SCIENTIFIC OPINION

Scientific Opinion on the risk to plant health posed by *Daktulosphaira vitifoliae* (Fitch) in the EU territory, with the identification and evaluation of risk reduction options[1]

EFSA Panel on Plant Health (PLH)[2,3]

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ABSTRACT

The Panel on Plant Health conducted a pest risk assessment for the grapevine insect pest, *Daktulosphaira vitifoliae* (an aphid species commonly known as phylloxera), in the European Union, identified risk reduction options and evaluated the effectiveness of the phytosanitary measures listed in Council Directive 2000/29/EC. Entry was assessed as potentially very likely for plants intended for planting (although the pathway is closed by Article 15 of Annex III) and very unlikely for fruit for consumption because transport and transfer would be very difficult, even though phylloxera has a moderate likelihood of association with the pathway. Establishment is very likely as the pest is already very widespread in the risk assessment area, occurring almost everywhere *Vitis* plants are present. Successful eradication is very unlikely and small populations can persist undetected in the soil. Spread within the EU is considered to be very likely because there are no effective barriers, it can disperse up to a few kilometres aided by the wind and it can readily be moved long distances with planting material. Grafting with resistant rootstocks throughout the EU ensures that the production of fruit and plants for planting is rarely affected by phylloxera infestations and, if so, only at a limited level. The Panel considers that the IIAII measures for *D. vitifoliae* do not assist in preventing entry and are ineffective in preventing spread because detection is so difficult. Restricting movements of plants for planting to cuttings grafted on resistant rootstocks, in combination with treatments (e.g. particularly fungicides and hot water treatments), was found to be the most effective risk reduction option. Limitations in the Cyprus protected zone regulations were identified.

KEY WORDS

grapevine, pest risk assessment, phylloxera, risk reduction, rootstock, strain, *Vitis* spp.

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SUMMARY

Following a request from the European Commission, the EFSA Panel on Plant Health (hereinafter the Panel) was asked to deliver a scientific opinion on the pest risk of *Daktulosphaira vitifoliae* for the European Union (EU) territory and to identify risk management options and evaluate their effectiveness in reducing the risks to plant health posed by the organism. In particular, the Panel was asked to provide an opinion on the effectiveness of the current EU requirements against *D. vitifoliae*, which are laid down in Council Directive 2000/29/EC, in reducing the risk of introduction of these pests into, and their spread within, the EU territory.

The Panel conducted the pest risk assessment following the general principles of the ‘Guidance on a harmonised framework for pest risk assessment and the identification and evaluation of pest risk management options’ (EFSA PLH Panel, 2010) and the ‘Guidance on methodology for evaluation of the effectiveness of options for reducing the risk of introduction and spread of organisms harmful to plant health in the EU territory’ (EFSA PLH Panel, 2012). As *D. vitifoliae* is already present in 18 EU Member States (in some of which it has been present for more than a century) and has been regulated by the EU, the Panel conducted the pest risk assessment taking into account the current EU plant health legislation.

The Panel reached the following conclusions:

With regard to the assessment of the risk to plant health posed by *D. vitifoliae (Fitch)*, for the EU territory:

<u>Entry</u>

- Entry is very likely for plants intended for planting with soil. Cuttings pose a lower risk. These risk ratings have been selected because (i) the pest is usually or regularly associated with the pathway at origin, (ii) the pest survives or mostly survives during transport or storage, (iii) the pest is not affected or is only partially affected by the current pest management procedures existing in the risk assessment area, and (iv) there are no or very few limitations on transfer of the pest to a suitable host in the risk assessment area. Although this pathway is prohibited by Annex III of Council Directive 2000/29/EC, 141 records of illegal plants for planting *Vitis* imports from third countries were made by Member States between 1994 and 2013.

- Entry is very unlikely for fruit of *Vitis* spp. for consumption. Even though the pest is moderately likely to be associated with the pathway at the origin, (i) it may not survive during transport or storage, (ii) it may not survive the current pest management procedures existing in the risk assessment area, and (iii) it may not be transferred to a suitable host in the risk assessment area.

Uncertainty is rated as low as there is strong evidence of phylloxera entering with plants intended for planting while there is no published information on entry with fruit of *Vitis* spp. for consumption.

<u>Establishment</u>

- Establishment is very likely as the pest is already very widespread in the risk assessment area, occurring almost everywhere *Vitis* plants are present. There are very few examples of successful eradication and small populations can persist undetected until considerable infestations have developed.

Uncertainty is rated as low as the information available from the literature and the evidence obtained from the risk assessment area strongly support this conclusion.

Spread

- Spread is very likely as (i) the pest has numerous ways of spreading naturally and with human assistance, (ii) large quantities of propagation material are often transported within the EU, (iii) no effective barriers to spread exist, because *Vitis* plants are mainly grown in field conditions and in open greenhouses, and phylloxera can persist in the soil for up to five years without its host, (iv) the host is already widespread in the area of potential establishment, and (v) the environmental conditions for infestation are mostly suitable in the area of potential establishment.

Uncertainty is rated as low as the information available from the literature and the evidence obtained from the risk assessment area strongly support this conclusion.

Consequences

- Impact is rated as minor on grafted plants, as grafting with resistant rootstocks ensures that the production of fruit and plants for planting is rarely affected by phylloxera infestations and, if so, only at a limited level. Additional control measures are rarely necessary.

- Impact is rated as massive on ungrafted plants, as outbreaks of phylloxera where plants are not grafted can readily have dramatic consequences on the production of *Vitis* in fruit and plants for planting except in some areas where soil conditions, e.g. sandy soils, are not suitable for phylloxera. The only effective solution when outbreaks occur in ungrafted plants is replanting with wine grape cultivars grafted on resistant rootstocks. Wild European populations of *V. vinifera* are not directly threatened by phylloxera because the natural habitats of wild grapevine are in areas prone to flooding that are less suitable for the pest. However, indirectly, future genetic exchange between the small remaining wild European populations of *V. vinifera* subsp. *silvestris* and naturalised *Vitis* genotypes introduced because of phylloxera resistance is of some concern.

Uncertainty is low as the well-documented history of phylloxera in Europe clearly demonstrates the very serious negative consequences of growing wine grapes on non-resistant rootstocks.

With regard to the risk reduction options, the Panel evaluated the phytosanitary measures against the introduction and spread of *D. vitifoliae* listed in Council Directive 2000/29/EC, explored the possible consequences if these measures were to be removed and identified additional risk reduction options to enhance the current measures. The Panel focused the analysis of available risk reduction options against entry and spread of phylloxera on the only relevant pathway, plants intended for planting. The Panel identified several measures that could work effectively when combined in a systems approach and are already practised to some extent in the risk assessment area as a phytosanitary measure or as general viticultural practice: (i) visual inspections, (ii) restricting trade to scions grafted on resistant rootstocks, (iii) limiting the types of grapevine planting material to be traded such as dormant cuttings that carry fewer phylloxera, (iv) certification schemes with complementary measures designed to ensure pest freedom, (v) pest-free areas, (vi) treatments of the consignment (especially fumigation and hot water treatments), (vii) restrictions in the trade of the consignment after entry, (viii) internal surveillance and (ix) containment. Although measures such as restricting trade to cuttings with scions grafted on resistant rootstocks together with fungicide and hot water treatments can be highly effective, only the prohibition of entry of *Vitis* spp. plants from third countries, as already defined in Annex III of Council Directive 2000/29/EC, can be considered as a stand-alone option. Since plants for planting is the only pathway that requires phytosanitary measures, the prohibition in Annex III makes the Annex IIAII listing to prevent the introduction of *D. vitifoliae* into the EU unnecessary. The Panel considers that the Annex IIAII measures designed to prevent pest spread within the EU are ineffective for two main reasons. Firstly, they are based on inspection and the effectiveness of visual inspection in the field and of potted vines is low (though moderate for cuttings) and, secondly, *D. vitifoliae* is already widespread in the EU and, even where it is recorded as absent, area freedom is difficult to guarantee. Only treatment of the consignment has been recognised by the Panel as highly effective in maintaining the Cyprus protected zone, but it needs to be more clearly defined to ensure that the optimal treatment, e.g. fungicides and hot water, is selected. Although there is variability in the aggressiveness of strains worldwide and there is a lack of research, there is currently no clear evidence that strains that are more aggressive than those in the EU are present outside the EU, indicating that additional measures are not required to protect the EU from non-European populations of *D. vitifoliae*.

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BACKGROUND AS PROVIDED BY THE EUROPEAN COMMISSION

The current European Union plant health regime is established by Council Directive 2000/29/EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community (OJ L 169, 10.7.2000, p. l).

The Directive lays down, amongst others, the technical phytosanitary provisions to be met by plants and plant products and the control checks to be carried out at the place of origin on plants and plant products destined for the Union or to be moved within the Union, the list of harmful organisms whose introduction into or spread within the Union is prohibited and the control measures to be carried out at the outer border of the Union on arrival of plants and plant products.

Arabic mosaic virus, Tomato black ring virus, Raspberry ringspot virus, Strawberry latent ringspot virus, Strawberry crinkle virus, Strawberry mild yellow edge virus, *Daktulosphaira vitifoliae* (Fitch), *Eutetranychus orientalis* Klein, *Parasaissetia nigra* (Nietner), *Clavibacter michiganensis* spp. *michiganensis* (Smith) Davis *et al.*, *Xanthomonas campestris* pv. *vesicatoria* (Doidge) Dye, *Didymella ligulicola* (Baker, Dimock and Davis) v. Arx, and *Phytophthora fragariae* Hickmann var. *fragariae* are regulated harmful organisms in the EU. They are all listed in Annex II, Par A, Section II of Council Directive 2000/29/EC, which means that they are organisms known to occur in the EU and whose introduction into and spread within the EU is banned if they are found present on certain plants or plant products.

Given the fact that these organisms are already locally present in the EU territory and that they are regulated in the EU since a long time, it is considered to be appropriate to evaluate whether these organisms still deserve to remain regulated under Council Directive 2000/29/EC, or whether, if appropriate, they should be regulated in the context of the marketing of plant propagation material, or be deregulated. In order to carry out this evaluation a recent pest risk analysis is needed which takes into account the latest scientific and technical knowledge on these organisms, including data on their agronomic and environmental impact, as well as their present distribution in the EU territory.

The revision of the regulatory status of these organisms is also in line with the outcome of the recent evaluation of the EU Plant Health Regime, which called for a modernisation of the system through more focus on prevention and better risk targeting (prioritisation).

TERMS OF REFERENCE AS PROVIDED BY THE EUROPEAN COMMISSION

EFSA is requested, pursuant to Article 29(1) and Article 22(5) of Regulation (EC) No 178/2002, to provide a pest risk assessment of Arabic mosaic virus, Tomato black ring virus, Raspberry ringspot virus, Strawberry latent ringspot virus, Strawberry crinkle virus, Strawberry mild yellow edge virus, *Daktulosphaira vitifoliae* (Fitch), *Eutetranychus orientalis* Klein, *Parasaissetia nigra* (Nietner), *Clavibacter michiganensis* spp. *michiganensis* (Smith) Davis *et al.*, *Xanthomonas campestris* pv. *vesicatoria* (Doidge) Dye, *Didymella ligulicola* (Baker, Dimock and Davis) v. Arx, and *Phytophthora fragariae* Hickmann var. *fragariae*, for the EU territory.

For each organism EFSA is asked to identify risk management options and to evaluate their effectiveness in reducing the risk to plant health posed by the organism. EFSA is also requested to provide an opinion on the effectiveness of the present EU requirements against those organisms, which are laid down in Council Directive 2000/29/EC, in reducing the risk of introduction of these pests into, and their spread within, the EU territory.

Even though a full risk assessment is requested for each organism, in order to target its level of detail to the needs of the risk manager, and thereby to rationalise the resources used for its preparation and to speed up its delivery, EFSA is requested to concentrate in particular on the analysis of the present spread of the organism in comparison with the endangered area, the analysis of the observed and potential impacts of the organism as well as the availability of effective and sustainable control methods.

ASSESSMENT

1. Introduction

1.1. Purpose

This document presents a pest risk assessment prepared by the Panel on Plant Health for *Daktulosphaira vitifoliae* (Fitch), in response to a request from the European Commission. The risk assessment area is the territory of the European Community (EU-28), and the opinion includes the identification and evaluation of risk management options in terms of their effectiveness in reducing the risk posed by the organism.

1.2. Scope

The scope of the opinion is to assess the risks posed by *D. vitifoliae* to the risk assessment area and to identify and evaluate risk reduction options.

2. Methodology and data

2.1. Methodology

2.1.1. The guidance documents

The risk assessment is conducted in line with the principles described in the documents 'Guidance of the Scientific Committee on transparency in the scientific aspects of risk assessment carried out by EFSA' (EFSA Scientific Committee, 2009) and 'Guidance on a harmonised framework for pest risk assessment and the identification and evaluation of pest risk management options' (EFSA PLH Panel, 2010).

The detailed questions in the EFSA-adapted EPPO) risk assessment scheme, presented in the above-mentioned guidance document, are used as a checklist to ensure that all relevant elements are included. However, as the terms of reference require the opinion to '*concentrate in particular on the analysis of the present spread of the organism in comparison with the endangered area, the analysis of the observed and potential impacts of the organism as well as the availability of effective and sustainable control methods*', the opinion provides only a limited assessment of entry and establishment. The entry section (Section 3.2) examines the different pathways that have been found to transport the pest species and assesses the effectiveness of the current measures in Council Directive 2000/29/EC[4] in terms of preventing entry. The establishment section (Section 3.3) focuses on determining (i) the area of potential establishment outdoors and in protected crops; and (ii) the extent to which there are still significant areas suitable for establishment where the pest is not present.

The evaluation of risk reduction options is conducted in line with the principles described in the above-mentioned guidance document (EFSA PLH Panel, 2010), as well as with those in 'Guidance on methodology for evaluation of the effectiveness of options to reduce the risk of introduction and spread of organisms harmful to plant health in the EU territory' (EFSA PLH Panel, 2012).

In order to follow the principle of transparency, as described in Section 3.1 of the guidance document on the harmonised framework for risk assessment (EFSA PLH Panel, 2010) '… *Transparency requires that the scoring system to be used is described in advance. This includes the number of ratings, the description of each rating …. the Panel recognises the need for further development…*' the Plant Health Panel developed rating descriptors to provide clear justification when a rating was given, which are presented in Appendix A of this opinion.

[4] Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. Official Journal of the European Communities L 169/1, 10.7.2000, p. 1–112.

2.1.2. Methods used for conducting the risk assessment

The pest categorisation assesses all those characteristics of the pest observed outside the risk assessment area and useful to the completion of the pest risk assessment. The level of detail provided is therefore in accordance with the relevance of the information in assessing the risk of entry, establishment, spread and impact of the pest in the risk assessment area. This should reduce repetitions and redundancies in the document.

Because *D. vitifoliae* is already present in the EU territory and has been regulated for a long time in Council Directive 2000/29/EC (Annex IIAII of Council Directive 2000/29/EC[5]), and even before that with the Convention of 1878[6], the assessment of probability of entry (Section 3.2) focuses on the potential for further entry of *D. vitifoliae* from non-EU countries into the risk assessment area, i.e. the EU, whereas the assessment of the probability of spread (Section 3.4) has been conducted with regard to further spread of the pest within and between the EU Member States. Therefore, the Panel, when conducting the pest risk assessment, not only took into account the existing legislation but also discussed the situation that might arise if these regulations were lifted.

The conclusions for entry, establishment, spread and impact are presented separately and the descriptors used to assign qualitative ratings are provided in Appendix A.

2.1.3. Methods used for evaluating the risk reduction options

The Panel identifies potential risk reduction options and evaluates them with respect to their effectiveness and technical feasibility, i.e. consideration of the technical aspects that influence their practical application. The sustainability of the options is based on the definition of 'sustainable agriculture' such as '*capable of being continued with minimal long-term effect on the environment/capable of being maintained at a steady level without exhausting natural resources or causing severe ecological damage*'.[7] The evaluation of the risk reduction options in terms of the potential cost-effectiveness of measures and their implementation is not within the scope of the Panel's evaluation. The descriptors used to assign qualitative ratings for the evaluation of the effectiveness and technical feasibility of risk reduction options are shown in Appendix A.

2.1.4. Level of uncertainty

For the risk assessment conclusions on entry, establishment, spread and impact, and for the evaluation of the effectiveness of the risk reduction options, the levels of uncertainty are rated separately.

The descriptors used to assign qualitative ratings to the levels of uncertainty are shown in Appendix A.

2.2. Data

2.2.1. Literature search

An extensive literature search on *D. vitifoliae* was conducted at the beginning of the mandate. The literature search follows the first three steps (preparation of protocols and questions, search, selection of studies) of the EFSA guidance on systematic review methodologies (EFSA, 2010). As the same species is often mentioned under several synonyms (Section 3.1.1.1), the most frequent, together with the most often applied common names, were used for the extensive literature search and can be found in Appendix B. Further references and information were obtained from experts and from citations within the references. Initially almost all phylloxera research took place in Europe and, during the first

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[5] Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. Official Journal of the European Communities L 169/1, 10.7.2000, p. 1–112.

[6] Convention between Germany, Austria–Hungary, Spain, France, Italy, Portugal and Switzerland on measures to be taken against *Phylloxera vastatrix*. IPE, supra n.16, Volume IV, 1565.

[7] Collins English Dictionary—Complete and Unabridged 10th Edition 2009. Source location: HarperCollins Publishers. Available online: http://dictionary.reference.com/browse/sustainable. Accessed 2 July 2013.

decade of the phylloxera problem, almost 500 papers were published and more than 2000 papers had appeared by 1980 (Galet, 1982). The Panel estimates that, since 1980, about a thousand new papers on phylloxera have been published.

2.2.2. Data collection

Owing to the scarcity of information concerning the current situation of the pest in the risk assessment area, the PLH Panel undertook the following actions:

1. A short questionnaire on the current situation at country level based on the information available in the EPPO plant quarantine data retrieval system (PQR) was sent to the National Plant Protection Organisation (NPPO) contacts of all the EU Member States in January 2013. Answers were received until March 2013. In some cases, supplementary information was also sought for clarification. A summary table with the answers received is presented in the entry section (Table 1).

2. For the evaluation of the probability of entry, the Europhyt database was consulted by searching for pest-specific notifications on interceptions. Europhyt is a web-based network launched by the Directorate General for Health and Consumers (DG SANCO), and is a sub-project of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database provides notifications of interceptions of plants or plant products that do not comply with EU legislation.

3. Pest risk assessment

3.1. Pest categorisation

3.1.1. Identity of the pest

The organism under assessment is the grape phylloxera (*Daktulosphaira vitifoliae* Fitch, Homoptera: Phylloxeridae), a gall-forming aphid native to North America which is an obligate plant parasite of grape (*Vitis* spp.). Grape phylloxera was described in 1855 from leaves of native American *Vitis* spp. (Russell, 1974). According to Granett et al. (2001), *D. vitifoliae* is currently recognised as a single species. Although variability in biological characteristics has been observed in phylloxera populations, no clear proof of speciation has been published yet. Differences in life cycle and DNA profiles leave the question of speciation open (Granett et al., 2001). See also Section 3.1.5.1.

3.1.1.1. Taxonomy

The organism under assessment is a clear single taxonomy entity and currently has the following valid scientific name:

<u>Name:</u>

Daktulosphaira vitifoliae (Fitch), 1856

<u>Synonyms:</u>

Phylloxera vastatrix Planchon, 1868

Phylloxera vitifoliae (Fitch), 1851

Viteus vitifoliae (Fitch), 1867

Viteus vitifolii (Fitch), 1867

Taxonomic position:

Insecta: Hemiptera: Homoptera: Phylloxeridae

The common names used in English-speaking countries are grapevine phylloxera and vine louse.

3.1.1.2. Identification

Clear morphological descriptions of this pest have been published extensively and can be used for identification (e.g. Granett et al., 2001; Forneck and Huber, 2009).

3.1.2. Current distribution

3.1.2.1. Global distribution

Grape phylloxera is native to North America, but does not damage North American host plants of the genus *Vitis*. Severe damage was observed in Europe after a French wine merchant imported phylloxera infested US vines to his Rhône vineyards for hybridisation in 1862. It initially devastated European grapevines (*Vitis vinifera* L.) in France, then spread throughout Europe and finally across the world to almost all areas where grapes are grown (Granett et al., 2001; and Figure 1). The dramatic impacts of this pest resulted, in 1878, in the first international agreement to prevent the spread of a plant pest (MacLeod et al., 2010).

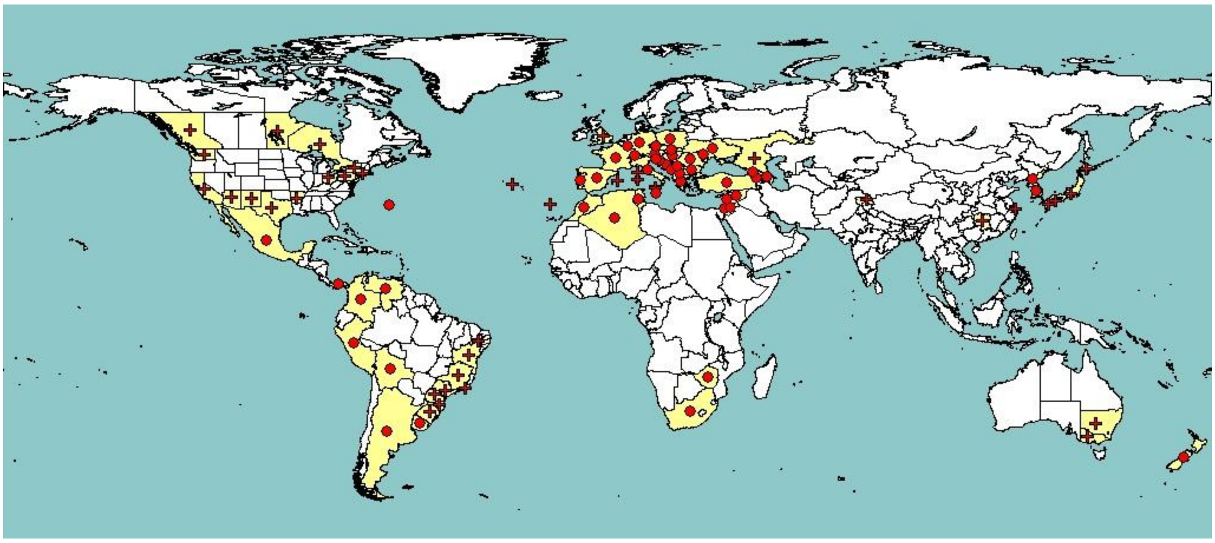

Figure 1: Global distribution of *Daktulosphaira vitifoliae* (extracted from EPPO PQR (2014, version 5.3.1) accessed on 26 March 2014). Red circles represent pest presence as national records and red crosses show pest presence as sub-national records.

3.1.2.2. Occurrence in the risk assessment area

In the EU, the pest occurs in 18 Member States (Table 1), that, with the exception of Cyprus (which is a protected zone, Section 3.1.3), include all the major European vineyard areas (Figure 2; Table 2). However, confirmation of absence is considered to be very difficult when there is a low level of infestations in the roots (Malumphy, 2012).

Table 1: The current distribution of *Daktulosphaira vitifoliae* in the risk assessment area, based on the answers received via email from the NPPOs

Member State*	Current situation	Source
Austria	Present in all parts of the area where host plants are grown	Email from NPPO of 22 February 2013
Belgium	Absent, no pest records (Still no findings of the pest since the previous verification of the status (2011))	Email from NPPO of 22 February 2013
Bulgaria	Present restricted distribution	Email from NPPO of 21 February 2013
Croatia	Present in Istra, Slavonija (Feričanci), and Međimurje county	Email from NPPO of 18 March 2013
Cyprus	Absent, protected zone based on annual surveys	Email from NPPO of 27 February 2013
Czech Republic	Present, restricted distribution	Email from NPPO of 12 February 2013
Denmark	Absent, no pest records	Email from NPPO of 14 February 2013
Estonia	Absent, no pest records	Email from NPPO of 12 February 2013
Finland	Absent, no pest records	Email from NPPO of 21 February 2013
France	Present, widespread Corsica: present, few occurrences	Email from NPPO of 11 March 2013
Germany	Present, restricted distribution	Email from NPPO of 22 February 2013
Greece	Present, widespread	Email from NPPO of 22 February 2013
Hungary	Present, restricted distribution	Email from NPPO of 18 February 2013
Iceland	Absent, no records	Email from NPPO of 15 March 2013
Ireland	Absent, no pest records	Email from NPPO of 22 February 2013
Italy	Present, no details	Email from NPPO of 21 February 2013
Latvia	Absent, no pest records	EPPO PQR (2011)
Lithuania	Absent, no pest records	Email from NPPO of 21 February 2013
Luxembourg	Present, no details	EPPO PQR (1988)
Malta	Present, no details	Email from NPPO of 20 February 2013
Norway	Absent, no pest records	Email from NPPO of 14 March 2013
Poland	Present, restricted distribution (confirmed by surveys)	Email from NPPO of 22 February 2013
Portugal	Portugal: present, restricted distribution Portugal Azores area: present no details Portugal Madeira area: present no details	Email from NPPO of 22 February 2013
Romania	Present, widespread	Email from NPPO of 14 February 2013
Slovak Republic	Present, no details	Email from NPPO of 19 February 2013
Slovenia	Present: only in some areas, where host crop(s) are grown	Email from NPPO of 25 February 2013
Spain	Present, widespread	EPPO PQR (2011)
Sweden	Not known to occur; no pest records	Email from NPPO of 21 February 2013
The Netherlands	Absent, confirmed by survey	Email from NPPO of 20 February 2013
United Kingdom	Present, restricted distribution	Email from NPPO of 7 January 2014

*Note: the definition of 'no pest records' has in some cases been interpreted as 'no pest surveys'.

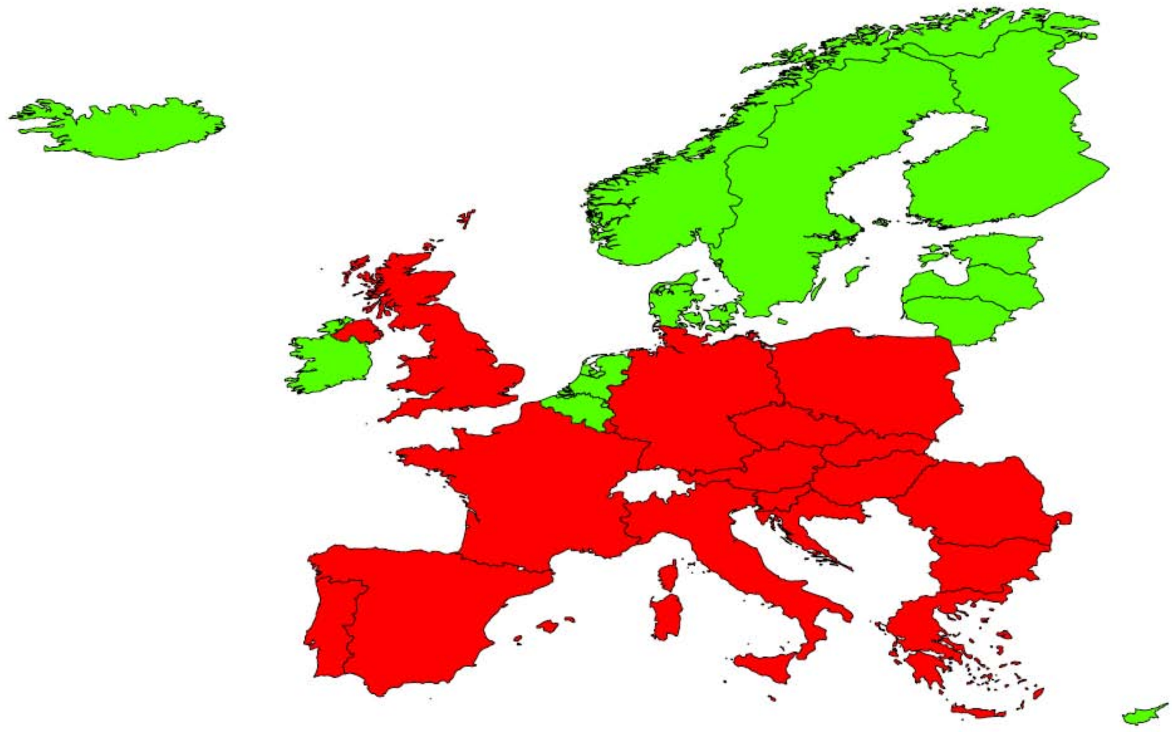

Figure 2: European distribution of *Daktulosphaira vitifoliae* in the 30 replies obtained from European Member States, Iceland and Norway based on the information presented in Table 1. Different colours represent the different status of the pest: absent or no records (countries in green) or present (countries in red).

3.1.3. Regulatory status

This species is a regulated harmful organism in the EU and listed in Council Directive 2000/29/EC in the following sections:

- Annex I, Part B—Harmful organisms whose introduction into, and whose spread within, certain protected zones shall be banned

Species	**Protected zone(s)**
1.1. *Daktulosphaira vitifoliae* (Fitch)	CY

- Annex II, Part A—Harmful organisms whose introduction into, and spread within, all Member States shall be banned if they are present on certain plants or plant products
    - Section II—Harmful organisms known to occur in the Community and relevant for the entire Community
        - Insects, mites and nematodes, at all stages of their development

Species	**Subject of contamination**
2. *Daktulosphaira vitifoliae* (Fitch)	Plants of *Vitis* L., other than fruit and seeds

- Annex IV, Part B—Special requirements which shall be laid down by all Member States for the introduction and movement of plants, plant products and other objects into and within certain protected zones

Plants, plant products and other objects	**Special requirements**	**Protected zone(s)**
21.1. Plants of *Vitis* L., other than fruit and seeds	Without prejudice to the prohibition in Annex III Part A point 15, on introducing plants of *Vitis* L. other than fruits from third countries (except Switzerland) into the Community, official statement that the plants: (a) originate in an area known to be free from *Daktulosphaira vitifoliae* (Fitch); or (b) have been grown at a place of production which has been found free from *Daktulosphaira vitifoliae* (Fitch) on official inspections carried out during the last two complete cycles of vegetation; or (c) have been subject to fumigation or other appropriate treatment against *Daktulosphaira vitifoliae* (Fitch)	CY
21.2. Fruits of *Vitis* L.	The fruits shall be free from leaves and official statement that the fruits: (a) originate in an area known to be free from *Daktulosphaira vitifoliae* (Fitch); or (b) have been grown at a place of production which has been found free from *Daktulosphaira vitifoliae* (Fitch) on official inspections carried out during the last two complete cycles of vegetation; or (c) have been subject to fumigation or other appropriate treatment against *Daktulosphaira vitifoliae* (Fitch).	CY

In the same regulation there are limitations to the movement of *Vitis* plants and parts of plants which could influence the entry and spread of *D. vitifoliae*, although not directly addressed to it

- Annex III, Part A—Plants, plant products and other objects the introduction of which shall be prohibited in all Member States

Description	**Country of origin**
15. Plants of *Vitis* L., other than fruits	Third countries other than Switzerland

The above-mentioned Article 15 is to be considered in combination with Commission Directive 2004/31/EC[8], where:

(2) Under Directive 2000/29/EC, the introduction into the Community of plants of *Vitis* L., other than fruits, originating in third countries is prohibited.

[8] Commission Directive 2004/31/EC of 17 March 2004 amending Annexes I, II, III, IV and V to Council Directive 2000/29/EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. Official Journal of the European Union L 85/18, 23.3.2004, p. 18–23.

(3) From information supplied by Switzerland, it appears that the measures Switzerland applies as regards the introduction into and movement within its territory of plants of *Vitis* L., other than fruits, are equivalent to the measures laid down in Directive 2000/29/EC. Therefore, plants of *Vitis* L., other than fruits, originating in Switzerland should be allowed to enter the Community.

- Annex V—Plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community—in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community

- Part A—Plants, plant products and other objects originating in the Community

    - Section I—Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community and which must be accompanied by a plant passport

        - 1.4 Plants of [...] *Vitis* L., other than fruit and seeds.

    - Section II—Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for certain protected zones, and which must be accompanied by a plant passport valid for the appropriate zone when introduced into or moved within that zone

        - 1.3. Plants, other than fruit and seeds, of [...] *Vitis* L.

        - 1.9. Fruits [...] of *Vitis* L.

- Part B—Plants, plant products and other objects originating in territories, other than those territories referred to in Part A

    - Section II—Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for certain protected zones

        - 6a. Fruits of *Vitis* L.

Phylloxera is also regulated in other parts of the world, for instance in Australia, where the quarantine legislation defines conditions for the movement of not only planting and propagating material but also equipment, machinery, grapes, grape products and grapevine diagnostic samples (NVHSC, 2009).

3.1.4. Potential for establishment and spread in the risk assessment area

D. vitifoliae feeds only on plants of the genus *Vitis* spp. Like all Phylloxeridae, it is oviparous (Davis, 2012) and has both sexual and asexual stages (Figure 3).

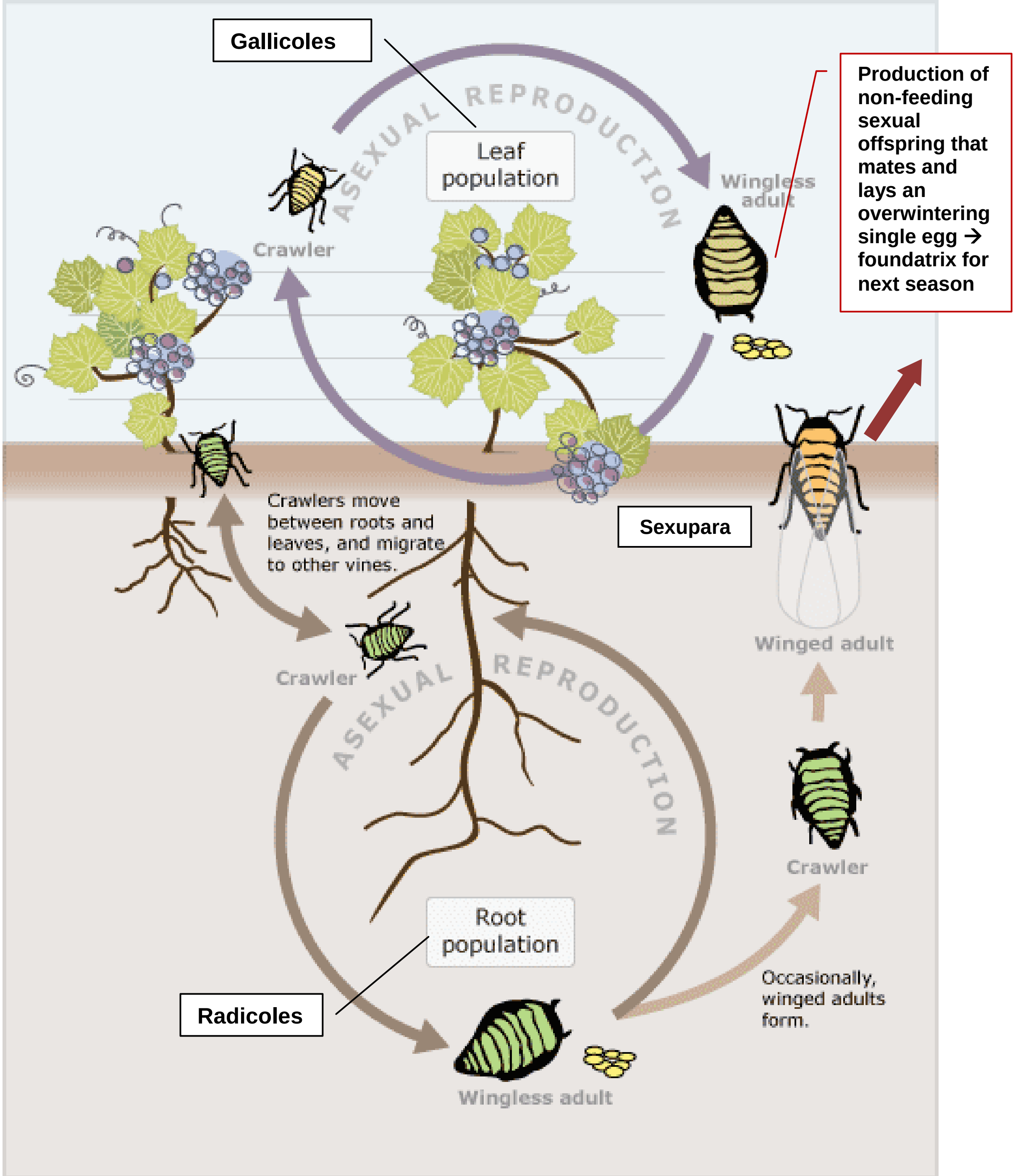

Figure 3: Life cycle of *D. vitifoliae*, image provided in Maggy Wassilieff, Viticulture, Pests and diseases, Te Ara, the Encyclopaedia of New Zealand, updated 14/11/2012, available online: http://www.TeAra.govt.nz/en/diagram/18318/phylloxera-aphid-life-cycle and adapted from other sources (e.g. Granett et al., 2001).

An asexual fundatrix hatches from the overwintering egg and lays eggs on roots or leaves. Asexual eggs, nymphs and adults occur on *Vitis* leaves and roots. Adults and nymphs whose feeding activities result in galls on leaves are called gallicoles, while those causing galls on roots are termed radicoles. Eggs hatch into first instars, or crawlers, that are mobile and can move between roots and leaves to establish new feeding sites. After the first instar, the four succeeding nymphal stages of gallicoles and radicoles tend to stay and feed in the same place. Radicoles may develop into wingless or winged adults. Wingless adults stay in the ground and reproduce asexually. Radicoles developing into winged adults emerge from the ground and undergo eclosion into winged adult sexuparae (alates). These winged forms do not feed, but disperse and then lay male and female eggs asexually. The sexuals which develop from these eggs moult four times into wingless adults, again without feeding. The adult sexuals have a mating period of about 24 hours (Forneck et al., 2001a) and each female lays a single overwintering egg. Forneck and Huber (2009) provide a detailed overview of the complex life cycle of phylloxera, including the endogenous and exogenous factors influencing the life cycle. Powell (2012) provides a review of the biology supported by detailed pictures of the life stages and damage. On American *Vitis* spp., the full life cycle occurs with an alternation between gallicoles and radicoles. On European *V. vinifera,* cultivars, radicoles predominate and gallicoles are mostly absent (EPPO/CABI, 1997) except on interspecific grapevine hybrids. In most of Europe, the anholocyclic (asexual) stage, which is also the most damaging, is the dominant form. Holocyclic (sexual) phases are considered to occur in Europe, because sexuparae have been found emerging in vineyards, though sexually produced eggs have not been observed since 1909, supposedly because they occur at very low numbers, are not easy to detect and look very similar to asexual eggs (Forneck and Huber, 2009).

Phylloxera does not require a vector to spread.

3.1.4.1. Host range

As mentioned above, this pest has a very restricted host range since it only feeds on *Vitis* spp. (Powell, 2008). Members of the *Vitis* genus are perennial plants which occur in the wild and in cultivation, where they are either grown from rooted dormant hardwood or green softwood cuttings or, more often, obtained by grafting a scion cultivar onto a suitable rootstock (Section 3.1.5). The number of *Vitis* species worldwide is estimated to range from 40 to more than 60, while the number of varieties is believed to be about 8 000, of which only 200–300 are cultivated on a large scale (Galet, 2000). *Vitis* plants are widely cultivated in the risk assessment area (Table 2), where they are grown for the production of fresh (table grapes) and dried fruits (e.g. sultana, Zante currants), juices, fermented drinks (wine and spirits) and for ornamental purposes.

3.1.4.2. Climatic conditions

The current worldwide distribution of *D. vitifoliae* comprises all ecoclimatic zones where *Vitis* plants can survive (Figure 1). In Europe, phylloxera occurs wherever *Vitis* spp. is present, except at the northern limits of the distribution of outdoor *Vitis* (Belgium, Denmark, Estonia, Ireland, Latvia, Lithuania, the Netherlands, Finland and Sweden) and Cyprus (Figure 2). However, the detection of low population densities of phylloxera is very difficult (see Section 4.1.1.1).

3.1.4.3. Current establishment in the risk assessment area

The area of establishment of the pest in the risk assessment area can be considered to correspond to the area where the pest is currently present, as shown in Figure 2 and Table 2, and covers 18 Member States. The pest can be found in the following habitats in the risk assessment area:

- Outdoors: (i) commercial vineyards for wine, table grapes and dried grapes, (ii) natural and semi-natural areas with European and imported *Vitis* spp., (iii) abandoned vineyards, (iv) vegetation in close proximity to vineyards, (v) nurseries for the production of rootstocks, grafted plants, and for certified grapevine material (rootstocks and scions), (vi) private and public gardens and (vii) academic research collections.

- Protected cultivation: (i) for commercial and private production of table grapes, (ii) nurseries for production of rootstocks, grafted plants, and mother plots for certified grapevine material (rootstocks and scions) and (iii) academic research collections.

Table 2: Area (in hectares (ha)) of *Vitis* sp. production in Europe (holdings, cultivated area under vines (CAV) and agricultural area in use broken down by type of production, size class and regions [vit_bs1] for 2009, Eurostat).

	Area under all vine varieties	**Area under wine grapevine varieties**	**Area for the production of quality wines psr**	**Area for the production of other wines**	**Area for production of other wines, including potable spirits**	**Area under table grapevines**	**Planted root stock for grafting**	**Area under vines for propagation in nurseries**	**Area under parent vines**	**Area under dried grapevine varieties**
EU-27	**3 288 404**	**3 153 889**	**1 872 979**	**1 279 715**	**86 405**	**83 434**	**:**	**4 576**	**5 834**	**:**
Austria	45 586	45 533	45 533	0	0	0	0	53	0	0
Belgium	70 [(a)]									
Bulgaria	59 699	56 133	35 889	20 245	41	3 499	67	17	50	:
Croatia	32 709 [(b)]									
Czech Republic	16 290	16 144	14 986	1 157	3	101	0	12	33	0
Cyprus	8 939	8 606	300	8 306	0	286	1	0	21	26
France	788 595	779 426	483 055	296 371	77 189	6 167	0	1 065	1 936	:
Germany	102 378	102 130	102 130	1	0	72	0	276	21	0
Greece	96 345	54 389	12 557	41 832	0	14 803	50	6	103	26 993
Hungary	84 229	82 657	75 998	6 659	0	868	0	132	572	0
Italy	647 145	604 626	317 694	286 932	0	36 854	1 233	2 579	1 853	0
Luxembourg	1 303	1 302	1 302	0	0	1	0	0	0	0
Malta	738	615	440	174	0	120	1	3	0	0
Poland	400[(b)]									
Portugal	178 267	173 590	107 055	66 535	0	2 333	1 908	54	382	0
Romania	180 262	170 291	25 694	144 602	9 172	794	694	27	73	:
Slovenia	11 663	8 865	8 865	0	0	0	0	59	17	0
Slovakia	12 846	12 637	12 453	184	0	169	0	32	9	0
Spain	1 048 104	1 028 258	621 540	406 718	0	17 362	:	241	738	1 505
The Netherlands	158 [(b)]									
United Kingdom	1 198	1 198	0	0	0	0	0	0	0	0

(a): Data source for Belgium: agricultural census 2010 of Statistics Belgium (Belgian Federal Government, 2013). Available online: http://statbel.fgov.be/fr/modules/pressrelease/statistiques/economie/recensement_agricole_de_mai_2010.jsp

(b): Data source for Croatia, Poland, the Netherlands: Land use—1000 ha—annual data (apro_cpp_luse) for 2010, Eurostat

3.1.4.4. Spread capacity

The spread capacity of this pest is mainly determined by human-assisted dispersal mechanisms. Phylloxera-infested *Vitis* spp. plants and parts of plants were historically traded for fruit and wine production, for breeding, and for establishment of new vineyards. As a result, *D. vitifoliae* is a major pest worldwide of cultivated grapevine *Vitis* spp. (Vitaceae) (Powell et al., 2013).

A more detailed assessment of spread is provided in Section 3.4.

3.1.5. Potential for consequences in the risk assessment area

D. vitifoliae has for a long time been an important pest in the majority of wine-producing countries throughout the world, starting around 1860 (Granett et al., 2001), when it was accidentally imported into France and devastated the French wine industry, destroying over 1 million ha of ungrafted *V. vinifera* vineyards (Benheim et al., 2012).

The frequency, severity and distribution of infestations depend on a combination of environmental, physiological and genetic factors (Powell and Herbert, 2005) and especially on the degree of host plant resistance and on the strain of the pest (Benheim et al., 2012). Premature senescence in autumn, stunting of lateral shoot growth, reduced grape yields, reduced overall vigour or a general weak spot within a group of vines are all potential signs (Powell, 2008). However, once a weak spot is identified pest spread is likely to be already at an advanced stage and could have reached plants that still appear to be relatively vigorous (Herbert et al., 2003).

Gallicoles inhibit growth and degrade the quality of annual shoots. Radicoles are more harmful than gallicoles: they damage and weaken the root system of commercial *V. vinifera* L. varieties, which results in significant yield losses. Severe infestations can lead to withering and even the death of vines (Pavloušek, 2012). Root infestation usually kills vines in 3 to 10 years (Folwell et al., 2001).

Damage can be caused by nodosities (galls on young root tips, representing the first symptoms of infection) and by tuberosities (galls occurring on lignified roots that can be observed after a longer period of infestation). The formation of either nodosities or tuberosities is controlled by different genetic mechanisms (Roush et al., 2007), but both nodosities and tuberosities significantly disrupt the vascular system, affecting nutrient and water transportation, and absorption. The damage is worst on mature roots of susceptible grape species/cultivars, where the tuberosities swell and crack, producing access points for soil-borne fungi that can destroy large portions of the root system and eventually lead to plant death (Edwards et al., 2007). The size of the tuberosities is positively correlated with phylloxera performance and the numbers of feeding individuals (Omer et al., 1999). Frequently the indirect damage produced by pathogenic fungi (e.g. *Roesleria hypogea*) and nematodes (Hoschitz and Reisenzein, 2004) is the final cause of plant decline (Reisenzein, 2005). Nodosities occur on *V. vinifera* roots and all rootstocks that are partially resistant. Nodosities function as feeding sites for phylloxera and significantly alter the primary and secondary metabolism of the roots (Lawo et al., 2011; Du et al., 2013). Tuberosities are rarer, occur on *V. vinifera* and less resistant rootstocks, and result in limited root damage (Benheim et al., 2012). Root populations are frequently observed on partially resistant rootstocks, where they feed on immature roots producing nodosities (Powell et al., 2013). Damage is not only caused by radicoles on grapevine (*V. vinifera* L.) roots, but can also be caused by gallicoles on leaves of North American grape species (e.g. *Vitis berlandieri, Vitis riparia* and *Vitis rupestris*) and their hybrids (Roush et al., 2007), and, to a lesser extent, on *V. vinifera* (Strapazzon and Girolami, 1983; Vorwerk, 2007; Koennecke et al., 2011; Vidart et al., 2013). Gallicoles are widespread in continental USA and Europe on rootstock foliage (Granett et al., 2001). Partially resistant *V. vinifera* genotypes may be severely affected by leaf galls and express decline, but no plant mortality has yet been documented (personal communication from Professor Dr László Kocsis, University of Pannonia Georgikon Faculty, email message of 17 January 2014). The primary effect of damage to leaves is a decrease in photosynthesis. For example, on cultivar Seyval, the photosynthetic rate on leaf-infested plants was reduced by 50–84 % when compared with uninfested leaves (Granett et al., 2001). Leaf galling on susceptible cultivars prevents leaf expansion and causes leaf distortion and shortened shoots, with a consequent reduction in photosynthesis, poor canopy architecture, leaf necrosis, premature defoliation, delayed ripening, reduced grape quality and more damage by winter injury (Johnson et al., 2009). A phylloxera-infested leaf shows significant changes in the primary metabolism, such as increased water, nutrient and mineral transport, glycolysis and fermentation (Nabity et al., 2013). The observed variation between grapevine genotypes in the ability to support leaf-feeding phylloxera is due to gall formation and/or survival rather than to the nutritional content of the leaves (Granett and Kocsis, 2000). Granett et al. (2005) considered that the earliest leaf galls in spring are caused by individuals overwintering as hibernating stages on the roots of the same vine or vines nearby. All in all, gallicoles are generally considered far less damaging than radicoles (Benheim et al., 2012). The level of phylloxera infestation in grafted vineyards that can occur on partially resistant rootstocks depends on multiple factors (Section 3.1.4.2). In addition, phylloxera can cause significant problems when multiple stresses (e.g. drought, anoxia) add to phylloxera infestation on roots over several vegetation periods. Processes leading to dormancy and frost resistance might result in frost damage and eventually kill off vines in winter (Folwell et al., 2001).

Recent transcriptomic studies provide evidence that the metabolism of phylloxera-infested leaves and roots is significantly altered and several metabolic pathways are affected (Lawo et al., 2011, 2013; Griesser et al., 2014), indicating systemic changes in the entire vine. The main effects are on sink–source translocation and carbon allocation, resulting in delayed ripening and decreased frost resistance. Furthermore, changes in the plant defence responses show clear evidence that general defence pathways are weakened and may increase susceptibility to other grapevine pests.

The observed association between grapevine phylloxera and soil-borne fungal infection of roots (with *Cylindrocarpon destructans*, *Fusarium* spp., *Phaeoacremonium* spp. and *Pythium ultimum*) can amplify the rate and extent of grapevine decline (Powell, 2008).

3.1.5.1. Differences in phylloxera aggressiveness

Aggressiveness and virulence are terms that are used inconsistently in the literature to describe phylloxera biotypes and strains either in terms of their performance (e.g. their rate of development and reproduction) on different hosts and in different environments or in terms of the damage they cause to hosts (Granett et al., 2001; Herbert et al., 2010). However, for biotypes, aggressiveness is always measured in terms of their performance rather than on their impact on the host plant (Granett et al., 1985). Since it is used so inconsistently, the term virulence is not used in this opinion.

"Biotypes" of phylloxera are defined according to their performance on a particular host by bioassays. However, use of the term biotype is not always straightforward as the values found for performance depend on the type of bioassay, which is difficult to standardise. Therefore, the Panel considers the term "strain" better to distinguish phylloxera populations worldwide. The term "strain" is used for a single founder lineage (clone) propagated either under laboratory conditions and/or as a field clone and characterised by its performance on the host, geographical origin and/or phylloxera genotype. Superclones are aphid genotypes that constitute 40–60 % of a population in a region (Vorburger et al., 2003). In the specific case of phylloxera, two superclones have been reported in Australia as having the broadest geographic distribution and the highest performance and damage levels (Powell et al., 2013). However, the term superclones will only rarely be used further in this opinion as the difference with "strain" in terms of performance and level of damage is not clear.

Over recent decades, evidence of the existence of different phylloxera strains has become more apparent because of differences in their performance on different *Vitis* genotypes. New strains can evolve, such as biotype B (Granett et al., 1985), of which strong infestations were discovered on the partially resistant rootstock genotype AXR#1 (*V. vinifera* 'Aramon' × *V. rupestris*) (Sullivan, 1996). A wide range of strains have been reported in Europe (Song and Granett, 1990; Forneck et al., 2001b; Yvon and Peros, 2003), Australasia (King and Rilling, 1985; Corrie et al., 1997), Canada (Stevenson, 1970), South Africa (De Klerk, 1979) and the USA (Williams and Shambaugh, 1988; De Benedictis and Granett, 1992).

It is not possible to accurately characterise the distribution of all strains in different countries owing to the lack of a genetic basis for strain identification, the difficulties of conducting consistent bioassays and because the link between phenotype (in terms of performance and effects on the host) and genotype has often not been determined. Furthermore, the changes that phylloxera shows are strongly dependent on the characteristics of the environment (host, abiotic factors, etc.). However, it is clear that the two Australian superclones, with accurate descriptions of their genotype, do represent strains that have not been found elsewhere. Regardless of genetic and physiological differences in grape phylloxera populations, comparative studies of grape phylloxera morphology have so far yielded no evidence that strains can be distinguished based on morphological characteristics (Forneck and Huber, 2009). Considerable variability in morphological traits has been observed, although this is mainly caused by environmental factors (Granett et al., 2001).

Within the wide range of strains described, two main groups can be distinguished: the first group shows better performance on susceptible *V. vinifera* roots (e.g. *V. vinifera* cv. Riesling) (hereafter susVv group) and the second group shows better performance on partially resistant rootstocks, from American species or hybrids with *V. vinifera* (e.g. T5C, C3309, 41B) (hereafter resV group). Laboratory studies on host adaptation have been undertaken (Forneck et al., 2001b; Trethowan and Powell, 2007; Herbert et al., 2008, 2010) and confirmation of strains belonging to both groups has been provided from field observations (Kocsis et al., 2002; Granett et al., 2003). Experiments in the field are scarce as a consequence of the complexity of the host–plant interactions with environmental factors.

In Europe, the majority of phylloxera strains screened belong to the resV group (Forneck et al., 2001b; Kocsis et al., 2002; Powell et al., 2013) whereas in Australia most of the strains identified belong to the susVv group (Umina et al., 2007), including the two superclones. The dominance of the susVv group in Australia is the result of growing mainly non-grafted *V. vinifera*. Although the genetic diversity and aggressiveness of European phylloxera strains of susVv group is high, no convincing evidence has been provided for *Vitis* decline attributed to a particular phylloxera strain in the risk assessment area. This is probably due to the generally high number of strains existing in vineyards and even on single vines, inconsistent procedures for identifying aggressiveness and the loss of awareness that phylloxera is a potential cause of decline (personal communication from Professor Astrid Forneck, University of Natural Resources and Life Sciences, Tulln, email message of 4 March 2014).

The population dynamics and dispersal potential of each phylloxera strain depend on a combination of factors: phylloxera genotype, host plant species, the cultivar and the environmental conditions (Powell et al., 2013). The above-mentioned factors will also affect the successful establishment of newly introduced phylloxera strains. In Europe, almost 200 distinct leaf-galling genotypes have been identified with the use of microsatellite markers from eight populations sampled in different countries (Vorwerk and Forneck, 2006), while 152 genotypes were identified from five populations sampled only in Austria (Griesser and Forneck, 2009). Although it is still unclear how these genotypes relate to the number of strains, there is evidence that the genetic diversity in phylloxera populations is the result of sexual recombination, multiple introductions, migration, human transportation and mutations occurring during the anholocyclic phases (e.g. Forneck et al., 2000; Vorwerk and Forneck, 2006; Islam et al., 2013) and any adaptation that evolves through the asexual stage (the principal method of reproduction in Europe) can quickly become common and widespread.

Information on the genetic structure of European phylloxera mainly results from studies of gallicole populations in abandoned vineyards. No significant effects of the host genotype or overlapping pest genotypes have been found. There is no published information on the interaction or migration of European phylloxera genotypes from leaf to root-feeding or from the feeding of rootstock leaves to *V. vinifera*. The complexity of phylloxera populations in the field is high and may change depending on the season, climatic conditions and cultivation techniques applied (Forneck et al., 2000).

The existence of different aggressiveness levels in phylloxera strains illustrated above has important implications on the effectiveness of risk reduction options (Korosi et al., 2012), in particular for managing ungrafted vines and in the selection of phylloxera-resistant rootstocks (Powell, 2008).

3.1.6. Conclusion on pest categorisation

Phylloxera has been present in Europe since the middle of the 19th century. It can be managed successfully by grafting European vines on partially resistant North American rootstocks. *D. vitifoliae* is no longer considered to be a significant pest of grafted vines in Europe by EPPO (2002). Recent information concerning the potential development of aggressive phylloxera strains within and outside the EU needs further investigation to determine whether this pest could still present a significant risk to the risk assessment area. This is the main reason for continuing the risk assessment.

3.2. Probability of entry

The Panel conducted the assessment of the probability of entry of phylloxera assuming the absence of the relevant phytosanitary regulations in Council Directive 2000/29/EC. However, all the data on imports and interceptions presented in this document were obtained under the regulations currently in place in the EU. These data should be interpreted with caution because quantities of imported products would probably change if the regulations were to be removed and because the numbers of interceptions will depend on the procedures for import control currently in place at the EU borders. Since *D. vitifoliae* already occurs in most of the Member States of the EU (Figure 2 and Table 1), the assessment considers the potential for additional entry from third countries.

3.2.1. Identification of pathways

The Panel identified the following pathways for entry of *D. vitifoliae* from the areas where the pest is present to the risk assessment area:

1. plants of *Vitis* spp. intended for planting;
2. fresh fruit of *Vitis* spp. for consumption;
3. leaves of *Vitis* spp.;
4. soil;
5. dried fruit of *Vitis* spp.;
6. natural entry from areas outside the EU;
7. import of living *D. vitifoliae* specimens for scientific purposes.

3.2.1.1. Selection of the most important pathways

The selection of the most important pathways for further assessment from those listed above was based on the EFSA guidance on a harmonised framework for pest risk assessment and the identification and evaluation of pest risk reduction options (EFSA PLH Panel, 2010), which states that (i) the most relevant pathways should be selected using expert judgement and, where there are different origins and end uses, it is sufficient to consider only realistic worst-case pathways, and (ii) closed pathways may also be considered, as the pests identified may support existing phytosanitary measures. Furthermore, some pathways may be closed by phytosanitary measures which might be withdrawn at a future date. In such cases, the risk assessment may need to be continued.

<u>Pathway 1: plants of *Vitis* intended for planting excluding seeds</u>

The Panel considers the import of *Vitis* spp. plants intended for planting to be a key pathway for assessment. The spread of phylloxera all around the world is well documented as a consequence of the movement of planting material (Morrow, 1973; Granett et al., 2001). The quality and quantity of all the products obtained from *Vitis* spp. (table grapes, raisins, wine and other drinks) very much depend on the rootstock genotype and scion variety selected. Because of this, and because grapevines are mainly propagated by vegetative means, the movement of planting material for genotype selection, propagation and breeding is of direct relevance to nurseries, growers and wine makers. The entry from outside Europe of plants of *Vitis* L., other than fruits, is prohibited under Annex III of Council Directive 2000/29 (Section 3.1.3). However, the analysis of the non-compliance data from Europhyt shows that illegal imports of *Vitis* spp. plants are attempted. On Europhyt, 188 records of non-compliance were made by the Member States between 1994 and 2013 on *Vitis* living plants and parts of plants for planting, planted or able to germinate, other than seeds. The main types of non-compliance recorded are given below. They are classified according to the commodity categories in the Europhyt database and are therefore not completely consistent with the classification provided in this opinion. The categories are presented in decreasing levels of risk. The total number of interceptions is given in brackets, excluding those where the country of origin was not specified:

- Plants intended for planting, already planted: Armenia (1), Egypt (1), Georgia (1), Islam Republic of Iran (1), Lebanon (3), Russian Federation (4), Syria Arab Republic (1), Turkey (16) and USA (2).

- Plants intended for planting, not yet planted: Canada (1), Cape Verde (1), Republic of Macedonia (2), Georgia (1), Israel (1), Lebanon (1), Republic of Moldova (4), Russian Federation (2), Serbia (25), Thailand (3), Turkey (31), USA (10), Yugoslavia (1).

- Cuttings: Albania (1), Argentina (1), Brazil (1), Canada (1), Israel (4), Republic of Moldova (1), Russian Federation (1), Tunisia (1), Turkey (8), Uganda (1), USA (1).

- Branches with foliage: Islamic Republic of Iran (1), Jordan (7), Lebanon (4), Turkey (32).

- Cut branches without foliage: Republic of Macedonia (1), Turkey (1).

- Stored products capable of germinating: Jordan (1).

This pathway is closed by the measures listed in Annex III of the EU Plant Health Directive and there is very little prospect that this phytosanitary prohibition will be withdrawn in future because of the risks posed by the large number of *Vitis* spp. pests absent from the EU.

Although the plants for planting pathway is closed, the Panel has undertaken a brief assessment of the plants for planting pathway to evaluate the risks posed by non-compliance. Greater detail on the plants for planting pathways is given in Section 3.4.2 related to the risk of spread. Although Europhyt provides a different classification, it is appropriate to distinguish the following types of plants for planting pathways for phylloxera because they are the most important and pose different risks: (i) rooted cuttings for grafting or planting that can have hibernating crawlers on the roots and winter eggs on the bark, (ii) cuttings without roots (dormant canes) for grafting that can carry winter eggs on the bark, (iii) cuttings without roots (non-dormant canes) for grafting that can have crawlers and eggs and (iv) potted vines (potted plants with soil) for planting that can have radicoles on the roots and gallicoles on the leaves, and hibernating stages when plants are traded in winter.

Phylloxera, therefore, can readily be associated with, transported and transferred by all four of these plants for planting pathways. Although cuttings can have winter eggs and some types can transport hibernating crawlers, compared with potted vines (that can have radicoles on their roots and gallicoles on their leaves) (i) they have fewer niches for phylloxera to hide, (ii) life stages other than eggs are more likely to be detected, (iii) some treatments may be undertaken (see Section 4.1.2.2), (iv) there is less protection from conditions of transport and (v) a much smaller number of insects per unit can be transported. Potted vines not only provide the greatest opportunity for association, transport and transfer but also have the potential to carry the greatest number of insects per unit because the roots in the soil and the stems and leaves can all carry different stages of phylloxera that are very difficult to eliminate and detect on inspection. However, all the described categories of plants for planting represent a very likely pathway for entry of this pest.

Pathway 2: fresh fruit of *Vitis* spp. for consumption

Fresh grapes are identified by the Panel as a possible pathway due to the very large volume of fresh fruit imported into the EU from third countries (Tables 3 and 4). The import of fresh grapes for wine production from third countries is excluded from further analysis as it is not a common practice in Europe and no evidence even of anecdotal trade could be obtained. Therefore, the import of fresh fruit for consumption is the only pathway considered in detail in this opinion.

Table 3: Trade in fresh grapes to the EU in 2012 (Eurostat)

Partner	Weight (100 kg)
South Africa	1 611 830
Chile	1 604 550
Egypt	504 671
Peru	413 425
Brazil	383 294
India	370 777
Turkey	232 093
Argentina	192 401
Namibia	121 417
Former Yugoslav Republic of Macedonia	91 144
Morocco	82 192
United States	49 950
Moldova	44 159
Israel	33 173
Mexico	17 442
Bosnia and Herzegovina	6 651
Lebanon	4 409
Montenegro	2 194
Tunisia	1 080
Zambia	820
Panama	402
Serbia	244
Occupied Palestinian Territory	240
China	182
Brunei	153
Suriname	125
Naru	120
Switzerland	100
Kosovo	68
Mauritius	41
Russian Federation	41
Thailand	18
Honduras	12
Saudi Arabia	8
Ghana	2
Iran	2

3.2.1.2. Secondary pathways

Pathway 3: leaves of *Vitis* spp.

The largest number of non-compliance records of *Vitis* plants recorded in Europhyt (79 % of the total) is on leaves. The total number of interceptions between 1994 and 2013 is given in brackets: Armenia

(3), Australia (1), Azerbaijan (11), Chile (1), Egypt (22), Georgia (1), Islamic Republic of Iran (1), Israel (2), Jordan (18), Lebanon (21), Russian Federation (7), Syria Arab Republic (16), Thailand (1), Turkey (738) and origin not specified (3). Most consignments were sent to Austria and Germany and the Panel presumes that they were imported for human consumption. Since transfer is very unlikely to occur via this pathway, it is not considered further.

Pathway 4: soil

Phylloxera is able to survive for up to seven days as a first instar and for up to nine days as an intermediate instar in the absence of a food source (Kingston et al., 2009) and for years (up to five) on root pieces remaining intact in the soil (Hermann, 2003). However, soil has not been considered in detail as no further information is available, probably because phylloxera in soil is not easily detected, and import of soil from third countries is prohibited in the EU.

Pathway 5: dried fruit of *Vitis* spp.

The Panel does not consider dried grapes (raisins, currants and sultanas) to be a potential pathway for phylloxera owing to the extremely low probability of the pest surviving the drying process. Thus, this pathway has not been considered further.

Pathway 6: natural entry from areas outside the EU

Phylloxera apterous stages (first instar radicoles and gallicoles) can move naturally for more than 100 m by crawling under and over the ground or by being blown in the wind (e.g. King and Buchanan, 1986; Hawthorne and Dennehy, 1991; Kopf, 2000). Alate stages occur in late summer to autumn and may disperse over longer distances by flying above the boundary layer and being blown by the wind from 100 m up to a few kilometres (Stellwaag, 1928; Granett et al., 2001). More information is provided in Section 3.4.1.

As natural dispersal is limited, it can only occur in a few cases where there are interconnected wine-growing regions, e.g. between Bulgaria and Turkey, either side of the borders of the EU. Entry by natural spread is therefore very unlikely.

Pathway 7: import of living *D. vitifoliae* specimens for scientific purposes

This pathway is covered by Commission Directive 2008/61/EC,[9] which sets out the conditions under which certain harmful organisms, plants, plant products and other objects listed in Annexes I–V to Council Directive 2000/29/EC may be introduced into or moved within the Community, or certain protected zones thereof, for trial or scientific purposes and for work on varietal selections. Since such movement is strictly controlled, it is not considered further in this opinion.

3.2.2. Pathway 2: probability of association with the pathway at origin

Grapes for consumption can be considered as a potential pathway for entry, since phylloxera can be transported in grape bunches. At harvest time, both radicoles and gallicoles are present on the plant and, if first instar crawlers are present on grapes, they can travel with the fruit, the packing boxes, machinery and the clothing or footwear of the grape pickers (Powell, 2008). Phylloxera first instar crawlers were found to be able to survive on grape bunches for up to 16 hours, with a survival rate of 73 % at 15 °C and of 71 % at 25 °C, in an experimental trial simulating transportation conditions of harvested grapes to the winery (Deretic et al., 2003).

[9] Commission Directive 2008/61/EC of 17 June 2008 establishing the conditions under which certain harmful organisms, plants, plant products and other objects listed in Annexes I to V to Council Directive 2000/29/EC may be introduced into or moved within the Community or certain protected zones thereof, for trial or scientific purposes and for work on varietal selections. Official Journal of the European Union L 158/41, 18.6.2008, p. 41–55.

Table grapes are imported into Europe in large amounts (Table 3) throughout the year (Table 4). The likelihood of the pest being associated with table grapes during the harvesting phase, mainly in the form of gallicoles, is rated as moderate with medium uncertainty.

Table 4: Monthly trade in fresh grapes to EU from third countries during 2012 (data refer to 100 kg; Eurostat)

Imports of table grapes from outside EU in 2012 (100 kg) (Eurostat)	
January	732 516
February	817 067
March	977 336
April	772 464
May	662 069
June	436 170
July	250 046
August	78 027
September	109 785
October	229 210
November	291 435
December	355 561

3.2.3. Pathway 2: probability of survival during transport or storage

Table grapes are generally transported and stored at –1.0 to 4 °C, with 90–95 % relative humidity (RH) and an air velocity of approximately 6–10 m/min. Gould (1994) considered that cold storage can be effective in killing phylloxera; however, Biosecurity Australia (2011) considers that both the first instar, which is considered to be the overwintering stage for populations living on roots (Granett et al., 2001), and the winter eggs may survive at the temperatures used for cold storage and transport.

Depending on the combination of temperature and humidity, fruit can be stored for up to six months before being marketed (Table 5).

Table 5: Maximum storage period of table grapes according to temperature and RH (GDV, 2013)

Temperature	RH	Max. duration of storage
–1 to 0 °C	90 %	4 weeks
1–4 °C	90–95 %	8 weeks
–1 to –0.5 °C	90–95 %	8–24 weeks (depending upon variety)

The use of controlled atmospheres can extend the life of fruit, thus allowing it to survive prolonged periods of transport and storage: the addition of ozone inside containers helps to control moulds, yeasts and bacteria in the air and on the fruit surface, as well as consuming ethylene to delay fruit decay. Phylloxera survival is inhibited not only by very long durations of transport and storage, but also because grapevine fruit do not provide food for phylloxera. Although radicoles are known to be able to survive for up to seven days as a first instar and up to nine days as an intermediate instar in the absence of food (Kingston et al., 2009), this survival phase remains shorter than the storage period for grapes. Although similar data are not available for gallicoles, the Panel survival time without food to be similar to that for radicoles.

Fumigation with SO_2 is a common practice for pest control on table grapes (Mencarelli et al., 2005). Fumigation of table grapes with SO_2 or CO_2 has recently been mentioned as a method for management of grapevine phylloxera on Californian table grapes exported to Western Australia (Biosecurity Australia, 2013).

Long periods of transport and storage, fumigation and lack of food make the probability of survival of phylloxera via the fruit pathway very low with medium uncertainty, because information on gallicole biology is incomplete.

3.2.4. Pathway 2: probability of survival to existing pest management procedures

Since phylloxera is very unlikely to survive the temperatures used during transport and the pest does not cause symptoms on the fruit, detection will be very difficult. Fumigation (see Section 3.2.3) could further reduce pest presence, if applied as a risk reduction option.

3.2.5. Pathway 2: probability of transfer to a suitable host

Table grapes are widely distributed throughout the risk assessment area and consignments arrive throughout the year including suitable periods for pest establishment. After entering the EU, table grapes may be repacked, distributed to sales outlets throughout the EU and bought for personal consumption. Despite considerable wastage, the waste is not expected to be disposed close to suitable hosts. The probability of transfer to a suitable host is therefore rated as very low, with low uncertainty.

3.2.6. Conclusions on the probability of entry

Rating	Justification
Pathway 1 Plants of *Vitis* spp. intended for planting excluding seeds *Very likely*	The likelihood of entry would be very high for plants with soil while cuttings pose a lower risk, because the pest: • is usually or regularly associated with the pathway at origin; • survives or mostly survives during transport or storage; • is not affected or is partially affected by the current pest management procedures existing in the risk assessment area; • has no or very few limitations for transfer to a suitable host in the risk assessment area.
Pathway 2 Fruit of *Vitis* spp. for consumption *Very unlikely*	The likelihood of entry would be very low because the pest: • is moderately likely to be associated with the pathway at the origin; • may not survive during transport or storage; • may not survive the current pest management procedures existing in the risk assessment area; • may not transfer to a suitable host in the risk assessment area.

3.2.7. Uncertainties on the probability of entry

Rating	Justification
Low	There is strong evidence of phylloxera entering with plants intended for planting while there is no published information on entry with fruit of *Vitis* spp. for consumption.

3.3. Probability of establishment

3.3.1. Availability of suitable hosts and alternate hosts in the risk assessment area

European grapevines (*Vitis vinifera* subsp. *sativa*) are used in all wine and table grape European production areas. *Vitis* spp. are also widely grown as ornamentals. They have probably been domesticated from wild populations of *Vitis vinifera* subsp. *sylvestris* (Levadoux, 1956), the only taxon of this genus that naturally occurs in Europe (Tröndle et al., 2010). Introduced *Vitis* species of American and Asian origins and their hybrids occur very widely in the EU. Suitable hosts for both leaf and root-feeding forms of phylloxera are therefore widespread and abundant in Europe in all areas and habitats where *Vitis* spp. are found (Ocete et al., 2011). Populations mainly consist of the following four types:

i. Wild grapevine (*Vitis vinifera* subsp. *silvestris*) in a highly fragmented distribution with disjoint micropopulations or metapopulations (Terral et al., 2010).
ii. *V. vinifera* cultivars, either grafted on American rootstocks or ungrafted.
iii. American *Vitis* spp. or interspecific hybrids (*V. vinifera* × American *Vitis* spp.) for use as rootstocks or as leaf-forming entire plants.
iv. Interspecific hybrids for grapevine production (*V. vinifera* × American *Vitis* spp.), either grafted or, more rarely, ungrafted.

Phylloxera does not need an alternative host or another species to complete its life cycle.

3.3.2. Suitability of the environment

Phylloxera can survive everywhere grapevine plants are grown in Europe (Terral et al., 2010).

At a local scale, the following abiotic factors need to be taken into account in considering the potential for phylloxera establishment:

- <u>Temperature</u> strongly influences phylloxera population growth and the level of impact, although temperature ranges can be genotype specific (Powell, 2012).
  The upper thermal limit for survival of all stages of phylloxera is 36–40 °C (Keen et al., 2002; Fisher and Albrecht, 2003). Minimum temperatures for survival are poorly defined as phylloxera may respond to frost events by moving lower down in the soil, limiting the impact of low temperatures (Powell, 2012).
  - Hibernating immature stages survive temperatures of less than 16 °C (Granett and Timper, 1987).
  - Fecundity reaches a maximum at 21–28 °C (Granett and Timper, 1987). However, Makee (2004) found that the maximum number of eggs was laid at 22–25 °C.
  - Egg hatching occurs at a minimum temperature of > 7–8 °C (Granett and Timper, 1987; Makee, 2004).
  - Nymphal stage mortality is significantly higher at 5 °C and 35 °C while almost constant at 15, 25 and 30 °C (Makee, 2004).
  - A degree–day model has been developed to predict the time of emergence of phylloxera (Johnson et al., 2009).

- <u>Relative humidity</u> (RH) is very rarely mentioned in the literature and has been studied only by Korosi et al. (2012). They found that two phylloxera genotypes survived at 40 °C for 75–90 minutes at 30 % RH, and for over 2 hours at 100 % RH. However, the authors also observed that humidity alone had no significant impact on phylloxera mortality, whereas temperature affected phylloxera mortality both with and without humidity.

- <u>Root size</u> influences longevity and fecundity but not fertility (Makee, 2004). Because the phylloxera population increases with the number of rootlets available, root architecture and rootstock genotype are also important influencing factors (Bauerle et al., 2007).

- <u>Edaphic characteristics</u>: soil pH, organic carbon and texture influence phylloxera population abundance (Powell et al., 2013). The pest cannot live in permanent or temporary anoxic conditions or in soils with rough material such as gravel or sand, although the reasons are not clear (Ocete et al., 2011, 2012). The crawlers have been observed to survive for seven days under water at 5 °C (Korosi et al., 2009) and without food at 25 °C (Kingston et al., 2009). The impact of soil properties on phylloxera continues to be debated. However, it is likely to be more complex than focusing on a single textural property such as the proportion of sand, as demonstrated by the very contrasting results obtained in different trials (Chitkowski and Fisher, 2005; Reisenzein et al., 2007).

The probability of establishment of phylloxera has never been observed to be influenced by competition with other pests for the same resources. Moreover, the studies conducted on natural enemies have not identified any species capable of having a significant negative impact on phylloxera populations (Table 9). Establishment is, thus, not affected by natural enemies already present in the risk assessment area.

3.3.3. Cultural practices and control measures

The following effects of cultural practices on the establishment of phylloxera have been observed:

- Irrigation may increase the establishment of root-feeding forms by providing additional rootlets and support for the feeding of phylloxera on the vine. However, by increasing the vigour of the plant and reducing drought stress, the level of impact of the pest is reduced (Section 3.6.1.3).

- Tillage operations can favour the development of fine roots in the upper soil profile especially if applied in combination with green cover and irrigation. In such conditions, phylloxera populations have very favourable conditions to develop (Powell et al., 2013).

- Mulching or the application of compost had contrasting results (Powell et al., 2013), either enhancing or worsening conditions for phylloxera establishment and survival on the root system. Such measures also affect its ability to disperse through the soil.

Existing pest management practices (see Section 3.6.1.4) are not likely to prevent the establishment of phylloxera. The use of grafted plants can reduce but not prevent establishment. Eradication campaigns are very unlikely to be successful and require draconian action: removal of host plants, soil disinfection and no planting with *Vitis* spp. for a considerable period (Powell, 2012). Furthermore, the confirmation of effectiveness of an eradication programme is very hard to demonstrate because there is long period of latency (several years) following a phylloxera infestation before there is clear evidence of vine stress symptoms (Herbert et al., 2003; Bruce et al., 2011a; Hałaj et al., 2011).

3.3.4. Other characteristics of the pest affecting the probability of establishment

Phylloxera reproduces parthenogenetically with a generation time that can be less than a month, so vineyards may have three to ten generations per year with, on average, 50 eggs laid per radicole female (Granett et al., 2001). These characteristics result in a high probability of establishment even if low numbers of parthenogenetically reproductive individuals are introduced to vineyards.

Phylloxera is polymorphic with numerous strains (Powell et al., 2013) as summarised in Section 3.1.5. Genetic variation within and between European phylloxera populations is high (e.g. Vorwerk and Forneck, 2006). Genetic mutations in phylloxera strains during the course of only five generations are common (Vorwerk and Forneck, 2007). Studies on phylloxera adaptation to different *Vitis* hosts have shown changes in pest performance (see Powell et al. (2013) for a review), but the genetic basis for variation in pest performance has not yet been elucidated.

The potential for development of transient populations has not been analysed as the establishment of phylloxera has already been observed in the risk assessment area.

3.3.5. Conclusions on the probability of establishment

Rating	Justification
Very likely	The likelihood of establishment is very high because the pest is already very widespread in the risk assessment area, occurring almost everywhere *Vitis* plants are present. There are very few examples of successful eradication and small populations can persist undetected until considerable infestations have developed.

3.3.6. Uncertainties on the probability of establishment

Rating	Justification
Low	The information available from the literature and the evidence obtained from the risk assessment area strongly support this conclusion.

3.4. Probability of spread

3.4.1. Spread by natural means

Crawlers and winged adults (alates) are the stages of phylloxera that actively disperse. Crawlers can migrate through pores in the soil from infested roots to uninfested roots either by moving through cracks or along root channels or by moving over the ground and re-entering the soil through cracks. In these circumstances, they may cover distances of up to 100 m per year (Stevenson, 1975; King and Buchanan, 1986; Hawthorne and Dennehy, 1991; Kopf, 2000). Moreover, crawlers may climb upwards along the vine trunk to the foliage, from where they can be blown by wind for several metres to other vines (passive dispersal) (Granett et al., 2001). Winged adults may spread actively assisted by wind from late summer to autumn (Börner and Schilder, 1933; Stevenson and Jupp, 1976). Alates climb upwards along the trunk by positive phototaxis from which they may fly above the boundary layer and be blown by the wind for several kilometres (Stellwaag, 1928; Granett et al., 2001). This is shown by the higher numbers of catches in the more elevated sticky traps. Traps 1.5 m above ground had higher numbers than 0.8 m above ground (Stevenson and Jupp, 1976) and another study showed higher numbers in traps 1.30 m above ground than in those at 0.45 m (Weinmann 1997). All authors confirm that the wind enables passive dispersal.

3.4.2. Spread by human assistance

The principal ways phylloxera can spread with human assistance have been identified by the Panel as:

i. equipment and machinery,

ii. grape containers and trucks,

iii. people and their vehicles,

iv. planting material,

v. parts of grapevine plants other than planting material.

(i), (ii), (iii) Equipment and machinery, containers and trucks, people and vehicles

The first three methods of spread are most likely to transport the pest for a few kilometres although long-distance movements may also occur. This method of spread can largely be prevented by good hygiene, e.g. the disinfestation of equipment following existing protocols (Korosi et al., 2009; NVHSC, 2009; PGIBSA, 2012).

(iv) Planting material

The principal risk of spread of phylloxera in the pest risk assessment area is due to planting material because it is frequently and abundantly traded between Member States (Tables 7 and 8).

Officially, only phylloxera-free planting material with a plant passport is allowed to be moved within the EU. However, infested plant material has been intercepted from Italy and from Spain by the Netherlands on five occasions between 2007 and 2009 when, briefly, specific attention was spent on detecting the presence of phylloxera (Europhyt). Between 1997 and 2013, the UK intercepted phylloxera on seven occasions (twice each from Spain, France and Germany and once from the Netherlands). If such material ends up near or in vineyards (very likely in the case of plants for planting), phylloxera might easily establish and spread.

In order to provide a clear analysis of all the alternative ways that grapevine planting material can be traded, a brief summary of the procedures is provided.

Process of propagating grapevines: Seeds are used only in plant breeding programmes, as each seedling is a new combination of genes with newly expressed characteristics, while the aim of vine propagation is to guarantee standard characteristics in the clones.

Vitis asexual propagation can be done in two main ways: via tissue culture and via cuttings. The former is mainly undertaken for research and the latter is the common practice applied by nurseries. The products that can be obtained in this way can be classified as:

- Rooted cuttings: one-year-old cuttings with roots ready to plant; they can be either grafted or not and are transported in a dormant phase.
- Dormant canes: cuttings without roots produced for grafting purposes.
- Non-dormant canes: herbaceous cuttings without roots, to be grafted in the same season; this category includes buds.
- Potted vines: a grafted vine that has completed a grafting stage, is placed in a pot and can be planted in the following season of the same year it was cut.

In addition to the propagation methods mentioned above, other methods exist, e.g. callused cuttings, ground and air layering, topworking by budding or by grafting.

The sequence of actions for producing rooted cuttings is as follows: cutting (select fresh, dormant mature one-year-old canes) → grafting (of rooted or unrooted cuttings) → callusing → waxing → planting → lifting → processing (hydration, trimming, inspection).

Producers in the EU Member States should follow the grape certification programme defined by Council Directive 68/193/EEC for the vegetative propagation of vines marketed within the EU. Since the list of alternative forms of traded grapevine plants is classified differently in this Council Directive, the Panel has provided a summary table to show the relationship between the different categories as listed in the legislation and in the current opinion (Table 6).

Table 6: Categories of grapevine plants for planting as listed in the Council Directive 68/193/EEC and in the current opinion, with some characteristics influencing the likelihood of presence of phylloxera (grafted, with soil, dormant).

Category provided in the Directive	Subcategory provided in the Directive	Definition provided in the Directive	Corresponding type of product as named in the opinion	Grafted	With soil	Dormant
Propagating	Rooted	Ungrafted pieces of	Rooted cuttings	No	No	Yes

material in form of young vine plants	cuttings	rooted vine shoot or herbaceous shoot, intended for planting ungrafted or for use as rootstocks				
	Rooted grafts	Pieces of vine shoot or herbaceous shoot joined by grafting, the underground part of which is rooted	Rooted cuttings	Yes	No	Yes
			Potted vines	Yes	Yes	No
Propagating material in form of parts of young vine plants	Vine shoots:	One-year shoots	Dormant canes	No	No	Yes
	Herbaceous shoots	Unlignified shoots	Non-dormant canes	No	No	No
	Graftable rootstock cuttings	Pieces of vine shoot or herbaceous shoot intended to form the underground part when preparing rooted grafts	Dormant canes	No	No	Yes
	Top-graft cuttings	Pieces of vine shoot or herbaceous shoot intended to form the part above ground when preparing rooted grafts or when grafting plants *in situ*	Dormant and non-dormant canes	No	No	Yes/no
	Nursery cuttings	Pieces of vine shoot or herbaceous shoot intended for the production of rooted cuttings	Dormant and non-dormant canes	No	No	Yes/no
	Missing from the categories proposed in the legislation		Plant tissue cultures, non-grafted potted plants			

Ornamental plants are included in the trade of planting material, although no data are available on the origins, destinations, amounts and frequencies of trade. Some examples of ornamental cultivars that can be found in EU are: *V. vinifera* 'Spetchley Red', *V. vinifera* 'Brant', the species *Vitis coignetiae* and various table grape varieties (Hajdu, 2007).

In summary, four types of planting material pathways related to phylloxera movement can be distinguished:

- Rooted cuttings: can carry hibernating radicoles and overwintering eggs.
- Dormant canes: can carry winter eggs on the bark.
- Non-dormant canes: can carry crawlers and eggs.
- Potted vines: can carry radicoles on the roots and gallicoles on their leaves, and hibernating stages when plants are traded in winter.

(v) Parts of grapevine plants other than planting material

Apart from plants intended for planting, the pest can spread with human assistance on other living parts of the plant, such as fruits (see Tables 8 and 9), leaves and branches with foliage. Powell (2012) presents a summary table (see Table 10.2 in the reference) of the main potential vectors for human-assisted spread of phylloxera, linking them with the corresponding risk reduction option in place in Australia. All phylloxera life stages can be potentially transported on grapevine planting material as rooted cuttings or potted vines (Powell, 2008). However, as noted in the entry section, the likelihood of movement via these pathways is very low.

Dormant material (grafted rooted cuttings and dormant canes (rootstock and scions) is usually kept in cold storage facilities in the nursery. Rarely, grafts may be stored by placing the dormant material in sand (outside the facilities). Transportation of certified grapevine dormant material occurs in bundles during the winter season from nurseries to the grower by lorry. Rooted green plant material is potted in containers made out of paper, plastic or natural materials (e.g. clay pots). Transportation occurs on plastic sealed wooden racks or in plastic casks from the greenhouses (nursery) to the grower by lorry.

In the past, transportation of infested plant material was responsible for the current widespread distribution of *D. vitifoliae* in the EU since its initial introduction into France around 1860. However, it is not clear whether the spread of phylloxera in Europe is due only to further spread from the original French introduction or arises from new imports from outside Europe. As phylloxera occurs in almost all wine-producing areas in Europe and there are few inspections of intra-EU trade, it is difficult to determine the extent to which phylloxera is continuing to spread. Plant passporting, certification of propagation material and the strong incentive for the viticulture industry to provide clean material suggests that any spread that occurs will mainly be through trade in ornamental *Vitis*.

Table 7: Intra-European trade of canes in 2012 (data refer to 100 kg; Eurostat).

Importing Member State	Exporting Member State													
	AT	**BG**	**CZ**	**DE**	**ES**	**UK**	**EL**	**HU**	**IT**	**NL**	**PL**	**PT**	**RO**	**SI**
AT	:	:	:	1 609	:	:	:	220	1	4 006	:	:	:	:
BG	35	:	:	2	:	:	:	:	:	414	:	:	:	:
CZ	676	:	:	79	:	:	:	:	6	678	23	:	:	:
DE	:	:	:	:	:	:	:	:	2 710	:	:	5	:	:
DK	:	:	:	:	:	:	:	:	67	223	:	:	:	:
ES	:	:	:	:	:	:	:	:	:	:	:	323	:	:
FR	29	:	:	14	633	:	:	:	:	26	:	9	:	:
HU	576	:	:	9	:	:	:	:	:	46	:	:	:	653
IE	:	:	:	:	:	1	:	:	:	:	:	:	:	:
IT	167	:	:	807	44	:	130	168	:	:	:	:	54	17
PT	:	:	:	:	87	:	:	:	45	:	:	:	:	:
RO	1 921	249	:	88	260	:	:	111	8 913	450	:	:	:	:
SI	287	426	6	44	:	:	:	143	2	123	:	:	50	:
SK	635	:	2 532	58	:	:	:	0	0	689	29	:	:	:

Table 8: Intra-European trade of cuttings, grafted or rooted in 2012 (data refer to 100 kg; Eurostat).

Importing Member State	Exporting Member State																
	AT	**BG**	**CZ**	**DE**	**DK**	**ES**	**UK**	**EL**	**HU**	**IT**	**LV**	**NL**	**PL**	**PT**	**RO**	**SI**	**SK**
AT	:	31	:	171	:	0	:	:	232	684	:	5	:	:	11	750	1 475
BE	:	:	:	:	:	37	:	:	:	108	:	35	:	:	:	:	:
BG	129	:	31	110	:	:	:	101	:	277	:	2	:	:	:	:	:
CZ	134	:	:	14	:	:	:	:	:	6	:	13	158	:	:	476	:
DE	10	:	9	:	:	1	:	:	:	465	:	3	:	:	:	:	:
DK	:	:	0	:	:	:	:	:	:	:	:	11	:	:	:	:	:
EE	:	:	:	:	:	:	:	:	:	:	:	3	:	:	:	:	:
ES	:	:	:	:	:	:	:	:	:	5 184	:	:	:	37	:	:	:
FI	:	:	:	:	:	:	:	:	:	:	:	11	:	:	:	:	:
FR	302	:	:	7	:	726	:	47	:	5 814	:	50	:	111	:	343	:
UK	:	:	:	:	:	:	:	:	:	69	:	135	:	:	:	:	:
EL	:	:	:	:	:	25	:	:	:	1 099	:	:	:	:	:	:	:
HU	490	:	:	6	:	:	:	:	:	9	:	:	:	:	:	:	:
IE	:	:	:	:	:	:	638	:	:	40	:	0	:	:	:	:	:
IT	3	6	:	112	:	267	:	4	117	:	1	72	:	:	387	143	:
LT	:	:	:	9	:	:	:	:	:	:	:	6	:	:	:	:	:
LU	:	:	:	423	:	0	:	:	:	:	:	:	:	:	:	:	:
MT	:	:	:	:	:	:	:	:	:	14	:	:	:	:	:	:	:
NL	:	40	:	:	772	:	:	:	:	:	:	:	:	:	:	:	:
PL	:	:	:	21	:	:	:	:	:	:	:	0	:	:	:	:	:
PT	:	:	:	:	:	1 207	:	:	:	1 874	:	1	:	:	:	:	:
RO	473	102	:	191	:	:	:	:	92	21 105	:	:	:	:	:	:	:
SE	:	:	:	37	:	:	:	:	:	:	:	2	:	:	:	:	:
SI	74	:	:	1	:	6	:	:	25	98	:	10	:	:	:	:	:
SK	10	:	91	7	:	:	:	:	0	0	:	7	158	:	:	:	:

3.4.3. Conclusions on the probability of spread

Rating	Justification
Very likely	The likelihood of spread is rated as very high because the pest: • has numerous ways of spreading naturally and with human assistance; • large quantities of propagation material are often transported within the EU; • no effective barriers to spread exist, due to the fact that *Vitis* plants are mainly grown in field conditions and open greenhouses, and phylloxera can persist in the soil for up to five years without its host; • the host is already widespread in the area of potential establishment; • the environmental conditions for infestation are mostly suitable in the area of potential establishment.

3.4.4. Uncertainties on the probability of spread

Rating	Justification
Low	The information available from the literature and the evidence obtained from the risk assessment area strongly support this conclusion.

3.5. Conclusion regarding endangered areas

Phylloxera can establish in all areas where *Vitis* spp. is cultivated and wild *Vitis* occurs. At the northern edge of the phylloxera range (Figure 2), radicole populations may have fewer generations than in the south and also lower population densities. Gallicole populations occur on susceptible hosts and are more abundant where these hosts (interspecific hybrids in commercial vineyards or naturalised rootstocks) occur. Gallicole populations may have similar numbers of generations in northern and southern regions, but lower population densities in the south owing to higher temperatures and the earlier grape harvest dates. Although there are many other factors to take into account, phylloxera tends to be more damaging in vineyards of southern Europe because of the greater number of generation and higher population densities of radicoles as long as no drought stress occurs. Furthermore, radicoles are far more difficult to detect and control than gallicoles.

3.6. Assessment of consequences

3.6.1. Pest effects

3.6.1.1. Negative effects on crop yield and/or quality of cultivated plants

This pest is defined by Pavloušek (2012) as a permanent biotic stress factor, occurring in the majority of grapevine-growing countries of the world, including Europe. When phylloxera was accidentally imported into Europe in the 19th century, its impact was dramatic: most European *Vitis* was killed by the pest, vines were removed and replaced by European *Vitis* grafted on partially resistant North American rootstock (Granett et al., 2001). However, the impacts in terms of yield, fruit quality and vine vigour have rarely been quantified. The way in which phylloxera influences *Vitis* spp. physiology, vitality and yield and the aggressiveness of different strains (Herbert et al., 2010) are described in Section 3.1.5.

3.6.1.2. Magnitude of the negative effects on crop yield and/or quality of cultivated plants in the risk assessment area in the absence of control measures

<u>Ungrafted *Vitis vinifera* varieties.</u> When ungrafted European *Vitis* is used for wine production in the EU, the area should be free of phylloxera or the vines should be planted in soils known to be unsuitable for the pest (e.g. sandy soils). If phylloxera is present, European vines will eventually not survive a phylloxera attack in most European wine production areas.

Vitis vinifera varieties grafted on resistant/partially resistant rootstocks. Grafted plants substantially reduce the impact of phylloxera. Generally *Vitis* cultivars are grafted on resistant rootstocks and phylloxera is not considered to be a serious problem. However, there are several reports describing yield reductions, reduced plant vigour, decreased frost resistance and reduced longevity due to the presence of phylloxera on the roots of grafted vines (e.g. Pavloušek, 2012).

Ornamental *Vitis* spp. *Vitis* species and varieties are also planted for ornamental purposes. The Panel has not found any published information on the impact of phylloxera on ornamental *Vitis*.

3.6.1.3. Control of the pests in the risk assessment area in the absence of phytosanitary measures

Apart from the use of resistant rootstocks, the pest has not been effectively controlled in the risk assessment area by other methods since it was introduced into Europe. Neither natural enemies nor chemical control have had any significant effect on phylloxera populations. The Panel has reviewed below the different control measures that are currently applied in the risk assessment area in an attempt at reducing the damage caused by the pest. Currently, no biological or chemical control agents registered against phylloxera are available in Europe (Kirchmair et al., 2009).

Available potential control measures in the risk assessment area

Biological control

Table 9: Natural enemies of *Daktulosphaira vitifoliae* listed in literature

Natural enemy	Country	References	Observations
Beauveria bassiana		Granett et al. (2001)	Effects on phylloxera survival *in vitro*, detailed results are unpublished
Cephalosporium spp.		Vega (1956)	Its effectiveness against phylloxera was only hypothesised by the author
Heterorhabditis bacteriophora and *Steinernema glaseri*	USA	English-Loeb et al. (1999)	Although authors observed that *H. bacteriophora* had a significantly greater effect than *S. glaseri*, the laboratory results highlight constraints to its use in the field
Metarhizium anisopliae	Germany	Kirchmair et al. (2004a)	After one month, no fresh phylloxera infections were observed in 8 of the 10 treated pots
Metarhizium anisopliae	Germany	Porten and Huber (2003)	Method to classify the level of root infection
Metarhizium anisopliae	Germany	Kirchmair et al. (2004b)	Field trial with positive results, but longer trials in different sites are suggested
Metarhizium anisopliae	Germany	Kirchmair et al. (2007)	Field trial for two consecutive seasons
Metarhizium anisopliae	Germany	Huber and Kirchmair (2007)	Pros: also effective against other grape pests; cons: risk of spread and establishment in the environment as well as non-target effects. Uncertainty: dead phylloxera individuals were not sufficiently quantifiable
Tyroglyphus phylloxerae		van Driesche and Bellows (1996)	In 1873, Riley sent the predatory mite *Tyroglyphus phylloxerae* to France to control the grape phylloxera. The mite was established but did not exert control as hoped

Integrated pest management (IPM) tools

i. Use of rootstock cultivars with resistances is the main IPM tool to control phylloxera. Currently about 50 partially resistant rootstocks (bred in the late 19th century) are in use (JKI, 2007). However, only a few with higher resistance (crosses with *V. cinerea* and with *M. rotundifolia*) are commercially available. Grafting has been used effectively since the end of the 19th century and offers a good long-term solution, since resistance-breaking genotypes do not seem to have evolved in grape phylloxera very often. Phylloxera resistance in the plant is not completely understood and involves high lignin, cellulose and pectin contents in the cell wall and, in some genotypes, a hypersensitive reaction resulting in necrosis around the point attacked by the pest (Raman et al., 2009; Dietrich et al., 2010). Although durability of resistance to phylloxera has been surprisingly long, it is important to realise that it is difficult to predict whether phylloxera populations in the future will overcome this resistance (Lin et al., 2012).

   On partially resistant rootstocks, root populations of phylloxera can survive, but only on immature and feeder roots (Granett et al., 2005), and nodosities can develop on resistant, partially resistant and susceptible grapevine hybrids (Powell, 2008; Benheim et al., 2012). The majority of rootstock varieties currently in use are only partially resistant to phylloxera. In fact, the vigorous root system of partially resistant rootstock cultivars may compensate for the damage caused by the feeding of the pest on their roots (Granett et al., 1987). Nevertheless, when a severe phylloxera attack occurs in conjunction with other factors (e.g. dry weather and removal of leaves) partial host resistance can collapse (Blank et al., 2009).

   The cultivar ‘Börner’ (*Vitis riparia* Michx. × *Vitis cinerea* Arnold) was one of the first rootstock hybrids with high resistance to be commercially available (Pavloušek, 2012). A total of 38 expressed sequence tags (ESTs) were sequenced and annotated by Dietrich et al. (2010). Currently, in the selection of new rootstock genotypes, resistance to phylloxera remains a crucial aspect and is tested on different strains (e.g. G1, G4 and G30 in Clingeleffer et al., 2011) and it has been found that phylloxera may also feed on Börner cultivars. The American species *M. rotundifolia* represents a source of resistance and has been implemented in breeding programmes to develop rootstock cultivars with higher phylloxera resistance than in many *Vitis* species (Grzegorczyk and Walker, 1998). The resistance mechanisms are not yet clear and screenings are still under way.

   Furthermore, the action of replanting with more resistant rootstock grafted plants in infested vineyards remains a last resort and IPM control tactics should still be deployed to reduce plant damage and attempt to avoid the need for replanting (Lotter, 2000).

ii. Good irrigation management can help by increasing plant vigour and therefore limiting the negative effects of the pest. This has been demonstrated by Bates et al. (2001) on partially resistant grapevine genotypes. The decrease in vine dry mass caused by drought alone was 34 %, by the pest alone was 21 % and by the two stressors acting in combination was 54 %.

iii. Disinfestation treatments for footwear and hand-held equipment can be used. Dunstone et al. (2003) recommended the use of the easily available sodium hypochlorite (NaOCl), with 100 % mortality obtained on first instars immersed in 2 % NaOCl for at least 30 seconds. Korosi et al. (2012) confirmed the effectiveness of dry heat disinfestations at 45 °C for 75 minutes at 30 % RH on different strains.

iv. The pest is unlikely to survive composting practices (Bishop et al., 2002) if turned windrow systems are thoroughly remixed and the windrow reformed several times during the composting process, ensuring that all material reaches pasteurisation temperatures (Keen et al., 2002).

v. The results of application of compost have been contradictory until now (Powell et al., 2013). Soil mulches, by modifying the soil environment, could have a direct positive effect in limiting pest populations above and below ground or, indirectly, in influencing host physiology. Less recommended is the application of green waste compost, which increases the risk of pest dispersal above ground (Powell, 2008).

vi. In certain low-lying areas where grapevines are still grown with their own roots (and are thus susceptible to *D. vitifoliae*), plants can be protected by flooding in winter for 40–50 days in order to reduce phylloxera populations (Granett et al., 2001). However, since the pest remains present, and at potentially dangerous population densities, it is still recommended that such plants are replaced by grafted plants (EPPO, 2002).

vii. Organic farming seems to limit the amount of damage produced by root necrosis following phylloxera attacks. Granett et al. (2001) interpreted this as being due to the negative effects of conventional farming on microbial ecology, organic farming suppressing soil pathogens or the development of resistance to chemical pesticides. Powell (2012) provided another explanation: this method of production could change the physical and textural properties of the soil environment, influencing the pest mobility and survival.

Chemical control

For phylloxera, chemical control is not recommended by EPPO (2002). However, there are papers referring to the application of the chemical control against phylloxera. The main advantages and disadvantages are summarised in Powell and Herbert (2005) and Powell (2008, 2012). Powell (2012) also provides a table listing chemical insecticides tested against gallicoles and radicoles with corresponding references (Table 10.4, page 244, in the reference). Among the cited herbicides, aldicarb, carbofuran, endosulfan, fenamiphos, hexachlorocyclohexane, imidacloprid, oxamyl, spirotetramat, thiamethoxam are also included in the list of pesticides authorised for use on table and wine grapes in Europe (DG SANCO, 2014).

3.6.1.4. Effectiveness of the control measures currently applied in the risk assessment area

The worldwide practice of grafting *Vitis vinifera* cultivars with resistant rootstocks against phylloxera is still the most effective and environmentally friendly control measure. All other methods mentioned under IPM and biological control may contribute to pest reduction in commercial vineyards, but are currently relatively unimportant.

3.6.2. Environmental consequences

The Panel considers that the pest principally affects crop yield and quality. Environmental side effects are negligible with low uncertainty in the current area of distribution and in the risk assessment area. The species has been recorded in the risk assessment area for a very long time without any evidence of negative consequences on the environment. The pest is usually kept under control by grafting plants on partially resistant rootstocks, which is a sustainable and environmentally friendly risk reduction option. An environmental effect of the pest is the increased amount and frequency of pesticide applications that may be used by some nurseries to help ensure that their plants are phylloxera-free.

3.6.2.1. Occurrence of the pest in natural habitats, private gardens or amenity land

The pest is restricted to *Vitis* spp. and occurs on *Vitis* in natural habitats, private gardens and amenity land. Generally, the occurrence of the pest in uncultivated habitats, where control measures are not taken, may pose a threat to vineyards because naturalised rootstocks can provide habitats for the development of very large gallicole populations that may infest neighbouring vineyards.

Another risk concerns wild European populations of *V. vinifera* subsp. *silvestris*. Over the last 150 years, the distribution of the wild grapevine in Europe has been reduced dramatically almost to extinction, related (a) to the arrival of new pests from North America including phylloxera (Arnold et al., 2005) and (b) to hybridisation between wild European populations of *V. vinifera* subsp. *silvestris* and naturalised *Vitis* genotypes introduced for rootstock selection and production (Arrigo and Arnold, 2007; Di Vecchi-Staraz et al., 2009; Terral et al., 2010; Zecca et al., 2010; Ocete et al., 2011). The impact of phylloxera on the small remaining wild grapevine populations is limited because the natural habitats of wild grapevine are in areas prone to flooding that are less suitable for the pest (Terral et al., 2010; Ocete et al., 2011, 2012). However, indirectly, future genetic exchange between the small remaining wild European grapevine populations and naturalised *Vitis* genotypes introduced because of phylloxera resistance remains an issue of some concern (Arrigo and Arnold, 2007; Terral et al., 2010; Ocete et al., 2011).

3.6.3. Conclusion on the assessment of consequences

Rating	Justification
Grafted plants *Minor*	Grafting with resistant rootstocks ensures that the production of fruit and plants for planting is rarely affected by phylloxera infestations and, if so, only at a limited level. Additional control measures are rarely necessary.
Ungrafted plants *Massive*	Outbreaks of phylloxera where plants are not grafted can readily have dramatic consequences on the production of *Vitis* in fruit and plants for planting except in some areas where soil conditions (e.g. sandy soils) are not suitable for phylloxera. The only effective solution when outbreaks occur in ungrafted plants is replanting with wine grape cultivars grafted on resistant rootstocks. Wild European populations of *V. vinifera* are not directly threatened by phylloxera because the natural habitats of wild grapevine are in areas prone to flooding that are less suitable for the pest. However, indirectly, future genetic exchange between the small remaining wild European populations of *V. vinifera* subsp. *silvestris* and naturalised *Vitis* genotypes introduced because of phylloxera resistance is of some concern.

3.6.4. Uncertainties on the assessment of consequences

Rating	Justification
Low	The well-documented history of phylloxera in Europe clearly demonstrates the very serious negative consequences of growing wine grapes on non-resistant rootstocks.

4. Identification and evaluation of risk reduction options

The identification and evaluation of risk reduction options has been undertaken for the main pathways identified during the assessment of the risk of entry (Section 3.1.2). An analysis has been made on each option taking into account the application of phytosanitary measures within and outside the risk assessment area together with its appropriateness as a stand-alone option or as part of a systems approach. The information presented has been selected to support the Panel's ratings for reliability and uncertainty. At the end of the section, a table summarises the most appropriate options identified.

The Panel considers plants of *Vitis* spp. intended for planting as the only pathway for which risk reduction options are required to prevent the introduction and spread of phylloxera. For this pathway, the Panel distinguishes four categories of traded products: rooted cuttings, dormant and non-dormant canes, and potted vines (see Section 3.4.2). For each risk reduction option, a single rating is given, unless there is evidence that the efficacy of the option will be different for one or more plants for planting category. Surprisingly little work has been done on developing risk reduction options for phylloxera even though it has been a quarantine pest for longer than any other organism. This is probably due to the efficacy of partially resistant and resistant rootstocks (Benheim et al., 2012).

4.1. Options before entry

4.1.1. Detection of the pest at the place of production by inspection or testing

4.1.1.1. Visual inspection at the place of production

The main limitations of visual inspection are due to the small size of the pest (approximately 0.3–1.0 mm) and its potential widespread distribution in infested vineyards both above ground and in the soil (Powell, 2008, 2012). In addition, different environmental conditions, management methods used by each vineyard as well as the genetic diversity of phylloxera populations make it very difficult to predict peaks in emergence accurately and therefore the optimal timing for visual inspections (Powell and Herbert, 2005).

Early phylloxera presence is difficult to detect due to the lack of obvious above-ground signs. Damage becomes visible two to three years after the initial infestation, when grapevines show stress symptoms in the foliage or canopy. The number of galls per leaf correlates with gallicole population density and can be used for sampling purposes (Granett and Kocsis, 2000).

Powell et al. (2013) summarise the main monitoring systems for field inspection: below ground by examination of root samples, either *in situ* or *ex situ*, together with pitfall, sticky (both trunk and aerial), suction and emergence traps. Emergence traps capture more phylloxera than trunk traps and are more efficient than root sampling (Powell and Herbert, 2005).

This option is already practised in the risk assessment area. The Panel considers that this risk reduction option would not be effective on its own but may be an appropriate component of a systems approach.

Reliability:

Effectiveness: low

Technical feasibility: very high as already in use in the risk assessment area

Uncertainty: low; the literature confirms that visual inspection is unreliable

4.1.1.2. Specified testing at the place of production

Powell and Herbert (2005) consider the phylloxera-specific probe approach more reliable than the pathogenesis-related (PR) approach. The phylloxera-specific probe (barcoding) approach has already been validated in field conditions (Bruce et al., 2011a) but needs further testing to quantify pest presence (Powell, 2012). A limitation of specific testing is that the presence of fungi interacting with phylloxera may change the stress or defence signal produced in infested vines and therefore interfere with chemical and spectral detection methods (Powell, 2008). This option is not practised in the risk assessment area and, for the reasons given above, it is not considered appropriate by the Panel.

Reliability:

Effectiveness: negligible

Technical feasibility: low

Uncertainty: low

4.1.2. Prevention of infestation of the commodity at the place of production

4.1.2.1. Specified treatment of the crop

EPPO (2002) does not include chemical control among the recommended plant protection practices for phylloxera. Powell (2012) reviews the chemical insecticides tested against gallicoles and radicoles. Although this option is already practised in the risk assessment area, for the reasons provided in Section 3.6.1.3, the Panel does not consider this to be an appropriate risk reduction option even in a systems approach.

Reliability:

Effectiveness: low

Technical feasibility: very high

Uncertainty: low

4.1.2.2. Consignment should be composed of specified cultivars

The use of partially resistant rootstock genotypes for grafting *V. vinifera* cultivars can reduce but does not prevent phylloxera infestations. Even so, it represents the most reliable control option applied worldwide against phylloxera (Section 3.1.5.). Variability in the plant's response to phylloxera attacks remains due to the complementary effect of stress factors, e.g. adverse climatic conditions and damage caused by cultural practices to leaves and roots, and pest strains, which can heavily reduce the plant resistance to the pest (Section 3.6.1.3.).

Although this option is the most commonly used control option against phylloxera worldwide, it is unlikely to ensure a pest-free consignment. As such this risk reduction option would not be effective on its own but would be an important component of a systems approach.

Reliability:

Effectiveness: moderate

Technical feasibility: very high

Uncertainty: low

4.1.2.3. Specified growing conditions of the crop

Certain growing conditions and cultural practices are known to affect phylloxera development, e.g. pH, organic carbon concentration and soil texture (Section 3.3.3). This knowledge is mainly based on empirical experience and there is either limited scientific experimentation, e.g. on the effect of sandy soils on phylloxera, or the results are inconsistent, as in the case of mulching (Huber et al., 2003; Powell, 2012).

This option is practised in the risk assessment area but, owing to the inconsistencies and uncertainties reflected in the literature, it is not considered appropriate by the Panel even as a component of a systems approach.

Reliability:

Effectiveness: moderate for sandy soil, low for mulching

Technical feasibility: low for sandy soil, high for mulching

Uncertainty: high for both options

4.1.2.4. Specified age of plant, growth stage or time of year of harvest

As explained in Section 3.4.2, the type of *Vitis* plants for planting material influences the likelihood of phylloxera presence. The Panel considers the order of phylloxera risk, from most likely to least likely, as:

potted vines > rooted cuttings > dormant canes > non-dormant canes

Although this could be employed as a risk reduction option, it is currently practised for other reasons, such as for nurseries to provide grapevine growers with different options to respond to their specific production needs. The Panel could not find evidence of the application of this option for phytosanitary purposes. However, as this classification of plant for planting types exists, it would not be unrealistic to use it for phytosanitary purposes. As outlined in Section 3.2.1.1 (pathway 1) and Section 3.4.2, potted vines are particularly risky (due to the possible presence of phylloxera on the roots) but they are not often used in viticulture and are usually selected only when replanting is required. However, *Vitis* potted plants produced for horticultural and ornamental purposes can also represent a high risk. At the other end of the spectrum, green cuttings (non-dormant canes) represent a very low risk and the risk of rooted cuttings and dormant canes is intermediate. Although not currently a phytosanitary measure in the EU, all these categories of planting material are commonly traded in the EU so such a risk reduction option would be straightforward to implement. However, since phylloxera crawlers and eggs can still be found on non-dormant canes, this risk reduction option is appropriate for use only in a systems approach.

Reliability:

Effectiveness: medium

Technical feasibility: medium

Uncertainty: high

4.1.2.5. Certification scheme

The risk assessment area has a compulsory EU certification scheme (Council Directive 68/193/EEC) for the marketing of material for the vegetative propagation of the vine within the EU. However, this scheme only specifies phytosanitary requirements in general terms, i.e. '*The presence of harmful organisms which reduce the usefulness of the propagation material shall be at the lowest possible level*' (Annex I, Article 4) explicitly mentioning only the following cultivars: GFLV, ArMV, GLRaV-1, GLRaV-3, and GFkV (the last one for rootstocks only). This directive was amended by Council Directive 2002/11/EC[10], which provides a clearer connection with Council Directive 2000/29/EC in Article 21(c). EPPO published a certification scheme in 2008 for the production of pathogen-tested material of grapevine varieties and rootstocks. Its relevance for the reduction of risks concerning phylloxera is low because the sentence where this pest is mentioned '*conditions are favourable (e.g. sandy soils, low levels of infestation by phylloxera, Viteus vitifoliae)*' indicates that certified material can be produced even if phylloxera is present. Thus, the EU and EPPO schemes only require low (or lowest possible) population densities of phylloxera.

Some examples of certification schemes outside the EU include:

- The NAPPO (North American Plant Protection Organization: Canada, Mexico, USA) grapevine certification programme is primarily designed to control phytoplasmas, viruses and virus-like agents. It is voluntary and in the USA involves the states of California, Missouri, New York,

[10] Council Directive 2002/11/EC of 14 February 2002 amending Directive 68/193/EEC on the marketing of material for the vegetative propagation of the vine and repealing Directive 74/649/EEC. Official Journal of the European Communities L 53/20, 23.2.2002, p. 20–27.

Oregon and Washington. The Canadian certification scheme explicitly requires freedom from phylloxera for plants destined for British Columbia (CFIA, 2009).

- The Chilean certification scheme requires compulsory phytosanitary measures to be taken against six viruses: GFLV, GLRaV-1, GLRaV-2, GLRaV-3, GVA and GVB (Resolución 7605 Exenta, 2007)[11].
- The South African certification scheme also includes freedom from phylloxera as listed in Schedule 2 of the Plant Improvement Act, 1976[12].
- Australia developed a national phylloxera management protocol (NVHSC, 2009) which includes four interstate certification assurance agreements (ICAs): ICA-22 (for the movement of grape must and juice), ICA-23 (for the movement of whole wine grapes), ICA-37 (for hot water treatment of grapevines), and ICA-33 (for the movement of whole wine grapes where fruit fly as well as phylloxera is an issue). In addition to national regulation, each state has developed its own protocol. For example, the South Australia quarantine standard (Biosecurity SA, 2013) covers phylloxera on the following pathways: equipment for grape production, grapes (table), grapes (wine), grape marc and must, grapevines, grapevine tissue cultures, machines and equipment, plants, general (including household and potted plants), rooted plants (including turf, household plants), soil (scientific or commercial use) and turf.

This option is already practised in the risk assessment area, and confirmed by the Panel as an appropriate risk reduction option in a systems approach.

Reliability:

Effectiveness: high if formulated, as in the Australian scheme, with complementary measures designed to achieve phylloxera freedom, as in a systems approach. The efficacy of the current EU scheme is low.

Technical feasibility: very high

Uncertainty: low

4.1.3. Establishment and maintenance of pest freedom of a crop, place of production or area

4.1.3.1. Pest-free production site

According to the literature, it is not possible to guarantee and maintain pest freedom of production sites for phylloxera owing to the difficulty of detection in field inspections, long latent periods (two to five years from the time of initial infestation for symptoms to appear; Scott, 2002; Skinkis et al., 2009), and survival in the soil for years even in the absence of living plants.

The Panel does not consider this option appropriate even in a systems approach.

Reliability:

Effectiveness: negligible

Technical feasibility: negligible

Uncertainty: low

[11] Resolución 7605 Exenta de 1 Junio 2007 establece norma expecífica de certificación de material de propagación de vides (*Vitis* spp.) y deroga resolución N°2.411, de 2007. Publicación 12 Decembre 2013, Ministerio de Agricultura; Servicio Agrícola y Ganadero; División Semillas.

[12] Plant Improvement Act, 1976 (Act No 53 of 1976). South African plant certification scheme for wine grapes.

4.1.3.2. Pest-free place of production

As already described in Section 3.4, phylloxera does not actively disperse over long distances, but easily spreads with human assistance from one field to another. Thus, even if some parts of a vineyard are physically separated, it will be difficult to prevent the movement of phylloxera over the whole vineyard. As noted above, sandy soil conditions may substantially reduce phylloxera populations but are too unreliable to use as a phytosanitary measure to ensure pest freedom.

In addition, for the same reasons given for pest freedom of the production site, principally the difficulty of detection, the Panel does not consider this option appropriate even in a systems approach.

Reliability:

Effectiveness: negligible

Technical feasibility: negligible

Uncertainty: low

4.1.3.3. Pest-free area

An example of the application of this measure outside the risk assessment area can be found in Australia, where the territory is divided into Phylloxera Infested Zones (PIZ), where the pest is present, Phylloxera Risk Zones (PRZ), where the pest status is undetermined, and Phylloxera Exclusion Zones (PEZ), where pest entry must be avoided because the pest is absent.

This option is currently practised in the risk assessment area for intra-EU trade by Cyprus, which is a protected zone. The Panel identified it as an appropriate risk reduction option but only in a systems approach because of the difficulties in pest detection making it difficult to provide a categorical assurance of pest freedom.

Reliability:

Effectiveness: moderate

Technical feasibility: high

Uncertainty: moderate

4.2. Options after harvest, at pre-clearance or during transport

4.2.1. Detection of the pest in consignments by inspection or testing

4.2.1.1. Visual inspection of the consignment

Most of the limitations identified in Section 4.1.1.1, concerning field inspections, also apply to traded consignments. Plants for planting are traded in different forms (Section 4.1.1.2) and visual inspections are more difficult in potted vines than cuttings and more difficult for non-dormant than for dormant cuttings. Unfortunately, a barcoding approach (using phylloxera-specific DNA probes) for dormant plant material has not yet been fully developed, but its implementation to provide support to visual inspections is technically possible.

This option is currently practised in the risk assessment area and the Panel concluded that this risk reduction option is appropriate for a systems approach.

Reliability:

Effectiveness: moderate for dormant and non-dormant canes and rooted cuttings, low for potted plants

Technical feasibility: very high

Uncertainty: low

4.2.1.2. Specified testing of the consignment

In the risk assessment area, specific testing for the identification of phylloxera does not occur and the research currently being conducted to develop tests is addressed more to the enhancement of field inspections than to border inspections (Bruce et al., 2011a, b; Benheim et al., 2012).

This option is not practised in the risk assessment area, and for the reasons provided in Section 4.1.1.1, it is not considered appropriate by the Panel.

Reliability:

Effectiveness: negligible

Technical feasibility: negligible

Uncertainty: low

4.2.2. Removal of the pest from the consignment by treatment or other phytosanitary procedures

4.2.2.1. Specified treatment

A general remark concerning all the sanitary practices described below (e.g. hot water treatments and fungicides) is that they are not commonly applied in all European nurseries, as highlighted by a survey conducted in Spain and published recently (Gramaje et al., 2012).

Chemical treatments

Chemical treatments on the consignments are already practised in the risk assessment area, and are considered to be appropriate for inclusion in a systems approach.

Fumigation. As an alternative to fumigation with methyl bromide, EPPO (2012) indicates that phosphine and phosphine with carbon dioxide fumigation on grapevines for planting are effective.

Reliability:

Effectiveness: high

Technical feasibility: high

Uncertainty: low

Fungicides and bactericides. Prior to grafting or prior to packing, rootstock and scion cuttings are usually immersed in fungicides and bactericides (e.g. captan, didecyldimethylammonium chloride, hydrogen peroxide, 8-hydroxyquinoline sulphate; Gramaje et al., 2009; Bertsch et al., 2013). Although their application is not directly addressed to phylloxera, they are expected to increase pest mortality, but only anecdotal evidence (Morganstern, 2008) could be collected by the Panel.

Reliability:

Effectiveness: moderate

Technical feasibility: very high

Uncertainty: medium

Physical treatments

Physical treatments of the consignments are already practised in the risk assessment area (with the exclusion of gamma irradiation), and considered to be appropriate for inclusion in a system approach.

Cold storage. Low temperatures have been used for a long time to inhibit decay and extend the shelf life of *Vitis* planting material, particularly to obtain dormant cuttings or overwintering potted plants. Cold has a potential as a quarantine treatment, especially when cold storage is used as part of the normal distribution and marketing practices (Gould, 1994). However, the first instar, which is considered to be the overwintering stage for populations living on roots (Granett et al., 2001), and the winter eggs may survive the temperatures used for cold storage and transport (Biosecurity Australia, 2011).

Reliability:

Effectiveness: low

Technical feasibility: very high

Uncertainty: medium

Hot water treatment. For grapevine, this is considered to be an effective alternative to methyl bromide for the control of phylloxera and a number of other pests and pathogens including *Planococcus ficus*, *Calepitrimerus vitis* and *Meloidogyne* sp. (EPPO, 2009). It can be applied to scions, root cuttings and potted vines (Powell, 2008). A full description of the treatment and of its effectiveness against *D. vitifoliae* is provided by EPPO (2009) and CFIA (2009).

Reliability:

Effectiveness: very high

Technical feasibility: very high

Uncertainty: low

Gamma irradiation. This option has been investigated for its effectiveness against phylloxera and the degree to which the storage and preservation of grape material is affected. It is not practised because the process is slow and can cause mutagenesis in plant material (Makee et al., 2008; Benheim et al., 2012).

Reliability:

Effectiveness: high

Technical feasibility: low

Uncertainty: medium

4.2.2.2. Removal of parts of plants from the consignment

The preparation of *Vitis* cuttings (rooted or dormant canes) for the market includes the removal of the green parts of the plant and young roots. These are the parts of the plant where phylloxera feeds, hides, survives chemical treatments and can remain undetected during the packing phase. This option does not apply to potted vines.

This option is not currently practised in the risk assessment area for phytosanitary purposes but the Panel identified it as an appropriate risk reduction option in a systems approach.

Reliability:

Effectiveness: high

Technical feasibility: very high

Uncertainty: low

4.2.2.3. Specific handling/packing methods of the consignment

This is not considered to be a potential option against phylloxera as it has not been studied. Therefore, the Panel does not consider it as an appropriate risk reduction option.

Reliability:

Effectiveness: negligible

Technical feasibility: negligible

Uncertainty: low

4.3. Options after entry

4.3.1.1. Restrictions in the trade of the consignment (e.g. period of entry, distribution in the pest risk assessment area, certain parts of the host and certain genotypes) import under special licence/permit and specified restrictions

The existence of protected zones for trade in *Vitis* L. plants and fruits to Cyprus (Annex IV, Part B, Articles 21.1 and 21.2) and the requirement for plant passports (Annex VA, Section I, Article 1.4, and Section II, Articles 1.3 and 1.9) are options currently applied in the risk assessment area and relevant to this section. The effectiveness of the Cyprus protected zone was confirmed by the Cyprus NPPO in 2013 (Section 3.1.2.2, Table 1). However, the problems of phylloxera detection make surveys to confirm pest freedom difficult to perform and reduce the reliability of inspections despite the plant passporting requirements for *Vitis* movement. The extent to which the low number of phylloxera interceptions reported in the EU (see Section 3.4.2, point iv) is due to the limited numbers of inspections or to the difficulty of detection is not clear.

In addition to these two options, other options could be considered, e.g. the restriction of movement to certain cultivars (Section 4.1.1.2, point ii) and to certain types of plants for planting (Section 4.1.1.2, point iv). For these options the analyses and ratings are provided in the previous section.

This option is currently practised in the risk assessment area and the Panel confirmed it as an appropriate risk reduction option in a systems approach.

Reliability:

Effectiveness: moderate for plant passports and for protected zones

Technical feasibility: very high

Uncertainty: low

4.3.1.2. Internal surveillance at the places of production (e.g. field inspections) or distribution (e.g. markets) in the pest risk assessment area

The reliability and uncertainty of field inspections were analysed and rated in Section 4.1.1.1. This option is currently practised in the risk assessment area and the Panel confirmed it as an appropriate risk reduction option in a systems approach.

Reliability:

Effectiveness: low

Technical feasibility*:* very high

Uncertainty: low

4.3.1.3. Eradication

As mentioned in Section 3.3.3, there is no evidence that eradication of *D. vitifoliae* can be achieved in the EU or in elsewhere in the world (Powell, 2008; Benheim et al., 2012). None of the chemical or biological measures available are capable of eradicating this pest. In areas where the infestation occurs, the only successful strategy is to remove and burn the vines, treat the soil, and replant it with wine grape cultivars grafted on a resistant rootstock (Folwell et al., 2001). Even when this is undertaken, the risk of reinfestation by accidental reintroduction remains. In addition, because latent infestations can occur for long periods (Hałaj et al., 2011), the very long time required to guarantee vineyard freedom from phylloxera makes this option unrealistic. The only conditions under which an eradication campaign could be effective would require crop destruction and change of use. Although already practised in the risk assessment area, the Panel considers eradication of phylloxera unrealistic.

Reliability:

Effectiveness: low

Technical feasibility: negligible

Uncertainty: low

4.3.1.4. Containment

Owing to the low rate of natural phylloxera dispersal (Section 3.4), its containment could be possible by restricting the movement of infested plants, machinery and people between vineyards or by applying hygienic measures. In addition, certain arrangements currently applied outside the risk assessment area to reduce the probability of spread of the pest from the infested area may help contain the pest, such as the use of buffer zones (e.g. a 2 km buffer zone around Lake Victoria, Australia, is required in NVHSC, 2005), and disinfestation treatments of machinery and clothes (Dunstone et al., 2003; Powell, 2008; Korosi et al., 2012) These options are not yet applied in the risk assessment area but the results obtained in Australia demonstrate their usefulness in combination with other risk reduction options.

Although these options are not applied in the risk assessment area, the Panel considers them appropriate in a systems approach.

Reliability:

Effectiveness: moderate

Technical feasibility: high

Uncertainty: low

4.4. Prohibition

As indicated in Section 3.1.3, entry from third countries (other than Switzerland) of *Vitis* plants, other than fruits, is prohibited in Council Directive 2000/29/EC (Annex III, Part A, Article 15). In spite of this prohibition, the Panel obtained evidence from Europhyt of attempts to import *Vitis* plants from third countries (Section 3.2.1.1). Although illegal imports still occur, this is clearly a highly effective stand-alone measure in preventing phylloxera entry from third countries.

Reliability:

Effectiveness: very high

Technical feasibility: very high

Uncertainty: low

4.5. Effectiveness of listing of the pest in Annex IIAII

The regulations in EU Council Directive 2000/29/EC that directly or indirectly affect *D. vitifoliae* are set out in Section 3.1.3 of this opinion and are summarised here. *D. vitifoliae* is listed in Annex IIAII as a harmful organism known to occur in the Community and relevant for the entire Community, and its introduction into, and spread within, all Member States is banned if present on plants of *Vitis* L., other than fruit and seeds. In addition, Cyprus is a protected zone for this pest with regulations designed to prevent both (i) the introduction and spread of the pest with any commodity (see Annex IB) and (ii) the entry of *D. vitifoliae* with *Vitis* plants (by ensuring that the plants come from a pest-free area or a pest-free place of production or have been subjected to treatments) and fruit (which must be free from leaves and come from a pest-free area or a pest-free place of production or have been subjected to treatments) (see Annex IVB). There are no requirements relevant to *D. vitifoliae* in Annex IVA.

Indirectly, the likelihood of the introduction of *D. vitifoliae* into the EU is significantly affected by the prohibition of the import of *Vitis* plants (except fruit) from third countries (except Switzerland) in Annex III. Annex VB states that *Vitis* fruit that is imported from third countries should be inspected. Within the EU, Annex VAI requires that all trade in *Vitis* plants (other than fruit and seed) is inspected and has a plant passport. If sent to a protected zone, *Vitis* fruit as well as plants (but not seed) must be inspected and have a plant passport.

The prohibition of import of plants for planting in Annex III makes the Annex IIAII listing to prevent the introduction of *D. vitifoliae* into the EU unnecessary because Section 3.2.1 of this opinion shows that, essentially, plants for planting is the only pathway that requires phytosanitary measures. The 188 records of *Vitis* imports from third countries extracted from Europhyt between 1994 and 2013, of which 141 are for plants for planting, show that compliance with the Annex III measures is not perfect, but the Panel considers that this is not likely to be strengthened by listing phylloxera in Annex IIAII. Owing to the many other highly damaging *Vitis* pests that are absent from the EU, it is very unlikely that the Annex III measures will be withdrawn. Since fruit is a very unlikely entry pathway, the inspections required by Annex VB for *Vitis* are not expected to affect pest entry.

The Annex IIAII measures, together with the *Vitis* inspection and plant passporting requirements in Annex VAI, to prevent pest spread within the EU require more detailed consideration. However, these measures can also be considered as ineffective because, as set out in Sections 4.1.1.1 and 4.1.2.1 of this opinion, the effectiveness of visual inspection is low in the field and for potted vines and moderate for cuttings (rooted cuttings and dormant and non-dormant canes) with low uncertainty. Since *D. vitifoliae* is already widespread in the EU and, even where it is recorded as absent, area freedom is difficult to guarantee, such phytosanitary measures can also be considered as unnecessary. The compulsory EU certification scheme has low effectiveness because the presence of harmful organisms only has to be reduced to the lowest possible level.

Based on the analysis in this opinion, the more stringent regulations designed to protect the Cyprus protected zone also have limitations. Concerning the three alternatives, the Panel considers that pest freedom in the place of production has negligible effectiveness, pest freedom in the area of production is moderately effective and fumigation or other treatments vary in effectiveness. Hot water treatment is very highly effective while fumigation and gamma radiation is highly effective with low uncertainty, whereas fungicide and bactericide treatments are moderately effective. Some treatments can only be used for particular commodity types, e.g. cuttings. To strengthen the measures, it would be appropriate to specify the types of treatment that should be carried out. A systems approach could also be designed based on the variety of measures identified as appropriate in this opinion.

In summary, based on a detailed analysis of the risk reduction options available and the current EU regulations, the Panel considers that the IIAII measures for *D. vitifoliae* are ineffective and that only one of the optional measures to protect the Cyprus protected zone (treatments) is highly effective but needs to be more clearly defined.

According to the results of a survey conducted by EPPO in 2010, 8 EU Member States (Cyprus, Estonia, Germany, Latvia, Malta, Portugal, Romania and the United Kingdom) did not support the deregulation of the pest, 10 Member States were in favour (Belgium, Bulgaria, Croatia, the Czech Republic, France, Ireland, the Netherlands, Slovakia, Slovenia and Spain) and only Finland did not express an opinion (Suffert, 2012). The reasons for the different opinions were not published.

Table 10: Summary of the options identified by the Panel as relevant for the pathway of plants of *Vitis* spp. intended for planting. The table also provides information on the current application of the option with phytosanitary purposes in the risk assessment area, application of each option alone (A) or in combination (C) and on the level of uncertainty connected to each specific measure. Details for each measure and justification of the rating are provided in the text above.

No	Option	Already practised	Alone (A)/in combination (C)	Possible measure	Uncertainty
1	Detection of the pest at the place of production	✓	C	Visual inspection	Low
2	Prevention of infestation of the commodity at the place of production	✓	C	Consignment composed of specific cultivars	Low
3			C	Specified growth stage of plant	High
4		✓	C	Certification scheme	Low
5	Establishment and maintenance of pest freedom	✓	C	Pest-free area	Moderate
6	Detection of the pest in consignments	✓	C	Visual inspection	Low
7	Removal of the pest from the consignment	✓	C	Fumigation	Low
8		✓	C	Fungicides or bactericides	Medium
9		✓	C	Cold storage	Medium
10		✓	C	Hot water treatment	Low
11			C	Removal of parts of plants	Low
12	Options after entry	✓	C	Restrictions in the trade of the consignment	Low
13		✓	C	Internal surveillance	Low
14		✓	C	Containment	Low
15		✓	A	Prohibition	Low

CONCLUSIONS

After consideration of the evidence, the Panel reached the following conclusions.

With regard to the assessment of the risk to plant health posed by *D. vitifoliae* (Fitch), for the EU territory:

Entry

- Entry is very likely for plants intended for planting with soil. Cuttings pose a lower risk. These risk ratings have been selected because (i) the pest is usually or regularly associated with the pathway at origin, (ii) the pest survives or mostly survives during transport or storage, (iii) the pest is not affected or is only partially affected by the current pest management procedures existing in the risk assessment area, and (iv) there are no or very few limitations on transfer of the pest to a suitable host in the risk assessment area. Although this pathway is prohibited by Annex III of Council Directive 2000/29/EC, 141 records of illegal plants for planting *Vitis* imports from third countries were made by Member States between 1994 and 2013.

- Entry is very unlikely for fruit of *Vitis* spp. for consumption. Even though the pest is moderately likely to be associated with the pathway at the origin, (i) it may not survive during transport or storage, (ii) it may not survive the current pest management procedures existing in the risk assessment area, and (iii) it may not be transferred to a suitable host in the risk assessment area.

Uncertainty is rated as low as there is strong evidence of phylloxera entering with plants intended for planting while there is no published information on entry with fruit of *Vitis* spp. for consumption.

Establishment

- Establishment is very likely as the pest is already very widespread in the risk assessment area, occurring almost everywhere *Vitis* plants are present. There are very few examples of successful eradication and small populations can persist undetected until considerable infestations have developed.

Uncertainty is rated as low as the information available from the literature and the evidence obtained from the risk assessment area strongly support this conclusion.

Spread

- Spread is very likely as (i) the pest has numerous ways of spreading naturally and with human assistance, (ii) large quantities of propagation material are often transported within the EU, (iii) no effective barriers to spread exist, because *Vitis* plants are mainly grown in field conditions and in open greenhouses, and phylloxera can persist in the soil for up to five years without its host, (iv) the host is already widespread in the area of potential establishment, and (v) the environmental conditions for infestation are mostly suitable in the area of potential establishment.

Uncertainty is rated as low as the information available from the literature and the evidence obtained from the risk assessment area strongly support this conclusion.

Consequences

- Impact is rated as minor on grafted plants, as grafting with resistant rootstocks ensures that the production of fruit and plants for planting is rarely affected by phylloxera infestations and, if so, only at a limited level. Additional control measures are rarely necessary.

- Impact is rated as massive on ungrafted plants, as outbreaks of phylloxera where plants are not grafted can readily have dramatic consequences on the production of *Vitis* in fruit and plants for planting except in some areas where soil conditions, e.g. sandy soils, are not suitable for phylloxera. The only effective solution when outbreaks occur in ungrafted plants is replanting with wine grape cultivars grafted on resistant rootstocks. Wild European populations of *V. vinifera* are not directly threatened by phylloxera because the natural habitats of wild grapevine are in areas prone to flooding that are less suitable for the pest. However, indirectly, future genetic exchange between the small remaining wild European populations of *V. vinifera* subsp. *silvestris* and naturalised *Vitis* genotypes introduced because of phylloxera resistance is of some concern.

Uncertainty is low as the well-documented history of phylloxera in Europe clearly demonstrates the very serious negative consequences of growing wine grapes on non-resistant rootstocks.

With regard to the risk reduction options, the Panel evaluated the phytosanitary measures against the introduction and spread of *D. vitifoliae* listed in Council Directive 2000/29/EC, explored the possible consequences if these measures were to be removed and identified additional risk reduction options to enhance the current measures. The Panel focused the analysis of available risk reduction options against entry and spread of phylloxera on the only relevant pathway, plants intended for planting. The Panel identified several measures that could work effectively when combined in a systems approach and are already practised to some extent in the risk assessment area as a phytosanitary measure or as general viticultural practice: (i) visual inspections, (ii) restricting trade to scions grafted on resistant rootstocks, (iii) limiting the types of grapevine planting material to be traded such as dormant cuttings that carry fewer phylloxera, (iv) certification schemes with complementary measures designed to ensure pest freedom, (v) pest-free areas, (vi) treatments of the consignment (especially fumigation and hot water treatments), (vii) restrictions in the trade of the consignment after entry, (viii) internal surveillance and (ix) containment. Although measures such as restricting trade to cuttings with scions grafted on resistant rootstocks together with fungicide and hot water treatments can be highly effective, only the prohibition of entry of *Vitis* spp. plants from third countries, as already defined in Annex III of Council Directive 2000/29/EC, can be considered as a stand-alone option. Since plants for planting is the only pathway that requires phytosanitary measures, the prohibition in Annex III makes the Annex IIAII listing to prevent the introduction of *D. vitifoliae* into the EU unnecessary. The Panel considers that the Annex IIAII measures designed to prevent pest spread within the EU are ineffective for two main reasons. Firstly, they are based on inspection and the effectiveness of visual inspection in the field and of potted vines is low (though moderate for cuttings) and, secondly, *D. vitifoliae* is already widespread in the EU and, even where it is recorded as absent, area freedom is difficult to guarantee. Only treatment of the consignment has been recognised by the Panel as highly effective in maintaining the Cyprus protected zone, but it needs to be more clearly defined to ensure that the optimal treatment, e.g. fungicides and hot water, is selected. Although there is variability in the aggressiveness of strains worldwide and there is a lack of research, there is currently no clear evidence that strains that are more aggressive than those in the EU are present outside the EU, indicating that additional measures are not required to protect the EU from non-European populations of *D. vitifoliae*.

DOCUMENTATION PROVIDED TO EFSA

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APPENDICES

Appendix A. Ratings and descriptors

In order to follow the principle of transparency as described under Paragraph 3.1 of the Guidance document on the harmonised framework for risk assessment (EFSA PLH Panel, 2010)—*"... Transparency requires that the scoring system to be used is described in advance. This includes the number of ratings, the description of each rating ... the Panel recognises the need for further development ...*"—the Plant Health Panel has developed specifically for this opinion rating descriptors to provide clear justification when a rating is given.

1. Ratings used in the conclusion of the pest risk assessment

In this opinion of EFSA Panel on Plant Health, a rating system of five levels with their corresponding descriptors has been used to formulate separately the conclusions on entry, establishment, spread and impact as described in the following tables.

1.1. Rating of probability of entry

Rating	**Descriptors for *Daktulosphaira vitifoliae***
Very unlikely	The likelihood of entry would be very low because the pest: • is not, or is only very rarely, associated with the pathway at the origin; and/or • may not survive during transport or storage; and/or • cannot survive the current pest management procedures existing in the risk assessment area; and/or • may not transfer to a suitable host in the risk assessment area.
Unlikely	The likelihood of entry would be low because the pest: • is rarely associated with the pathway at the origin; and/or • survives at a very low rate during transport or storage; and/or • is strongly limited by the current pest management procedures existing in the risk assessment area; and/or • has considerable limitations for transfer to a suitable host in the risk assessment area.
Moderately likely	The likelihood of entry would be moderate because the pest: • is frequently associated with the pathway at the origin; and/or • survives at a low rate during transport or storage; and/or • is affected by the current pest management procedures existing in the risk assessment area; • and/or • has some limitations for transfer to a suitable host in the risk assessment area.

Rating	Descriptors for *Daktulosphaira vitifoliae*
Likely	The likelihood of entry would be high because the pest: • is regularly associated with the pathway at the origin; and/or • mostly survives during transport or storage; and/or • is partially affected by the current pest management procedures existing in the risk assessment area; and/or • has very few limitations for transfer to a suitable host in the risk assessment area.
Very likely	The likelihood of entry would be very high because the pest: • is usually associated with the pathway at the origin; and/or • survives during transport or storage; and/or • is not affected by the current pest management procedures existing in the risk assessment area; and/or • has no limitations for transfer to a suitable host in the risk assessment area.

1.2. Rating of probability of establishment

Rating	Descriptors for *Daktulosphaira vitifoliae*
Very unlikely	The likelihood of establishment would be very low because, even though the host plants are present in the risk assessment area, the environmental conditions are unsuitable and/or the host is susceptible for a very short time during the year; other considerable obstacles to establishment occur.
Unlikely	The likelihood of establishment would be low because, even though the host plants are present in the risk assessment area, the environmental conditions are mostly unsuitable and/or the host is susceptible for a very short time during the year; other obstacles to establishment occur.
Moderately likely	The likelihood of establishment would be moderate because, even though the host plants are present in the risk assessment area, the environmental conditions are frequently unsuitable and/or the host is susceptible for short time; other obstacles to establishment may occur.
Likely	The likelihood of establishment would be high because the host plants are present in the risk assessment area, they are susceptible for long time during the year and the environmental conditions are frequently suitable; no other obstacles to establishment occur.
Very likely	The likelihood of establishment would be very high because the host plants are present in the risk assessment area, they are susceptible for long time during the year and the environmental conditions are suitable for most of the host growing season; no other obstacles to establishment occur. Alternatively, the pest has already been established in the risk assessment area.

1.3. Rating of probability of spread

Rating	Descriptors for *Daktulosphaira vitifoliae*
Very unlikely	The likelihood of spread would be very low because the pest: • has only one specific way to spread which is not available/possible in the risk assessment area; and/or • highly effective barriers to spread exist; and/or • the host is not or is only occasionally present in the area of possible spread; and/or • the environmental conditions for infestation are unsuitable in the area of possible spread.
Unlikely	The likelihood of spread would be low because the pest: • has one or only a few specific ways to spread and its occurrence in the risk assessment area is occasional; and/or • effective barriers to spread exist; and/or • the host is not frequently present in the area of possible spread; and/or • the environmental conditions for infestation are mostly unsuitable in the area of possible spread.
Moderately likely	The likelihood of spread would be moderate because the pest: • has few specific ways to spread and its occurrence in the risk assessment area is limited; and/or • effective barriers to spread exist; and/or • the host is moderately present in the area of possible spread; and/or • the environmental conditions for infestation are frequently unsuitable in the area of possible spread.
Likely	The likelihood of spread would be high because the pest: • has some unspecific ways to spread, which occur in the risk assessment area; and/or • no effective barriers to spread exist; and/or • the host is usually present in the area of possible spread; and/or • the environmental conditions for infestation are frequently suitable in the area of possible spread.
Very likely	The likelihood of spread would be very high because the pest: • has multiple unspecific ways to spread, all of which occur in the risk assessment area; and/or • no effective barriers to spread exist; and/or • the host is widely present in the area of possible spread; and/or • the environmental conditions for infestation are mostly suitable in the area of possible spread.

1.4. Rating of magnitude of the potential consequences

Rating	Descriptors for *Daktulosphaira vitifoliae*
Minimal	Differences in crop production (saleable fruits and leaves, cut branches with foliage, plants for planting) are within normal day-to-day variation; no additional control measures are required
Minor	Crop production (saleable fruits and leaves, cut branches with foliage, plants for planting) is rarely reduced or at a limited level; additional control measures are rarely necessary.
Moderate	Crop production (saleable fruits and leaves, cut branches with foliage, plants for planting) is occasionally reduced to a limited extent; additional control measures are occasionally necessary.
Major	Crop production (saleable fruits and leaves, cut branches with foliage, plants for planting) is frequently reduced to a significant extent; additional control measures are frequently necessary.
Massive	Crop production (saleable fruits and leaves, cut branches with foliage, plants for planting) is always or almost always reduced to a very significant extent (severe crop losses that compromise the harvest); additional control measures are always necessary.

2. Ratings used for the evaluation of the risk reduction options

The Panel developed the following ratings with their corresponding descriptors for evaluating the effectiveness of the risk reduction options to reduce the level of risk.

2.1. Rating of the effectiveness of risk reduction options

Rating	Descriptors for *Daktulosphaira vitifoliae*
Negligible	The risk reduction option has no practical effect in reducing the probability of entry or establishment or spread, or the potential consequences.
Low	The risk reduction option reduces, to a limited extent, the probability of entry or establishment or spread, or the potential consequences.
Moderate	The risk reduction option reduces, to a substantial extent, the probability of entry or establishment or spread, or the potential consequences.
High	The risk reduction option reduces the probability of entry or establishment or spread, or the potential consequences, by a major extent.
Very high	The risk reduction option essentially eliminates the probability of entry or establishment or spread, or any potential consequences.

2.2. Rating of the technical feasibility of risk reduction options

Rating	Descriptors for *Daktulosphaira vitifoliae*
Negligible	The risk reduction option is not in use in the risk assessment area, and the many technical difficulties involved (e.g. changing or abandoning the current practices, implement new practices and or measures) make their implementation in practice impossible.
Low	The risk reduction option is not in use in the risk assessment area, but the many technical difficulties involved (e.g. changing or abandoning the current practices, implement new practices and or measures) make its implementation in practice very difficult or nearly impossible.
Moderate	The risk reduction option is not in use in the risk assessment area, but it can be implemented (e.g. changing or abandoning the current practices, implement new practices and or measures) with some technical difficulties.

High	The risk reduction option is not in use in the risk assessment area, but it can be implemented in practice (e.g. changing or abandoning the current practices, implement new practices and or measures) with limited technical difficulties.
Very high	The risk reduction option is already in use in the risk assessment area or can be easily implemented with no technical difficulties.

3. Ratings used for describing the level of uncertainty

For the risk assessment chapter—entry, establishment, spread and impact—as well as for the evaluation of the effectiveness of the management options, the level of uncertainty has been rated separately in coherence with the descriptors that have been defined specifically by the Panel in this opinion.

Rating	**Descriptors for *Daktulosphaira vitifoliae***
Low	No or little information or no or few data are missing, incomplete, inconsistent or conflicting. No subjective judgement is introduced. No unpublished data are used.
Medium	Some information is missing or some data are missing, incomplete, inconsistent or conflicting. Subjective judgement is introduced with supporting evidence. Unpublished data are sometimes used.
High	Most information is missing or most data are missing, incomplete, inconsistent or conflicting. Subjective judgement may be introduced without supporting evidence. Unpublished data are frequently used.

Appendix B. Extensive literature search

((Daktulosphaira OR Viteus OR Phylloxera) AND (vitifoliae OR vastatrix)) OR phylloxera

ISI Web of knowledge on 14 October 2013

= 2172 results

First one dating 1800

Between 1980–2013 = 731 results

Google Scholar on 14 October 2013

= 13500 results

Between 1980–2013 = 10100 results