NAME OF THE ORGANISM: Cherry leaf roll virus (CLRV00)

GENERAL INFORMATION ON THE PEST

Name as submitted in the project specification (if different to the preferred name):

Pest category:

Viruses and viroids **1- Identity of the pest/Level of taxonomic listing:**
Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?

Yes
Is the pest defined at the species level or lower?:

Yes
Can listing of the pest at a taxonomic level higher than species be supported by scientific reasons or can species be identified within the taxonomic rank which are the (main) pests of concern?

* Not relevant: Fruits (including hops) sector, Ornamental sector, Vine sector

Is it justified that the pest is listed at a taxonomic rank below species level?

Not relevant
Conclusion:

* Candidate: Fruits (including hops) sector, Ornamental sector, Vine sector

Justification (if necessary):

CLRV is currently regulated in Council Directive 2000/29/EC on plants of Rubus spp. intended for planting. CLRV is also listed on Juglans regia L., Olea Europea L, Prunus avium L. and Prunus cerasus L. in the fruit marketing directive. CLRV is also included in EPPO PM 4 Standards for the following hosts: Rubus (PM 4/10), hops (PM 4/16) olive (PM 4/17), cherry (PM 4/29) and Sambuscus (PM 4/32). However, CLRV was detected in the following new host plants: grapevine (Herrera and Madariaga, 2001), Malus domestica (Woo et al., 2012), Vaccinium darrowii (Woo et al., 2012), Actinidia chinensis (Blouin et al., 2013) and Ribes rubrum (Woo and Pearson, 2014) in the last six years. These findings show that the CLRV host range is much wider than previously reported. At the moment CLRV is not listed in EPPO PM 4 Standards for grapevine, Malus, Vaccinium and Ribes, which Standards were approved before the CLRV was detected on these hosts. Malus, Hop, Vaccinium and Ribes are symptomless hosts of CLRV and therefore no economic impact has been recorded on these hosts. As economic damage has been recorded on grapevine and kiwifruits (Ipach et al. 2003; Komorowska et al., 2012; Martelli and Boudon-Padieu 2006; Blouin et al., 2013 ), these two hosts are analysed within the RNQP project.
- Vitis: Based on analogy with other nepoviruses which are involved in the etiology of grapevine infective degeneration disease which affect Vitis vinifera and inter-species hybrid, as well as on insufficient study and data on the presence and prevalence of CLRV in grapevine rootstocks (inter-species hybrids mainly between Vitis rupestris, Vitis riparia and Vitis berlandieri) and other species of the genus Vitis, it is proposed to analyse the RNQP Status of CLRV on the entire Vitis genus.
- Actinidia: Worldwide, the kiwifruit cultivation mainly involves two species: A. deliciosa, representing the vast majority of the commercial production and A. chinensis, which comprises most of the newest cultivars. CLRV has been detected on A. chinensis in New Zealand. There is a lack of information about presence of the virus on other species of Actinidia. This is why the analysis of the entire Actinidia genus is performed. CLRV can spread via pollen and seed in nature in many of the host plants, however, no information is available in the literature on this mode of transmission in Actinidia.
- Rubus: experts recommended analysing the RNQP status for the whole genus. **2 – Status in the EU:**

Is this pest already a quarantine pest for the whole EU?

No
Presence in the EU:

Yes
List of countries (EPPO Global Database):

Austria (2014); Belgium (2015); Bulgaria (1996); Croatia (2011); Czech Republic (1992); Finland (2011); France (2016); France/Corse (2016); Germany (1997); Greece (2008); Hungary (1996); Italy (1996); Netherlands (2015); Poland (2013); Portugal (1997); Romania (1986); Slovakia (2000); Slovenia (1995); Spain (2011)
Conclusion:

candidate
Justification (if necessary):

Data of the presence of this pest on the EU territory are available in EPPO Global Database (<https://gd.eppo.int/>). CLRV was recorded on grapevine in Germany (Ipach et al., 2003) and Poland (Komorowska et al., 2012). No systematic surveys of CLRV were performed in the EU on many of its natural woody hosts, including Actinidia spp, therefore its presence on these hosts is probably underestimated.

HOST PLANT N°1: Actinidia (1ATIG) for the Fruits (including hops) sector.

Origin of the listing:

IIA2AWG
Plants for planting:

Plants intended for planting, other than seeds **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**

No
Conclusion:

Evaluation continues **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**

Yes
Conclusion:

Candidate

Justification:

CLRV is a graft transmissible agent (EFSA, 2014), which is transmitted through vegetative multiplication of infected host plants. This virus is pollen-borne and seed transmitted in some of the natural hosts, but it is not yet known for Actinidia. CLRV seems to spread along the row of Actinidia plants, suggesting a possible mechanical spread by pruning/girdling equipment (Blouin et al., 2013). All these characteristics make CLRV being a potential threat for the kiwifruit production even thoufh additional studies are needed to fully understand its ecology in this host plant.
Remark: CLRV is easily transmitted by water in greenhouse experiments from herbaceous plant to herbaceous plants, but it would probably be less efficient under natural conditions (Bandte et al., 2007). **5 - Economic impact:**
Are there documented reports of any economic impact on the host?

Yes
Justification:

Up to now 13 viruses have been isolated from kiwifruit. Many of these viruses are not associated with important symptoms and/or spread (the non-specialists viruses and the kiwifruit-adopted viruses) and are not considered to be economically important in commercial orchards. However, the viruses induced diseases in kiwifruit comprises CLRV and Pelargonium zonate spot virus (PZSV), two viruses that pose more serious threats with respect to symptoms and spread (Blouin et al., 2013). These two viruses are pollen-borne and seed transmitted, although it is not yet known if this occurs in kiwifruit. Although the two viruses were identified recently, they have already been associated with significant symptoms, with consequences for yield. CLRV was isolated from a A. chinensis cv. Hort16A orchard in which vines were showing necrotic symptoms on leaves, as well as cane die-back and bark cracking. Some of the fruit from the infected vines do not have the beak at the calyx end that is characteristic of the Hort16A cultivar. Additionally, the fruit from infected vines are uneven in size, and the crop yield is reduced (Blouin et al, 2013).
What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)

Major
Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?

No
Conclusion:

Candidate
Justification:

Impact is considered as unacceptable in relation to crop losses in yield and quality, extra costs of specific testing and replanting of infected vines. Population genetics study of CLRV isolates has shown that transfer between different hosts species by pollen is likely to be rare, possibly as a consequence of the need for pollen germination and ovule fertilisation for transmission (EFSA, 2014). **6 - Are there feasible and effective measures available to prevent the presence of the pest on the plants for planting at an incidence above a certain threshold (including zero) to avoid an unacceptable economic impact as regards the relevant host plants?**

Yes

Conclusion:

candidate
Justification:

The application of measures, including visual inspection, specific testing, production of pathogen-free planting materials, and the destruction of infected kiwiplants are available. Application of phytosanitary measures allow a control of the kiwi plants intended to be imported into the EU. **7- Is the quality of the data sufficient to recommend the pest to be listed as a RNQP?**

Yes

Conclusion:

Candidate
Justification:

 **CONCLUSION ON THE STATUS:**

Recommended for listing as an RNQP, based on data **8 - Tolerance level:**
Is there a need to change the Tolerance level:

Yes
Proposed Tolerance levels:

Zero tolerance of symptomatic plants in the marketed material. **9 - Risk management measures:**
Is there a need to change the Risk management measure:

Yes
Proposed Risk management measure:

Based on visual examination carried out during the last growing season at appropriate time for the expression of symptoms.
- Non-certified plants (‘standard’): Not more than 5% of plants showing symptoms and all plants showing symptoms rogued out and destroyed within two weeks.
- Pre-basic (‘initial’), basic and certified:
Additional measures (in addition to non-certified) could include
• Inspection of mother plants;
• Periodic testing of pre-basic mother plants. **REFERENCES:**

* Bandte M, Eschevarria-Laza H J, Paschek U, Ulrichs C, Pestemer W, Schwarz D & Büttner C (2007) Transmission of plant viruses by water. In Proceedings of the 2nd Columbian Congress for Horticulture, 12-14 Sept. (pp. 31-43). Bogota, Columbia;
* Blouin A G, Pearson M N, Chavan R R, Woo E N Y, Lebas B S M, Veerakone S, Ratti C, Biccheri R, MacDiarmid R M & Cohen D (2013) Viruses of kiwifruit (Actinidia species). Journal of Plant Pathology 95, 221-235;
* Bos L (1999) Plant viruses, unique and intriguing pathogens. Backhuys Publishers Leiden.
* Büttner C, von Bargen S, Bandte M & Myrta A (2011) Cherry leaf roll virus. In: Hadidi A, Barba M, Candresse T, Jelkmann W. (Eds.), Virus and Virus-Like Diseases of Pome and Stone Fruits. APS Press, St. Paul, USA, pp. 119–125;
* EFSA Panel on Plant Health (PLH) (2014) Scientific Opinion on the pest categorisation of Cherry leafroll virus. EFSA Journal 2014;12(10):3848, 23 pp. doi:10.2903/j.efsa.2014.3848 <http://www.efsa.europa.eu/en/efsajournal/doc/3848.pdf>;
* EU COM (2015) Recommendation of the Working Group on the Annexes of the Council Directive 2000/29/EC – Section II – Listing of Harmful Organisms as regards the future listing of Cherry leafroll virus;
* Herrera M & Madariaga V M (2001) Presence and incidence of grapevine viruses in the central zone of Chile. Agricultura Técnica, 61(4), 393-400. [Review of Plant Pathology 81(9), September 2002, abst. 8532, p 1213];
* Ipach U, Kling L & Lesemann D (2003) First record of Cherry leaf roll virus in Germany. Extended abstracts of the 14th ICVG Conference, Locorotondo, Italy, 12-17th September, 2003: 17-18;
* Komorowska B, Golis T & Berniak H (2012) Survey of Grapevine Viruses in Poland. Proceeding of the 17th Congress of ICVG, Davis, California, USA, 7-14th Octobar, 2012: 206-207;
* Martelli G P & Boudon-Padieu E (2006) Directory of infectious diseases of grapevines. International Council for the Study of Virus and Virus-like Diseases of Grapevines: 1-280;
* Oliver J E, Fuchs M F (2011) Fanleaf degeneration/decline disease of grapevines. Available at: www.nysipm.cornell.edu/factsheets/grapes/diseases/fanleaf.pdf 2011;
* Woo E N Y & Pearson M N (2014) Biological and molecular variation of Cherry leaf roll virus isolates from Malus domestica, Ribes rubrum, Rubus idaeus, Rumex obtusifolius and Vaccinium darrowii. Plant Pathology 63, 838–845;
* Woo E N Y, Ward L I & Pearson M N (2013) First report of Cherry leaf roll virus in Vaccinium darrowii. New Disease Reports, 27: 16;
* Woo E N Y, Clover G R G, Pearson M N (2012) First report of Cherry leaf roll virus (CLRV) in Malus domestica. Australian Plant Disease Notes 7, 151-156;

HOST PLANT N°2: Juglans regia (IUGRE) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**

Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°3: Olea europaea (OLVEU) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**

Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°4: Prunus avium (PRNAV) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**

Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°5: Prunus cerasus (PRNCE) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**

Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°6: Rubus (1RUBG) for the Fruits (including hops) sector.

Origin of the listing:

IIA2AWG
Plants for planting:

Plants intended for planting **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**

Yes
Conclusion:

Evaluation continues

Justification (if necessary):

Rubus is covered by EPPO PM 4/10 Standard. However as experts of the Fruit SEWG recommended to analyse more deeply the economic impact, evaluation continues for impact. **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**

Conclusion:

Justification:

 **5 - Economic impact:**
Are there documented reports of any economic impact on the host?

No impact
Justification:

What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)

Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?

Is there unacceptable economic impact caused to other hosts (or the same host with a different intended use) produced at the same place of production due to the transfer of the pest from the named host plant for planting?

Conclusion:

Not candidate
Justification:

Experts agreed that impact is acceptable on Rubus (usually latent on this host) and proposed to deregulate the pest on this host. **CONCLUSION ON THE STATUS:**

Disqualified: impact is acceptable on Rubus (usually latent on this host). **8 - Tolerance level:**
Is there a need to change the Tolerance level:

Yes
Proposed Tolerance levels:

Delisting. **9 - Risk management measures:**
Is there a need to change the Risk management measure:

Yes
Proposed Risk management measure:

Delisting. **REFERENCES:**

* EFSA Panel on Plant Health (PLH) (2014) Scientific Opinion on the pest categorisation of Cherry leafroll virus. EFSA Journal 2014;12(10):3848, 23 pp. doi:10.2903/j.efsa.2014.3848 <http://www.efsa.europa.eu/en/efsajournal/doc/3848.pdf>;
* EU COM (2015) Recommendation of the Working Group on the Annexes of the Council Directive 2000/29/EC – Section II – Listing of Harmful Organisms as regards the future listing of Cherry leafroll virus;

HOST PLANT N°7: Rubus (1RUBG) for the Ornamental sector.

Origin of the listing:

IIA2AWG
Plants for planting:

Plants intended for planting **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**

Yes
Conclusion:

Evaluation continues

Justification (if necessary):

Rubus is covered by EPPO PM 4/10 Standard. There are at least 10 species of Rubus grown for ornamental purposes for different flower colours or foliage. However as experts of the Fruit SEWG recommended to analyse more deeply the economic impact, evaluation continues for impact. **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**

Conclusion:

Justification:

Usually propagated vegetatively and no references could be found to the susceptibility or resistance of ornamental Rubus as compared to the variation in normal Rubus cultivars, so it is proposed to conclude they would react to the pest in a similar way. **5 - Economic impact:**
Are there documented reports of any economic impact on the host?

No impact
Justification:

No specific documented references could be found for impacts on ornamental Rubus species as distinct from fruiting species so it is proposed to conclude they may react to the pest in a similar way.
What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)

Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?

Is there unacceptable economic impact caused to other hosts (or the same host with a different intended use) produced at the same place of production due to the transfer of the pest from the named host plant for planting?

Conclusion:

Not candidate
Justification:

Experts agreed that impact is acceptable on Rubus (usually latent on this host) and proposed to deregulate the pest on this host. **CONCLUSION ON THE STATUS:**

Disqualified: impact is acceptable on Rubus (usually latent on this host). **8 - Tolerance level:**
Is there a need to change the Tolerance level:

Yes
Proposed Tolerance levels:

Delisting. **9 - Risk management measures:**
Is there a need to change the Risk management measure:

Yes
Proposed Risk management measure:

Delisting. **REFERENCES:**

* EFSA Panel on Plant Health (PLH) (2014) Scientific Opinion on the pest categorisation of Cherry leafroll virus. EFSA Journal 2014;12(10):3848, 23 pp. doi:10.2903/j.efsa.2014.3848 <http://www.efsa.europa.eu/en/efsajournal/doc/3848.pdf>;
* EPPO (2009) Certification scheme for Rubus. Bulletin OEPP/EPPO Bulletin 39, 271–277;
* EU COM (2015) Recommendation of the Working Group on the Annexes of the Council Directive 2000/29/EC – Section II – Listing of Harmful Organisms as regards the future listing of Cherry leafroll virus;

HOST PLANT N°8: Vitis (1VITG) for the Vine sector.

Origin of the listing:

IIA2AWG
Plants for planting:

Plants intended for planting, other than seeds **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**

No
Conclusion:

Evaluation continues **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**

Yes
Conclusion:

Candidate

Justification:

Viruses infect host plants systemically and all plant parts, including parts used for vegetative propagation (Bos, 1999). CLRV is a graft transmissible agent (EFSA, 2014), which is transmitted through the vegetative multiplication of infected host plants. CLRV can spread via pollen and seed, by nature, at variable rate allowing effective intra-specific dispersal of the virus in many of the host plants. It is seed-borne in birch, walnut, cherry, eldeberry, elm, olive and wild potato. Strains in walnut and birch can be pollen-transmitted to receptive host plants. However, no information is available on this mode of transmission in other natural hosts, including grapevine. Vector transmission by nematodes and insects has not been demonstrated (Buttner et al., 2011, Rebenstorf et al., 2006). CLRV is easily transmitted by water in greenhouse experiments from herbaceous to herbaceous plants, but it would probably be less efficient under natural conditions (Bandte et al., 2007). **5 - Economic impact:**
Are there documented reports of any economic impact on the host?

Yes
Justification:

CLRV is associated with fanleaf like symptoms on grapevines-infectious degeneration diseases (Martelli & Boudon-Padieu, 2006). Infectious degeneration disease is one of the most severe viral disease complexes of grapevine worldwide. This disease is known to affect grapevines in all temperate regions where Vitis vinifera and hybrid rootstocks are grown. Infected grapevines exhibit a progressive degeneration (causal agents European and Mediterranean nepoviruses), which leads to a shortened productive lifespan of the affected vineyards by reducing yield (up to 80%) and quality, often ending in vine death. Fruit clusters are often smaller and fewer in number and exhibit irregular ripening and poor berry set. All nepoviruses involved in fanleaf degeneration/decline can cause similar symptoms (Oliver & Fuchs, 2011). Infected propagation materials may show reduced ability to root or poor graft take. The symptoms of CLRV infected grapevine include leaf yellowing, chlorosis and yellow leaf mosaic, additionally the berries drop off or remain small in Germany (Ipach et al., 2003). The symptoms on grapevines reported in Poland consist of leaf distortion, discoloration and mottling, downward rolling, as well as poor fruit setting, irregular ripening and reduced size of the berries. But majority of the CLRV infected samples were subject to mixed infections with other viruses (GLRaV-1,-2-3,-5, RSPaV, GVA, GVB, GFLV, GFkV) (Komorowska et al., 2012). Unfortunately, because there has been no systematic study on the prevalence, distribution, biology and impact of CLRV on grapevine as a new host, there is very limited information.
What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)

Major
Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?

No
Conclusion:

Candidate
Justification:

Impact is considered as unacceptable in relation to crop losses in yield and quality, extra costs of specific testing and replanting of infected vines. CLRV can spread via pollen and seed by nature in many of the host plants, however, no information is available on this mode of transmission in grapevine and some other new hosts. Since grapevines are self-fertile and outcrosses are minimal, seed and pollen transmission of nepoviruses are of only minor importance in grapevine (Oliver and Fuchs, 2011). Population genetics study of CLRV isolates has shown that transfer between different hosts species by pollen is likely to be rare, possibly as a consequence of the need for pollen germination and ovule fertilisation for transmission (EFSA, 2014). **6 - Are there feasible and effective measures available to prevent the presence of the pest on the plants for planting at an incidence above a certain threshold (including zero) to avoid an unacceptable economic impact as regards the relevant host plants?**

Yes

Conclusion:

candidate
Justification:

The presence of CLRV on grapevine in the EU require visual inspection and specific testing for freedom in the production of planting material and breeding of resistant cultivars. CLRV should be included in the list of the pathogen in the production of pathogen-tested material of grapevine varieties and rootstocks. Plants giving positive results in any test should be removed and destroyed immediately. This would add extra costs to nursery stock production and replanting of infected plants in vineyards. **7- Is the quality of the data sufficient to recommend the pest to be listed as a RNQP?**

Yes

Conclusion:

Candidate
Justification:

 **CONCLUSION ON THE STATUS:**

Recommended for listing as an RNQP, based on data **8 - Tolerance level:**
Is there a need to change the Tolerance level:

Yes
Proposed Tolerance levels:

Zero tolerance of symptoms. **9 - Risk management measures:**
Is there a need to change the Risk management measure:

Yes
Proposed Risk management measure:

Based on visual examination carried out at least twice during the last growing season at appropriate times for the expression of symptoms.
- Non-certified plants (‘standard’): Not more than 5% [reduced from current 10%] of plants showing symptoms of nepoviruses (Arabis mosaic virus, Grapevine fanleaf virus and Cherry leaf roll virus) and not more than 10% of plants showing any virus symptoms and all plants showing symptoms rogued out and destroyed within two weeks.
- Pre-basic (‘initial’), basic and certified:
Additional measures (in addition to non-certified) could include periodic testing of pre-basic mother plants.
Justification (if necessary):

Only the testing of Pre-basic material is proposed. Experts agreed with the same recommendations than for the other nepoviruses (even though it is not proved that it can be transmitted by nematodes). As no vector is identified, and no pollen transmission is demonstrated, isolation is not needed. **REFERENCES:**

* Bandte M, Eschevarria-Laza H J, Paschek U, Ulrichs C, Pestemer W, Schwarz D & Büttner C (2007) Transmission of plant viruses by water. In Proceedings of the 2nd Columbian Congress for Horticulture, 12-14 Sept. (pp. 31-43). Bogota, Columbia;
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* Ipach U, Kling L & Lesemann D (2003) First record of Cherry leaf roll virus in Germany. Extended abstracts of the 14th ICVG Conference, Locorotondo, Italy, 12-17th September, 2003: 17-18;
* Komorowska B, Golis T & Berniak H (2012) Survey of Grapevine Viruses in Poland. Proceeding of the 17th Congress of ICVG, Davis, California, USA, 7-14th Octobar, 2012: 206-207;
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