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Pest categorisation of non-EU viruses of *Fragaria* L.

EFSA Panel on Plant Health (PLH),

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Abstract

Following a request from the EU Commission, the Panel on Plant Health addressed the pest categorisation of the viruses and viroids of *Fragaria* L. determined as being either non-EU or of undetermined standing in a previous EFSA opinion. These infectious agents belong to different genera and are heterogeneous in their biology. With the exclusion of strawberry latent virus and strawberry latent C virus for which very limited information exists, the pest categorisation was completed for 12 viruses having acknowledged identities and available detection methods. All these viruses are efficiently transmitted by vegetative propagation techniques, with plants for planting representing the major pathway for long-distance dispersal and thus considered as the major pathway for entry. Depending on the virus, additional pathway(s) can also be *Fragaria* seeds, pollen and/or vector(s). Most of the viruses categorised here are known to infect only one or few plant genera, but some of them have a wide host range, thus extending the possible entry pathways. Strawberry chlorotic fleck-associated virus, strawberry leaf curl virus, strawberry necrotic shock virus, strawberry pallidosis-associated virus, strawberry vein banding virus (SVBV) and tomato ringspot virus meet all the criteria evaluated by EFSA to qualify as potential Union quarantine pests (QPs). For SVBV, the Panel considered that following its entry and establishment into the EU territory, an impact of uncertain magnitude is expected mainly because a synergistic effect may occur in strawberry in case of mixed infections with viruses already present in the EU. Strawberry crinivirus 3, strawberry crinivirus 4 and strawberry polerovirus 1 meet all criteria for being considered as potential Union QPs, except for the impact in the EU territory, on which the Panel was unable to conclude. *Fragaria chiloensis* cryptic virus, *Fragaria chiloensis* latent virus and strawberry pseudo mild yellow edge virus do not meet the criterion of having potential negative impact in the EU. For several viruses, especially those recently discovered, the categorisation is associated with high uncertainties mainly because of the absence of data on their biology, distribution and impact. Since this opinion addresses specifically the non-EU viruses, in general, these viruses do not meet the criteria assessed by EFSA to qualify as potential Union regulated non-quarantine pests.

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1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

1.1.1. Background

Council Directive 2000/29/EC¹ on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community establishes the present European Union plant health regime. The Directive lays down the phytosanitary provisions 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. In the Directive's 2000/29/EC annexes, the list of harmful organisms (pests) whose introduction into or spread within the Union is prohibited, is detailed together with specific requirements for import or internal movement.

Following the evaluation of the plant health regime, the new basic plant health law, Regulation (EU) 2016/2031² on protective measures against pests of plants, was adopted on 26 October 2016 and will apply from 14 December 2019 onwards, repealing Directive 2000/29/EC. In line with the principles of the above mentioned legislation and the follow-up work of the secondary legislation for the listing of EU regulated pests, EFSA is requested to provide pest categorisations of the harmful organisms included in the annexes of Directive 2000/29/EC, in the cases where recent pest risk assessment/ pest categorisation is not available.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 22(5.b) and Article 29(1) of Regulation (EC) No 178/2002³, to provide scientific opinion in the field of plant health.

EFSA is requested to prepare and deliver a pest categorisation (step 1 analysis) for each of the regulated pests included in the appendices of the annex to this mandate. The methodology and template of pest categorisation have already been developed in past mandates for the organisms listed in Annex II Part A Section II of Directive 2000/29/EC. The same methodology and outcome is expected for this work as well.

The list of the harmful organisms included in the annex to this mandate comprises 133 harmful organisms or groups. A pest categorisation is expected for these 133 pests or groups and the delivery of the work would be stepwise at regular intervals through the year as detailed below. First priority covers the harmful organisms included in Appendix 1, comprising pests from Annex II Part A Section I and Annex II Part B of Directive 2000/29/EC. The delivery of all pest categorisations for the pests included in Appendix 1 is June 2018. The second priority is the pests included in Appendix 2, comprising the group of *Cicadellidae* (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), the group of *Tephritidae* (non-EU), the group of potato viruses and virus-like organisms, the group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. and the group of *Margarodes* (non-EU species). The delivery of all pest categorisations for the pests included in Appendix 2 is end 2019. The pests included in Appendix 3 cover pests of Annex I part A section I and all pest categorisations should be delivered by end 2020.

For the above mentioned groups, each covering a large number of pests, the pest categorisation will be performed for the group and not the individual harmful organisms listed under "such as" notation in the Annexes of the Directive 2000/29/EC. The criteria to be taken particularly under consideration for these cases, is the analysis of host pest combination, investigation of pathways, the damages occurring and the relevant impact.

Finally, as indicated in the text above, all references to 'non-European' should be avoided and replaced by 'non-EU' and refer to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

¹ 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. OJ L 169/1, 10.7.2000, p. 1–112.

² Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants. OJ L 317, 23.11.2016, p. 4–104.

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

1.1.2.1. Terms of Reference: Appendix 1

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IIAI

(a) Insects, mites and nematodes, at all stages of their development

<i>Aleurocantus</i> spp.	<i>Numonia pyrivorella</i> (Matsumura)
<i>Anthonomus bisignifer</i> (Schenkling)	<i>Oligonychus perditus</i> Pritchard and Baker
<i>Anthonomus signatus</i> (Say)	<i>Pissodes</i> spp. (non-EU)
<i>Aschistonyx eppoi</i> Inouye	<i>Scirtothrips aurantii</i> Faure
<i>Carposina niponensis</i> Walsingham	<i>Scirtothrips citri</i> (Moultx)
<i>Enarmonia packardii</i> (Zeller)	<i>Scolytidae</i> spp. (non-EU)
<i>Enarmonia prunivora</i> Walsh	<i>Scrobipalopsis solanivora</i> Povolny
<i>Grapholita inopinata</i> Heinrich	<i>Tachypterellus quadrigibbus</i> Say
<i>Hishomonus phycitis</i>	<i>Toxoptera citricida</i> Kirk.
<i>Leucaspis japonica</i> Ckll.	<i>Unaspis citri</i> Comstock
<i>Listronotus bonariensis</i> (Kuschel)	

(b) Bacteria

Citrus variegated chlorosis	<i>Xanthomonas campestris</i> pv. <i>oryzae</i> (Ishiyama)
<i>Erwinia stewartii</i> (Smith) Dye	Dye and pv. <i>oryzicola</i> (Fang. et al.) Dye

(c) Fungi

<i>Alternaria alternata</i> (Fr.) Keissler (non-EU pathogenic isolates)	<i>Elsinoe</i> spp. Bitanc. and Jenk. Mendes
<i>Anisogramma anomala</i> (Peck) E. Müller	<i>Fusarium oxysporum</i> f. sp. <i>albedinis</i> (Kilian and Maire) Gordon
<i>Apiosporina morbosa</i> (Schwein.) v. Arx	<i>Guignardia piricola</i> (Nosa) Yamamoto
<i>Ceratocystis virescens</i> (Davidson) Moreau	<i>Puccinia pittieriana</i> Hennings
<i>Cercoseptoria pini-densiflorae</i> (Hori and Nambu) Deighton	<i>Stegophora ulmea</i> (Schweinitz: Fries) Sydow & Sydow
<i>Cercospora angolensis</i> Carv. and Mendes	<i>Venturia nashicola</i> Tanaka and Yamamoto

(d) Virus and virus-like organisms

Beet curly top virus (non-EU isolates)	Little cherry pathogen (non- EU isolates)
Black raspberry latent virus	Naturally spreading psorosis
Blight and blight-like	Palm lethal yellowing mycoplasma
Cadang-Cadang viroid	Satsuma dwarf virus
Citrus tristeza virus (non-EU isolates)	Tatter leaf virus
Leprosis	Witches' broom (MLO)

Annex IIB

(a) Insect mites and nematodes, at all stages of their development

<i>Anthonomus grandis</i> (Boh.)	<i>Ips cembrae</i> Heer
<i>Cephalcia lariciphila</i> (Klug)	<i>Ips duplicatus</i> Sahlberg
<i>Dendroctonus micans</i> Kugelan	<i>Ips sexdentatus</i> Börner
<i>Gilpinia hercyniae</i> (Hartig)	<i>Ips typographus</i> Heer
<i>Gonipterus scutellatus</i> Gyll.	<i>Sternochetus mangiferae</i> Fabricius
<i>Ips amitinus</i> Eichhof	

(b) Bacteria

Curtobacterium flaccumfaciens pv. *flaccumfaciens*
(Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton

Hypoxyton mammatum (Wahl.) J. Miller

Gremmeniella abietina (Lag.) Morelet

1.1.2.2. Terms of Reference: Appendix 2

List of harmful organisms for which pest categorisation is requested per group. The list below follows the categorisation included in the annexes of Directive 2000/29/EC.

Annex IAI**(a) Insects, mites and nematodes, at all stages of their development**

Group of Cicadellidae (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), such as:

- | | |
|--|---|
| 1) <i>Carneocephala fulgida</i> Nottingham | 3) <i>Graphocephala atropunctata</i> (Signoret) |
| 2) <i>Draeculacephala minerva</i> Ball | |

Group of Tephritidae (non-EU) such as:

- | | |
|--|---|
| 1) <i>Anastrepha fraterculus</i> (Wiedemann) | 12) <i>Pardalaspis cyanescens</i> Bezzi |
| 2) <i>Anastrepha ludens</i> (Loew) | 13) <i>Pardalaspis quinaria</i> Bezzi |
| 3) <i>Anastrepha obliqua</i> Macquart | 14) <i>Pterandrus rosa</i> (Karsch) |
| 4) <i>Anastrepha suspensa</i> (Loew) | 15) <i>Rhacochlaena japonica</i> Ito |
| 5) <i>Dacus ciliatus</i> Loew | 16) <i>Rhagoletis completa</i> Cresson |
| 6) <i>Dacus curcurbitae</i> Coquillett | 17) <i>Rhagoletis fausta</i> (Osten-Sacken) |
| 7) <i>Dacus dorsalis</i> Hendel | 18) <i>Rhagoletis indifferens</i> Curran |
| 8) <i>Dacus tryoni</i> (Froggatt) | 19) <i>Rhagoletis mendax</i> Curran |
| 9) <i>Dacus tsuneonis</i> Miyake | 20) <i>Rhagoletis pomonella</i> Walsh |
| 10) <i>Dacus zonatus</i> Saund. | 21) <i>Rhagoletis suavis</i> (Loew) |
| 11) <i>Epochra canadensis</i> (Loew) | |

(c) Viruses and virus-like organisms

Group of potato viruses and virus-like organisms such as:

- | | |
|----------------------------------|--|
| 1) Andean potato latent virus | 4) Potato black ringspot virus |
| 2) Andean potato mottle virus | 5) Potato virus T |
| 3) Arracacha virus B, oca strain | 6) non-EU isolates of potato viruses A, M, S, V, X and Y (including Yo, Yn and Yc) and Potato leafroll virus |

Group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L., such as:

- | | |
|--------------------------------------|--|
| 1) Blueberry leaf mottle virus | 8) Peach yellows mycoplasma |
| 2) Cherry rasp leaf virus (American) | 9) Plum line pattern virus (American) |
| 3) Peach mosaic virus (American) | 10) Raspberry leaf curl virus (American) |
| 4) Peach phony rickettsia | 11) Strawberry witches' broom mycoplasma |
| 5) Peach rosette mosaic virus | 12) Non-EU viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L. |
| 6) Peach rosette mycoplasma | |
| 7) Peach X-disease mycoplasma | |

Annex IIAI

(a) Insects, mites and nematodes, at all stages of their development

Group of *Margarodes* (non-EU species) such as:

- 1) *Margarodes vitis* (Phillipi)
- 2) *Margarodes vredendalensis* de Klerk
- 3) *Margarodes prieskaensis* Jakubski

1.1.2.3. Terms of Reference: Appendix 3

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IAI

(a) Insects, mites and nematodes, at all stages of their development

<i>Acleris</i> spp. (non-EU)	<i>Longidorus diadecturus</i> Eveleigh and Allen
<i>Amauromyza maculosa</i> (Malloch)	<i>Monochamus</i> spp. (non-EU)
<i>Anomala orientalis</i> Waterhouse	<i>Myndus crudus</i> Van Duzee
<i>Arrhenodes minutus</i> Drury	<i>Nacobbis aberrans</i> (Thorne) Thorne and Allen
<i>Choristoneura</i> spp. (non-EU)	<i>Naupactus leucoloma</i> Boheman
<i>Conotrachelus nenuphar</i> (Herbst)	<i>Premnotrypes</i> spp. (non-EU)
<i>Dendrolimus sibiricus</i> Tschetverikov	<i>Pseudopityophthorus minutissimus</i> (Zimmermann)
<i>Diabrotica barberi</i> Smith and Lawrence	<i>Pseudopityophthorus pruinosis</i> (Eichhoff)
<i>Diabrotica undecimpunctata howardi</i> Barber	<i>Scaphoideus luteolus</i> (Van Duzee)
<i>Diabrotica undecimpunctata undecimpunctata</i> Mannerheim	<i>Spodoptera eridania</i> (Cramer)
<i>Diabrotica virgifera zea</i> Krysan & Smith	<i>Spodoptera frugiperda</i> (Smith)
<i>Diaphorina citri</i> Kuway	<i>Spodoptera litura</i> (Fabricus)
<i>Heliothis zea</i> (Boddie)	<i>Thrips palmi</i> Karny
<i>Hirschmanniella</i> spp., other than	<i>Xiphinema americanum</i> Cobb sensu lato (non-EU populations)
<i>Hirschmanniella gracilis</i> (de Man) Luc and Goodey	<i>Xiphinema californicum</i> Lamberti and Bleve-Zacheo
<i>Liriomyza sativae</i> Blanchard	

(b) Fungi

<i>Ceratocystis fagacearum</i> (Bretz) Hunt	<i>Mycosphaerella larici-leptolepis</i> Ito et al.
<i>Chrysomyxa arctostaphyli</i> Dietel	<i>Mycosphaerella populorum</i> G. E. Thompson
<i>Cronartium</i> spp. (non-EU)	<i>Phoma andina</i> Turkensteen
<i>Endocronartium</i> spp. (non-EU)	<i>Phyllosticta solitaria</i> Ell. and Ev.
<i>Guignardia laricina</i> (Saw.) Yamamoto and Ito	<i>Septoria lycopersici</i> Speg. var. <i>malagutii</i> Ciccarone and Boerema
<i>Gymnosporangium</i> spp. (non-EU)	<i>Thecaphora solani</i> Barrus
<i>Inonotus weirii</i> (Murril) Kotlaba and Pouzar	<i>Trechispora brinkmannii</i> (Bresad.) Rogers
<i>Melampsora farlowii</i> (Arthur) Davis	

(c) Viruses and virus-like organisms

Tobacco ringspot virus	Pepper mild tigré virus
Tomato ringspot virus	Squash leaf curl virus
Bean golden mosaic virus	Euphorbia mosaic virus
Cowpea mild mottle virus	Florida tomato virus
Lettuce infectious yellows virus	

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex I A II**(a) Insects, mites and nematodes, at all stages of their development**

Meloidogyne fallax Karssen

Rhizoecus hibisci Kawai and Takagi

Popillia japonica Newman

(b) Bacteria

Clavibacter michiganensis (Smith) Davis et al.
ssp. *sepedonicus* (Spieckermann and Kotthoff)
Davis et al.

Ralstonia solanacearum (Smith) Yabuuchi et al.

(c) Fungi

Melampsora medusae Thümen

Synchytrium endobioticum (Schilbersky) Percival

Annex I B**(a) Insects, mites and nematodes, at all stages of their development**

Leptinotarsa decemlineata Say

Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Non-EU viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. are pests listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether they fulfil the criteria of quarantine pests or those of regulated non-quarantine pests (RNQPs) for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States (MSs) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

The EFSA PLH Panel decided to address the pest categorisation of this large group of infectious agents in several steps, the first of which has been to list non-EU viruses and viroids (viruses and viroids, although different biological categories, are summarised together as 'viruses' in the rest of this opinion) of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. (EFSA PLH Panel, 2019a).

The process has been detailed in a recent Scientific Opinion (EFSA PLH Panel, 2019a), in which it has been also clarified that 'In the process, three groups of viruses were distinguished: non-EU viruses, viruses with significant presence in the EU (known to occur in several MSs, frequently reported in the EU, widespread in several MSs) or so far reported only from the EU, and viruses with undetermined standing for which available information did not readily allow to allocate to one or the other of the two above groups. A non-EU virus is defined by its geographical origin outside of the EU territory. As such, viruses not reported from the EU and occurring only outside of the EU territory are considered as non-EU viruses. Likewise, viruses occurring outside the EU and having only a limited presence in the EU (reported in only one or few MSs, with restricted distribution, outbreaks) are also considered as non-EU. This opinion provides the methodology and results for this classification which precedes but does not prejudice the actual pest categorisation linked with the present mandate. This means that the Panel will then perform pest categorisations for the non-EU viruses and for those with undetermined standing. The viruses with significant presence in the EU or so far reported only from the EU will also be listed, but they will be excluded from the current categorisation efforts. The Commission at any time may present a request to EFSA to categorise some or all the viruses excluded from the current EFSA categorisation'. The same statements and definitions reported above also apply to the current opinion.

Due to the high number of viruses to be categorised and their heterogeneity in terms of biology, host range and epidemiology, the EFSA PLH Panel established the need of finalising the pest categorisation in separate opinions by grouping non-EU viruses and viruses with undetermined standing according to the host crops. This strategy has the advantage of reducing the number of infectious agents to be considered in each opinion and appears more convenient for the stakeholders that will find grouped in a single opinion the categorisation of the non-EU viruses and those with undetermined standing infecting one or few specific crops. According to this decision, the current opinion covers the pest categorisation of the viruses of *Fragaria* that have been listed as non-EU viruses or as viruses with undetermined standing in the previous EFSA scientific opinion (EFSA PLH Panel, 2019a).

The viruses categorised in the current opinion are listed in Table 1.

Table 1: Non-EU viruses and viruses with undetermined standing of *Fragaria*

Non-EU	<i>Fragaria chiloensis</i> cryptic virus (FCCV), <i>Fragaria chiloensis</i> latent virus (FCILV), strawberry chlorotic fleck-associated virus (StCFV), strawberry crinivirus 3 (SCrV-3), strawberry crinivirus 4 (SCrV-4), strawberry latent C virus (SLCV), strawberry latent virus (StLV), strawberry leaf curl virus (StLCV), strawberry necrotic shock virus (SNSV), strawberry pallidosis-associated virus (SPaV), strawberry polerovirus 1 (SPV-1), strawberry pseudo mild yellow edge virus (SPMYEV), tomato ringspot virus (ToRSV)
Undetermined standing	Strawberry vein banding virus (SVBV)

One of the viruses of *Fragaria* addressed here (ToRSV) is also able to infect *Malus*, *Cydonia*, *Pyrus*, *Vitis* and *Prunus*, and therefore has also been addressed previously in the pest categorisations on non-EU viruses and viroids of *Cydonia*, *Malus* and *Pyrus* (EFSA PLH Panel, 2019b), *Vitis* (EFSA PLH Panel, 2019c) and *Prunus* (EFSA PLH Panel, 2019d). Non-EU viruses of *Ribes* L. and *Rubus* L. will be addressed in other opinions.

Virus-like diseases of unknown aetiology caused by phytoplasmas and other graft-transmissible bacteria are not addressed in this opinion.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

Literature search on viruses of *Fragaria* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as search term. Relevant papers were reviewed and further references and information were obtained from experts, as well as from citations within the references and grey literature. When the collected information was considered sufficient to perform the virus categorisation, the literature search was not further extended; as a consequence, the data provided here for each virus are not necessarily exhaustive.

2.1.2. Database search

Pest information, on the host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, 2019) and relevant publications. When the information from these sources was limited, it has been integrated with data from CABI crop protection compendium (CABI; <https://www.cabi.org/cpc/>). The database Fauna Europaea (de Jong et al., 2014; <https://fauna-eu.org>) has been used to search for additional information on the distribution of vectors, especially when data were not available in EPPO and/or CABI.

Data about the import of commodity types that could potentially provide a pathway for a pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications

of plant pests detected in the territory of the MS and the phytosanitary measures taken to eradicate or avoid their spread.

Information on the taxonomy of viruses and viroids was gathered from the Virus Taxonomy: 2018 Release (<https://talk.ictvonline.org/taxonomy/>), an updated official classification by the International Committee on Taxonomy of Viruses (ICTV). Information on the taxonomy of viruses not yet included in that ICTV classification was gathered from the primary literature source describing them. According to ICTV rules (<https://talk.ictvonline.org/information/w/faq/386/how-to-write-a-virus-name>), names of viruses are not italicised in the present opinion.

2.2. Methodologies

The Panel performed the pest categorisation for viruses of *Fragaria*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018b) and as defined in the International Standard for Phytosanitary Measures No 11 (FAO, 2013) and No 21 (FAO, 2004).

This work was initiated following an evaluation of the EU plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union quarantine pest and for a Union RNQP in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific terms of reference received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

Table 2 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. All relevant criteria have to be met for the pest to potentially qualify either as a quarantine pest or as a RNQP. If one of the criteria is not met, the pest will not qualify. A pest that does not qualify as a quarantine pest may still qualify as a RNQP that needs to be addressed in the opinion. For the pests regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone; thus, the criteria refer to the protected zone instead of the EU territory.

It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, whereas addressing social impacts is outside the remit of the Panel.

Table 2: Pest categorisation criteria under evaluation, as defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism	Is the pest present in the EU territory? If not, it cannot be a regulated non-quarantine pest. (A regulated non-quarantine pest must be present in the risk assessment area)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future	The protected zone system aligns with the pest free area system under the International Plant Protection Convention (IPPC). The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone)	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential regulated non-quarantine pest were met, and (2) if not, which one(s) were not met

The Panel will not indicate in its conclusions of the pest categorisation whether to continue the risk assessment process, but following the agreed two-step approach, will continue only if requested by the risk managers. However, during the categorisation process, experts may identify key elements and knowledge gaps that could contribute significant uncertainty to a future assessment of risk. It would be useful to identify and highlight such gaps so that potential future requests can specifically target the major elements of uncertainty, perhaps suggesting specific scenarios to examine.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pests established, or have they been shown to produce consistent symptoms and to be transmissible? (Yes or No)

Yes, except for SLCV and StLV, the viruses of *Fragaria* categorised in the present opinion are either classified as species in the official ICTV classification scheme, or if not yet officially classified, unambiguously represent tentative new species of clear identity.

No, for SLCV and StLV, which are excluded from further categorisation, because of large uncertainties on their identity and, for StLV, on its status as a strawberry-infecting virus.

In Table 3, the information on the identity of the viruses categorised in the present opinion is reported. Most of them (FCILV, SCFaV, SNSV SPaV, SPMYEV, SVBV and ToRSV) are included in the ICTV official classification scheme and therefore no uncertainty is associated with their identity. FCCV, SCrV-3, SCrV-4, StLCV and SPV-1 have not yet been officially classified, mainly because they have been recently discovered and/or available information on their classification is not conclusive. However, molecular and/or biological features of these viruses allowed proposing their tentative classification as novel species in established genera, thus recognising them as unique infectious entities distinct from those previously reported. Therefore, also for viruses belonging to tentative species, there is no uncertainty on their identity, although a limited uncertainty remains on their final taxonomic assignment.

There are large uncertainties on the identity of SLCV and on its ability to produce consistent symptoms (EFSA PLH Panel, 2014). As a consequence, the Panel decided to exclude it from further categorisation in the current efforts. However, an analysis of this virus can be found in a previous EFSA opinion (EFSA PLH Panel, 2014). There are also large uncertainties concerning StLV. This virus is only briefly described in a conference proceeding in which it was suggested to be a Cripa-like virus based on a partial unreleased sequence (Tzanetakis and Martin, 2008). However, crupaviruses have so far only been reported from arthropods. Therefore, whether StLV is indeed a strawberry-infecting virus, or a virus infecting another organism associated with strawberry, remains an open question. In addition, there is no information about the biology of StLV (host range, transmission mechanism(s), pathogenicity to strawberry). Consequently, the Panel decided to exclude it from further categorisation.

Table 3: Identity of viruses categorised in the present opinion

VIRUS name ^(a)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Justification ^(b)
Fragaria chiloensis cryptic virus (FCCV)	Yes	Tentative species in the genus <i>Deltapartitivirus</i> , family <i>Partitiviridae</i> (Tzanetakis and Martin, 2005a,b)
Fragaria chiloensis latent virus (FCILV)	Yes	Approved species in the genus <i>Illarvirus</i> , family <i>Bromoviridae</i>
Strawberry chlorotic fleck-associated virus (SCFaV)	Yes	Approved species in the genus <i>Closterovirus</i> , family <i>Closteroviridae</i>
Strawberry crinivirus 3 (SCrV-3)	Yes	Tentative species in the genus <i>Crinivirus</i> , family <i>Closteroviridae</i> (Tzanetakis and Martin, 2013; Chen et al., 2018)
Strawberry crinivirus 4 (SCrV-4)	Yes	Tentative species in the genus <i>Crinivirus</i> , family <i>Closteroviridae</i> (Tzanetakis and Martin, 2013; Ding et al., 2016; Chen et al., 2018)

VIRUS name^(a)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Justification^(b)
Strawberry latent virus (StLV)	No	StLV is only briefly described in a conference proceeding (Tzanetakis and Martin, 2008). On the basis of a partial unreleased sequence it was then suggested to be a Cripa-like virus (family <i>Dicistroviridae</i>). Cripaviruses have only been so far reported from arthropods. Therefore, whether StLV is indeed a strawberry-infecting virus as opposed to a virus infecting another organism associated with strawberry remains an open question
Strawberry latent C virus (SLCV)	No	The virus has been described as a putative species in the family <i>Rhabdoviridae</i> only based on some electron microscope observations on tissues of diseased plants (Yoshikawa et al., 1986; Yoshikawa and Inouye, 1988). As discussed in a previous EFSA opinion, the identity of SLCV is unclear and <i>'there is a distinct possibility that it might have been mistaken as a separate virus species, but it may only represent either a particular strain of a known strawberry virus or a complex of several strawberry viruses'</i> (EFSA PLH Panel, 2014). SLCV is associated with a disease defined by specific differential symptoms caused in a range of strawberry indicators. However as noted in a previous EFSA opinion <i>'it is unclear whether this differential symptomatology always allows an unambiguous identification of SLCV'</i> (EFSA PLH Panel, 2014)
Strawberry leaf curl virus (StLCV)	Yes	Tentative species in the genus <i>Begomovirus</i> , family <i>Geminiviridae</i> (El-gaied et al., 2008)
Strawberry necrotic shock virus (SNSV)	Yes	Approved species in the genus <i>Ilarvirus</i> , family <i>Bromoviridae</i>
Strawberry pallidosis-associated virus (SPaV)	Yes	Approved species in the genus <i>Crinivirus</i> , family <i>Closteroviridae</i>
Strawberry polerovirus 1 (SPV-1)	Yes	Tentative species in the genus <i>Polerovirus</i> , family <i>Luteoviridae</i> (Xiang et al., 2015)
Strawberry pseudo mild yellow edge virus (SPMYEV)	Yes	Approved species in the genus <i>Carlavirus</i> , family <i>Betaflexiviridae</i>
Strawberry vein banding virus (SVBV)	Yes	Approved species in the genus <i>Caulimovirus</i> , family <i>Caulimoviridae</i>
Tomato ringspot virus (ToRSV)	Yes	Approved species in the genus <i>Nepovirus</i> , family <i>Secoviridae</i>

(a): According to ICTV rules (<https://talk.ictvonline.org/information/w/faq/386/how-to-write-a-virus-name>), names of viruses are not italicised.

(b): Tentative species refers to a proposed novel virus/viroid species not yet approved by ICTV.

3.1.2. Biology of the pest

All the viruses considered in the present pest categorisation are efficiently transmitted by vegetative propagation techniques. Some of them may be mechanically transmitted by contaminated tools and/or injuries, but this process is generally considered to be at best inefficient in hosts such as *Fragaria* species. Some of these agents have additional natural transmission mechanisms, as outlined in Table 4.

Table 4: Seed-, pollen- and vector-mediated transmission of the categorised viruses, with the associated uncertainty

VIRUS name	Seed transmission	Seed transmission uncertainty (refs)	Pollen transmission	Pollen transmission uncertainty (refs)	Vector transmission	Vector transmission uncertainty (refs)
Fragaria chiloensis cryptic virus (FCCV)	Yes	No uncertainty (Tzanetakis and Martin, 2013)	Yes	No uncertainty (Tzanetakis and Martin, 2013)	No	Not known for FCCV and members of the family <i>Partitiviridae</i> are not known to be vector-transmitted (Ghabrial et al., 2012; Vainio et al., 2018)
Fragaria chiloensis latent virus (FCILV)	Yes	No uncertainty (Tzanetakis and Martin, 2005b, 2013; Martin and Tzanetakis, 2006)	Yes	No uncertainty (Tzanetakis and Martin, 2005b, 2013; Martin and Tzanetakis, 2006)	No	Not known for FCILV (Martin and Tzanetakis, 2006). However, pollen transmission of some other ilarviruses is reported to be facilitated by thrips (Greber et al., 1992; Sdoodee and Teakle, 1993; Klose et al., 1996)
Strawberry chlorotic fleck-associated virus (SCFaV)	No	Not known for SCFaV (Tzanetakis and Martin, 2007, 2013), and closteroviruses are not known to be seed-transmitted (Martelli et al., 2012)	No	Not known for SCFaV, and closteroviruses are not known to be pollen-transmitted (Martelli et al., 2012)	Yes	No uncertainty. Efficiently transmitted by the aphid <i>Aphis gossypii</i> (Tzanetakis and Martin, 2007)
Strawberry crinivirus 3 (SCrV-3)	No	Not known for SCrV-3 (Tzanetakis et al., 2006; Martelli et al., 2012; Tzanetakis and Martin, 2013), and criniviruses are not known to be seed-transmitted (Tzanetakis et al., 2006; Martelli et al., 2012; Tzanetakis and Martin, 2013)	No	Not known for SCrV-3 and criniviruses are not known to be pollen-transmitted (Tzanetakis et al., 2006; Tzanetakis and Martin, 2013)	Yes	No uncertainty. Efficiently transmitted by whiteflies (<i>Trialeurodes</i> spp. and <i>Bemisia</i> spp.) (Martelli et al., 2012; Tzanetakis and Martin, 2013)

VIRUS name	Seed transmission	Seed transmission uncertainty (refs)	Pollen transmission	Pollen transmission uncertainty (refs)	Vector transmission	Vector transmission uncertainty (refs)
Strawberry crinivirus 4 (SCrV-4)	No	Not known for SCrV-4 (Tzanetakis et al., 2006; Martelli et al., 2012; Tzanetakis and Martin, 2013) and criniviruses are not known to be seed-transmitted (Tzanetakis et al., 2006; Martelli et al., 2012; Tzanetakis and Martin, 2013)	No	Not known for SCrV-4 (Tzanetakis et al., 2006; Tzanetakis and Martin, 2013) and criniviruses are not known to be pollen-transmitted	Yes	No uncertainty. Efficiently transmitted by whiteflies (<i>Trialeurodes</i> spp. and <i>Bemisia</i> spp.) (Martelli et al., 2012; Tzanetakis and Martin, 2013)
Strawberry leaf curl virus (StLCV)	No	Not known for StLCV and members of the family <i>Geminiviridae</i> are generally not reported to be seed-transmitted (Rojas et al., 2018)	No	Not known for StLCV and members of the family <i>Geminiviridae</i> are generally not reported to be pollen-transmitted	Yes	No uncertainty. StLCV is transmitted by the whitefly <i>Bemisia tabaci</i> (Tzanetakis and Martin, 2013)
Strawberry necrotic shock virus (SNSV)	Yes	No uncertainty (Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013)	Yes	No uncertainty (Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013)	No	Not known for SNSV (Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013); however, pollen transmission of some ilarviruses is known to be facilitated by thrips (Greber et al., 1992; Sdoodee and Teakle, 1993; Klose et al., 1996)
Strawberry pallidosis-associated virus (SPaV)	No	No uncertainty (Tzanetakis et al., 2006; Tzanetakis and Martin, 2013)	No	No uncertainty (Tzanetakis et al., 2006; Tzanetakis and Martin, 2013)	Yes	No uncertainty. Efficiently transmitted by the whitefly <i>Trialeurodes vaporariorum</i> (Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013)
Strawberry polerovirus 1 (SPV-1)	No	Not known for SPV-1 and members of the family <i>Luteoviridae</i> are generally not reported to be seed-transmitted	No	Not known for SPV-1 and members of the family <i>Luteoviridae</i> are generally not reported to be pollen-transmitted	Cannot be excluded	Not known for SPV-1, but members of the family <i>Luteoviridae</i> are reported to be transmitted by aphids

VIRUS name	Seed transmission	Seed transmission uncertainty (refs)	Pollen transmission	Pollen transmission uncertainty (refs)	Vector transmission	Vector transmission uncertainty (refs)
Strawberry pseudo mild yellow edge virus (SPMYEV)	No	No uncertainty (Yoshikawa, 1991)	No	Not known for SPMYEV and members of the genus <i>Carlavirus</i> are generally not reported to be pollen-transmitted	Yes	No uncertainty. Efficiently transmitted by aphids (<i>Chaetosiphon</i> sp. and <i>A. gossypii</i>) (Yoshikawa, 1991; Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013)
Strawberry vein banding virus (SVBV)	No	Not known for SVBV and members of the genus <i>Caulimovirus</i> are generally not reported to be seed-transmitted (Geering and Hull, 2012)	No	Not known for SVBV and members of the genus <i>Caulimovirus</i> are generally not reported to be pollen-transmitted	Yes	No uncertainty. Efficiently transmitted by the aphids <i>Chaetosiphon fragaefolii</i> , <i>C. thomasi</i> and <i>C. jacobii</i> (Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013)
Tomato ringspot virus (ToRSV)	Cannot be excluded	Reported in herbaceous hosts, other than <i>Fragaria</i> (Sanfaçon and Fuchs, 2011; EFSA PLH Panel, 2013; EPPO, 2019) (http://sdb.im.ac.cn/vide/descr836.htm)	Cannot be excluded	Reported in herbaceous hosts, other than <i>Fragaria</i> (Sanfaçon and Fuchs, 2011; EFSA PLH Panel, 2013) (http://sdb.im.ac.cn/vide/descr836.htm)	Yes	No uncertainty. Known to be transmitted by <i>Xiphinema americanum</i> sensu lato (including <i>X. americanum</i> sensu stricto, <i>X. bricolense</i> , <i>X. californicum</i> , <i>X. intermedium</i> , <i>X. rivesi</i> , <i>X. inaequale</i> , <i>X. tarjanense</i>) (EFSA PLH Panel, 2018a)

3.1.3. Intraspecific diversity

Viruses generally exist as quasi-species, which means that they accumulate in a single host as a cluster of closely related sequence variants slightly differing from each other (Andino and Domingo, 2015). This is likely due to competition among the diverse genomic variants generated as a consequence of the error-prone viral replication system (higher in RNA than in DNA viruses) and the ensuing selection of the most fit variant distributions in a given environment (Domingo et al., 2012). This means that a certain level of intraspecific diversity is expected for all viruses. This genetic variability may interfere with the efficiency of detection methods, especially when they are based on polymerase chain reaction (PCR), thus generating uncertainties on the reliability and/or sensitivity of the detection for all the existing viral variants. As an example, high intraspecific divergence has been observed in the X4 domain of the ToRSV RNA2 between different virus strains (Jafarpour and Sanfaçon, 2009; Rivera et al., 2016). However, for the other viruses of *Fragaria* spp. categorised here, there is only scarce information on their intraspecific diversity.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, for most viruses of *Fragaria* categorised in the present opinion, molecular detection methods are available. Moreover, serological and biological methods are also available for some of them.

For most of the categorised viruses, molecular and/or serological detection methods are available. However, in the absence or near absence of information on the genetic variability of these agents, it is not possible to guarantee the specificity of the available detection methods and whether they can detect the majority of the strains of that particular virus. This is particularly true in the case of detection methods based on PCR, because one or a few mutations in the binding sites of primers may be sufficient to abolish amplification of a particular variant. It must also be stressed that virus detection is sometimes difficult, because of uneven virus distribution, low virus titres or the presence of inhibitors in the extracts to be tested. For some of the categorised viruses, only biological methods based on bioassays are available, which generates uncertainty on the reliability of detection. In Table 5, the information on the availability of detection and identification methods for each categorised virus is summarised, together with the associated uncertainty.

Table 5: Available detection and identification methods of the categorised viruses with the associated uncertainty

VIRUS name	Are detection and identification methods available for the pest?	Justification (key references)	Uncertainties
Fragaria chiloensis cryptic virus (FCCV)	Yes	Tzanetakis and Martin (2005a), Silva-Rosales et al. (2013)	No uncertainty
Fragaria chiloensis latent virus (FCILV)	Yes	Martin and Tzanetakis (2006), Silva-Rosales et al. (2013)	No uncertainty
Strawberry chlorotic fleck-associated virus (SCFaV)	Yes	Martin and Tzanetakis (2006)	Uncertainty (absence of a proven protocol) ^(a)
Strawberry crinivirus 3 (SCrV-3)	Yes	Chen et al. (2018)	No uncertainty
Strawberry crinivirus 4 (SCrV-4)	Yes	Chen et al. (2018)	No uncertainty
Strawberry leaf curl virus (StLCV)	Yes	El-gaied et al. (2008)	Uncertainty (absence of a proven protocol) ^(a)
Strawberry necrotic shock virus (SNSV)	Yes	Martin and Tzanetakis (2006), Silva-Rosales et al. (2013)	No uncertainty
Strawberry pallidosis-associated virus (SPaV)	Yes	Tzanetakis et al. (2004a), Silva-Rosales et al. (2013)	No uncertainty
Strawberry polerovirus 1 (SPV-1)	Yes	Xiang et al. (2015), Thekke-Veetil and Tzanetakis (2016)	Uncertainty (absence of a proven protocol) ^(a)
Strawberry pseudo mild yellow edge virus (SPMYEV)	Yes	Yoshikawa et al. (1986)	Biological indexing is available. Serological tests have been developed; however, there is uncertainty about the availability of the antiserum. No molecular detection method is available
Strawberry vein banding virus (SVBV)	Yes	EFSA PLH Panel (2014)	No uncertainty
Tomato ringspot virus (ToRSV)	Yes	(EPPO Diagnostic protocol PM 7/49)	No uncertainty

(a): For this virus, a detection assay has been developed. However, there is very limited information as to whether this assay allows the detection of a wide range of isolates of the agent.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

The viruses of *Fragaria* categorised here have been reported in Africa, America, Asia, Oceania and non-EU European countries. Their distribution outside the EU is reported in Table 6, which was prepared using data from the EPPO and/or CABI databases (accessed from 2 February 2019 to 31 May 2019), and, when not available in these sources, from extensive literature searches. For some viruses, data from EPPO and CABI are not consistent; these cases have been highlighted by superscript numbers in Table 6. Available distribution maps are provided in Appendix A.

Table 6: Distribution outside the EU of the categorised viruses of *Fragaria*.

VIRUS name	Distribution according to EPPO and/or CABI crop protection compendium databases	Additional information (refs)
Fragaria chiloensis cryptic virus (FCCV)	na ^(a)	AMERICA: Chile (Tzanetakis and Martin, 2005a)
Fragaria chiloensis latent virus (FCILV)	na ^(a)	AMERICA: Chile (Tzanetakis and Martin, 2005a), Mexico (Silva-Rosales et al., 2013), USA (GenBank GQ865677) ^(b) OCEANIA: New Zealand (GenBank KT160431-3) ^(b)
Strawberry chlorotic fleck-associated virus (SCFaV)	na ^(a)	AMERICA: USA (Tzanetakis and Martin, 2007)
Strawberry crinivirus 3 (SCrV-3)	na ^(a)	AMERICA: USA (GenBank EU267168) ^(b) ASIA: China (GenBank KX852314) ^(b)
Strawberry crinivirus 4 (SCrV-4)	na ^(a)	AMERICA: Canada (Ding et al., 2016), USA (GenBank EU490423) ^(b) ASIA: China (GenBank KY488557-8) ^(b)
Strawberry leaf curl virus (StLCV)	na ^(a)	AFRICA: Egypt (El-gaied et al., 2008)
Strawberry necrotic shock virus (SNSV)	ASIA: China ^(b) AMERICA: Canada ^(b) , USA ^(b) OCEANIA: Australia ^(b) (Map: Appendix A.1)	AMERICA: Mexico (Silva-Rosales et al., 2013) ASIA: Philippines (Pinon and Martin, 2018); Japan (Tzanetakis et al., 2004b)
Strawberry pallidosis-associated virus (SPaV)	ASIA: China ^(b) (Map: Appendix A.2)	AMERICA: USA (Tzanetakis et al., 2004a); Mexico (Silva-Rosales et al., 2013)
Strawberry polerovirus 1 (SPV-1)	na ^(a)	AMERICA: Argentina (Luciani et al., 2016), USA (Thekke-Veetil and Tzanetakis, 2016), Canada (Xiang et al., 2015)
Strawberry pseudo mild yellow edge virus (SPMYEV)	na ^(a)	AMERICA: USA (Martin and Tzanetakis, 2006) ASIA: Japan (Martin and Tzanetakis, 2006)
Strawberry vein banding virus (SVBV)	AFRICA: Egypt AMERICA: Brazil, Canada, Chile, USA ASIA: China, Japan EUROPE (non-EU): Russia, Serbia OCEANIA: Australia (Map: Appendix A.3)	

VIRUS name	Distribution according to EPPO and/or CABI crop protection compendium databases	Additional information (refs)
Tomato ringspot virus (ToRSV)	AFRICA: Egypt, Togo; AMERICA: Argentina, Brazil, Canada, Chile, Colombia, Mexico, Peru, Puerto Rico, USA, Venezuela ASIA: China, India, Iran, Japan, Jordan, Republic OF Korea, Oman, Pakistan, Taiwan ^(d) EUROPE (non-EU): Belarus, Russia, Serbia, Turkey OCEANIA: Fiji, New Zealand (Map: Appendix A.4)	

(a): No information available.

(b): Information retrieved from GenBank.

(c): Record found in CABI but not in EPPO.

(d): Record found in EPPO but not in CABI.

3.2.2. Pest distribution in the EU

Are the pests present in the EU territory? If present, are the pest widely distributed within the EU?

Yes, for SVBV and ToRSV, however, they are not reported to be widely present in the EU.

No, for FCCV, FCILV, SCFaV, SCrV-3, SCrV-4, StLCV, SNSV, SPaV, SPV-1, SPMYEV.

Only two viruses of *Fragaria* categorised here (SVBV and ToRSV) have been reported in the EU (Table 7), where they are considered to have a restricted distribution or a transient status. Given their restricted distribution, the Panel considers that these viruses fulfil the definition of non-EU viruses used in the present categorisation efforts.

With regard to ToRSV, as discussed in a previous EFSA opinion (EFSA PLH Panel, 2019b) ‘the viruses have been sporadically detected in some MSs, but the reports, generally old, have not been followed by extensive spread, thus suggesting that the virus remains restricted. Moreover, identification of these viruses has been followed by eradication efforts therefore (...) ToRSV detected in MSs are generally under eradication or have been already eradicated (e.g. (...) ToRSV in Italy in 2018, EPPO, 2018a,b; (...) ToRSV in the Netherlands, EPPO 2018b). In addition, some reports on the presence of these viruses in the EU MSs are likely incorrect or have been rectified by further publications [e.g. (...) ToRSV in France (EPPO, 2018b)]. Taking this into account, the presence of (...) ToRSV in the EU MSs is considered rare and, in any case, restricted and under official control’.

With respect to SVBV, as also stated in a previous EFSA scientific opinion (EFSA PLH Panel, 2014), the available reports show only restricted distribution in the EU.

For the viruses not reported to occur in the EU, uncertainties on their possible presence in the EU derives from the lack of specific surveys and/or from their recent discovery. Table 7 reports the currently known EU distribution of the viruses of *Fragaria* considered in the present opinion.

Table 7: EU distribution of non-EU viruses or viruses with undetermined standing of *Fragaria* (those viruses not reported in the EU are excluded from this table)

VIRUS name	EU MSs from which the pest is reported
Strawberry vein banding virus (SVBV)	Czech Republic, Slovakia (Present, few occurrences); Hungary, Italy (Present, restricted distribution); Netherlands ^(a)
Tomato ringspot virus (ToRSV)*	Croatia (Present, few occurrences), France (Present), Germany (Transient, under eradication), Lithuania (Present), Netherlands (Transient, under eradication) ^(b) , Poland (Present), Slovakia (Present, restricted distribution), Slovenia (Restricted distribution) ^(c)

*: See discussion on presence and prevalence in the EU MSs above.

(a): Information retrieved from GenBank.

(b): EPPO Reporting Service November 2018 (EPPO, 2018).

(c): Record found in CABI but not in EPPO.

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

Table 8: Non-EU viruses of *Fragaria* in the Council Directive 2000/29

Annex I, Part A	Harmful organisms whose introduction into, and spread within, all Member States shall be banned
Section I	Harmful organisms not known to occur in any part of the community and relevant for the entire community
(d)	Viruses and virus-like organisms
4.	Tomato ringspot virus
5.	Viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L., such as:
	(l) Strawberry vein banding virus
	(n) Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.

3.3.2. Legislation addressing the hosts of non-EU viruses of *Fragaria*

Hosts of the viruses categorised here are regulated in the Council Directive 2000/29/EC. The legislation addressing *Fragaria* is presented in Table 9. Two derogations to this directive, 2003/248 and 2003/249, allow importation from Argentina and Chile, respectively, of *Fragaria* plants with the requirements to check the imported plants during the growing season and send a final report to the Commission. Besides the other pests listed in the Council Directive 2000/29/EC, the derogation 2003/249 lists another six pests including one virus (*Fragaria chiloensis* ilarvirus) and one vector (*Chaetosiphon thomasi* Hille Ris Lambers) of a virus (SVBV) categorised here. Specific amendments to Annex V to Council Directive 2000/29/EC (Commission implementing Directive 2019/523) establishes that, starting from 1 September 2019, strawberry fruits imported from Third Countries must be accompanied by a phytosanitary certificate. Several non-EU viruses of *Fragaria* may also infect other hosts or have a wide host range, with the related legislation for these other hosts being reported in Section 3.4.1.

Table 9: Regulations applying to *Fragaria* hosts and commodities that may involve the viruses categorised in the present opinion in Annexes III, IV and V of Council Directive 2000/29/EC

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
18.	Plants of <i>Cydonia</i> Mill., <i>Malus</i> Mill., <i>Prunus</i> L. and <i>Pyrus</i> L. and their hybrids, and <i>Fragaria</i> L., intended for planting, other than seeds	Without prejudice to the prohibitions applicable to the plants listed in Annex III A (9), where appropriate, non-European countries, other than Mediterranean countries, Australia, New Zealand, Canada, the continental states of the USA

Annex IV, Part A	Special requirements which must be laid down by all Member States for which the introduction and movement of plants, plant products and other objects into and within all Member States	
Section I	Plants, plant products and other objects originating from outside the community	
19.2	Plants of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. intended for planting, other than seeds, originating in countries where the relevant harmful organisms are known to occur on the genera Concerned The relevant harmful organisms are [...] — on <i>Fragaria</i> L.: — <i>Phytophthora fragariae</i> Hickman, var. <i>fragariae</i>, — Arabis mosaic virus, — Raspberry ringspot virus, — Strawberry crinkle virus, — Strawberry latent ringspot virus, — Strawberry mild yellow edge virus, — Tomato black ring virus, — <i>Xanthomonas fragariae</i> Kennedy et King; [...] — on all species: non-European viruses and virus-like organisms	Without prejudice to the provisions applicable to the plants where appropriate listed in Annex III(A)(9) and (18), and Annex IV(A)(I)(15) and (17), official statement that no symptoms of diseases caused by the relevant harmful organisms have been observed on the plants at the place of production since the beginning of the last complete cycle of vegetation
21.1.	Plants of <i>Fragaria</i> L. intended for planting, other than seeds, originating in countries where the relevant harmful organisms are known to occur The relevant harmful organisms are: — Strawberry latent 'C' virus, — Strawberry vein banding virus, — Strawberry witches' broom mycoplasma	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(18), and Annex IV(A)(I)(19.2), official statement that: (a) the plants, other than those raised from seed, have been: — either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those harmful organisms, or — derived in direct line from material which is maintained under appropriate conditions and has been subjected, within the last three complete cycles of vegetation, at least once, to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those harmful organisms, (b) no symptoms of diseases caused by the relevant harmful organisms have been observed on plants at the place of production, or on susceptible plants in its immediate vicinity, since the beginning of the last complete cycle of vegetation

21.2.	Plants of <i>Fragaria</i> L. intended for planting, other than seeds, originating in countries where <i>Aphelenchoides besseyi</i> Christie is known to occur	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(18), and Annex IV(A)(I) (19.2) and (21.1), official statement that: (a) either no symptoms of <i>Aphelenchoides besseyi</i> Christie have been observed on plants at the place of production since the beginning of the last complete cycle of vegetation or (b) in the case of plants in tissue culture the plants have been derived from plants which complied with section (a) of this item or have been officially tested by appropriate nematological methods and have been found free from <i>Aphelenchoides besseyi</i> Christie
21.3.	Plants of <i>Fragaria</i> L., intended for planting, other than seeds	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(18), and Annex IV(A)(I) (19.2), (21.1) and (21.2), official statement that the plants originate in an area known to be free from <i>Anthonomus signatus</i> Say and <i>Anthonomus bisignifer</i> (Schenkling)
Section II	Plants, plant products and other objects originating in the Community	
12.	Plants of <i>Fragaria</i> L., <i>Prunus</i> L. and <i>Rubus</i> L., intended for planting, other than seeds	Official statement that: (a) the plants originate in areas known to be free from the relevant harmful organisms; or (b) no symptoms of diseases caused by the relevant harmful organisms have been observed on plants at the place of production since the beginning of the last complete cycle of vegetation. The relevant harmful organisms are: — on <i>Fragaria</i> L.: — <i>Phytophthora fragariae</i> Hickman var. <i>fragariae</i> — Arabis mosaic virus — Raspberry ringspot virus — Strawberry crinkle virus — Strawberry latent ringspot virus — Strawberry mild yellow edge virus — Tomato black ring virus — <i>Xanthomonas fragariae</i> Kennedy and King — on <i>Prunus</i> L.: — Apricot chlorotic leafroll mycoplasma — <i>Xanthomonas arboricola</i> pv. <i>pruni</i> (Smith) Vauterin et al. — on <i>Prunus persica</i> (L.) Batsch: <i>Pseudomonas syringae</i> pv. <i>persicae</i> (Prunier et al.) Young et al., — on <i>Rubus</i> L.: — Arabis mosaic virus — Raspberry ringspot virus — Strawberry latent ringspot virus — Tomato black ring virus.

14.	Plants of <i>Fragaria</i> L., intended for planting, other than seeds	Without prejudice to the requirements applicable to the plants listed in Annex IV(A)(II)(12) official statement that: (a) the plants originate in areas known to be free from <i>Aphelenchoides besseyi</i> Christie; or (b) no symptoms of <i>Aphelenchoides besseyi</i> Christie have been observed on the plants at the place of production since the beginning of the last complete cycle of vegetation; or (c) in the case of plants in tissue culture, the plants have been derived from plants complying with section (b) of this item or have been officially tested by appropriate nematological methods and have been found free from <i>Aphelenchoides besseyi</i> Christie
24.1.	Plants with roots, intended for planting, grown in the open air, of <i>Allium porrum</i> L., <i>Asparagus officinalis</i> L., <i>Beta vulgaris</i> L., <i>Brassica</i> spp. and <i>Fragaria</i> L. and bulbs, tubers and rhizomes, grown in the open air, of <i>Allium ascalonicum</i> L., <i>Allium cepa</i> L., <i>Dahlia</i> spp., <i>Gladiolus</i> Tourn. ex L., <i>Hyacinthus</i> spp., <i>Iris</i> spp., <i>Lilium</i> spp., <i>Narcissus</i> L. and <i>Tulipa</i> L., other than those plants, bulbs, tubers and rhizomes to be planted in accordance with Article 4.4(a) or (c) of Council Directive 2007/33/EC	Without prejudice to the requirements applicable to the plants in Annex IV, Part A, Section II (24) there shall be evidence that the Union provisions to combat <i>Globodera pallida</i> (Stone) Behrens and <i>Globodera rostochiensis</i> (Wollenweber) Behrens are complied with
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	
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	
2.1	Plants intended for planting, other than seeds, of the genera <i>Abies</i> Mill., <i>Apium graveolens</i> L., <i>Argyranthemum</i> spp., <i>Asparagus officinalis</i> L., <i>Aster</i> spp., <i>Brassica</i> spp., <i>Castanea</i> Mill., <i>Cucumis</i> spp., <i>Dendranthema</i> (DC.) Des Moul., <i>Dianthus</i> L. and hybrids, <i>Exacum</i> spp., <i>Fragaria</i> L., <i>Gerbera</i> Cass., <i>Gypsophila</i> L., all varieties of New Guinea hybrids of <i>Impatiens</i> L., <i>Lactuca</i> spp., <i>Larix</i> Mill., <i>Leucanthemum</i> L., <i>Lupinus</i> L., <i>Pelargonium</i> l'Hérit. Ex Ait., <i>Picea</i> A. Dietr., <i>Pinus</i> L., <i>Platanus</i> L., <i>Populus</i> L., <i>Prunus laurocerasus</i> L., <i>Prunus lusitanica</i> L., <i>Pseudotsuga</i> Carr., <i>Quercus</i> L., <i>Rubus</i> L., <i>Spinacia</i> L., <i>Tanacetum</i> L., <i>Tsuga</i> Carr., <i>Ulmus</i> L., <i>Verbena</i> L. and other plants of herbaceous species, other than plants of the family <i>Gramineae</i> , intended for planting, and other than bulbs, corms, rhizomes, seeds and tubers	

3.3.3. Legislation addressing the organisms that vector the viruses of *Fragaria* categorised in the present opinion (Directive 2000/29/EC)

The vector of SCrV-3, SCrV-4, StLCV and the nematode vectors of ToRSV, are listed in Directive 2000/29/EC:

- *Bemisia tabaci* Genn. (non-European populations) is listed in Annex I, AI, position (a) 7.
- *Bemisia tabaci* Genn. (European populations) is listed in Annex I, BI, position (a) 1.
- *Bemisia tabaci* Genn. is listed in Annex IV, AI:

- 45.1. Plants of herbaceous species and plants of *Ficus* L. and *Hibiscus* L., intended for planting, other than bulbs, corms, rhizomes, seeds and tubers, originating in non-European countries:

Without prejudice to the requirements applicable to the plants in Annex IV, Part A, Section I (27.1), (27.2), (28), (29), (32.1), (32.3) and (36.1), official statement that the plants:

- a) originate in an area, established in the country of export by the national plant protection service in that country, as being free from *Bemisia tabaci* Genn. (non-European populations) in accordance with relevant International Standards for Phytosanitary Measures, and which is mentioned on the certificates referred to in Articles 7 or 8 of this Directive under the rubric 'Additional declaration',
or
 - b) originate in a place of production, established in the country of export by the national plant protection service in that country, as being free from *Bemisia tabaci* Genn. (non-European populations) in accordance with relevant International Standards for Phytosanitary Measures, and which is mentioned on the certificates referred to in Articles 7 or 8 of this Directive under the rubric 'Additional declaration', and declared free from *Bemisia tabaci* Genn. (non-European populations) on official inspections carried out at least once each three weeks during the nine weeks prior to export,
or
 - c) in cases where *Bemisia tabaci* Genn. (non-European populations) has been found at the place of production, are held or produced in this place of production and have undergone an appropriate treatment to ensure freedom from *Bemisia tabaci* Genn. (non-European populations) and subsequently this place of production shall have been found free from *Bemisia tabaci* Genn. (non-European populations) as a consequence of the implementation of appropriate procedures aiming at eradicating *Bemisia tabaci* Genn. (non-European populations), in both official inspections carried out weekly during the nine weeks prior to export and in monitoring procedures throughout the said period. Details of the treatment shall be mentioned on the certificates referred to in Article 7 or 8 of this Directive,
or
 - d) originate from plant material (explant) which is free from *Bemisia tabaci* Genn. (non-European populations); are grown *in vitro* in a sterile medium under sterile conditions that preclude the possibility of infestation with *Bemisia tabaci* Genn. (non-European populations); and are shipped in transparent containers under sterile conditions.
- 45.2. Cut flowers of *Aster* spp., *Eryngium* L., *Gypsophila* L., *Hypericum* L., *Lisianthus* L., *Rosa* L., *Solidago* L., *Trachelium* L., and leafy vegetables of *Ocimum* L., originating in non-European countries:

Official statement that the cut flowers and leafy vegetables:

- originate in a country free from *Bemisia tabaci* Genn. (non-European populations),
or
 - immediately prior to their export, have been officially inspected and found free from *Bemisia tabaci* Genn. (non-European populations).
- 45.3. Plants of *Solanum lycopersicum* L. intended for planting, other than seeds, originating in countries where Tomato yellow leaf curl virus is known to occur
 - a) Where *Bemisia tabaci* Genn. is not known to occur
 - b) Where *Bemisia tabaci* Genn. is known to occur

Without prejudice to the requirements applicable to plants listed in Annex III(A)(13) and Annex IV (A)(I)(25.5), (25.6) and 25.7 where appropriate

Official statement that no symptoms of Tomato yellow leaf curl virus have been observed on the plants

Official statement that:

- (a) no symptoms of Tomato yellow leaf curl virus have been observed on the plants, and
 - (aa) the plants originate in areas known to be free from *Bemisia tabaci* Genn., or
 - (bb) the place of production has been found free from *Bemisia tabaci* Genn. on official inspections carried out at least monthly during the three months prior to export;

or

- (b) no symptoms of Tomato yellow leaf curl virus have been observed on the place of production and the place of production has been subjected to an appropriate treatment and monitoring regime to ensure freedom from *Bemisia tabaci* Genn.

- 46. Plants intended for planting, other than seeds, bulbs, tubers, corms and rhizomes, originating in countries where the relevant harmful organisms are known to occur.

The relevant harmful organisms are:

- Bean golden mosaic virus,
- Cowpea mild mottle virus,
- Lettuce infectious yellow virus,
- Pepper mild tigré virus,
- Squash leaf curl virus,
- other viruses transmitted by *Bemisia tabaci* Genn.

- (a) Where *Bemisia tabaci* Genn. (non-European populations) or other vectors of the relevant harmful organisms are not known to occur

Official statement that no symptoms of the relevant harmful organisms have been observed on the plants during their complete cycle of vegetation

- (b) Where *Bemisia tabaci* Genn. (non-European populations) or other vectors of the relevant harmful organisms are known to occur

Without prejudice to the requirements applicable to the plants listed in Annex III(A)(13) and Annex IV(A)(I)(25.5), (25.6), (32.1), (32.2), (32.3), (35.1), (35.2), (44), (45.1), (45.2) and (45.3) where appropriate

Official statement that no symptoms of the relevant harmful organisms have been observed on the plants during an adequate period, and

- (a) the plants originate in areas known to be free from *Bemisia tabaci* Genn. and other vectors of the relevant harmful organisms;

or

- (b) the place of production has been found free from *Bemisia tabaci* Genn. and other vectors of the relevant harmful organisms on official inspections carried out at appropriate times;

or

- (c) the plants have been subjected to an appropriate treatment aimed at eradicating *Bemisia tabaci* Genn.;

or

- (d) the plants originate from plant material (explant) which is free from *Bemisia tabaci* Genn. (non-European populations) and which did not show any symptoms of the relevant harmful organisms; are grown in vitro in a sterile medium under sterile conditions that preclude the possibility of infestation with *Bemisia tabaci* Genn. (non-European populations); and are shipped in transparent containers under sterile conditions.

- *Bemisia tabaci* Genn. is also listed in Annex IV, AII:

26.1. Plants of *Solanum lycopersicum* L., intended for planting, other than seeds

Without prejudice to the requirements applicable to the plants, where appropriate, listed in Annex IV (a)(II)(18.6) and (23) official statement that:

(a) the plants originate in areas known to be free from Tomato yellow leaf curl virus;

or

(b) no symptoms of Tomato yellow leaf curl virus have been observed on the plants;

and

(aa) the plants originate in areas known to be free from *Bemisia tabaci* Genn;

or

(bb) the place of production has been found free from *Bemisia tabaci* Genn. on official inspections carried out at least monthly during the three months prior to export;

or

(c) no symptoms of Tomato yellow leaf curl virus have been observed on the place of production and the place of production has been subjected to an appropriate treatment and monitoring regime to ensure freedom from *Bemisia tabaci* Genn.

- *Bemisia tabaci* Genn. is also listed in Annex IV, B:

Plants, plant products and other objects	Special requirements	Protected zone(s)
24.1. Unrooted cuttings of <i>Euphorbia pulcherrima</i> Willd., intended for planting	Without prejudice to the requirements applicable to the plants listed in Annex IV(A)(I)(45.1), where appropriate, official statement that: (a) the unrooted cuttings originate in an area known to be free from <i>Bemisia tabaci</i> Genn. (European populations), or (b) no signs of <i>Bemisia tabaci</i> Genn. (European populations) have been observed either on the cuttings or on the plants from which the cuttings are derived and held or produced at the place of production on official inspections carried out at least each three weeks during the whole production period of these plants on this place of production, or (c) in cases where <i>Bemisia tabaci</i> Genn. (European populations) has been found at the place of production, the cuttings and the plants from which the cuttings are derived and held or produced in this place of production have undergone an appropriate treatment to ensure freedom from <i>Bemisia tabaci</i> Genn. (European populations) and subsequently this place of production shall have been found free from <i>Bemisia tabaci</i> Genn. (European populations) as a consequence of the implementation of appropriate procedures aiming at eradicating <i>Bemisia tabaci</i> Genn. (European populations), in both official inspections carried out weekly during the three weeks prior to the movement from this place of production and in monitoring procedures throughout the said period. The last inspection of the above weekly inspections shall be carried out immediately prior to the above movement	IRL, P (Azores, Beira Interior, Beira Litoral, Entre Douro e Minho and Trás-os-Montes), UK, S, FI

Plants, plant products and other objects	Special requirements	Protected zone(s)
24.2. Plants of <i>Euphorbia pulcherrima</i> Willd., intended for planting, other than: — seeds, — those for which there shall be evidence by their packing or their flower (or bract) development or by other means that they are intended for sale to final consumers not involved in professional plant production, — those specified in 24.1	Without prejudice to the requirements applicable to the plants listed in Annex IV(A)(I)(45.1), where appropriate official statement that: (a) the plants originate in an area known to be free from <i>Bemisia tabaci</i> Genn. (European populations), - or (b) no signs of <i>Bemisia tabaci</i> Genn. (European populations) have been observed on plants at the place of production on official inspections carried out at least once each three weeks during the nine weeks prior to marketing, - or (c) in cases where <i>Bemisia tabaci</i> Genn. (European populations) has been found at the place of production, the plants, held or produced in this place of production have undergone an appropriate treatment to ensure freedom from <i>Bemisia tabaci</i> Genn. (European populations) and subsequently this place of production shall have been found free from <i>Bemisia tabaci</i> Genn. (European populations) as a consequence of the implementation of appropriate procedures aiming at eradicating <i>Bemisia tabaci</i> Genn. (European populations), in both official inspections carried out weekly during the three weeks prior to the movement from this place of production and in monitoring procedures throughout the said period. The last inspection of the above weekly inspections shall be carried out immediately prior to the above movement, and (d) evidence is available that the plants have been produced from cuttings which: (da) originate in an area known to be free from <i>Bemisia tabaci</i> Genn. (European populations), - or (db) have been grown at a place of production where no signs of <i>Bemisia tabaci</i> Genn. (European populations) have been observed on official inspections carried out at least once each three weeks during the whole production period of these plants, - or (dc) in cases where <i>Bemisia tabaci</i> Genn. (European populations) has been found at the place of production, have been grown on plants held or produced in this place of production having undergone an appropriate treatment to ensure freedom from <i>Bemisia tabaci</i> Genn. (European populations) and subsequently this place of production shall have been found free from <i>Bemisia tabaci</i> Genn. (European populations) as a consequence of the implementation of appropriate procedures aiming at eradicating <i>Bemisia tabaci</i> Genn. (European populations), in both official inspections carried out weekly during the three weeks prior to the movement from this place of production and in monitoring procedures throughout the said period. The last inspection of the above weekly inspections shall be carried out immediately prior to the above movement	IRL, P (Azores, Beira Interior, Beira Litoral, Entre Douro e Minho and Trás-os-Montes), UK, S, FI

Plants, plant products and other objects	Special requirements	Protected zone(s)
24.3. Plants of <i>Begonia</i> L., intended for planting, other than seeds, tubers and corms, and plants of <i>Dipladenia</i> A.DC., <i>Ficus</i> L., <i>Hibiscus</i> L., <i>Mandevilla</i> Lindl. and <i>Nerium oleander</i> L., intended for planting, other than seeds	Without prejudice to the requirements applicable to the plants listed in Annex IV(A)(I)(45.1), where appropriate, official statement that: (a) the plants originate in an area known to be free from <i>Bemisia tabaci</i> Genn. (European populations), or (b) no signs of <i>Bemisia tabaci</i> Genn. (European populations) have been observed on plants at the place of production on official inspections carried out at least once each three weeks during the nine weeks prior to marketing, or (c) in cases where <i>Bemisia tabaci</i> Genn. (European populations) has been found at the place of production, the plants, held or produced in this place of production have undergone an appropriate treatment to ensure freedom from <i>Bemisia tabaci</i> Genn. (European populations) and subsequently this place of production shall have been found free from <i>Bemisia tabaci</i> Genn. (European populations) as a consequence of the implementation of appropriate procedures aiming at eradicating <i>Bemisia tabaci</i> Genn. (European populations), in both official inspections carried out weekly during the three weeks prior to the movement from this place of production and in monitoring procedures throughout the said period, or (d) for those plants for which there shall be evidence by their packing or their flower development or by other means that they are intended for direct sale to final consumers not involved in professional plant production, the plants have been officially inspected and found free from <i>Bemisia tabaci</i> Genn. (European populations) immediately prior to their movement	IRL, P (Azores, Beira Interior, Beira Litoral, Entre Douro e Minho and Trás-os-Montes), UK, S, FI

- *Xiphinema americanum* sensu lato is listed in Annex I, AI, position (a) 26.
- *Xiphinema americanum* sensu lato is also listed in Annex IV, AI:
 - 31 – Plants of *Pelargonium* L'Herit. ex Ait., intended for planting, other than seeds, originating in countries where Tomato ringspot virus is known to occur:
 - a) where *Xiphinema americanum* Cobb sensu lato (non-European populations) or other vectors of Tomato ringspot virus are not known to occur;
 - b) where *Xiphinema americanum* Cobb sensu lato (non-European populations) or other vectors of Tomato ringspot virus are known to occur
- *Xiphinema californicum* is listed in Annex I, AI, position (a) 27.
- *Xiphinema californicum* is also listed in Annex IV, AI:
 - 31. Plants of *Pelargonium* L'Herit ex Ait., intended for planting, other than seeds, originating in countries where Tomato ringspot virus is known to occur:
 - a) where *Xiphinema americanum* Cobb sensu lato (non-European populations) or other vectors of Tomato ringspot virus are not known to occur;
 - b) where *Xiphinema americanum* Cobb sensu lato (non-European populations) or other vectors of Tomato ringspot virus are known to occur.

The arthropods identified as potential vectors of some viruses of *Fragaria* categorised here [(*Aphis gossypii* (Hemiptera, *Aphididae*), *Trialeurodes vaporariorum* (Hemiptera, *Aleyrodidae*), *Chaetosiphon fragaefolii* (Hemiptera, *Aphididae*), *C. thomasi* (Hemiptera, *Aphididae*), *C. jacobii* (Hemiptera, *Aphididae*)], are not explicitly mentioned in the Directive 2000/29/EC.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

While most viruses categorised in the present opinion have been reported only from *Fragaria* spp., some other viruses have a natural host range including many (ToRSV) or a few non-*Fragaria* species (SNSV that also infects *Rubus* spp.). For FCCV, FCILV, SCFaV, SCrV-3, SCrV-4, SPaV, SPV-1, SPMYEV, SVBV there are no other natural hosts reported and there is only one report of tomato as an experimental host for StLCV (El-gaied et al., 2008) while for all other viruses, data on experimental transmission and additional hosts are not available. From the biology of other members of the relevant virus genera, it can be proposed that additional natural hosts may exist for FCILV, SCrV-3, SCrV-4, StLCV, SPaV, SPV-1, SPMYEV, SVBV, while for FCCV and SCFaV, this is considered unlikely. Regulation addressing other natural hosts exist for SNSV and ToRSV (Table 10). It should be considered that for all viruses categorised here, additional natural hosts that have not been reported so far may exist. This uncertainty is even higher for recently discovered viruses.

Table 10: Natural hosts other than *Fragaria* L. of viruses categorised in the present opinion, together with their regulatory status and the associated uncertainties

VIRUS name	Other than <i>Fragaria</i> hosts (refs)	Regulation addressing other than <i>Fragaria</i> hosts ^(a)	Uncertainties
Strawberry necrotic shock virus (SNSV)	<i>Rubus</i> sp.	<i>Rubus</i> sp.: IVAI 19.2, 24; IVAII 12; VA 2.1; VBI 1;	Natural hosts belong to different families (Martin et al., 2013). Additional natural hosts may exist
Tomato ringspot virus (ToRSV)	EPPO: MAJOR: <i>Pelargonium x hortorum</i> , <i>Prunus persica</i> , <i>Rubus idaeus</i> MINOR: <i>Gladiolus</i> , <i>Hydrangea macrophylla</i> , <i>Pelargonium</i> , <i>Prunus</i> spp., <i>P. avium</i> , <i>P. domestica</i> , <i>P. dulcis</i> , <i>Punica granatum</i> , <i>Ribes nigrum</i> , <i>Ribes uva-crispa</i> , <i>Rosa</i> , <i>Rubus</i> , <i>Rubus fruticosus</i> , <i>Vaccinium corymbosum</i> , <i>Vitis vinifera</i> , woody plants INCIDENTAL: <i>Fraxinus americana</i> , <i>Malus</i> , <i>Rubus laciniatus</i> , <i>Solanum lycopersicum</i> , <i>Solanum tuberosum</i> WILD/WEED: <i>Stellaria media</i> , <i>Taraxacum officinale</i> <i>Cydonia</i> (EFSA PLH Panel, 2019b)	<i>Cydonia</i> sp.: IIIAI 9, 18; IIIB 1; IVAI 7.4, 7.5, 14.1, 17, 19.2, 20; IVAII 9, 13; IVB 21; VAI 1.1; VAII 1.3, 1.4; VBI 3, 6; VBII 3, 4; <i>Fraxinus</i> sp.: IVAI 2.3, 2.4, 2.5, 11.4; VB 2, 6; <i>Gladiolus</i> sp.: IVAII 24.1, VA 3 <i>Malus</i> sp.: IIIAI 9, 18; IIIB 1; IVAI 7.4, 7.5, 14.1, 17, 19.2, 22.1, 22.2; IVAII 9, 15; IVB 21; VAI 1.1; VAII 1.3, 1.4; VBI 3, 6; VBII 3, 4 <i>Narcissus</i> sp.: IIBII 4; IVAI 30; IVAII 22, 24.1; IVB 3 <i>Pelargonium</i> sp.: IVAI 27.1, 27.2, 31; IVAII 20, VAI 2.1; VBI 2 <i>Prunus</i> sp.: IIIA 9, 18; IVAI 7.4, 7.5, 14.1, 16.6, 19.2, 23.1, 23.2; IVAII 12, 16; VB 20.5, VAI 1.1, 2.1, VAII 1.2, VBI 1, 2, 3, 6 <i>Punica</i> sp.: IVAI 16.6; IVB 3; VA3 <i>Ribes</i> sp.: IVAI 19.2; VB 3 <i>Rosa</i> sp.: IIIA 9, IVAI 44, 45.2; VBI 2	This virus has a large natural host range; it is unlikely that all natural hosts have been identified

VIRUS name	Other than <i>Fragaria</i> hosts (refs)	Regulation addressing other than <i>Fragaria</i> hosts ^(a)	Uncertainties
		<i>Rubus</i> sp.: IVAI 19.2, 24; IVAII 12; VA 2.1; VBI 1 <i>Solanum</i> sp.: IIIA 10,11,12; IVAI 25.1,25.2,25.3, 25.4,25.4.1,25.4.2,25.5,25.6,25.7, 25.7.1, 25.7.2, 28.1, 36.2, 45.3, 48; IVAII 18.1,18.1.1, 18.2,18.3,18.3.1,18.4,18.5, 18.6, 18.6.1, 18.7,26.1,27; IVBI 20.1, 20.2; VAI 1.3, 2.4; VAII 1.5; VB 1,3,4 <i>Vaccinium</i> sp.: VB 3 <i>Vitis</i> sp.: IIIA 15, IVAII 17, IVB 21.1, 21.2, 32 VAI 1.4, VAII 1.3, 1.9, 6a	

(a): Numbers reported in this column refer to articles from Council Directive 2000/29/EC.

3.4.2. Entry

Are the pests able to enter into the EU territory? (Yes or No) If yes, identify and list the pathways

Yes, for the viruses of *Fragaria* categorised here. These agents may enter the EU territory with infected *Fragaria* plants for planting. Some of them have additional pathways including plants for planting of other natural hosts, seeds, pollen and/or vectors.

All the viruses of *Fragaria* categorised here can be transmitted by vegetative propagation material. Therefore, plants for planting of *Fragaria* must be considered as potentially the most important entry pathway. SNSV has at least one additional natural host (*Rubus*) and ToRSV has a wide host range, including additional natural hosts that also are vegetatively propagated (e.g. *Cydonia* spp., *Malus* spp., *Pyrus* spp., *Rubus* spp., *Rosa* spp., *Vaccinium* spp.), thus providing additional entry pathways. Some viruses of *Fragaria* categorised here can also be transmitted by seeds, and/or pollen, and/or vectors (Table 4), that may also provide entry pathways. Information on seed, pollen and vector transmission is limited for some of the categorised viruses, especially for those recently discovered. Missing evidence on the transmission mechanisms for these viruses causes uncertainties on the possible pathways. Major entry pathways for the viruses categorised here are summarised in Table 11.

Current legislation prohibits entry in the EU of plants for planting, other than seeds (the definition of which includes pollen) of *Fragaria* from non-EU countries (Annex IIIA 18), but introduction of *Fragaria* plants is permitted from Mediterranean countries, Australia, New Zealand, Canada and the continental states of the USA (Annex IIIA 18). This means that the entry pathway regarding *Fragaria* plants for planting is only partially closed for those viruses present in the above-mentioned countries. However, restrictions applying to plants for planting – in general (e.g. Annex IVAI 33, 36.1, 39, 40, 43, 46) or specifically referring to *Fragaria* (e.g. annex IVAI 14.1, 19.2, 23.1 and 23.2) in relation to other harmful organisms may restrict the areas from which plants for planting of *Fragaria* can be imported.

Although not specifically stated in the legislation, pollen for pollination is considered as dormant plants for planting (EFSA PLH Panel, 2013), thus import of *Fragaria* pollen for pollination from Mediterranean countries, Australia, New Zealand, Canada and the continental states of the USA, without prejudice to other provisions, is also permitted (EFSA PLH Panel, 2013). However, as already stated in a previous EFSA opinion (EFSA PLH Panel, 2013): 'It should be stressed that the current legislation is complex and difficult to understand and that its interpretation when it comes to the specific case of pollen for pollination purposes is far from obvious'. The Panel notes that it has no information on the volume of potential trade of *Fragaria* pollen.

As noted above in Section 3.4.1, the current legislation regulates several non-*Fragaria* hosts of the viruses categorised here (e.g. *Cydonia*, *Fraxinus*, *Gladiolus*, *Malus*, *Narcissus*, *Pelargonium*, *Prunus*, *Punica*, *Ribes*, *Rosa*, *Rubus*, *Solanum*, *Vaccinium*, *Vitis*). Import from non-EU countries of plants for planting of some of these hosts (e.g. *Cydonia*, *Malus*, *Pyrus*, *Rosa* and/or *Vitis*) is also banned (Annex

IIIAI 9, 15 and 18), but introduction of dormant plants (free from leaves, flowers and fruit) of *Cydonia*, *Malus* and *Pyrus* and their hybrids is permitted from Mediterranean countries, Australia, New Zealand, Canada and the continental states of the USA (Annex IIIAI 18). This means that the entry pathway of plants for planting of these host genera is only partially regulated for those viruses present in the above-mentioned countries. Requirements applying to plants for planting in general (e.g. Annex IVAI 33, 36.1, 46) or specifically referring to *Vitis* and other hosts (e.g. Annex IVB 21.1, 21.2, 32.1, 32.2) in relation to other harmful organisms may contribute to restrict the areas from which plants for planting can be imported as dormant plants or the areas where such material can be planted. However, these requirements have likely a minor effect to mitigate virus entry in the EU.

Import of *Fragaria* seeds is not regulated, as for many other species (e.g. *Cydonia*, *Malus* and *Pyrus*), while seeds of *Vitis* are currently prohibited from Third Countries other than Switzerland.

The import of *Fragaria* fruits from any Third Country is not currently regulated, but since the 1 September 2019, they should be accompanied by a phytosanitary certificate (implementing Directive (EU) 2019/523 of 21.03.2019). The relevance of this measure for viruses categorised here is unclear. It is noteworthy for those agents that may be seed-transmitted, although fruit import is unlikely to represent a pathway of major relevance.

Although Annex IVAI 19.2, requires '*official statement that no symptoms of diseases caused by the relevant harmful organisms*' (e.g. non-European viruses and virus-like organisms) '*have been observed on the plants at the place of production since the beginning of last complete cycle of vegetation*', this measure is considered to have limited impact in preventing import of infected plants of *Fragaria* intended for planting. This is because symptoms in the infected plants are often not obvious. Similarly, Annex IVAI 21.1, applies to '*plants of *Fragaria* L. intended for planting, originating in countries where the relevant harmful organisms (SVBV) are known to occur on *Fragaria* L.*' and determines requirements for testing and certification. Also, in this case, the needed certification and testing requirements for plants for planting is limited to only some of the viruses of *Fragaria* categorised here, thus regulating only partially the related entry pathways.

Similar requirements, without prejudice to other provisions (e.g. Annex I and III), are established in Annex IV with respect to plants of *Malus*, *Prunus* and *Rubus* intended for planting (Annex IVAI 19.2, 22.1, 23.2 and 24) for which certification (or an equivalent) excluding the presence of '*Non-European viruses and virus-like organisms*' (19.2) or of ToRSV (22.1, 23.2 and 24) is requested. The Panel also notes that this legislation is complex, which may create interpretation problems, and it does not completely eliminate the risk of introduction with the plants for planting pathway for at least some of the viruses categorised here.

Annex V (BI1 and BII3) establishes that plants for planting, pollen and/or parts of plants of several host species (*Cydonia*, *Malus*, *Pyrus*, *Prunus*, *Rosa* and *Rubus*) concerned must be accompanied by a valid phytosanitary certificate in order to be introduced into the EU. Seeds of some of the non-*Fragaria* hosts (*Rubus* sp., *Solanum lycopersicum*) of viruses categorised here (SNSV and ToRSV) are regulated (VBI 1) and a phytosanitary certificate is requested.

Annex VA lists all the potential hosts which must be checked and accompanied by a plant passport. This measure may impair the spread of viruses on *Fragaria* and other species that are regulated in the EU (such as *Cydonia*, *Malus* and *Pyrus*), but has no effect on the dissemination of viruses on non-regulated host plants.

ToRSV is transmitted by nematodes and therefore may enter the EU with viruliferous nematodes. The major entry pathways for nematodes are soil and growing media from areas where the nematodes occur. These pathways are closed by current legislation (Annex IIIA 14 of EU Directive 2000/29/EC). According to a previous EFSA pest categorisation of *Xiphinema americanum* sensu lato (EFSA PLH Panel, 2018a), only '*Soil and growing media attached to plants (hosts or non-host plants) from areas where the nematode occurs*' is a major entry pathway for nematodes vectoring viruses. '*This pathway is not closed as plants may be imported with soil or growing media attached to sustain their live*'. In the same opinion, '*soil and growing media attached to (agricultural) machinery, tools, packaging materials*' has been identified as an entry pathway, but it '*is not considered an important pathway*' (EFSA PLH Panel, 2018a).

In summary, the current legislation only partially regulates the *Fragaria* plants for planting (and pollen) entry pathway for the viruses categorised here. In addition, for plants for planting of many non-*Fragaria* natural hosts of ToRSV there are no special requirements formulated, leaving open potential entry pathways. Finally, the import of seeds of *Fragaria* is not regulated. Pathways regarding vectors are partially regulated.

Table 11: Major potential entry pathways identified for the viruses of *Fragaria* under categorisation and the respective regulatory status

Virus name	<i>Fragaria</i> plants for planting ^(a)	<i>Fragaria</i> pollen ^(a)	<i>Fragaria</i> seeds ^(a)	Plants for planting/ seeds/ pollen of other hosts ^(a)	Viruliferous vectors ^(a)	Uncertainty factors
Fragaria chiloensis cryptic virus (FCCV)	Pathway partially regulated (virus present in Chile) ^(b)	Pathway partially regulated (virus present in Chile) ^(b)	Pathway open	Not a pathway: FCCV is not known to have other natural host (s)	Not a pathway: FCCV is not known to have vector (s)	– Geographic distribution – Existence of vector(s) – Existence and volume of trade of <i>Fragaria</i> pollen and seeds – Existence of other natural hosts
Fragaria chiloensis latent virus (FCILV)	Pathway partially regulated (virus present in Chile and USA) ^(b)	Pathway partially regulated (virus present in Chile and USA) ^(b)	Pathway open	Not a pathway: FCILV is not known to have other natural host (s)	Not a pathway: FCILV is not known to have vector (s)	– Geographic distribution – Existence of vector(s) – Existence and volume of trade of <i>Fragaria</i> pollen and seeds – Existence of other natural hosts
Strawberry chlorotic fleck-associated virus (SCFaV)	Pathway partially regulated (virus present in USA) ^(b)	Not a pathway: SCFaV is not known to be pollen-transmitted	Not a pathway: SCFaV is not known to be seed-transmitted	Not a pathway: SCFaV is not known to have other natural host (s)	Pathway open	– Geographic distribution – Seed and pollen transmission – Existence of other natural hosts
Strawberry crinivirus 3 (SCrV-3)	Pathway partially regulated (virus present in USA) ^(b)	Not a pathway: SCrV-3 is not known to be pollen-transmitted	Not a pathway: SCrV-3 is not known to be seed-transmitted	Not a pathway: SCrV-3 is not known to have other natural host (s)	Pathway open	– Geographic distribution – Seed and pollen transmission – Existence of other natural hosts
Strawberry crinivirus 4 (SCrV-4)	Pathway partially regulated (virus present in Canada and USA) ^(b)	Not a pathway: SCrV-4 is not known to be pollen-transmitted	Not a pathway: SCrV-4 is not known to be seed-transmitted	Not a pathway: SCrV-4 is not known to have other natural host (s)	Pathway open	– Geographic distribution – Seed and pollen transmission – Existence of other natural hosts

Virus name	<i>Fragaria</i> plants for planting ^(a)	<i>Fragaria</i> pollen ^(a)	<i>Fragaria</i> seeds ^(a)	Plants for planting/ seeds/ pollen of other hosts ^(a)	Viruliferous vectors ^(a)	Uncertainty factors
Strawberry leaf curl virus (StLCV)	Pathway partially regulated (virus present in Egypt) ^(b)	Not a pathway: StLCV is not known to be pollen-transmitted	Not a pathway: StLCV is not known to be seed-transmitted	Not a pathway: StLCV is not known to have other natural host (s)	Pathway closed by current legislation. <i>B. tabaci</i> is listed in Annex IAI	– Geographic distribution – Pollen and seed transmission – Existence of other natural hosts
Strawberry necrotic shock virus (SNSV)	Pathway partially regulated (virus present in Australia, Canada, USA) ^(b)	Pathway partially regulated (virus present in Australia, Canada, USA) ^(b)	Pathway open	Pathway partially regulated for <i>Rubus</i>	Pathway closed: no vector is known	– Geographic distribution – Existence of vector(s) – Existence of other natural hosts
Strawberry pallidosis-associated virus (SPaV)	Pathway partially regulated (virus present in USA) ^(b)	Not a pathway: SPaV is not known to be pollen-transmitted	Not a pathway: SPaV is not known to be seed-transmitted	Not a pathway: SPaV is not known to have other natural host (s)	Pathway open	– Geographic distribution – Seed and pollen transmission – Existence of other natural hosts
Strawberry polerovirus 1 (SPV-1)	Pathway partially regulated (virus present in Argentina, Canada and USA) ^(b)	Not a pathway: SPV-1 is not known to be pollen-transmitted	Not a pathway: SPV-1 is not known to be seed-transmitted	Not a pathway: SPV-1 is not known to have other natural host (s)	Pathway possibly open: unknown vector(s) may exist.	– Geographic distribution – Seed, pollen and vector transmission – Existence of other natural hosts
Strawberry pseudo mild yellow edge virus (SPMYEV)	Pathway partially regulated (virus present in USA) ^(b)	Not a pathway: SPMYEV is not known to be pollen-transmitted	Not a pathway: SPMYEV is not known to be seed-transmitted	Not a pathway: SPMYEV is not known to have other natural host (s)	Pathway open	– Geographic distribution – Seed and pollen transmission – Existence of other natural hosts
Strawberry vein banding virus (SVBV)	Pathway partially regulated (virus present in Australia, Canada, Chile, Egypt and USA) ^(b)	Not a pathway: SVBV is not known to be pollen-transmitted	Not a pathway: SVBV is not known to be seed-transmitted	Not a pathway: SVBV is not known to have other natural host (s)	Pathway open	– Geographic distribution – Seed and pollen transmission – Existence of other natural hosts

Virus name	<i>Fragaria</i> plants for planting ^(a)	<i>Fragaria</i> pollen ^(a)	<i>Fragaria</i> seeds ^(a)	Plants for planting/ seeds/ pollen of other hosts ^(a)	Viruliferous vectors ^(a)	Uncertainty factors
Tomato ringspot virus	Pathway partially regulated (virus present in Argentina, Australia, Canada, Chile, Egypt, Turkey, New Zealand and USA) ^(b)	Pathway possibly open: pollen transmission may exist	Pathway possibly open: seed transmission may exist	Pathway partially regulated: existence of a wide range of regulated and unregulated hosts	Pathway partially regulated: viruliferous nematodes can enter with the soil and growing media still attached to plants	– Geographic distribution – Seed and pollen transmission in <i>Fragaria</i>

(a): Pathway open: only applicable if the pathway exists, open means that there is no regulation or ban that prevents entry via this pathway.

Pathway closed: opposite of 'pathway open': there is a ban that completely prevents entry via the pathway.

Pathway possibly open: the existence of the pathway, which is not closed by current legislation, is not supported by direct evidence regarding the biology of that virus. However, based on comparisons with the biology of closely related viruses (in the same genus or in the same family), the existence of the pathway cannot be excluded.

Not a pathway: there is no evidence supporting the existence of the pathway.

Pathway regulated: regulations exist that limit the probability of entry along the pathway, but there is not a complete ban on imports.

Pathway partially regulated: the legislation does not cover all the possible paths (e.g. regulations exist for some hosts, but not for others; a ban exists for some non-EU MSs but not for all).

(b): Import not banned from the listed country(ies).

Interceptions of non-EU viruses of *Fragaria* were searched in the Europhyt database on 24 April 2019 (EUROPHYT, 2019). Only 5 interceptions of ToRSV were reported, mainly from ornamental hosts. They date back to more than 10 years ago (Table 12). No interception was registered in the case of FCILV, SCFaV, SNSV, SPaV, SPMYEV and SVBV.

FCCV, SCRv-3, SCRv-4 and SPV-1 are not listed in Europhyt.

Table 12: Interceptions of ToRSV in the EU (Source: Europhyt, search done on 24 April 2019)

VIRUS/VIROID name	Europhyt interception	Year of interception	Origin	Plant species on which it has been intercepted
Tomato ringspot virus (ToRSV)	5	1997	Israel	<i>Pelargonium</i> sp.
		1997	Israel	<i>Pelargonium</i> sp.
		1999	USA	<i>Pelargonium</i> sp.
		1999	France	<i>Pelargonium x hortorum</i>
		2008	Italy	<i>Malus</i> sp.

The analysis of entry pathways is affected by uncertainties linked with the limited information available on (a) the transmission biology and host range of the categorised viruses and (b) their geographical distribution.

In summary, the only pathways the Panel considered relevant for the entry of the viruses categorised here are:

- Entry pathway involving plants for planting of *Fragaria*, other than seeds: this pathway is partially regulated for all the viruses categorised here because the viruses are present in countries from which import of *Fragaria* plants for planting is allowed.
- Entry pathway involving pollen of *Fragaria*: this pathway is partially regulated for FCCV, FCILV, SNSV and ToRSV. For all other viruses there is no evidence supporting the existence of this pathway, with uncertainties, because they are not reported to be pollen-transmitted.

- Entry pathway involving seeds of *Fragaria*: this pathway is open for FCCV, FCILV and SNSV. The pathway is possibly open for ToRSV. For the other viruses, this is not considered a pathway, sometimes with uncertainty, because they are not reported to be seed-transmitted.
- Entry pathway involving non-*Fragaria* hosts. This pathways is considered:
 - partially regulated for SNSV and ToRSV;
 - not to be a pathway for FCCV, FCILV, SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPV-1, SPMYEV and SVBV (because they have a narrow host range, likely restricted to *Fragaria*).
- Entry pathway involving vectors: this pathway refers to:
 - nematode-transmitted viruses (ToRSV). In accordance with the current legislation, the nematode vector pathway (independent of the considered species) is partially regulated. In fact, although import of soil and growing media in the EU is banned, nematodes can still enter the EU with soil and growing media attached to plants for planting imported from countries in which these vectors are present. Moreover, these viruses may have hosts other than *Fragaria* that may be not regulated or only partially regulated.
 - arthropod-transmitted viruses (SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPMYEV and SVBV). The arthropod vector pathway is considered open, with the exception of StLCV for which the *B. tabaci* pathway is considered closed by legislation. For SPV-1, the vector of which, if any, has not been identified yet, the pathway is considered possibly open. For the other agents (FCCV, FCILV and SNSV) this is not considered a pathway, with uncertainty.

3.4.3. Establishment

Are the pests able to become established in the EU territory? (Yes or No)

Yes, natural hosts of the viruses under categorisation are widespread in the EU and climatic conditions are appropriate for their establishment wherever their hosts may grow in the EU.

3.4.3.1. EU distribution of main host plants

Fragaria widely occur in the EU as commercial crops as well as wild plants. Details on the area of *Fragaria* production in individual EU Member States are provided in Table 13.

Table 13: Strawberry Area (cultivation/harvested/production) (1,000 ha). Date of extraction from Eurostat 06/02/2019 (S0000 – Strawberries). 'na' stands for data not available.

EU country/Year	2013	2014	2015	2016	2017
Austria	1.29	1.13	1.14	1.14	1.14
Belgium	1.63	1.70	1.80	1.90	1.98
Bulgaria	0.60	0.67	0.76	0.68	0.66
Croatia	0.29	0.31	0.29	0.37	0.37
Cyprus	0.05	0.06	0.05	0.04	0.04
Czechia	0.50	0.62	0.58	0.71	0.69
Denmark	1.03	1.08	1.09	1.17	1.16
Estonia	0.50	0.40	0.50	0.44	0.53
Finland	3.08	2.92	3.01	6.30	6.89
France	3.24	3.26	3.29	3.34	3.37
Germany (until 1990 former territory of the FRG)	15.58	15.35	14.72	14.30	14.16
Greece	1.30	1.35	1.28	1.49	1.47
Hungary	0.79	0.66	0.74	0.77	0.74
Ireland	0.23	0.19	0.19	0.19	0.19
Italy	5.52	5.69	5.60	4.88	4.85
Latvia	0.40	0.40	0.40	0.50	0.50
Lithuania	0.97	1.00	1.01	0.78	0.84
Luxembourg	0.00	0.00	0.00	0.01	0.01

EU country/Year	2013	2014	2015	2016	2017
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	1.77	1.81	1.77	1.72	1.69
Poland	40.20	52.90	52.30	50.78	49.84
Portugal	0.44	0.58	0.32	0.39	0.31
Romania	2.36	2.40	2.56	2.72	3.25
Slovakia	0.57	0.20	0.36	0.17	0.12
Slovenia	0.00	0.09	0.11	0.11	0.11
Spain	7.97	7.79	7.21	6.87	6.82
Sweden	1.88	1.94	1.99	2.01	1.97
United Kingdom	5.00	5.00	4.50	5.00	4.70

3.4.3.2. Climatic conditions affecting establishment

Except for those affecting the hosts, no ecoclimatic constraints for the viruses categorised here exist. Therefore, it is expected that these viruses are able to establish wherever their hosts may live. *Fragaria* is largely cultivated in the EU. The Panel therefore considers that climatic conditions will not impair the ability of viruses addressed here to establish in the EU. However, it must be taken into consideration that virus accumulation and distribution within natural hosts may be influenced by environmental conditions. The same applies to symptom expression and severity, that may be affected by climatic conditions (e.g. temperature and light).

3.4.4. Spread

Are the pests able to spread within the EU territory following establishment? (Yes or No) How?

Yes, all of the categorised viruses can spread through the trade of plants for planting. Some of them can also be spread by vectors and/or seeds and/or pollen

RNQPs: Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects?

Yes, all the categorised viruses are spread mainly by plants for planting

Long-distance spread of the viruses infecting *Fragaria* categorised here is mainly due to human activities (e.g. movement of plants for planting). Some of these viruses have also natural spread mediated by vectors that are mainly involved in short-distance movement.

3.4.4.1. Vectors and their distribution in the EU (if applicable)

Vectors are known for many of the viruses categorised here (SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPMYEV, SVBV and ToRSV; Table 4). For three of them (FCCV, FCILV and SNSV), the existence of vectors is not known and the biology of related agents would suggest the absence of vectors. In the case of SPV-1, based on the biology of related viruses, the existence of vector(s) appears possible, but has not been proven (Table 4).

Identified arthropod vectors are either aphids (*Aphis gossypii*, *Chaetosiphon fragaefolii*, *C. thomasi*, *C. jacobii*) or whiteflies (*Bemisia tabaci* and *Trialeurodes vaporariorum*).

A. gossypii is widely distributed worldwide. In particular in Europe, it is present in Austria, Belgium, Bulgaria, Cyprus, Czechoslovakia (former), Denmark, France, Germany, Greece, Hungary, Italy, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the UK (Figure 1; CABI, 2019) and it has a broad host range including over than 92 plant families. *C. fragaefolii* has been reported in Belgium, Bulgaria, France, Germany, Italy, Portugal, Spain and the UK (Figure 2; CABI, 2019).

The two whiteflies *B. tabaci* and *T. vaporariorum* are also widely distributed worldwide. In the EU, *B. tabaci* has been found in Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Malta, the Netherlands, Poland, Portugal, Slovenia, Spain, Sweden and the UK (Figure 3; EPPO, 2019). While *T. vaporariorum* is present in Austria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Malta, the Netherlands, Poland, Portugal, Slovenia, Spain and the UK (Figure 4; EPPO, 2019).

Nematode species *X. americanum* sensu stricto and *Xiphinema americanum* sensu lato (i.e. *X. bricolense*, *X. californicum*, *X. inaequale*, *X. tarjanense*) transmitting ToRSV have not been recorded in the EU. *X. intermedium* has been reported in Portugal (de Jong et al., 2014; <https://fauna-eu.org/>), but without any reference to a specific publication. *X. rivesi* has been reported in six EU MSs [France, Germany, Italy, Portugal, Slovenia, Spain, Figure 5 (EFSA PLH Panel, 2018a)]. Although under experimental condition the ability of EU populations of *X. rivesi* to transmit ToRSV has been demonstrated, they have never been associated with the spread of the corresponding viral diseases under field condition in the EU (EFSA PLH Panel, 2018a).



Figure 1: Global distribution map for *Aphis gossypii* (extracted from the CABI crop compendium accessed on 8 May 2019)

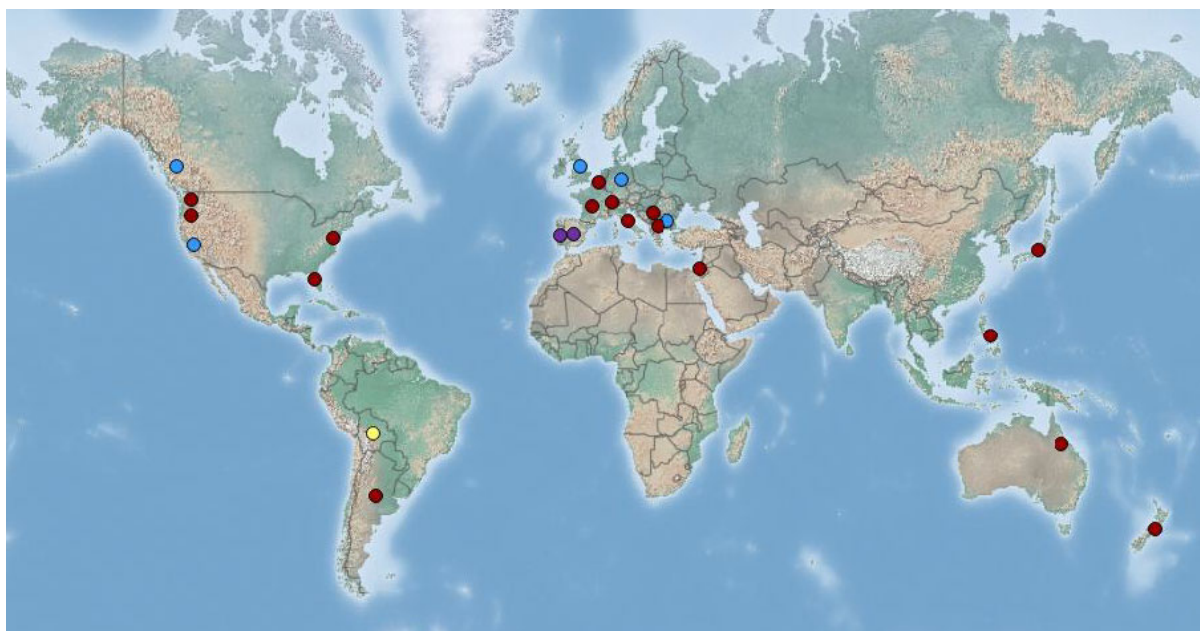


Figure 2: Global distribution map for *Chaetosiphon fragaefolii* (extracted from the CABI crop compendium accessed on 8 May 2019)

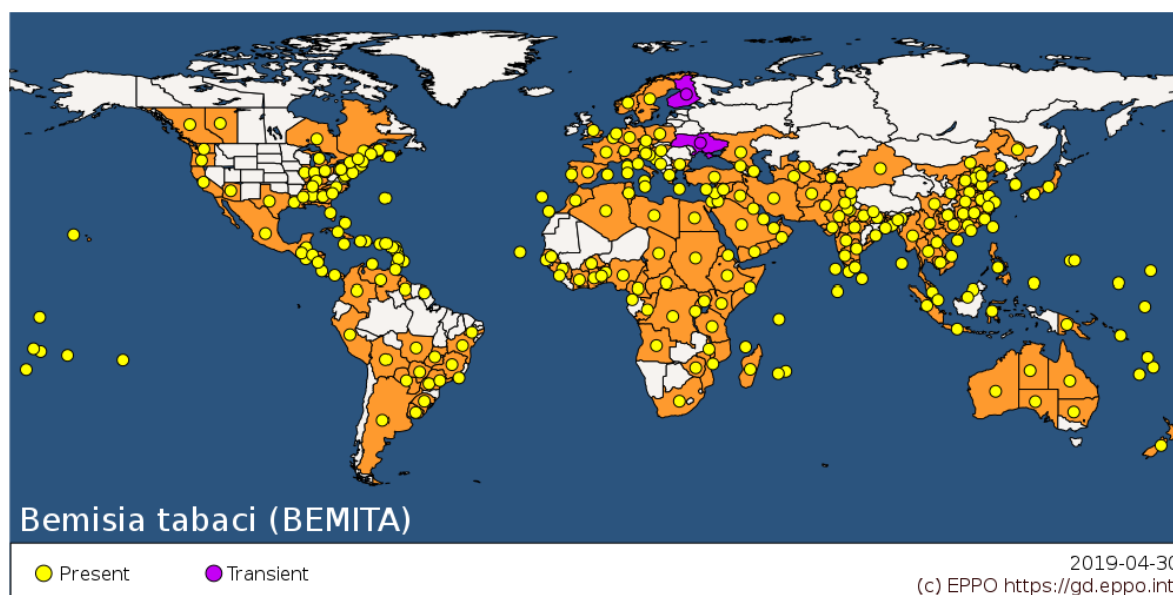


Figure 3: Global distribution map for *Bemisia tabaci* (extracted from the EPPO Global Database accessed on 30 April 2019)

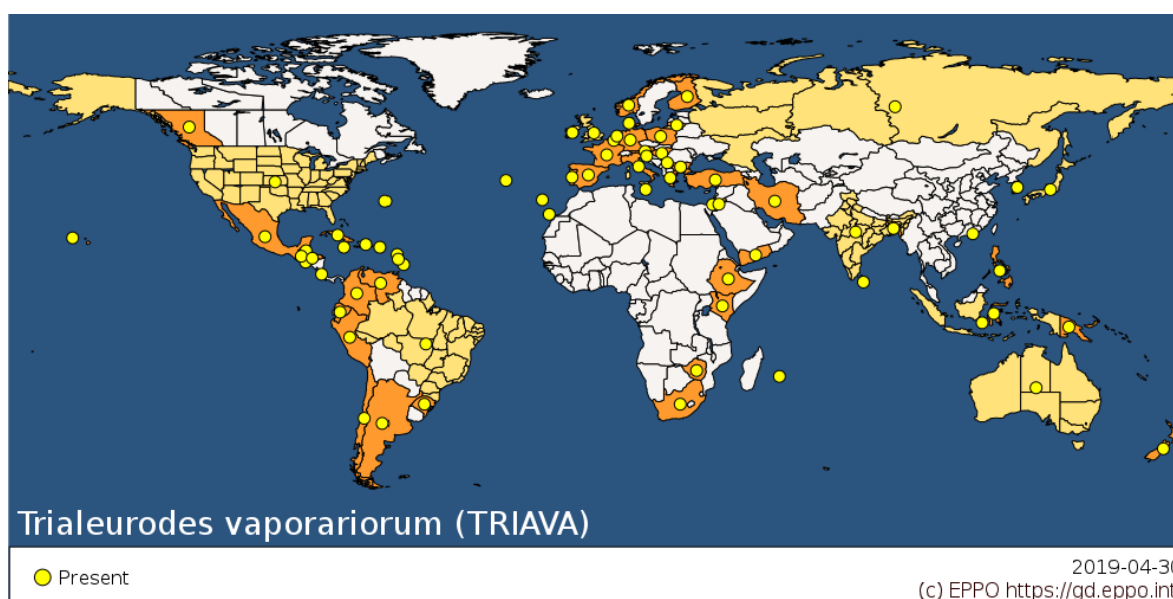


Figure 4: Global distribution map for *Trialeurodes vaporariorum* (extracted from the EPPO Global Database accessed on 30 April 2019)

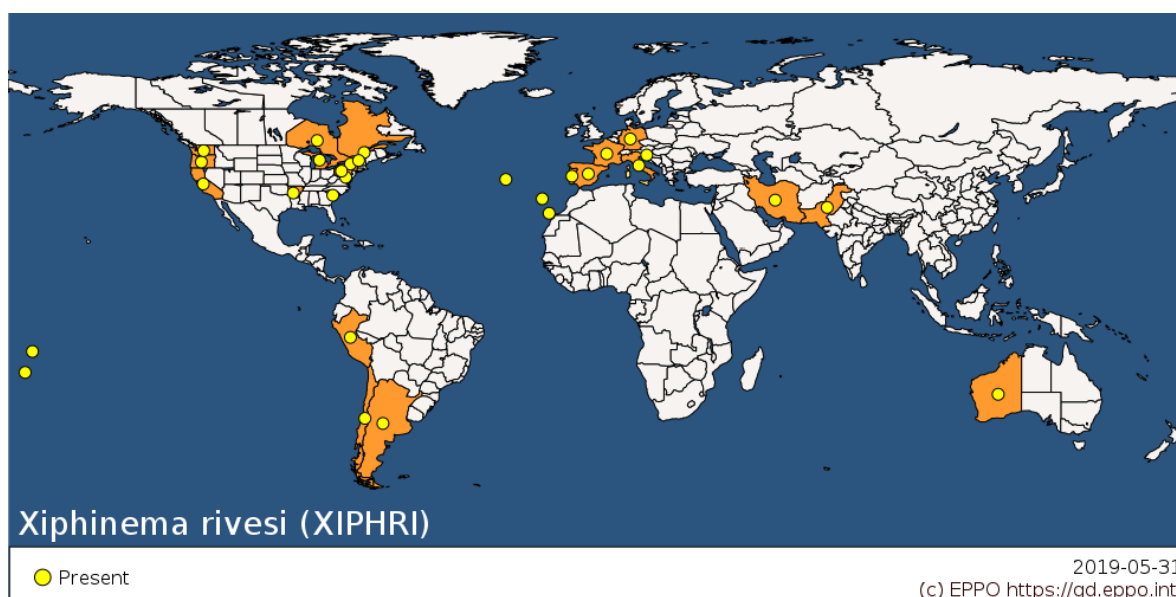


Figure 5: Global distribution map for *Xiphinema rivesi* (extracted from the EPPO Global Database accessed on 31 May 2019)

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?

Yes, for SCFaV, StLCV, SNSV, SPaV, SVBV and ToRSV, which may all induce severe disease in economically relevant crops.

No, for FCCV, FCILV, and SPMYEV since they have not been clearly associated with symptomatic infection in *Fragaria* or in other hosts.

For SCrV-3, SCrV-4, and SPV-1, the Panel was **unable to come to a conclusion** because of lack of conclusive data on the association with symptoms.

RNQP: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?⁴

Yes, for SCFaV, StLCV, SNSV, SPaV, SVBV and ToRSV. Given the severity of the symptoms these viruses may cause in *Fragaria* their presence in plants for planting they would severely impact their intended use. In addition, some of these agents may also have an impact on plants for planting of other hosts.

No, for FCCV, FCILV and SPMYEV. In the absence of a clear link to a symptomatology, these viruses are not expected to impact the intended use of *Fragaria* plants for planting, except possibly under some specific situations.

For SCrV-3, SCrV-4 and SPV-1 the Panel was **unable to come to a conclusion** because of lack of conclusive data on the association with symptoms.

Mixed infections by several viruses are quite common in *Fragaria*, making a straightforward association between a putative causal agent and particular symptoms often difficult. This situation may generate uncertainty on the specific role of a particular virus in the elicitation of certain diseases. However, the close association of an infectious agent with a specific symptomatology allows considering it as a harmful organism. In addition, it has been suggested that some strawberry decline syndromes are associated with synergistic effects of viruses in mixed infections (Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013). This raises the possibility that viruses with limited or no impact when present alone may have significant impact when in mixed infection, further complicating the present analysis and increasing the uncertainties.

⁴ See Section 2.1 on what falls outside EFSA's remit.

In many cases, the link between some of the categorised agents and symptoms is at best tenuous. This is mostly true for recently discovered agents for which very little information is available. In addition, uncertainties may exist on this aspect because for most of these viruses the susceptibility has not been tested on a range of *Fragaria* cultivars nor the potential for detrimental synergistic interactions with other viruses has been investigated. In the most extreme cases, there is only information on symptomatology in specific indicator *Fragaria* clones and it is difficult to extend these observations to cultivated strawberry varieties, further adding uncertainties. The impact of the viruses categorised is summarised in Table 14.

Table 14: Expected impact in the EU territory of the categorised viruses

VIRUS name	Would the pests' introduction have an economic or environmental impact on the EU territory?	Reasoning and uncertainties with relevant references	<u>RNQP: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?</u>
<i>Fragaria chiloensis</i> cryptic virus (FCCV)	No	This virus has not been reported to cause any obvious symptom or yield losses in <i>Fragaria</i> (Tzanetakis and Martin, 2005a,b, 2013; Martin and Tzanetakis, 2006; Tzanetakis, 2010)	No
<i>Fragaria chiloensis</i> latent virus (FCILV)	No	The virus does not cause symptoms on <i>F. chiloensis</i> or on strawberry cultivars but there are uncertainties because FCILV is commonly found in mixed infections (Tzanetakis and Martin, 2013). It induces mild symptoms when grafted onto the <i>F. vesca</i> cv. UC-4 indicator. Overall, FCILV is not expected to have impact, except possibly under some specific situations (susceptibility of specific <i>F. vesca</i> cultivars, mixed infections)	No
Strawberry chlorotic fleck-associated virus (SCFaV)	Yes	The virus causes chlorotic fleck symptoms on <i>F. vesca</i> and <i>F. virginiana</i> indicators; it does not induce leaf or fruit symptoms on strawberry cultivars, but can cause 70% runner reduction (Horn and Carver, 1962; Martin and Tzanetakis, 2006; Tzanetakis and Martin, 2013)	Yes
Strawberry crinivirus 3 (SCrV-3)	Unable to conclude because of lack of information	The virus has been reported in association with strawberry pallidosis, however this observation is not conclusive since SCrV-3 was found always in mixed infections (Tzanetakis and Martin, 2013; Chen et al., 2018)	Unable to conclude because of lack of information
Strawberry crinivirus 4 (SCrV-4)	Unable to conclude because of lack of information	The virus has been reported in association with strawberry pallidosis, however this observation is not conclusive since SCrV-4 was found always in mixed infections (Tzanetakis and Martin, 2013; Chen et al., 2018)	Unable to conclude because of lack of information
Strawberry leaf curl virus (StLCV)	Yes	The virus induces leaf curling, rolling and cupping, reduction of leaf size, with yellow edges and vein banding (El-gaied et al., 2008)	Yes

VIRUS name	Would the pests' introduction have an economic or environmental impact on the EU territory?	Reasoning and uncertainties with relevant references	<u>RNQP: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?</u>
Strawberry necrotic shock virus (SNSV)	Yes	Graft-inoculated <i>F. vesca</i> plants show symptoms after 6–14 days, with severe necrosis on the first three leaves only, whereas the new leaves are symptomless (Martin and Tzanetakis, 2006). The impact of the virus can be significant both on strawberry production (up to 15% yield reduction) and on runner production (up to 75%) (Johnson et al., 1984). In <i>Rubus</i> , the virus is symptomless (Martin et al., 2013)	Yes
Strawberry pallidosis-associated virus (SPaV)	Yes	SPaV is associated with the pallidosis disease. Pallidosis is latent in most modern strawberry cultivars in the USA and in <i>F. vesca</i> indicators. SPaV induces only mild symptoms, consisting of small chlorotic leaves and shortened runners, in <i>F. virginiana</i> (Tzanetakis and Martin, 2013). In addition, SPaV in mixed infection with other viruses has been suggested to be involved in a strawberry decline syndrome (Tzanetakis and Martin, 2013). However, in any of those cases, conclusive evidence is still missing since Koch's postulates have not been fulfilled. Despite the uncertainties, the Panel considers that in situations of mixed infections (and possibly in some EU cultivars) an impact could be expected in the EU	Yes
Strawberry polerovirus 1 (SPV-1)	Unable to conclude because of lack of conclusive information	SPV-1 has been proposed to be involved in the strawberry decline (SD) disease, characterised by reddening of the leaves, stunted foliage, small fruit and brittle root symptoms (Xiang et al., 2015). SD can severely affect strawberry production; for instance, the disease caused a 50 million dollars loss in California in 2002 and 2003 (Xiang et al., 2015). However, the data only shows a limited correlation between the presence of SPV-1 and the disease and the study did not involve analysis of healthy controls	Unable to conclude because of lack of conclusive information
Strawberry pseudo mild yellow edge virus (SPMYEV)	No	Infected strawberry plants are usually symptomless, as well as <i>F. virginiana</i> 'UC-10' and 'UC-11' indicators. Graft-inoculated <i>F. vesca</i> plants developed yellow to red mottled discoloration and necrosis, whereas <i>F. virginiana</i> 'UC-12' clone shows a yellow to reddish coloration, together with necrosis in some areas of older leaves (Martin and Tzanetakis, 2006). No information is available about the impact of the disease both in the US and Japan (Martin and Tzanetakis, 2006).	No

VIRUS name	Would the pests' introduction have an economic or environmental impact on the EU territory?	Reasoning and uncertainties with relevant references	<u>RNQPs: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?</u>
		Overall, SPMYEV is not expected to have impact, except possibly under some specific situations (susceptibility of specific <i>F. vesca</i> cultivars, mixed infections)	
Strawberry vein banding virus (SVBV)	Yes	SVBV induces leaf curling, vein banding and necrosis in <i>F. vesca</i> and <i>F. virginiana</i> indicators. Reductions of runner production, fruit quality and yield are reported in some strawberry cultivars in the USA. SVBV does not seem to induce severe symptomatology in many recent strawberry varieties when in single infections (Tzanetakis et al., 2013). However, mixed infections can result in more severe symptoms, in particular those involving strawberry crinkle virus (SCV) (Martin and Tzanetakis, 2006), which is present in the EU. Impact is expected but its magnitude could be limited ^(a)	Yes
Tomato ringspot virus (ToRSV)	Yes	Although generally not considered an important problem in strawberry, ToRSV has been reported to cause very severe symptoms in some varieties. In addition, this virus causes severe symptoms in many of its other hosts including <i>Prunus</i> spp., <i>Malus</i> spp., <i>Rubus</i> spp. and <i>Vitis</i> spp. (Yang et al., 1986; Stace-Smith and Converse, 1987; Pinkerton et al., 2008; Martelli and Uyemoto, 2011; Sanfaçon and Fuchs, 2011)	Yes

(a): The conclusion on potential consequences of SVBV in a previous EFSA categorisation (EFSA PLH Panel, 2014) was 'SVBV is considered a minor problem in strawberry cultivation. It, however, has the potential to cause symptoms in some strawberry varieties or when in mixed infections with other strawberry viruses. No environmental impact from SVBV is identified'.

3.6. Availability and limits of mitigation measures

Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?

Yes, measures are already in place (see Section 3.3) and additional measures could be implemented to further regulate the identified pathways or to limit entry, establishment, spread or impact.

RNQPs: Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?

Yes, certification and testing to exclude infection by some of the viruses categorised here is already requested. Extension of these measures to the viruses not yet covered by certification may help mitigate the risks associated with infection of plants for plantings.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to *Fragaria* (see Section 3.3). Potential additional measures to mitigate the risk of entry of the viruses categorised here may include:

- banning import of *Fragaria* (and for SNSV, also *Rubus*) plants for planting (including pollen) that can be imported from some non-EU countries,
- extend to some or all of the viruses analysed here the requirements imposed on imported *Fragaria* plants for planting, other than seeds (point 21.1 of Annex IVaI),
- for ToRSV, extension of phytosanitary measures, of certification schemes and testing requirements and of plant passport requirements to specifically include hosts other than *Fragaria*.

Some of the viruses may also enter into the EU through viruliferous nematodes or arthropods. In agreement with a recent EFSA scientific opinion (EFSA PLH Panel, 2018a), an additional measure could be the regulation of soil and growing media attached to imported plants. Additional measure against arthropods may include mechanical, physical or chemical treatment of consignments identified as potential entry pathways.

3.6.1.1. Additional control measures

Additional control measures in Table 15 were selected from a longer list of possible control measures reported in EFSA PLH Panel (2018b). Additional control measures are organisational measures or procedures that directly affect pest abundance.

Table 15: Selected control measures (a full list is available in EFSA PLH Panel, 2018b) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)	Agent(s)
Growing plants in isolation	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses In the case of viruses categorised here, insect-proof greenhouses may isolate plants for planting from vectors. Isolation from natural soil may prevent infestation by in viruliferous nematodes	Spread	SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPMYEV, SVBV and possibly SPV-1 (insect-proof greenhouses); ToRSV (isolation from soil)
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage. The treatments addressed in this information sheet are: a) fumigation; b) spraying/dipping pesticides; c) surface disinfectants; d) process additives; e) protective compounds The points b) and c) could apply to remove viruliferous	Entry	SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPMYEV, SVBV and possibly SPV-1

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)	Agent(s)
	arthropods that may transmit some of the viruses categorised here		
Cleaning and disinfection of facilities, tools and machinery	The physical and chemical cleaning and disinfection of facilities, tools, machinery, transport means, facilities and other accessories (e.g., boxes, pots, pallets, palox, supports, hand tools). The measures addressed in this information sheet are: washing, sweeping and fumigation. These measures may remove viruliferous nematodes and arthropods	Spread	SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPMYEV, SVBV, ToRSV and possibly SPV-1
Physical treatments on consignments or during processing	This information sheet deals with the following categories of physical treatments: irradiation / ionisation; mechanical cleaning (brushing, washing); sorting and grading, and; removal of plant parts (e.g. debarking wood). This information sheet does not address: heat and cold treatment (information sheet 1.14); roguing and pruning (information sheet 1.12) Mechanical cleaning and removal of plant parts (e.g. leaves from fruit consignments may remove viruliferous insects). Establishing a fast entry into a cold chain (for long term storage of plant material or for distribution into the food chain) is a very effective way to prevent spread and establishment of arthropod vectors and the viruses they transmit	Entry	SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPMYEV, SVBV and possibly SPV-1
Roguing and pruning	Roguing is defined as the removal of infested plants and/or uninfested host plants in a delimited area, whereas pruning is defined as the removal of infested plant parts only, without affecting the viability of the plant Removal of infected plants is extremely efficient for all	Establishment and Spread	All viruses categorised here

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)	Agent(s)
	categorised viruses, especially for those not transmitted by vectors. Identification of infected plants in the field may be difficult when exclusively based on visual inspection. Pruning does not apply to the specific case of <i>Fragaria</i>		
Chemical treatments on crops including reproductive material	Chemical treatments on crops may prevent infestations by viruliferous arthropods	Spread	SCFaV, SCrV-3, SCrV-4, StLCV, SPaV, SPMYEV, SVBV and possibly SPV-1
Post-entry quarantine and other restrictions of movement in the importing country	This information sheet covers post-entry quarantine of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; Prohibition of import of relevant commodities into the domestic country Relevant commodities are plants, plant parts and other materials that may carry pests, as either infection, infestation, or contamination Identifying virus-infected plants limits the risks of entry, establishment and spread in the EU	Entry, Establishment and Spread	All viruses categorised here

3.6.1.2. Additional supporting measures

Potential supporting measures are listed in Table 16. They were selected from a list of possible control measures reported in EFSA PLH Panel (2018b). Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance.

Table 16: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018a,b) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/establishment/spread/impact)	Agents
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols.	Entry and Spread	All viruses categorised here

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/establishment/spread/impact)	Agents
	Diagnostic protocols describe the minimum requirements for reliable diagnosis of regulated pests Laboratory testing may identify viruses independently of the presence of symptoms in the host, even if for some agents proven or official diagnostic protocols are currently not available		
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by a National Plant Protection Organization in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. A key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent in the pursued phytosanitary objective. Traceability aims to provide access to any and all information that may help to prove the compliance of consignments with the phytosanitary requirements of importing countries Certified and approved premises may guarantee the absence of the harmful viruses from <i>Fragaria</i> plants and plant parts that are imported for research and/or breeding purposes, from countries allowed to export them into EU MSs	Entry and Spread	All viruses categorised here
Delimitation of Buffer zones	ISPM 5 defines a buffer zone as 'an area surrounding or	Spread	Only for viruses with efficient spread mechanism

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/establishment/spread/impact)	Agents
	adjacent to an area officially delimited for phytosanitary purposes in order to minimise the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate' (ISPM 5). The objectives for delimiting a buffer zone can be to prevent spread from the outbreak area and to maintain a pest free production place, site or area A buffer zone may contribute to reduce the spread of non-EU viruses of <i>Fragaria</i> after entry into the EU		besides plants for planting (e.g. viruses vectored by nematodes and arthropods)
Phytosanitary certificate and plant passport	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) a) export certificate (import into the EU) b) plant passport (EU internal trade)	Entry and Spread	All viruses categorised here
Certification of reproductive material (voluntary/ official)	Certification of reproductive material, when not already implemented, would contribute to reduce the risks associated with entry or spread	Entry and Spread	All viruses categorised here
Surveillance	Official surveillance may contribute to early detection of the viruses categorised here, enabling immediate adoption of control measures if the agents are found to have become established	Spread	All viruses categorised here

3.6.1.3. Biological or technical factors limiting the effectiveness of measures to prevent the entry, establishment and spread of the pest

- Explicitly list in the legislation the viruses that are only mentioned under the general term of 'Non-European viruses',
- Latent infection status for some viruses (FCCV, FCILV, SPMYEV) and uncertain association with symptoms for others (SCrV-3, SCrV-4, SPV-1),
- Asymptomatic phase of virus infection renders visual detection unreliable,
- Absence of proven detection protocol for newly described agents,

- Wide host range for some agents (ToRSV),
- Difficulties to control vectors for soil-borne viruses (ToRSV),
- Lack of information on potential vector(s) for some agents,
- Difficulties to control pollen-mediated transmission for some agents (FCCV, FCILV, SNSV, ToRSV).

3.7. Uncertainty

In the present opinion, viruses for which very different levels of information are available have been analysed in parallel, including recently described agents for which very limited information is available. The main areas of uncertainty affecting the present categorisation efforts concern:

- biological information on the categorised viruses, especially those described recently based on high-throughput sequencing data, is often very limited;
- distribution, both in the EU and outside the EU, of the viruses categorised here, in particular but not only for the recently described ones;
- volume of imported plants for planting, seeds and pollen of hosts;
- interpretation of the legislation;
- pathogenicity of some agents and, for others, the extent to which they would efficiently spread and have impact under conditions prevailing in the EU;
- reliability of available detection methods, which is mainly due to (i) the absence of information on the intraspecific variability of several agents (especially those recently reported) and (ii) the lack of proven detection protocols for a range of viruses.

For each virus, the specific uncertainties identified during the categorisation process are reported in the conclusion tables below.

4. Conclusions

The Panel's conclusions on pest categorisation of non-EU viruses of *Fragaria* are as follows:

SCFaV, StLCV, SNSV, SPaV, SVBV and ToRSV meet all the criteria evaluated by EFSA to qualify as potential Union quarantine pests. FCCV, FCILV and SPMYEV do not meet the criterion of having negative impact in the EU.

For SCrV-3, SCrV-4 and SPV-1, the Panel was unable to conclude on the potential consequences in the EU territory. However, all these agents meet all the other criteria evaluated by EFSA to qualify as Union quarantine pests.

All the viruses categorised in the current opinion do not meet the criteria evaluated by EFSA to qualify as potential RNQPs because they are non-EU viruses explicitly mentioned or considered as regulated in Annex IAI of Directive 2000/29/EC.

The Panel wishes to stress that these conclusions are associated with particularly high uncertainty in the case of viruses discovered only recently and for which the information on distribution, biology and epidemiology are extremely scarce. A consequence of this situation is that for particular viruses the results of the categorisation efforts presented here could be very significantly impacted by the development of novel information.

The Panel conclusions are summarised in Table 17 and reported in detail in Tables 18.1–18.10. In an effort to present these conclusions in a more concise and coherent form, viruses belonging to the same family/genus and with similar evaluation were grouped as follows:

- Table 18.3 shows members of the genera *Closterovirus* and *Crinivirus* (SCFaV and SPaV, respectively) for which the Panel concluded that their introduction and spread is expected to have an impact in the EU.
- Table 18.4 shows members of the genus *Crinivirus* for which the Panel was unable to conclude on their impact (SCrV-3 and SCrV-4)

Table 17: Summary table of Panel's conclusions on pest categorisation of non-EU viruses and viroids of *Fragaria*

VIRUS name	All the criteria evaluated to qualify as potential Union quarantine pest are met	Panel unable to conclude on impact, all the other criteria to qualify as potential Union quarantine pest are met	Criteria evaluated to qualify as potential Union regulated non-quarantine pest	Conclusion table nr
Fragaria chiloensis cryptic virus (FCCV)	No		No	18.1
Fragaria chiloensis latent virus (FCILV)	No		No	18.2
Strawberry chlorotic fleck-associated virus (SCFaV)	Yes		No	18.3
Strawberry crinivirus 3 (SCrV-3)		Yes	No	18.4
Strawberry crinivirus 4 (SCrV-4)		Yes	No	18.4
Strawberry leaf curl virus (StLCV)	Yes		No	18.5
Strawberry necrotic shock virus (SNSV)	Yes		No	18.6
Strawberry pallidosis-associated virus (SPaV)	Yes		No	18.3
Strawberry polerovirus 1 (SPV-1)		Yes	No	18.7
Strawberry pseudo mild yellow edge virus (SPMYEV)	No		No	18.8
Strawberry vein banding virus (SVBV)	Yes		No	18.9
Tomato ringspot virus (ToRSV)	Yes		No	18.10

Tables 18: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Table 18.1: *Fragaria chiloensis* cryptic virus (FCCV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of FCCV is established and diagnostic techniques are available	The identity of FCCV is established and diagnostic techniques are available	Absence of a proven diagnostic protocol
Absence/presence of the pest in the EU territory (Section 3.2)	FCCV is not known to be present in the EU	FCCV is not known to be present in the EU. Therefore, FCCV does	Possible unreported presence in the EU

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
		not meet this criterion to qualify as potential Union RNQP	
Regulatory status (Section 3.3)	FCCV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	FCCV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	FCCV not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	The main pathway, plants for planting of <i>Fragaria</i> spp., is partially regulated by existing legislation. If FCCV were to enter in the EU, it would be able to establish and spread	Plants for planting constitute the main means for long-distance spread for FCCV	– Geographic distribution – Existence of vector(s) – Existence and volume of trade of <i>Fragaria</i> pollen and seeds – Existence of other natural hosts
Potential for consequences in the EU territory (Section 3.5)	Potential consequences are likely nil or very limited since no symptoms in <i>Fragaria</i> have been associated with FCCV infection. Therefore, FCCV does not meet this criterion to qualify as a potential Union quarantine pest	The presence of FCCV on plants for planting of <i>Fragaria</i> is not expected to impact their intended use. Therefore, FCCV does not meet this criterion to qualify as a potential Union RNQP	
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	FCCV does not meet one of the criteria evaluated by EFSA to qualify as a potential Union quarantine pest. It is not known to cause economic or environmental damage	FCCV does not meet two of the criteria evaluated by EFSA to qualify as a potential Union RNQP: (1) it is not present in the EU and can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'; (2) it is not expected to impact the intended use of <i>Fragaria</i> plants for planting	
Aspects of assessment to focus on/scenarios to	The main knowledge gaps or uncertainties identified concern: – Possible unreported presence in the EU; – Biology (host range and vector transmission);		

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
address in future if appropriate	– Existence and volume of trade of <i>Fragaria</i> pollen and seeds. Given the very limited information available on this virus, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.2: *Fragaria chiloensis* latent virus (FCILV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of FCILV is established and diagnostic techniques are available	The identity of FCILV is established and diagnostic techniques are available	Absence of a proven diagnostic protocol
Absence/presence of the pest in the EU territory (Section 3.2)	FCILV is not known to be present in the EU	FCILV is not known to be present in the EU. Therefore, FCILV does not meet this criterion to qualify as potential Union RNQP	Possible unreported presence in the EU
Regulatory status (Section 3.3)	FCILV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	FCILV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	FCILV not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	The main pathway, plants for planting of <i>Fragaria</i> spp., is partially regulated by existing legislation. If FCILV were to enter in the EU, it would be able to establish and spread	Plants for planting constitute the main means for long-distance spread for FCILV	– Geographic distribution – Existence of vectors – Existence and volume of trade of <i>Fragaria</i> pollen and seeds – Existence of other natural hosts
Potential for consequences in the EU territory (Section 3.5)	Potential consequences are likely nil or very limited since no symptoms in strawberry have been associated with FCILV infection. Therefore, FCILV does not meet this criterion to qualify as a potential Union quarantine pest	The presence of FCILV on plants for planting of strawberry is not expected to impact their intended use. Therefore, FCILV does not meet this criterion to qualify as a potential Union RNQP	
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Conclusion on pest categorisation (Section 4)	FCILV does not meet one of the criteria evaluated by EFSA to qualify as a potential Union quarantine pest. It is not known to cause economic or environmental damage	FCILV does not meet two of the criteria evaluated by EFSA to qualify as a potential Union RNQP: (1) it is not present in the EU and can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'; (2) it is not expected to impact the intended use of <i>Fragaria</i> plants for planting	
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – Possible unreported presence in the EU; – Biology (host range and vector transmission); – Existence and volume of trade of <i>Fragaria</i> pollen and seeds. Given the very limited information available on this virus, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.3: Strawberry chlorotic fleck-associated virus (SCFaV) and Strawberry pallidosis associated virus (SPaV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of SCFaV and SPaV is established and diagnostic techniques are available	The identity of SCFaV and SPaV is established and diagnostic techniques are available	Absence of a proven diagnostic protocol
Absence/presence of the pest in the EU territory (Section 3.2)	SCFaV and SPaV are not known to be present in the EU	SCFaV and SPaV are not known to be present in the EU. Therefore, SCFaV and SPaV do not meet this criterion to qualify as potential Union RNQPs	Possible unreported presence in the EU
Regulatory status (Section 3.3)	SCFaV and SPaV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SCFaV and SPaV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SCFaV and SPaV not explicitly mentioned in Directive 2000/29/EC

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	SCFaV and SPaV are able to enter in the EU. The main pathway, plants for planting of <i>Fragaria</i> spp., is partially regulated by existing legislation. The viruliferous vector pathway is also open. If SCFaV and SPaV were to enter in the EU, they would be able to establish and spread	Plants for planting constitute the main means for long-distance spread for these viruses	– Geographic distribution – Existence of other natural hosts
Potential for consequences in the EU territory (Section 3.5)	Introduction and spread of SCFaV and/or SPaV would have a negative impact on the EU strawberry industry	The presence of SCFaV and/or SPaV on strawberry plants for planting would have a negative impact on their intended use	Efficiency of spread and magnitude of the impact under EU conditions
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	SCFaV and SPaV meet all the criteria evaluated by EFSA to qualify as potential Union quarantine pests	SCFaV and SPaV are non-EU viruses (considered as regulated in Annex IAI of Directive 2000/29/EC as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'), and as such, do not meet the EFSA criterion to qualify as a potential Union RNQP	
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – Possible unreported presence in the EU; – Existence of other natural hosts; – Efficiency of spread and magnitude of the impact under EU conditions. Given the very limited information available on these viruses, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.4: Strawberry crinivirus 3 (SCrV-3) and Strawberry crinivirus 4 (SCrV-4)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of SCrV-3 and SCrV-4 is established and diagnostic techniques are available	The identity of SCrV-3 and SCrV-4 is established and diagnostic techniques are available	Absence of a proven diagnostic protocol
Absence/presence of the pest in the EU territory (Section 3.2)	SCrV-3 and SCrV-4 are not known to be present in the EU	SCrV-3 and SCrV-4 are not known to be present in the EU. Therefore, SCrV-3 and SCrV-4 do not meet this criterion to qualify as potential Union RNQPs	Possible unreported presence in the EU
Regulatory status (Section 3.3)	SCrV-3 and SCrV-4 can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SCrV-3 and SCrV-4 can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SCrV-3 and SCrV-4 not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	SCrV-3 and/or SCrV-4 are able to enter, become established and spread in the EU. The main pathway, plants for planting of <i>Fragaria</i> spp., is partially regulated by existing legislation. The viruliferous vector pathway is also open. If SCrV-3 and SCrV-4 were to enter in the EU, they would be able to establish and spread	Plants for planting constitute the main means for long-distance spread for these viruses	– Geographic distribution – Existence of other natural hosts – Efficiency of spread under EU conditions
Potential for consequences in the EU territory (Section 3.5)	Due to limited information, the Panel is unable to conclude on the potential consequences of these viruses in the EU territory	Due to limited information, the Panel is unable to conclude whether the presence of these viruses on <i>Fragaria</i> plants for planting would impact their intended use	
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	With the exception of the criterion regarding the potential for consequences in the EU territory, for which the Panel is unable to conclude (see Section 3.5), SCrV-3 and	SCrV-3 and SCrV-4 are non-EU viruses (considered as regulated in Annex IAI of Directive 2000/29/EC as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L.,	

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
	SCrV-4 meet all the other criteria evaluated by EFSA to qualify as potential Union quarantine pests	<i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.), and as such, do not meet the EFSA criterion to qualify as a potential Union RNQP	
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – Potential consequences in the EU territory, on which the Panel was unable to conclude due to the limited information; – Possible unreported presence in the EU; – Biology (host range); – Efficiency of natural spread under EU conditions. Given the very limited available information on these viruses, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.5: Strawberry leaf curl virus (StLCV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of StLCV is established and diagnostic techniques are available	The identity of StLCV is established and diagnostic techniques are available	Absence of a proven diagnostic protocol
Absence/presence of the pest in the EU territory (Section 3.2)	StLCV is not known to be present in the EU	StLCV is not known to be present in the EU. Therefore, StLCV does not meet this criterion to qualify as a potential Union RNQP	Possible unreported presence in the EU
Regulatory status (Section 3.3)	StLCV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	StLCV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	StLCV not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	StLCV is able to enter, become established and spread in the EU. The main pathway plants for planting of <i>Fragaria</i> spp. is partially regulated by existing legislation. The vectors of StLCV, <i>Bemisia</i>	Plants for planting constitute the main means for long-distance spread for these viruses	– Geographic distribution – Pollen and seed transmission – Existence of other natural hosts

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
	<i>tabaci</i> , is regulated by current legislation. If StLCV were to enter in the EU, it would be able to establish and spread		
Potential for consequences in the EU territory (Section 3.5)	Introduction and spread of StLCV would have a negative impact on the EU strawberry industry	The presence StLCV on plants for planting would have a negative impact on their intended use	Efficiency of spread and magnitude of the impact under EU conditions
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	StLCV meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	StLCV is a non-EU virus (considered as regulated in Annex IAI of Directive 2000/29/EC as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'), and as such, does not meet the EFSA criterion to qualify as a potential Union RNQP	
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – Possible unreported presence in the EU; – Host range; – Efficiency of spread and magnitude of the impact under EU conditions. Given the very limited information available on this virus, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.6: Strawberry necrotic shock virus (SNSV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of SNSV is established and diagnostic techniques are available	The identity of SNSV is established and diagnostic techniques are available	Absence of a proven diagnostic protocol
Absence/presence of the pest in the EU territory (Section 3.2)	SNSV is not known to be present in the EU	SNSV is not known to be present in the EU and therefore does not meet this criterion to qualify as a potential Union RNQP	Possible unreported presence in the EU

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Regulatory status (Section 3.3)	SNSV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SNSV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SNSV not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	SNSV is able to enter, become established and spread in the EU. The main pathway plants for planting of <i>Fragaria</i> spp. is partially regulated by existing legislation. The <i>Rubus</i> pathway of plants for planting is partially regulated. Other potential pathways (other hosts, seeds) may possibly be open. If SNSV were to enter the EU territory, it could become established and spread.	Plants for planting constitute the main means for long-distance spread for SNSV	– Geographic distribution – Existence of vectors – Existence of other natural hosts
Potential for consequences in the EU territory (Section 3.5)	Introduction and spread of SNSV would have a negative impact on the EU strawberry industry and on other crops	The presence of SNSV on plants for planting would have a negative impact on their intended use	Magnitude of the impact under EU conditions
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	SNSV meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	SNSV is a non-EU virus (considered as regulated in Annex IAI of Directive 2000/29/EC as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'), and as such, does not meet the EFSA criterion to qualify as a potential Union RNQP	

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – Possible unreported presence in the EU; – Biology (host range and vector transmission); – Magnitude of the impact under EU conditions. Given the very limited information available on this virus, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.7: Strawberry polerovirus-1 (SPV-1)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of SPV-1 is established and diagnostic techniques are available	The identity of SPV-1 is established and diagnostic techniques are available	Absence of a proven diagnostic protocol
Absence/presence of the pest in the EU territory (Section 3.2)	SPV-1 is not known to be present in the EU	SPV-1 is not known to be present in the EU. Therefore, it does not meet this criterion to qualify as a potential Union RNQP	Possible unreported presence in the EU
Regulatory status (Section 3.3)	SPV-1 can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SPV-1 can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SPV-1 not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	SPV-1 is able to enter, become established and spread in the EU. The main pathway plants for planting of <i>Fragaria</i> spp. is partially regulated by existing legislation. Other potential pathways (vectors) may possibly be open. If SPV-1 were to enter in the EU, it would be able to establish and spread	Plants for planting constitute the main means for long-distance spread for SPV-1	– Geographic distribution – Seed, pollen and vector transmission – Existence of other natural hosts
Potential for consequences in the EU territory (Section 3.5)	Due to limited information, the Panel is unable to conclude on the potential consequences of SPV-1 in the EU territory	Due to limited information, the Panel is unable to conclude whether the presence of SPV-1 on <i>Fragaria</i> plants for planting would	

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
		impact their intended use	
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	With the exception of the criterion regarding the potential for consequences in the EU territory, for which the Panel is unable to conclude (see Section 3.5), SPV-1 meets all the other criteria evaluated by EFSA to qualify as potential Union quarantine pest	SPV-1 is a non-EU virus (considered as regulated in Annex IAI of Directive 2000/29/EC as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'), and as such, does not meet the EFSA criterion to qualify as a potential Union RNQP	
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – Potential consequences in the EU territory, on which the Panel was unable to conclude due to the limited information; – Possible unreported presence in the EU; – Biology (host range, pollen, seed and vector transmission). Given the very limited available information on this virus, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.8: Strawberry pseudo mild yellow edge virus (SPMYEV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of SPMYEV is established and diagnostic techniques are available	The identity of SPMYEV is established and diagnostic techniques are available	Biological indexing is available. Serological tests have been developed, however there is uncertainty about the availability of the antiserum. No molecular detection is available
Absence/presence of the pest in the EU territory (Section 3.2)	SPMYEV is not known to be present in the EU	SPMYEV is not known to be present in the EU. Therefore, it does not meet this criterion to qualify as a potential Union RNQP	Possible unreported presence in the EU

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Regulatory status (Section 3.3)	SPMYEV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SPMYEV can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'	SPMYEV not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	SPMYEV is able to enter, become established and spread in the EU. The main pathway plants for planting of <i>Fragaria</i> spp. is partially regulated by existing legislation. Other potential pathways (vectors) may possibly be open. If SPMYEV were to enter in the EU, it would be able to establish and spread	Plants for planting constitute the main means for long-distance spread for SPMYEV	– Geographic distribution – Seed, pollen and vector transmission – Existence of other natural hosts
Potential for consequences in the EU territory (Section 3.5)	Potential consequences are likely nil or very limited. Therefore, SPMYEV does not meet this criterion to qualify as a potential Union quarantine pest	The presence of SPMYEV on plants for planting of strawberry is not expected to impact their intended use. Therefore, SPMYEV does not meet this criterion to qualify as a potential Union RNQP	
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	SPMYEV does not meet one of the criteria evaluated by EFSA to qualify as a potential Union quarantine pest: it is not known to cause economic or environmental damage	SPMYEV does not meet two of the criteria evaluated by EFSA to qualify as a potential Union RNQP: (1) it is not present in the EU and can be considered as regulated in Annex IAI as 'Non-European viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L.'; (2) it is not expected to impact the intended use of <i>Fragaria</i> plants for planting	

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – Possible unreported presence in the EU; – Biology (host range, seed, pollen and vector transmission). Given the very limited available information on this virus, the development of a full PRA will not allow to resolve the uncertainties attached to the present categorisation until more data become available		

Table 18.9: Strawberry vein banding virus (SVBV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of SVBV is established and diagnostic techniques are available	The identity of SVBV is established and diagnostic techniques are available	No uncertainty
Absence/presence of the pest in the EU territory (Section 3.2)	SVBV has been reported in 5 MSs (Czech Republic, Slovakia, Hungary, Italy and The Netherlands). However, its presence can be considered restricted	SVBV has been reported in 5 MSs (Czech Republic, Slovakia, Hungary, Italy and The Netherlands). However, its presence can be considered restricted. Therefore, SVBV does not meet this criterion to qualify as a potential Union RNQP	More widespread and unreported presence in the EU
Regulatory status (Section 3.3)	SVBV is currently regulated in Annex IAI	SVBV is currently regulated in Annex IAI	No uncertainty
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	SVBV is able to further enter, become established and spread in the EU. The main pathway, plants for planting of <i>Fragaria</i> spp., is partially regulated by existing legislation. The vectors of SVBV (<i>Chaetosiphon fragaefolii</i> , <i>C. thomasi</i> , <i>C. jacobii</i>) are not regulated by current legislation, therefore the vector pathway is also open	Plants for planting constitute the main means for long-distance spread of SVBV	– Geographic distribution – Seed and pollen transmission – Existence of other natural hosts
Potential for consequences in the EU territory (Section 3.5)	Introduction and spread of SVBV would have a negative impact on the EU strawberry industry.	The presence of SVBV on plants for planting would have a negative impact on their intended use	Efficiency of spread and magnitude of the impact under EU conditions
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Conclusion on pest categorisation (Section 4)	SVBV meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest. More severe symptoms are mainly expected in mixed infections, in particular those involving strawberry crinkle virus (SCV), which is present in the EU. However, it should be noted that in the present categorisation the Panel is only assessing whether SVBV would have impact (irrespective of the magnitude), while in a previous categorisation of this virus (EFSA PLH Panel, 2014) the Panel concluded that SVBV would not meet a more stringent criterion (which was used at the time) of having severe impact in the EU.	SVBV is a non-EU virus (regulated in Annex IAI of Directive 2000/29/EC), and, as such, does not meet the EFSA criterion to qualify as a potential Union RNQP	
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – More widespread and unreported presence in the EU; – Biology (host range, seed and pollen transmission). – Efficiency of spread and magnitude of the impact under EU conditions		

Table 18.10: Tomato ringspot virus (ToRSV)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of ToRSV is established and diagnostic techniques are available	The identity of ToRSV is established and diagnostic techniques are available	No uncertainty
Absence/presence of the pest in the EU territory (Section 3.2)	ToRSV has been sporadically and transiently reported from several MSs but its presence is restricted and/or under eradication	ToRSV has been sporadically and transiently reported from several MSs but its presence is restricted and/or under eradication. Therefore, ToRSV does not meet this criterion to qualify as a potential Union RNQP	More widespread presence in the EU

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Regulatory status (Section 3.3)	ToRSV is currently regulated in Annex IAI	ToRSV is currently regulated in Annex IAI	No uncertainty
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	ToRSV is able to enter or further enter, become established and spread in the EU. The <i>Fragaria</i> plants for planting pathway is partially regulated by existing legislation. Entry is also possible on plants for planting of other hosts, on seeds of herbaceous hosts and with viruliferous nematodes	Plants for planting constitute the main means for long-distance spread for ToRSV	– Geographical distribution; – Seed and pollen transmission in woody hosts; – Efficiency of natural spread under EU conditions; – Origin and trade volumes of plants for planting of unregulated host species; – Significance of the seed and pollen pathway given the absence of information on the volume of imported seeds and pollen of non-<i>Fragaria</i> hosts
Potential for consequences in the EU territory (Section 3.5)	Introduction and spread of ToRSV would have a negative impact on the EU strawberry industry and on other crops	The presence of ToRSV on <i>Fragaria</i> plants for planting would have a negative impact on their intended use	Magnitude of the impact under EU conditions
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread into the EU	Certification of planting material for susceptible hosts is the most efficient control method	No uncertainty
Conclusion on pest categorisation (Section 4)	ToRSV meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	ToRSV is a non-EU virus (considered as regulated in Annex IAI of Directive 2000/29/EC), and as such does not meet the EFSA criterion to qualify as a potential Union RNQP	
Aspects of assessment to focus on/scenarios to address in future if appropriate	The main knowledge gaps or uncertainties identified concern: – More widespread presence in the EU; – Origin and trade volumes of plants for planting, seeds and pollen of unregulated host species; – Significance of the seed and pollen pathway given the absence of information on the volume of imported seeds and pollen of other hosts; – Efficiency of natural spread and magnitude of the impact under EU conditions.		

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Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017)
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017)

Measures	Control (of a pest) is defined in ISPM 5 (FAO 2017) as 'Suppression, containment or eradication of a pest population' (FAO, 1995). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance
Pathway	Any means that allows the entry or spread of a pest (FAO, 2017)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017)
Protected zones (PZ)	A Protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017)
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2017)

Abbreviations

DG SANTÉ	Directorate General for Health and Food Safety
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
ICTV	International Committee on Taxonomy of Viruses
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PCR	polymerase chain reaction
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
QP	quarantine pest
RNQP	Regulated non-quarantine pest
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

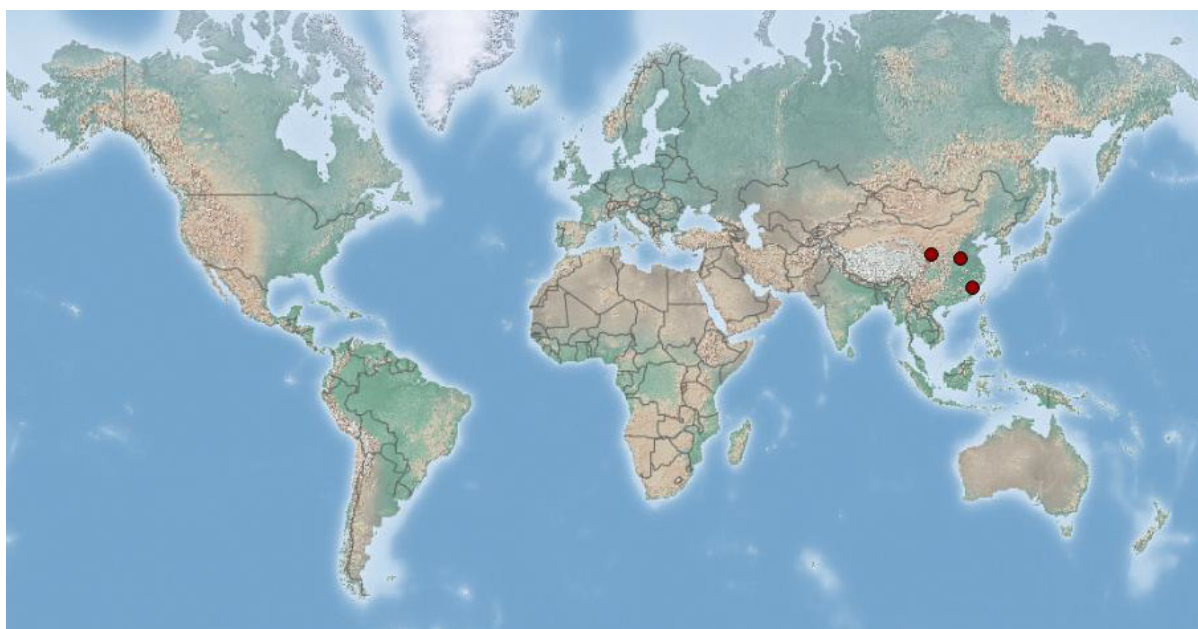
Appendix A – Distribution maps of viruses

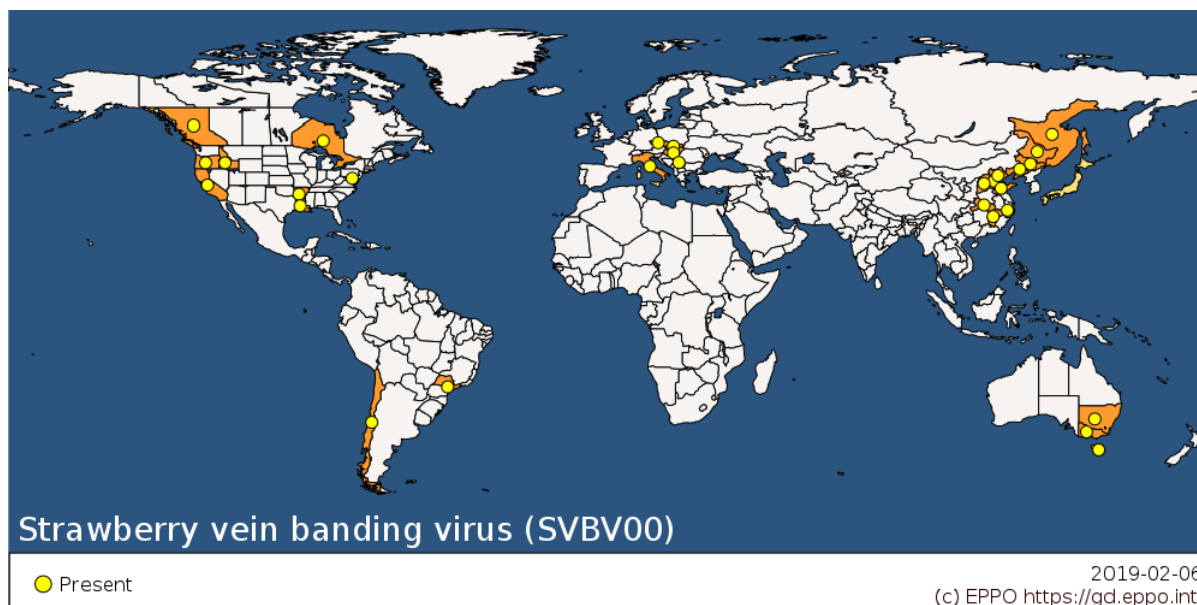
A.1. Distribution map of Strawberry necrotic shock virus (CABI, 2019)

Legend: Red: Present, no further details; Light blue: Widespread



A.2. Distribution map of Strawberry pallidosis-associated virus (CABI, 2019)



A.3. Distribution map of Strawberry vein banding virus (EPPO, 2019)**A.4. Distribution map of Tomato ringspot virus (EPPO, 2019)**