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Commodity risk assessment of *Corylus avellana* and *Corylus colurna* plants from Serbia

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Abstract

The European Commission requested the EFSA Panel on Plant Health to prepare and deliver risk assessments for commodities listed in Commission Implementing Regulation (EU) 2018/2019 as 'High risk plants, plant products and other objects'. This Scientific Opinion covers the plant health risks posed by the two following hazelnut commodities to be imported from Serbia. 1. Bare rooted plants: 1- to 3-year-old plants of *Corylus avellana* or *C. avellana* grafted on *C. colurna*, without leaves. 2. Plants in pots: 2-year-old plants of *C. avellana*, without leaves. The assessment was performed by taking into account the available scientific information, including the technical information provided by Serbia. The relevance of any pest for this Opinion was based on evidence following defined criteria. One EU quarantine pest, i.e. Flavescence dorée phytoplasma, fulfilled all relevant criteria and was selected for further evaluation. For this pathogen, the risk mitigation measures proposed in the Technical Dossier from Serbia were evaluated separately for bare rooted plants and for plants in pots, taking into account the possible limiting factors. For the selected pathogen, an expert judgement was given on the likelihood of pest freedom of plants for planting, for both commodities taken together, considering the risk mitigation measures, including uncertainties associated with the assessment. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,837 and 10,000 bare rooted plants and plants in pots per 10,000 would be free of Flavescence dorée phytoplasma.

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Keywords: *Corylus avellana*, *Corylus colurna*, hazelnut, plants for planting, bare rooted plants, plants in pots, European Union

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1. Introduction

1.1. Background and Terms of Reference as provided by European Commission

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031¹, on the protective measures against pests of plants, has been applied from December 2019. Provisions within the above Regulation are in place for the listing of 'high risk plants, plant products and other objects' (Article 42) on the basis of a preliminary assessment, and to be followed by a commodity risk assessment. A list of 'high risk plants, plant products and other objects' has been published in Regulation (EU) 2018/2019². Scientific opinions are therefore needed to support the European Commission and the Member States in the work connected to Article 42 of Regulation (EU) 2016/2031, as stipulated in the Terms of reference.

1.1.2. Terms of reference

In view of the above and in accordance with Article 29 of Regulation (EC) No. 178/2002³, the Commission asks EFSA to provide scientific opinions in the field of plant health.

In particular, EFSA is expected to prepare and deliver risk assessments for commodities listed in the relevant Implementing Act as 'High risk plants, plant products and other objects'. Article 42, paragraphs 4 and 5, establishes that a risk assessment is needed as a follow-up to evaluate whether the commodities will remain prohibited, removed from the list and additional measures will be applied or removed from the list without any additional measures. This task is expected to be on-going, with a regular flow of dossiers being sent by the applicant required for the risk assessment.

Therefore, to facilitate the correct handling of the dossiers and the acquisition of the required data for the commodity risk assessment, a format for the submission of the required data for each dossier is needed.

Furthermore, a standard methodology for the performance of 'commodity risk assessment' based on the work already done by Member States and other international organisations needs to be set.

In view of the above and in accordance with Article 29 of Regulation (EC) No. 178/2002, the Commission asks EFSA to provide scientific opinion in the field of plant health for *Corylus avellana* from Serbia taking into account the available scientific information, including the technical dossier provided by Serbia.

1.2. Interpretation of the Terms of Reference

The EFSA Panel on Plant Health (hereafter referred to as 'the Panel') was requested to conduct a commodity risk assessment of *Corylus avellana* from Serbia following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019). After assessing the Dossier, one of the commodities (i.e. bare rooted plants) turned out to be produced also by grafting *Corylus avellana* on *Corylus colurna* rootstock. Therefore, the assessment was extended to *C. colurna*.

The EU quarantine pests that are regulated as a group in the Commission Implementing Regulation (EU) 2019/2072 were considered and evaluated separately at species level.

Annex II of Implementing Regulation (EU) 2019/2072 lists certain pests as non-European populations or isolates or species. These pests are regulated quarantine pests. Consequently, the respective European populations, or isolates, or species are non-regulated pests.

Annex VII of the same Regulation, in certain cases (e.g. point 32) makes reference to the following countries that are excluded from the obligation to comply with specific import requirements for those

¹ Regulation (EU) 2016/2031 of the European Parliament and of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) 228/2013, (EU) 652/2014 and (EU) 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC. OJ L 317, 23.11.2016, pp. 4–104.

² Commission Implementing Regulation (EU) 2018/2019 of 18 December 2018 establishing a provisional list of high risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031 and a list of plants for which phytosanitary certificates are not required for introduction into the Union, within the meaning of Article 73 of that Regulation C/2018/8877. OJ L 323, 19.12.2018, pp. 10–15.

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

non-European populations, or isolates, or species: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (SeveroZapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug), San Marino, Serbia, Switzerland, Turkey, Ukraine and United Kingdom (except Northern Ireland⁴). Those countries are historically linked to the reference to 'non-European countries' existing in the previous legal framework, Directive 2000/29/EC. Consequently, for those countries, any pests identified, which are listed as non-European species in Annex II of Implementing Regulation (EU) 2019/2072 should be investigated as any other non-regulated pest.

Pests listed as 'Regulated Non-Quarantine Pest' (RNQP) in Annex IV of the Commission Implementing Regulation (EU) 2019/2072, and deregulated pests (i.e. pests that were listed as quarantine pests in the Council Directive 2000/29/EC and were deregulated by Commission Implementing Regulation (EU) 2019/2072) were not considered for further evaluation.

In its evaluation, the Panel:

- Checked whether the information included in the technical dossier (hereafter referred to as 'the Dossier') provided by Serbian Authority (Plant Protection Directorate; Ministry of Agriculture, Forestry and Water Management; Republic of Serbia – the PPD) was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested to the applicant.
- Selected the relevant Union quarantine pests and protected zone quarantine pests (as specified in Commission Implementing Regulation (EU) 2019/2072⁵, hereafter referred to as 'EU quarantine pests') and other relevant pests present in Serbia and associated with the commodity.
- Did not assess the effectiveness of measures for Union quarantine pests for which specific measures are in place for the import of the commodity from the specific country in Commission Implementing Regulation (EU) 2019/2072 and/or in the relevant legislative texts for emergency measures and provided that the specific country is in the scope of those emergency measures. The assessment was restricted to whether or not the applicant country applies those measures.
- Assessed the effectiveness of the measures described in the dossier for those Union quarantine pests for which no specific measures are in place for the import of the commodity from the specific applicant country and other relevant pests present in applicant country and associated with the commodity.

Risk management decisions are not within EFSA's remit. Therefore, the Panel provided a rating based on expert judgement on the likelihood of pest freedom for each relevant pest given the risk mitigation measures proposed by the PPD of Serbia.

2. Data and methodologies

2.1. Data provided by the PPD of Serbia

The Panel considered all the data and information (hereafter called 'the Dossier') provided by the PPD of Serbia on 9 June 2020, including the additional information provided by the PPD of Serbia on 6 October 2020, 31 December 2020 and 12 February 2021, after EFSA's requests. The Dossier is managed by EFSA.

The structure and overview of the Dossier are shown in Table 1. The number of the relevant section is indicated in the Opinion when referring to a specific part of the Dossier.

⁴ In accordance with the Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, and in particular Article 5(4) of the Protocol on Ireland/Northern Ireland in conjunction with Annex 2 to that Protocol, for the purposes of this Annex, references to Member States include the United Kingdom in respect of Northern Ireland.

⁵ Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019, OJ L 319, 10.12.2019, p. 1–279.

Table 1: Structure and overview of the Dossier

Dossier section	Overview of contents	Filename
1.0	Technical Dossier	Serbia Hazelnut Planting Material Dossier 290520.pdf
2.0	Annex I	ANNEX I Hazelnut phenological phases
2.1	Overview of phenological phases from December 2017 till April 2020 for Plot no 1061	Hazelnut orchard- Plot no 1061 (100 ha).xlsx
2.2	Overview of phenological phases from December 2017 till April 2020 for Plot no 910	Hazelnut orchard- Plot no 910 (148 ha).xlsx
2.3	Description of catkin phenological phases	Phenology.catkins.pdf
2.4	Description of female phenological phases	Phenology.Female.pdf
2.5	Description of vegetation phenological phases	Phenology.Vegetation.pdf
3.0	Annex II	ANNEX II – MoU and Protocol import requirements
3.1	Memorandum of understanding between NPPO of Italy and NPPO of Serbia on cooperation in the plant health field	MoU-eng..PDF
3.2	Protocol between NPPO of Italy and NPPO of Serbia on the phytosanitary requirements for export of hazelnut propagating material and hazelnut fruit plants from Italy to Serbia	Protocol -eng..PDF
3.3	Technical regulations for the production of plants and multiplication materials of “certified” material of hazelnut to be exported in Serbia	Technical Annex - ENG.pdf
4.0	Annex III	ANNEX III – Literature search and Reference list with scanned scientific papers
4.1	Review of registered pests and pathogens, literature source and the main topic of the research and relevance in regards of planting material of hazelnut	Harmful organisms HAZELNUT.pdf
4.2	References of harmful organisms registered in Serbia on hazelnut	Reference list HAZELNUT.pdf
4.3	Folder with 23 papers	Scientific papers HAZELNUT
5.0	Annex IV	ANNEX IV – Protocols
5.1	Protocol for detection and identification of <i>Xanthomonas arboricola</i> pv <i>corylina</i> from plant material	Protocol for detection and identification of X a pv corylina.pdf
5.2	Protocol for inspection for hazelnut mother plants and nurseries	PROTOCOL FOR INSPECTION FOR HAZELNUT MOTHER PLANTS AND NURSERIES1.pdf
6.0	Annex V	ANNEX V – Production procedure control reference documents
6.1	Application of Agriser d.o.o for production fruit trees from 24/4/2019 (in Serbian)	1. Application for production fruit trees.pdf
6.2	Application of Agriser doo for plant health control (in Serbian)	2. Application for plant health control.pdf
6.3	Laboratory report on nematodes for Agriser d.o.o (in Serbian)	3. Lab report on nematodes.pdf
6.4	Documentation on origine for Agriser d.o.o (in Serbian)	4. Documentation on origine.pdf
6.5	Records on I and II field control performed on 30/7/2018 and 6/11/2018 for Agriser d.o.o (in Serbian)	5. Records on I and II field control.pdf
6.6	Plant health certificate from 18/11/2019 for Agriser d.o.o (in Serbian)	6. Plant health certificate.pdf

Dossier section	Overview of contents	Filename
6.7	Certificate on production from 25/11/2019 for Agriser d.o.o (in Serbian)	7. Certificate on production.pdf
7.0	Annex VI	ANNEX VI – Labels of registered pesticides
7.1	Label of Abastate (in Serbian)	Abastate_1L_260x140mm.pdf
7.2	User guide for Abastate (in Serbian)	Abastate uputstvo 21.10.2019.pdf
7.3	Label of Amon 020 EW (in Serbian)	Amon 020 EW - etiketa.pdf
7.4	User guide of Amon 020 EW (in Serbian)	Amon 020 EW - Uputstvo.pdf
7.5	Label of Dentamet (in Serbian)	Dentamet 160x155.pdf
7.6	Label of Nitropol S (in Serbian)	Nitropol S- 1 l-za ganu.pdf
7.7	Label of Nordox 75 WG (in Serbian)	Nordox_SRB_200x287_10kg_2020.pdf
8.0	Response for clarification from 6 October 2020	
8.1	Response for clarification on the information provided in the Dossier submitted by the Plant Protection Directorate of Serbia on plants for planting of <i>Corylus avellana</i>	1_PPD Response for clarification on the information provided in the Dossier submitted by the Plant Protection Directorate of Serbia on plants for planting of <i>Corylus avellana</i> EFSA.DOC
8.2	General_Guidelines for the use of substrates and FAQ, Klasmann-Deilmann	2_8667_KD_General_Guidelines_FAQ_2018_Aufb_v07_RZ_WEB(1).PDF
8.3	Phytosanitary certificate of Hungary for peat Sphagnum sp. to be exported to Serbia from 22/1/2020	3_FITO (1).pdf
8.4	Characteristics of product group TS 3	4_Slika1 (1).jpg
8.5	Declaration (EN standard) TS 3 (in Croatian)	5_Slika2.jpg
8.6	Declaration (EN standard) TS 3 (in Serbian)	6_Slika3 (1).jpg
8.7	Picture of a package of Klasmann-Deilmann substrate TS 3	7_Slika4.jpg
9.0	Additional information provided by Serbia on 31 December 2020	
9.1	Response of Plant Protection Directorate (NPPO Serbia)	ANNEX I Response Plant Protection Directorate MAFWM of Serbia to the request for clarification on the information provided in the dossier <i>Corylus avellana</i> .PDF
9.2	Translated files for Appendix V (Dossier Section 6.0)	ANNEX II – Appendix V
9.3	Translated files for Appendix VI (Dossier Section 7.0)	ANNEX II – Appendix VI
10.	Clarification on pests status for selected pests received on 12 February 2021	Response of the PPD on pest status for listed pest

The data and supporting information provided by the PPD of Serbia formed the basis of the commodity risk assessment. The below overview reports the references relevant for harmful organisms present in Serbia as listed in Dossier Section 4.2.

- Cvrković T, Chetverikov P, Vidović B and Petanović R, 2016. Cryptic speciation within *Phytoptus avellanae* (Eriophyoidea: Phytoptidae) revealed by molecular data and observation on molting Tegenotus-like nymphs. *Experimental and Applied Acarology*, 68, 83–96.
- Čalić A, Gašić K, Ivanović M, Kuzmanović N and Obradović A, 2010. Ponovna pojava plamenjače leske. X Savetovanje o zaštiti bilja, Zlatibor, pp. 33–34. (in Serbian).
- Čalić A, Gašić K, Ivanović M, Kuzmanović N and Obradović A, 2011. Proučavanje osetljivosti sojeva *Xanthomonas arboricola* pv. *corylina* prema baktericidima. XI Savetovanje o zaštiti bilja, Zlatibor, pp. 31–32. (in Serbian).
- Graora D, Dervišević M and Spasić D, 2016. Prilog poznavanju *Anthribus fasciatus* (Coleoptera: Anthribidae), predatora štitastih vašiju (Hemiptera: Coccidae). XV Simpozijum o zaštiti bilja, Zlatibor, pp. 39. (in Serbian).
- Konjević A, Petrović M, Nikolić M and Milova Ž, 2019. Monitoring of brown marmorated stink bug (*Halyomorpha halys* Stal) in Serbia and first record of damage. VIII Congress on Plant Protection, Zlatibor, pp. 197. (Abstract).

- Marinković S, Chetverikov PE, Cvrković T, Vidović B and Petanović R, 2019. Supplementary description of five species from the genus *Cecidophyopsis* (Eriophyoidea: Eriophyidae: Cecidophyinae). *Systematic and Applied Acarology*, 24, 1555–1578.
- Milenković S and Mitrović M, 2001. Hazelnut pests in Serbia. *Acta Horticulturae*, 556, 403–406. (Abstract)
- Mladenović K, Stojnić B, Vidović B and Radulović Z, 2013. New records of the tribe Bryobiini Berlese (Acari: Tetranychidae: Bryobiinae) from Serbia, with notes about associated predators (Acari: Phytoseiidae). *Archives of Biological Sciences*, 65, 1199–1210.
- Obradović A and Ivanović M, 2008. Bakterioze leske. IX Savetovanje o zaštiti bilja, Zlatibor, pp. 140–141. (in Serbian).
- Obradović A, Ivanović M and Čalić A, 2010. Bacterial diseases of hazelnut. *Biljni lekar*, 38, 192–201. (in Serbian, English abstract).
- Petanović R, Dobričević K and Bošković R, 1989. Life cycle of hazelnut big bud mite *Phytoptus avellanae* (Nal.) (Acarida: Eriophyoidea) and the results of its control. *Zaštita bilja*, 40, 442–451. (in Serbian, English abstract).
- Petanović R, Pešić M, Stamenković S and Milenković S, 1997. Eriofide voćaka: rasprostranjenosti, značaj i suzbijanje. Book of abstracts III Yugoslavean Symposia on Plant Protection, Vrnjačka Banja, pp. 31–32. (in Serbian).
- Petrović A, Jurišić A and Rajković D, 2010. The most common species of tetranychid mites (Acari: Tetranychidae) on stone fruits. *Biljni lekar*, 38, 381–386. (in Serbian, English abstract).
- Prokić A, 2014. *Xanthomonas arboricola* pv. *corylina* – identification of the pathogen and the population biodiversity. Doctoral Dissertation. University of Belgrade – Faculty of Agriculture, Belgrade – Zemun, pp. 1–139. (in Serbian, English abstract).
- Prokić A, Gašić K, Ivanović M, Kuzmanović N, Blagojević N and Obradović A, 2012a. Metode detekcije i identifikacije *Xanthomonas arboricola* pv. *corylina*, patogena gajene leske. XIV Simpozijum o zaštiti bilja i IX Kongres o korovima, Zlatibor, pp. 114–115. (in Serbian).
- Prokić A, Gašić K, Ivanović M, Kuzmanović N, Blagojević N and Obradović A, 2012b. Modifikacija protokola za izolaciju i testiranje patogenosti *Xanthomonas arboricola* pv. *corylina*. XIV Simpozijum o zaštiti bilja i IX Kongres o korovima, Zlatibor, pp. 115–116. (in Serbian).
- Prokić A, Gašić K, Ivanović N, Šević M, Pulawska J and Obradović A, 2012c. Detection and identification methods and new tests as developed and used in the framework of COST873 for bacteria pathogenic to stone fruits and nuts: *Xanthomonas arboricola* pv. *corylina*. *Journal of Plant Pathology* 94 ediyioni ETS, S, 127–133. (Abstract).
- Prokić A, Kuzmanović N, Ivanović M, Blagojević N, Gašić K and Obradović A, 2014. Molecular differentiation of *Xanthomonas arboricola* pv. *corylina* strains isolated from hazelnut in Serbia. VII Congress on Plant Protection: Integrated Plant Protection Knowledge – Based Step Towards Sustainable Agriculture, Forestry and Landscape Architecture, Zlatibor, pp. 307–308.
- Stamenković S, Milenković S, Pešić M and Mitrović M, 1997. Population dynamic, harmfulness and control of *Phytoptus avellanae* (Nalepa) in western Serbia. *Acta Horticulturae*, 445, 521–526. (Abstract).
- Stojnić B, Mladenović K, Milanović S, Marić I and Milenković I, 2014. Spider mites and predatory mites (Acari: Tetranychidae, Phytoseiidae) on hazels in Serbia. VII Congress on Plant Protection: Integrated Plant Protection Knowledge – Based Step Towards Sustainable Agriculture, Forestry and Landscape Architecture, Zlatibor, pp. 242–243.
- Thalji R, 2010. Aphids and their predators on fruit trees in gardens and treelined roadsides. *Biljni lekar*, 38, 15–27. (in Serbian, English abstract).
- Vasić T, Jevremović D, Krnjaja V, Leposavić A, Andjelković S, Živković S and Paunović S, 2017. Morphological description and molecular detection of *Pestalotiopsis* sp. on hazelnut in Serbia *Spanish Journal of Agricultural Research*, 15, e10SC02, 5 pp. <https://doi.org/10.5424/sjar/2017153-11297>
- Vukajlović FN, Predojević DZ, Miljković KO, Tanasković ST, Gvozdenac SM, Perišić VM, Grbović FJ and Pešić SB, 2019. Life history of *Plodia interpunctella* (Lepidoptera: Pyralidae) on dried fruits and nuts: Effects of macronutrients and secondary metabolites on immature stages. *Journal of Stored Products Research*, 83, 243–253.

2.2. Literature searches performed by EFSA

The following searches were combined: i) a general search to identify pests of *Corylus avellana* and *C. colurna* in different databases and ii) a general search to identify pests associated with *Corylus* as a genus. The general searches were run between 13 July and 6 August 2020 using the databases indicated in Table 2. No language, date or document type restrictions were applied in the search strategy.

The search strategy and search syntax were adapted to each of the databases listed in Table 2, according to the options and functionalities of the different databases and CABI keyword thesaurus.

As for Web of Science, the literature search was performed using a specific, ad hoc established search string (see Appendix B). The string was run in 'All Databases' with no range limits for time or language filters.

Finally, the pest list that was assessed included all the pests associated with *C. avellana* and *C. colurna* and all EU quarantine pests associated with *Corylus* as genus.

Table 2: Databases used by EFSA for the compilation of the pest list associated with *Corylus*, *C. avellana* and *C. colurna*

Database	Platform/Link
Aphids on World Plants	http://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
Database of Insects and their Food Plants	http://www.brc.ac.uk/dbif/hosts.aspx
Database of plant pests in Israel	https://www.moag.gov.il/en/Pages/SearchNegaim.aspx
Database of the World's Lepidopteran Hostplants	https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsm/
EPPO Global Database	https://gd.eppo.int/
EUROPHYT	https://webgate.ec.europa.eu/europhyt/
Leaf-miners	http://www.leafmines.co.uk/html/plants.htm
Nemaplex	http://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx
New Zealand Fungi	https://nzfungi2.landcareresearch.co.nz/default.aspx?NavControl=search&selected=NameSearch
NZFUNGI - New Zealand Fungi (and Bacteria)	https://nzfungi.landcareresearch.co.nz/html/mycology.asp?ID=
Plant Pest Information Network New Zealand	https://www.mpi.govt.nz/news-and-resources/resources/registers-and-lists/plant-pest-information-network/
Plant Viruses Online	http://bio-mirror.im.ac.cn/mirrors/pvo/vide/famindex.htm
Scalenet	http://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php
TRACES	https://webgate.ec.europa.eu/tracesnt/login
USDA ARS Fungi Database	https://nt.ars-grin.gov/fungalDATABASES/fungushost/fungushost.cfm
Web of Science: All Databases (Web of Science Core Collection, CABI: CAB Abstracts, BIOSIS Citation Index, Chinese Science Citation Database, Current Contents Connect, Data Citation Index, FSTA, KCI-Korean Journal Database, Russian Science Citation Index, MEDLINE, SciELO Citation Index, Zoological Record)	Web of Science https://www.webofknowledge.com
World Agroforestry	http://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749

Additional searches, limited to retrieve documents, were run when developing the Opinion. The available scientific information, including previous EFSA opinions on the relevant pests and diseases and the relevant literature and legislation [e.g. Regulation (EU) 2016/2031; Commission Implementing Regulations (EU) 2018/2019; (EU) 2018/2018⁶, (EU) 2019/2072] were taken into account.

⁶ Commission Implementing Regulation (EU) (EU) 2018/2018 of 18 December 2018 laying down specific rules concerning the procedure to be followed in order to carry out the risk assessment of high-risk plants, plant products and other objects within the meaning of Article 42(1) of Regulation (EU) 2016/2031 of the European Parliament and of the Council. OJ L 323, 19.12.2018, p. 7–9.

2.3. Methodology

When developing the Opinion, the Panel followed the EFSA Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019).

In the first step, pests potentially associated with the commodity in the country of origin (EU quarantine pests and other pests) that may require risk mitigation measures were identified. The EU non-quarantine pests not known to occur in the EU were selected based on evidence of their potential impact in the EU. After the first step, all the relevant pests that may need risk mitigation measures were identified.

In the second step, the overall efficacy of the proposed risk mitigation measures for each pest is evaluated. A conclusion on the pest-freedom status of the commodity for each of the relevant pests is achieved and uncertainties are identified. Pest freedom was assessed by estimating the number of infested/infected plants out of 10,000 exported plants. Further details on the methodology used to estimate the likelihood of pest freedom are provided in Section 2.3.3.

2.3.1. Commodity data

Based on the information provided by the PPD of Serbia, the characteristics of the commodities were summarised.

2.3.2. Identification of pests potentially associated with the commodity

To evaluate the pest risk associated with the importation of *C. avellana* and *C. colurna* from Serbia, a pest list was compiled. The pest list is a compilation of all identified plant pests associated with *C. avellana* and *C. colurna* based on information provided in Dossier Sections 4.1 and 4.2 and on searches performed by the Panel. In addition, all EU quarantine pests associated with any species of *Corylus* were added to the list.

The scientific names of the host plants (i.e. *Corylus avellana*, *Corylus colurna* and *Corylus*) were used when searching in the EPPO Global database and CABI Crop Protection Compendium. The same strategy was applied to the other databases excluding EUROPHYT, TRACES-NT and Web of Science.

EUROPHYT was investigated by searching for the interceptions associated with *C. avellana* and *C. colurna* commodities imported from Serbia from 1995 to May 2020 and TRACES-NT from May 2020 to January 2021, respectively.

The search strategy used for Web of Science Databases was designed combining English common names for pests and diseases, terms describing symptoms caused by pests on plants, and the scientific and common names of the commodity (i.e. *Corylus avellana* and *Corylus colurna*) and excluding pests that were identified using searches in other databases. The search strings are detailed in Appendix B. The searches in Web of Science Databases were run on 13 July 2020.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *C. avellana* and *C. colurna* were included in the pest list.

The compiled pest list (see Microsoft Excel® file in Appendix E) includes all identified agents associated with *C. avellana* and/or *C. colurna*, potentially including predators and parasitoids of insects and not harmful microorganisms, and all quarantine pests that use *Corylus* as host. The pest list was eventually further compiled with other relevant information (e.g. EPPO Codes, taxonomic information, categorisation, distribution) useful for the selection of the pests relevant for the purposes of this Opinion.

The evaluation of the compiled pest list was carried out in two steps: first, the relevance of the EU quarantine pests was evaluated (Section 4.1); second, the relevance of any other plant pests was evaluated (Section 4.2).

Pests for which limited information was available on one or more criteria used to identify them as relevant for this Opinion, e.g. on potential impact, are listed in Appendix D (List of potential pests not further assessed).

2.3.3. Listing and evaluation of risk mitigation measures

The proposed risk mitigation measures were listed and evaluated separately for the commodities considered in the Opinion, which are bare rooted plants and plants in pots as specified in Section 3.1. When evaluating the potential pest freedom of the commodity, the following types of potential

infestation/infection sources for *C. avellana* and *C. colurna* plants in export nursery and relevant risk mitigation measures were considered (see also Figure 1):

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

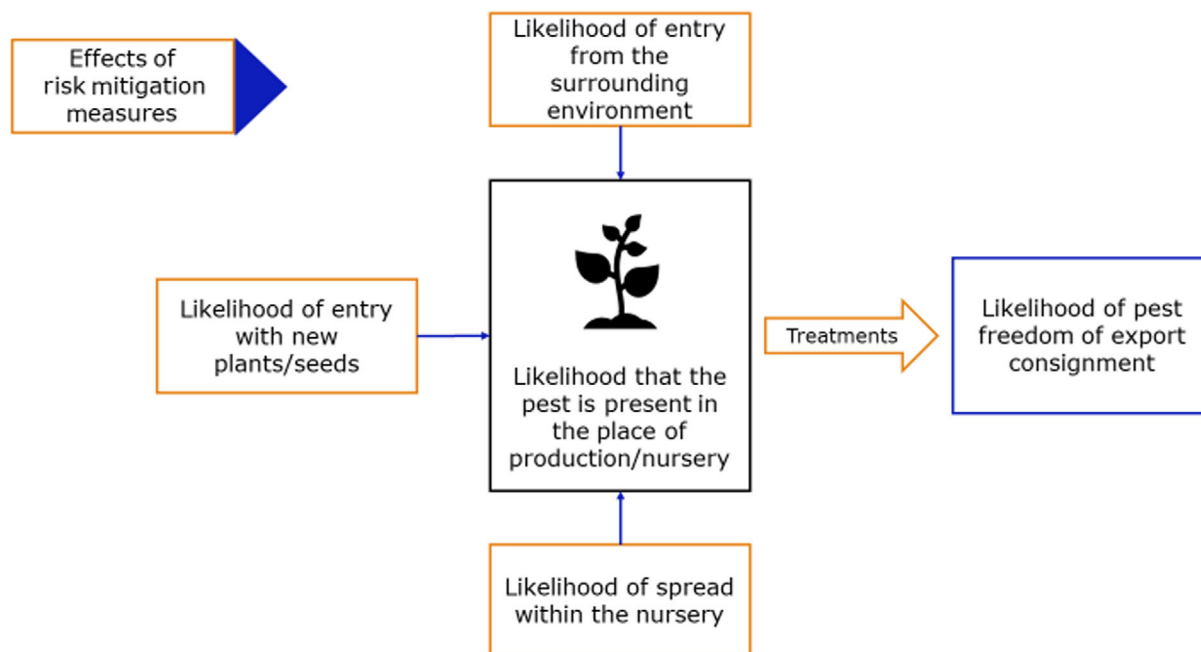


Figure 1: General factors considered for the estimation of pest freedom

The risk mitigation measures proposed by the PPD of Serbia were evaluated.

Information on the biology, likelihood of entry of the pest to the export nursery, of its spread inside the nursery and the effect of measures on the specific pests were summarised in pest sheet of pests selected for further evaluation (see Appendix A).

2.3.4. Expert Knowledge Elicitation

To estimate the pest freedom of the commodities, an Expert Knowledge Elicitation (EKE) was performed following EFSA Guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific question for the EKE was defined as follows: 'Taking into account (i) the risk mitigation measures listed in the Dossier, and (ii) other relevant information, how many of 10,000 *C. avellana* and *C. colurna* plants (i.e. bare rooted plants or plants in pots) will be infested with the relevant pest/pathogen when arriving in the EU?'

The risk assessment uses individual plants as most suitable granularity. The following reasoning is given:

- There is no quantitative information available on clustering of plants during production.
- For the pests under consideration, a cross contamination during transport is not likely.
- Plants will be finally distributed to final consumers by wholesaler and retailers.

The uncertainties associated with the EKE were taken into account and quantified in the probability distribution applying the semi-formal method described in Section 3.5.2 of the EFSA-PLH Guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Finally, the results were reported in terms of the likelihood of pest freedom. The lower 5% percentile of the uncertainty distribution reflects the Opinion that pest freedom is with 95% certainty above this limit.

The EKE was performed together for bare rooted plants and plants in pots, if the biology of the pest, the production systems and the risk mitigation measures suggested the same likelihood of pest freedom for both commodities.

3. Commodity data

3.1. Description of the commodity

The commodities to be imported into the EU from Serbia are:

- 1) bare rooted plants of *C. avellana* (common name: hazelnut; family: Betulaceae) and of *C. avellana* grafted on *C. colurna* (common name: Turkish hazelnut; family: Betulaceae); and
- 2) plants in pots of *C. avellana* (common name: hazelnut; family: Betulaceae).

Bare rooted plants: Dormant plants without leaves and washed roots either 1- to 3-year-old plants (depending on production technology) of *C. avellana* or 3-year-old plants of *C. avellana* grafted on *C. colurna*.

Plants in pots: Dormant plants of *C. avellana* without leaves, 2-year-old, cultivated in pots with substrate for one year.

According to Dossier Section 9.1, production of plants for planting using the different production technologies occurs in open fields in all nurseries intended to export hazelnut plants for planting to the EU.

The plants in pots are grown in commercial growing medium 'TS 3 fine "Aquasave"' (Klasmann-Deilmann, composition: 100% Sphagnum peat moss, lime, mineral fertiliser).

The hazelnut planting material is commercialised in dormant phenological phase. The intended use of the commodity is distribution to final consumers by wholesaler and retailers. Both commodities are marketable from October to May, although export of planting material to the EU should occur from October to March–April (Dossier Section 1.0). In 2019, 16,345 hazelnut plants for planting were exported to the EU. The planned volumes in 2020 and in the next years will be based on market requirements, but the operators are expecting a positive trend. Expectation of the major nursery is that there is a potential that export will increase over 300,000 plants for planting per year (Dossier Section 1.0). The total annual production volume intended to be exported to the EU is around one million plants ranging from 10,000 to 400,000 plants per nursery as specified in Appendix F (Dossier Section 9.1).

Although the phytosanitary management undertaken is different among the producers, the sanitary status of the plants reflects the standard required by the national legislation of the Republic of Serbia. The phytosanitary status of the production is controlled by the producers as well by official inspection controls. The plants produced for export are certified plants according to the legislation listed in Dossier Section 1.0. All marketed plants are produced only in registered nurseries under the official inspections. Various available measures are applied to reduce the risks at the place of production.

The varieties of *C. avellana* that are expected to be exported into the EU according to Dossier Section 9.1 are the following: 'Tonda Gentile Romana', 'Tonda di Giffoni', 'Tonda Gentile delle Langhe', 'Fertile de Coutard (Barcelona)', 'Nocchione', 'Tonda Franciscana', 'Halls Giant', 'Rimski', 'Istrian oblong', 'Pauetet', 'Segorbe', 'Cosfort', 'Avellino', 'Kubanj', 'Soči-1', 'Prezident (Karamanovski)', 'Cosford', 'Ludolf', 'Istarski duguljasti', 'Mogul', 'Multiflorum', 'Istrian round', 'Redleaf Lambert', 'Istarski Okrugli' (Dossier Section 9.1).

The diameter at the collar of the plants ranges from 1 to 2 cm and their height from 65 to 220 cm (Dossier Section 9.1).

According to Dossier Section 9.1, only one nursery (Agriser d.o.o.) plans to export Certified and Standard planting material while all other nurseries are planning to export Standard.

3.2. Description of the production areas

The whole territory of Serbia is a production area for hazelnut planting material, but the production is very much concentrated in two regions: the Vojvodina region (north of Serbia) and the Rasina district (central Serbia) (Dossier Section 1.0). Vojvodina is a field crop growing region. Therefore, the nurseries are using the opportunity to rotate the production plots and to settle them in isolation out of other horticulture production and plants. In the Rasina region, the nurseries are settled in valleys, where, due to winter and spring frost risks, there is no fruit and grape production, this occurs several kilometres away on hilly slopes (Dossier Section 9.1).

In Serbia, there are 92 registered nurseries that produced the hazelnut plants for planting from the 2014/15 to 2020/21 growing seasons. Twenty-one of these registered nurseries intend to export hazelnut plants for planting from Serbia to the EU. According to Dossier Section 9.1, phytosanitary

requirements and quality standards for production intended for the domestic market that are prescribed by national legislation correspond to EU requirements, so that the production management is the same for exports and for the domestic market. Two of the twenty-one export nurseries are specialised in the production of hazelnut, and two in hazelnut and walnut, while the remaining nurseries also produce other woody and fruit plants. The surface area of nurseries varies between 0.2 and 61 ha. The plants are grown in rows that are placed at a distance of 50–120 cm and plants in rows are 10–40 cm from one another. For more details, see Dossier Section 9.1.

Figure 2 shows the nurseries that declared intention to export hazelnut plants for planting to the EU.

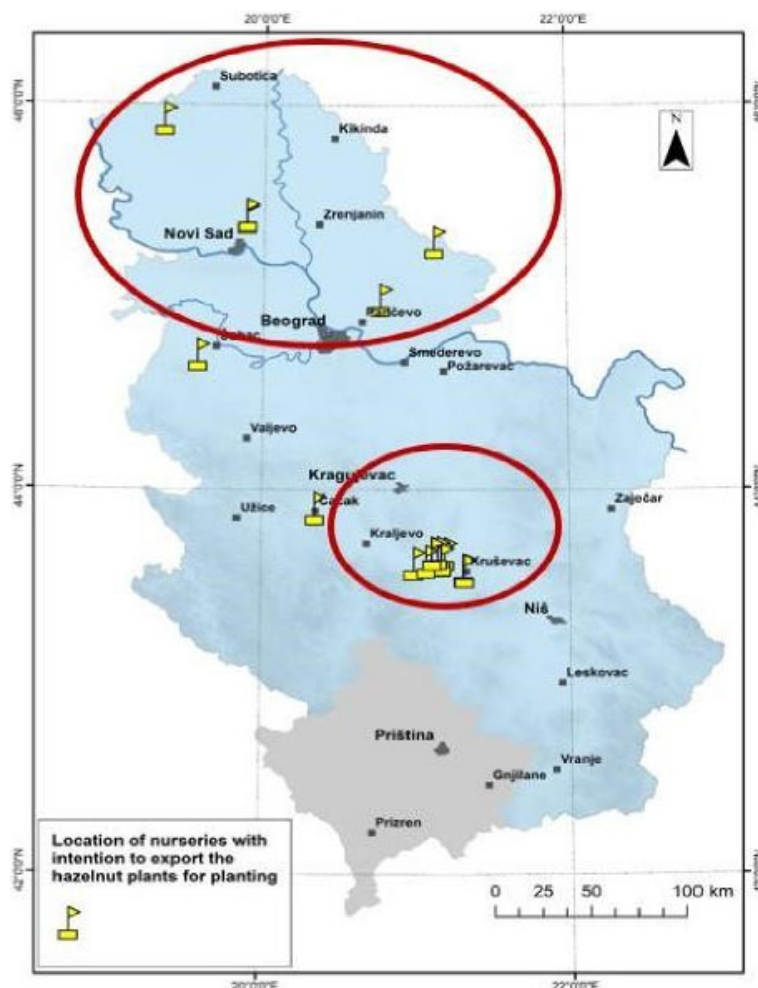


Figure 2: Location of the nurseries intending to export hazelnut plants for planting to the EU

The list of nurseries that declared the intention to export hazelnut plants for planting to the EU is presented in Appendix F together with further specific information provided in Dossier Section 9.1.

Based on the global Köppen–Geiger climate zone classification (Kottek et al., 2006), the climate of the production areas of the hazelnut planting material regions in Serbia is reported as Cold-summer Mediterranean climate (Csc), i.e. main climate (C): warm temperate; precipitation (s): summer dry; temperature (c): cool summer (Dossier Section 1.0). However, according to Milovanović et al. (2017), the most common climate type in Serbia is Dfb, i.e. main climate (D): snow climate; precipitation (f): fully humid; temperature (b): warm summer, followed by Cfb, i.e. main climate (C): warm temperate climate; precipitation (f): fully humid; temperature (b): warm summer.

3.3. Production and handling processes

3.3.1. Growing conditions

The growing medium used for the production is soil (according to the ISPM 40, FAO 2017). The soil tests are the obligatory prerequisite for establishment of the nursery production in Serbia (Dossier

Section 1.0). The specific soil treatment applied in the nurseries intending to export hazelnut plants for planting to the EU can be found in Appendix F.

One nursery (Agrisier, owned by Ferrero Trading Lux S.A.) declared the export of potted hazelnut planting material. This nursery purchased substrate ('TS 3 fine "Aquasave" ' growing medium in the last growing period) from the EU (producer German company, Klasmann-Deilmann, export from Hungary, country of origin Lithuania) that is accompanied by the Phytosanitary certificate issued by the country of substrate origin. The imported substrate from the EU is not further disinfected as in the producer's catalogue (https://klasmann-deilmann.com/vp-content/uploads/8667_KD_General_Guidelines_FAK_2018_Aufb_v07_RZ_VEB.pdf) disinfection of the substrate is not recommended because it destroys useful organisms. The producer guarantees that the substrate is free from harmful organisms and nematodes (Dossier Section 8.1). The composition of the growing medium is 100% *Sphagnum* peat moss, lime and mineral fertiliser (Dossier Section 9.1).

According to Dossier Section 9.1, production of plants for planting using the different production technologies occurs in open fields in all nurseries intending to export hazelnut plants for planting to the EU. Soil treatments in open fields in nurseries intending to export to the EU can be found in Appendix F.

In most nurseries, the plants are irrigated by drip irrigation with water from deep wells and in one nursery irrigation was with artificial rain (Dossier Section 9.1). For more details on the irrigation system and source of water in different nurseries, see Appendix F.

3.3.2. Source of planting material

According to Dossier Sections 1.0 and 8.1, in production technologies H1, H2, H3 and H4 (see Section 3.3.3. for a description of production technologies), the rooted shoots are produced in mother plantations from mother plants of *C. avellana*. Rooted shoots are removed from the mother plants during the dormant period of vegetation. Grafting of *C. avellana* varieties on *C. colurna* rootstock concerns only the production process H5 (see Section 3.3.3).

Mother plants are located either within or outside nurseries and are 1–20 years old depending on the nursery, see Appendix F for more details. The mother plants originate from Serbia, the EU and Russia. Some nurseries obtain the propagation material from other nurseries in Serbia or from the EU (Dossier Section 9.1, see also Appendix F).

According to Dossier Section 9.1, the phytosanitary status of the mother plants is visually assessed every year during official control. Mother plants are sampled and tested in case of symptoms.

According to Dossier Section 9.1, mother plants are pruned at the start of the vegetation period to the ground level. Mother plants are cultivated constantly keeping in mind soil maintenance (four to five times), pesticide treatments (four to five times), manual and mechanical weeding (three to four times), irrigation and fertigation. The mother plants can be used for 1) direct propagation of shoots, or 2) scions for grafting. During May, metal rings are placed around new shoots at their base, and this area of mother plants is covered with soil. The metal rings encourage the formation of a new and better developed root system during the rest of vegetation period. At the end of the vegetation period, after the plants drop their foliage, those shoots for which the metal ring triggered the development of new roots, are harvested. Some nurseries do not place metal rings, but just covering the shoots with soil, twice in May and June. In autumn, or at the latest in February, scions used for grafting are cut to 2–3 cm from the base. They are stored in cold storage, at temperature of 1–3°C at high relative humidity (Dossier Section 9.1). The age and position of mother plants in nurseries intended to export in the EU are specified in Appendix F.

Dossier Section 9.1 specifies: 'the origin of seeds of *C. colurna* intended for rootstock production is as follows. Each nursery producing grafted plants for planting has their own *C. colurna* plants. During the vegetation period, these plants are subjected to treatment with pesticide in accordance with recommendation of the extension service. The plants serve exclusively to produce seeds intended to produce rootstocks. After collection, they are placed in a refrigerator for stratification at a temperature of 0–2°C. Germination is carried out after their removal from the refrigerator. To prevent the appearance of pathogens and pests, regular protection is applied during the vegetation period. The mother plants of *C. colurna* are subjects of official inspection every year as for other mother plants, and for sampling if any suspicious symptoms are seen. Rootstocks are produced in the open field. Sowing is carried out with germinated seeds at distance of 60 × 20 cm.'

3.3.3. Production cycle

Five different production technologies (i.e. H1, H2, H3, H4 and H5) as designated in the Serbian Dossier Section 1.0 are used in Serbia (see Figure 3). Production processes on plants for planting differs on i) the propagation from rooted suckers in mother plantation or grafted rootstocks by hazelnut variety scions and ii) 1- or 3-year-old plants production. According to Dossier Section 9.1, production of plants for planting using the different production technologies occurs in open fields in all nurseries that intended to export hazelnut plants for planting to the EU.

H1	Vegetation 1											
	J	F	M	A	M	J	J	A	S	O	N	D
			C		R						M	

H2	Vegetation 1											
	J	F	M	A	M	J	J	A	S	O	N	D
	Production 1-year-old rooted shoots						P	Growth				R

H3	Vegetation 1											
	J	F	M	A	M	J	J	A	S	O	N	D
	Production 1-year-old rooted shoots						P pots	Growth				M

H4	Vegetations 1 and 2											
	J	F	M	A	M	J	J	A	S	O	N	D
	Production 2-year-old rooted shoots						C	Growth				M

H5	Rootstock production											
	Vegetation 1											
	J	F	M	A	M	J	J	A	S	O	N	D
	G		P	Planting tree growth								

G* Grafting, P Planting, C Cutting 1-year plants

Figure 3: Hazelnut planting material production process for the five different production technologies as explained in the submitted Dossier (H1, H2, H3, H4, H5)

The production cycles for the five technologies (H1–H5) performed in Serbia are described below. Only technology H3 refers to plants for planting in pots, while all the others are intended to be bare rooted plants. Technology H5 refers to *C. avellana* grafted on rootstock of *C. colurna*.

- H1 – Hazelnut planting material production technology 1** (one vegetation, production of rooted shoots in mother plantation from mother plants)
 - March: Cutting-back (shortening) the mother plants; preventive pest and disease control.
 - April: Irrigation, preventive disease and pest control, weed management.
 - May: Shoot selection and placement of metal rings; wrapping, covering of ringed shoots with soil; irrigation, fertigation, weed management, soil cover, preventive disease and pest control.
 - June to October: Irrigation, fertigation, weed management, soil cover, preventive disease and pest control; official inspection controls in June and August–September.
 - November to February: Removal of the plants from soil; plant selection and storage in a trap with sawdust.
- H2 – Hazelnut planting material production technology 2** (two vegetations, production of rooted shoots in mother plantation from mother plants, replanting in open field and second vegetation growth)

- Previous vegetation: Production of annual shoots – planting material plants from mother plants; preventive pest and disease control; soil analysis for the presence of quarantine nematodes; land preparation for planting (ploughed at 35 cm, disc harrowed and tilled using a cultivator).
 - December to March: Planting 1-year-old rooted shoots from December to March in an open field; irrigation systems installation; preventive pest and disease control.
 - April to October: Official inspection controls in June and August–September; irrigation, fertigation, weed management, disease and pest control.
 - November: Preventive pest and disease control.
 - December: Removal of the plants from soil; plant selection and storage in a trap with sawdust.
- 3) H3 – Hazelnut planting material production technology 3** (two vegetations, production of rooted shoots in mother plantation from mother plants, replanting in pots with substrate and second vegetation growth)
- Previous vegetation: Production of shoot planting material plants from mother plants.
 - December to March: Planting the 1-year-old shoots – planting material plants to the pots with substrate; preventive plant and disease control.
 - April to September: Irrigation, fertigation, preventive diseases and pests control; official inspection controls in June and August–September.
 - October to December: Marketing.
- 4) H4 – Hazelnut planting material production technology 4** (three vegetations, production of rooted shoots in mother plantation from mother plants, replanting in open field and additional two vegetation growth in the open field)
- Two previous vegetations: Production of 1-year-old shoots from mother plants; second vegetation in open field growth on its own root.
 - December to March: Cutting plants; preventive pest and disease control.
 - April to September: Irrigation, fertigation, weed management, preventive disease and pest control; official inspection controls in June and August–September.
 - October: Preventive disease and pest control.
 - November to December: Removal of the plants from soil; plant selection and storage in a trap with sawdust; marketing.
- 5) H5 – Hazelnut planting material production technology 5** (three vegetations, grafting cultivars on Turkish hazelnut *Corylus colurna* L.)
- Two vegetations: Turkish hazelnut *Corylus colurna* L. rootstock seedlings growth; official control.
 - January to February: Whip and tongue grafting according to cultivar request.
 - March: Planting the grafted rootstocks to open field; preventive pest and disease control.
 - April to September: Irrigation, fertigation, weed management, preventive disease and pest control; official inspection controls in June and August–September.
 - October: Preventive disease and pest control.
 - November to December: Removal of the plants from soil; plant selection and storage in a trap with sawdust.

Complementary to the above overview on the production cycles for the five technologies (H1–H5) performed in Serbia, Dossier Section 9.1 provides the following additional information on some steps or terms.

The grafting tools are disinfected by 70% alcohol or CI products. The graft wound is protected against infections with stretch foil and graft wax. The grafting site is protected after removing the graft foil with FUNGURAN 500 g of copper as active substance per 1 kg of formulation.

Soil covering is the basic for the hazelnut multiplication from mother plants. The soil cover is mentioned as an operation performed in May when metal rings are placed around the new shoots at their base, and this area of mother plants is covered by soil.

After removal of the plants from the field, some nurseries for the short-term conservation of roots and their protection from sun and wind trapping (covering) the roots in sawdust. The root system and

the root neck are buried. The temperature is as the temperature in the field, trapping with sawdust keeps temperature at the root zone above 0°C.

Fertigation concerns the fact that some nurseries use an irrigation system for fertiliser application.

Inspections mentioned are official.

For technology H3, Dossier Section 8.1 specifies the procedure for the plants in pots as follows: 'while uprooting the one-year old plant produced in the nursery, the uprooting machine has a shaker that shakes the soil from the plant. Additionally, the rest of the soil is removed by washing the plant individually. Individual plants are washed with clean water that is under pressure without any added chemicals. The plants are potted in pots for the next growing vegetation. Planting in the growing substrate occurs at the beginning of the last vegetation period. The growing medium is a substrate from the EU (TS 3 fine 'Aquasave') which is accompanied by the Phytosanitary certificate issued by the country of substrate origin. The imported substrate from the EU is not further disinfected.'

3.3.4. Post-harvest and export procedures

The following information was provided by the PPD of Serbia (Dossier Section 1.0).

The planting material is taken from the soil from October onwards. Once the plants are uprooted by the machine, they are immediately sorted and placed in bundles. Behind the plant uprooting machine, the tractor with a metal pallet moves where the bundles are placed. During the day, pallets are used for root washing, each plant is washed separately, the pallets are re-packed and the plants are taken to the storage (2°C). At the plant uprooting machine, there is a shaker that shakes the soil from the plant. Additionally, the rest of the soil is removed by washing the plant individually. Individual plant is washed by clean water that is under pressure without any added chemical.

The plants are classified based on the quality of adherence at the joint site, the development of the root system and the above-ground part and the age of the plants. Classification of seedlings is carried out in two classes. First class includes seedlings with good developed root system, normally developed and well-developed graft connection site.

Labelling takes place after quality check per each plant or as a 10-plant package. The bundles consisting of 10 (or 20) plants are placed on the pallet. After the pallet is packed, an additional paper label is added describing what is on the pallet (e.g. variety name, pallet number, plant class and total number of plants per pallet). Usually the paper labels are on both sides of the pallet. The number of plants per pallet depends on planting material quality class. The consignment consists of 6,000–9,000 plants per truck. The planting material is stored in cold chambers at a controlled temperature of 1–3°C and relative humidity over 95% until the export delivery (Dossier Section 1.0 and 9.1). The plants are packed into wooden box pallets (dimensions: 1,000 × 1,200 × 1,000 mm), with around 300 plants per pallet. Pallets are made of heat-treated wood with a mark/stamp that indicates that they have been heat-treated. After packing of plants and before the export, each pallet is coated with transparent stretch wrap from all four sides. The top of the pallet is coated with black mulch film. The plants for export are shipped by frigo trucks that secure transport conditions of 5–10°C and humidity around 80% (Dossier Section 9.1).

Before export delivery, the producer is obliged to inform the PPD of Serbia of the shipment and the official inspection consists of a documentation check; visual inspection and sampling of suspicious plants is also carried out. The export inspection is carried out at the place of loading of propagating material of *Corylus* intended for export to the EU. The Phyto certificate for export is issued after official inspection.

3.4. Surveillance system in Serbia

According to Dossier Section 1.0, hazelnut planting material is under permanent surveillance and monitoring. The process is under official controls and there are official records of the production surveillance in all registered nurseries. The procedures and protocols for the commodity, hazelnut planting material are in line with EPPO Standards PM 4/31 (1) Certification scheme on pathogen-tested material of hazelnut and PM 3/72 (1) Elements common to inspection of places of production, area-wide surveillance, inspection of consignments and lot identification.

o Registration

- Planting material production can be performed only by a legal person and entrepreneur registered in the Register of propagating material producers.

- The register is maintained by the PPD of Serbia (66 active registered hazelnut producers, total number of all registered producers of planting material is 400).
- The producer has to annually report the production of propagating material.
- The producer is keeping all records of production and marketing of propagating material.
- The Plant Protection Directorate issues a decision by which the producer of the planting material is registered in this Register and assigns a unique registration number.

○ **Application**

- The registered producer of the planting material in the approval process must submit a production application as well as an application for plant health inspections on the prescribed forms and within the prescribed deadlines.
- The application shall be accompanied by appropriate documentation. Applications are submitted for each location where production is made, separately. Document check on the origin of used propagating material determines the origin of the used propagating material, species, variety and category.
- The producer is obliged to submit a detailed production plan.
- The application shall be accompanied by proof of the origin of the planting material used.
- The producer of the planting material is obliged to provide the certificates of the health inspection of the soil and substrates, as well as the certificates of health status of the rootstocks and scions (buds) for the planting material within the prescribed deadlines.
- A health inspection of the soil and substrate for the presence of nematodes is carried out once a year, 30 days before the beginning of production – the establishment of planting, and every fourth year in the mother plantation, before vegetation starts.
- Applications are submitted on the prescribed forms in two copies.

○ **Official inspection (mandatory)**

Inspections are conducted on the basis of the application by the producer. They are conducted by categories and by plant species at least two times per vegetation. A document check is performed to determine the origin of the used propagating material, species, variety and category.

Plant health checks in objects for production of propagating material are carried out during the growing season to determine the presence of disease and pests at a time when the symptoms can be observed. Records for every inspection are made. If the propagating material meets the prescribed requirements, the Certificates on propagating material production and Certificate on plant health condition are issued.

Health checks applies to:

- Hazelnut planting material;
- Soil and substrate;
- Plants that are potential host of harmful organisms, as well as plants located in the immediate environment of plantings or facilities.

At least two visual inspections are mandatory, first when the plants characteristics of species and cultivars are the most pronounced and when symptoms of plant diseases and pests can be best seen; second, when plants express a uniform development and it is possible to estimate the general appearance of plant material and yield.

Plant health checks can be performed more than two times per year, if this is needed due to unfavourable conditions for production of propagating material or specificity of harmful organisms.

Plant health checks of crops and facilities are performed in the presence of producers. A report is written on each control, and signed by the responsible person from the producer side and authorised persons.

Plant health checks of soil and substrates for the presence of nematodes is performed once a year, 30 days before the starting the production (establishment of crops, 30 days before establishment of facilities and every fourth year in mother plantations, before the starting of vegetation).

The report on the results of completed testing on the presence of nematodes, as well as tests for viruses, is an integral part of the records.

If the inspection determines that the propagating material does not meet the conditions specified in the law and it is implementing regulations, the plant material must be destroyed in the presence of phytosanitary inspectors.

If the inspection determines that the planting material meets all the requirements prescribed, the authorised Agricultural Service issues Certificate on plant health condition, and Plant Protection Directorate, Certificate on propagating material production.

○ **Labelling**

After obtaining the Certificate on production, the producer files an application for phytosanitary inspection for printing labels for all categories of propagating material. The label has a unique serial number and it guarantees that each plant for planting is produced under official inspection by an official certification procedure including at least two visual surveys per vegetation. The number of labels indicates the number of inspected plants; the label is issued based on the PPD of Serbia Certificate, which confirms that the plants were produced according to official procedures. The hazelnut plants for planting that did not pass the certification procedure (visual controls) are forbidden from being placed on the market.

Printing of labels is carried out by only one authorised organisation. The colour of label describes each category of plant material. The authorised organisation shall keep a record of issued labels. When marketing, propagating material must match the declared variety, the prescribed standards of quality, health and how originally packaged and labelled (individually or in a group).

Categories of plant material are:

- Pre-basic: A pre-basic propagating material is a reproductive material produced under the responsibility of the breeder or his agents, it is used for the production of basic plant material, and has been tested according to the latest international standards for the presence of diseases and pests. It is held under strict conditions with no possibility for infection.
- Basic: The basic planting material is a reproductive material derived from pre-basic propagating material used for the production of certified planting material, it is produced in mother plantations under the control of an authorised organisation. It is marked with a white label.
- Certified: Certified planting material is propagating material created from the basic planting materials and intended for the production of certified plants or production of standard plant material. It is marked with a blue label.
- Standard: Standard planting material is reproductive planting material that originated from reproduction of certified material and is intended for the production of standard plants. It is marked with an orange certificate.
- Standard marked with the label S-A in distribution: Standard planting material that originated from reproduction of standard plants, or from mother plants approved in accordance with the Law on Seeds and Propagating Material (Official Gazette of RS No. 54/93), it is marked in distribution with an orange coloured certificate and with the special label S-A.

○ **National surveys**

Every year the PPD prepares and organises activities for conducting two programmes:

- 1) Programme of Measures for Plant Health
- 2) Programme of monitoring, forecasting and reporting of pests, as part of the support to producers and exporters related to improving the plant health status.

The Programme of Measures for Plant Health aims at the prevention, early detection, monitoring, suppression and eradication of harmful organisms on the plants. This programme defines the actual measures, time limits, manner of implementing those measures, the entities that will implement them, sources of funds and manner of provision and use of the funds, as well as the manner of controlling the implementation of the measures.

In accordance with the Programme of Measures for Plant Health, a specific survey to verify the status of harmful organisms in soil is carried out every year. This includes pests as *Globodera pallida*, *G. rostochiensis*, *Clavibacter michiganensis* sp *sepedonicus* and *Synchytrium endobioticum*, which are prescribed EU requirements for the import of hazelnut planting material. There is no specific survey of the above harmful organisms in hazelnuts plants.

Additionally, through the programme of monitoring, forecasting and reporting of pests, the PPD of Serbia finances the gathering of biological, meteorological and other data to predict the occurrence of harmful organisms and reporting on the presence, occurrence and spread of harmful organisms and forecast the occurrence of harmful organisms, the development and movement of their populations, and indicate optimal timeframes for their suppression using tools such as: Automatic Weather Stations, pheromone traps, light traps and spore traps.

○ **Inspection before export**

After at least two on-site inspections carried out in that year during the vegetation in registered nurseries, prior to export, an additional export inspection is carried out at the place of loading of propagating material of *Corylus* material intended for export to the EU.

Before export, roots of bare rooted plants are washed to remove all soil.

Inspection is performed in accordance with ISPM 23 and implies:

- examination of documents associated with a consignment.
- verification of consignment identity and integrity.
- visual examination for pests and other phytosanitary requirements (such as freedom from soil) (Dossier Section 1.0).

The examination for pests and other phytosanitary requirements (such as freedom from soil) before export is performed using naked eye inspection. In case of any suspicion of the presence of pests, samples are taken for laboratory analysis. Measures depending on the type of pest can be chemical treatment if appropriate or destruction of infested plants (Dossier Section 9.1).

According to Dossier Section 1.0, the PPD of Serbia provides technical information to the staff involved in official plant health controls and certification for export on plant health status of harmful organisms and new findings and risks, measures, notifications, specific phytosanitary requirements and additional declarations for import/export, acting in specific cases in international trade according to relevant International Standards for Phytosanitary Measures (ISPM), as well as communication with National Plants Protection Organisations (NPPOs) of other countries.

The PPD of Serbia issues phytosanitary certificates in accordance with ISPM 7 (Export certification system) and ISPM 12 (Guidelines for phytosanitary certificates) as well as the specific requirements of the importing country.

4. Identification of pests potentially associated with the commodity

The compiled pest list (see Microsoft Excel® file in Appendix E) including all agents associated with *Corylus avellana* or *Corylus colurna* and all EU quarantine pests associated with *Corylus* yielded 894 pests. That list also included 26 RNQPs and 3 deregulated pests that were subsequently excluded from the evaluation, as indicated in Section 1.2.

4.1. Selection of relevant EU quarantine pests associated with the commodity

The EU listing of Union quarantine pests and protected zone quarantine pests (Commission Implementing Regulation (EU) 2019/2072) is based on assessments concluding that the pests can enter, establish, spread and have potential impact in the EU.

Seventeen EU quarantine pests that are reported in the compiled pest list were evaluated (Table 3).

The relevance of an EU quarantine pest for this Opinion was based on evidence that:

- 1) the pest is present in Serbia;
- 2) *Corylus avellana* and/or *C. colurna* and/or other species belonging to the genus *Corylus* are hosts of the pest;
- 3) one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all three criteria were selected for further evaluation.

Out of the 17 EU quarantine pests evaluated, 1 pest (Flavescence dorée phytoplasma, FDp), present in Serbia and known to be associated with the commodities was selected for further evaluation (see Table 3).

Table 3: Overview of the evaluation of the 17 EU quarantine pest species known to be associated with *C. avellana*, *C. colurna* or to the genus *Corylus* for their relevance for this Opinion

Number	Pest name according to EU legislation ^(a)	EPPO code	Group	Pest present in Serbia	<i>Corylus</i> confirmed as a host (reference)	Pest can be associated with bare rooted plants ^(b)	Pest can be associated with plants in pots ^(b)	Pest relevant for the Opinion
1	<i>Anisogramma anomala</i> (synonym: <i>Apioporthes anomala</i>)	CRSPAN	Fungi	No	Yes, as <i>C. avellana</i> (EPPO, online)	Not evaluated	Not evaluated	No
2	<i>Anoplophora chinensis</i>	ANOLCN	Insects	No	Yes, as <i>C. avellana</i> (EPPO, online)	Not evaluated	Not evaluated	No
3	<i>Anoplophora glabripennis</i>	ANOLGL	Insects	No	Yes, as <i>C. colurna</i> (EPPO, online)	Not evaluated	Not evaluated	No
4	<i>Choristoneura conflictana</i>	ARCHCO	Insects	No	Yes, as <i>Corylus</i> (Robinson et al., online)	Not evaluated	Not evaluated	No
5	<i>Choristoneura rosaceana</i>	CHONRO	Insects	No	Yes, as <i>C. avellana</i> (EPPO, online)	Not evaluated	Not evaluated	No
6	<i>Cryptosporella anomala</i>	CRSPAN	Fungi	No	Yes, as <i>Corylus</i> (Farr and Rossman, online)	Not evaluated	Not evaluated	No
7	Grapevine flavescence dorée phytoplasma (synonym: Flavescence dorée phytoplasma)	PHY64	Phytoplasma	Yes	Yes, as <i>C. avellana</i> (Casati et al., 2017; Mehle et al., 2019)	Yes	Yes	Yes
8	<i>Lopholeucaspis japonica</i>	LOPLJA	Insects	No	Yes, as <i>C. avellana</i> (García Morales et al., online)	Not evaluated	Not evaluated	No
9	<i>Naupactus leucoloma</i>	GRAGLE	Insects	No	Yes, as <i>C. avellana</i> (Snare, 2006)	Not evaluated	Not evaluated	No
10	<i>Oemona hirta</i>	OEMOHI	Insects	No	Yes, as <i>Corylus</i> (EPPO, online)	Not evaluated	Not evaluated	No
11	<i>Phymatotrichopsis omnivora</i>	PHMPOM	Fungi	No	Yes, as <i>C. avellana</i> (Snare, 2006)	Not evaluated	Not evaluated	No
12	<i>Phytophthora ramorum</i> (non-EU isolates)	PHYTRA	Oomycetes	No ^(c)	Yes, as <i>C. avellana</i> (Denman et al., 2005)	Yes	Yes	No
13	<i>Popillia japonica</i>	POPIJA	Insects	No	Yes, as <i>C. avellana</i> (EPPO, online)	Not evaluated	Not evaluated	No
14	<i>Thaumetopoea processionea</i>	THAUPR	Insects	Yes	Yes, as <i>Corylus</i> (CABI, online)	No	No	No

Number	Pest name according to EU legislation ^(a)	EPPO code	Group	Pest present in Serbia	<i>Corylus</i> confirmed as a host (reference)	Pest can be associated with bare rooted plants ^(b)	Pest can be associated with plants in pots ^(b)	Pest relevant for the Opinion
15	Tulare apple mosaic virus (synonym: Tulare apple mosaic ilarvirus) as non-European viruses, viroids and phytoplasmas 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.	TAMV00	Virus	No	Yes, as <i>C. avellana</i> (Brunt et al., online)	Not evaluated	Not evaluated	No
16	<i>Xyleborus xylographus</i> as Scolytidae non-European	XYLBXY	Insects	No	Yes, as <i>C. avellana</i> (Snare, 2006)	Not evaluated	Not evaluated	No
17	<i>Xylosandrus compactus</i> as Scolytidae non-European	XYLSCO	Insects	No	Yes, as <i>C. avellana</i> (Faccoli, 2021)	Not evaluated	Not evaluated	No

(a): Commission Implementing Regulation (EU) 2019/2072.

(b): The question whether the pest can be associated with the commodity was evaluated only if the questions on the presence in Serbia and the association with *Corylus*, *C. avellana* or *C. colurna* were answered with 'Yes'.

(c): *Phytophthora ramorum* is indicated as present in Serbia by EPPO (online), CABI (online), and Farr and Rossman (online). However, NPPO of Serbia considers the pathogen as absent/eradicated based on intensive surveys conducted from 2009 to 2020 (Dossier Section 9.1). Therefore, the Panel considers *Phytophthora ramorum* as no longer present in Serbia.

4.2. Selection of other relevant pests (not regulated in the EU) associated with the commodity

The information provided by the PPD of Serbia, integrated with the search EFSA performed, was evaluated to assess whether there are other potentially relevant pests of *C. avellana* or *C. colurna* present in the country of export. For these potential pests not regulated in the EU, pest risk assessment information on the probability of introduction, establishment, spread and impact is usually lacking. Therefore, these pests that are potentially associated with *C. avellana* or *C. colurna* were also evaluated to determine their relevance for this Opinion based on evidence that:

- 1) the pest is present in Serbia;
- 2) the pest is (i) absent or (ii) has a limited distribution in the EU and phytosanitary measures are in place in at least one of the relevant EU MS or all evidence of introduction is recent (no older than five years);
- 3) *Corylus avellana* and/or *C. colurna* is a host of the pest;
- 4) one or more life stages of the pest can be associated with the specified commodity;
- 5) the pest may have an impact in the EU.

Pests that fulfilled all five criteria were selected for further evaluation.

Based on the information collected, 848 not regulated potential pests known to be associated with *C. avellana* and/or *C. colurna* were evaluated for their relevance to this Opinion. Species were excluded from further evaluation when at least one of the conditions listed above (1–5) was not met. Details can be found in the Appendix E (Microsoft Excel® file). None of the pests not regulated in the EU was selected for further evaluation because none of them met all selection criteria.

4.3. Overview of interceptions

Data on the interception of harmful organisms on plants of *C. avellana* or *C. colurna* can provide information on some of the organisms that can be present on *C. avellana* or *C. colurna* despite the current measures taken.

According to EUROPHYT online (accessed on 6 August 2020) and TRACES-NT online (accessed on 5 February 2021), there were no interceptions of plants for planting of *C. avellana* or *C. colurna* from Serbia destined to the EU Member States due to the presence of harmful organisms between 1995 and January 2021.

4.4. List of potential pests not further assessed

From the list of pests not selected for further evaluation, the Panel highlighted two species (see Appendix D) for which the currently available evidence provides no reason to select these species for further evaluation in this Opinion. A specific justification of the inclusion in this list is provided in Appendix D for each species.

4.5. Summary of pests selected for further evaluation

One pest identified to be present in Serbia while having potential for association with the commodities destined for export is listed in Table 4. The effectiveness of the risk mitigation measures proposed for the commodities by the Serbia was evaluated for this selected pest.

Table 4: List of relevant pests selected for further evaluation

Number	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
1	Flavescence dorée phytoplasma	PHYPP64	Grapevine flavescence dorée phytoplasma	Acholeplasmatales, Acholeplasmataceae	Phytoplasma	EU quarantine pest according to Commission Implementing Regulation (EU) 2019/2072

5. Risk mitigation measures

For the selected pest (see Table 4), the Panel assessed the possibility that it could be present in the exporting nurseries and assessed the probability that pest freedom is achieved by the proposed risk mitigation measures acting on the pest under evaluation.

The information used in the evaluation of the effectiveness of the risk mitigation measures is summarised in a pest data sheet (see Appendix A).

5.1. Possibility of pest presence in the export nurseries

For the selected pest (see Table 4), the Panel assessed the likelihood that the pest could be present in the exporting nurseries by evaluating the possibility that *C. avellana* and/or *C. colurna* in the export nurseries are infested either by:

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

5.2. Risk mitigation measures proposed

With the information provided by the PPD of Serbia (Dossier Sections 1.0, 8.0 and 9.1), the Panel summarised the risk mitigation measures (see Table 5) proposed by Serbia on the hazelnut planting material production.

Table 5: Overview of proposed risk mitigation measures for *Corylus avellana* and/or *C. colurna* plants designated for export to the EU from Serbia

N	Risk mitigation measure	Implementation
1	Introduction of controlled planting material	Introduction of planting material for establishment of mother plantations, nurseries and plantations is based on Memorandum of Understanding and Protocol on the phytosanitary requirements for the export of hazelnut propagating material and hazelnut fruit plants from the Italian Republic to Republic of Serbia, signed in February 2018. It specifies the specific phytosanitary measures and procedures in Italy to export hazelnut propagating material and hazelnut fruit plants, genus <i>Corylus</i> to the Republic of Serbia. The protocol guarantees the plant health, traceability and commercial quality of the planting material to be marketed on the territory of the Republic of Serbia, starting from the 2017–2018 export campaign (Dossier Section 1.0). The status of mother plants imported from countries different from Italy is obtained after tests in a similar way as specified above (Dossier Section 9.1).
2	Mandatory laboratory testing	Mandatory laboratory testing of plants for planting for <i>Xanthomonas coryllina</i> on imports.
3	Certification scheme	Certification scheme was established in 2005 by the Regulation (Law on propagating material of fruits, vine and hops) and harmonised with the EPPO. Throughout the certification scheme, the origin of each plant is known so that health or trueness to type may be traced. The use of propagation material in nurseries to produce plant propagation material (certified and CAC) is checked by an officially authorised service that controls the plant health, origin and amount of such material on the basis of field inspections and of the records and documents presented by the nursery. The nursery plant protection program and the field check inspections take into account other important pests that can affect quality, so that the certified plants and plants of category CAC delivered to the fruit grower are substantially free from quarantine pests and RNQPs. Plants leaving the scheme carry an official certificate (label) indicating the certifying authority, the plant producer and the certification status of the plants as well as the nursery (producer) registration number and number of certificate. According to Dossier Section 9.1, the phytosanitary requirements and quality standards for production intended for the domestic market that are prescribed by national legislation correspond to the EU requirements, so that the production management is the same for exports and for the domestic market.

N	Risk mitigation measure	Implementation
4	Soil inspections and treatments	Soil analyses are obligatory steps in the process of establishment of nursery production each year and the soil analyses are mandatory in the process of application for the production each year. Also, Serbia can guarantee requested official statements for <i>Clavibacter sepedonicus</i> (Spieckermann and Kottho) Nouiou et al. <i>Synchytrium endobioticum</i> (Schilb.) Percival, <i>Globodera pallida</i> (Stone) Behrens, <i>Globodera rostochiensis</i> (Wollenweber) Behrens in accordance with pest status of these pathogens in Serbia. According to Dossier Section 9.1, the soil is not treated.
5	Visual inspections	The competent authority, and the professional operator under the official supervision of the competent authority, shall carry out checks and take any other actions to ensure that: (a) the plants shall at least appear, on visual inspection, to be practically free from pests, (b) any plants showing visible signs or symptoms of the pests specified in Dossier Section 1.0, at the stage of the growing crop, have been treated properly immediately upon their appearance or, when appropriate, have been eliminated. According to 'Protocol for inspection for hazelnut mother plants and nurseries' (Dossier Section 5.2), two visual inspections of mother plantation (in the period May–June and August–September), and two visual inspections of nursery (in the period June and August–September) have to be performed. The following pests are monitored during these visual inspections: symptoms of <i>Pseudomonas avellanae</i>, <i>Xanthomonas arboricola</i> pv. <i>corylina</i>, <i>Phytophthora avellanae</i>, <i>Armillariella mellea</i>, <i>Verticillium albo-atrum</i>, <i>Verticillium dahlia</i>. Visual inspections are performed in nurseries by the naked eye twice a year. In spring–summer for the first time and for the second time before the end of vegetation. Sampling occurs only when there is suspicion of the presence of viruses and phytoplasma. Visual assessment of the mother plants occurs every year during official control. Mother plants are sampled and tested in case of symptoms.
6	Pesticide treatments	The nurseries perform chemical (pesticide) treatments. Several pesticides are used in a preventative way against targeted pest species (i.e.: <i>Phytophthora avellanae</i> and <i>Xanthomonas arboricola</i> pv. <i>corylina</i>), e.g. Abamectin, Copper oxide, Sulfur, Paraffin oil (Dossier Sections 1.0 and 9.1). Details on pesticide treatment can be found in Table E1 of Dossier Section 1.0.
7	Inspection before export	The examination for pests and other phytosanitary requirements (such as freedom from soil) before export is performed by naked eye inspection. If there is any suspicion of the presence of pests, samples are taken for the laboratory analysis. Measures depending on the type of pest can be chemical treatment if appropriate or destruction of infested plants (Dossier Section 9.1). For more details see Section 3.4. part 'Inspection before export'.
8	Checks performed by the PPD	The PPD of Serbia carry out checks and take any other actions to ensure that the plants appear, on visual inspection, to be practically free from quarantine pests and regulated non quarantine pests.
9	Surveillance and monitoring	According to Dossier Section 1.0, hazelnut planting material is under permanent surveillance and monitoring. The process is under official controls and there are official records of the production surveillance in all registered nurseries. The procedures and protocols for the commodity, hazelnut planting material are in line with EPPO Standards PM 4/31 (1) and PM 3/72 (1).

N	Risk mitigation measure	Implementation
		As in Dossier Section 5.2, mother plants and plants for planting are inspected and monitored for the presence of the following pests: <i>Pseudomonas avellanae</i> , <i>Xanthomonas arboricola</i> pv. <i>corylina</i> , <i>Phytoptus avellanae</i> , <i>Armillariella mellea</i> , <i>Verticillium alboatrum</i> , <i>Verticillium dahlia</i> . In addition, according to Dossier Section 9.1, other inspection targets in the nursery are: <i>Clavibacter sepedonicus</i> , <i>Synchytrium endobioticum</i> , <i>Globodera pallida</i> , <i>Globodera rostochiensis</i> , <i>Apple mosaic ilarvirus</i> , <i>Anisogramma anomala</i> , <i>Popilia japonica</i> , <i>Anoplophora chinensis</i> . Details of the inspection and monitoring are specified in Dossier Section 9.1.
10	Root treatment	<u>Bare rooted plants</u>: Uprooting, removal of soil. Additionally, the rest of the soil is removed by washing the plant individually. Individual plants are washed with clean water that is under pressure without any added chemicals. <u>Plants in pots</u>: Uprooting, removal of soil. Additionally, the rest of the soil is removed by washing the plant individually. Individual plants are washed with clean water that is under pressure without any added chemicals. Planting in pots in commercial growing substrate for the next growing vegetation.
11	Rotation	The production of plants for planting is in strict crop rotation. The rotation of the plant for planting production fields is obligatory by the Serbian regulation. Nursery production can occur on the same plot for a maximum of 3 years. The crop history at the field is presented when registering production every year. Given the availability of large areas of land on which nursery plants can be produced in the Vojvodina region, new production is always on 'virgin land' on which no nursery has ever been produced before. In the Rasina districts, the common practice is for leguminous crops for 2–3 years and then again different fruit species then hazelnut plants for planting (Dossier Section 9.1).
12	Isolation	Isolation is a Good Agriculture Practice measure applied by nurseries to set the planting material plots at least of 500 m from fruit plantations of the same species, even when this is not regulated, as in the case of hazelnut. The inspectors, during official controls inspect the vicinity of the nursery for the presence of fruit growing plantations (Dossier Section 9.1).
13	Measures taken to avoid recontamination or re-infestation of growing medium in pots	According to Dossier Section 9.1, in the nursery, the following measures are taken to avoid recontamination or re-infestation of growing medium during the last growing season for plants in pots: – physical isolation of the growing medium from soil and other possible sources of contamination; – use agro-textile foil, geographical distance from other host plants, removal of infested plants and plant debris; – hygiene measures, using clean tools, equipment, containers, disinfection of tools and equipment, personal hygiene, routines for use of packaging material and packaging facilities. — using water free from EU quarantine pests, such as <i>Ralstonia solanacearum</i> and other harmful bacteria and viruses, - uncontaminated water sources; – Pesticide applications to prevent or treat pest and diseases as well as possible vectors (Dossier Section 9.1).
14	Management of fallen leaves	Fallen leaves are generally collected and removed from the nurseries (Dossier Section 9.1). For more details, see Appendix F.
15	Hygiene measures applied to plants grown in pots	All tools and devices are disinfected with alcohol (Dossier Section 9.1).
16	Management of non-cultivated herbaceous plants and weeds	Some of the nurseries are regularly cultivated, and the access roads are filled with gravel. In other nurseries, there are no weeds, because the land is regularly maintained by inter-row tillage with machines, and in-line tillage is carried out manually, with hoes. In general, all nurseries that are intending to export plants manage weeds mechanically by hand tools cultivation depending on the appearance of weeds (Dossier Section 9.1).

N	Risk mitigation measure	Implementation
17	Measure to reduce Flavescence dorée phytoplasma outside the nurseries	Specific control measures applied against FDp and its vector <i>S. titanus</i> include: 1) Removal and destruction of infected plants with roots; 2) Destruction of abandoned vineyards and other hosts plants in the immediate and wider environment of production or mother plantations; 3) Destruction of wild grape vines in the immediate and wider vicinity of active vineyards; 4) Control of weeds and wild grape plants as potential reservoirs of phytoplasma, including <i>Clematis vitalba</i> and <i>Alnus glutinosa</i> ; 5) Control of <i>S. titanus</i> in vineyards in accordance with recommendations of the Plant protection forecast and report service (PIS) (Dossier Section 9.1).

5.3. Evaluation of the current measures for the selected relevant pests including uncertainties

The relevant risk mitigation measures acting on the selected pest were identified. Any limiting factors on the effectiveness of the measures were documented.

All the relevant information including the related uncertainties deriving from the limiting factors used in the evaluation are summarised in a pest data sheet provided in Appendix A. Based on this information, for the selected pest, an expert judgement is given for the likelihood of pest freedom taking into consideration the risk mitigation measures and their combination acting on the pest.

An overview of the evaluation of the relevant pest is given in Section 5.3.1. The outcome of the EKE regarding pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.3.2.

The biology of the pest, the production systems and the risk mitigation measures suggested the same likelihood of pest freedom for both commodities; therefore, the EKE was performed together for bare rooted plants and plants in pots.

5.3.1. Overview of the evaluation of Flavescence dorée phytoplasma

Overview of the evaluation of Flavescence dorée phytoplasma for bare rooted plants and plants in pots					
Rating of the likelihood of pest freedom	Extremely frequently pest free (based on the Median).				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free plants	9,837 out of 10,000 plants	9,903 out of 10,000 plants	9,946 out of 10,000 plants	9,977 out of 10,000 plants	9,996 out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infested plants	4 out of 10,000 plants	23 out of 10,000 plants	54 out of 10,000 plants	97 out of 10,000 plants	163 out of 10,000 plants
Summary of the information used for the evaluation	Possibility that the pest could become associated with the commodity The pest could be present in the surrounding of the nurseries at the distance of over 1 km and could be introduced into the nurseries by means of insect vectors. The pest could also enter the nurseries with infected plant material. Plants intended for export to the EU may become infected directly by means of vectors or through infected plant material from mother plants. Measures taken against the pest and their efficacy FDp and its vectors are officially controlled in vineyard and this may reduce the inoculum pressure in the surrounding of the nurseries. Although not targeting specifically FDp vectors, preventative treatments with some insecticides are expected to reduce the level of vector population in the nurseries.				

Interception records

In the EUROPHYT/TRACES-NT database, there are no records of notification of *C. avellana* and *C. colurna* plants for planting neither from Serbia nor from other countries due to the presence of FDp between 1995 and January 2021 (EUROPHYT/TRACES-NT, online).

Shortcomings of current measures/procedures

FDp has been recently reported on hazelnut. Therefore, current measures in place in the nurseries including inspections do not target specifically the pest. The disease has been described so far as asymptomatic on hazelnut. As inspections are carried out on visual basis, there is little chance that the disease is detected.

Main uncertainties

- The level of susceptibility of *C. avellana* to FDp.
- Host status of *C. colurna*.
- The efficiency of the vectors in transmitting FDp to hazelnut.

5.3.2. Outcome of Expert Knowledge Elicitation

Table 6 and Figure 4 show the outcome of the EKE regarding pest freedom after the evaluation of the proposed risk mitigation measures for the evaluated pest including an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the proposed risk mitigation measures for bare rooted plants and plants in pots designated for export to the EU.

Table 6: Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against Flavescence dorée phytoplasma on commodities designated for export to the EU. In panel A, the median value for the assessed level of pest freedom for the pest is indicated by 'M', the 5% percentile is indicated by 'L' and the 95% percentile is indicated by 'U'. The percentiles together span the 90% uncertainty range regarding pest freedom. The pest freedom categories are defined in panel B of the table

Number	Group	Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
1	Phytoplasma	Flavescence dorée phytoplasma				L	M			U

PANEL A

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

PANEL B

COLOR

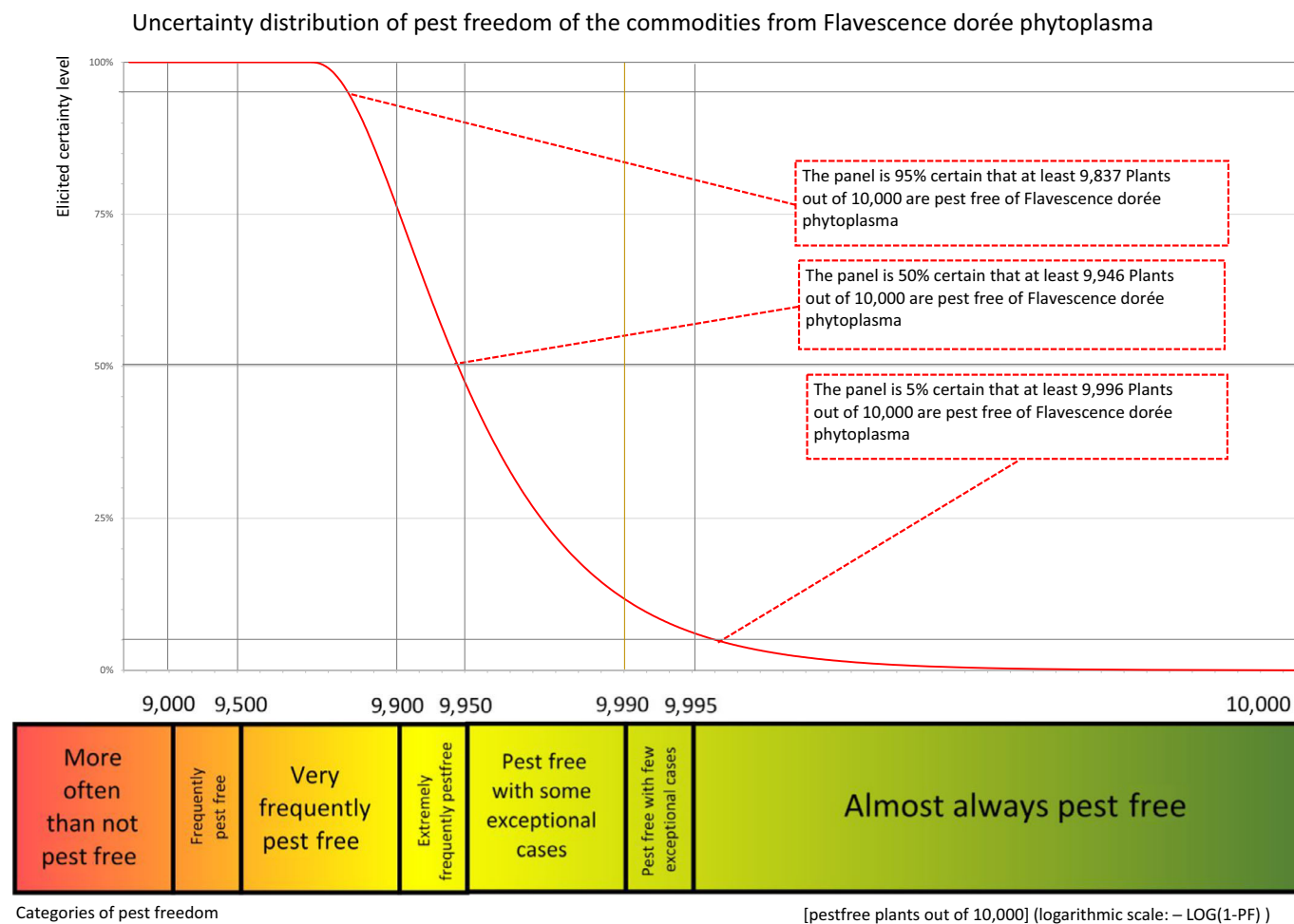


Figure 4: Elicited certainty (y-axis) of the number of pest-free bare rooted plants of *Corylus avellana* and *C. avellana* grafted on *C. colurna*, and plants in pots of *C. avellana* (x-axis; log-scaled) out of 10,000 plants designated for export to the EU introduced from Serbia for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%). The Panel is 95% sure that 9,837 or more plants per 10,000 will be free from Flavescence dorée phytoplasma

6. Conclusions

There is one quarantine pest in the EU identified to be present in Serbia and considered as potentially associated with bare rooted plants of *C. avellana* and *C. avellana* grafted on *C. colurna*, and with plants in pots of *C. avellana* imported from Serbia: Flavescence dorée phytoplasma.

For Flavescence dorée phytoplasma, the likelihood of pest freedom for bare rooted plants and plants in pots following evaluation of proposed risk mitigation measures was estimated as 'extremely frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,837 and 10,000 plants per 10,000 will be free from Flavescence dorée phytoplasma.

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Glossary

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

Abbreviations

CABI	Centre for Agriculture and Bioscience International
CAC	Conformitas Agraria Communitatis
EKE	Expert Knowledge Elicitation
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
FDp	Flavescence dorée phytoplasma
ISPM	International Standards for Phytosanitary Measures
MAFWM	Ministry of Agriculture, Forestry and Water Management
MLO	Mycoplasma-like organism
NPPO	National Plants Protection Organisation
PLH	Plant Health
PPD	Plant Protection Directorateaaaa Ministry of Agriculture, Forestry and Water Managementaaa Republic of Serbia
PRA	Pest Risk Assessment
RNQPs	Regulated Non-Quarantine Pests

Appendix A – Data sheets of pests selected for further evaluation

A.1. Flavescence dorée phytoplasma

A.1.1. Organism information

Taxonomic information	Current valid scientific name: Flavescence dorée phytoplasma (FDp) For the purposes of this document, the distinction between the two FDp subgroups 16SrV-C and 16SrV-D was not taken into account. Synonyms: Grapevine flavescence dorée phytoplasma, Flavescence dorée MLO, Flavescence dorée mycoplasma-like organism, Grapevine yellows Name used in the EU legislation: Grapevine flavescence dorée phytoplasma [PHYP64] Order: Acholeplasmatales Family: Acholeplasmataceae Common name: baco 22A disease, flavescence dorée of grapevine Name used in the Dossier: –
Group	Phytoplasma
EPPO code	PHYP64
Regulated status	The pest is listed in Annex II of Regulation (EU) 2019/2072 as Grapevine flavescence dorée phytoplasma [PHYP64]. The pest is included in the EPPO A2 list (EPPO, online_a). Flavescence dorée phytoplasma is quarantine in Canada, Israel, Mexico, Morocco, Tunisia, and United States of America (EPPO, online_b).
Pest status in Serbia	Flavescence dorée phytoplasma is present with restricted distribution in Serbia (EPPO, online_c, Dossier Section 9.1). Its presence is reported in seven vineyard production areas, with incidence ranging from less than 5–97% by Kuzmanovic et al. (2011).
Pest status in the EU	Flavescence dorée phytoplasma is listed under Commission Implementing Regulation 2019/2072 in Annex II, Part B, as a Union quarantine pest known to occur in the EU. Moreover, Annex VI prohibits the introduction of <i>Vitis</i> L. plants from third countries other than Switzerland, and Annex VIII details the internal movement requirements for <i>Vitis</i> plants. The general requirements for surveys of quarantine organisms in the EU territory are laid down in Regulation (EU) 2016/2031. Flavescence dorée phytoplasma is present with restricted distribution in Austria, Croatia, France, Hungary, Italy, Portugal and Slovenia (EPPO, online_c).
Host status of <i>Corylus avellana</i>	<i>Corylus avellana</i> was reported as host very recently by Casati et al. (2017): Flavescence dorée phytoplasma has been found in asymptomatic association with <i>C. avellana</i> and <i>Orientus ishidae</i> as vector. Mehle et al. (2019) have also evidenced hazelnut decline, in association with different phytoplasmas including 16SrV and isolates considered identical to those causing grapevine flavescence dorée disease.
PRA information	Available Pest Risk Assessment: – Analysis of the pest risk from Grapevine flavescence dorée phytoplasma to Austrian viticulture (Steffek et al., 2007), – Risk to plant health of Flavescence dorée for the EU territory (EFSA PLH Panel, 2016).

Other relevant information for the assessment

Biology	Flavescence dorée phytoplasma is endemic to Europe and naturally associated with European <i>Alnus</i> spp. (Malembic-Maher et al., 2020). Flavescence dorée phytoplasma are pleomorphic, non-culturable bacteria with no cell walls, known as phloem-obligate parasites. In infected plants, FDp multiplies and stays within the phloem sieve tubes. It survives during winter into the canes and roots from where it then moves, during spring, to the upper parts of the plants (EFSA PLH Panel, 2014). Flavescence dorée phytoplasma is acquired from the phloem by sap ingestion by the insects (<i>Scaphoideus titanus</i> on <i>Vitis</i> sp., <i>Dictyopharida europea</i>, <i>Orientus ishidae</i> and <i>Phlogotettix cyclops</i>). Flavescence dorée phytoplasma passes through the vector's alimentary canal and multiplies in the midgut. Then, it colonises the haemolymph before entering and multiplying in the salivary gland. Finally, it is delivered to another host plant through saliva (Lefol et al., 1993, 1994). Between the acquisition by the insect and its transmission to another host plant, there is a temperature-dependent latency period between 10 and 45 days long. The transmission mode is termed 'persistent and propagative' because, after phytoplasma acquisition and the latency period, the insect vector remains infectious for life, also during moulting. Transovarial transmission has never been reported. Transmission is also possible through grafting (Boudon-Padieu, 2002). There are no reports of transmission by root grafting. Following infection, it takes one year for the symptoms to become visible in susceptible hosts. The maximum distance expected to be covered in one year by FDp disease was estimated at 44 m (with a 95% uncertainty range of 1–1,300 m), with <i>S. titanus</i> being the main limiting factor on disease progression (EFSA, 2020). Most of the information including that reported above, comes from the pathosystem on <i>Vitis</i>. However, other pathosystems are known but poorly described.	
Symptoms	Main type of symptoms	On <i>C. avellana</i> , the FDp has only been reported recently in asymptomatic tissues (Casati et al., 2017). The pathogen has been reported in declining plants (leaf yellowing or curling, leaf drops and in a limited number of cases, proliferation of sprouts from roots and or trunks, witches' broom symptoms) in association with other phytoplasmas (Mehle et al., 2019). The role of FDp in the elicitation of symptoms still needs to be defined.
	Presence of asymptomatic plants	Asymptomatic association with <i>C. avellana</i> reported (Casati et al., 2017).
	Confusion with other pathogens/pests	Infection by different phytoplasma reported, e.g. <i>Candidatus</i> Phytoplasma fragariae (Mehle et al., 2019).
Host plant range	Species belonging to the genus <i>Vitis</i> are the most economically important FDp hosts: <i>V. vinifera</i> , <i>V. armurensis</i> , <i>V. champinii</i> , <i>V. doaniana</i> , <i>V. labrusca</i> , <i>V. longii</i> , <i>V. pentagona</i> , <i>V. riparia</i> , <i>V. rubra</i> , <i>V. rupestris</i> , <i>V. simpsonii</i> , <i>V. sylvestris</i> and interspecific hybrids used as rootstocks (EFSA PLH Panel, 2014; EPPO, 1996). Other hosts are <i>Ailanthus altissima</i> , <i>Alnus</i> spp. and <i>Clematis vitalba</i> (EFSA PLH Panel, 2014). In addition, FDp was recently reported from <i>C. avellana</i> and <i>Salix</i> sp. (Casati et al., 2017).	
Reported evidence of impact	Impact range was estimated by EFSA PLH Panel (2016). Flavescence dorée phytoplasma and its insect vectors are already widely present in the EU. Additional impact would occur if FDp was introduced in areas where it does not yet occur.	
Pathways and evidence that the commodity is a pathway	Possible pathways of entry for FDp are plants for planting and insect vectors, both as hitchhikers and actively flying insects (<i>Scaphoideus titanus</i> on <i>Vitis</i> sp., <i>Dictyopharida europea</i>, <i>Orientus ishidae</i> and <i>Phlogotettix cyclops</i>). <i>Orientus ishidae</i> is a vector of FDp commonly associated with <i>C. avellana</i>. <i>Corylus avellana</i> was reported as a host very recently by Casati et al. (2017). Flavescence dorée phytoplasma was reported from leaves and even petioles of <i>C. avellana</i>. Therefore, the Panel assumes that the pathogen moves systemically throughout the phloem of the plant as repeatedly documented in other hosts (EFSA PLH Panel, 2014; EFSA PLH Panel, 2016), making the commodity a pathway, despite the scarcity of information available about the presence of FDp in phloem of stems and roots of <i>C. avellana</i>.	
Surveillance information	Official surveillance on FDp phytoplasma and <i>Scaphoideus titanus</i> , with the undertaking of measures has been implemented since 2005 with the adoption of the Order on measures to control FDp in Serbia. Surveillance of FDp and its main vector <i>Scaphoideus titanus</i> is carried	

out throughout the country in all districts and vine regions (Dossier Section 9.1). Surveillance of the FDp is carried out by visual inspection of facilities for production of grapevine planting material (mother blocks, nursery and isolation belt), visual inspection of production plantations and their immediate surroundings (Dossier Section 9.1).

In 2009–2020, more than 4,500 samples of grapevine (*Vitis vinifera*) were tested by molecular analysis performed by the laboratory of Plant Protection Institute Zemun-Belgrade (Dossier Section 9.1).

A.1.2. Possibility of pest presence in the nursery

A.1.2.1. Possibility of entry from the surrounding environment

Flavescence dorée phytoplasma is present with restricted distribution in Serbia (EPPO, online_c; Dossier Section 9.1). The possibility of entry of FDp from the surrounding environment is through sap-sucking insect vectors. After having acquired FDp on host plants (e.g. *Ailanthus altissima*, *Alnus* sp., *Clematis alba*, *Corylus avellana*, *Salix* sp., *Vitis* sp.), insect vectors remain infectious for the rest of their lives. Flavescence dorée phytoplasma presence in grapevine can be observed about one year after the infection but may remain asymptomatic in other host plants. The infection of a few plants could be caused by occasional vectors, such as *Dictyophara europaea*, *Orientus ishidae* and *Phlogotettix cyclops*, which can transfer FDp to grapevines from other plant species (EFSA, 2020).

Dictyophara europaea (Hemiptera: Dictyopharidae): the European lantern fly is a polyphagous species widely distributed in the western Palaearctic. It is able to transmit FDp from *Clematis vitalba* to grapes under natural conditions (Filippin et al., 2009), although the latter is not among its preferred hosts (Lessio and Alma, 2008). Even if its vector ability seems to be proven, it is considered only an occasional vector of FDp (Lessio and Alma, 2008; Linder and Cavadini, 2014). The presence of *D. europaea* on hazelnut has been recorded (personal communication by Francesco Sanna, 2020).

Orientus ishidae (Hemiptera: Cicadellidae): the mosaic leafhopper is a polyphagous species. First reported in the EU in 1998, its vector ability was confirmed in laboratory experiments (Lessio et al., 2016; Malembic-Maher et al., 2020), although with limited efficiency compared to *S. titanus*. *Orientus ishidae* is widespread in vineyard agroecosystems. Its eggs can be found on *Vitis* spp. However, the insect does not move frequently to grapevine and is therefore considered only a very occasional vector of FDp (Jermini et al., 2019; Lessio et al., 2019). Nevertheless, *O. ishidae* has been associated with *Corylus avellana* and FDp by Casati et al. (2017) in Switzerland. The development cycle of the insect is done on *C. avellana* (personal communication by Francesco Sanna, 2020).

Phlogotettix cyclops (Hemiptera: Cicadellidae): this Asian leafhopper species is currently present in some EU grapevine-growing countries (Austria, Croatia, Czech Republic, France, Hungary, Italy and Romania). Recent findings from Austria highlighted its putative vector role (Strauss and Reisenzein, 2018) and infected specimens have been found on grapevines as well as on *C. vitalba* and *Ulmus laevis* that were growing near the vineyards (Reisenzein and Strauss, 2019). The first transmission trials proved its capacity to acquire FDp from *C. vitalba* (Reisenzein and Strauss, 2019) and other preliminary results support the hypothesis that *P. cyclops* has the capacity to infect grapevines with FDp. However, further studies are needed to verify whether this species serves as a vector of FDp (EFSA, 2020).

All mentioned vectors of FDp are present in Serbia (Dossier Section 9.1), *Orientus ishidae* (Šćiban and Kosovac, 2020) sporadically on *Vitis* sp., *Populus alba*, *Salix alba*, *Malus sylvestris*, *Prunus cerasifera* and *Amorpha fruticosa* (Dossier Section 9.1), *Dictyophara europaea* (EPPO, online_d; Fauna Europaea, online) widespread (Dossier Section 9.1) and *Scaphoideus titanus* (EPPO, online_e) with restricted distribution (Dossier Section 9.1). In addition, *Phlogotettix cyclops* has also been reported in Serbia (Fauna Europaea, online; Šćiban and Kosovac, 2020).

The rate of transfer of FDp from the wild compartment to vineyards (EFSA PLH Panel, 2016), and similarly, from the vineyards to the wild compartment, by vectors other than *S. titanus*, are unknown but are likely to be very low.

The maximum distance expected to be covered in one year by FDp disease was estimated at 44 m (with a 95% uncertainty range of 1–1,300 m), with *S. titanus* being the main limiting factor on disease progression (EFSA, 2020).

The nurseries intended to export the commodities to the EU are surrounded by other nurseries and agricultural crops. According to Dossier Section 9.1, nurseries intended for export of hazelnut to the

EU are located in isolated area without FDp, but there is not officially declared pest-free area. Minimum distance in a straight line between the export nurseries and vineyards and the infested area of the FDp is at least 1 km (Dossier Section 9.1).

There are windbreak treelines around some nurseries consisting either of *Populus nigra* var. *italica* or *Robinia pseudoacacia*, but these are not reported as hosts of FDp.

Possibility of hitchhiking activity of insect vectors through cars, vehicles and humans cannot be excluded.

Uncertainties:

- level of susceptibility of *C. avellana* to FDp;
- presence of FDp in phloem of stems and roots of *C. avellana*;
- abundance of FDp-contaminated plants (grapevine or alternative hosts) in the surroundings of the nursery;
- rate of transfer from grapevine or wild compartment to *C. avellana*;
- presence and abundance of the insect vectors around the nurseries;
- role of *Dictyophara europaea*, *Orientus ishidae* and *Phlogotettix cyclops* as potential insect vectors;
- role of *Dictyophara europaea*, *Orientus ishidae* and *Phlogotettix cyclops* as hitchhikers is not known.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nursery from the surrounding area. The pathogen can be present in the surrounding areas and the transfer rate could be enhanced by the presence of efficient insect vectors.

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

Flavescence dorée phytoplasma has been shown to be transmitted by grafting in grapevine, and is likely to be transmitted by grafting in other host plants. Flavescence dorée phytoplasma might therefore enter the nursery through the introduction of infected and asymptomatic plants of *C. avellana* or other susceptible hosts (e.g. grapevine), although this is expected to occur only very rarely.

It is known that production processes may rely on plant material coming from outside the nurseries (Dossier Sections 1.0 and 9.1).

The origin of the mother plants is Italy, Serbia, Bulgaria, Russia and France. There are some nurseries that introduce scions and rootstocks from other Serbian nurseries or import from European countries. Mother plants are visually assessed every year during official controls and sampled and tested in case of symptoms (Dossier Section 9.1).

Uncertainties:

- level of susceptibility of *C. avellana* for FDp,
- presence of FDp in phloem of stems and roots of *C. avellana*,
- host status of *C. colurna* for FDp,
- contamination of *C. avellana* in a nursery has never been reported.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nursery with new plants/seeds or soil growing medium.

A.1.2.3. Possibility of spread within the nursery

If FDp is present within the nursery either on plants to be exported or on mother plants, spread would occur by phloem feeding insect vectors or grafting. Potential insect vectors are insects such as *O. ishidae*, *D. europaea* and *P. cyclops* (Casati et al., 2017).

Uncertainties:

- level of susceptibility of *C. avellana* to FDp;
- presence of FDp in phloem of stems and roots of *C. avellana*;
- abundance of FDp-contaminated plants inside the nurseries;
- presence and abundance of the insect vectors in the nurseries;
- role of *Dictyophara europaea*, *Orientus ishidae* and *Phlogotettix cyclops* as potential insect vectors;

- effect of the insecticide treatments on the insect vectors;
- contamination of *C. avellana* in a nursery has never been reported;
- rate of successful transmission of FDp through grafting.

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

A.1.3. Information from interceptions

In the EUROPHYT/TRACES-NT database, there are no records of notification of *Corylus avellana* and *C. colurna* plants for planting neither from Serbia nor from other countries due to the presence of FDp between the years 1995 and January 2021 (EUROPHYT/TRACES-NT, online).

A.1.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures proposed in Serbia are summarised and an indication of their effectiveness on Flavescence dorée phytoplasma is provided.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties on bare rooted plants	Evaluation and uncertainties on plants in pots
1	Introduction of controlled planting material	Yes	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.
2	Mandatory laboratory testing	No	Not applicable	Not applicable
3	Certification scheme	Yes	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.
4	Soil inspections and treatments	No	Not applicable	Not applicable
5	Visual inspections	Yes	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties on bare rooted plants	Evaluation and uncertainties on plants in pots
6	Pesticide treatments	Yes, indirectly on the vector	The pesticides have no direct effect on FDp. The risk mitigation measure is considered to have some effect on the vectors (at the egg stage Paraffin oil) or to be very effective against the young stages (Abamectin). <u>Uncertainties:</u> – It is uncertain if the Paraffin oil may reach the egg when it is laid in the bark.	The pesticides have no direct effect on FDp. The risk mitigation measure is considered to have some effect on the vectors (at the egg stage Paraffin oil) or to be very effective against the young stages (Abamectin). <u>Uncertainties:</u> – It is uncertain if the Paraffin oil may reach the egg when it is laid in the bark.
7	Inspection before export	No	Not applicable	Not applicable
8	Checks performed by the PPD of Serbia	Yes	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.
9	Surveillance and monitoring	Yes	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.	The risk mitigation measure is considered to have some effect; however, the report of hazelnut as host is recent and no symptoms have been associated with FDp so far. <u>Uncertainties:</u> – It is uncertain if the infected hazelnut plants show symptoms.
10	Root treatment	No	Not applicable	Not applicable
11	Rotation	No	Not applicable	Not applicable
12	Isolation	Yes	This risk mitigation measure may have some effect. <u>Uncertainties:</u> – The level of susceptibility of hazelnut to FDp is not known.	This risk mitigation measure may have some effect. <u>Uncertainties:</u> – The level of susceptibility of hazelnut to FDp is not known.
13	Measures taken to avoid recontamination or re-infestation of growing medium in pots	No	Not applicable	Not applicable
14	Management of fallen leaves	No	Not applicable	Not applicable
15	Hygienic measures applied to plants grown in pots	No	Not applicable	Not applicable

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties on bare rooted plants	Evaluation and uncertainties on plants in pots
16	Management of non-cultivated herbaceous plants and weeds	Yes, indirectly on the vector	Some vectors are polyphagous; therefore, the removal of weeds is expected to lower the vector population. <u>Uncertainties:</u> – Association of the vector with the herbaceous plants is unknown. – The abundance of the vector is not known.	Some vectors are polyphagous; therefore, the removal of weeds is expected to lower the vector population. <u>Uncertainties:</u> – Association of the vector with the herbaceous plants is unknown. The abundance of the vector is not known.
17	Measure to reduce FDP outside the nurseries	Yes	The removal of infected <i>Vitis</i> plants or other host plants that could serve as reservoir from the surrounding of the nurseries is expected to reduce the inoculum potential in the environment. <u>Uncertainties:</u> – No uncertainty	The removal of infected <i>Vitis</i> plants or other host plants that could serve as reservoir from the surrounding of the nurseries is expected to reduce the inoculum potential in the environment. <u>Uncertainties:</u> – No uncertainty

A.1.5. Overall likelihood of pest freedom for bare rooted plants and plants in pots

A.1.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested bare rooted plants and plants in pots

Main production area is located in areas with few vineyards and this would result in a limited likelihood of entry from the surrounding. The vectors that might be efficient are only sporadically present in Serbia. The scenario also assumes that hazelnut is poorly susceptible, and disease is associated with the development of symptoms allowing measures to be promptly undertaken. Insecticide treatments are efficient in reducing vector populations in the nurseries.

A.1.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested bare rooted plants and plants in pots

Most nurseries are located in grape vine production areas and the pest is present in some of those production areas in Serbia. In addition, infested areas have been reported in a range of a few kilometres from the nurseries. At least one vector is reported as widespread in Serbia. This may result in a relevant likelihood of entry from the surrounding. In addition, the scenario assumes hazelnut to be a suitable host for FDP and disease to be fully asymptomatic hampering detection and control. Insecticide treatments are not sufficient to completely prevent infestation by insect vectors.

A.1.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested bare rooted plants and plants in pots (Median)

The median is closer to lower values because there is little evidence that hazelnut is a suitable host of the pathogen and the probability of introduction from the surroundings of nurseries is most likely to be low.

A.1.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

There are main uncertainties about the level of susceptibility of *C. avellana* to FDP and the host status of *C. colurna*. In addition, there is uncertainty on the efficiency of the vectors in transmitting FDP to hazelnut and on the abundance of vectors in the production areas.

A.1.5.5. Elicitation outcomes of the assessment of the pest freedom for Flavescence dorée phytoplasma on bare rooted plants and plants in pots

The following Tables show the elicited and fitted values for pest infestation/infection (Table A.1) and pest freedom (Table A.2).

Table A.1: Elicited and fitted values of the uncertainty distribution of pest infestation by Flavescence dorée phytoplasma per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					25		50		100					200
EKE	0.712	1.88	3.95	8.34	14.7	23.1	32.3	53.6	80.3	96.9	117	140	163	181	199

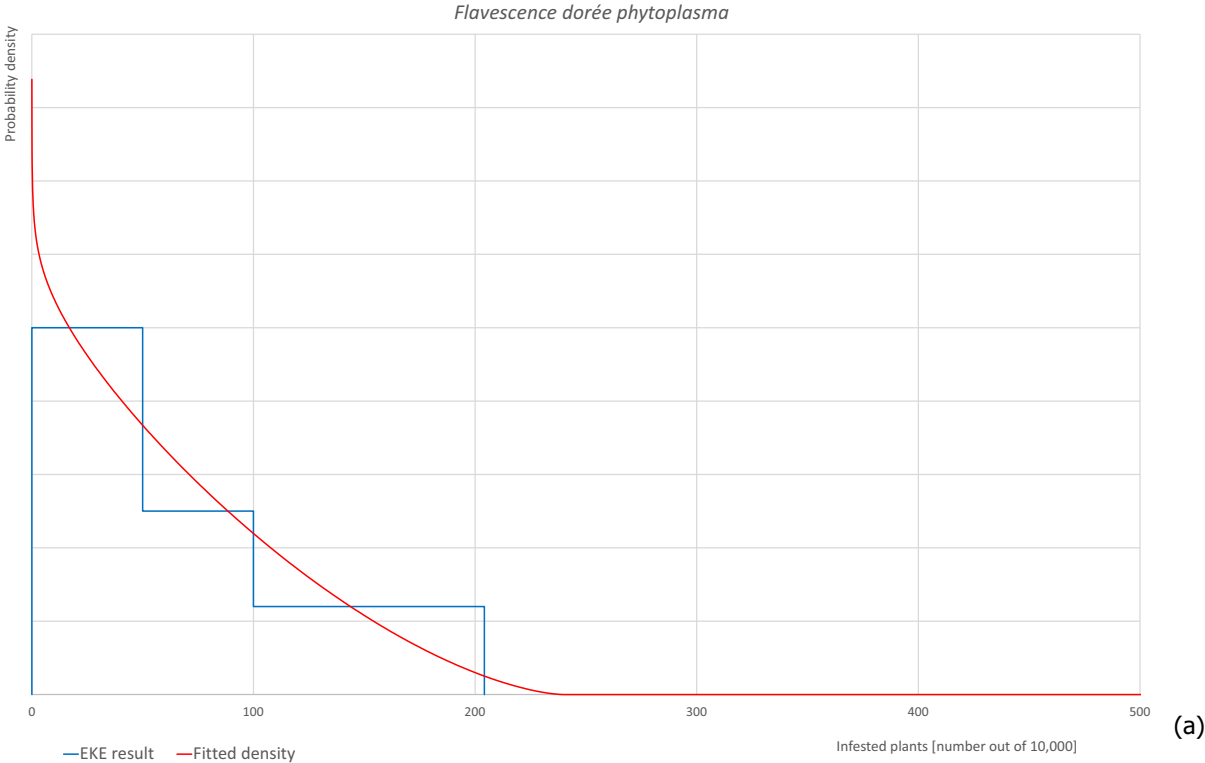
The EKE result is the BetaGeneral(0.9458,2.5598,0,240) distribution fitted with @Risk version 7.6.

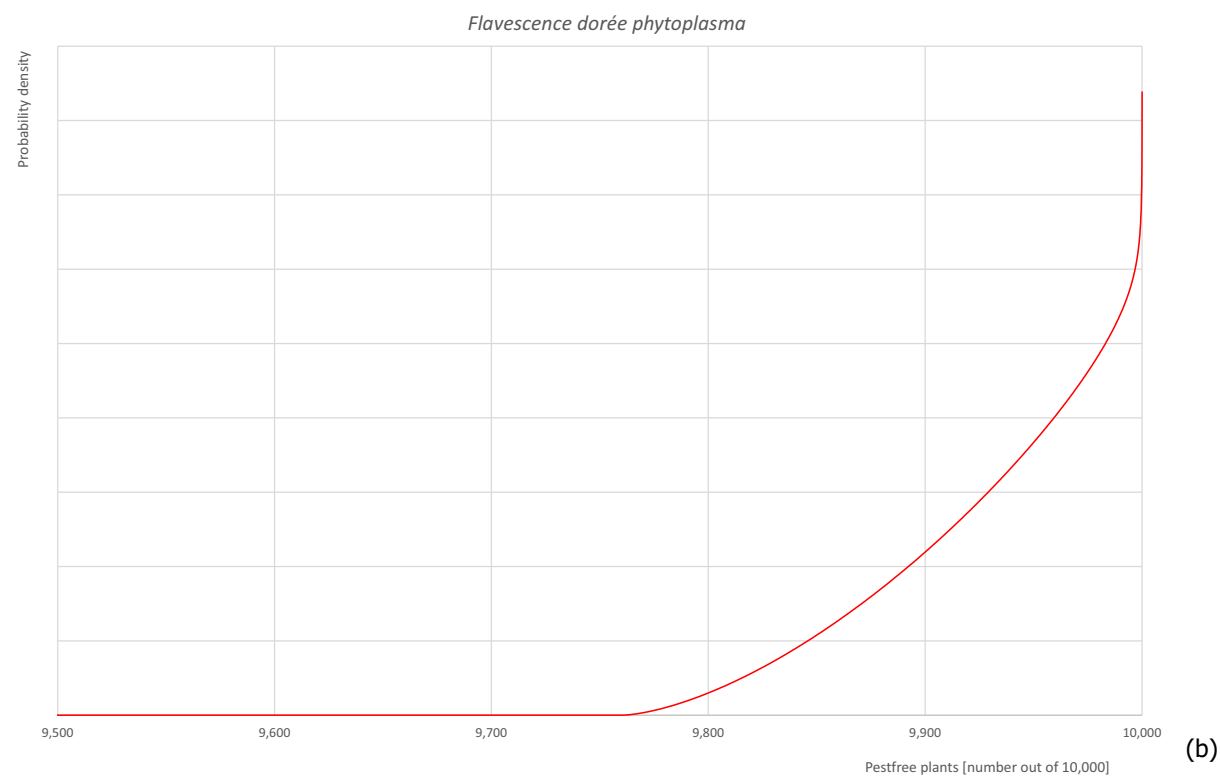
Based on the numbers of estimated infested plants, the pest freedom was calculated (i.e. = 10,000 – number of infested plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.2.

Table A.2: The uncertainty distribution of plants free of Flavescence dorée phytoplasma per 10,000 plants calculated by Table A.1

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,800					9,900		9,950		9,975					9,999
EKE results	9,801	9,819	9,837	9,860	9,883	9,903	9,920	9,946	9,968	9,977	9,985	9,992	9,996	9,998	9,999

The EKE results are the fitted values.





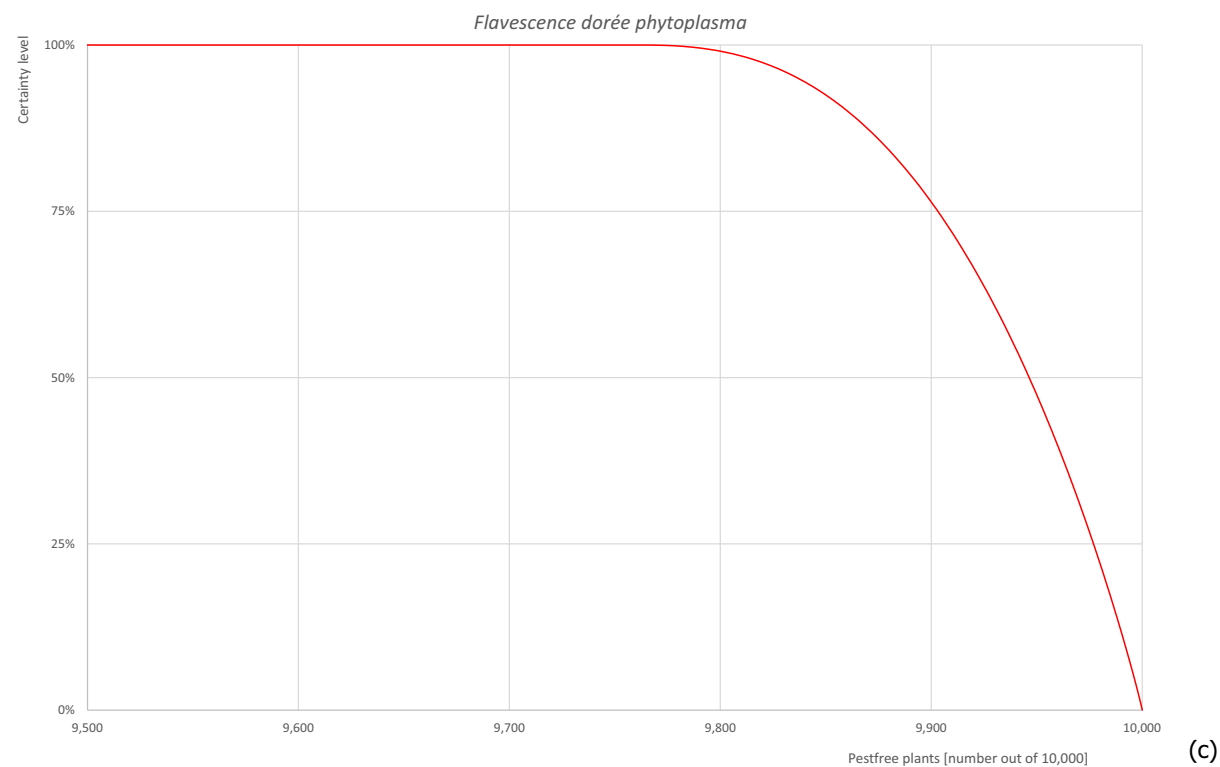


Figure A.1: (a) Comparison of judged values for the uncertainty distribution of pest infestation per 10,000 plants (histogram in blue) and fitted distribution (red line); (b) density function to describe the uncertainties of the likelihood of pest freedom; (c) descending distribution function of the likelihood of pest freedom

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Appendix B – Web of Science All Databases Search Strings

In Table B.1, the search string for *Corylus avellana* used in Web of Science is reported. Totally, 89 papers were retrieved. Titles and abstracts were screened, and 43 pests were added to the list of pests (see Appendix E).

Table B.1: Search string for *Corylus avellana*

Web of Science	TOPIC: ("Corylus avellana" OR "C. avellana")
All databases	AND TOPIC: (pathogen* OR pathogenic bacteria OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect\$ OR mite\$ OR phytoplasm* OR arthropod* OR nematod* OR disease\$ OR infecti* OR damag* OR symptom* OR pest\$ OR vector OR hostplant\$ OR "host plant\$" OR "host" OR "root lesion\$" OR decline\$ OR infestation\$ OR damage\$ OR symptom\$ OR dieback* OR "die back*" OR "malaise" OR aphid\$ OR curculio OR thrip\$ OR cicad\$ OR miner\$ OR borer\$ OR weevil\$ OR "plant bug\$" OR spittlebug\$ OR moth\$ OR mealybug\$ OR cutworm\$ OR pillbug\$ OR "root feeder\$" OR caterpillar\$ OR "foliar feeder\$" OR virosis OR viroses OR blight\$ OR wilt\$ OR wilted OR canker OR scab\$ OR "rot" OR "rots" OR "rotten" OR "damping off" OR "damping-off" OR blister\$ OR "smut" OR "mould" OR "mold" OR "damping syndrome\$" OR mildew OR scald\$ OR "root knot" OR "root-knot" OR rootknot OR cyst\$ OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant\$parasitic" OR "root feeding" OR "root\$feeding" OR "gall" OR "ambrosia beetle\$" OR "gall\$" OR "bark beetle\$") NOT TOPIC: ("winged seeds" OR metabolites OR *tannins OR climate OR "maple syrup" OR syrup OR mycorrhiz* OR "carbon loss" OR pollut* OR weather OR propert* OR probes OR spectr* OR antioxidant\$ OR transformation OR RNA OR DNA OR "Secondary plant metabolite\$" OR metabol* OR "Phenolic compounds" OR Quality OR Abiotic OR Storage OR Pollen* OR fertil* OR Mulching OR Nutrient* OR Pruning OR drought OR "human virus" OR "animal disease*" OR "plant extracts" OR immunological OR "purified fraction" OR "traditional medicine" OR medicine OR mammal* OR bird* OR "human disease*" OR biomarker\$ OR "health education" OR bat\$ OR "seedling\$ survival" OR "anthropogenic disturbance" OR "cold resistance" OR "salt stress" OR salinity OR "aCER method" OR "adaptive cognitive emotion regulation" OR nitrogen OR hygien* OR "cognitive function\$" OR fossil\$ OR *toxicity OR Miocene OR postglacial OR "weed control" OR landscape) NOT TOPIC: ("Acanalonia conica" OR "Agrobacterium tumefaciens" OR "Anisogramma anomala" OR "Anoplophora chinensis" OR "Apple mosaic virus" OR "Choristoneura rosaceana" OR "Colletotrichum acutatum" OR "Corythucha arcuata" OR "Curculio nucum" OR "Gnomoniopsis smithogilvyi" OR "Malacosoma americanum" OR "Malacosoma disstria" OR "Megaplatypus mutatus" OR "Monilinia fructigena" OR "Oeomona hirta" OR "Orgyia leucostigma" OR "Oxycarenum lavaterae" OR "Popillia japonica" OR "Pseudomonas avellanae" OR "Xanthomonas arboricola pv. corylina" OR "Xyleborinus attenuatus" OR "Xylosandrus germanus" OR "Anisogramma anomala" OR "Apple mosaic virus" OR "Choristoneura rosaceana" OR "Curculio nucum" OR "Cydia latiferreana" OR "Erysiphe corylacearum" OR "Gonocerus acuteangulatus" OR "Lymantria dispar" OR "Melolontha melolontha" OR "Myzocallis coryli" OR "Nematospora coryli" OR "Phyllactinia guttata" OR "Phytoptus avellanae" OR "Pratylenchus vulnus" OR "Pseudomonas avellanae" OR "Pucciniastrum coryli" OR "Xanthomonas arboricola pv. corylina" OR "Xyleborus dispar" OR "Amphitetranynchus viennensis" OR "Archips rosana" OR "Armillaria mellea" OR "Armillaria ostoyae" OR "Aspergillus niger" OR "Candidatus Phytoplasma asteris" OR "Chinavia hilaris" OR "Colletotrichum fioriniae" OR "Diaporthe australafricana" OR "Diplodia seriata" OR "Eulecanium tiliae" OR "Euproctis chrysorrhoea" OR "Eutypa lata" OR "Fomitiporia mediterranea" OR "Fomitopsis pinicola" OR "Fusicoccum amygdali" OR "Gibberella baccata" OR "Heterobasidion annosum" OR "Heterobasidion annosum sensu lato" OR "Hyphantria cunea" OR "Lymantria monacha" OR "Malacosoma neustria" OR "Monilinia fructigena" OR "Neonectria ditissima" OR "Operophtera brumata" OR "Orgyia antiqua" OR "Orthosia cerasi" OR "Otiorhynchus armadillo" OR "Parthenolecanium corni" OR "Penicillium digitatum" OR "Phytoplasma fragariae" OR "Phytoplasma mali" OR "Phytoplasma pyri" OR "Prunus necrotic ringspot virus" OR "Rosellinia necatrix" OR "Tortrix viridana" OR "Xyleborinus saxesenii" OR "Pratylenchus penetrans" OR "Rhizobium radiobacter" OR "Rhizobium rhizogenes" OR "Saturnia pyri" OR "Aspergillus flavus")

OR "Penicillium notatum" OR "Alternaria alternata" OR "Alternaria tenuissima" OR "Dothiorella iberica" OR "Dothiorella parva" OR "Megaplatypus mutatus" OR "Sphaeropsis sapinea" OR "Corylobium avellanae" OR "Macrosiphum euphorbiae" OR "Macrosiphum corylicola" OR "Mesocallis corylicola" OR "Myzocallis coryli" OR "Neochromaphis coryli" OR "Aculus comatus" OR "Cecidophyopsis vermiformis" OR "Tegonotus depressus" OR "Vasates comatus" OR "Vasates comatus" OR "Phytocoptella avellanae" OR "Eotetranychus carpini" OR "Eotetranychus pruni" OR "Eotetranychus tiliarum" OR "Tetranychopsis horridus" OR "Attelabus nitens" OR "Byctiscus betulae" OR "Deporaus betulae" OR "Deporaus mannerheimi" OR "Rhynchites sericeus" OR "Apoderus coryli" OR "Agrilus angustulus" OR "Agrilus laticornis" OR "Agrilus viridis" OR "Trachys minutus" OR "Phytoecia cylindrica" OR "Pogonocherus hispidulus" OR "Saperda populnea" OR "Gonioctena pallida" OR "Gonioctena viminalis" OR "Phytodecta pallida" OR "Cryptocephalus bipunctatus" OR "Cryptocephalus coryli" OR "Cryptocephalus primarius" OR "Cryptocephalus sexpunctatus" OR "Agelastica alni" OR "Galerucella lineola" OR "Altica brevicollis" OR "Luperus flavipes" OR "Coeliodes ruber" OR "Curculio nucum" OR "Ramphus pulicarius" OR "Rhynchaenus avellanae" OR "Rhynchaenus stigma" OR "Otiorynchus singularis" OR "Peritelus sphaeroides" OR "Phyllobius argentatus" OR "Phyllobius calcaratus" OR "Phyllobius maculicornis" OR "Phyllobius oblongus" OR "Phyllobius pyri" OR "Polydrusus cervinus" OR "Polydrusus mollis" OR "Polydrusus pterygomalis" OR "Polydrusus sericeus" OR "Polydrusus undatus" OR "Strophosomus melanogrammus" OR "Gonodera luperus" OR "Contarinia coryli" OR "Contarinia cybelae" OR "Dasineura corylina" OR "Lestodiplosis aprimiki" OR "Mikomya coryli" OR "Oligotrophus tympanifex" OR "Arboridia ribauti" OR "Edwardsiana avellanae" OR "Edwardsiana frustrator" OR "Edwardsiana hippocastani" OR "Edwardsiana ishidai" OR "Edwardsiana lethierryi" OR "Edwardsiana plebeja" OR "Edwardsiana rosae" OR "Edwardsiana spinigera" OR "Erythroneura angusta" OR "Fagocyba cruenta" OR "Alebra coryli" OR "Alebra wahlbergi" OR "Alnetoidia alneti" OR "Lindbergina aurovittata" OR "Oncopsis avellanae" OR "Ribautiana cruciata" OR "Ribautiana debilis" OR "Ribautiana tenerrima" OR "Ribautiana ulmi" OR "Typhlocyba quercus" OR "Zygina flammigera" OR "Zygina tiliae" OR "Cicadetta montana" OR "Acanthosoma haemorrhoidale" OR "Coniortodes salicellus" OR "Deraeocoris scutellaris" OR "Lygocoris pabulinus" OR "Lygocoris viridis" OR "Malacocoris chlorizans" OR "Miris striatus" OR "Orthops cervinus" OR "Orthotylus marginalis" OR "Orthotylus prasinus" OR "Orthotylus tenellus" OR "Pantilius tunicatus" OR "Phylus coryli" OR "Phytocoris longipennis" OR "Psallus perrisi" OR "Psallus variabilis" OR "Palomena prasina" OR "Pentatoma rufipes" OR "Eulecanium tiliae" OR "Parthenolecanium corni" OR "Chionaspis salicis" OR "Lepidosaphes conchyformis" OR "Corylobium avellanae" OR "Myzocallis coryli" OR "Asterobemisia avellanae" OR "Pealius quercus" OR "Pamphilus fumipennis" OR "Allantus coryli" OR "Croesus brischkei" OR "Hemichroa crocea" OR "Nematus acuminatus" OR "Nematus willigkiae" OR "Nematus leucotrochus" OR "Pachyprotasis rapae" OR "Tenthredo fagi" OR "Tenthredo livida" OR "Thecla betulae" OR "Polygonia c-album" OR "Abraxas sylvata" OR "Biston strataria" OR "Cabera exanthemata" OR "Cabera pusaria" OR "Campaea margaritata" OR "Aethalura punctulata" OR "Colotois pennaria" OR "Agriopis aurantiaria" OR "Agriopis marginaria" OR "Ectropis bistortata" OR "Ennomos autumnaria" OR "Epione repandaria" OR "Erannis defoliaria" OR "Alcis repandata" OR "Hypomecis punctinalis" OR "Lomaspilis marginata" OR "Odontopera bidentata" OR "Opisthograptis luteolata" OR "Paradarisa extersaria" OR "Parectropis similaria" OR "Phigalia pilosaria" OR "Plagodis pulveraria" OR "Selenia dentaria" OR "Selenia tetralunaria" OR "Apocheima hispidaria" OR "Abraxas grossulariata" OR "Geometra papilionaria" OR "Hemithea aestivaria" OR "Jodis lactearia" OR "Asthenes albulata" OR "Epirrita autumnata" OR "Epirrita christyi" OR "Epirrita dilutata" OR "Eulithis testata" OR "Hydrelia sylvata" OR "Hydriomena furcata" OR "Mesoleuca albicillata" OR "Operophtera brumata" OR "Lasiocampa quercus" OR "Malacosoma neustria" OR "Trichiura crataegi" OR "Heterogenea asella" OR "Calliteara pudibunda" OR "Dicallopora fascelina" OR "Euproctis similis" OR "Orgyia antiqua" OR "Orgyia recens" OR "Acronicta alni" OR "Craniophora ligustri" OR "Eupsilia transversa" OR "Cosmia trapezina" OR "Amphipyra pyramidea" OR "Phlogophora meticulosa" OR "Pseudoips fagana" OR "Pseudoips fagana" OR "Pseudoips prasinana" OR "Brachionycha sphinx" OR "Dryobotodes eremita" OR "Xylena exsoleta" OR "Lacanobia contigua" OR "Lacanobia oleracea" OR "Melanchra persicariae" OR "Orthosia cerasi" OR "Orthosia cruda" OR "Orthosia incerta" OR "Orthosia miniosa" OR "Polia nebulosa" OR "Pyrrhia umbra" OR "Herminia grisealis" OR "Paracolax tristalis" OR "Pechipogo strigilata" OR "Diarsia mendica" OR "Noctua fimbriata" OR "Noctua janthina" OR "Xestia ditrapezium" OR "Xestia triangulum" OR "Colocasia coryli" OR "Notodonta dromedarius" OR "Phalera bucephala" OR "Ptilodon capucina" OR "Stauropus fagi" OR "Saturnia pavonia" OR "Mimas tiliae" OR "Habrosyne pyritoides" OR "Ochropacha duplaris" OR "Coleophora anatipennella" OR "Coleophora binderella" OR "Coleophora currucipennella" OR "Coleophora fuscocuprella" OR "Coleophora milvipennis" OR "Coleophora orbitella" OR "Coleophora serratella" OR "Coleophora

violacea OR "*Eriocrania chrysolepidella*" OR "*Dichomeris ustalella*" OR "*Hypatima rhomboidella*" OR "*Parachronistis albiceps*" OR "*Recurvaria nanella*" OR "*Teleiodes wagae*" OR "*Parornix devoniella*" OR "*Phyllonorycter coryli*" OR "*Phyllonorycter nicellii*" OR "*Incurvaria pectinea*" OR "*Bucculatrix demaryella*" OR "*Ectoedemia minimella*" OR "*Stigmella floslactella*" OR "*Stigmella microtheriella*" OR "*Esperia oliviella*" OR "*Alabonia geoffrella*" OR "*Oecophora bractella*" OR "*Telechrysis tripuncta*" OR "*Endotracha flammealis*" OR "*Epinotia brunnichana*" OR "*Epinotia solandriana*" OR "*Epinotia tenerana*" OR "*Gypsonoma dealbana*" OR "*Hedya pruniana*" OR "*Cacoecimorpha pronubana*" OR "*Choristoneura hebenstreitella*" OR "*Pandemis cerasana*" OR "*Pandemis corylana*" OR "*Tortricodes alternella*" OR "*Tortrix viridana*" OR "*Acleris emargana*" OR "*Argyresthia ivella*" OR "*Ypsolopha parenthesella*" OR "*Diurina fagella*" OR "*Dryocoetus alni*" OR "*Lymantora coryli*" OR "*Apion vorax*" OR "*Drepana curvatula*" OR "*Hypatima rhomboidella*" OR "*Asthena albulata*" OR "*Chloroclysta siterata*" OR "*Crocallis elinguaris*" OR "*Epirrita autumnata*" OR "*Epirrita christyi*" OR "*Erannis defoliaria*" OR "*Geometra papilionaria*" OR "*Operophtera brumata*" OR "*Operophtera brumata*" OR "*Parornix avellanella*" OR "*Parornix devoniella*" OR "*Phyllonorycter coryli*" OR "*Phyllonorycter coryli*" OR "*Phyllonorycter danica*" OR "*Phyllonorycter nicellii*" OR "*Phyllonorycter sp.*" OR "*Incurvaria intermediella*" OR "*Eriogaster lanestris*" OR "*Poecilocampa populi*" OR "*Trichiura crataegi*" OR "*Calliteara pudibunda*" OR "*Lymantria dispar*" OR "*Stigmella floslactella*" OR "*Stigmella floslactella*" OR "*Stigmella microtheriella*" OR "*Stigmella microtheriella*" OR "*Acronicta alni*" OR "*Acronicta leporina*" OR "*Acronicta psi*" OR "*Acronicta rumicis*" OR "*Agrochola helvola*" OR "*Cosmia trapezina*" OR "*Eupsilia transversa*" OR "*Lacanobia suasa*" OR "*Orthosia gothica*" OR "*Pseudopsis pratincola*" OR "*Datana ministra*" OR "*Notodonta dromedaria*" OR "*Stauropus fagi*" OR "*Polygonia c-album*" OR "*Polygonia c-album*" OR "*Colocasia coryli*" OR "*Elasmopalpus lignosellus*" OR "*Euzophera osseata*" OR "*Plodia interpunctella*" OR "*Agria tau*" OR "*Anisota stigma*" OR "*Anisota virginiana*" OR "*Automeris io*" OR "*Automeris io*" OR "*Citheronia regalis*" OR "*Hyalophora cecropia*" OR "*Saturnia lindia*" OR "*Synanthedon codeti*" OR "*Synanthedon spuleri*" OR "*Acleris cristana*" OR "*Acleris emargana*" OR "*Acleris rhombana*" OR "*Acleris variegana*" OR "*Adoxophyes orana*" OR "*Archips betulana*" OR "*Archips crataegana*" OR "*Archips rosana*" OR "*Archips xylosteana*" OR "*Capua vulgana*" OR "*Choristoneura hebenstreitella*" OR "*Cydia latiferreana*" OR "*Eulia ministrana*" OR "*Gypsonoma dealbana*" OR "*Pandemis cerasana*" OR "*Pandemis corylana*" OR "*Tortricodes alternella*" OR "*Trachys minutus*" OR "*Orchestes signifer*" OR "*Orchestes stigma*" OR "*Coleophora binderella*" OR "*Coleophora fuscopretella*" OR "*Coleophora orbitella*" OR "*Coleophora violacea*" OR "*Ectoedemia minimella*" OR "*Paracrania chrysolepidella*" OR "*Incurvaria pectinea*" OR "*Parornix devoniella*" OR "*Phyllonorycter coryli*" OR "*Phyllonorycter nicellii*" OR "*Stigmella floslactella*" OR "*Stigmella microtheriella*" OR "*Xiphinema pyrenaicum*" OR "*Meloidogyne sp.*" OR "*Paralongidorus maximus*" OR "*Pratylenchus vulnus*" OR "*Pratylenchus penetrans*" OR "*Xanthomonas arboricola* pv. *corylina*" OR "*Cladosporium sp.*" OR "*Gibberella avenacea*" OR "*Gibberella gordonii*" OR "*Glomerella acutata*" OR "*Ampagia rudis*" OR "*Liothula omnivora*" OR "*Myzocalis coryli*" OR "*Oeonia hirta*" OR "*Stigmella microtheriella*" OR "*Tulare apple mosaic virus*" OR "*Chionaspis lintneri*" OR "*Comstockaspis perniciosus*" OR "*Diaspidiotus distinctus*" OR "*Diaspidiotus ostreaeformis*" OR "*Eulecanium rugulosum*" OR "*Eulecanium tiliae*" OR "*Kerria lacca lacca*" OR "*Lepidosaphes conchiformis*" OR "*Lepidosaphes ulmi*" OR "*Lopholeucaspis japonica*" OR "*Parthenolecanium corni corni*" OR "*Parthenolecanium rufulum*" OR "*Peliococcus serratus*" OR "*Phenacoccus aceris*" OR "*Pulvinaria vitis*" OR "*Rhodococcus turanicus*" OR "*Amphitetranychus viennensis*" OR "*Bryobia rubrioculus*" OR "*Eotetranychus carpini*" OR "*Eotetranychus coryli*" OR "*Eotetranychus pruni*" OR "*Oligonychus caucasicus*" OR "*Oligonychus kobachidzei*" OR "*Panonychus ulmi*" OR "*Tetranychus canadensis*" OR "*Tetranychus turkestanii*" OR "*Tetranychus urticae*" OR "*Tetranychopsis horridus*" OR "*Tetranychopsis iranensis*" OR "*Acanthonitschkea tristis*" OR "*Actinocladium rhododorum*" OR "*Allantoportha decedens*" OR "*Alternaria alternata*" OR "*Alternaria arborescens*" OR "*Alternaria tenuis*" OR "*Alternaria tenuissima*" OR "*Angustimassarina coryli*" OR "*Anisogramma anomala*" OR "*Annulohypoxyton multiforme* var. *multiforme*" OR "*Anthostoma dubium*" OR "*Apioportha anomala*" OR "*Apiosporium persoonii*" OR "*Armillaria gallica*" OR "*Armillaria mellea*" OR "*Arthopyrenia antecellens*" OR "*Arthrobotrys superba*" OR "*Ascochyta coryli*" OR "*Aspergillus glaucus*" OR "*Asteroma coryli*" OR "*Asteromella gorcholtii*" OR "*Bertia moriformis*" OR "*Biscogniauxia anceps*" OR "*Biscogniauxia mediterranea*" OR "*Botryobasidium pruinaum*" OR "*Botryosphaeria obtusa*" OR "*Botrytis cinerea*" OR "*Brachysporium nigrum*" OR "*Brunnippa calyculiformis*" OR "*Calosphaeria corylina*" OR "*Camarops lutea*" OR "*Camarosporium propinquum*" OR "*Candelabrum spinulosum*" OR "*Cenangium dolosum*" OR "*Ceratostoma venetum*" OR "*Cercospora coryli*" OR "*Cerrena unicolor*" OR "*Chaetosphaerella phaeostroma*" OR "*Chaetosphaeria myriocarpa*" OR "*Chaetosphaeria ovoidea*" OR "*Chalara affinis*" OR "*Chalara insignis*" OR "*Chloridium claviforme*" OR "*Chondrostereum purpureum*" OR "*Ciboria coryli*" OR "*Cladobotryum fungicola*" OR

Cladosporium aphidis OR "*Cladosporium exile*" OR "*Cladosporium fumago*" OR "*Cladosporium fumago* f. *coryli*" OR "*Cladosporium fusiforme*" OR "*Cladosporium herbarum*" OR "*Cladosporium inversicolor*" OR "*Cladosporium lycoperdinum*" OR "*Cladosporium perangustum*" OR "*Cladosporium phyllactiniicola*" OR "*Cladosporium psychrotolerans*" OR "*Codinaea fertilis*" OR "*Colletotrichum acutatum*" OR "*Colletotrichum fiorinae*" OR "*Coniothecium complanatum*" OR "*Coniothecium sp.*" OR "*Conoplea olivacea*" OR "*Coronophora angustata*" OR "*Coronophora ovipara*" OR "*Corynesporopsis quercicola*" OR "*Creopus gelatinosus*" OR "*Cristinia gallica*" OR "*Cryptadelphia fusiformis*" OR "*Cryptocoryneum condensatum*" OR "*Cryptodiaporthe pyrrhocystis*" OR "*Cryptospora corylina*" OR "*Cryptosporella corylina*" OR "*Cryptosporiopsis coryli*" OR "*Cryptosporiopsis grisea*" OR "*Cryptosporiopsis tarraconensis*" OR "*Cylindrosporium coryli*" OR "*Cytospora ambiens*" OR "*Cytospora corylicola*" OR "*Cytospora fuckelii*" OR "*Cytospora fugax*" OR "*Cytospora phlyctaenoides*" OR "*Cytospora sp.*" OR "*Cytosporina sp.*" OR "*Daedaleopsis confragosa*" OR "*Daldinia decipiens*" OR "*Daldinia fissa*" OR "*Daldinia lloydii*" OR "*Daldinia vernicosa*" OR "*Dasyscyphus calyculiformis*" OR "*Dasyscyphus virgineus*" OR "*Diaporthe amygdali*" OR "*Diaporthe australafricana*" OR "*Diaporthe conjuncta*" OR "*Diaporthe decedens*" OR "*Diaporthe eres*" OR "*Diaporthe foeniculina*" OR "*Diaporthe revellens*" OR "*Diaporthe sp.*" OR "*Diaporthella cryptica*" OR "*Diaporthella sp.*" OR "*Diatrype bullata*" OR "*Diatrype decorticata*" OR "*Diatrype disciformis*" OR "*Diatrype flavovirens*" OR "*Diatrype stigma*" OR "*Diatrype subaffixa* var. *rappazii*" OR "*Diatrype undulata*" OR "*Diatrypella favacea*" OR "*Diatrypella guceviczii*" OR "*Diatrypella pulvinata*" OR "*Diatrypella verruciformis*" OR "*Diatrypella verruciformis*" OR "*Didymella corylicola*" OR "*Diplococcium lawrencei*" OR "*Diplodia coryli*" OR "*Diplodia corylina*" OR "*Diplodia herbarum*" OR "*Diplodia sapinea*" OR "*Diplodia sarmentorum*" OR "*Discosia artocreas*" OR "*Dothichiza turgida*" OR "*Dothiorella iberica*" OR "*Dothiorella omnivora*" OR "*Dothiorella parva*" OR "*Dothiorella sp.*" OR "*Dothiorella symphoricarposicola*" OR "*Dothiorella vidmadera*" OR "*Eichleriella deglubens*" OR "*Elsinoe coryli*" OR "*Encoelia fascicularis*" OR "*Encoelia furfuracea*" OR "*Endophragmiella boothii*" OR "*Endophragmiella uniseptata*" OR "*Endothia gyrosa*" OR "*Endoxyla cirrhosa*" OR "*Epicoccum nigrum*" OR "*Eremothecium coryli*" OR "*Eremothecium cymbalariae*" OR "*Erysiphe corylacearum*" OR "*Eutypa flavovirens*" OR "*Eutypa lata*" OR "*Eutypa lejoplaca*" OR "*Eutypella leprosa*" OR "*Eutypella sorbi*" OR "*Fenestella macrospora*" OR "*Flagelloscypha merxmulleri*" OR "*Fomes annosus*" OR "*Fomes fomentarius*" OR "*Fomes igniarius*" OR "*Fomes unguatus*" OR "*Fomitiporia mediterranea*" OR "*Fomitiporia punctata*" OR "*Fusarium lateritium*" OR "*Fuscoporia ferrea*" OR "*Fusidium rhodospermum*" OR "*Fusisporium episphaericum*" OR "*Ganoderma lucidum*" OR "*Genea hispidula*" OR "*Genea sphaerica*" OR "*Genea verrucosa*" OR "*Gloeocystidiellum porosum*" OR "*Gloeosporium coryli*" OR "*Gloeosporium corylinum*" OR "*Gloeosporium perexiguum*" OR "*Gloeosporium rostratum*" OR "*Gloeosporium vogelianum*" OR "*Gnomonia amoena*" OR "*Gnomonia coryli*" OR "*Gnomonia gnomon*" OR "*Gnomonia incrassata*" OR "*Gnomonia ischnostyla*" OR "*Gnomonia monodii*" OR "*Gnomonia nervisequa*" OR "*Gnomonia pseudoamoena*" OR "*Gnomonia setacea*" OR "*Gnomonia tubiformis*" OR "*Gnomonia vulgaris*" OR "*Gnomoniella avellanae*" OR "*Gnomoniella coryli*" OR "*Gnomoniella vulgaris*" OR "*Helminthosporium macrocarpum*" OR "*Helminthosporium rhopaloides*" OR "*Helminthosporium sp.*" OR "*Helminthosporium velutinum*" OR "*Helotium sulphurinum*" OR "*Heteroconium tetracolum*" OR "*Hydnobolites cerebriformis*" OR "*Hymenochaete cinnamomea*" OR "*Hymenoscyphus fructigenus*" OR "*Hyphoderma praetermissum*" OR "*Hyphoderma radula*" OR "*Hyphoderma setigerum*" OR "*Hyphodontia breviseta*" OR "*Hyphodontia sambuci*" OR "*Hypocrea aureoviridis*" OR "*Hypocrea crystalligena*" OR "*Hypocrea estonica*" OR "*Hypocrea gelatinosa*" OR "*Hypocrea lixii*" OR "*Hypocrea longipilosa*" OR "*Hypocrea parestonica*" OR "*Hypocrea rufa*" OR "*Hypocrea strictipilosa*" OR "*Hypomyces rosellus*" OR "*Hypoxylon cohaerens*" OR "*Hypoxylon confluens*" OR "*Hypoxylon fragiforme*" OR "*Hypoxylon fuscum*" OR "*Hypoxylon howeanum*" OR "*Hypoxylon multifforme*" OR "*Hypoxylon perforatum*" OR "*Hypoxylon pulcherrimum*" OR "*Hysterographium flexuosum*" OR "*Hysterographium fraxini*" OR "*Kirschsteiniotelia aethiops*" OR "*Labrella coryli*" OR "*Laeticorticium roseum*" OR "*Lasiosphaeria caudata*" OR "*Lasiosphaeria punctata*" OR "*Lasiosphaeria vestita*" OR "*Lentomita hirsutula*" OR "*Leotia lubrica*" OR "*Leptopodia elastica*" OR "*Leptosphaeria avellanae*" OR "*Leptosphaeria vagabunda*" OR "*Letendraea helminthicola*" OR "*Lindtneria trachyspora*" OR "*Lophiostoma compressum*" OR "*Macrophoma corylina*" OR "*Mamiania coryli*" OR "*Mamianiella coryli*" OR "*Massarina microcarpa*" OR "*Melampsorium carpini*" OR "*Melanconiella flavovirens*" OR "*Melanconis flavovirens*" OR "*Melanogaster broomeanus*" OR "*Melanomma pulvis-pyrius*" OR "*Melogramma campylosporium*" OR "*Microdiplodia coryli*" OR "*Microdiplodia microsporella*" OR "*Microsphaera alni*" OR "*Mollisia benesuada*" OR "*Monilia coryli*" OR "*Monilia fructigena*" OR "*Monilia laxa*" OR "*Moniliopsis foliicola*" OR "*Monochaetia concentrica*" OR "*Monochaetia coryli*" OR "*Monodictys putredinis*" OR "*Monostichella coryli*" OR "*Monostichella sp.*" OR "*Mycena alcalina*" OR "*Mycena haematopoda*"

OR "Mycena pseudocorticola" OR "Mycoporum quercus var. ilicis" OR "Mycosphaerella caricae" OR "Mycosphaerella punctiformis" OR "Myxosporium griseum" OR "Myxosporium roumegueri" OR "Naemospora sp." OR "Nectria cinnabarina" OR "Nectria coryli" OR "Nectria ditissima" OR "Nectria punicea" OR "Nemania serpens" OR "Nematosporea coryli" OR "Nitschkia cupularis" OR "Ophiognomonia ischnostyla" OR "Ophiovalsa corylina" OR "Otthia corylina" OR "Otthia spiraeae" OR "Penicillium aurantiogriseum" OR "Penicillium glaucum" OR "Penicillium sp." OR "Peniophora sp." OR "Peroneutypa heteracantha" OR "Pestalotia coryli" OR "Pestalotiopsis guepinii" OR "Pezicula aesculea" OR "Pezicula corylina" OR "Pezicula sp." OR "Phaeoblastophora peckii" OR "Phaeodothis winteri" OR "Phanerochaete tuberculata" OR "Phellinus alni" OR "Phellinus contiguus" OR "Phellinus ferruginosus" OR "Phellinus igniarius" OR "Phoma exigua" OR "Phoma pomorum" OR "Phomatosporea leptasca" OR "Phomopsis avellana" OR "Phomopsis decedens var. conjuncta" OR "Phomopsis revellens" OR "Phomopsis sp." OR "Phyllactinia corylea" OR "Phyllactinia guttata" OR "Phyllactinia suffulta" OR "Phyllosticta corylaria" OR "Physalospora obtusa" OR "Phytophthora cactorum" OR "Phytophthora citricola" OR "Phytophthora syringae" OR "Piggotia coryli" OR "Pleonectria coryli" OR "Pleospora henningsiana" OR "Pleospora vulgaris var. putaminum" OR "Pleurostoma vibratile" OR "Polydesmia pruinosa" OR "Polyporus brumalis" OR "Polyporus ciliatus" OR "Polyporus lepideus" OR "Polyporus leptoccephalus" OR "Polyporus melanopus" OR "Polyporus tubaeformis" OR "Polyporus tuberaster" OR "Polyporus varius" OR "Pseudocytalium fecundissimum" OR "Pseudophacidium necans" OR "Pseudospiropes nodosus" OR "Pseudospiropes obclavatus" OR "Pucciniastrum coryli" OR "Pyramidospora herculiformis" OR "Pyrenula coryli" OR "Ramularia coryli" OR "Ramularia inaequalis" OR "Rhinocladiella coryli" OR "Rosellinia corticium" OR "Rosellinia helvetica" OR "Rosellinia necatrix" OR "Rosellinia subsimilis" OR "Saccosoma farinaceum" OR "Sarcoscypha coccinea" OR "Schizophyllum commune" OR "Schizopora paradoxa" OR "Sclerotinia fructigena" OR "Scytinostromella heterogenea" OR "Septomyxa fagicola" OR "Septoria avellanae" OR "Septoria coryli" OR "Sillia ferruginea" OR "Sillia karstenii" OR "Sistotremastrum niveocreum" OR "Skeletocutis nivea" OR "Sphaeropsis coryli" OR "Splanchnonema loricatum" OR "Sporidesmium coronatum" OR "Sporidesmium ehrenbergii" OR "Sporormiella pulchella" OR "Steccherinum ochraceum" OR "Stereum hirsutum" OR "Stereum rugosum" OR "Stictis confusum" OR "Strigula lateralis" OR "Strossmayeria atriseda" OR "Stylonectria applanata" OR "Synaptospora olandica" OR "Taeniolella scripta" OR "Taeniolina scripta" OR "Tapesia lividofusca" OR "Taphrina coryli" OR "Thyridaria sp." OR "Thyronectria coryli" OR "Thyronectria rhodochlora" OR "Tomasellia gelatinosa" OR "Trabutia quercina" OR "Trametes hirsuta" OR "Trametes multicolor" OR "Trametes pubescens" OR "Trametes versicolor" OR "Trematosphaeria pertusa" OR "Trichoderma lignorum" OR "Trichoderma sp." OR "Trichosphaeria melanostigmoides" OR "Trichosphaeria notabilis" OR "Trichothecium roseum" OR "Trimmatostroma salicis" OR "Tubercularia vulgaris" OR "Tyromyces semipileatus" OR "Ucinula sp." OR "Valdensia heterodoxa" OR "Valsa ambiens" OR "Valsa ceratosperma" OR "Valsa fuckelii" OR "Velutaria rufo-olivacea" OR "Veronaea botryosa" OR "Vuilleminia comedens" OR "Vuilleminia coryli" OR "Wettsteinina coryli" OR "Winterella corylina" OR "Xylaria hypoxylon" OR "Zignoella ovoidea" OR "Contarinia cybelae" OR "Dasineura corylina" OR "Mikomya coryli" OR "Aculus comatus" OR "Anthocoptes loricatus" OR "Cecidophyopsis vermiformis" OR "Coptophylla lamimani" OR "Eriophyes betulae" OR "Phyllocoptes coryli" OR "Phytoptus avellanae" OR "Phytoptus coryli" OR "Phytoptus coryligallorum" OR "Phytoptus pseudogallorum" OR "Tegonotus depressus" OR "Vasates comatus" OR "Xiphinema pyrenaicum" OR "Trichodorus pseudobursatus" OR "Megaplatypus mutatus" OR "Anisogramma anomala" OR "Aspergillus glaucus" OR "Chondrostereum purpureum" OR "Ciboria amentacea" OR "Clonostachys rosea" OR "Coniothecium complanatum" OR "Cryptosporella corylina" OR "Cryptosporella corylina" OR "Cucurbitaria coryli" OR "Cylindrosporella coryli" OR "Cytospora fuckelii" OR "Diaporthe revellens" OR "Discosporium" OR "Elsinoe" OR "Fenestella macrospora" OR "Fusarium" OR "Fusarium poae" OR "Glomerella acutata" OR "Gnomonia gnomon" OR "Hymenochaetopsis corrugata" OR "Hymenochaetopsis tabacina" OR "Hypoxylon fuscum" OR "Infundibulicybe geotropica" OR "Lactarius pyrogalus" OR "Mamianiella coryli" OR "Melogramma campylosporium" OR "Microdiplodia coryli" OR "Monostichella coryli" OR "Mycosphaerella corylaria" OR "Myxosporium roumegueri" OR "Paxillus involutus" OR "Peniophora cinerea" OR "Phanerochaete sordida" OR "Phyllactinia guttata" OR "Piggotia coryli" OR "Pseudomonas avellanae" OR "Pseudomonas syringae pv. coryli" OR "Pseudomonas syringae pv. syringae" OR "Scleroderma bovista" OR "Septoria" OR "Sillia ferruginea" OR "Skeletocutis nivea" OR "Thelonectria mammoidea" OR "Trametes" OR "Trametes versicolor" OR "Tuber borchii" OR "Tyromyces chioneus" OR "Valsa auerswaldii" OR "Vuilleminia comedens" OR "Xanthomonas arboricola pv. corylina" OR "Apioportha anomala" OR "Aspergillus glaucus" OR "Chondrostereum purpureum" OR "Ciboria amentacea" OR "Coniothecium complanatum" OR "Cryptospora corylina" OR "Cucurbitaria coryli" OR "Cytospora fuckelii" OR "Diaporthe revellens" OR "Discosporium" OR "Elsinoe" OR "Fenestella

macrospora" OR "Fusarium" OR "Gloeosporium coryli" OR "Glomerella acutata" OR "Gnomoniella vulgaris" OR "Hymenochaete corrugata" OR "Hymenochaete tabacina" OR "Hypoxyton fuscum" OR "Mamianiella coryli" OR "Melogramma campylosporium" OR "Microdiplodia coryli" OR "Monostichella coryli" OR "Mycosphaerella corylaria" OR "Myxosporium roumegueri" OR "Nectria mammoidea" OR "Nectria ochroleuca" OR "Ophiovalsa corylina" OR "Paxillus involutus" OR "Peniophora cinerea" OR "Peniophora crenea" OR "Phomopsis" OR "Phyllactinia guttata" OR "Phyllactinia suffulta" OR "Phyllactinia suffulta f. coryli-avellanae" OR "Polystictus versicolor" OR "Pseudomonas avellanae" OR "Pseudomonas syringae pv. coryli" OR "Pseudomonas syringae pv. syringae" OR "Septoria" OR "Septoria avellanae" OR "Sillia ferruginea" OR "Skeletocutis nivea" OR "Trametes" OR "Tuber borchii" OR "Tyromyces chioneus" OR "Valsa auerswaldii" OR "Vuilleminia comedens" OR "Xanthomonas arboricola pv. corylina")
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In Table B.2, the search string for *Corylus colurna* used in Web of Science is reported. Totally, four papers were retrieved. Titles and abstracts were screened, and 0 pests were added to the list of pests (see Appendix E).

Table B.2: Search string for *Corylus colurna*

Web of Science	TOPIC: ("Corylus colurna" OR "C. colurna")
All databases	AND TOPIC: (pathogen* OR pathogenic bacteria OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect\$ OR mite\$ OR phytoplasma* OR arthropod* OR nematod* OR disease\$ OR infecti* OR damag* OR symptom* OR pest\$ OR vector OR hostplant\$ OR "host plant\$" OR "host" OR "root lesion\$" OR decline\$ OR infestation\$ OR damage\$ OR symptom\$ OR dieback* OR "die back*" OR "malaise" OR aphid\$ OR curculio OR thrip\$ OR cicad\$ OR miner\$ OR borer\$ OR weevil\$ OR "plant bug\$" OR spittlebug\$ OR moth\$ OR mealybug\$ OR cutworm\$ OR pillbug\$ OR "root feeder\$" OR caterpillar\$ OR "foliar feeder\$" OR virosis OR viroses OR blight\$ OR wilt\$ OR wilted OR canker OR scab\$ OR "rot" OR "rots" OR "rotten" OR "damping off" OR "damping-off" OR blister\$ OR "smut" OR "mould" OR "mold" OR "damping syndrome\$" OR mildew OR scald\$ OR "root knot" OR "root-knot" OR rootknot OR cyst\$ OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant\$parasitic" OR "root feeding" OR "root\$feeding" OR "gall" OR "ambrosia beetle\$" OR "gall\$" OR "bark beetle\$") NOT TOPIC: ("winged seeds" OR metabolites OR *tannins OR climate OR "maple syrup" OR syrup OR mycorrhiz* OR "carbon loss" OR pollut* OR weather OR propert* OR probes OR spectr* OR antioxidant\$ OR transformation OR RNA OR DNA OR "Secondary plant metabolite\$" OR metabol* OR "Phenolic compounds" OR Quality OR Abiotic OR Storage OR Pollen* OR fertil* OR Mulching OR Nutrient* OR Pruning OR drought OR "human virus" OR "animal disease*" OR "plant extracts" OR immunological OR "purified fraction" OR "traditional medicine" OR medicine OR mammal* OR bird* OR "human disease*" OR biomarker\$ OR "health education" OR bat\$ OR "seedling\$ survival" OR "anthropogenic disturbance" OR "cold resistance" OR "salt stress" OR salinity OR "aCER method" OR "adaptive cognitive emotion regulation" OR nitrogen OR hygien* OR "cognitive function\$" OR fossil\$ OR *toxicity OR Miocene OR postglacial OR "weed control" OR landscape)

Appendix C – Personal communication

Francesco Sanna, 2020

In November 2020, the Panel contacted Dr Francesco Sanna (Collaborator of University of Padova, Department of Agronomy, Food, Natural Resources, Animals and the Environment, Padova, Italy) to obtain information on the association of *Dictyophara europaea* and *Phlogotettix cyclops* with *Corylus avellana* and its ability to transfer Flavescence dorée phytoplasma.

The information provided is as follows: 'Both *Dictyophara europaea* and *Phlogotettix cyclops* were found infected by Flavescence dorée phytoplasma; however, to date only *Dictyophara europaea* is considered to be a confirmed vector. With respect to the association with *Corylus avellana*, both species are polyphagous (especially *D. europaea*, which is extremely polyphagous) and it is likely that they can go on *Corylus avellana* although I do not have any paper confirming this. Personally, I have seen *D. europaea* on *Corylus avellana*, but I have no personal experience with *P. cyclops*. Moreover, the most important vector of Flavescence dorée phytoplasma is *Orientus ishidae*, which is not only a confirmed vector of Flavescence dorée phytoplasma but is also able to perform its full life cycle on *Corylus avellana*.'

The information provided by Dr Francesco Sanna has been used in Section A.1.2.1 of Appendix A.

Francesco Sanna provided his consent with the way his contribution has been presented in this Opinion.

The Panel wishes to acknowledge Dr Francesco Sanna for his contribution.

Appendix D – List of pests that can potentially cause an effect not further assessed

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

N	Pest name	EPPO code	Group	Pest present in Serbia	Present in the EU	<i>Corylus</i> confirmed as a host (reference)	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
1	<i>Bryobia angustisetis</i>	–	Mites	Yes	No	Yes, as <i>Corylus avellana</i> and <i>C. colurna</i> (Dossier Section 1.0; Migeon and Dorkeld, online)	Yes	Nodata	Lack of information on impact. However, congeneric species present in the EU are causing damage somewhere in the world.
2	<i>Bryobia ulmophila</i>	–	Mites	Yes	Limited (Greece, Hungary)	Yes, as <i>Corylus avellana</i> (Dossier Section 1.0)	Yes	Nodata	Lack of information on impact. However, congeneric species present in the EU are causing damage somewhere in the world.

Appendix E – Excel file with the pest list of *Corylus avellana* and *Corylus colurna*

Appendix E can be found in the online version of this output (in the 'Supporting information' section): <https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2021.6571#support-information-section>

Appendix F – Excel file with additional information provided by Serbia on exporting nurseries

Appendix F can be found in the online version of this output (in the 'Supporting information' section): <https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2021.6571#support-information-section>