SCIENTIFIC OPINION

Scientific Opinion on the pest categorisation of *Prunus necrotic ringspot virus*[1]

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

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ABSTRACT

The Panel on Plant Health performed a pest categorisation of *Prunus necrotic ringspot virus* (PNRSV) for the European Union (EU) territory. PNRSV is a well-defined virus species of the genus *Ilarvirus* for which the entire genome sequence and molecular detection assays are available. It is transmitted by vegetative multiplication of infected hosts and also via seeds and pollen (both horizontally and vertically) in some of its hosts. PNRSV has a somewhat restricted natural host range, which contains *Prunus* spp., hops, roses and *Rubus ellipticus* (yellow Himalayan raspberry). It is listed on plants of *Rubus* for planting in Annex IIAI of Directive 2000/29EC, probably as a result of confusion with the closely related *Apple mosaic virus*. PNRSV is widely present in the EU, but there are no records on its regulated hosts. It is not expected to be affected by ecoclimatic conditions wherever its hosts are present, and it has the potential to establish in large parts of the EU territory. PNRSV can spread through efficient seed- and pollen-mediated transmission mechanisms and through the movement of vegetatively propagated plants for planting. However, the existence of efficient and widely adopted certification systems for *Prunus* spp. constitutes a limitation to PNRSV spread. Although the virus alone or when in mixed infection can cause significant diseases in some hosts, the actual impact of PNRSV appears to be limited.

KEY WORDS

Apple mosaic virus, biology, *Ilarvirus*, impact, pollen transmission, quarantine pest, seed transmission

[1] On request from the European Commission, Question No EFSA-Q-2014-00284, adopted on 25 September 2014.

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The current European Union plant health regime is established by Council Directive 2000/29/EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community (OJ L 169, 10.7.2000, p. 1).

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

The Commission is currently carrying out a revision of the regulatory status of organisms listed in the Annexes of Directive 2000/29/EC. This revision targets mainly organisms which are already locally present in the EU territory and that in many cases are regulated in the EU since a long time. Therefore it is considered to be appropriate to evaluate whether these organisms still deserve to remain regulated under Council Directive 2000/29/EC, or whether, if appropriate, they should be regulated in the context of the marketing of plant propagation material, or be deregulated. The revision of the regulatory status of these organisms is also in line with the outcome of the recent evaluation of the EU Plant Health Regime, which called for a modernisation of the system through more focus on prevention and better risk targeting (prioritisation).

In order to carry out this evaluation, a recent pest risk analysis is needed which takes into account the latest scientific and technical knowledge on these organisms, including data on their agronomic and environmental impact, as well as their present distribution in the EU territory. In this context, EFSA has already been asked to prepare risk assessments for some organisms listed in Annex IIAII. The current request concerns 23 additional organisms listed in Annex II, Part A, Section II as well as five organisms listed in Annex I, Part A, Section I, one listed in Annex I, Part A, Section II and nine organisms listed in Annex II, Part A, Section I of Council Directive 2000/29/EC. The organisms in question are the following:

Organisms listed in Annex II, Part A, Section II:

- *Ditylenchus destructor* Thorne
- *Circulifer haematoceps*
- *Circulifer tenellus*
- *Helicoverpa armigera* (Hübner)
- *Radopholus similis* (Cobb) Thorne (could be addressed together with the IIAI organism *Radopholus citrophilus* Huettel Dickson and Kaplan)
- *Paysandisia archon* (Burmeister)
- *Clavibacter michiganensis* spp. insidiosus (McCulloch) Davis *et al*.
- *Erwinia amylovora* (Burr.) Winsl. *et al*. (also listed in Annex IIB)
- *Pseudomonas syringae* pv. *persicae* (Prunier *et al*.) Young *et al*.
- *Xanthomonas campestris* pv. *phaseoli* (Smith) Dye
- *Xanthomonas campestris* pv. *pruni* (Smith) Dye
- *Xylophilus ampelinus* (Panagopoulos) Willems *et al*.
- *Ceratocystis fimbriata* f. sp. *platani* Walter (also listed in Annex IIB)
- *Cryphonectria parasitica* (Murrill) Barr (also listed in Annex IIB)
- *Phoma tracheiphila* (Petri) Kanchaveli and Gikashvili
- *Verticillium albo-atrum* Reinke and Berthold
- *Verticillium dahliae* Klebahn
- *Beet leaf curl virus*
- *Citrus tristeza virus* (European isolates) (also listed in Annex IIB)
- Grapevine flavescence dorée MLO (also listed in Annex IIB)

- Potato stolbur mycoplasma
- *Spiroplasma citri* Saglio *et al*.
- *Tomato yellow leaf curl virus*

Organisms listed in Annex I, Part A, Section I:

- *Rhagoletis cingulata* (Loew)
- *Rhagoletis ribicola* Doane
- *Strawberry vein banding virus*
- Strawberry latent C virus
- Elm phloem necrosis mycoplasm

Organisms listed in Annex I, Part A, Section II:

- *Spodoptera littoralis* (Boisd.)

Organisms listed in Annex II, Part A, Section I:

- *Aculops fuchsiae* Keifer
- *Aonidiella citrina* Coquillet
- *Prunus necrotic ringspot virus*
- *Cherry leafroll virus*
- *Radopholus citrophilus* Huettel Dickson and Kaplan (could be addressed together with IIAII organism *Radopholus similis* (Cobb) Thorne)
- *Scirtothrips dorsalis* Hendel
- *Atropellis* spp.
- *Eotetranychus lewisi* McGregor
- *Diaporthe vaccinii* Shaer.

TERMS OF REFERENCE AS PROVIDED BY THE EUROPEAN COMMISSION

EFSA is requested, pursuant to Article 29(1) and Article 22(5) of Regulation (EC) No 178/2002, to provide a pest risk assessment of *Ditylenchus destructor* Thorne, *Circulifer haematoceps, Circulifer tenellus, Helicoverpa armigera* (Hübner), *Radopholus similis* (Cobb) Thorne, *Paysandisia archon* (Burmeister), *Clavibacter michiganensis* spp. *insidiosus* (McCulloch) Davis *et al*, *Erwinia amylovora* (Burr.) Winsl. *et al, Pseudomonas syringae pv. persicae* (Prunier *et al)* Young *et al. Xanthomonas campestris* pv. *phaseoli* (Smith) Dye, *Xanthomonas campestris* pv. *pruni* (Smith) Dye, *Xyîophilus ampelinus* (Panagopoulos) Willems *et al, Ceratocystis fimbriata* f. sp. *platani* Walter, *Cryphonectria parasitica* (Murrill) Barr, *Phoma tracheiphila* (Petri) Kanchaveli and Gikashvili, *Verticillium albo-atrum* Reinke and Berthold, *Verticillium dahliae* Klebahn, *Beet leaf curl virus*, *Citrus tristeza virus* (European isolates), Grapevine flavescence dorée MLO, Potato stolbur mycoplasma, *Spiroplasma citri* Saglio *et al, Tomato yellow leaf curl virus, Rhagoletis cingulata* (Loew), *Rhagoletis ribicola* Doane, *Strawberry vein banding virus*, Strawberry latent C virus, Elm phloem necrosis mycoplasma, *Spodoptera littoralis* (Boisd.), *Aculops fuchsiae* Keifer, *Aonidiella citrina* Coquillet, *Prunus necrotic ringspot virus*, *Cherry leafroll virus*, *Radopholus citrophilus* Huettel Dickson and Kaplan (to address with the IIAII *Radopholus similis* (Cobb) Thorne), *Scirtothrips dorsalis* Hendel, *Atropellis* spp., *Eotetranychus lewisi* McGregor and *Diaporthe vaccinii* Shaer., for the EU territory.

In line with the experience gained with the previous two batches of pest risk assessments of organisms listed in Annex II, Part A, Section II, requested to EFSA, and in order to further streamline the preparation of risk assessments for regulated pests, the work should be split in two stages, each with a specific output. EFSA is requested to prepare and deliver first a pest categorisation for each of these 38 regulated pests (step 1). Upon receipt and analysis of this output, the Commission will inform EFSA for which organisms it is necessary to complete the pest risk assessment, to identify risk reduction options and to provide an assessment of the effectiveness of current EU phytosanitary requirements (step 2). *Clavibacter michiganensis* spp. *michiganensis* (Smith) Davis *et al.* and *Xanthomonas campestris* pv. *vesicatoria* (Doidge) Dye, from the second batch of risk assessment requests for Annex IIAII organisms requested to EFSA (ARES(2012)880155), could be used as pilot cases for this approach, given that the working group for the preparation of their pest risk assessments has been constituted and it is currently dealing with the step 1 "pest categorisation". This proposed modification of previous request would allow a rapid delivery by EFSA by May 2014 of the first two outputs for step 1 "pest categorisation", that could be used as pilot case for this request and obtain a prompt feedback on its fitness for purpose from the risk manager's point of view.

As indicated in previous requests of risk assessments for regulated pests, in order to target its level of detail to the needs of the risk manager, and thereby to rationalise the resources used for their preparation and to speed up their delivery, for the preparation of the pest categorisations EFSA is requested, in order to define the potential for establishment, spread and impact in the risk assessment area, to concentrate in particular on the analysis of the present distribution of the organism in comparison with the distribution of the main hosts and on the analysis of the observed impacts of the organism in the risk assessment area.

ASSESSMENT

1. Introduction

1.1. Purpose

This document presents a pest categorisation prepared by the EFSA Scientific Panel on Plant Health (hereinafter referred to as the Panel) for the species *Prunus necrotic ringspot virus* (PNRSV) in response to a request from the European Commission.

1.2. Scope

The risk assessment area is the territory of the European Union (hereinafter referred to as the EU) with 28 Member States (hereinafter referred to as MSs), restricted to the area of application of Council Directive 2000/29/EC.

2. Methodology and data

2.1. Methodology

The Panel performed the pest categorisation for PNRSV following guiding principles and steps presented in the EFSA Guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010) and as defined in the International Standards for Phytosanitary Measures No 11 (FAO, 2013) and ISPM No 21 (FAO, 2004).

In accordance with the Guidance on a harmonised framework for pest risk assessment in the EU (EFSA PLH Panel, 2010), this work is initiated as result of the review or revision of phytosanitary policies and priorities. As explained in the background of the European Commission request, the objective of this mandate is to provide updated scientific advice to the European risk managers for their evaluation of whether these organisms listed in the Annexes of the Directive 2000/29/EC still deserve to remain regulated under Council Directive 2000/29/EC, or whether they should be regulated in the context of the marketing of plant propagation material, or be deregulated. Therefore, to facilitate the decision making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for quarantine pest according to ISPM 11 (FAO, 2013) but also for regulated non-quarantine pest according to ISPM 21 (FAO, 2004) and includes additional information required as per 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 1 presents the ISPM 11 (FAO, 2013) and ISPM 21 (FAO, 2004) pest categorisation criteria against which the Panel provides its conclusions. It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regards to the principle of separation between risk assessment and risk management (EFSA founding regulation[4]), 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, in agreement with the Guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010).

[4] 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.

Table 1: International Standards for Phytosanitary Measures ISPM 11 (FAO, 2013) and ISPM 21 (FAO, 2004) pest categorisation criteria under evaluation

Pest categorisation criteria	ISPM 11 for being a potential quarantine pest	ISPM 21 for being a potential regulated non-quarantine pest
Identity of the pest	The identity of the pest should be clearly defined to ensure that the assessment is being performed on a distinct organism, and that biological and other information used in the assessment is relevant to the organism in question. If this is not possible because the causal agent of particular symptoms has not yet been fully identified, then it should have been shown to produce consistent symptoms and to be transmissible	The identity of the pest is clearly defined
Presence (ISPM 11) or absence (ISPM 21) in the PRA area	The pest should be **absent from all or a defined part of the PRA area**	The pest is **present** in the PRA area
Regulatory status	If the pest is present but not widely distributed in the PRA area, it should be under official control or expected to be under official control in the near future	The pest is under official control (or being considered for official control) in the PRA area with respect to the specified plants for planting
Potential for establishment and spread in the PRA area	The PRA area should have ecological/climatic conditions including those in protected conditions suitable for the establishment and spread of the pest and, where relevant, host species (or near relatives), alternate hosts and vectors should be present in the PRA area	–
Association of the pest with the plants for planting and the effect on their intended use	–	Plants for planting are a pathway for introduction and spread of this pest
Potential for consequences (including environmental consequences) in the PRA area	There should be clear indications that the pest is likely to have an unacceptable economic impact (including environmental impact) in the PRA area	–
Indication of impact(s) of the pest on the intended use of the plants for planting	–	The pest may cause severe economic impact on the intended use of the plants for planting
Conclusion	If it has been determined that the pest has the potential to be a quarantine pest, the PRA process should continue. If a pest does not fulfil all of the criteria for a quarantine pest, the PRA process for that pest may stop. In the absence of sufficient information, the uncertainties should be identified and the PRA process should continue	If a pest does not fulfil all the criteria for an regulated non-quarantine pest, the PRA process may stop

In addition, in order to reply to the specific questions listed in the terms of reference, three issues are specifically discussed only for pests already present in the EU: the analysis of the present EU distribution of the organism in comparison with the EU distribution of the main hosts, the analysis of the observed impacts of the organism in the EU and the pest control and cultural measures currently implemented in the EU.

The Panel will not indicate in its conclusions of the pest categorisation whether to continue the risk assessment process as it is clearly stated in the terms of reference that at the end the pest categorisation the European Commission will indicate if further risk assessment work is required following their analysis of the Panel's scientific opinion.

2.2. Data

2.2.1. Literature search

A literature search on PNRSV was conducted at the beginning of the mandate. The search was conducted for the scientific name of the pest together with the most frequently used common names on the ISI Web of Knowledge database. Further references and information were obtained from experts, from citations within the references as well as from grey literature.

2.2.2. Data collection

To complement the information concerning the current situation of the pest provided by the literature and online databases on pest distribution, damage and management, the PLH Panel sent a short questionnaire on the current situation at country level, based on the information available in the European and Mediterranean Plant Protection Organization (EPPO) Plant Quarantine Retrieval (PQR) system, to the National Plant Protection Organisation (NPPO) contacts of the 28 EU MSs, and of Iceland and Norway. Iceland and Norway are part of the European Free Trade Association (EFTA) and are contributing to EFSA data collection activities, as part of the agreements EFSA has with these two countries. A summary of the pest status based on EPPO PQR and NPPO replies is presented in Table 2.

Information on the distribution of the main host plants was obtained from the EUROSTAT database.

3. Pest categorisation

3.1. Identity and biology of *Prunus necrotic ringspot virus*

3.1.1. Taxonomy

Prunus necrotic ringspot virus (PNRSV) was first described in the USA by Cochran and Hutchins (1941) as the agent responsible for a ringspot disease of peach and was later given its name by Allen (1963). A comprehensive description of PNRSV was made by Fulton in 1970 and a recent review of this virus was prepared by Hammond in 2011. PNRSV is a well-described and well-characterised virus. It is a member of the subgroup 3 of the genus *Ilarvirus* in the family *Bromoviridae* (Bujarski et al., 2012). Complete sequences are available for the three genomic RNAs of PNRSV and complete or, more frequently, partial genomic sequences are available for a range of isolates.

3.1.2. Biology of *Prunus necrotic ringspot virus*

PNRSV genomic RNAs are encapsidated in icosahedral particles of ca. 22–30 nm diameter (Fulton, 1970; Bujarski et al., 2012). It is a graft transmissible agent (Fulton, 1970; Hammond, 2011) that, like other plant viruses, is transmitted through vegetative multiplication of infected host plants. In addition, there is evidence that PNRSV is transmitted via seeds and pollen at variable rates in several natural hosts, including *Prunus* spp., hops (*Humulus* spp.) and roses (*Rosa* spp.), as well as in some experimental hosts such as *Cucurbita maxima* (reviewed Card et al., 2007; Hammond, 2011). In at least some of these hosts, pollen transmission is both vertical (resulting in infected seeds and, upon

germination, seedlings) and horizontal (resulting in infection of the pollinated mother plant). There is also evidence that PNRSV is vertically transmitted by pollen (resulting in infection of the pollinated plant) in some *Prunus* spp. hosts, and in particular in cherry (Card et al., 2007; Hammond, 2011). PNRSV can be transmitted to experimental herbaceous hosts by mechanical inoculation, but this mechanism is unlikely to be of significance under natural conditions.

Despite early reports suggesting that PNRSV might be transmitted by mites or by nematodes, more recent studies dispelled these hypotheses (Fulton, 1970; Hammond, 2011). On the other hand, there is evidence that thrips, and in particular the western flower thrips (*Frankliniella occidentalis*) and *Thrips tabaci*, may facilitate the pollen-mediated transmission of PNRSV via their feeding on infected pollen (Greber et al., 1992; Milne and Walter, 2003; Hammond, 2011). However, the contribution of thrips to the spread of PNRSV in *Prunus* spp. orchards remains to be precisely determined (Hammond, 2011).

PNRSV has a rather limited natural host range, which comprises a number of *Prunus* species, including all cultivated species, hops (*Humulus* spp.) and roses (*Rosa* spp.) (Fulton, 1970; Hammond, 2011). In addition, an instance of natural infection of *Rubus ellipticus* (yellow Himalayan raspberry) by PNRSV has been reported in India (Sharma et al., 1998). The experimental host range of PNRSV comprises plants of more than 21 dicotyledonous families (Fulton, 1970).

3.1.3. Intraspecific diversity

There is evidence for substantial biological, serological and molecular variability within PNRSV (reviewed in Hammond, 2011). Depending on the isolate, mild or more severe symptoms (so-called rugose mosaic symptoms) may be observed in infected cherry trees. PNRSV isolates from rugose mosaic-showing trees could be separated into three serotypes (Mink et al., 1987). Phylogenetic analyses involving RNA3 sequences from a number of isolates failed to identify significant correlations among molecular variability of the viruses, severity of symptoms, host plants and geographical origin (reviewed in Hammond, 2011, and references therein). However, analysis of PNRSV isolates from rose indicated that the most frequent serotype in rose was different from that in *Prunus*, suggesting that there may exist some level of host adaptation or barriers to interspecific transmission (Moury et al., 2001).

3.1.4. Detection and identification of *Prunus necrotic ringspot virus*

PNRSV can be detected by biological indexing in either woody (grafting) or herbaceous (mechanical inoculation) hosts (Fulton, 1970; Hammond, 2011). However, such techniques are cumbersome and frequently lack sensitivity; therefore, other detection assays are generally used. Despite the limited serological cross-reactions observed between PNRSV and *Apple mosaic virus* (ApMV) (Fulton, 1968; Fulton, 1970), serological assays, in particular enzyme-linked immunosorbent assays (for which commercial kits are available), can be used to detect PNRSV. Molecular detection assays based on molecular hybridisation (Herranz et al., 2005) or on reverse transcription polymerase chain reaction are also available (Rowhani et al., 1995; Hammond et al., 1999; Marbot et al., 2003; Sánchez-Navarro et al., 2005; reviewed in Hammond, 2011) and permit reliable detection of the virus.

3.2. Current distribution of *Prunus necrotic ringspot virus*

3.2.1. Global distribution of *Prunus necrotic ringspot virus*

PNRSV has been reported from a very wide range of countries and from all continents (Figure 1) and is common and widespread in its *Prunus* spp. hosts (Hammond, 2011). In particular, the virus has been reported from the following non-EU European countries: Albania, Bosnia and Herzegovina, Moldova, Montenegro, Serbia, Turkey and Ukraine (EPPO PQR, 2012). Given that it does not always induce conspicuous symptoms, the virus might be more widely distributed than indicated by the available reports.

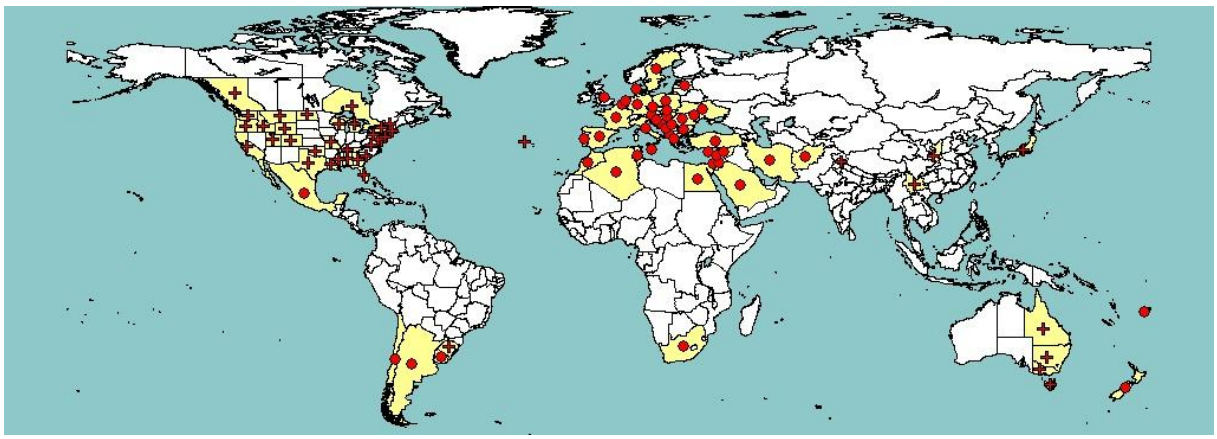

Figure 1: Global distribution map for *Prunus necrotic ringspot virus* (extracted from EPPO PQR, version 5.3.1, accessed in June 2014). Red circles represent pest presence as national records and red crosses represent pest presence as sub-national records (note that this figure combines information from different dates, some of which could be out of date)

3.2.2. Distribution of *Prunus necrotic ringspot virus* in the EU

PNRSV is reported from a wide range of EU MSs (22 MSs, see Table 2); however, as stated above, it should be considered that PNRSV is probably under-reported, given the limited symptoms it can cause in some hosts. There are no EU records of PNRSV occurrence in its regulated *Rubus* spp. hosts, and only four records of PNRSV interception in the EUROPHYT database (for more information, see also EFSA PLH Panel, 2013). All of these records concern shipments from the USA of *Prunus* spp. pollen for pollination purposes.

Table 2: Current distribution of *Prunus necrotic ringspot virus* in the 28 EU MSs, Iceland and Norway, based on answers received via email from the NPPOs or, in absence of reply, on information from EPPO PQR

Country	NPPO answer	NPPO comments
Austria	Present, no details	
Belgium	Present, no details	No surveys are carried out, no specific information for *Rubus* is available. *Prunus necrotic ringspot virus* on *Rubus* is considered as *Apple mosaic virus* following EPPO PQR5 and the EPPO datasheet. The status of this pest is also "Present, no details" with the same remark (no surveys are carried out, no specific information for *Rubus* is available)
Bulgaria	Present, restricted distribution	
Croatia	Present, no further data	Found on peach (*Prunus persica*), sweet cherry (*Prunus avium*), sour cherry (*Prunus cerasus*) and rose (*Rosa* spp.)
Cyprus	Present, widespread	
Czech Republic	Present, no details	We are not able to specify the status, as the only relevant publication available is Sucha and Svobodova (2010)
Denmark	Present, no details	
Estonia	–	
Finland	Absent, no pest records	
France	Present, widespread	
Germany	On *Rubus*: no records	

Country	NPPO answer	NPPO comments
	On other hosts: present, widespread	
Greece [(a)]	Present, widespread	
Hungary	Present in all parts of the country On *Rubus*: absent, no pest records	
Ireland	Absent, no pest records	
Italy	Present, widespread	
Latvia [(a)]	Present, no details	
Lithuania [(a)]	–	
Luxembourg [(a)]	–	
Malta	Present, no details	
Netherlands	Present, not in *Rubus* spp.	
Poland	Present, few occurrences	In 2009–2013, in total, 2 426 visual inspections were carried out by the SPHSIS on *Prunus* plants for planting. In addition, 2 072 samples were tested in the laboratory. In total, the virus was detected in seven samples (collected from *Prunus avium* plants)
Portugal	Present	
Romania [(a)]	Present, no details	
Slovak Republic	Present, no details	
Slovenia	Absent, no pest records on *Rubus* L.	
Spain	Present, widespread	
Sweden	Present	
UK	Present, in all parts of the area	
Iceland [(a)]	–	
Norway [(a)]	–	

–, no information available.
(a): When no information was made available to EFSA, the pest status in the EPPO PQR (2012) was used.

3.3. Regulatory status in the EU

3.3.1. Council Directive 2000/29/EC

3.3.1.1. Harmful organism

PNRSV is a regulated harmful organism in the EU and is currently listed in Annex II, Part A, Section I of Council Directive 2000/29/EC (Table 3).

Table 3: *Prunus necrotic ringspot virus* in Council Directive 2000/29/EC

Annex II, Part A	Harmful organisms whose introduction into, and spread within, all Member States shall be banned if they are present on certain plants or plant products	
Section I	Harmful organisms not known to occur in the community and relevant for the entire community	
(d)	Virus and virus-like organisms	
	Species	**Subject of contamination**
12	Prunus necrotic ringspot virus [(a)]	Plants of *Rubus* L., intended for planting

(a): Prunus necrotic ringspot virus is not present in *Rubus* L. in the Community.

3.3.1.2. Regulated hosts of *Prunus necrotic ringspot virus*

PNRSV has more potential hosts than those for which it is regulated in Annex IIAI (see section 3.4.1). In addition, it is important to mention that other specific commodities (e.g. pollen and seed) could also be a pathway of introduction of the pest in the risk assessment area.

Below, specific requirements of Annex IV and Annex V of Council Directive 2000/29/EC are presented for only the host plants and commodities regulated for PNRSV in Annex IIAI (Table 4).

Table 4: *Prunus necrotic ringspot virus* host plants in Council Directive 2000/29/EC

Annex IV, Part A	Special requirements which must be laid down by all Member States for 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 outside the Community	
	Plants, plant products and other objects	**Special requirements**
24	Plants of *Rubus* L. intended for planting, originating in countries where harmful organisms are known to occur on *Rubus* L. The relevant harmful organism is Prunus necrotic ringspot virus	Without prejudice to the requirements applicable to the plants, listed in Annex IV(A)(I)(19.2), (a) the plants shall be free from aphids, including their eggs (b) official statement that: (aa) the plants 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 relevant harmful organisms using appropriate indicators for equivalent methods and has been found free, in these tests, from those harmful organisms (bb) 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
Annex V	Plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community—in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community	
Part A	Plants, plant products and other objects originating in the Community	
Section I	Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community and which must be accompanied by a plant passport	
2	Plants, plant products and other objects produced by producers whose production and sale is authorised to persons professionally engaged in plant production, other than those plants, plant products and other objects which are prepared and ready for sale to the final consumer, and for which it is ensured by the responsible official bodies of the Member States, that the production thereof is clearly separate from that of other products	
2.1	Plants intended for planting other than seeds of the genera […] *Rubus* L.	
Part B	Plants, plant products and other objects originating in territories, other than those territories referred to in Part A	
Section I	Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community	
1	Plants, intended for planting, other than seeds but including seeds of […] *Rubus* L.	

3.3.2. Marketing directives

Host plants of PNRSV that are regulated in Annex IIAI of Council Directive 2000/29/EC are explicitly mentioned in the following marketing directive:

- Council Directive 2008/90/EC[5]

3.4. Elements to assess the potential for establishment and spread in the EU

3.4.1. Host range

The natural host range of PNRSV appears to be rather limited. It has been reported in a number of *Prunus* species including all cultivated species such as peach, cherry, almond and plum. It has also been reported in hops (*Humulus* spp.) and in roses (*Rosa* spp.) (reviewed in Fulton, 1970; Hammond, 2011). However, the experimental host range of PNRSV is fairly wide and includes hosts in 21 dicotyledonous genera (reviewed in Fulton, 1970; Hammond, 2011).

Remarkably, despite the fact that PNRSV is listed on *Rubus* spp. plants for planting in Directive 2000/29/EC, the Panel was only able to identify a single report of PNRSV in a *Rubus* species, *Rubus ellipticus* (yellow Himalayan raspberry) from India (Sharma et al., 1998). This species is not cultivated or reported in the EU (CAB International, 2014), but is considered an invasive alien species in several regions of the world. There is no information on natural infection of raspberry (*R. idaeus*) or of blackberry (*R. fruticosus*) by PNRSV.

In contrast to PNRSV, ApMV has been reported frequently in *Rubus* spp. (Baumann et al., 1982, 1984, 1988; Stace-Smith and Shier, 1989; Sokmen et al., 2005; Medina et al., 2006; Citir and Ilbagi, 2008; Paunovic et al., 2011; Petrzik and Lenz, 2011). ApMV is a distinct species (Fulton, 1972; Paunovic et al., 2011; Petrzik and Lenz, 2011) but a close and serologically cross-reacting relative of PNRSV (Fulton, 1968, 1970). These cross-reactions may have led to a misidentification of the actual virus that is present and, therefore, to the listing of PNRSV for *Rubus* spp. hosts. Indeed, the distinction between PNRSV and ApMV as two distinct species was gradually acquired as characterisation techniques and better diagnostic assays became available.

3.4.2. EU distribution of main host plants

The natural host range of PNRSV (see section 3.4.1) includes cultivated and wild *Prunus* spp., hops and roses, all of which are widely cultivated in the EU (for some of them, see detailed data in Table 5).

Table 5: Area of peach, cherry and hop production in the EU in 2011 according to the Eurostat database (crop products—annual data [apro_cpp_crop]—extracted on 11 August 2014)

Member State	Area of production (in 1 000 ha)		
	Peach	Cherry	Hop
Austria	0.2	0.3	0.2
Belgium	–	1.2	0.2
Bulgaria	4.2	9.4	0
Croatia	1.4	3.8	0
Cyprus	0.3	0.3	–
Czech Republic	0.7	2.6	4.6
Denmark	0	1.5	–
Estonia	–	0	–
Finland	–	0	–
France	6.6	9.7	0.7
Germany	0	8.2	18.6

[5] Council Directive 2008/90/EC of 29 September 2008 on the marketing of fruit plant propagating material and fruit plants intended for fruit production. OJ L 267/8, 8.10.2008, p. 8–22.

Member State	Area of production (in 1 000 ha)		
	Peach	Cherry	Hop
Greece	32.3	9.9	0
Hungary	6.7	17.7	–
Ireland	–	–	–
Italy	54.9	29.4	–
Latvia	–	0.1	0
Lithuania	–	0.8	0
Luxembourg	–	0	–
Malta	0	–	–
Netherlands	–	0.7	–
Poland	3.5	45.5	1.6
Portugal	3.7	5.7	0
Romania	1.7	6.9	0.2
Slovakia	0.5	0	0.2
Slovenia	0.5	0.1	1.4
Spain	50.8	25	0.5
Sweden	–	0	–
UK	–	0	0
EU-28	166.6	174.8	–

–, no data available in Eurostat.

3.4.3. Analysis of the potential distribution of *Prunus necrotic ringspot virus* in the EU

As is the case for other plant viruses, PNRSV is not expected to be significantly affected by local ecoclimatic conditions, as long as these are suitable for the development of its host plants. Given the wide distribution of its host plants in Europe, it can be considered that PNRSV has the potential to establish in large parts of the EU territory.

3.4.4. Spread capacity

PNRSV has the potential to spread both through pollination and seed production in its natural or cultivated hosts and through the movement of plants for planting of the various host species that are vegetatively propagated.

For some of these hosts (*Prunus* spp.), the existence of efficient and widely adopted voluntary certification systems, however, constitutes a strong limitation to the spread of PNRSV through the plants for planting pathway.

3.5. Elements to assess the potential for consequences in the EU

3.5.1. Potential effects of *Prunus necrotic ringspot virus*

PNRSV causes foliar symptoms in the form of rings, green or yellow spots and chlorotic patterns in many of its *Prunus* spp. hosts. Occasionally, these symptoms can also become necrotic with a loss of the necrotised areas resulting in "shot-hole"-type symptoms. In addition, PNRSV may impact fruit growth (by up to 10–30 %) and yield (by up to 20–60 %) and also delay fruit maturity (Saunier, 1972). It may also affect plants for planting in nurseries by reducing bud-take and tree survival (Topchiiska, 1983). As is common for viruses, symptom severity is affected by virus isolate and host species and variety (Howell and Mink, 1988; Mink et al., 1987; Lang and Howell, 2001). It appears, for example, that, in cherry, some PNRSV isolates cause only mild symptoms or even asymptomatic infections (Mink and Aichele, 1984). In addition, synergistic effects from mixed infections between PNRSV and other common *Prunus*-infecting viruses, such as *Prune dwarf virus* have been reported (reviewed in Hammond, 2011).

In roses, PNRSV causes leaf mosaic, and, in hops, infection is either symptomless or results in discoloured rings, bands or mosaic (Fulton, 1970). The impact of infection on production in these hosts is, however, poorly documented.

Overall, despite considerable uncertainties, it is clear that at least some isolates of PNRSV have the potential to cause diseases with significant impacts on at least some of their *Prunus* spp. hosts. Given that most *Rubus* spp. do not appear to be natural hosts (with the possible exception of *R. ellipticus*), the potential effects of PNRSV infection in cultivated *Rubus* species appear non-existent or negligible.

There are no identified environmental consequences of PNRSV infection.

3.5.2. Observed impact of *Prunus necrotic ringspot virus* in the EU

PNRSV is a common virus in *Prunus* spp. crops (Hammond, 2011). It is present in a wide range of EU MSs and its pollen-mediated mode of dissemination renders its control difficult. On the other hand, the severity of symptoms varies greatly owing to virus isolates and host varieties. In addition, the existence of voluntary certification schemes for *Prunus* spp. reduces the impact of PNRSV by ensuring that new orchards can be planted with healthy materials. Overall, the impact of PNRSV, albeit difficult to assess, is considered to be limited in *Prunus* spp. hosts and limited or negligible in hops and roses. Given the absence of records in the EU and the strong doubts about the potential host status of European *Rubus* species, there is no observed impact of PNRSV on its regulated *Rubus* spp. hosts.

3.6. Currently applied control methods in the EU

For *Prunus* spp., the existence of voluntary certification schemes significantly reduces the risk and impact of PNRSV.

Thermotherapy alone or in combination with chemotherapy or *in vitro* meristem-tip culture has been shown to effectively eliminate PNRSV from infected hosts and to allow the production of healthy plants (Deogratias et al., 1989).

3.7. Uncertainty

In the near absence of records, it is uncertain if regulated *Rubus* spp. could indeed be natural hosts for PNRSV. There are some uncertainties about the efficiency of seed and pollen transmission of PNRSV in its hosts and about the precise prevalence of PNRSV in its various hosts in the different EU MSs. There are significant uncertainties about the precise impact of PNRSV on its hosts in the various EU MSs.

CONCLUSIONS

The Panel summarised in Table 6 below its conclusions on the key elements addressed in this scientific opinion in consideration of the pest categorisation criteria defined in ISPM 11 and ISPM 21 and of the additional questions formulated in the terms of reference.

Table 6: The Panel's conclusions on the pest categorisation criteria defined in the International Standards for Phytosanitary Measures (ISPM) No 11 and No 21 and on the additional questions formulated in the terms of reference (ToR)

Criterion of pest categorisation	**Panel's conclusions on ISPM 11 criterion** *Provide answers to the questions in the column below*	**Panel's conclusions on ISPM 21 criterion** *Provide answers to the questions in the column below*	**List of main uncertainties** *List key uncertainties*
Identity of the pest	*Is the identity of the pest clearly defined? Do clearly discriminative detection methods exist for the pest?* PNRSV is a well-characterised virus and its taxonomy is clear. Reliable		Only very limited uncertainties

Criterion of pest categorisation	Panel's conclusions on ISPM 11 criterion *Provide answers to the questions in the column below*	Panel's conclusions on ISPM 21 criterion *Provide answers to the questions in the column below*	List of main uncertainties *List key uncertainties*
	detection and identification tests are available		
Absence/presence of the pest in the risk assessment area	*Is the pest absent from all or a defined part of the risk assessment area?* PNRSV is widely present in the EU	*Is the pest present in the risk assessment area?* PNRSV is widely present in the EU	Some uncertainties exist on the precise prevalence and distribution
Regulatory status	*Mention in which annexes of 2000/29/EC and the marketing directives the pest and associated hosts are listed without further analysis* *Indicate also whether the hosts and/or commodities for which the pest is regulated in AIIAI or II are comprehensive of the host range* PNRSV is listed in Annex IIAI of Directive 2000/29EC on *Rubus* spp. plants for planting, which do not appear to belong to the natural host range, with the exception of *Rubus ellipticus*, a wild species from the Himalayan region. PNRSV is not listed on its known natural hosts		Uncertainties if *Rubus* species other than *R. ellipticus* can be natural hosts
Potential establishment and spread	*Does the risk assessment area have ecological conditions (including climate and those in protected conditions) suitable for the establishment and spread of the pest?* *And, where relevant, are host species (or near relatives), alternate hosts and vectors present in the risk assessment area?* PNRSV is already widely present in the EU. It is not expected to be affected by ecoclimatic conditions wherever its hosts are able to develop PNRSV has the potential to spread both through pollination and seed production in at least some of its hosts and through the movement of plants for planting	*Are plants for planting a pathway for introduction and spread of the pest?* PNRSV affects a range of vegetatively propagated hosts and can be associated with the plants for planting pathway	Some uncertainties exist on efficiency of pollen-mediated spread in some hosts
Potential for consequences in the risk assessment area	*What are the potential for consequences in the risk assessment area?* *Provide a summary of impact in terms of yield and quality losses and environmental consequences* The potential impact is significant in *Prunus* spp. hosts, is more limited in other natural hosts (hops, roses) and is non-existent in the regulated *Rubus* spp. hosts. However, the actual impact appears to be limited No PNRSV environmental impact is clearly identified	*If applicable, is there indication of impact(s) of the pest as a result of the intended use of the plants for planting?* The potential impact is significant in *Prunus* spp. hosts, is more limited in other natural hosts (hops, roses) and is non-existent in the regulated *Rubus* spp. hosts. However, the actual impact appears to be limited No PNRSV environmental impact is clearly identified	Significant uncertainties exist on the actual impact of PNRSV in many of its hosts
Conclusion on pest categorisation	*Provide an overall summary of the above points* PNRSV is a well-characterised virus, which is not regulated in any of its important hosts. It is widely present in the EU and is not expected to be affected by ecoclimatic conditions,	*Provide an overall summary of the above points* PNRSV is widely present in the EU. The virus affects a range of vegetatively propagated hosts and can be associated with the plants for	Uncertainties exist on the prevalence and distribution of PNRSV, on the efficiency of pollen-mediated

Criterion of pest categorisation	Panel's conclusions on ISPM 11 criterion *Provide answers to the questions in the column below*	Panel's conclusions on ISPM 21 criterion *Provide answers to the questions in the column below*	List of main uncertainties *List key uncertainties*
	wherever its hosts are able to develop. Given its pollen-mediated spread mechanism, there are few areas of its potential range where it is expected to be absent Although difficult to evaluate, the actual impact of PNRSV appears to be limited. No PNRSV environmental impact is identified	planting pathway Although difficult to evaluate, the actual impact of PNRSV appears to be limited. No PNRSV environmental impact is identified	spread in some hosts, and on the actual impact of PNRSV in many of its hosts
Conclusion on specific ToR questions	*If the pest is already present in the EU, provide a brief summary of* – *the analysis of the present distribution of the organism in comparison with the distribution of the main hosts, and the distribution of hardiness/climate zones, indicating in particular if in the risk assessment area, the pest is absent from areas where host plants are present and where the ecological conditions (including climate and those in protected conditions) are suitable for its establishment, and* – *the analysis of the observed impacts of the organism in the risk assessment area* PNRSV is widely distributed in the EU and is reported from at least 22 Member States. It is not expected to be affected by ecoclimatic conditions, wherever its hosts are able to develop. Given its pollen-mediated spread mechanism, there are few areas of its potential range where it is expected to be absent Although difficult to evaluate, the actual impact of PNRSV appears to be limited. No PNRSV environmental impact is identified		Significant uncertainties affect both PNRSV distribution and its impact

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ABBREVIATIONS

ApMV	*Apple mosaic virus*
EC	European Commission
EFSA	European Food Safety Authority
EPPO	European and Mediterranean Plant Protection Organization
EPPO-PQR	European and Mediterranean Plant Protection Organization Plant Quarantine Retrieval system
EU	European Union
ISPM	International Standard for Phytosanitary Measures
MS(s)	Member State(s)
NPPO	National Plant Protection Organisation
PNRSV	*Prunus necrotic ringspot virus*
PRA	Pest Risk Analysis