 2013). The terms 'European populations' and 'non-European populations' of B. tabaci used in the Regulation (EU) 2019/2072 do not refer to specific populations or taxonomic entities but stipulate a geographic origin of B. tabaci, from inside and outside Europe, respectively. In Regulation (EU) 2019/2072, Turkey is considered as European. In this respect, B. tabaci populations in Turkey are considered to be European populations. In the EU, non-European populations of B. tabaci have a quarantine status, while European populations have a quarantine status for specified protected zones.

Biology

During oviposition, females insert eggs with the pedicel directly into leaf tissue (Paulson and Beardsley, 1985). It has four instars. The first instar with legs, called crawler, finds a permanent spot on a leaf and stays there for the rest of its nymphal development (Walker et al., 2009).

The pest is a phloem-feeder and can be found mainly on leaves (Cohen et al., 1996). B. tabaci has a high reproductive potential and each female can lay an average of 80 to more than 300 eggs during their lifetime. The number of eggs laid depends on temperature and the host plant, but generally under favourable conditions (e.g. tomato production in greenhouses) even the introduction of only a few founding insects will lead to a massive upsurge in insect densities. Under these conditions, four to five insect generations per year can develop (EFSA, 2013).

B. tabaci adults can have directional and active flights. Whiteflies seldom need to fly more than a few centimetres to a few metres to find suitable host plants. However, they may cover distances of a few kilometres. B. tabaci adults can spread over longer distances by passive transport with wind.
Symptoms | Main type of symptoms | Wide range of symptoms can occur on plants due to direct feeding of the pest, contamination of honeydew and sooty moulds, transmitted viruses and phytotoxic responses. Plants exhibit one or more of these symptoms: chlorotic spotting, vein yellowing, intervein yellowing, leaf yellowing, yellow blotching of leaves, yellow mosaic of leaves, leaf curling, leaf crumpling, leaf vein thickening, leaf enations, leaf cupping, stem twisting, plant stunting, wilting, leaf loss and silivering of leaves (CABI, online; EPPO, 2004).

Presence of asymptomatic plants | No asymptomatic period is known to occur in the infested plants. However, eggs and first-instar larvae are difficult to detect. Symptoms of the infestation by the insect are visible.

Confusion with other pathogens/pests | *B. tabaci* can be easily confused with other species such as glasshouse whitefly *Trialeurodes vaporariorum*, *B. afer*, *T. lauri*, *T. packardi*, *T. ricini* and *T. variabilis*. A microscopic slide is needed for morphological identification (EPPO, 2004).

Host plant range | *B. tabaci* is a polyphagous pest with a wide host range, including more than 1,000 different plant species (Abd-Rabou and Simmons, 2010). Some species of *Berberis* are hosts of the pest.

Evidence that the commodity can be a pathway | All life stages of *B. tabaci* (eggs, larvae and adults) are present on the leaves of the plants. Therefore, plants without leaves are not considered a pathway for *B. tabaci*. However, if plants are traded with leaves, this could be a pathway for *B. tabaci*. It is possible that *Berberis* plants exported from Turkey to the EU could be exported with leaves.

Surveillance information | In dossier Section 1.5.3, it is stated that the site of production has been found free from *B. tabaci* on official inspections carried out at appropriate times to detect the pest.

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A.1.2. Possibility of pest presence in the nursery

A.1.2.1. Possibility of entry from the surrounding environment

*Bemisia tabaci* is a polyphagous species that is widespread in Turkey and reported occurring in many horticultural crops. *Berberis* plants are grown in open field nurseries. Flying adults of *Bemisia tabaci*, able to fly or be transferred by the wind over kilometres, can enter the nursery from host plants that might be present in the surrounding environment.

Uncertainties:
- It is not known what is the pressure of the *B. tabaci* population in the surrounding environment of the nursery.
- Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery from the surrounding environment.

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

*Bemisia tabaci* could enter the nursery with infested propagation material of host plants species.

Uncertainties:
- The origin of the propagation material in relation to the infested areas;
- The presence and the numbers of other host plants in the export nursery

Taking into consideration the above evidence and uncertainties, the Panel considers it is possible that the pest could enter the nursery with new plants.

A.1.2.3. Possibility of spread within the nursery

Flying adults can spread from infested host plants within the nursery.
Uncertainties: There are no uncertainties.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the nursery is possible.

A.1.3. Information from interceptions

*Bemisia tabaci* is the most intercepted pest species on plants for planting in the EU. There were 72 interceptions of *B. tabaci* on different commodities imported into the EU from Turkey, mainly on *Capsicum annum*. Considering imports of *Berberis* plants from Turkey to the EU, between 1994 and 2022, there are no records of interceptions of *B. tabaci* (EUROPHYT and TRACES, online, [Accessed: 4 May 2022]).

A.1.4. Evaluation of the risk mitigation options

In the table below, all risk mitigation measures currently applied in Turkey are listed and described and an indication of their effectiveness on *B. tabaci* is provided.

The possibility of the presence of *B. tabaci* on potted plants and the control effect of the risk mitigation measures applied was already assessed for Lonicera plants to be exported to the EU (EFSA, 2022). Therefore, the panel assessed the differences of the production areas, production methods and pest management actions and time of export between of Lonicera and Berberis production in Turkey. The panel concluded that there were only minor differences between the production systems of Berberis and Lonicera in Turkey which had no significant effect on the evaluation of the level of pest freedom of the exported plants. Therefore, the results of the Expert Knowledge Elicitation for *B. tabaci* from the Lonicera dossier (deciduous Lonicera) were used for the estimation of pest freedom of *B. tabaci* on deciduous *B. thunbergii* from Turkey.

| No. | Risk mitigation measure (name) | Description | Effective | Evaluation/ Uncertainties |
|-----|-------------------------------|-------------|-----------|---------------------------|
| 1   | Certified material            | **Turkey is a member of the International Plant Protection Convention (IPPC) and is obliged to implement the International Standards on Phytosanitary Measures (ISPM) published by the IPPC.** | Yes | **Plants originate from certified nurseries.** |
| 2   | Phytosanitary certificates and plant passport | **Phytosanitary Certificates/Re-Export Phytosanitary Certificates are issued in exportation of plants and plant products with respect to plant health. Plant health inspectors are responsible from exportation and importation controls, sampling and issuing certificates.** | Yes | **Uncertainties: Information is not sufficient to judge the quality of inspections, etc.** |
| 3   | Growing media                | **Is composed entirely of peat or fibre of *Cocos nucifera* L. and has not been previously used for growing plants or for any other agricultural purposes. It is also stored and maintained under appropriate conditions to keep it free from quarantine pests.** | **No** | **B. tabaci is present on leaves only.** |
| 4   | Pesticide application        | **For all crops in Turkey, pesticides are applied according to the Technical Instructions for Plant Protection and according to the principles of integrated pest management.**<br>**A list of pesticide active ingredients and doses authorised on ornamental plants was provided.**<br>**No details on frequencies of application have been provided.** | Yes | **Among the insecticides listed, there are active ingredients that can be effective against B. tabaci.**<br>**Uncertainties:**<br>**The frequency of application is not known.** |
| No. | Risk mitigation measure (name) | Description                                                                                     | Effective | Evaluation/ Uncertainties |
|-----|--------------------------------|-----------------------------------------------------------------------------------------------|-----------|---------------------------|
| 5   | Surveillance and monitoring   | Both processes are conducted according to Turkish phytosanitary regulations. Nurseries are inspected once per year. | Yes       | Symptoms of *B. tabaci* infestations could be detected. Uncertainties: The details of surveillance and monitoring are not given (e.g. number of plants, intensity of surveys and inspections, etc.). |
| 6   | Sampling and laboratory testing | For the identification of viruses, bacteria, fungi and nematodes in the seedlings to be exported, 1 kg sample is taken from growing media in pots as composite sample. Also samples from leaves, stems, etc., are taken separately by the inspector and send to the laboratory for analysis. The seedlings in the production area are examined macroscopically for pests. | No        | -                          |
| 7   | Refrigeration                 | Transportation is made with refrigerated trucks. The dispatch is made as pots (piece) and the pots are stacked one by one in a row in the truck. The moisture content is between 85% and 95%. Trailers temperature must be between 2°C and 4°C. | Yes       | Low temperatures can slow down its development but not kill the insect. Uncertainties: No uncertainties. |
| 8   | Pre-consignment inspection    | Prior to export, planting material for which a Phytosanitary Certificate is to be issued shall be subjected to phytosanitary inspection. Only certified plants for planting may be exported. Phytosanitary inspectors are responsible for export controls, sampling and issuing certificates. | Yes       | Symptoms and presence of *B. tabaci* infestations could be detected. Uncertainties: Information is not sufficient to judge the quality of inspections. |

### A.1.4.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments
- There are targeted inspections and treatments for *B. tabaci*.  
- The pest population pressure in the surrounding environment is very low.  
- Suitable hosts are not widely distributed in the production area.  
- Plants are traded in the months when population level of *Bemisia* is very low.  
- Weed control in the nurseries prevent overwintering populations of *Bemisia*.

### A.1.4.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments
- There are nurseries producing *Berberis* spp. plants located in the area where *B. tabaci* is present in high populations.  
- There are suitable hosts in the production area, in close proximity with *Berberis* plants.  
- The pest could go undetected during inspections of the nursery and no specific treatments are applied.  
- The exported *Berberis* species are mostly not in dormant stage (if traded in March/April or in October) and they have leaves.  
- Population level of *Bemisia* in March, April and October could be high.  
- Lack of effective weed control in the nurseries does not prevent the introduction of *Bemisia* from overwintering weed populations on weeds.
A.1.4.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

- The trade of the Berberis plants takes place in seasons when the activity of B. tabaci is very low.
- In general, plants are expected to have no leaves at the time of export, but plants traded in March/April or October could have leaves.

A.1.4.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

- We express high uncertainty on the exact trading season and the implementation of the risk mitigation measures targeting Bemisia in the nurseries.
A.1.5. Elicitation outcomes of the assessment of the pest freedom for *Bemisia tabaci* on *Berberis thunbergii* plants

**Table A.1:** Elicited and fitted values of the uncertainty distribution of pest infestation by *Bemisia tabaci* per 10,000 plants

| Percentile | 1% | 2.5% | 5% | 10% | 17% | 25% | 33% | 50% | 67% | 75% | 83% | 90% | 95% | 97.5% | 99% |
|------------|----|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|
| Elicited   | 1  | 15   | 30 | 50  | 80  |     |     |     |     |     |     |     |     |       |     |
| EKE        | 1.01 | 1.86 | 3.26 | 6.07 | 9.9 | 14.7 | 19.7 | 30.5 | 42.7 | 49.6 | 57.4 | 65  | 72   | 76    | 80  |

The EKE results are BetaGeneral (1.0242, 1.6196, 0.42, 85) fitted with @Risk version 7.6.

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

**Table A.2:** The uncertainty distribution of plants free of *Bemisia tabaci* per 10,000 plants calculated by Table A.1

| Percentile | 1% | 2.5% | 5% | 10% | 17% | 25% | 33% | 50% | 67% | 75% | 83% | 90% | 95% | 97.5% | 99% |
|------------|----|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|
| Values     | 9,920 | 9,950 | 9,970 | 9,985 |     |     |     |     |     |     |     |     |     |       |     |
| EKE results | 9,920 | 9,924 | 9,928 | 9,935 | 9,943 | 9,950 | 9,957 | 9,969 | 9,980 | 9,985 | 9,990 | 9,994 | 9,997 | 9,998 | 9,999 |

The EKE results are the fitted values.
Commodity risk assessment of *Berberis thunbergii* plants from Turkey
A.1.6. Reference list

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A.2. Malacosoma parallela

A.2.1. Organism information

| Taxonomic information | Current valid scientific name: Malacosoma parallela Staudinger |
|-----------------------|---------------------------------------------------------------|
| Synonyms: Bombbyx neustria var. parallela Staudinger, 1887 (Zolotuhin and Zahiri, 2008) |
| Name used in the EU legislation: – |
| Order: Lepidoptera |
| Family: Lasiocampidae |
| Common name: mountain ring silk moth |
| Name used in the Dossier: Malacosoma parallela |

| Group | Insects |
|-------|---------|
| EPPO code | MALAPA |
| Regulated status | The pest is included in the EPPO A2 list (EPPO, online). |
| Pest status in Turkey | Malacosoma parallela is present in Turkey, with no further details on its distribution (EPPO, online; CABI). |
| Pest status in the EU | Malacosoma parallela is absent in the EU. |

| Host status on Berberis | Berberis species are reported as a host of Malacosoma parallela (EPPO, online). |
|--------------------------|--------------------------------------------------------------------------------|

| PRA information | EPPO Pest Risk Assessments available (EPPO, online): |
|-----------------|-----------------------------------------------------|
| | • Pest Risk Management report |
| | • Report of a Pest Risk Assessment |
| | • Pest Risk Assessment Scheme |

M. parallela was identified as an actionable pest in the EFSA commodity risk assessment of Malus domestica plants from Turkey (EFSA, 2022)

| Other relevant information for the assessment | Biology |
|--------------------------------------------|---------|
| Larvae of the moth are a notorious defoliating pest of forest trees. In its current area of distribution, main outbreaks of M. parallela occur in mountain forests at an altitude of 1,000–1,800 m where the pest finds optimal conditions for its development. It can occur up to 2,400 m. Flight peaks of M. parallela usually occur between June and July, depending on altitude. The moth completes one generation per year. Adults have a crepuscular behaviour. Copulation occurs 2–3 h after emergence of the adults. Eggs are laid in groups; egg masses usually contain from 100 to 400 eggs covered by a thick layer of special female secretion (spumaline), which is shining whitish grey and silvery when fresh and then turns dark. Egg masses are laid around thin branches of host plants. The layer of secretion protects eggs against unfavourable conditions during overwintering. One female usually makes one egg mass, but sometimes two or three. |

A2. Malacosoma parallela

A2.1. Organism information

| Taxonomic information | Current valid scientific name: Malacosoma parallela Staudinger |
|-----------------------|---------------------------------------------------------------|
| Synonyms: Bombbyx neustria var. parallela Staudinger, 1887 (Zolotuhin and Zahiri, 2008) |
| Name used in the EU legislation: – |
| Order: Lepidoptera |
| Family: Lasiocampidae |
| Common name: mountain ring silk moth |
| Name used in the Dossier: Malacosoma parallela |

| Group | Insects |
|-------|---------|
| EPPO code | MALAPA |
| Regulated status | The pest is included in the EPPO A2 list (EPPO, online). |
| Pest status in Turkey | Malacosoma parallela is present in Turkey, with no further details on its distribution (EPPO, online; CABI). |
| Pest status in the EU | Malacosoma parallela is absent in the EU. |

| Host status on Berberis | Berberis species are reported as a host of Malacosoma parallela (EPPO, online). |
|--------------------------|--------------------------------------------------------------------------------|

| PRA information | EPPO Pest Risk Assessments available (EPPO, online): |
|-----------------|-----------------------------------------------------|
| | • Pest Risk Management report |
| | • Report of a Pest Risk Assessment |
| | • Pest Risk Assessment Scheme |

M. parallela was identified as an actionable pest in the EFSA commodity risk assessment of Malus domestica plants from Turkey (EFSA, 2022)

| Other relevant information for the assessment | Biology |
|--------------------------------------------|---------|
| Larvae of the moth are a notorious defoliating pest of forest trees. In its current area of distribution, main outbreaks of M. parallela occur in mountain forests at an altitude of 1,000–1,800 m where the pest finds optimal conditions for its development. It can occur up to 2,400 m. Flight peaks of M. parallela usually occur between June and July, depending on altitude. The moth completes one generation per year. Adults have a crepuscular behaviour. Copulation occurs 2–3 h after emergence of the adults. Eggs are laid in groups; egg masses usually contain from 100 to 400 eggs covered by a thick layer of special female secretion (spumaline), which is shining whitish grey and silvery when fresh and then turns dark. Egg masses are laid around thin branches of host plants. The layer of secretion protects eggs against unfavourable conditions during overwintering. One female usually makes one egg mass, but sometimes two or three. |
Neonate larvae appear from the end of March at the same time as young leaves of host plants. Usually all hatch during 1–2 days and begin to make a web nest on branches. They feed on young leaves around the nest. The nest is usually constructed by the group of individuals hatched from one egg mass. It can be up to 25 cm long and 17 cm wide. When caterpillars reach third or fourth instar, the group usually leaves the first nest and constructs new ones (two or three) in places where there is more food. Larvae moult five times before making cocoons on leaves and in other different places at the end of May and in June (Grechkin, 1956; Degtyareva, 1964; Sarkissyan, 1972; Romanenko, 1981; Maslov, 1988).

Symptoms

| Main type of symptoms | Defoliation of host plants is usually very spectacular. The presence of egg masses, nests and individual caterpillars is easily detected. Moths are attracted by sources of light |
|-----------------------|--------------------------------------------------------------------------------------------------|
| Presence of asymptomatic plants | No, if present the pest is easy to detect |
| Confusion with other pests | Egg masses encircle thin branches of host plants similar to the egg masses of the closely related European species *Malacosoma neustria*. |

Host plant range

*M. parallela* is extremely polyphagous and causes most damage in its native range to *Quercus* spp., *Prunus* spp. and *Malus* spp. Significant damage also occurs on various other woody species, including many native species of Central Asia: *Berberis integerrima*, *Chaenomeles japonica*, *Cotoneaster insignis*, *Cotoneaster suavis*, *Crataegus hissarica*, *Crataegus pontica*, *Crataegus turkestanica*, *Cytisus oblonga*, *Prunus armeniaca*, *Prunus avium*, *Prunus cerasus*, *Prunus divaricata*, *Prunus mahaleb*, *Prunus padus*, *Prunus persica*, *Pyrus communis*, *Rosa canina*, *Rosa corymbifera*, *Rosa kokanica*, *Rosa marcanetica*, *Salix excelsa*, *Salix tenuijulis*, *Sorbus persica*, *Sorbus turkestanica*. Other native and planted deciduous trees and shrubs are damaged occasionally: *Atraphaxis pyrifolia*, *Elaeagnus angustifolia*, *Fraxinus sogdiana*, *Hippophae rhamnoides*, *Juglans regia*, *Lonicera korolkowii*, *Lonicera nummulariifolia*, *Myricaria bracteata*, *Populus alba*, *Populus tremula*, *Ribes nigrum*, *Ribes rubrum*, *Rubus idaeus*, *Rubus turkestanicus* and *Ulmus minor* (Pavlovskii and Shtakelberg, 1955; Grechkin, 1956; Degtyareva, 1964; Sarkissyan, 1972; Romanenko, 1981; Maslov, 1988).

Reported evidence of impact

*M. parallela* is an important defoliator of many deciduous trees in different countries in Eastern Europe, Central Asia (Armenia, Tajikistan). Outbreaks often last for two consecutive years. It was especially noted as a very dangerous pest of oak in the mountains of Armenia (Sarkissyan, 1972) and of forests, fruit trees and shrubs of *Rosaceae*, *Fagaceae* and *Elaeagnaceae* in the mountains of Tajikistan (Grechkin, 1956; Degtyareva, 1964). It attacks both stressed and healthy trees of different ages. Outbreaks occur throughout large mountain areas, often resulting in 100% defoliation and sometimes leading to the death of trees and forests. Damage may be caused by this species alone, or in association with *Yponomeuta padellus*, *Euproctis kargalica*, *Erschoviella musculana*, *Lymantria dispar* or other defoliators. Attacks may result in serious changes in the environment over large areas, including problems of erosion.

Pathways and evidence that the commodity is a pathway

All stages of the life cycle can be transported on host plants moving in trade, particularly plants for planting and cut branches. Eggs, larvae and pupae (cocoons) may be associated with wood carrying bark.

Surveillance information

No surveillance information is currently available from the Turkish NPPO.

A.2.2. Possibility of pest presence in the nursery

A.2.2.1. Possibility of entry from the surrounding environment

If present in the surroundings, the pest can enter the nursery as Turkey is producing *Berberis* plants for planting outdoors. The pest could enter the nursery mainly by active dispersal (flight). Being highly polyphagous, the pest could be associated with many host plants occurring in the surroundings.
Uncertainties:

- No data available on the distribution of the pest or population densities in the areas of production in Turkey.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery.

A.2.2.2. Possibility of entry with new plants/seeds

The pest (larvae, pupae and mainly eggs) can be transported on host plants, particularly plants for planting and cut branches. The presence of the pest can be easily detected by visual inspection; however, egg masses can be overlooked by non-trained personnel.

Uncertainties:

- Uncertain if certified material is inspected for this pest

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery, though unlikely because all stages can be detected by visual inspection.

A.2.2.3. Possibility of spread within the nursery

If the pest enters the nursery from the surroundings, it could spread either by adult flight, larval movement or infested plant material. Active dispersal of larvae is possible especially if plants are touching with each other (as in stoolbeds). Given that the pest is polyphagous, the pest could be associated with other host plants produced in the nursery.

Taking into consideration the above evidence, the Panel considers that the transfer of the pest within the nursery is possible.

A.2.3. Information from interceptions

There are no records of interceptions of Berberis plants from Turkey due to the presence of M. parallela between 1994 and April 2022 (EUROPHYT and TRACES-NT, online).

A.2.4. Evaluation of the risk mitigation options

In the table below, all risk mitigation measures currently applied in Turkey are listed and an indication of their effectiveness on M. parallela is provided. The description of the risk mitigation measures currently applied in Turkey is provided in Table 6.

| No. | Risk mitigation measure (name) | Description | Effective | Evaluation/Uncertainties |
|-----|--------------------------------|-------------|-----------|--------------------------|
| 1   | Certified material             | Turkey is a member of the International Plant Protection Convention (IPPC) and is obliged to implement the International Standards on Phytosanitary Measures (ISPM) published by the IPPC. | Yes | Uncertainties: The details of the certification process are not given (e.g. number of plants, intensity of surveys and inspections, etc.). |
| 2   | Phytosanitary certificates and plant passport | Phytosanitary Certificates/Re-Export Phytosanitary Certificates are issued in exportation of plants and plant products with respect to plant health. Plant health inspectors are responsible from exportation and importation controls, sampling and issuing certificates. | Yes | Uncertainties: Information is not sufficient to judge the quality of inspections, etc. |
| 3   | Growing media                 | Is composed entirely of peat or fibre of Cocos nucifera L. and has not been previously used for growing plants or for any other agricultural purposes. It is also stored and maintained under appropriate conditions to keep it free from quarantine pests. | No | M. parallela is present on leaves only. |
| No. | Risk mitigation measure (name) | Description | Effective | Evaluation/Uncertainties |
|-----|-------------------------------|-------------|-----------|--------------------------|
| 4   | Pesticide application         | For all crops in Turkey, pesticides are applied according to the Technical Instructions for Plant Protection and according to the principles of integrated pest management. A list of pesticide active ingredients and doses authorised on ornamental plants was provided. No details on frequencies of application have been provided. | Yes | Uncertainties: The frequency of application is not known. |
| 5   | Surveillance and monitoring   | Both processes are conducted according to Turkish phytosanitary regulations. Nurseries are inspected once per year. | Yes | Potential *M. parallela* infestations could be easily detected, though egg masses might be overlooked by non-trained personnel. Uncertainties: Specific figures on the intensity of survey (sampling effort) are not provided. |
| 6   | Sampling and laboratory testing | For the identification of viruses, bacteria, fungi and nematodes in the seedlings to be exported, 1 kg sample is taken from growing media in pots as composite sample. Also samples from leaves, stems, etc., are taken separately by the inspector and send to the laboratory for analysis. The seedlings in the production area are examined macroscopically for pests. | No | |
| 7   | Refrigeration                 | Transportation is made with refrigerated trucks. The dispatch is made as pots (piece) and the pots are stacked one by one in a row in the truck. The moisture content is between 85% and 95%. Trailers temperature must be between 2°C and 4°C. | Yes | Low temperatures can slow down its development but not kill the insect |
| 8   | Pre-consignment inspection     | Prior to export, planting material for which a Phytosanitary Certificate is to be issued shall be subjected to phytosanitary inspection. Only certified plants for planting may be exported. Phytosanitary inspectors are responsible for export controls, sampling and issuing certificates. | Yes | The presence of *M. parallela* infestations could be detected. Information is not sufficient to assess the quality of inspections. |

A.2.4.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

- Limited distribution/climatic restrictions.
- All material is produced within the nurseries.
- Insecticides are effective against eggs, larvae and adults.
- Natural enemies are present in the environment.
- Visual inspection is performed by trained personnel.
- Control of mother plants.
A.2.4.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

- Berberis is a preferred host.
- Spread to more areas in Turkey/no climatic restrictions.
- Most of the propagation material is produced in other nurseries.
- Natural and human-assisted dispersal play a role in spreading the pest.
- Insecticides are not effective against eggs, larvae and adults.
- Natural enemies are not present or affected by pesticide treatments.
- Inspections are not effective in identifying pest presence.

A.2.4.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Due to the limited information available about pest presence and pressure in the nursery area, the panel considers lower values for being as likely as higher values.

A.2.4.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Main uncertainties:

- Data on efficacy of inspections are limited.
- Timing of insecticide applications is unclear.
- Pest pressure in the nursery areas is not known.
The following tables show the elicited and fitted values for pest infestation (Table A.3) and pest freedom (Table A.4).

**Table A.3:** Elicited and fitted values of the uncertainty distribution of pest infestation by *Malacosoma parallela* per 10,000 plants

| Percentile | 1% | 2.5% | 5% | 10% | 17% | 25% | 33% | 50% | 67% | 75% | 83% | 90% | 95% | 97.5% | 99% |
|------------|----|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|
| Elicited values | 0 | 9 | 17 | 30 | 50 |
| EKE | 0.379 | 0.906 | 1.76 | 3.43 | 5.68 | 8.51 | 11.5 | 17.8 | 25.1 | 29.4 | 34.3 | 39.2 | 44.0 | 47.3 | 50.1 |

The EKE results are the fitted values.

Based on the numbers of estimated infested plants, 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.4.

**Table A.4:** The uncertainty distribution of plants free of *Malacosoma parallela* per 10,000 plants calculated by Table A.3

| Percentile | 1% | 2.5% | 5% | 10% | 17% | 25% | 33% | 50% | 67% | 75% | 83% | 90% | 95% | 97.5% | 99% |
|------------|----|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-----|
| Values | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 | 9,950 |
| EKE results | 9,950 | 9,953 | 9,961 | 9,986 | 9,971 | 9,975 | 9,982 | 9,991 | 9,994 | 9,997 | 9,998 | 9,999 | 9,999 | 9,999 | 9,999 |

The EKE results are the fitted values.
Commodity risk assessment of *Berberis thunbergii* plants from Turkey

(a)

(b)
**A.2.5. Reference list**

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**Figure A.2:** (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. $1 - \text{pest infestation proportion expressed as percentage}$); (c) descending uncertainty distribution function of pest infestation per 10,000 plants.
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, 242 papers were retrieved. Titles and abstracts were screened, and 26 pests were added to the list of pests (see Appendix D).

| Web of Science All databases | TOPIC: |
|-----------------------------|--------|
|                            | ("Berberis" OR "barberry") |
| AND                        |        |
|                            | ("pathogen" OR pathogenic bacteria OR fung OR oomycet OR myce OR bacteri OR virus OR viroid OR insect OR mite OR phytoplasm OR arthropod OR nematod OR disease OR infect OR damag OR symptom OR pest OR vector OR hostplant OR "host plant" OR host OR "root lesion" OR decline OR infestation OR damage OR symptom OR dieback OR "die back" OR malaise OR aphid OR curculio OR thriss OR cicada OR miner OR weevil OR "plant bug" OR spittlebug OR moth OR mealybug OR cutworm OR pillbug OR "root feeder" OR caterpillar OR "foliar feeder" OR virosis OR viruses OR blight OR wilt OR wilted OR canker OR scab OR rot OR rot OR "rotten" OR "damping off" OR "damping-off" OR blister OR smut OR "mould" OR "mould" OR "damping syndrome" OR mildew OR scald OR "root knot" OR "root-knot" OR rootkit OR cyst OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant\$parasitic" OR "root feeding" OR "rootsfeeding" OR "Acar" OR "host" OR "gall" OR "gall" OR "whitefly" OR "whitefly" OR "aleurodidae" OR "Thysanoptera" OR "Moths" OR "scale" OR "scale\$" OR "Thripidae" OR "leaffoppers" OR "leaffopper\$" OR "plant pathogens" OR "Fungal" OR "Aphididae") |
| NOT                        |        |
|                            | ("heavy metal" OR "pollut" OR "weather" OR "propert" OR probes OR "spectr" OR "antioxidant" OR "transformation" OR "Secondary plant metabolite" OR metabolite OR Postharvest OR Pollin OR Ethylene OR Thinning OR ferti OR Mulching OR Nutrient 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 diseases" OR "cancer" OR "therapeutic" OR "psoriasis" OR "blood" OR "medicinal ethnobotany" OR "Nitrogen-fixing" OR "patients" OR "Probiotic drugs" OR "Antioxidant" OR "Anti-Inflammatory" OR "plasma levels" OR "ethnomedical" OR "traditional uses of medicinal plants" OR "Antitumor" OR "Neuroprotective" OR "Hypoglycemic") |
| NOT                        |        |
|                            | ("Abortiporus biennis" OR "Bryobia rubricolus" OR "Eotetranyschus carpinii" OR "Paraplonobia barberisi" OR "Sonotetranyschus albiflorae" OR "Tetranyschus turkestani" OR "Tetranyschus urticae" OR "Thyatira batis" OR "Timora beatrix" OR "Diaecrisia unifascia" OR "Chionaema bellissima" OR "Aglyla albi" OR "Aglyla metaxantha" OR "Aglyla ramelana" OR "Berberisomyia sobolevi" OR "Jaapiella kovalevi" OR "Amegosiphon platycusum" OR "Aphis nasturtii" OR "Aphis odine" OR "Aphis spiraeo" OR "Aulacorthum solani" OR "Berberidaphis lydiae" OR "Liosomaphis atra" OR "Liosomaphis berberidis" OR "Liosomaphis ornata" OR "Myzus persicae" OR "Toxoptera auranti" OR "Toxoptera citricida" OR "Metopolion berberinutritium" OR "Wahlgrienelli nervata" OR "Greeneidea kumaoni" OR "Macrospiram pachysiphon" OR "Prochilus erigeronis" OR "Rhopalosphum rufidominals" OR "Xenosiphonaphis conandri" OR "Hydaphias hofmannii" OR "Tricaudatus polygnii" OR "Macrospiram euphorbiae" OR "Aphis berberiderum" OR "Aphis patagonica" OR "Liosomaphis himalayensis" OR "Arge ochropus" OR "Bernisia tabaci" OR "Caleia annulipes" OR "Coccus hesperidum" OR "Diaspidiotus pemenicosus" OR "Lobesia botrana" OR "Aporia crataegi" OR "Callihopalus bifasciatus" OR "Omphalocera dentosa" OR "Coryphista meadii" OR "Alcis repandata" OR "Argyresthia bonnetella" OR "Calliteara pudibunda" OR "Dasineura berberidis" OR "Eupithecia exigua" OR "Eupithecia subfuscata" OR "Euproctis similis" OR "Gonocerus acuteangulatus" OR "Hemithoea aestivalia" OR "Lacanobia thalassina" OR "Melanchra persicariae" OR "Odontopera bidentata" OR)
Commodity risk assessment of Berberis thunbergii plants from Turkey

“Pareulype berberata” OR “Phlogophora meticulosa” OR “Rhogaleis cerasi” OR “Rheagoltis meigeni” OR “Rheumaptera cervinalis” OR “Spilosoma luteum” OR “Strymonia pruni” OR “Agrochola helvola” OR “Alpyia octomaculata” OR “Athyma opalina” OR “Attacus taprobanis” OR “Auchmis detersa” OR “Auchmis inextricata” OR “Biston regalis” OR “Cadra cautella” OR “Calliteara grotiei” OR “Callosamia promethea” OR “Carposina berberidella” OR “Cheimaphila salicella” OR “Gastropacha quercifolia” OR “Hyaloaphora cecropia” OR “Hyperchira incisa” OR “Hyphantria cunea” OR “Larrenannis orthogrammaria” OR “Lycia hirtaria” OR “Lymnantri dispar” OR “Neostauropus sikkimensis” OR “Omphalocera cariosa” OR “Paracystola acroantha” OR “Pitheochooa decipiens” OR “Plodia interpunctella” OR “Pseudoglaea olivata” OR “Rheumaptera undulata” OR “Rhopota myrtillana” OR “Samia cyania” OR “Samia walkerii” OR “Somena scintillans” OR “Trabala vishnu” OR “Triphosa haesitata” OR “Orgyia leucostigma” OR “Lindingsaspis rossi” OR “Cacocinimorpha pronubana” OR “Drosophila suzuki” OR “Malacosoma americanum” OR “Malacosoma parallela” OR “Ceratis capita” OR “Ceroplastes ceriferus” OR “Thyridopteryx ephemeraeformis” OR “Aleuroplatus berbericolis” OR “Aleuroplatus ovatus” OR “Bemisia berbericola” OR “Bemisia shinanensis” OR “Aceria caliberberis” OR “Acleris variega” OR “Anomoia purmund” OR “Arge berberidis” OR “Conistra ligula” OR “Ditula angustiorana” OR “Diurnea lipsiella” OR “Exapate congelatella” OR “Gymnoscelis rufesciata” OR “Lasioptera berberina” OR “Oriusn ishidae” OR “Ouarapteryx sambucaria” OR “Phyllococptes granulatus” OR “Pseudotelphusa tessella” OR “Pulvinaria floccifera” OR “Rheagoltis berberidis” OR “Peribatodes rhomboidaria” OR “Hypomecis punctinalis” OR “Ectropis crepuscularia” OR “Lasiocampa quercus” OR “Crocallis tuciaria” OR “Dolopolca punctulana” OR “Ligidia adustata” OR “Lyca graecius” OR “Zeuzera pyrina” OR “Athetis lepigone” OR “Ceroplastes sinensis” OR “Aphis fabae” OR “Aegosocna pegani” OR “Bactericera berberae” OR “Cacopysilla curtiantenina” OR “Cymophila fabra” OR “Cymophila olideaexocha” OR “Euphyrrula berberae” OR “Trioza berbericola” OR “Trioza berberidis” OR “Trioza fissa” OR “Trioza inlechsis” OR “Trioza liscinies” OR “Trioza longipennis” OR “Trioza nilisches” OR “Trioza scotti” OR “Trioza striacauda” OR “Trioza subberbericola” OR “Aonidiella aurantii” OR “Aonidiella citrina” OR “Arctorthezia pseudoccidentalis” OR “Aspidispes densiflora” OR “Aspidiotus neri” OR “Cercoccus koebele” OR “Cerococcus parrotii” OR “Ceroplastes japonicus” OR “Ceroplastes pseudoceriferus” OR “Chrysophthalmus aonidium” OR “Chrysophthalmus dictysompar” OR “Coccura suwakoensis” OR “Coccus pseudomagnoliarum” OR “Diaspidiotus africanus” OR “Diaspidiotus uvae” OR “Dynaspidiotus britanicus” OR “Epidiaspis lep” OR “Erimococcus kimmericus” OR “Heliococcus sulci” OR “Hemelkesia lataniae” OR “Icerya purchasi” OR “Lecanodiaspis prosopisid” OR “Lecanodiaspis thammnosae” OR “Lepidosaphes malicola” OR “Lepidosaphes ulmi” OR “Magnococcus berberis” OR “Neoselenaspis silvaticus” OR “Paracoccus burnerae” OR “Parlatoeopis longispina” OR “Parlatoria cameli” OR “Parlatoria oleae” OR “Parlatoria perlangdi” OR “Parthenolecanium persicae” OR “Peliococcus morrisoni” OR “Phenacoccus aceris” OR “Phenacoccus berberis” OR “Phenacoccus tataricus” OR “Pseudaulacispis cockerelli” OR “Pseudaulacispis pentagona” OR “Pseudococcus constocki” OR “Spirorococcus braggi” OR “Pseudococcus martinitus” OR “Puccinia arnhetheri” OR “Didymosphaeria oblitescens” OR “Gnomonia comari” OR “Leptospheria fuscella” OR “Monilinia fructigena” OR “Roselinia neactrix” OR “Verticillium albo-atrum” OR “Verticillium dahleiae” OR “Alternaria alternata” OR “Erysiphe berberidica” OR “Puccinia graminis f. sp. Tritici” OR “Puccinia striformoides” OR “Sclerotinia sclerotiorum” OR “Thyronectria berberidis” OR “Erysiphe communis” OR “Eutypa lata” OR “Rebentischia uniaudata” OR “Rhzoctonia solani” OR “Sclerotium rolfsii” OR “Pleospora herbarum” OR “Puccinia graminis f. oryzae” OR “Puccinia graminis” OR “Puccinia striformis” OR “Phoma glomerata” OR “Phylactinia gutta” OR “Septoria berberidis” OR “Phytophthora nicotianae var. Parasitica” OR “Polychaeton quercinum” OR “Hymenoaetha colliculosa” OR “Heterobasidion annosum” OR “Phytophthora cinnamomi” OR “Phytophthora ramorum” OR “Phythatrichum omnivor” OR “Puccinia graminis” OR “Phytophthora kernoviae” OR “Didymella nigricans” OR “Lyomyces sambuci” OR “Neofuscococcus luteum” OR “Angiulospora longissima” OR “Angiulospora cressia” OR “Bacilllspora aquatica” OR “Campylospora parvula” OR “Epicoccum nigrum” OR “Thyronectria lamy” OR “Heliscus lugdunensis” OR “Diploida berberidina” OR “Amphisphaeria berberidica” OR “Amphisphaeria dussenii” OR “Apiosporium salicinum” OR “Ascochyta australis” OR “Ascochyta berberidina” OR “Asteromassaria berberidica” OR “Belonium subantarcticum” OR “Blenoria patagonica” OR “Botryosphaeria dothidea” OR
Commodity risk assessment of *Berberis thunbergii* plants from Turkey

“Botryosphaeria ribis” OR “Calospora etilis” OR “Camarosporium antarcticum” OR “Camarosporium berberidicola” OR “Camarosporium berberidis” OR “Capnodium berberidis” OR “Cercospora bouteleoue” OR “Cephosphora foliicola” OR “Cephosphora magnellanica” OR “Chaetomium setosum” OR “Ciboria ranikhetiensis” OR “Cladosporium acedicola” OR “Cladosporium fumago” OR “Cladosporium quinsee” OR “Cladosporium ushuaiense” OR “Coccomyces coronatus” OR “Colletotrichum aotearoa” OR “Coniochaeta ligniaria” OR “Coniochaeta niesslii” OR “Coniochaeta sanguinolenta” OR “Coniothyrium berberidiphilium” OR “Coniothyrium berberidis” OR “Coniothyrium insitivum” OR “Coronophora paucispora” OR “Corticium calceum” OR “Corticum incarnatum var. Antarticum” OR “Corticum solani” OR “Coryneum foliicola” OR “Crumenula antarctica” OR “Cucurbitaria oredmediterranea” OR “Cummisiniella antarctica” OR “Cummisiniella mirabilissima” OR “Cummisiniella santa” OR “Cummisiniella standleyana” OR “Cummisiniella stolpiana” OR “Cumminsiella wootoniana” OR “Desmella quenstis” OR “Diaporthe detrusa” OR “Diatrype berberidis” OR “Dicaeoma poulformae” OR “Dichomera macrospora” OR “Didymella aliena” OR “Didymella cadubiae” OR “Didymosphaeria berberidincola” OR “Didymosphaeria epidermidis” OR “Diplodia berberidis” OR “Diplodia mahoniae” OR “Diplodia microsporella” OR “Dothidea berberidis” OR “Dothidea hippophaes” OR “Dothidea indica” OR “Dothiorella ribs” OR “Edythea berberidis” OR “Edythea quenstis” OR “Edythea soratensis” OR “Edythea tenella” OR “Eichleriella leucophaea” OR “Epitea berberidis” OR “Eriosephaeria australis” OR “Erysipe berberidis” OR “Erysipe dimorpha” OR “Erysipe golovini” OR “Erysipe multappendicitis” OR “Erysipe polygoni” OR “Erysipe sichuanica” OR “Erysipe thaxteri” OR “Eutypa peraffinis” OR “Eutypella aquiliearisis” OR “Eutypella russels” OR “Excipularia fusispora” OR “Fenestella rostrata” OR “Fumago pannosa” OR “Fumago vagans” OR “Gambiolea cornuta” OR “Gibbera patagonica” OR “Guignardia cytsi” OR “Haematomyxa pakistani” OR “Helminthosporium velutinum” OR “Heliotium buccinula” OR “Heliotium caudatum” OR “Heliotium titubans” OR “Hendersonia dicksonii” OR “Hendersonia saamntorum” OR “Heterosporium berberidis” OR “Himexia antarctica” OR “Hoehnelliella perplexa” OR “Hymenoscyphus buccinula” OR “Hymenoscyphus leucopus” OR “Hyphoderma praetermissum” OR “Hypoderma brachysporum” OR “Junghuhria vincta” OR “Karschia fuegiana” OR “Keissleriella cladothia” OR “Lachnum albilidum” OR “Laestadia angulata” OR “Lambertella berberidis” OR “Lambertella kumaoica” OR “Laschia antarctica” OR “Leptosphaeria artemisiae” OR “Leptosphaeria berberidicola” OR “Leptosphaeria berberidis” OR “Leptosphaeria castagnei” OR “Leptosphaeria coniothyrium” OR “Leptosphaeria inconspicua” OR “Leptosphaeria punjabensis” OR “Leptothyrium berberidis” OR “Lophiohoma macrostomoides” OR “Lophiostoma quadrinucleatum” OR “Lophodermium berberidis” OR “Lophodermium hysterooides” OR “Marasmius copelandii” OR “Marasmius salalis” OR “Marasmius sphaeroderms” OR “Massaria berberidica” OR “Massaria marginata” OR “Massaria polymorpha” OR “Melinonoma pulvis-pyrius” OR “Melinonoma pulvercula” OR “Melasmia berberidis” OR “Methasphaeria desolationis” OR “Microdiplodia microsporella” OR “Microthyrium fagi” OR “Moellerodiscus berberidis” OR “Monochaetia berberidica” OR “Monochaetia berberidis” OR “Montagnella berberidis” OR “Mycoporum hippocastani” OR “Mycosphaerella ambiens” OR “Mycosphaerella berberidis” OR “Nectria antarctica” OR “Nectria berberidicola” OR “Nectria lamyi” OR “Odontia arguta” OR “Oncopodium antoniae” OR “Otthia amelanchieris” OR “Otthia lisae” OR “Pestalotia berberidis” OR “Pestalotia lodophurenis” OR “Pestalotia osyridis” OR “Pestalotospissa japonica” OR “Pestalozzina berberidina” OR “Pestalozzina berberidina” OR “Phaeodothis winteri” OR “Phoma berberidella” OR “Phoma berberina” OR “Phoma empetrifolia” OR “Phoma herbarum” OR “Phomopsis berberidis” OR “Phyllactinia berberidis” OR “Phyllosticta berberidica” OR “Phyllosticta berberidis” OR “Phyllosticta garboviskii” OR “Phyllosticta japonica” OR “Phyllosticta mahonincola” OR “Phyllosticta westendorpii” OR “Phytophthora plurivora” OR “Platyosporoides togwotiensis” OR “Pleosphaeria fuegiana” OR “Pleospora aggregata” OR “Pleospora amelanchieris” OR “Pleospora berberidis” OR “Pleospora berberidis” OR “Pleospora coronata” OR “Pleospora quadricularis” OR “Pleospora quadriseptata” OR “Pleospora rudis” OR “Pleospora togwotiensis” OR “Polyporus lepideus” OR “Polyporus vaporarius” OR “Poria punctata” OR “Pseudocercospore berberidis-vulgaris” OR “Pseudocercospore napiniae” OR “Puccinia graminis” OR “Puccinia antarctica” OR “Puccinia barri-aranae” OR “Puccinia berberidis” OR “Puccinia berberidis-darwini” OR “Puccinia culmicola” OR “Puccinia droogenis” OR “Puccinia fendleri” OR “Puccinia magellanaica” OR “Puccinia magellanica” OR “Puccinia meyeri-albertii” OR “Puccinia montanensis” OR “Puccinia naumanniana” OR “Puccinia
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poculiformis” OR “Puccinia rameliana” OR “Puccinia ramelianoidea” OR “Puccinia stolpiana” OR “Puccinia wurthii” OR “Pucciniastrum goeppertianum” OR “Puccinosira clemensiae” OR “Puccinosira comuta” OR “Pythium debaryanum” OR “Ramaria subaurantiaca” OR “Ramularia berberidis” OR “Rebentischia pomiformis” OR “Rhabdospora berberidis” OR “Rosellinia sanguinolenta” OR “Rosellinia subminutis” OR “Saccardoella berberidis” OR “Saccardoella transylvanica” OR “Sarcostroma berberidis” OR “Sclerotium dothideoides” OR “Scytinostroma duriaculum” OR “Seimatosporium berberidcola” OR “Sphaeropsis berberidis” OR “Sporochisma saccardoi” OR “Stagonospora berberidina” OR “Stenella quitensis” OR “Stictis polyocca” OR “Stylophthora indica” OR “Tassia laurina” OR “Thyronectria caudata” OR “Togninia minima” OR “Trametes versicolor” OR “Tryblidaria esfandiarii” OR “Tryblidaria pakistani” OR “Uredo berberidis” OR “Uredo clemensiae” OR “Uredo stolpiana” OR “Uropyxis naumanniana” OR “Uropyxis quitensis” OR “Valsaria insitiva” OR “Zignoella longispora” OR “Phoma macrostoma” OR “Aureobasidium pullulans” OR “Phoma andina” OR “Cyrtidula hippocastani” OR “Dasyascyphus australis var. Lasiodopa” OR “Dasyascyphus minutissimus” OR “Diaphotroae koelreuteriae” OR “Nectria episphea” OR “Nodulosphaeria robusta” OR “Phylllosticta mahonieae” OR “Nectria cinnabarina” OR “Cumminsiella texana” OR “Curreya berberidis” OR “Cytospora berberidis” OR “Curcubita berberidis” OR “Parodiella negeriana” OR “Plowrightia berberidis” OR “Puccinia brachypodi” OR “Botrytis cinerea” OR “Erysiphe berberidis var. Asiatica” OR “Microsphaera grossulariae” OR “Myrothecium inundatum” OR “Pezicula microsor” OR “Microsphaera alni” OR “Acarospora berberidis” OR “Aecidium aridum” OR “Aecidium berberidis-morisonensis” OR “Aecidium berberidis-rusculifoliae” OR “Aecidium jacobsthalii-henrici” OR “Aecidium levellieanum” OR “Aecidium montanum” OR “Aecidium navarum” OR “Aecidium niitakense” OR “Aecidium subflammans” OR “Aecidium teodorescu” OR “Aecidium tubiforme” OR “Agaricus aureus” OR “Agaricus berberidcola” OR “Agaricus subflammans” OR “Agyrium subantarcticum” OR “Aecidium haussknecchtianum” OR “Puccinia pseudostriformis” OR “Puccinia pygmaea” OR “Coccomyces dentatus” OR “Microsphaeropsis conielloides” OR “Phyllosticta capitans” OR “Puccinia minshansenis” OR “Puccinia brachypodi-phoenicoidis” OR “Meloidogyne javanica” OR “Meloidogyne hapla” OR “Meloidogyne arenaria” OR “Xiphinema brevicolle” OR “Pratylenchus penetrans” OR “Merlinus brevidens” OR “Pratylenchus vulnus” OR “Boledoros typicus” OR “Rotylenchus buxophilus” OR “Boledoros impar” OR “Boledoros volutus” OR “Boledoros thylactus” OR “Tylenchus bhitai” OR “Xiphinema globosum” OR “Meloidogyne incognita” OR “Apple mosaic virus” OR “Cucumber mosaic virus” OR “Impatiens necrotic spot virus” OR “Tomato spotted wilt virus” OR “Pseudomonas syringae pv. berberidis” OR “Phytoplasma - 16SrV-B subgroup” OR “Phytoplasma - 16SrII-C subgroup” OR “Phytoplasma - 16SrIII-F subgroup” OR “Geoenamus dobroticus” OR “Paratylenchus vandenbrandei” OR “Cricemonoides morgenstis” OR “Tratylenchus vicinus” OR “Neopsilenchus magnidens” OR “Trophurus impar” OR “Pratylenchoides alkani” OR “Merlinus brevidens” OR “Scutytlenchus tartuensis” OR “Puccinia meyeri-albertii” OR “Pseudargyrotoza conwagana” OR “Rhashistis mongoliana mongoliana” OR “Sphenoraia berberi” OR “Sphenoraia yajangensis” OR “Stenoluperus nipponensis” OR “Xyleborus brevis” OR “Zeugophora cyanae” OR “Rhashistis mongoliana centrosinaria” OR “Rhashistis mongoliana pallicosta” OR “Orthespa glareicollic” OR “Orthespar impressionicollis” OR “Pandemis ribeana” OR “Phenacoccus prodigialis” OR “Eucocita inexcrtata” OR “Elaeostethus brevis” OR “Aphthona varipes” OR “Aporia agathon” OR “Aporia hippi” OR “Aporia leucodice” OR “Attacus atlas” OR “Cacia ceterifa” OR “Colletotrichum acutatum” OR “Colletotrichum gloeosporioides” OR “Gloeosporium berberidis” OR “Alternaria macrospora” OR “Alternaria solani” OR “Aspergillus flavus” OR “Cercospora citrullina” OR “Clonostachys rosea” OR “Colletotrichum cucodes” OR “Colletotrichum coffeaeum” OR “Colletotrichum kahawae” OR “Diaporthe tera” OR “Fusarium lateritium” OR “Fusarium falciforme” OR “Fusarium nematicumphilum” OR “Fusarium oxysporum” OR “Fusarium solani” OR “Haplothrips andresi” OR “Haplothrips angusticornis” OR “Acaudaleryodes rachipora” OR “Metcalfe pruinose” OR “Taeiothrips inconsequens” OR “Corythulus punctatissimus” OR “Malacosoma neustria” OR “Aphis poni” OR “Rhopalosiphum fulvabdominale” OR “Contarinia nasturtii” OR “Dendrothrips saltatrix” OR “Haplothrips reuteri” OR “Mycetothrips albicorcoris” OR “Thrips meridionalis” OR “Thrips tabaci” OR “Thrips trehernei” OR “Metcalfe pruinosa”)
Appendix C – List of pests that can potentially cause an effect not further assessed

Table C.1: List of potential pests not further assessed

| Pest name                  | EPPO code | Group | Pest present in Turkey | Berberis confirmed as a host (reference) | Pest can be associated with the commodity | Impact | Justification for inclusion in this list |
|----------------------------|-----------|-------|------------------------|------------------------------------------|-------------------------------------------|--------|------------------------------------------|
| Erysiphe berberidicola     | –         | Fungi | Yes                    | No                                       | Yes                                       | Yes    | Uncertain No records of official control in EU. Genus of Erysiphe contains fungi with impact, but and there is no information available on potential impact for Erysiphe berberidicola. |
| Lepidosaphes malicola      | LEPSML    | Insects | Yes                   | Limited (Greece, Bulgaria)               | Yes                                       | Yes    | Uncertain No records of official control in EU; limited information on damage; apple damage reported in Israel. |
Appendix D – Excel file with the pest list of *Berberis* spp.

Appendix D can be found in the online version of this output (in the 'Supporting information' section): [https://doi.org/10.2903/j.efsa.2022.7392](https://doi.org/10.2903/j.efsa.2022.7392).