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Pest categorisation of the non-EU phytoplasmas of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.

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Abstract

Following a request from the European Commission, the EFSA Panel on Plant Health performed a pest categorisation of nine phytoplasmas of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. (hereafter "host plants") known to occur only outside the EU or having a limited presence in the EU. This opinion covers the (i) reference strains of '*Candidatus* Phytoplasma australiense', '*Ca*. P. fraxini', '*Ca*. P. hispanicum', '*Ca*. P. trifolii', '*Ca*. P. ziziphi', (ii) related strains infecting the host plants of '*Ca*. P. aurantifolia', '*Ca*. P. pruni', and '*Ca*. P. pyri', and (iii) an unclassified phytoplasma causing Buckland valley grapevine yellows. Phytoplasmas can be detected by available methods and are efficiently transmitted by vegetative propagation, with plants for planting acting as a major entry pathway and a long-distance spread mechanism. Phytoplasmas are also transmitted in a persistent and propagative manner by some insect families of the Fulgoromorpha, Cicadomorpha and Sternorrhyncha (order Hemiptera). No transovarial, pollen or seed transmission has been reported. The natural host range of the categorised phytoplasmas varies from one to more than 90 plant species, thus increasing the possible entry pathways. The host plants are widely cultivated in the EU. All the categorised phytoplasmas can enter and spread through the trade of host plants for planting, and by vectors. Establishment of these phytoplasmas is not expected to be limited by EU environmental conditions. The introduction of these phytoplasmas in the EU would have an economic impact. There are measures to reduce the risk of entry, establishment, spread and impact. Uncertainties result from limited information on distribution, biology and epidemiology. All the phytoplasmas categorised here meet the criteria evaluated by EFSA to qualify as potential Union quarantine pests, and they do not qualify as potential regulated non-quarantine pests, because they are non-EU phytoplasmas.

Keywords: Crotalaria witches' broom phytoplasma, North American grapevine yellows, peach yellow leaf roll, pear decline, pest risk, plant health, plant pest, quarantine, sweet potato little leaf

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1. Introduction

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

1.1.1. Background

Council Directive 2000/29/EC[1] on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community establishes the present European Union plant health regime. The Directive lays down the phytosanitary provisions and the control checks to be carried out at the place of origin on plants and plant products destined for the Union or to be moved within the Union. In the Directive's 2000/29/EC annexes, the list of harmful organisms (pests) whose introduction into or spread within the Union is prohibited, is detailed together with specific requirements for import or internal movement.

Following the evaluation of the plant health regime, the new basic plant health law, Regulation (EU) 2016/2031[2] on protective measures against pests of plants, was adopted on 26 October 2016 and will apply from 14 December 2019 onwards, repealing Directive 2000/29/EC. In line with the principles of the above mentioned legislation and the follow-up work of the secondary legislation for the listing of EU regulated pests, EFSA is requested to provide pest categorisations of the harmful organisms included in the annexes of Directive 2000/29/EC, in the cases where recent pest risk assessment/ pest categorisation is not available.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 22(5.b) and Article 29(1) of Regulation (EC) No 178/2002[3], to provide scientific opinion in the field of plant health.

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

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

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

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

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

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

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

1.1.2.1. Terms of Reference: Appendix 1

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

Annex IIAI

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

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

(b) Bacteria

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

(c) Fungi

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

(d) Virus and virus-like organisms

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

Annex IIB

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

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

(b) Bacteria

Curtobacterium flaccumfaciens pv. flaccumfaciens (Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton

Gremmeniella abietina (Lag.) Morelet

Hypoxylon mammatum (Wahl.) J. Miller

1.1.2.2. Terms of Reference: Appendix 2

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

Annex IAI

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

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

1) *Carneocephala fulgida* Nottingham
2) *Draeculacephala minerva* Ball
3) *Graphocephala atropunctata* (Signoret)

Group of Tephritidae (non-EU) such as:

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

(c) Viruses and virus-like organisms

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

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

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

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

Annex IIAI

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

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

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

1.1.2.3. Terms of Reference: Appendix 3

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

Annex IAI

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

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

(b) Fungi

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

(c) Viruses and virus-like organisms

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

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex IAII

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

Meloidogyne fallax Karssen	*Rhizoecus hibisci* Kawai and Takagi
Popillia japonica Newman	

(b) Bacteria

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

(c) Fungi

Melampsora medusae Thümen	*Synchytrium endobioticum* (Schilbersky) Percival

Annex I B

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

Leptinotarsa decemlineata Say	*Liriomyza bryoniae* (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.1.3. Interpretation of the Terms of Reference

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

The EFSA PLH Panel decided to address the pest categorisation of this group of infectious agents in two steps: first, a list of the non-EU phytoplasmas of the host plants (EFSA PLH Panel, 2020) and second, the present pest categorisation.

The process is described in EFSA PLH Panel (2020), in which a systematic approach identified 27 phytoplasmas reported to naturally infect one or more of host plants. "Among these phytoplasmas, based on information on distribution and prevalence both inside and outside the EU, the Panel identified 10 non-EU phytoplasmas, known to occur only outside the EU or having only a limited presence in the EU. The remaining 17 phytoplasmas, non-EU phytoplasmas known to occur only outside the EU or having only a limited presence in the EU, whose ability to infect host species is not fully confirmed by available literature (3 phytoplasmas), or phytoplasmas which have a substantial presence in the EU or are so far reported from the EU only (14 phytoplasmas), will not be categorised within the current mandate." One non-EU phytoplasma ('*Candidatus* Phytoplasma phoenicium', PHYPPH) was excluded from further categorisation, as a recent pest risk assessment is available (EPPO, 2017). The same statements and definitions reported above also apply to the current opinion.

This opinion provides the pest categorisation of the 9 non-EU phytoplasmas with confirmed presence in at least one of the host plants, that have been listed in EFSA PLH Panel (2020). Although phytoplasmas have not yet been cultivated *in vitro*, phylogenetic analyses based on various conserved genes have shown that they represent a distinct, monophyletic clade within the class Mollicutes. Phytoplasmas are therefore accommodated within the '*Candidatus* Phytoplasma' genus. Within this genus, several sub-taxa have been described to accommodate organisms sharing less than 97.5% similarity among their 16S rRNA gene sequences. Additional species are described to accommodate organisms that, despite their 16S rRNA gene sequence being > 97·5% similar to those of other '*Ca*. Phytoplasma' species, are characterized by distinctive biological, phytopathological and genetic properties. Conversely, some organisms, despite their 16S rRNA gene sequence being < 97·5% similar to that of any other '*Ca*. Phytoplasma' species, are not presently described as *Candidatus* species, due to their poor overall characterization (IRPCM, 2004). The current opinion covers only phytoplasma strains infecting at least one of the host plants within their officially described '*Ca*. P. species'. To this purpose, pathogens were identified according to the list of strains/-related strains within the original '*Ca*. P. species' description, when available. Otherwise, affiliation to a '*Ca*. P. species'-related strain was based on the identity of the 16S rRNA subgroup. In one case, in the absence of '*Ca*. P. species' description, the pathogen strain is addressed as 'unclassified'.

The current opinion covers the following entities:

- '*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL),
- '*Ca*. P. australiense' (reference strain),
- '*Ca*. P. fraxini' (reference strain),
- '*Ca*. P. hispanicum' (reference strain),
- '*Ca*. P. pruni'-related strain (North American grapevine yellows, NAGYIII),
- '*Ca*. P. pyri'-related strain (peach yellow leaf roll, PYLR),
- '*Ca*. P. trifolii' (reference strain),
- '*Ca*. P. ziziphi' (reference strain),
- An unclassified phytoplasma causing Buckland valley grapevine yellows.

Viruses, virus-like diseases of unknown aetiology or diseases caused by other graft-transmissible bacteria of the host plants are not addressed in this opinion.

The new Plant Health Regulation (EU) 2016/2031[4], on the protective measures against pests of plants, will be applying from December 2019. The regulatory status sections (3.3.) of the present opinion are still based on Council Directive 2000/29/EC, as the document was adopted in November 2019.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on non-EU phytoplasmas infecting the host plants was conducted at the beginning of the categorisation in the Web of Science (WoS) database, using the scientific name of the pests as search term. Relevant papers were reviewed and further references and data were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the EPPO Global Database (EPPO GD) (EPPO, 2019) and relevant publications. Data kindly provided by National Plant Protection Organisations of the EU MS were also considered.

Information on pest vectors was retrieved from the Hemiptera-Phytoplasma-Plant biological interaction database (Trivellone, 2019). Data on the EU distribution of pest vectors were retrieved from the Fauna Europaea database (de Jong et al., 2014), and the Catalogue of Life 2019 checklist (Roskov et al., 2019). To ensure appropriate screening of the literature on the EU distribution of the species/genera, a WoS search was performed using the species name as a search string. All results were individually checked. When more than 300 items were retrieved, the search was refined by including 'Europe' as search string.

Data about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

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

[4] Regulation (EU) 2016/2031 of the European Parliament 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.

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

2.2. Methodologies

The Panel performed the pest categorisation for the non-EU phytoplasmas of the host plants following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018) and in the International Standard for Phytosanitary Measures (ISPM) No 11 (FAO, 2013) and No 21 (FAO, 2004).

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

Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. All relevant criteria have to be met for the pest to potentially qualify either as a quarantine pest or as a RNQP. If one of the criteria is not met, the pest will not qualify. A pest that does not qualify as a quarantine pest may still qualify as a RNQP that needs to be addressed in the opinion. For the pests regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone; thus, the criteria refer to the protected zone instead of the EU territory.

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

Table 1: Pest categorisation criteria under evaluation, as defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32-35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/ presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism	Is the pest present in the EU territory? If not, it cannot be a RNQP. (A RNQP must be present in the risk assessment area)
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future	The protected zone system aligns with the pest free area system under the International Plant Protection Convention (IPPC) The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone)	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32-35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential RNQP were met, and (2) if not, which one(s) were not met

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

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?

YES, the identity of the non-EU phytoplasmas of the host plants is clear.

Phytoplasmas are accommodated within the '*Candidatus* Phytoplasma' genus. Within this genus, several species have been described based on their 16S rRNA gene sequences. Within the species, strains officially included in the species description share a common signature at this locus. For each species, a reference strain is described, and its 16S rRNA sequence determined. Strains with minimal differences in the 16S rRNA gene (≥ 97.5% identity) are considered as related strains. In the presence of minimal differences of the 16S rRNA gene, if the two phytoplasmas are transmitted by different vectors, have a different natural plant host (or, at least, their behaviour is significantly different in the same plant host), and there is evidence of significant molecular diversity, the description of a new species is recommended (IRPCM, 2004). The current opinion covers pathogens at the strain level, infecting at least one of the host plants within their officially described '*Ca*. P. species'. In one case (Buckland valley grapevine yellows) the phytoplasma has not yet been assigned to a '*Ca*. P.' species.

Key information on the identity of the phytoplasmas categorised in the present opinion is reported in Table 2.

Table 2: Justification for establishing identity of the phytoplasmas categorised here

Phytoplasma name, reference strain/ related strain name	Justification
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)	A categorisation of the '*Ca*. P. aurantifolia' reference strain is already available (EFSA PLH Panel, 2017), under the name Witches' broom disease of lime phytoplasma. The disease has only been reported in *Citrus* spp. (Zreik et al., 1995). The phytoplasma belongs to the 16SrII ribosomal group (IRPCM, 2004). Many other diseases have been associated with phytoplasmas within the 16SrII group, and those infecting the host plants are categorised here, including '*Ca*. P. australasia' [PHYPAA], as this species is not officially accepted (IRPCM, 2004). Phytoplasmas of the 16Sr-II group are the causal agents of sweet potato little leaf (SPLL) [PHYP39], crotalaria witches'-broom phytoplasma (CrWB), pear decline Taiwan II (PDTWII), papaya mosaic, peanut witches' broom phytoplasma, sunn hemp witches' broom phytoplasma, Australian big bud of tomato, dieback of papaya, mosaic of papaya, yellow crinkle of papaya, tomato big bud (TBB) [PHYP01], dwarf disease of sweet potato, little leaf of sweet potato. Inclusion of 16Sr-II phytoplasma strains papaya yellow crinkle (PpYC), papaya mosaic (PpM), and tomato big bud (TBB) into the '*Ca*. P. australasia' taxon (White et al., 1998) has not been further supported (IRPCM, 2004)
'*Ca.* P. australiense' (reference strain)	The '*Ca*. P. australiense' species includes different phytoplasma genetic lineages. They are the causal agents of: Australian grapevine yellows (AUSGY; AGY); Strawberry lethal yellows; papaya dieback (PpDB); phormium yellow leaf (PYL), Australian lucerne yellows. Within the species (Davis et al., 1997a), three distinct subgroups are proposed based on sequence analyses of the tuf gene: tuf 1, tuf 2, and tuf 3 (Andersen et al., 2006). A related strain is reported in Australia (Getachew et al., 2007). The phytoplasma is listed as PHYPAU in the EPPO GD
'*Ca.* P. fraxini' (reference strain)	The '*Ca*. P. fraxini' species (Griffiths et al., 1999) includes members of the AshY phytoplasma group (16SrVII-A). They are the causal agents of Ash yellows (AshY) and lilac witches' broom (LWB) diseases in North America (Sinclair et al., 1996). Phytoplasmas of the same 16Sr group (subgroup -C) have been reported to infect *Fragaria* (Fernandez et al., 2013) in Argentina, although their status within the '*Ca*. P. fraxini' is uncertain. The phytoplasma is listed as PHYPFR in the EPPO GD
'*Ca.* P. hispanicum' (reference strain)	The '*Ca*. P. hispanicum' species includes different phytoplasma genetic lineages. They are the causal agents of: Mexican periwinkle virescence (MPV) which was indicated as reference strain, strawberry multiplier (STRAWB1), Mexican potato purple top (MPPT-SINPV), papaya apical curl necrosis (PACN-Br04) and strawberry red leaf (StrawRL-Tc1) (Davis et al., 2016). Other diseases recently described and associated with this phytoplasma species are: broccoli stunt in Brazil (Perez-Lopez et al., 2016), strawberry green petal disease in Mexico (Perez-Lopez and Dumonceaux, 2016), and strawberry fruit phyllody (SFP-Br02)) in Brazil (Melo et al., 2018). The Strawberry multiplier disease phytoplasma is listed as PHYP75 in the EPPO GD. The phytoplasma listed as Strawberry witches' broom mycoplasm (SYWB00) in Annex IAI was detected before the development of molecular identification tools, therefore its designation as related strain of '*Ca*. P. hispanicum' is uncertain. Phytoplasmas identified in *Melia azedarach* (Davis et al., 2016) are now included in '*Ca*. P. meliae' (Fernandez et al., 2016). The '*Ca*. P. hispanicum' is listed as PHYP07 in the EPPO GD

Phytoplasma name, reference strain/ related strain name	Justification
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	16SrIII NAGY phytoplasma strains are closely related to, but distinct from, strains of '*Ca*. Phytoplasma pruni', cause of Prunus X-disease, based on deduced 3- dimensional structure of SecY proteins, and SNPs (single nucleotide polymorphisms) in 16S rRNA, secY, and ribosomal protein (rp) genes. They differ from '*Ca*. Phytoplasma pruni' in regions of the 16S rRNA gene corresponding to three segments described as species-unique for '*Ca*. Phytoplasma pruni' (Davis et al., 2014)
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	This disease peach yellow leaf roll (PYLR) was first observed in 1948 in the Sacramento Valley, California, USA. The incidence of PYLR remained relatively low until an epidemic outbreak in the late 1970s and early 1980s (Marcone et al., 2014). A disease named Almond brown line and decline (ABLD) may also be caused by PYLR phytoplasma (Uyemoto et al., 1992). The PYLR phytoplasma is phylogenetically closely related to, but not identical to, the '*Ca*. P. pyri' reference strain agent of the pear decline disease, PD. In most molecular analyses based on ribosomal and non-ribosomal DNA sequences, PYLR is indistinguishable from the PD phytoplasma (Seemuller and Schneider, 2004). Comparison of genes coding the immunodominant membrane protein (IMP) clearly indicates that PYLR and PD are different (Morton et al., 2003). For this reason, the PYLR is considered as a related strain of the '*Ca*. P. pyri' (Seemuller and Schneider, 2004)
'*Ca.* P. trifolii' (reference strain)	The '*Ca*. P. trifolii' phytoplasma includes Clover proliferation (CPR) as the reference strain, and alfalfa witches'-broom (AWB), brinjal little leaf (BLL), beet leafhopper-transmitted virescence (BLTV), Illinois elm yellows (ILEY), potato witches'-broom (PWB), potato yellows (PY), tomato big bud in California (TBBc) and phytoplasmas from *Fragaria multicipita* (FM) (Hiruki and Wang, 2004). The latter is an invalid taxon, as *F. multicipita*, thought to be a rare plant with unusual vegetative morphology, is actually a phytoplasma-diseased aberrant growth form of *F. virginiana* (Jomantiene et al., 1998a). The vegetative morphology of *F. multicipita* is typical of strawberry plants affected by multiplier disease found in winter production strawberry fields in Florida, as also confirmed by molecular analyses (Davis et al., 1998). The phytoplasma is listed as PHYPTR in the EPPO GD, together with the following other names: Lucerne witches' broom phytoplasma, Potato witches' broom phytoplasma and proliferation of clover. Other microorganisms are listed in the EPPO GD as PHYP61 (Willow witches' broom phytoplasma) and PHYP62 (Brinjal little leaf phytoplasma and Eggplant little leaf phytoplasma). These can be assigned to '*Ca*. P. trifolii' in agreement with the species description (Hiruki and Wang, 2004)
'*Ca.* P. ziziphi' (reference strain)	The '*Ca*. P. ziziphi' species includes the causal agents of Jujube witches' broom phytoplasma (or witches' broom of jujube), the sweet cherry virescence (SCV), a stem fasciation disease of persimmon trees, the cherry lethal yellows (CLY5) in China, the peach yellows in India (PY-In), and the Euonimus witches' broom in China, among others. These phytoplasmas form a homogenous ecological lineage (within the 16SrV-B) based on analysis of genetic loci that encode important phytoplasma cellular components, including an array of ribosomal proteins and preprotein translocase subunit SecY (Wang et al., 2018b), although minor RFLP patterns are predicted by in silico restriction digestion of their 16s rRNA sequences (Ren et al., 2017). Sequence analyses of the 16S rRNA gene of several Chinese isolates of JWB confirm that the pathogen causes consistent symptoms from different regions and cultivars (Bu et al., 2016). The genome of '*Ca*. P. ziziphi' has been recently sequenced (Wang et al., 2018a). PHYPZI is the EPPO code for '*Ca*. P. ziziphi'
Buckland valley grapevine yellows phytoplasma	This phytoplasma shows about 97,0% sequence identity to '*Candidatus* Phytoplasma asteris' (16SrI), its closest relative, therefore it fulfills the requisite for being classified as a different species, although this has not been done so far (Fiona Constable, Microbiology, Agriculture Victoria Research, Department of Jobs, Precincts and Regions, AgriBio, 30/01/2019, personal communication). The Buckland valley grapevine yellows phytoplasma has been assigned as reference isolate of the 16SrXXIII group (Zhao and Davis, 2016). No variation was detected between isolates of the phytoplasma when Heteroduplex Mobility Assay of the tuf gene was done and it is possible that this phytoplasma lacks molecular diversity (Constable and Symons, 2004)

3.1.2. Biology of the pest

All the phytoplasmas considered in the present pest categorisation are efficiently transmitted by grafting of infected scions on healthy plants, as well as by phloem feeder insect vectors. Phytoplasmas are transmitted by insects in the order Hemiptera. However, vector species are restricted to only a few families of the Fulgoromorpha and Cicadomorpha (most of the vector species belong to Cicadellidae and Cixiidae), and of Sternorrhyncha (Psyllidae) (Weintraub and Beanland, 2006)). Within a family, some species are known to be phytoplasma vectors, while others are not. Transmission is persistent and propagative, and insects are infective for life. No transovarial transmission has been reported for the phytoplasmas categorised here.

The phytoplasma transmission process consists of:

i) acquisition of the pathogen during feeding on an infected plant,
ii) a latent period in the insect, during which the phytoplasma crosses the midgut barrier, multiplies within the insect body and colonizes its salivary glands, and
iii) inoculation of the bacterium during feeding on a healthy plant.

Details on the symptoms on the host plants, incubation period and epidemiology are listed in Table 3. Symptoms on other plants are listed in Appendix A. The known vector species are listed in Table 4. Phytoplasma infection is often due to a single phytoplasma strain/species, and insect vectors can acquire this phytoplasma and transmit it to other plants of the same species or other susceptible species. Therefore, the epidemiological cycle is simple, since a single phytoplasma is transmitted among susceptible plants of one or more botanical species. It appears that vectors can act in closed or open epidemiological cycles. A closed cycle is represented by a phytoplasma that circulates between the main, if not exclusive, host plant and the main, if not exclusive, vector species (Bosco and D'Amelio, 2010). No pollen and seed transmissions have been reported for the phytoplasmas considered in this opinion.

For this pest categorisation, two vector categories were identified (Trivellone, 2019):

1) An insect species is considered a competent vector if the phytoplasma capability to overcome the barriers of gut and salivary glands has been proven using classical acquisition/inoculation experiments in the laboratory, or inoculation trials with caged infected specimens collected from the field.
2) An insect species is considered a potential vector if the phytoplasma has been detected in the insect body using standard molecular methods, or inoculated to artificial medium under laboratory conditions. The status as a potential vector does not prove the ability to transmit the phytoplasma from plant to plant.

Table 3: Symptoms on the target host plants, incubation period and epidemiological details of the phytoplasmas categorised here. For symptoms on other plants, see Appendix A

Phytoplasma name, reference strain/ related strain name	Symptoms	Incubation period	Epidemiological details
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	*Fragaria*: strawberry leaves from fruit (Streten et al., 2005c). *Prunus*: symptoms of chlorotic leafroll on one branch or on the whole crown with scattered dieback of several branches (Rasoulpour et al., 2019), (plum) little leaf, leaf rolling, rosetting, yellowing and shoot proliferation (Zirak et al., 2009b), bronzing of foliage and tattered and shot-holed leaves (Zirak et al., 2010).	In *Prunus* (apricot), the minimum time between inoculation and symptom expression is of 21 months (Rasoulpour et al., 2019). In *Pyrus*, diseased seedlings begin to exhibit the characteristic upward leaf curling symptoms of pear decline (PDTWII) three to six months after transmission (Liu et al., 2011). In *Carica papaya*: the mean time from symptom appearance to plant death is about 4 months (Padovan and Gibb, 2001), while bunchy top symptoms appear 3 months after inoculation to papaya by *Empoasca*	Disease transmission rates by *Orosius occidentalis* and *O. albicinctus* leafhoppers are above 60% when leafhoppers are allowed to acquire the phytoplasma on infected plants and about 20% when field-captured leafhoppers are used for the transmission (Akhtar et al., 2009, 2013)

Phytoplasma name, reference strain/ related strain name	Symptoms	Incubation period	Epidemiological details
	Pyrus: leaf redness and curling followed by progressive weakening and wilt (Liu et al., 2011); general dieback, poor terminal growth, and poorly developed root systems (Schneider and Gibb, 1997). *Vitis*: decline, leaf yellowing and shortening of internodes (Ghayeb Zamharir et al., 2017), late season leaf curl, LSLC (Gibb et al., 1999)	*papayae* (Perez et al., 2010). The infectious period (incubation period plus the period from postincubation to time-to-death period) of infected papaya ranges from 6 to 9 months (Esker et al., 2006)	
'*Ca.* P. australiense' (reference strain)	*Fragaria*: plants growing flatter to the ground, purpling of older leaves, reduced leaf size, yellowing of younger leaves, and sometimes plant death (Liefting et al., 2007). *Prunus*: yellowing of leaf margins and rolling, drying and necrosis (leaves), proliferation of shoots along branches (Jones et al., 2005)	In infected papaya, plant apical death occurs within 2 weeks of first visible external symptom expression, and 3 weeks of first detection of phytoplasma in host tissue (Guthrie et al., 2001); plants survive less than 3 months (Padovan and Gibb, 2001)	No information was found
'*Ca.* P. fraxini' (reference strain)	*Fragaria*: phyllody (Fernandez et al., 2013). *Prunus* spp: decline, leaf reddening, yellowing, shortening of internodes, witches' broom and reduced fruit size (Zunnoon-Khan et al., 2010). *Vitis*: severe yellows, decline, reduced internode size and leaf with lack of lignification (Ghayeb Zamharir et al., 2017; Zambon et al., 2018)	Mortality of infected trees occurs within 2 years in young ash trees and up to 10 years after infection of old trees (reviewed in (Olivier et al., 2009)). Mortality (30%) over an 8-year study period is reported for *Fraxinus velutina* adult trees in Arizona, with a lag time between ash infection and symptom development of about 2 years (Bricker and Stutz, 2004). Symptom incubation up to 4 years has been reported in 20% of the ash trees of a US population (Sinclair and Griffiths, 1995)	No information was found
'*Ca.* P. hispanicum' (reference strain)	*Fragaria*: fruit phyllody, achenes' hypertrophy and leaf reddening (Cui et al., 2018), slow growth (Melo et al., 2018), deformation of fruits, large, elongated purple leaves and green petals (Avendano-Benequen et al., 2017), stunting, young leaves with yellowing at the edges, mature leaves with curling and a reddish colouration at the abaxial face, death (Fernandez et al., 2015)	*Fragaria* in Mexico: symptoms observed in strawberry planted between 30 and 60 days after transplanting and during crop development (Avendano-Benequen et al., 2017). In late '90s, symptoms of strawberry disease in Florida were observed as soon as the plants were removed from shipping containers in autumn (Jomantiene et al., 1998b)	Strawberry disease occurred in commercial fields in west central Florida during the 1995 to 1996 winter growing season, with transplant originating from Canadian nurseries (Harrison et al., 1997). Plants shipped from Canada and transplanted in Florida for fruit production displayed disease symptoms suggesting possible infection by phytoplasma (Jomantiene et al., 1998b)

Phytoplasma name, reference strain/ related strain name	Symptoms	Incubation period	Epidemiological details
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	*Vitis*: Symptoms of NAGYIII are similar to those of other grapevine yellows diseases that occur globally, and include leaf reddening in red-fruited cultivars (cvs.), leaf chlorosis in white-fruited cvs., downward rolling of leaf margins, dieback of shoot tips, abortion of fruit clusters, and nonuniform maturation of shoot stem periderm (Wolf, 2015)	NAGYIII affected vines often die within 2 or 3 years of symptom onset (Wolf, 2015)	Infected plants may show symptoms the same year of the infection, but usually severe symptoms are expressed a year after the infection. Plants usually die within 4 years since infection. The highest incidence of NAGYIII diseased plants is found in vineyards bordered by woods with deciduous trees, especially *Prunus* and *Vitis* spp. (Wolf, 2015)
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	*Prunus*: PYLR causes chlorosis, downward curling of leaf tips and rolling of leaf margins in mid-summer due to a cork layer deposition, while leaves remain normal in size	One year (Uyemoto et al., 1999)	Disease incidence did not differ among peach cvs., but was significantly lower in 4 year old or younger peach trees than in older plants. PYLR incidence was higher in peach orchards adjacent to commercial pear orchards and the incidence decreased with distance from pears (Purcell et al., 1981). Furthermore, since there is no evidence that PYLR spreads from peach to peach, pear trees are regarded as the primary pathogen reservoir (Marcone et al., 2014)
'*Ca.* P. trifolii' (reference strain)	*Fragaria*: stunting, small leaves, multiple crowns and no runners (Jomantiene et al., 1998a). *Prunus persica*: leaf rolling, little leaf, rosetting, yellowing, bronzing of foliage and tattered and shot-holed leaves (Zirak et al., 2010). *Prunus dulcis*: little leaf, leaf rolling, dieback of branches, rosette and yellowing (Zirak et al., 2009a)	No information was found	In Iran, 80% of winter-collected date palm showing streak yellows symptoms were positive, but only 20% of spring samples were positive (Ghayeb Zamharir and Eslahi, 2019). Phytoplasmas were detected in celery (*Apium graveolens*) from six plots in Spain, only in the late cultivation cycle (November), while no phytoplasma was detected at the end of the previous cultivation cycles (June and August). The same phytoplasma strain was detected in

Phytoplasma name, reference strain/ related strain name	Symptoms	Incubation period	Epidemiological details
			two weed species (*Amaranthus blitoides* and *Setaria adhaerens*) growing nearby celery plots (Alfaro-Fernandez et al., 2017)
'*Ca.* P. ziziphi' (reference strain)	*Prunus* spp: the diseased trees develop flowers having white petals with green veins or abnormal floral structures having cupped, green petals; the affected flowers fail to set fruit (Wang et al., 2014). Leaf symptoms start in early summer with upward leaf curling followed by yellowing, reddening and premature fall and stunting (Paltrinieri et al., 2006). *Malus*: little leaf, leaf margin involute and yellows (Li et al., 2014b)	Upon grafting of symptomatic shoots on healthy jujube plants symptoms appear after 48 weeks (Ye et al., 2017). '*Ca*. P. ziziphi' phytoplasma can survive in branches during winter and roots are not necessary for the multiplication of phytoplasma and the development of phytoplasma symptom (Zhao et al., 2009a)	Two year old apples may show '*Ca*. Phytoplasma ziziphi'-like symptoms, but the phytoplasma does not infect adult trees (Li et al., 2014b)
Buckland valley grapevine yellows phytoplasma	*Vitis:* Yellowing, downward curling of leaves, stunted shoots that do not harden off, but remain rubbery, shoot tips dye and bunches shrivel and fall	No information was found	Up to about 30% incidence was reported in Chardonnay plots (Constable et al., 2004). This phytoplasma affects many grapevines and is characterized by remission of symptoms, some recurrence and occurrences in previously unaffected grapevines (Constable et al., 2003)

Table 4: Competent and potential insect vector species of the non-EU phytoplasmas of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. with the associated uncertainty

Phytoplasma name, reference strain/related strain name	Competent vectors	Potential vectors	Uncertainties
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet	*Orosius albicinctus* adults collected by sweep net in *Medicago sativa* fields showing FBP symptoms associated to 16SrII-C and -D phytoplasmas were able to transmit the phytoplasma to healthy *M. sativa*, *Vigna radiata*, *Pisum sativum*, *Daucus carota* (Salehi et al., 2016a), and *Sesamum indicum* (Ikten et al., 2014). The leafhoppers were also	*Hishimonus phycitis* (Gopala and Rao, 2018), *Neoaliturus haematoceps* (Ozdemir, 2018), *Empoasca decipiens* (Parrella et al., 2008), *Empoasca* spp., *Amrasca bigutula, Circulifer* spp., *and Nisia* spp. (Sharif et al., 2019); *Orosius spp.* (Al-Subhi et al., 2017).	None

Phytoplasma name, reference strain/related strain name	Competent vectors	Potential vectors	Uncertainties
potato little leaf, SPLL)'	able to acquire the phytoplasma on infected sesame plants (Esmailzadeh-Hosseini et al., 2007); *Orosius argentatus* is a vector of the TBB phytoplasma to tomato, several legume species, and lucerne (Padovan and Gibb, 2001). *Orosius cellulosa* is the vector of cotton virescence phytoplasma (Desmidts et al., 1973), which is now known to be a 16SrII-C subgroup member (Marzachì et al., 2009) *Orosius lotophagorum* is also a vector of sweet potato little leaf disease (Padovan and Gibb, 2001). *Orosius orientalis* transmits phytoplasmas from infected to healthy chickpea plants (Akhtar et al., 2009). *Empoasca papayae* transmitted the Bunchy Top Symptoms to inoculated papaya plants (Perez et al., 2010), *Cacopsylla chinensis* was able to transmit PDTWII phytoplasma to *Pyrus serotina* (Liu et al., 2011)		
'*Ca*. P. australiense' (reference strain)	*Zeoliarus oppositus* polyphagous insects are able to vector '*Ca*. P. australiense' to *Coprosma robusta* and *Cordyline australis;* (Winks et al., 2014), *Z. atkinsoni* transmitted *Phormium* yellow leaf phytoplasma to healthy New Zealand flax *(Phormium tenax)* as detected by symptomatology and PCR. Accordingly, the phytoplasma was detected in the vector salivary glands (Liefting et al., 1997)	*Arawa variegata* and *Recilia hospes* (Charles et al., 2002)	None
'*Ca*. P. fraxini' (reference strain)	Field-collected *Amplicephalus funzaensis* and *Exitianus atratus* are able to transmit 16SrVII phytoplasmas to healthy *Phaseolus vulgaris* plants, as plants showed symptoms 5 weeks after inoculation and were PCR-positive (Perilla-Henao et al., 2016)	*Scaphoideus titanus*, *Orientus ishidae* (Zambon et al., 2018), *Colladonus clitellarius* (Hill and Sinclair, 2000), *Graminella nigrifrons* (Arocha-Rosete et al., 2011)	None
'*Ca*. P. hispanicum' (reference strain)	Phytoplasmas of the 16SrXIII ribosomal group (*Ca.* P. hispanicum) have been detected in the psyllid *Bactericera cockerelli* collected from potato and pepper plants in Mexico, and these	*Homalodisca liturata* (Servin-Villegas et al., 2018)	The vector role of *B. cockerelli* is uncertain, as information was retrieved from a Master thesis, but not

Phytoplasma name, reference strain/related strain name	Competent vectors	Potential vectors	Uncertainties
	phytoplasmas were transmitted by this psyllid to potato, pepper, and tomato plants (Negroe, 2007)		supported by a peer-reviewed publication
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	None reported	*Jikradia olitoria* insects collected in vineyards with NAGYIII history are potential vectors of NAGYIIIβ sequevar in artificial feeding experiments (Lenzi et al., 2019)	None
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	*Cacopsylla pyricola.* Field transmissions to peach trees occur when psyllids migrate in late autumn from pear orchards to neighboring peach orchards to overwinter there (Purcell and Suslow, 1984; Blomquist and Kirkpatrick, 2002)	*Paraphlepsius* spp. (Blomquist and Kirkpatrick, 2002)	None
'*Ca.* P. trifolii' (reference strain)	Adults of *Ceratagallia nitidula* and *Empoasca abrupta,* fed on chili peppers *(Capsicum annuum)* infected with a Mexican isolate of *'Ca.* P. trifolii', re-transmit the phytoplasma to healthy peppers (Salas-Munoz et al., 2018). *Circulifer tenellus* transmits the beet leafhopper-transmitted virescence agent (BLTVA) to potato and tomato in California (EFSA PLH Panel, 2015)*. Circulifer haematoceps* transmits an Iranian isolate of *'Ca.* P. trifolii' to healthy cabbage (*Brassica oleracea*), following acquisition on infected cabbage plants *(Salehi et al., 2007).* Specimens of *Orosius albicinctus* collected in Iranian fields of phytoplasma-infested herbaceous wild plants as well as nearby potato, alfalfa and sesame plots, transmit '*Ca.* Phytoplasma trifolii' to *Catharanthus roseus* (Omidi et al., 2010). The CP reference strain of '*Ca.* P. trifolii' is transmitted by *Macrosteles fascifrons* from *Trifolium hybridum* to *Callistephus chinensis, C. roseus, Daucus carota* and *Nicotiana rustica* (Hiruki and Wang, 2004). *Batracomorphus punctatus* and *Orosius argentatus* are reported as competent vectors of '*Ca.* P. trifolii' strains in Australia and *O. orientalis* in Iran (Trivellone, 2019)	*Hishimonus phycitis* (Gopala et al., 2018), (Kumar et al., 2017); *Neoaliturus pulcher* (Seyahooei et al., 2017); *Anaceratagallia laevis* and *Balclutha* spp. (Choueiri et al., 2007); *Ceratagallia* spp. (Crosslin et al., 2005); *Macrosteles sexnotatus* (Girsova et al., 2016)	None
	The disease is transmitted experimentally by the leafhopper		*Erythroneura sudra* (Wang et al., 2018b);

Phytoplasma name, reference strain/related strain name	Competent vectors	Potential vectors	Uncertainties
'*Ca.* P. ziziphi' (reference strain)	*Hishimonus sellatus* (Jung et al., 2003). *Hishimonoides chinensis* inoculated with phytoplasmas from infected *Ziziphus mauritiana* can transmit the disease, especially where *Paulownia* and *Z. mauritiana* are mixed or close together (Jin and Gao, 1984)		*Hishimonus lamellatus* (Trivellone, 2019)
Buckland valley grapevine yellows phytoplasma	None reported	None reported	None

3.1.3. Intraspecific diversity

Taking into account the reasoning of Section 3.1.1, intraspecific diversity is addressed up to the related strain level. Nevertheless, in most cases (with the exception of '*Ca*. P. pyri'-related strain (peach yellow leaf roll, PYLR) and Buckland valley grapevine yellows phytoplasma), sequevars (groups of strains characterised by a specific DNA sequence for one or several genes) have been reported, and these are listed in Table 5.

Table 5: Intraspecific variation of the phytoplasmas categorised here

Phytoplasma name, reference strain/related strain name	Justification
'*Ca.* P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	The peanut witches' broom phytoplasma group (16SrII) includes several strains with a worldwide distribution. Twenty-one 16SrII subgroups (A–U) have been described (Annex A). The Crotalaria witches' broom isolate from Oman belongs to a new lineage (16SrII-W) (Al-Subhi et al., 2017). Multilocus sequence analysis protocols indicate that 16SrII-C and -D isolates infecting vegetable crops and periwinkle from China (Cai et al., 2016) and Egypt (El-Sisi et al., 2018) are identical and cluster together, according to their country of origin, within the subgroup. Also, phytoplasmas of different 16SrII subgroups (-C and -D) may infect the same host, as shown for *Medicago sativa* in Iran (Esmailzadeh Hosseini et al., 2016)
'*Ca.* P. australiense' (reference strain)	Some evolutionary divergence in the 16SrXII-B group has been suggested. Analyses of genes (tuf, and rp operon) that are less conserved than the 16S rRNA gene can distinguish four subgroups (16SrXII-B (*tuf*-Australia I; *rp*-A), 16SrXII-B (*tuf*-New Zealand I; *rp*-B), 16SrXII-B (*tuf*-New Zealand II) and 16SrXII-B (*rp*-C). Strawberry lethal yellows 1, strawberry green petal, Australian grapevine yellows, pumpkin yellow leaf curl and cottonbush witches'broom phytoplasmas are members of the 16SrXII-B (tuf -Australia I; rp-A) subgroup. The strawberry lethal yellows 2 and cottonbush reduced yellow leaves phytoplasmas are assigned to the 16SrXII-B (tuf-New Zealand II; rp-B), subgroup. No relationship is present between these phytoplasma subgroups and collection date, location or host plant (Streten and Gibb, 2005)
'*Ca.* P. fraxini' (reference strain)	Based on sequence homology, similarity coefficients derived from RFLP of the 16S rDNA and phylogenetic analysis, six 16S rRNA subgroups have been described (16SrVII-A to -F) (da Silva Fugita et al., 2017). The subgroup 16SrVII-A incorporates North American isolates (Griffiths et al., 1999). There is uncertainty on whether 16S rRNA other than -A should be included in the '*Ca*. P. fraxini' species (Conci et al., 2005). Among these

Phytoplasma name, reference strain/related strain name	Justification
	subgroups, erigeron witches' broom from Brazil and Argentina (EriWB) phytoplasmas are included in VII-B subgroup (Barros et al., 2002; Meneguzzi et al., 2008), alfalfa witches'broom from Argentina (ArAWB) phytoplasma in VII-C subgroup (Conci et al., 2005), together with the causal agent of *Crotalaria juncea* shoot proliferation in Brazil (Flores et al., 2013). Within 16SrVII-D, a phytoplasma is reported in erigeron plants from Brazil (Flores et al., 2015), and a Chilean isolate from grapevine, previously classified as belonging to subgroup 16SrVII-A (Gajardo et al., 2009), was tentatively reclassified as a representative of subgroup 16Sr-E (Perez-Lopez et al., 2016). Finally, a 16SrVII phytoplasma identified in *Vernonia brasiliana* in Brazil has been assigned to -F subgroup (da Silva Fugita et al., 2017). Strain variation in aggressiveness has been reported both in ash trees and in an experimental host (*Catharanthus roseus*) (Sinclair and Griffiths, 2000)
'*Ca.* P. hispanicum' (reference strain)	Intraspecific variation exists within the '*Ca*. P. hispanicum' species, as several different 16SrXIII subgroups have been described within this species: 16SrXIII-A (Mexican periwinkle virescence), 16SrXIII-B (strawberry multiplier), 16SrXIII-D (potato purple top disease), 16SrXIII-E (papaya apical curl necrosis), 16SrXIII-F (strawberry red leaf) (Davis et al., 2016), 16SrXIII-H (broccoli stunt) (Perez-Lopez et al., 2016), 16SrXIII-I (strawberry green petal) (Perez-Lopez and Dumonceaux, 2016), 16SrXIII-J (strawberry fruit phyllody) (Melo et al., 2018), and a novel subgroup detected in strawberry in Chile (Cui et al., 2018). Phytoplasma isolates from *Melia azedarach* collected in Argentina, Bolivia and Paraguay, formerly included in '*Ca*. P. hispanicum' species (Davis et al., 2016), were then described as strains of the '*Ca*. P. meliae' species (Fernandez et al., 2016)
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	Based on their 16SrRNA gene sequence, the NAGYIII strains belong to two sequevars (NAGYIIIα and β), and they can be differentiated from '*Ca*. P. pruni' by the presence of a *Mse*I restriction site that is absent from the '*Ca*. P. species' reference strain. Because NAGYIII sequevars have not been reported in X-disease, there is uncertainty about whether NAGYIII and Prunus X-disease are caused by different phytoplasma genotypes (Davis et al., 2015)
'*Ca.* P. trifolii' (reference strain)	Three subgroups have been classified on the basis of sequence homology and the collective RFLP patterns of amplified 16S rRNA genes. CP, AWB, BLTV, PWB and TBBc are assigned to taxonomic subgroup CP-A, *Fragaria multicipita* belongs to subgroup CP-B and ILEY isolates are assigned to subgroup CP-C (Hiruki and Wang, 2004). Additional variants have been described. Isolates BLL, *Centaurea solstitialis* virescence (CSV1), *Catharanthus* phyllody (CPS), and PLL are assigned to subgroups VI-D, -E, -F, and -H respectively (Davis et al., 2012). Heterogeneity of the 16S rRNA has been reported for the '*Fragaria multicipita*', leading to assignation to -B or -G 16SrVI subgroups, depending on the sequence used for classification (Davis et al., 2003a, 2012). Sequence alignment of the '*Ca*. Phytoplasma trifolii' isolates from *Capsicum annum* revealed a low level of genetic diversity within subgroup 16SrVI-A in Turkey (Oksal et al., 2017) and Mexico, although in Mexico a second isolate was classified into a new subgroup (16SrVI-J) (Mauricio-Castillo et al., 2015). Group/subgroup assignation of the two 16SrVI-related strains described in *Araucaria heterophylla* (Gupta et al., 2010) and in *Datura inoxia* (Raj et al., 2009) is uncertain, as these strains share less than 97.5% sequence homology with *Ca*. P. trifolii, respectively
'*Ca.* P. ziziphi' (reference strain)	The '*Ca*. P. ziziphi' species includes strains from a homogenous ecological lineage (Wang et al., 2018a), although isolates with less than 99.7% variation on their 16S rRNA sequence have been associated to similar stem fasciation of persimmon trees in China (Wang et al., 2015a). Also, Indian16SrV-B isolates infecting peach differ from '*Ca*. P. zyzyphi' reference isolates upon sequence analyses of other genomic regions (eg. ribosomal protein rpl22 and rps3 and at the secY genes) (Marcone et al., 2014). A JWB disease in northeastern China is associated with JWB-DL strain representing a new, distinct '*Ca*. P. ziziphi'-related strain (Wei et al., 2007)

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

YES, the non-EU phytoplasmas categorised here can be detected by molecular methods.

For all the categorised phytoplasmas, molecular detection methods are available. Phytoplasmas are routinely detected by polymerase chain reaction (PCR). Universal and specific primers are available, and nested PCR protocols have been developed to overcome low pathogen titre in certain hosts and/or in the case of asymptomatic infection. However, there is a potential lack of specificity in the case of the design of nested PCR with universal primers. Diagnostics in woody host plants is sometimes difficult because of the uneven pathogen distribution, low phytoplasma loads or presence of inhibitors in the extracts to be tested. Several robust diagnostic protocols have also become available based on Real Time PCR and LAMP (loop mediated isothermal amplification) approaches. Identification of phytoplasmas is routinely achieved by sequencing of a specific 16S rRNA fragment followed by virtual restriction fragment length polymorphism (RFLP) analyses according to an available online tool (Zhao et al., 2009b; iPhyClassifier, 2019). Phytoplasma-specific symptoms may indicate phytoplasma infection, but cannot be used to identify the infecting '*Ca*. P. species'.

In Table 6, the detection and identification methods for each categorised phytoplasma is summarized together with the associated uncertainty.

Table 6: Available detection and identification methods of the phytoplasmas categorised here

Phytoplasma name, reference strain/ related strain name	Available detection and identification methods	Uncertainties
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	In the case of papaya, that can be infected by several phytoplasma species, ribosomal primers are available for the specific amplification of 16SrII phytoplasmas (P1/rSPLLS SUNH, (Schneider and Gibb, 1997)).	None
'*Ca.* P. australiense' (reference strain)	Locked Nucleic Acid (LNA) Probes are available to detect '*Ca*. P. australiense' in potatoes (Palmano et al., 2015).	None
'*Ca.* P. fraxini' (reference strain)	Phytoplasma-specific primers (PI and Tint) and AshY specific primers (fBI/rASHYS) are available to amplify a portion of the phytoplasma16S rDNA (Smart et al., 1996). Amplicon sequencing may be required to confirm the identification (Feeley et al., 2001)	None
'*Ca.* P. hispanicum' (reference strain)	Molecular characterization has been successfully performed using chaperonin-60 (cpn60) and DNA-dependent RNA polymerase b-subunit (rpoB) genes (Perez-Lopez and Dumonceaux, 2016)	None
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	NAGYIII strains can be differentiated from '*Ca*. P. pruni' by the presence of a *Mse*I restriction site on the 16S rRNA gene that is absent from that of the '*Ca*. P. species' reference strain (Davis et al., 2015)	None
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	Nested PCR with universal primers was applied in the certification of dormant *Prunus* buds in the US (Waterworth and Mock, 1999). A Real Time PCR system has also been reported (Sudarshana et al., 2011)	No details of the Real Time PCR protocol are provided in the reference (conference abstract only) (Sudarshana et al., 2011)
'*Ca.* P. trifolii' (reference strain)	Sensitive and quantitative diagnostic tools to investigate mixed infections of two phytoplasma isolates of '*Ca*. P. trifolii' are available, based on PCR-RFLP and micro-channel capillary electrophoresis (Wei	There are shortcomings in the qPCR assay, since it also detected aster yellows (group 16SrI) and pigeon pea witches'-

Phytoplasma name, reference strain/ related strain name	Available detection and identification methods	Uncertainties
	et al., 2016). A qPCR protocol based on ribosomal 16 gene was developed to detect Columbia Basin potato purple top in in plants and beet leafhoppers (Crosslin et al., 2006). A specific nested PCR protocol is also available (Smart et al., 1996).	broom (group 16SrIX) phytoplasmas in infected periwinkle plants (Crosslin et al., 2006)
'*Ca.* P. ziziphi' (reference strain)	Direct and nested PCRs were performed to target amplifications of three phytoplasma genomic loci, namely, a partial ribosomal rRNA operon (rrn), a ribosomal protein gene cluster rpsS-rplV-rpsC, and an extended secY locus that encodes ribosomal protein L15, preprotein translocation subunit secY, and methionine aminopeptidase (rplO-secYmap) (Wang et al., 2018b)). Primers F1/M23SR1804r (=F1/B6), and R16(CJ)F1/R1 are also available for specific diagnosis (Zhu et al., 1998)	None
Buckland valley grapevine yellows phytoplasma	Nested PCR with universal primers followed by RFLP was applied for pathogen detection and characterisation (Constable et al., 2002)	None

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

The distribution outside the EU of the phytoplasmas categorised here is reported in Table 7, based on data from the EPPO GD and/or the CABI Crop Protection Compendium (CPC) (CABI, 2019), and, when not available in these sources, from extensive literature searches.

The available distribution maps from the EPPO GD (for *Ca*. P. australiense (reference strain), *Ca*. P. fraxini (reference strain) and *Ca*. P. trifolii (reference strain)) are provided in Appendix B.

Table 7: Distribution outside the EU of the phytoplasmas categorised here

Phytoplasma name, reference strain/related strain name	Distribution based on the EPPO GD and/or CABI CPC	Additional information	Uncertainties
'*Ca.* P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	ASIA: Bangladesh, China, Indonesia, Japan, Korea, Malaysia, Philippines, Taiwan OCEANIA: Australia, Micronesia, New Caledonia, Niue, Palau, Papua New Guinea, Solomon Islands, Tonga, Vanuatu	AFRICA: Burkina Faso (Schneider et al., 1997); Egypt (Omar and Foissac, 2012; El-Sisi et al., 2018); Ethiopia (Bekele et al., 2011); Uganda (Arocha et al., 2009a); Tanzania (Testen et al., 2015) AMERICA: Brazil (Silva et al., 2014); Cuba (Acosta et al., 2013); Peru (Hodgetts et al., 2009) ASIA: Israel (Gera et al., 2007); Myanmar (Win et al., 2011); Pakistan (Akhtar et al., 2013); Saudi Arabia (Omar, 2017); Turkey (Ikten et al., 2014; Ozdemir and Cagirgan, 2015) OCEANIA: Wallis and Futuna Islands (Davis et al., 2005) EUROPE (non-EU): Serbia (Mitrovic et al., 2011)	Serbia: reported in six *Picris hieracioides* asymptomatic samples collected in vineyards (Mitrovic et al., 2011).

Phytoplasma name, reference strain/related strain name	Distribution based on the EPPO GD and/or CABI CPC	Additional information	Uncertainties
'*Ca.* P. australiense' (reference strain)	ASIA: Israel OCEANIA: Australia, New Caledonia, New Zealand	–	–
'*Ca.* P. fraxini' (reference strain)	AMERICA: Canada, Chile, Colombia, US ASIA: Iran	AMERICA: Argentina (Conci et al., 2005), Brazil (da Silva Fugita et al., 2017), ASIA: China, only one report in *Prunus* (cherry) (Li et al., 1997)	The report from China needs to be confirmed
'*Ca.* P. hispanicum' (reference strain)	AMERICA: Canada, US ASIA: Japan	AMERICA: Argentina, Brazil, Mexico (Davis et al., 2016); Chile (Cui et al., 2018) OCEANIA: New Caledonia (Davis et al., 2006)	The Strawberry witches'broom mycoplasm (SYWB00) reported in Canada and Japan by the EPPO GD was detected before the development of molecular identification tools. The strains identified in *Melia azedarach* in Bolivia (Davis et al., 2016) and Paraguay (Arneodo et al., 2005) were then included in '*Ca*. P. meliae' (Fernandez et al., 2016)
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	–	AMERICA: US (North-East) (Wolf, 2015).	–
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	–	AMERICA: US (California) (Marcone et al., 2014)	A disease named 'peach yellow leaf roll' was reported in peach orchards from Iran, but the causal agent was identified as '*Ca*. P. solani' (Allahverdi et al., 2014). Therefore, the phytoplasma reported in Iran was not PYLR
'*Ca.* P. trifolii' (reference strain)	AMERICA: Canada, Mexico, US; ASIA: Bangladesh, China, India, Iran, Korea, Uzbekistan, Syria, Turkey; EUROPE (non EU): Russia	ASIA: Jordan (Anfoka et al., 2003); Lebanon (Choueiri et al., 2007);	–
'*Ca.* P. ziziphi' (reference strain)	–	AMERICA: Colombia (Franco-Lara et al., 2017) ASIA: China (Wang et al., 2018b); India (Khan et al., 2008); Japan (Jung et al., 2003); Korea (Jung et al., 2012)	–

Phytoplasma name, reference strain/related strain name	Distribution based on the EPPO GD and/or CABI CPC	Additional information	Uncertainties
Buckland valley grapevine yellows phytoplasma	–	OCEANIA: Australia (Victoria) (Gibb et al., 1999)	–

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?

YES, '*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL;), '*Ca*. P. fraxini' (reference strain), '*Ca*. P. trifolii' (reference strain), '*Ca*. P. ziziphi' (reference strain) are reported to be present in the EU, but none of them is reported to be widely distributed.

NO, '*Ca*. P. australiense' (reference strain), '*Ca*. P. hispanicum' (reference strain), '*Ca*. P. pruni'-related strain (North American grapevine yellows, NAGYIII), '*Ca*. P. pyri'-related strain (peach yellow leaf roll, PYLR), and the unclassified Buckland valley grapevine yellows phytoplasma are not known to be present in the EU.

Four of the phytoplasmas categorised here were reported in the EU (Table 8), where they can be considered to have a restricted distribution, as all of them were reported only in few plants, in up to four EU MS and mostly by a single research group. In addition, in some cases ('*Ca*. P. aurantifolia'-related strains', '*Ca*. P. trifolii'), reports from the EPPO GD are presented with 'no details'.

Table 8: EU distribution of the non-EU phytoplasmas categorised here

Phytoplasma name, reference strain/ related strain name	EU MSs from which the pest is reported	Uncertainties
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	Greece, Portugal (EPPO GD: Present, no details), Italy (Tolu et al., 2006; Davino et al., 2007; Paltrinieri and Bertaccini, 2007; Parrella et al., 2008), UK (Reeder et al., 2010)	Reports from the EPPO GD in Greece and Portugal have no further details. The pest was reported i) in few batches of symptom-less potato plantlets obtained from two lots of seeds from different undescribed Italian locations and from unknown origins (Paltrinieri and Bertaccini, 2007); ii) in one batch (10 insects) out of 3 of field-collected *Empoasca decipiens* in Italy (Parrella et al., 2008); iii) in 3 field-collected *Calendula arvensis* plants, one *Solanum nigrum* plant, and one *Chenopodium* species (Tolu et al., 2006); iv) in the UK, where 50 (57%) of 88 plants showed obvious symptoms, at one location (Reeder et al., 2010)
'*Ca.* P. australiense' (reference strain)	None	none
'*Ca.* P. fraxini' (reference strain)	Italy (Bruni et al., 2005; Zambon et al., 2018)	The reports from Italy were published by the same group but not confirmed. *Vitis*: there is only one report concerning 9 plants detected by nested PCR out of 171 tested ones (Zambon et al., 2018). *Hypericum perforatum*: it is not known on how many plants the phytoplasma was identified (Bruni et al., 2005)

Phytoplasma name, reference strain/ related strain name	EU MSs from which the pest is reported	Uncertainties
'*Ca.* P. hispanicum' (reference strain)	None	none
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	None	none
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	None	A disease named 'peach yellow leaf roll' was reported in peach orchards from Spain, but the identified causal agent was '*Ca*. P. pyri', isolate PD, based on sequence analyses of 16S rRNA, *pnp*, *sec*Y, *imp*, *ace*F genes (Sabate et al., 2014; Sabate et al., 2018). Therefore, the phytoplasma reported in Spain was not PYLR
'*Ca.* P. trifolii' (reference strain)	Italy, Spain (EPPO GD: Present, no details), Austria (Borroto Fernandez et al., 2007), Czech Republic (Pribylova et al., 2009)	EPPO GD: Reports from EU MS refer to few infected plants (ranging from 1 to 28). Therefore, '*Ca*. P. trifolii' is not considered to be widely present in the EU
'*Ca.* P. ziziphi' (reference strain)	Italy (Pasquini et al., 2000; Paltrinieri et al., 2006)	Only a conference report from one plant from Italy with no details beside PCR-RFLP detection of mixed infections with '*Ca*. P. solani' and '*Ca*. P. asteris' (Paltrinieri et al., 2006). Only one full report from Italy (Pasquini et al., 2000), in the absence of any further characterization beside PCR and RFLP analyses
Buckland valley grapevine yellows phytoplasma	None	None

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

Non-EU phytoplasmas of the host plants are listed in Council Directive 2000/29/EC. All phytoplasma categorised here are listed in Annex IAI, under the generic definition 'Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.'. Details are presented in Table 9.

Annex IAI also mentions peach rosette (Annex IAI 5(f)), Peach X-disease (Annex IAI 5(g)) and Peach yellows (Annex IAI 5(h)) mycoplasmas. These are all strains of the '*Ca*. P. pruni' (reference strain), which has been reported several times in the EU (EFSA PLH Panel, 2020). However, '*Ca*. P. pruni'-related strain (NAGYIII) is closely related to, but distinct from, the above-mentioned strains of '*Ca*. Phytoplasma pruni'. Therefore, it cannot be considered regulated as Peach rosette, Peach X-disease and Peach yellows mycoplasmas.

Annex IAI also includes strawberry witches' broom mycoplasm (SYWB00), which is probably a strain of the '*Ca*. P. hispanicum'.

Table 9: Non-EU phytoplasmas of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. in the Council Directive 2000/29

Annex I, Part A	Harmful organisms whose introduction into, and spread within, all Member States shall be banned
Section I	**Harmful organisms not known to occur in any part of the community and relevant for the entire community**
(d)	**Viruses and virus-like organisms**

5.	Viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L., such as: (f) Peach rosette mycoplasma
	(g) Peach X-disease mycoplasma
	(h) Peach yellows mycoplasma
	(m) Strawberry witches' broom mycoplasma
	(n) Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.

3.3.2. Legislation addressing the hosts of the non-EU phytoplasmas of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L

Hosts and commodities that may involve the phytoplasmas categorised here are regulated in the Directive 2000/29/EC, and reported in Table 10. Two derogations to this directive, 2003/248 and 2003/249, allow importing *Fragaria* plants from Argentina and Chile, respectively, with the requirements to check the imported plants during the growing season and send a final report to the Commission.

Table 10: Regulations applying to *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. hosts and commodities that may involve the phytoplamas categorised in the present opinion in Annexes III, IV and V of Council Directive 2000/29/EC

Annex III, Part A	**Plants, plant products and other objects the introduction of which shall be prohibited in all Member States**	
	Description	Country of origin
9.	Plants of *Chaenomeles* Ldl., *Cydonia* Mill., *Crateagus* L., *Malus* Mill., *Prunus* L., *Pyrus* L., and *Rosa* L., intended for planting, other than dormant plants free from leaves, flowers and fruit	Non-European countries
15.	Plants of *Vitis* L., other than fruits	Third countries other than Switzerland
18.	Plants of *Cydonia* Mill., *Malus* Mill., *Prunus* L. and *Pyrus* L. and their hybrids, and *Fragaria* L., intended for planting, other than seeds	Without prejudice to the prohibitions applicable to the plants listed in Annex III A (9), where appropriate, non-European countries, other than Mediterranean countries, Australia, New Zealand, Canada, the continental states of the USA
Annex III, Part B	**Plants, plant products and other objects the introduction of which shall be prohibited in certain protected zones**	
	Description	Protected zone(s)
1	Without prejudice to the prohibitions applicable to the plants listed in Annex IIIA(9), (9.1), (18), where appropriate, plants and live pollen for pollination of: *Amelanchier* Med., *Chaenomeles* Lindl., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Malus* Mill., *Mespilus* L., *Pyracantha* Roem., *Pyrus* L. and *Sorbus* L., other than fruit and seeds, originating in third countries other than Switzerland and other than those recognised as being free from *Erwinia amylovora* (Burr.) Winsl. et al. in accordance with the procedure laid down in Article 18(2), or in which pest free areas have been established in relation to *Erwinia amylovora* (Burr.) Winsl. et al. in accordance with the relevant International Standard for Phytosanitary Measures and recognised as such in accordance with the procedure laid down in Article 18(2)	E (except the autonomous communities of Andalucia, Aragón, Castilla la Mancha, Castilla y León, Extremadura, the autonomous community of Madrid, Murcia, Navarra and La Rioja, the province of Guipuzcoa (Basque Country), the Comarcas of Garrigues, Noguera, Pla d'Urgell, Segrià and Urgell in the province of Lleida (Communidad autonoma de Catalunya), the Comarcas de L'Alt Vinalopó and El Vinalopó Mitjà in the province of Alicante and the municipalities of Alborache and Turís in the province of Valencia (Comunidad Valenciana)), EE, F (Corsica), IRL (except Galway city), I (Abruzzo, Apulia, Basilicata, Calabria, Campania, Emilia-Romagna (the provinces of Parma and Piacenza), Lazio, Liguria, Lombardy (except the provinces of Mantua, Milano, Sondrio and Varese), Marche, Molise, Piedmont (except the communes of Busca,

		Centallo and Tarantasca in the province of Cuneo), Sardinia, Sicily, Tuscany, Umbria, Valle d'Aosta, Veneto (except the provinces of Rovigo and Venice, the communes of Barbona, Boara Pisani, Castelbaldo, Masi, Piacenza d'Adige, S. Urbano and, Vescovana in the province of Padova and the area situated to the south of highway A4 in the province of Verona)), LV, LT (except the municipalities of Babtai and Kėdainiai (region of Kaunas)), P, SI (except the regions Gorenjska, Koroška, Maribor and Notranjska, and the communes of Lendava and Renče-Vogrsko (south from the highway H4)), SK (except the county of Dunajská Streda, Hronovce and Hronské Kľačany (Levice County), Dvory nad Žitavou (Nové Zámky County), Málinec (Poltár County), Hrhov (Rožňava County), Veľké Ripňany (Topoľčany County), Kazimír, Luhyňa, Malý Horeš, Svätuše and Zatín (Trebišov County)), FI, UK (Northern Ireland: excluding the townlands of Ballinran Upper, Carrigenagh Upper, Ballinran, and Carrigenagh in County Down, and the Electoral Area of Dunmurry Cross in Belfast, County Antrim; Isle of Man and Channel Islands)
Annex IV, Part A	**Special requirements which must be laid down by all Member States for which the introduction and movement of plants, plant products and other objects into and within all Member States**	
Section I	**Plants, plant products and other objects originating from outside the community**	
7.4	Whether or not listed among the CN codes in Part B of Annex V, wood of *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L. and *Sorbus* L., other than in the form of: – chips, sawdust and shavings, obtained in whole or part from these plants, – wood packaging material, in the form of packing cases, boxes, crates, drums and similar packings, pallets, box pallets and other load boards, pallet collars, dunnage, whether or not actually in use in the transport of objects of all kinds, except dunnage supporting consignments of wood, which is constructed from wood of the same type and quality as the wood in the consignments and which meets the same Union phytosanitary requirements as the wood in the consignment, but including that which has not kept its natural round surface, originating in Canada and the USA	Official statement that the wood: (a) originates in an area free from *Saperda candida* Fabricius, established by the national plant protection organisation in the country of origin, in accordance with the relevant International Standards for Phytosanitary Measures, which is mentioned on the certificates referred to in Article 13(1)(ii) under the rubric 'Additional declaration', or (b) has undergone an appropriate heat treatment to achieve a minimum temperature of 56 °C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood, which is to be indicated on the certificates referred to in Article 13(1)(ii), or (c) has undergone an appropriate ionising radiation to achieve a minimum absorbed dose of 1 kGy throughout the wood, to be indicated on the certificates referred to in Article 13(1)(ii)
7.5	Whether or not listed among the CN codes in Part B of Annex V, wood in the form of chips obtained in whole or part from *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L. and *Sorbus* L., originating in Canada and the USA.	Official statement that the wood: (a) originates in an area established by the national plant protection organisation in the country of origin as being free from Saperda candida Fabricius in accordance with the relevant International Standards for

		Phytosanitary Measures, which is mentioned on the certificates referred to in Article 13(1)(ii) under the rubric 'Additional declaration', or (b) has been processed into pieces of not more than 2,5 cm thickness and width, or (c) has undergone an appropriate heat treatment to achieve a minimum temperature of 56 °C for a minimum duration of 30 minutes throughout the entire profile of the chips, which is to be indicated on the certificates referred to in Article 13(1)(ii)
14.1	Plants intended for planting, other than scions, cuttings, plants in tissue culture, pollen and seeds, of *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L. and *Sorbus* L. originating in Canada and the USA	Without prejudice to the provisions applicable to the plants in Annex III(A)(9) and (18), Annex III (B)(1), (2) or Annex IV(A)(I), (17), (19.1), (19.2), (20), (22.1), (22.2), (23.1) and (23.2) where appropriate, official statement that the plants: (a) have been grown throughout their life in an area free from *Saperda candida* Fabricius, established by the national plant protection organisation in the country of origin, in accordance with relevant International Standards for Phytosanitary Measures, which is mentioned on the certificates referred to in Article 13(1)(ii), under the rubric 'Additional declaration', or (b) have been grown during a period of at least two years prior to export, or in the case of plants which are younger than two years have been grown throughout their life, in a place of production established as free from *Saperda candida* Fabricius in accordance with relevant International Standards for Phytosanitary Measures: (i) which is registered and supervised by the national plant protection organisation in the country of origin, and (ii) which has been subjected annually to two official inspections for any signs of *Saperda candida* Fabricius carried out at appropriate times, and (iii) where the plants have been grown in a site: – with complete physical protection against the introduction of *Saperda candida* Fabricius, or – with the application of appropriate preventive treatments and surrounded by a buffer zone with a width of at least 500 m where the absence of *Saperda candida*

		Fabricius was confirmed by official surveys carried out annually at appropriate times, and (iv) immediately prior to export the plants have been subjected to a meticulous inspection for thepresence of *Saperda candida* Fabricius, in particular in the stems of the plant, including, where appropriate, destructive sampling
16.6	Fruits of *Capsicum* (L.), *Citrus* L., other than *Citrus limon* (L.) Osbeck. and *Citrus aurantiifolia* (Christm.) Swingle, *Prunus persica* (L.) Batsch and *Punica granatum* L. originating in countries of the African continent, Cape Verde, Saint Helena, Madagascar, La Reunion, Mauritius and Israel	Without prejudice to the provisions applicable to the fruits in Annex IV(A)(I)(16.1), (16.2), (16.3), (16.4), (16.5) and (36.3), official statement that the fruits: (a) originate in a country recognised as being free of *Thaumatotibia leucotreta* (Meyrick) in accordance with relevant International Standards for Phytosanitary Measures, or (b) originate in an area established by the national plant protection organisation in the country of origin as being free from *Thaumatotibia leucotreta* (Meyrick), in accordance with the relevant International Standards for Phytosanitary Measures, which is mentioned on the certificates referred to in Article 13(1)(ii) under the rubric 'Additional declaration', or (c) originate in a place of production established by the national plant protection organisation in the country of origin as being free from Thaumatotibia leucotreta (Meyrick) in accordance with relevant International Standards for Phytosanitary Measures and information on traceability is included in the certificates referred to in the Article 13(1)(ii), and official inspections have been carried out in the place of production at appropriate times during the growing season, including a visual examination on representative samples of fruit, shown to be free from *Thaumatotibia leucotreta* (Meyrick), or (d) have been subjected to an effective cold treatment to ensure freedom from *Thaumatotibia leucotreta* (Meyrick) or another effective treatment to ensure freedom from *Thaumatotibia leucotreta* (Meyrick) and the treatment data should be indicated on the certificates referred to in Article 13(1)(ii), provided that the treatment method has been communicated in advance in writing by the national plant protection organisation of the third country concerned to the Commission.
17.	Plants of *Amelanchier* Med., *Chaenomeles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill.,	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(9), (9.1), (18),

	Eriobotrya Lindl., *Malus* Mill., Mespilus L., *Photinia davidiana* (Dcne.) Cardot, *Pyracantha* Roem., *Pyrus* L. and *Sorbus* L., intended for planting, other than seeds	Annex III(B)(1) or Annex IV(A)(I)(15), where appropriate, official statement: (a) that the plants originate in countries recognised as being free from *Erwinia amylovora* (Burr.) Winsl. et al. in accordance with the procedure laid down in Article 18(2), or (b) that the plants originate in pest free areas which have been established in relation to *Erwinia amylovora* (Burr.) Winsl. et al. in accordance with the relevant International Standard for Phytosanitary Measures and recognised as such in accordance with the procedure laid down in Article 18(2), or (c) that the plants in the field of production and in its immediate vicinity, which have shown symptoms of *Erwinia amylovora* (Burr.) Winsl. et al., have been removed
19.2	Plants of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. intended for planting, other than seeds, originating in countries where the relevant harmful organisms are known to occur on the genera Concerned The relevant harmful organisms are: — on Fragaria L.: – *Phytophtora fragariae* Hickman, var. *fragariae*, – Arabis mosaic virus, – Raspberry ringspot virus, – Strawberry crinkle virus, – Strawberry latent ringspot virus, – Strawberry mild yellow edge virus, – Tomato black ring virus, – *Xanthomonas fragariae* Kennedy et King — on *Malus* Mill.: – *Phyllosticta solitaria* Ell. and Ev.; — on *Prunus* L.: – Apricot chlorotic leafroll mycoplasm, – *Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin et al. — on *Prunus persica* (L.) Batsch: – *Pseudomonas syringae* pv. *persicae* (Prunier et al.) Young et al.;— on *Pyrus* L.: – *Phyllosticta solitaria* Ell. and Ev.; — on *Rubus* L.: – Arabis mosaic virus, – Raspberry ringspot virus, – Strawberry latent ringspot virus, – Tomato black ring virus, — on all species: non-European viruses and viruslike organisms	Without prejudice to the provisions applicable to the plants where appropriate listed in Annex III (A)(9) and (18), and Annex IV(A)(I)(15) and (17), official statement that no symptoms of diseases caused by the relevant harmful organisms have been observed on the plants at the place of production since the beginning of the last complete cycle of vegetation

20.	Plants of *Cydonia* Mill. And *Pyrus* L. intended for planting, other than seeds, originating in countries where Pear decline mycoplasm is known to occur	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(9) and (18), and Annex IV(A)(I)(15), (17) and (19.2) official statement that plants at the place of production and in its immediate vicinity, which have shown symptoms giving rise to the suspicion of contamination by Pear decline mycoplasm, have been rogued out at that place within the last three complete cycles of vegetation.
21.1.	Plants of *Fragaria* L. intended for planting, other than seeds, originating in countries where the relevant harmful organisms are known to occur The relevant harmful organisms are: – Strawberry latent 'C' virus, – Strawberry vein banding – virus, – Strawberry witches' broom – mycoplasm	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(18), and Annex IV(A)(I)(19.2), official statement that: (a) the plants, other than those raised from seed, have been: – either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those harmful organisms, or – derived in direct line from material which is maintained under appropriate conditions and has been subjected, within the last three complete cycles of vegetation, at least once, to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those farmful organisms, (b) no symptoms of diseases caused by the relevant harmful organisms have been observed on plants at the place of production, or on susceptible plants in its immediate vicinity, since the beginning of the last complete cycle of vegetation.
21.2.	Plants of *Fragaria* L. intended for planting, other than seeds, originating in countries where *Aphelenchoides besseyi* Christie is known to occur	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(18), and Annex IV(A)(I)(19.2) and (21.1), official statement that: (a) either no symptoms of Aphelenchoides besseyi Christie have been observed on plants at the place of production since the beginning of the last complete cycle of vegetation or (b) in the case of plants in tissue culture the plants have been derived from plants which complied with section (a) of this item or have been officially tested by appropriate nematological methods and have been found free from *Aphelenchoides besseyi* Christie
21.3.	Plants of *Fragaria* L., intended for planting, other than seeds	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(18), and Annex IV(A)(I)(19.2), (21.1) and (21.2), official statement that the plants originate in an area known to be free from *Anthonomus signatus* Say and *Anthonomus bisignifer* (Schenkling)

22.1	Plants of *Malus* Mill. Intended for planting, other than seeds, originating in countries where the relevant harmful organisms are known to occur on *Malus* Mill. The relevant harmful organisms are: – Cherry rasp leaf virus (American), – Tomato ringspot virus,	Without prejudice to the provisions applicable to the plants, listed in Annex III(A)(9) and (18), Annex III(B)(1) and Annex IV(A)(I)(15), (17) and (19.2), official statement that: (a) the plants have been: – either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for at least the relevant harmful organisms using appropriate indicatos or equivalent methods and has been found free, in these thests, from those harmful organisms, or – derived in direct line from material which is maintained under appropriate conditions and subjected, within the last three complete cycles of vegetation, at least once, to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those harmful organisms; (b) no symptoms of diseases caused by the relevant harmful organisms have been observed on plants at the place of production, or on susceptible plants in its immediate vicinity, since the beginning of the last complete cycle of vegetation
22.2	Plants of *Malus* Mill., intended for planting, other than seeds, originating in countries where apple proliferation mycoplasma is known to occur	Without prejudice to the provisions applicable to the plants, listed in Annex III(A)(9) and (18), Annex III(B)(1) and Annex IV(A)(I)(15), (17), (19.2) and (22.1), official statement that (a) the plants originate in areas known to be free from apple proliferation mycoplasm; or (b) (aa) the plants, other than those raised from seeds, have been: – either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for at least Apple proliferation mycoplasm using appropriate indicators or equivalent methods and has been found free, in these tests, from that harmful organism, or – derived in direct line from material which is maintained under appropriate conditions and subjected, within the last six complete cycles of vegetation, at least once, to official testing for at least Apple proliferation mycoplasm using appropriate indicators or equivalent methods and has been found free, in these tests, from the harmful organism, (bb) no symptoms of diseases caused by Apple proliferation mycoplasm have been observed on plants at the place of production, or on susceptible plants in its immediative vicinity,

		since the beginning of the last complete three cycles of vegetation
23.1	Plants of following species of *Prunus* L., intended for planting, other than seeds, originating in countries where Plum pox virus is known to occur: – *Prunus amygdalus* Batsch, – *Prunus armeniaca* L., – *Prunus blireiana* Andre, – *Prunus brigantina* Vill., – *Prunus cerasifera* Ehrh., – *Prunus cistena* Hansen, – *Prunus curdica* Fenzl and Fritsch., – *Prunus domestica* ssp. *domestica* L., – *Prunus domestica* ssp. *insititia* (L.) C.K. Schneid., – *Prunus domestica* ssp. *italica* (Borkh.) Hegi., – *Prunus glandulosa* Thunb., – *Prunus holosericea* Batal., – *Prunus hortulana* Bailey, – *Prunus japonica* Thunb., – *Prunus mandshurica* (Maxim.) Koehne, – *Prunus maritima* Marsh., – *Prunus mume* Sieb and Zucc., – *Prunus nigra* Ait., – *Prunus persica* (L.) Batsch, – *Prunus salicina* L., – *Prunus sibirica* L., – *Prunus simonii* Carr., – *Prunus spinosa* L., – *Prunus tomentosa* Thunb., – *Prunus triloba* Lindl., – other species of *Prunus* L. susceptible to Plux pox virus.	Without prejudice to the provisions applicable to the plants, listed in Annex III(A)(9) and (18), and Annex IV(A)(I)(15) and (19.2), official statement that: (a) the plants, other than those raised from seed, have been: – either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for, at least, Plum pox virus using appropriate indicators or equivalent methods and has been found free, in these tests, from that harmful organism, or – derived in direct line from material which is maintained under appropriate conditions and has been subjected, within the last three complete cycles of vegetation, at least once, to official testing for at least Plum pox virus using appropriate indicators or equivalent methods and has been found free, in these tests, from that harmful organism; (b) no symptoms of disease caused by Plum pox virus have been observed on plants at the place of production or on susceptible plants in its immediate vicinity, since the beginning of the last three complete cycles of vegetation; (c) plants at the place of production which have shown symptoms of disease caused by other viruses or virus-like pathogens, have been rogued out
23.2	Plants of Prunus L., intended for planting (a) originating in countries where the relevant harmful organisms are known to occur on *Prunus* L. (b) other than seeds, originating in countries where the relevant harmful organisms are known to occur (c) other than seeds, originating in non-European countries where the relevant harmful organisms are known to occur The relevant harmful organisms are: — for the case under (a): – Tomato ringspot virus; — or the case under (b): – Cherry rasp leaf virus (American), – Peach mosaic virus (American), – Peach phony rickettsia, – Peach rosette mycoplasm, – Peach yellows mycoplasm, – Plum line pattern virus (American), – Peach X-disease mycoplasm;	Without prejudice to the provisions applicable to the plants, where appropriate listed in Annex III (A)(9) and (18) or Annex IV(A)(I)(15), (19.2) and (23.1), official statement that (a) the plants have been: – either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those harmful organisms, or – derived in direct line from material which is maintained under appropriate conditions and has been subjected, within the last three complete cycles of vegetation, at least once, to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those harmful organisms, (b) no symptoms of diseases caused by the relevant harmful organisms have been observed

	— or the case under (c): – Little cherry pathogen	on plants at the place of production or on susceptible plants in its immediate vicinity, since the beginning of the last three complete cycles of vegetation
24.	Plants of *Rubus* L., intended for planting: (a) originating in countries where harmful organisms are known to occur on *Rubus* L. (b) other than seeds, originating in countries where the relevant harmful organisms are known to occur The relevant harmful organisms are: — in the case of (a): – Tomato ringspot virus, – Black raspberry latent virus, – Cherry leafroll virus, – Prunus necrotic ringspot virus, — in the case of (b): – Raspberry leaf curl virus (American) – Cherry rasp leaf virus (American)	Without prejudice to the requirements applicable to the plants, listed in Annex IV(A)(I)(19.2), (a) the plants shall be free from aphids, including their eggs (b) official statement that: (aa) the plants have been: – either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for at least the relevant harmful organisms using appropriate indicators or equivalent methods and has been found free, in these tests, from those harmful organism, or – derived in direct line from material which is maintained under appropriate conditions and has been subjected, within the last three complete cycles of vegetation, at least once, to official testing for at least relevant harmful organisms using appropriate indicators for equivalent methods and has been found free, in these tests, from those harmful organism (bb) no symptoms of diseases caused by the relevant harmful organisms have been observed on plants at the place of production, or on susceptible plants in its immediate vicinity, since the beginning of the last complete cycles of vegetation
44.	Herbaceous perennial plants, intended for planting, other than seeds, of the families Caryophyllaceae (except *Dianthus* L.), Compositae (except *Dendranthema* (DC.) Des Moul.), Cruciferae, Leguminosae and Rosaceae (except *Fragaria* L.), originating in third countries, other than European and Mediterranean countries	Without prejudice to the requirements applicable to plants, where appropriate, listed in Annex IV (A)(I)(32.1), (32.2), (32.3), (33) and (34) official statement that the plants: — have been grown in nurseries, and — are free from plant debris, flowers and fruits, and — have been inspected at appropriate times and prior to export, and – found free from symptoms of harmful bacteria, viruses and virus-like organisms, and – either found free from signs or symptoms of harmful nematodes, insects, mites and fungi, or have been subjected to appropriate treatment to eliminate such organisms
Section II	**Plants, plant products and other objects originating in the Community**	
9.	Plants of *Amelanchier* Med., *Chaenomeles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Malus* Mill., *Mespilus* L., *Photinia davidiana* (Dcne.) Cardot, *Pyracantha* Roem., *Pyrus* L. and	Official statement: (a) the plants originate in zones recognised as being free from *Erwinia amylovora* (Burr.) Winsl. et al. in accordance with the procedure referred to in Article 18(2); or

	Sorbus L., intended for planting, other than seeds	(b) that the plants in the field of production and its immediate vicinity, which have shown symptoms of *d'Erwinia amylovora* (Burr.) Winsl. et al., have beend rogued out
12.	Plants of *Fragaria* L., *Prunus* L. and *Rubus* L., intended for planting, other than seeds	Official statement that: (a) the plants originate in areas known to be free from the relevant harmful organisms; or (b) no symptoms of diseases caused by the relevant harmful organisms have been observed on plants at the place of production since the beginning of the last complete cycle of vegetation.The relevant harmful organisms are: — on *Fragaria* L.: – *Phytophthora fragariae* Hickman var. – fragariae – Arabis mosaic virus – Raspberry ringspot virus – Strawberry crinkle virus – Strawberry latent ringspot virus – Strawberry mild yellow edge virus – Tomato black ring virus – Xanthomonas fragariae Kennedy and King — on *Prunus* L.: – Apricot chlorotic leafroll mycoplasm – *Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin et al. — on *Prunus persica* (L.) Batsch: *Pseudomonas syringae* pv. *persicae* (Prunier et al.) Young et al., — on *Rubus* L.: – Arabis mosaic virus – Raspberry ringspot virus – Strawberry latent ringspot virus – Tomato black ring virus
13.	Plants of *Cydonia* Mill., and *Pyrus* L., intended for planting, other than seeds	Without prejudice to the requirements applicable to plants listed in Annex IV(A)(II)(9), official statement that: (a) the plants originate in areas known to be free from Pear decline mycoplasm; or (b) the plants at the place of production and in its immediate vicinity, which have shown symptoms giving rise to the suspicion of contamination by Pear decline mycoplasm, have been rogued out at that place within the last three complete cycles of vegetation
14.	Plants of *Fragaria* L., intended for planting, other than seeds	Without prejudice to the requirements applicable to the plants listed in Annex IV(A)(II)(12) official statement that:

		(a) the plants originate in areas known to be free from Aphelenchoides besseyi Christie; or (b) no symptoms of *Aphelenchoides besseyi* Christie have been observed on the plants at the place of production since the beginning of the last complete cycle of vegetation; or (c)in the case of plants in tissue culture, the plants have been derived from plants complying with section (b) of this item or have been officially tested by appropriate nematological methods and have been found free from *Aphelenchoides besseyi* Christie
15.	Plants of *Malus* Mill., intended for planting, other than seeds	Without prejudice to the requirements applicable to the plants listed in Annex IV(A)(II)(9), official statement that: (a) the plants originate in areas known to be free from Apple proliferation mycoplasm; or (b) (aa) the plants, other than those raised from seed, have been: – either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for at least Apple proliferation mycoplasm using appropriate indicators or equivalent methods and has been found, in these tests, free from that harmful organism, or – derived in direct line from material which is maintained under appropriate conditions and has been subjected, within the last six complete cycles of vegetation, at least once, to official testing for, at least, Apple proliferation mycoplasm using appropriate indicators or equivalent methods and has been found, in these tests, free from that harmful organism; (bb) no symptoms of diseases caused by Apple proliferation mycoplasm have been observed on the plants at the place of production, or on the susceptible plants in its immediate vicinity, since the beginning of the last three complete cycles of vegetation
16.	Plants of the following species of *Prunus* L., intended for planting, other than seeds: – *Prunus amygdalus* Batsch, – *Prunus armeniaca* L., – *Prunus blireiana* Andre, – *Prunus brigantina* Vill., – *Prunus cerasifera* Ehrh., – *Prunus cistena* Hansen, – *Prunus curdica* Fenzl and Fritsch., – *Prunus domestica* ssp. *domestica* L.,	Without prejudice to the requrements applicable to the plants listed in Annex IV(A)(II)(12), official statement that: (a) the plants originate in areas known to be free from Plum pox virus; or (b) (aa) the plants, other than those raised from seed, have been:

	– *Prunus domestica* ssp. *Insititia* (L.) C.K. Schneid, – *Prunus domestica* ssp. *italica* (Borkh.) Hegi., – *Prunus glandulosa* Thunb., – *Prunus holosericea* Batal., – *Prunus hortulana* Bailey, – *Prunus japonica* Thunb., – *Prunus mandshurica* (Maxim.) Koehne, – *Prunus maritima* Marsh., – *Prunus mume* Sieb. And Zucc., – *Prunus nigra* Ait., – *Prunus persica* (L.) Batsch, – *Prunus salicina* L., – *Prunus sibirica* L., – *Prunus simonii* Carr., – *Prunus spinosa* L., – *Prunus tomentosa* Thunb., – *Prunus triloba* Lindl. Other species of *Prunus* L. susceptible to Plum pox virus	– either officially certified under a certification scheme requiring them to be derived in direct line from material which has been maintained under appropriate conditions and subjected to official testing for, at least, plum pox virus using appropriate indicators or equivalent methods and has been found, in these tests, free from that harmful organism, or – derived in direct line from material which is maintained under appropriate conditions and has been subjected within the last three complete cycles of vegetation, at least once, to official testing for at least Plum pox virus using appropriate indicators for equivalent methods and has been found, in these tests, free from that harmful organism; bb) no symptoms of disease caused by Plum pox virus have been observed on plants at the place of production or on the susceptible plants in its immediate vicinity, since the beginning of the last three complete cycles of vegetation; cc) plants at the place of production which have shown symptoms of disease caused by other viruses or virus-like pathogens, have been rogued out
17.	Plants of *Vitis* L., other than fruit and seeds	Official statement that no symptoms of Grapevine Flavescence dorée MLO and *Xylophilus ampelinus* (Panagopoulos) Willems et al. have been observed on the mother-stock plants at the place of production since the beginning of the last two complete cycles of vegetation
24.1.	Plants with roots, intended for planting, grown in the open air, of *Allium porrum* L., *Asparagus officinalis* L., *Beta vulgaris* L., *Brassica* spp. and *Fragaria* L. and bulbs, tubers and rhizomes, grown in the open air, of *Allium ascalonicum* L., *Allium cepa* L., *Dahlia* spp., *Gladiolus* Tourn. ex L., *Hyacinthus* spp., *Iris* spp., *Lilium* spp., *Narcissus* L. and *Tulipa* L., other than those plants, bulbs, tubers and rhizomes to be planted in accordance with Article 4.4(a) or (c) of Council Directive 2007/33/EC	Without prejudice to the requirements applicable to the plants in Annex IV, Part A, Section II (24) there shall be evidence that the Union provisions to combat *Globodera pallida* (Stone) Behrens and *Globodera rostochiensis* (Wollenweber) Behrens are complied with
Annex IV, Part B	**Special requirements which shall be laid down by all Member States for the introduction and movement of plants, plant products and other objects into and within certain protected zones**	
Plant, plant products and other objects	Special requirements	Protected zone(s)
20.5 Plants of *Prunus* L. intended for planting, other than seeds	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(9) and (18) or Annex IV(A)(I)(19.2), (23.1) and (23.2) or Annex IV(A)(II)(12) and (16), official statement that:	UK

	(a) the plants have been grown throughout their life in places of production in countries where *Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin et al. is not known to occur, or (b) the plants have been grown throughout their life in an area free from *Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin et al. established by the national plant protection organisation in accordance with relevant International Standards for Phytosanitary Measures, or (c) the plants have been derived in direct line from mother plants which have shown no symptoms of *Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin et al. during the last complete cycle of vegetation, and no symptoms of *Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin et al. have been observed on the plants at the place of production since the beginning of the last complete cycle of vegetation, or (d) for plants of *Prunus laurocerasus* L. and *Prunus lusitanica* L. for which there shall be evidence by their packing or by other means that they are intended for sale to final consumers not involved in professional plant production no symptoms of *Xanthomonas arboricola* pv. *pruni* (Smith) Vauterin et al. have been observed on plants at the place of production since the beginning of the last complete growing season	
21. Plants and live pollen for pollination of: *Amelanchier* Med., *Chaeno meles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Malus* Mill., Mespilus L., *Photinia davidiana* (Dcne.) Cardot, *Pyracantha* Roem., *Pyrus* L. and *Sorbus* L., other than	Without prejudice to the prohibitions applicable to the plants listed in Annex IIIA(9), (9.1), (18) and IIIB(1), where appropriate, official statement that: a) the plants originate in third countries recognised as being free from *Erwinia amylovora* (Burr.) Winsl. et al. in accordance with the procedure laid down in Article 18(2), or b) the plants originate in pest free areas in third countries which have been established in relation to *Erwinia amylovora* (Burr.) Winsl. Et al. in accordance with the relevant International Standard for Phytosanitary Measures and recognised as such in accordance with the procedure laid down in Article 18(2), or c) the plants originate in the Canton of Valais in Switzerland, or d) the plants originate in the protected zones listed in the right-hand column, or e) the plants have been produced, or, if moved into a 'buffer zone', kept and maintained for a period of at least 7 months including the period 1 April to 31 October of the last complete cycle	E (except the autonomous communities of Andalucia, Aragón, Castilla la Mancha, Castilla y León, Extremadura, the autonomous community of Madrid, Murcia, Navarra and La Rioja, the province of Guipuzcoa (Basque Country), the Comarcas of Garrigues, Noguera, Pla d'Urgell, Segrià and Urgell in the province of Lleida (Communidad autonoma de Catalunya), the Comarcas de L'Alt Vinalopó and El Vinalopó Mitjà in the province of Alicante and the municipalities of Alborache and Turís in the province of Valencia (Comunidad Valenciana)), EE, F (Corsica), IRL (except Galway city), I (Abruzzo, Apulia, Basilicata, Calabria, Campania, Emilia-Romagna (the provinces of Parma and Piacenza), Lazio, Liguria, Lombardy (except the provinces of Mantua, Milano, Sondrio and Varese), Marche, Molise, Piedmont (except the communes of Busca, Centallo and Tarantasca in the province of Cuneo), Sardinia, Sicily, Tuscany, Umbria, Valle d'Aosta, Veneto (except the provinces of Rovigo and Venice, the communes of Barbona, Boara Pisani, Castelbaldo, Masi, Piacenza d'Adige, S. Urbano and, Vescovana in the province of Padova and the area situated to the south of highway A4 in the province of Verona)), LV, LT (except the

fruit and seeds	of vegetation, on a field: aa) located at least 1 km inside the border of an officially designated 'buffer zone' of at least 50 km^2 where host plants are subject to an officially approved and supervised control regime established at the latest before the beginning of the complete cycle of vegetation preceding the last complete cycle of vegetation, with the object of minimising the risk of *Erwinia amylovora* (Burr.) Winsl. et al. being spread from the plants grown there. Details of the description of this vegetation, with the object of minimising the risk of *Erwinia amylovora* (Burr.) →	municipalities of Babtai and Kėdainiai (region of Kaunas)), P, SI (except the regions Gorenjska, Koroška, Maribor and Notranjska, and the communes of Lendava and Renče-Vogrsko (south from the highway H4)), SK (except the county of Dunajská Streda, Hronovce and Hronské Kľačany (Levice County), Dvory nad Žitavou (Nové Zámky County), Málinec (Poltár County), Hrhov (Rožňava County), Veľké →
	→ Winsl. et al. being spread from the plants grown there. Details of the description of this 'buffer zone' shall be kept available to the Commission and to other Member States. Once the 'buffer zone' is established, official inspections shall be carried out in the zone not comprising the field and its surrounding zone of 500 m width, at least once since the beginning of the last complete cycle of vegetation at the most appropriate time, and all host plants showing symptoms of *Erwinia amylovora* (Burr.) Winsl. et al. should be removed immediately. The results of these inspections shall be supplied by 1 May each year to the Commission and to other Member States, and bb) which has been officially approved, as well as the 'buffer zone', before the beginning of the complete cycle of vegetation preceding the last complete cycle of vegetation, for the cultivation of plants under the requirements laid down in this point, and cc) which, as well as the surrounding zone of a width of at least 500 m, has been found free from *Erwinia amylovora* (Burr.) Winsl. et al. since the beginning of the last complete cycle of vegetation, at official inspection carried out at least: – twice in the field at the most appropriate time, e.g. once during June to August and once during August to November; and – once in the said surrounding zone at the most appropriate time, e.g. during August to November, and dd) from which plants were officially tested for latent infections in accordance with an appropriate laboratory method on samples officially drawn at the most appropriate period. Between 1 April 2004 and 1 April 2005, these provisions shall not apply to plants moved into and within the protected zones listed in the right-hand column which have been produced and maintained on fields located in officially	→ Ripňany (Topoľčany County), Kazimír, Luhyňa, Malý Horeš, Svätuše and Zatín (Trebišov County)), FI, UK (Northern Ireland: excluding the townlands of Ballinran Upper, Carrigenagh Upper, Ballinran, and Carrigenagh in County Down, and the Electoral Area of Dunmurry Cross in Belfast, County Antrim; Isle of Man and Channel Islands)

	designated 'buffer zones', according to the relevant requirements applicable before 1 April 2004	
21.1. Plants of *Vitis* L., other than fruit and seeds	Without prejudice to the prohibition in Annex III (A)(15), on introducing plants of *Vitis* L. other than fruits from third countries (except Switzerland) into the Union, official statement that the plants: (a) originate in the protected zones listed in the right hand column; or (b) have been subjected to an appropriate treatment to ensure freedom from *Daktulosphaira vitifoliae* (Fitch) according to a specification approved in accordance with the procedure referred to in Article 18(2).	CY
21.2. Fruits of *Vitis* L.	The fruits shall be free from leaves and official statement that the fruits: (a) originate in an area known to be free from *Daktulosphaira vitifoliae* (Fitch); or (b) have been grown at a place of production which has been found free from *Daktulosphaira vitifoliae* (Fitch) on official inspections carried out during the last two complete cycles of vegetation; or (c) have been subject to fumigation or other appropriate treatment against *Daktulosphaira vitifoliae* (Fitch)	CY
32. Plants of *Vitis* L., other than fruit and seeds.	Without prejudice to the provisions applicable to the plants listed in Annex III(A)(15), IVA(II)17, and IVB21.1, official statement that: (a) the plants originate and have been grown in a place of production in a country where Grapevine flavescence dorée MLO is not known to occur; or (b) the plants originate and have been grown in a place of production in an area free from Grapevine flavescence dorée MLO established by the national plant protection organisation in accordance with the relevant international standards; or (c) the plants originate and have been grown in either the Czech Republic, France (Alsace, Champagne-Ardenne, Picardie (département de l'Aisne), Ile de France (communes de Citry, Nanteuil-sur-Marne et Saâcy-sur-Marne) and Lorraine) or Italy (Apulia, Basilicata and Sardinia); or (cc) the plants originate and have been grown in Switzerland (except the Canton of Ticino and the Misox Valley); or	CZ, FR (Alsace, Champagne-Ardenne, Picardie (département de l'Aisne), Ile de France (communes de Citry, Nanteuil-sur-Marne et Saâcy-sur-Marne) and Lorraine), I (Apulia, Basilicata and Sardinia)

	(d) the plants originate and have been grown in a place of production where: (aa) no symptoms of Grapevine flavescence dorée MLO have been observed on the mother-stock plants since the beginning of the last two complete cycles of vegetation; and (bb) either (i) no symptoms of Grapevine flavescence dorée MLO have been found on the plants in the place of production; or, (ii) the plants have undergone hot water treatment of at least 50 °C for 45 minutes in order to eliminate the presence of Grapevine flavescence dorée MLO	

Annex V	**Plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community – in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community**
Part A	**Plants, plant products and other objects originating in the Community**
I.	**Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community and which must be accompanied by a plant passport**
1.1	Plants, intended for planting, other than seeds, of *Amelanchier* Med., *Chaenomeles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Malus* Mill., Mespilus L., *Photinia davidiana* (Dcne.) Cardot, *Prunus* L., other than *Prunus laurocerasus* L. and *Prunus lusitanica* L., *Pyracantha* Roem., *Pyrus* L. and *Sorbus* L.
1.4	Plants of *Choisya* Kunth, *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, *Casimiroa* La Llave, *Clausena* Burm. f., *Murraya* J. Koenig ex L., *Vepris* Comm., *Zanthoxylum* L. and *Vitis* L., other than fruits and seeds
2.1	Plants intended for planting, other than seeds, of the genera *Abies* Mill., *Apium graveolens* L., *Argyranthemum* spp., *Asparagus officinalis* L., *Aster* spp., *Brassica* spp., *Castanea* Mill., *Cucumis* spp., *Dendranthema* (DC.) Des Moul., *Dianthus* L. and hybrids, *Exacum* spp., *Fragaria* L., *Gerbera* Cass., *Gypsophila* L., all varieties of New Guinea hybrids of *Impatiens* L., *Lactuca* spp., *Larix* Mill., *Leucanthemum* L., *Lupinus* L., *Pelargonium* l'Hérit. Ex Ait., *Picea* A. Dietr., *Pinus* L., *Platanus* L., *Populus* L., *Prunus laurocerasus* L., *Prunus lusitanica* L., *Pseudotsuga* Carr., *Quercus* L., *Rubus* L., *Spinacia* L., *Tanacetum* L., *Tsuga* Carr., *Ulmus* L., *Verbena* L. and other plants of herbaceous species, other than plants of the family *Gramineae*, intended for planting, and other than bulbs, corms, rhizomes, seeds and tubers.
II.	**Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for certain protected zones, and which must be accompanied by a plant passport valid for the appropriate zone when introduced into or moved within that zone**
1.2	Plants intended for planting, other than seeds, of *Beta vulgaris* L., *Platanus* L., *Populus* L., *Prunus* L. and *Quercus* spp., other than *Quercus suber* and *Ulmus* L.
1.3	Plants, other than fruit and seeds, of *Amelanchier* Med., *Castanea* Mill., *Chaenomeles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Eucalyptus* L'Herit., *Malus* Mill., Mespilus L., *Photinia davidiana* (Dcne.) Cardot, *Pyracantha* Roem., *Pyrus* L., *Sorbus* L. and *Vitis* L.
1.4	Live pollen for pollination of *Amelanchier* Med., *Chaenomeles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Malus* Mill., Mespilus L., *Photinia davidiana* (Dcne.) Cardot, *Pyracantha* Roem., *Pyrus* L. and *Sorbus* L.
1.9	Fruits (bolls) of *Gossypium* spp. and unginned cotton, fruits of *Vitis* L.
Part B	**Plants, plant products and other objects originating in territories, other than those territories referred to in Part A**
I.	**Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community**
1.	Plants, intended for planting, other than seeds but including seeds of *Cruciferae*, *Gramineae*, *Trifolium* spp., originating in Argentina, Australia, Bolivia, Chile, New Zealand and Uruguay, genera *Triticum*, *Secale* and X *Triticosecale* from Afghanistan, India, Iran, Iraq, Mexico, Nepal, Pakistan,

	South Africa and the USA, *Citrus* L., *Fortunella* Swingle and *Poncirus* Raf., and their hybrids, *Capsicum* spp., *Helianthus annuus* L., *Solanum lycopersicum* L., *Medicago sativa* L., *Prunus* L., *Rubus* L., *Oryza* spp., *Zea mays* L., *Allium ascalonicum* L., *Allium cepa* L., *Allium porrum* L., *Allium schoenoprasum* L. and *Phaseolus* L.
2.	Parts of plants, other than fruits and seeds, of: – *Castanea* Mill., *Dendranthema* (DC.) Des Moul., *Dianthus* L., *Gypsophila* L., *Pelargonium* l'Herit. ex Ait, *Phoenix* spp., *Populus* L., *Quercus* L., *Solidago* L. and cut flowers of *Orchidaceae*, – conifers (*Coniferales*), – *Acer saccharum* Marsh., originating in the USA and Canada, – *Prunus* L., originating in non-European countries, – Cut flowers of *Aster* spp., *Eryngium* L., *Hypericum* L., *Lisianthus* L., *Rosa* L. and *Trachelium* L., originating in non-European countries, – Leafy vegetables of *Apium graveolens* L., *Ocimum* L., *Limnophila* L. and *Eryngium* L., – Leaves of *Manihot esculenta* Crantz, – Cut branches of *Betula* L. with or without foliage, – Cut branches of *Fraxinus* L., *Juglans ailantifolia* Carr., *Juglans mandshurica* Maxim., *Ulmus davidiana* Planch. and *Pterocarya rhoifolia* Siebold & Zucc., with or without foliage, originating in Canada, China, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea, Russia, Taiwan and USA, – *Amyris* P. Browne, *Casimiroa* La Llave, *Citropsis* Swingle & Kellerman, *Eremocitrus* Swingle, *Esenbeckia* Kunth., *Glycosmis* Corrêa, *Merrillia* Swingle, *Naringi* Adans., *Tetradium* Lour., *Toddalia* Juss. and *Zanthoxylum* L.
3.	Fruits of: – *Annona* L., *Cydonia* Mill., *Diospyros* L., *Malus* Mill., *Mangifera* L., *Passiflora* L., *Prunus* L., *Psidium* L., *Pyrus* L., *Ribes* L. *Syzygium* Gaertn., and *Vaccinium* L., originating in non-European countries,
6.	Wood within the meaning of the first subparagraph of Article 2(2), where it: (a) has been obtained in whole or part from one of the order, genera or species as described hereafter, except wood packaging material defined in Annex IV, Part A, Section I, Point 2: [...] — *Amelanchier* Medik., *Aronia* Medik., *Cotoneaster* Medik., *Crataegus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyracantha* M. Roem., *Pyrus* L. and *Sorbus* L., including wood which has not kept its natural round surface, except sawdust or shavings, originating in Canada or the USA
II.	**Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for certain protected zones**
	Without prejudice to the plants, plant products and other objects listed in I.
3.	Live pollen for pollination of *Amelanchier* Med., *Chaenomeles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Malus* Mill., Mespilus L., *Photinia davidiana* (Dcne.) Cardot, *Pyracantha* Roem., *Pyrus* L. and *Sorbus* L.
4.	Parts of plants, other than fruit and seeds, of *Amelanchier* Med., *Chaenomeles* Lindl., *Cotoneaster* Ehrh., *Crataegus* L., *Cydonia* Mill., *Eriobotrya* Lindl., *Malus* Mill., *Mespilus* L., *Photinia davidiana* (Dcne.) Cardot, *Pyracantha* Roem., *Pyrus* L. and *Sorbus* L.
6a.	Fruits of *Vitis* L.

3.3.3. Legislation addressing vectors of the non-EU phytoplasmas categorised here (Directive 2000/29/EC)

Some of the insects identified as competent vectors of some phytoplasmas categorised here (*Bactericera cockerelli, Circulifer haematoceps, C. tenellus*) are explicitly mentioned in the Directive 2000/29/EC, as detailed below:

- *Bactericera cockerelli* is listed in Annex IAI, point (a) 6.1.
- *Circulifer haematoceps* is mentioned in Annex IIAII, point (a) 5:

  Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds.

- *Circulifer tenellus* is mentioned in Annex IIAII, point (a) 6:

  Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds.

The remaining insects identified as competent vectors (*Amplicephalus funzaensis, Batracomorphus punctatus, Cacopsylla chinensis, Cacopsylla pyricola, Ceratagallia nitidula, Empoasca abrupta, Empoasca papayae, Exitianus atratus, Hishimonoides chinensis, Hishimonus sellatus, Macrosteles fascifrons, Orosius albicinctus, Orosius argentatus, Orosius cellulosa, Orosius orientalis, Orosius lotophagorum, Zeoliarus atkinsoni* and *Zeoliarus oppositus*) are not mentioned in the Directive 2000/29/EC.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

The reported natural host range of the phytoplasmas categorised here varies from restricted (NAGYIII, PYLR and Buckland valley grapevine yellows phytoplasmas) to wide ('*Ca*. P. aurantifolia'-related strains, '*Ca.* P. australiense', '*Ca*. P. fraxini', '*Ca*. P. hispanicum', '*Ca*. P. trifolii' and '*Ca*. P. ziziphi'). For each of these phytoplasmas, Table 11 and Appendix C integrate data from the list of non-EU phytoplasmas of the host plants (EFSA PLH Panel, 2020) with additional information on their natural hosts beside the host plants. Table 11 only lists other hosts listed by EPPO and other hosts that are regulated, while Appendix C lists regulated and unregulated other hosts. However, in all cases there is uncertainty about the possible existence of additional natural hosts not reported so far.

Table 11: Host plants, other natural hosts from EPPO and regulated other natural hosts from a WoS search of the phytoplasmas categorised in the present opinion, together with the regulatory status and the associated uncertainties. Complete list of other other natural hosts is detailed in Appendix C

Phytoplasma name, reference strain/ related strain name	Host plants	Other hosts	Regulation addressing other hosts	Uncertainties
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)	*Fragaria* (Streten et al., 2005c), *Malus* (Hashemi-Tameh et al., 2014), *Prunus* (Zirak et al., 2009b, 2010), *Pyrus* (Schneider and Gibb, 1997, Liu et al., 2011), *Vitis* (Constable et al., 2003; Ghayeb Zamharir et al., 2017).	EPPO Mayor: *Citrus* (PHYPAF); *Arachis hypogaea* (PHYPAA); *Ipomea batatas* (PHYP39) EPPO Incidental: *Dendrocalamus strictus*, *Fallopia japonica*, *Vigna mungo* (PHYPAF) EPPO Unclassified: *Fabaceae* (PHYPAA) *Allium cepa* (Sharif et al., 2019); *Apium graveolens* (Tran-Nguyen et al., 2003); *Beta vulgaris* ssp.	*Allium cepa*: IVAII 24.1, VAI 2.4, VBI 1; *Apium* spp.: IVAI 32.2; IVB 22; VAI 2.1, VBI 2; *Beta vulgaris*: IVAI 35.1, 35.2, IVAII 24.1, 25; IVB 23, 25, 27.1, 27.2; VAI 1.2; VAII 1.2, 1.6, 1.8; VBII 1, 5; *Brassica* spp.: IVAII 24.1, VAI 2.1; *Capsicum annuum* : IVAI 25.7; IVAII 18.7; *Citrus* spp.: IIIAI 16; IVAI 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 18, 18.1; IVAII 10, 10.1,	The susceptibility of *Fragaria*, *Malus* and *Vitis* is uncertain (fewer than 6 plants in a single report for each species). Natural hosts belong to different families. Additional natural hosts may exist

Phytoplasma name, reference strain/ related strain name	Host plants	Other hosts	Regulation addressing other hosts	Uncertainties
		esculenta (Mirzaie et al., 2007); *Brassica chinensis* (Davis and Tsatsia, 2009); *Brassica oleracea* (Sharif et al., 2019); *Capsicum annuum* (Sharma et al., 2015); *Cucumis sativus* (Tazehkand et al., 2010); *Daucus carota* (Al-Subhi et al., 2018); *Gerbera jamesonii* (Siddique, 2005); *Gossypium hirsutum* (Schneider et al., 1997); *Gypsophila paniculata* (Gera et al., 2007); *Helianthus* spp. (Mulpuri and Muddanuru, 2016); *Hibiscus rosa-sinensis* (Arocha et al., 2009a); *Lactuca sativa* (Cai et al., 2016); *Manihot esculenta* (Arocha et al., 2009a); *Medicago sativa* (Al-Subhi et al., 2018); *Nicotiana tabacum* (Schneider et al., 1999); *Passiflora edulis*, (Arocha et al., 2009a); *Pelargonium capitatum* (Lee et al., 2010); *Phaseolus vulgaris* (Arocha et al., 2009b); *Phoenix dactilifera* (Omar et al., 2018b); *Rosa* spp. (Arocha et al., 2010); *Solanum tuberosum* (Omar et al., 2018a); *Spinacia olearia* (Al-Subhi et al., 2018); *Trifolium repens* (Hosseini et al., 2013b)	30.1; IVB 31; VAI 1.5, 1.6; VBI 1, 3; *Cucumis* spp.: VAI 2.1; *Daucus* spp.: IVB 22; *Gerbera* spp.: VAI 2.1; *Gossypium* spp.: IVB 28, 28.1; VAII 1.8, 1.9; VBI 6; *Gypsophila* spp.: IVAI 32.2, 45.2, VAI 2.1, VBI 2; *Helianthus* spp.: IVAI 47, IVAII 26, VAI 2.4, VBI 1 *Hibiscus* spp.: IVAI 45.1; IVB 24.3; VBI 2.1; *Lactuca* spp.: VAI 2.1; *Manihot esculenta*: VBI 2; *Medicago sativa*: IVAI 49.1, 49.2, IVAII 28.1, 28.2; IVB 2.4; VBI 1; *Nicotiana tabacum*: IVAI 25.7; IVAII 18.7; *Passiflora* spp.: VBI 3; *Pelargonium* spp.: IVAI 27.1, 27.2, 31; IVAII 20, VAI 2.1; VBI 2; *Phaseolus* spp.: IVAI 51; IVAII 29, IVB 2.4; VAII 1.8; VBI 1, 5; *Phoenix* spp.: IIB 17; IVAI 37.1; IVAII 19.1; IVB 21.4, 21.5; VAI 2.3.1; VAII 1.3.1; VBI 2; *Rosa* spp.: IIIA 9, IVAI 44, 45.2; VBI 2; *Solanum* spp.: IIIAI 10, 11, 12, 13; IVAI 25.1, 25.2, 25.3, 25.4, 25.4.1, 25.4.2, 25.5, 25.6, 25.7, 25.7.1, 25.7.2, 28.1, 36.2, 45.3, 48; IVAII 18.1, 18.1.1, 18.2, 18.3, 18.3.1, 18.4, 18.5, 18.6, 18.6.1, 18.7, 26.1, 27; IVBI 20.1, 20.2; VAI 1.3, 2.4; VAII 1.5; VB 1, 3, 4; *Spinacia* spp. VAI 2.1; *Trifolium* spp.: VBI 1;	
***'Ca.* P. australiense' (reference strain)**	*Fragaria, Rubus, Vitis* (EPPO GD) *Prunus* (Jones et al., 2005)	EPPO Major: *Carica papaya*, EPPO Minor: *Phormium cookianum, Phormium tenax, Solanum pseudocapsicum* EPPO Unclassified: *Apium graveolens*,	*Apium* spp.: IVAI 32.2; IVB 22; VAI 2.1, VBI 2; *Cucumis* spp.: VAI 2.1; *Medicago sativa:* IVAI 49.1, 49.2, IVAII 28.1, 28.2; IVB 2.4; VBI 1; *Phaseolus* spp.: IVAI 51; IVAII 29, IVB 2.4; VAII 1.8; VBI 1, 5;	The susceptibility of *Prunus* needs to be confirmed (Jones et al., 2005). Natural hosts belong to different families. Additional

Phytoplasma name, reference strain/ related strain name	Host plants	Other hosts	Regulation addressing other hosts	Uncertainties
		Solanum tuberosum. *Cucumis myriocarpus* (Saqib et al., 2006); *Medicago sativa* (Liu et al., 2018); *Phaseolus* spp. (Streten and Gibb, 2006); *Trifolium pratense* (Saqib et al., 2006)	*Solanum* spp.: IIIAI 10,11,12,13; IVAI 25.1, 25.2, 25.3, 25.4, 25.4.1, 25.4.2, 25.5, 25.6, 25.7, 25.7.1, 25.7.2, 28.1, 36.2, 45.3, 48; IVAII 18.1, 18.1.1, 18.2, 18.3, 18.3.1, 18.4, 18.5, 18.6, 18.6.1, 18.7, 26.1, 27; IVBI 20.1, 20.2; VAI 1.3, 2.2, 2.4; VAII 1.5; VBI 1, 3, 4; *Trifolium* spp.: VBI 1;	natural hosts may exist
'*Ca.* P. fraxini' (reference strain)	*Fragaria* (Fernandez et al., 2013) *Prunus* (Zunnoon-Khan et al., 2010) *Vitis* (Gajardo et al., 2009; Ghayeb Zamharir et al., 2017; Zambon et al., 2018)	EPPO Major: *Fraxinus* spp. EPPO Unclassified: *Syringa* spp. *Phoenix dactylifera* (Ghayeb Zamharir and Eslahi, 2019); *Medicago sativa* (Conci et al., 2005)	*Fraxinus* spp.: IVAI 2.3, 2.4, 2.5, 11.4; VBI 2, 6; *Phoenix* spp.: IIB 17; IVAI 37.1; IVAII 19.1; IVB 21.4, 21.5; VAI 2.3.1; VAII 1.3.1; VBI 2; *Medicago sativa:* IVAI 49.1, 49.2, IVAII 28.1, 28.2; IVB 2.4; VBI 1;	Natural hosts belong to different families. Additional natural hosts may exist
'*Ca.* P. hispanicum' (reference strain)	*Fragaria* (Jomantiene et al., 1998a,b; Fernandez et al., 2015)	*Brassica oleracea* (Eckstein et al., 2013); *Solanum tuberosum* (Davis et al., 2016)	*Brassica* spp.: IVAII 24.1; IVB 22; VAI 2.1; *Solanum* spp.: IIIAI 10,11,12,13; IVAI 25.1, 25.2, 25.3, 25.4, 25.4.1, 25.4.2, 25.5, 25.6, 25.7, 25.7.1, 25.7.2, 28.1, 36.2, 45.3, 48; IVAII 18.1, 18.1.1, 18.2, 18.3, 18.3.1, 18.4, 18.5, 18.6, 18.6.1, 18.7, 26.1, 27; IVBI 20.1, 20.2; VAI 1.3, 2.2, 2.4; VAII 1.5; VBI 1, 3, 4.	Natural hosts belong to different families. Additional natural hosts may exist
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	*Vitis* (Davis et al., 2015)	none	–	–
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	*Prunus* (Marcone et al., 2014)	none	–	Despite the acknowledged high incidence of PYLR diseased peaches in orchards neighboured by pear trees, the presence of PYLR in pear has not been definitively assessed

Phytoplasma name, reference strain/ related strain name	Host plants	Other hosts	Regulation addressing other hosts	Uncertainties
'*Ca.* P. trifolii' (reference strain)	*Fragaria* (Hiruki and Wang, 2004); *Prunus* (Zirak et al., 2010); *Vitis* (Zambon et al., 2018)	EPPO Unclassified: *Medicago sativa, Melilotus albus, Nicotiana tabacum, Solanum* spp*., Solanum lycopersicum, Solanum tuberosum, Trifolium* spp. *Apium graveolens* (Alfaro-Fernandez et al., 2017); *Brassica olearacea* (Salehi et al., 2007); *Capsicum annuum* (Oksal et al., 2017); *Cucumis sativus* (Zibadoost et al., 2015); *Hibiscus rosa-sinensis* (Khasa et al., 2016); *Lupinus polyphyllus* (Girsova et al., 2017); *Phaseolus vulgaris* (Lee et al., 2004); *Phoenix dactylifera* (Ghayeb Zamharir and Eslahi, 2019); *Ulmus americana* (Flower et al., 2018); *Vaccinium myrtillus* (Borroto Fernandez et al., 2007); *Zea mays* (Zibadoost et al., 2015)	*Apium* spp.: IVAI 32.2; IVB 22; VAI 2.1, VBI 2; *Brassica* spp.: IVAII 24.1; IVB 22; VAI 2.1; *Capsicum* spp.: IVAI 16.6, 25.7, 36.3; IVAII 18.6.1, 18.7; VBI 1, 3; *Cucumis* spp.: VAI 2.1; *Hibiscus* spp.: IVAI 45.1; IVB 24.3; VBI 2.1; *Lupinus* spp.: VAI 2.1; *Medicago sativa:* IVAI 49.1, 49.2, IVAII 28.1, 28.2; IVB 2.4; VBI 1; *Nicotiana* spp.: IVAI 25.7; IVAII 18.7; *Phaseolus* spp.: IVAI 51; IVAII 29, IVB 2.4; VAII 1.8; VBI 1, 5; *Phoenix* spp.: IIB 17; IVAI 37.1; IVAII 19.1; IVB 21.4, 21.5; VAI 2.3.1; VAII 1.3.1; VBI 2; *Solanum* spp.: IIIAI 10,11,12,13; IVAI 25.1, 25.2, 25.3, 25.4, 25.4.1, 25.4.2, 25.5, 25.6, 25.7, 25.7.1, 25.7.2, 28.1, 36.2, 45.3, 48; IVAII 18.1, 18.1.1, 18.2, 18.3, 18.3.1, 18.4, 18.5, 18.6, 18.6.1, 18.7, 26.1, 27; IVBI 20.1, 20.2; VAI 1.3, 2.2, 2.4; VAII 1.5; VBI 1, 3, 4.; *Trifolium* spp.: VBI 1; *Ulmus* spp.: IVAI 14; IVAII 8.1; VAI 2.1; VAII 1.2; *Vaccinium* spp.: VBI 3; *Zea mays*: IVAI 52; xVBI 1;	Susceptibility of *Prunus* and *Vitis* is uncertain (fewer than 5 plants from one single report for each species). Natural hosts belong to different families. Additional natural hosts may exist
'*Ca.* P. ziziphi' (reference strain)	*Malus* (Li et al., 2014a,b) *Prunus* (Zhu et al., 1998; Wang et al., 2014; Wang et al., 2018a)	*Dianthus chinensis* (Zhang et al., 2010) *Diospyros kaki* (Wang et al., 2015a); *Trifolium subterraneum, Ulmus parvifolia*, (Trivellone, 2019);	*Dianthus spp:.* IVAI 27.1, 27.2, 29, 32.2; IVAII 20, 21.2; VAI 2.1; VBI 2; *Diospyros kaki:* VB 3; *Medicago sativa:* IVAI 49.1, 49.2, IVAII 28.1, 28.2; IVB 2.4; VBI 1; *Trifolium* spp.: VBI 1; *Ulmus* spp.: IVAI 14; IVAII 8.1; VAI 2.1; VAII 1.2;	Natural hosts belong to different families. Additional natural hosts may exist

Phytoplasma name, reference strain/ related strain name	Host plants	Other hosts	Regulation addressing other hosts	Uncertainties
Buckland valley grapevine yellows phytoplasma	*Vitis* (Constable et al., 2002)	none	–	–

3.4.2. Entry

Is the pest able to enter into the EU territory?

YES. Phytoplasmas may enter into the EU with infected plants for planting of the host plants and in some cases plants for planting of other natural hosts, and/or vectors.

As of September 2019, there were no records of interception of non-EU phytoplasmas of the host plants in the Europhyt database.

All the phytoplasmas of the host plants categorised here can be transmitted by vegetative propagation material. Therefore, plants for planting of the host species are the most important entry pathway. Moreover, some of these phytoplasmas have additional natural hosts that also are vegetatively propagated, thus providing additional entry pathways. No pollen and seed transmissions have been reported for the phytoplasmas categorised here.

The legislation shows discrepancies between the nomenclature of phytoplasmas used in Annex IAI (*"Non-European (...) virus-like organisms"* and mycoplasms) and the one used in the present pest categorisation ('*Candidatus* Phytoplasma species'). This discrepancy may generate confusion at entry points.

The current legislation prohibits entry in the EU of plants for planting of *Cydonia*, *Malus*, *Prunus*, and *Pyrus*, from non-EU countries (Annex IIIAI 9), but introduction of dormant plants of these genera and of *Fragaria* is permitted from Mediterranean countries, Australia, New Zealand, Canada and the continental states of the USA (Annex IIIAI 18). This means that the entry pathway regarding plants for planting is only partially regulated for those phytoplasmas present in the above-mentioned countries (Mediterranean countries, Australia, New Zealand, Canada, the continental states of the USA and Switzerland). The legislation prohibits entry in the EU of commercial plants of *Vitis* with the exception of plants coming from Switzerland (Annex IIIAI 15).

In the case of *Ribes* and *Rubus,* the current legislation does not prohibit entry in the EU from non-EU countries of plants for planting of these genera. Although in Annex IVAI 19.2 an *"official statement that no symptoms of diseases caused by the relevant harmful organisms"* (e.g. non-European viruses and virus-like organisms) *"have been observed on the plants at the place of production since the beginning of last complete cycle of vegetation"* is requested. This measure is considered to have limited impact in preventing import of virus-infected plants. Indeed, symptoms in the infected plants might not be obvious.

Annex VA lists all the potential hosts which must be checked and accompanied by a plant passport for movement within EU MS. This measure may impair the spread of phytoplasmas on listed genera and/or plant species, but has no effect on the dissemination of phytoplasmas on unregulated host plants.

Annexes VBI 1, 2 and VBII 3, 4 determine that plants for plantings of several host species (*Cydonia, Malus, Pyrus, Prunus, Rosa and Rubus*) must be accompanied by a valid phytosanitary certificate in order to be introduced in the EU. Although this measure may prevent the introduction of the phytoplasmas explicitly mentioned in Annex IAI (Peach rosette, Peach X-disease and Peach yellows mycoplasmas and Strawberry witches' broom mycoplasm), it might not be effective for the phytoplasmas categorised here, which are not explicitly mentioned, and are only covered by the general definition of *"Non-European (...) virus-like organism*s".

All phytoplasmas categorised here can also be transmitted by vectors (Table 4). Vectors may thus act as entry pathway. Information on vector transmission is limited for some of the categorised phytoplasmas. The risk of introducing insects that have not yet been reported as competent vectors for these pathogens generates uncertainties on the entry pathways.

The majority of the phytoplasmas categorised here ('*Ca.* P. aurantifolia'-related strains, '*Ca.* P. australiense', '*Ca.* P. fraxini', '*Ca.* P. pyri'-related strain, '*Ca.* P. trifolii', '*Ca.* P. ziziphi') are transmitted by different species of Hemiptera insects which are not regulated, thus providing additional entry pathways. *Bactericera cockerelli*, vector of '*Ca.* P. hispanicum', is listed in Annex IAI, which bans the entry of this vector.

Table 12 provides an overview of the main potential entry pathways for the non-EU phytoplasmas categorised here. In summary, the current legislation:

- regulates the plants for planting entry pathway for some of the phytoplasmas categorised here (*Cydonia*, *Fragaria*, *Malus*, *Prunus*, and *Pyrus*) if coming from specific countries (excluding Mediterranean countries, Australia, New Zealand, Canada, the continental states of the USA),
- closes the *Vitis* plants pathway,
- requires only visual inspection and an official declaration of absence of symptoms in the case of *Ribes* and *Rubus*.

For phytoplasmas with a wide host range, the plants for planting pathway is only partially regulated because these organisms may also enter in the EU through plants for planting of unregulated host species. The vector pathway is mainly not regulated.

Table 12: Main potential entry pathways for the non-EU phytoplasmas categorised here

Phytoplasma name, reference strain/ related strain name	Plants for planting of the host plants(1)	Plants for planting of other hosts(1)	Competent vectors(1)	Uncertainties
'*Ca.* P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	Pathway partially regulated by existing legislation (phytoplasma present in Australia, Turkey, Israel and Egypt)(2)	Pathway partially regulated: existence of a wide range of unregulated hosts	Pathway open	– Geographical distribution – Geographical distribution of competent vectors – Existence of other vectors – Existence of other natural hosts
'*Ca.* P. australiense' (reference strain)	Pathway partially regulated by existing legislation (phytoplasma present in Australia and New Zealand)(2)	Pathway partially regulated: existence of a wide range of unregulated hosts	Pathway open	– Geographical distribution – Geographical distribution of competent vectors – Existence of other vectors – Existence of other natural hosts
'*Ca.* P. fraxini' (reference strain)	Pathway partially regulated by existing legislation (phytoplasma present in Canada and USA)(2)	Pathway partially regulated: existence of a wide range of unregulated hosts	Pathway open	– Geographical distribution – Geographical distribution of competent vectors – Existence of other vectors – Existence of other natural hosts
'*Ca.* P. hispanicum' (reference strain)	Pathway partially regulated by existing legislation (phytoplasma present in Argentina, Canada, Chile and USA)(2)	Pathway partially regulated: existence of a wide range of unregulated hosts	Pathway regulated by current legislation. *Bactericera cockerelli* is listed in Annex IAI	– Geographical distribution – Uncertain role of *B. cockerelli* as vector – Existence of unreported vectors – Existence of other natural hosts
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	Pathway closed by existing legislation	Pathway possibly open: other natural hosts may exist	Pathway possibly open: unknown vectors may exist	– Geographical distribution – Existence of vectors – Existence of other natural hosts

Phytoplasma name, reference strain/ related strain name	Plants for planting of the host plants(1)	Plants for planting of other hosts(1)	Competent vectors(1)	Uncertainties
***'Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)**	Pathway partially regulated by existing legislation (PYLR is present in the USA)(2)	Pathway possibly open: other natural hosts may exist	Pathway open	– Geographical distribution – Geographical distribution of competent vectors Existence of unreported vectors – Existence of other natural hosts
***'Ca.* P. trifolii' (reference strain)**	Pathway partially regulated by existing legislation (phytoplasma present in Australia, Canada, Lebanon and USA)(2)	Pathway partially regulated: existence of a wide range of unregulated hosts	Pathway open	– Geographical distribution – Geographical distribution of competent vectors Existence of unreported vectors – Existence of other natural hosts
***'Ca.* P. ziziphi' (reference strain)**	Pathway closed by existing legislation	Pathway partially regulated: existence of a wide range of unregulated hosts	Pathway open	– Geographical distribution – Geographical distribution of competent vectors – Existence of unreported vectors – Existence of other natural hosts
Buckland valley grapevine yellows phytoplasma	Pathway closed by existing legislation	Pathway possibly open: other natural hosts may exist	Pathway possibly open: unknown vectors may exist	– Geographical distribution – Existence of vectors – Existence of other natural hosts

(1): Pathway open: only applicable if the pathway exists, open means that there is no regulation or ban that prevents entry via this pathway.
Pathway closed: opposite of 'pathway open': there is a ban that rules out entry via the pathway.
Pathway possibly open: the existence of the pathway, which is not closed by current legislation, is not supported by direct evidence regarding the biology of that phytoplasma. However, based on the lack of knowledge on other unknown competent vectors and natural hosts, the existence of the pathway cannot be excluded.
Pathway partially regulated: the legislation does not cover all the possible paths (e.g. regulations exist for some hosts, but not for others; a ban exists for some third countries but not for all).
(2): Import not banned from the listed countries.

The analysis of entry pathways is affected by uncertainties due to the transmission biology, host range and geographical distribution of the non-EU phytoplasmas. Based on the above data and considerations, the entry pathways of the phytoplasmas categorised here are summarized as follows:

- entry pathway involving plants for planting of the host plants: this pathway is closed for: '*Ca*. P. pruni'–related strain (NAGYIII), '*Ca*. P. ziziphi' and Buckland Valley grapevine yellows phytoplasma. It is partially regulated for '*Ca*. P. aurantifolia'–related strains, '*Ca*. P. australiense', '*Ca*. P. fraxini', '*Ca*. P. hispanicum', '*Ca*. P. pyri'–related strain (PYLR) and '*Ca*. P. trifolii' because these phytoplasmas are present in third countries from which the import of dormant host plants for planting is allowed.
- entry pathway involving other hosts: this pathway is partially regulated for other hosts of: '*Ca*. P. aurantifolia'–related strains, '*Ca*. P. australiense', '*Ca*. P. fraxini', '*Ca*. P. hispanicum', '*Ca*. P. trifolii' and '*Ca*. P. ziziphi' because of the existence of a wide range of unregulated hosts. It is possibly open for '*Ca*. P. pruni'–related strain (NAGYIII), '*Ca*. P. pyri'–related strain (PYLR) and Buckland Valley grapevine yellows phytoplasma because of the possible existence of unknown natural hosts.
- entry pathway involving infectious vectors: the pathway is open for '*Ca*. P. aurantifolia'–related strains, '*Ca*. P. australiense', '*Ca*. P. fraxini', '*Ca*. P. pyri'–related strain (PYLR), '*Ca*. P. trifolii' and '*Ca.* P. ziziphi' due to the unregulated status of their competent vectors. This pathway is possibly open for '*Ca*. P. pruni'–related strain (NAGYIII) and Buckland Valley grapevine yellows phytoplasma because of the possible existence of unknown competent vectors. This pathway is regulated for '*Ca*. P. hispanicum'.

3.4.3. Establishment

Are the pests able to become established in the EU territory?

YES, the host plants of the phytoplasmas under categorisation are widespread in the EU and climatic conditions are not limiting for phytoplasma development as long as they are suitable for host growth. The absence of vectors for some phytoplasmas may affect their establishment (see Section 3.4.4.).

3.4.3.1. EU distribution of main host plants

The host plants widely occur in the EU as commercial crops as well as wild plants. Details on the area of their production in individual EU MSs are provided in Table 13, as mean values for the period 2014-2018.

Table 13: Mean fruit area (cultivation/harvested/production) (1000 ha) of the host plants. Date of extraction from EUROSTAT 12/09/2019. Available data from the period 2014-2018 were used for calculating the mean value

Country	Mean (2014–2018)				
	Strawberries (S000)	Pome fruits (F1100)	Stone fruits (F1200)	Berries (Currants F3100; Black currants F3110; Red currants F3120; Gooseberries F3910; Raspberries F3200)	Grapes (W1000)
Austria	1,15	7,15	1,39	0,68	46,35
Belgium	1,87	16,19	1,37	0,28	0,19
Bulgaria	0,70	4,75	23,32	1,72	34,52
Croatia	0,32	6,30	9,40	0,11	23,43
Cyprus	0,05	0,58	1,29	0,00	6,15
Czechia	0,66	8,64	5,66	1,89	15,83
Denmark	1,13	1,67	0,85	1,76	0,00
Estonia	0,50	0,62	0,00	0,51	0,00
Finland	5,86	0,67	0,01	3,68	0,00
France	3,32	55,39	47,08	6,12	752,93
Germany	14,51	34,69	12,20	5,77	na
Greece	1,41	15,10	68,55	0,22	103,84
Hungary	0,76	35,61	34,02	3,25	68,77
Ireland	0,19	0,68	0,00	0,10	0,00
Italy	5,26	128,46	126,99	0,56	677,55
Latvia	0,46	3,16	0,40	1,34	0,00
Lithuania	0,89	11,49	1,53	9,51	0,00
Luxembourg	0,01	0,29	0,04	0,00	1,25
Malta	0,00	0,00	0,00	0,00	0,62
Netherlands	1,72	16,73	1,09	1,25	0,12
Poland	51,00	176,27	57,03	119,01	0,66
Portugal	0,38	27,84	12,54	0,21	178,92
Romania	2,84	59,97	76,60	0,30	173,56
Slovenia	0,11	2,60	0,59	0,44	15,82
Slovakia	0,20	2,29	1,33	0,02	8,55
Spain	7,14	56,50	147,02	2,14	940,31
Sweden	2,00	1,51	0,07	0,62	0,05
United Kingdom	4,78	17,86	1,02	6,33	1,95

3.4.3.2. Climatic conditions affecting establishment

Phytoplasma multiplication rates may be influenced in opposite ways by temperature in vectors and plants (Galetto et al., 2011; Salar et al., 2013). Moreover, climate affects vector and host plant biological parameters (eg. synchronicity between egg hatching and inoculum availability). Therefore, foreseeing the influence of climate on the establishment of phytoplasma diseases is difficult, with a lack of data in the literature.

Nevertheless, it is expected that the phytoplasmas categorised here would be able to establish wherever their host plants are grown, unless the absence of vectors prevents their establishment. The host plants are widely cultivated in the EU. The Panel therefore considers that climatic conditions will not impair the ability of the phytoplasmas addressed here to establish in the EU. At the same time, symptom expression and severity may be affected by climatic conditions (e.g. temperature and light) (see Section 3.5).

3.4.4. Spread

Is the pest able to spread within the EU territory following establishment? How?

YES, all the categorised phytoplasmas can spread through the trade of host plants for planting, and by vectors, whenever these are present in the EU.

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

YES, all the categorised phytoplasmas are spread mainly by the movement of infected plants for planting.

3.4.4.1. Vectors and their distribution in the EU

The presence and the geographic distribution in the EU of competent vectors of the non-EU phytoplasmas categorised here are reported in Table 14. Competent vectors of '*Ca*. P. aurantifolia'–related strains, '*Ca*. P. pyri'-related strain (peach yellow leafroll, PYLR), and '*Ca*. P. trifolii' are described and known to be present in the EU, according to the EPPO GD, Fauna Europaea, Catalogue of Life and a WoS literature search. Competent vectors of '*Ca*. P. australiense', '*Ca*. P hispanicum', '*Ca*. P. fraxini', and '*Ca*. P. ziziphi' are described, but not reported to be present in the EU. No competent vectors are known for '*Ca*. P. pruni'-related strain (NAGYIII) and Buckland Valley grapevine yellows phytoplasmas.

The possible unreported presence in the EU of known competent vectors of the phytoplasmas categorised here and the possibility that European phloem feeder insects may act as vectors of newly introduced phytoplasmas are sources of uncertainty in predicting the spread of non-EU phytoplasmas.

Table 14: EU distribution of competent vectors of the non-EU phytoplasmas categorised here

Phytoplasma name, reference strain/ related strain name	Competent vector	EU distribution (EPPO GD)	EU distribution (Fauna europaea)	EU distribution (Catalogue of Life)	EU distribution (WoS search)
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	*Orosius albicinctus, Orosius argentatus, Orosius cellulosa, Orosius lotophagorum, Orosius orientalis, Empoasca papayae, Cacopsylla chinensis*	–	*Orosius orientalis*: Greece, Spain, Portugal	–	–
'*Ca*. P. australiense' (reference strain)	*Zeoliarus oppositus, Zeoliarus atkinsoni*	–	–	–	–

Phytoplasma name, reference strain/ related strain name	Competent vector	EU distribution (EPPO GD)	EU distribution (Fauna europaea)	EU distribution (Catalogue of Life)	EU distribution (WoS search)
'*Ca.* P. fraxini' (reference strain)	*Amplicephalus funzaensis, Exitianus atratus*	–	–	–	–
'*Ca.* P. hispanicum' (reference strain)	*Bactericera cockerelli*	–	–	–	–
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	None reported	–	–	–	–
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	*Cacopsylla pyricola*	Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Italy, Netherlands, Poland, Romania, Slovenia, Spain, Sweden, UK	Austria, Belgium, Croatia, Czech Republic, Denmark, France, Germany, Greece, Italy, Netherlands, Poland, Romania, Slovakia, Spain, Sweden, UK	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, Poland, Romania, Slovenia, Spain, Sweden, UK	–
'*Ca.* P. trifolii' (reference strain)	*Ceratagallia nitidula, Empoasca abrupta, Circulifer tenellus, Circulifer haematoceps, Orosius albicinctus, Macrosteles. fascifrons, Batracomorphus punctatus, Orosius argentatus, Orosius orientalis*	*Circulifer tenellus*: France, Greece, Italy, Spain *Circulifer haematoceps*: Cyprus, Finland, France, Germany, Greece, Italy, Poland, Portugal, Spain	*Circulifer tenellus*: France, Greece, Italy, Spain *Orosius orientalis*: Greece, Spain, Portugal *Circulifer haematoceps*: Austria, Cyprus, Czech Republic, France, Greece, Hungary, Italy, Poland, Romania, Slovakia, Spain *Macrosteles fascifrons*: Finland, Sweden	*Circulifer haematoceps:* Widespread in Europe: Mediterranean region, Canary Islands *Macrosteles fascifrons:* Widespread in Europe: Italy, Spain, UK,	–
'*Ca.* P. ziziphi' (reference strain)	*Hishimonus sellatus, Hishimonoides chinensis*	–	–	–	–
Buckland valley grapevine yellows phytoplasma	None reported	–	–	–	–

3.5. Impacts

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

YES, the introduction in the EU of the phytoplasmas categorised here would have an economic impact.

RNQPs: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?[5]

YES, the pest presence would have an economic impact on the intended use of plants for planting.

Reported impacts caused by the phytoplasmas categorised here on the host plants are reported in Table 15, those on other hosts are listed in Appendix D. These phytoplasmas cause damage to the host plants in countries with environmental conditions similar to those present in the EU. They can be spread by infected plants for planting, therefore introduction of these pests in the EU is likely to impact the production of the host plants. Given that some of the pests also affect economically important crops beside the target host plants, their introduction in the EU may cause a broader damage. The susceptibility of *Fragaria*, *Malus*, and *Vitis* to '*Ca*. P. aurantifolia'-related strains, of *Prunus* to '*Ca*. P. australiense', and of *Prunus* and *Vitis* to'*Ca.* P. trifolii', as well as the actual presence of 'Ca. P. pyri'-related strain (PYLR) in *Pyrus* are uncertain.

Table 15: Impacts caused by the non-EU phytoplasmas categorised here on *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L., with relevant uncertainties

Phytoplasma name, reference strain/ related strain name	Impacts	Uncertainties
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	Based on 2012–2015 surveys in some orchards in Faraghe (Iran), 12.5% of the studied apricot trees showed symptoms (Rasoulpour et al., 2019). Disease severity observed in Australian pear orchard ranged from reduced bud viability to numerous dead limbs (Schneider and Gibb, 1997)	The susceptibility of *Fragaria* (Streten et al., 2005c), *Malus* (Hashemi-Tameh et al., 2014) and *Vitis* (Ghayeb Zamharir et al., 2017) is uncertain (fewer than 6 plants in a single report for each species
'*Ca.* P. australiense' (reference strain)	'*Ca*. P. australiense' infection has been consistently reported on *Fragaria*, *Rubus*, and *Vitis* plants. Impacts on strawberry plants with little leaf and lethal yellows disease range from stunting to reduced leaf size, yellowing of younger leaves and occasional plant death. Impacts on grape range from irregular chlorosis or yellowing of leaves. There is a single report of infection of *Prunus* (peach) in Bolivia (Jones et al., 2005)	The susceptibility of *Prunus* needs to be confirmed (only one disease note without details on number of infected plants) (Jones et al., 2005)
'*Ca.* P. fraxini' (reference strain)	'*Ca*. P. fraxini' phytoplasma strains have been reported in *Vitis vinifera* in Italy (Zambon et al., 2018), Chile (Gajardo et al., 2009) and Iran (Ghayeb Zamharir et al., 2017). Among the host plants, there are two reports in *Prunus* spp in China (Li et al., 1997) and Iran (Zunnoon-Khan et al., 2010), and one in *Fragaria* in Argentina (Fernandez et al., 2013). Infected *Fragaria* and *Prunus* show reduced fruit production, with lower quality	–

[5] See section 2.1 on what falls outside EFSA's remit.

Phytoplasma name, reference strain/ related strain name	Impacts	Uncertainties
'*Ca.* P. hispanicum' (reference strain)	'*Ca*. P. hispanicum' infects *Fragaria*, where the strawberry phyllody was found widely distributed with incidence levels up to 35% in Mexico (Avendano-Benequen et al., 2017). Strawberry varieties that are known as highly susceptible to the disease are Festival, Albion, Fortuna, Portola, San Andreas (Avendano-Benequen et al., 2017), Rosa Linda, Carlsbad, and Oso Grande (Harrison et al., 1997)	–
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	NAGYIII phytoplasma strains have been detected in *Vitis vinifera* only. Infected plants exhibit symptoms similar to those caused by Flavescence dorée phytoplasma and may die within 3 to 4 years from infection. Highly susceptible cvs, Chardonnay (from 3 to 25% infection rates over a 6-year period of infection), Pinot noir, Malbec, Riesling, as well as less susceptible ones (Cabernet franc, Cabernet Sauvignon, Sauvignon blanc, Petit Manseng, Viognier) are present in the EU (Wolf, 2015)	The susceptibility of other EU cvs is not known
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	Peach is the known host of the phytoplasma and well present in the EU. PYLR-infected trees are severely and rapidly damaged. Yields of PYLR-affected peach trees are drastically reduced by premature fruit drop (Marcone et al., 2014). Apricot, European plum and sweet cherry have failed to become infected by grafting with PYLR infected scions (Marcone et al., 2014). Marianna 2624 rootstock is probably resistant to the PYLR-MLO (Uyemoto et al., 1992)	The presence of PYLR in *Pyrus* has not been definitively assessed (Marcone et al., 2014)
'*Ca.* P. trifolii' (reference strain)	*Fragaria virginiana* and *F. chiloensis* can be infected by '*Ca*. P. trifolii', and this phytoplasma can presumably infect the commercial hybrid *F.* x *ananassa* (Jomantiene et al., 1998a). Impacts range from stunted to distorted and chlorotic leaves	Susceptibility of *Prunus* and *Vitis* is uncertain (fewer than 5 plants from one single report for each species) (Zirak et al., 2010); (Zambon et al., 2018)
'*Ca.* P. ziziphi' (reference strain)	A month following the first appearance of the virescence symptoms on sweet cherry plants (*Prunus avium*), the diseased trees became wilted and eventually died (Wang et al., 2014). The plants in a peach orchard in Northern Italy (identification made by RFLP and detected mixed infection with '*Ca*. P. solani' and '*Ca*. P. asteris') dried up and died in one to two weeks and sometimes sprouting of rootstock 'GF 677' was also observed; percentages of affected plants varied with cultivars and years: Cultivar 'Silver King' shows a stable symptom percentage of about 3%, cultivar 'Spring Crest' had 9% infected plants in 2001 and 2002, while in 2003 the percentage was 3%, cultivar 'May Crest' in 2001 had 3% infected plants but in the following years the disease presence was erratic (less than 1%) (Paltrinieri et al., 2006). The visual survey incidence of the disease on apple trees in China was about 3% (Li et al., 2014b)	–
Buckland valley grapevine yellows phytoplasma	Infection of grapevines with this phytoplasma causes weakening of the plants, lack of winter hardening of the new shoots, shoot tip death and bunches shriveling and falling, hampering grape production and reducing the longevity of the plants (Gibb et al., 1999)	There is a gap of knowledge on the vectors of this phytoplasma and on the susceptibility of grapevine cvs other than Chardonnay (pers. comm., Fiona Constable, Agriculture Victoria Research, Australia, 30/01/2019)

3.6. Availability and limits of mitigation measures

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

YES, measures are already in place (see Section 3.3) and potential additional measures for further regulating the identified pathways to limit entry, establishment, spread or impacts are listed in Section 3.6.1.

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

YES, measures are already in place (see Section 3.3) and potential additional measures for further regulating the identified pathways to limit entry, establishment, spread or impacts are listed in Section 3.6.1.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. (see Section 3.3). Potential additional measures to mitigate the risk of entry of the phytoplasmas categorised here may include:

- explicitly list in the legislation the categorised pests as "phytoplasmas", replacing "virus-like organisms of the host plants" in Annex IAI;
- extension of phytosanitary measures to specifically include hosts other than *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. for the phytoplasmas categorised here, that may be introduced as plants for planting;
- banning import of host plants for planting from the third countries where the phytoplasmas categorised here are reported;
- extension of certification schemes, testing requirements and phytosanitary certificates to natural hosts other than *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. for the phytoplasmas categorised here, that may be introduced as plants for planting.

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 16.

Table 16: Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)	Agents
Growing plants in isolation	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g., a dedicated structure such as glass or plastic greehouses. Insect-proof greenhouses to isolate plants for planting from vectors	Spread	Competent vector present in the EU: PYLR, '*Ca*. P. trifolii', '*Ca.* P. aurantifolia'–related strains, and possibly for all the others
Waste management	Treatment of the waste (deep burial, composting, incineration, chipping, production of bio-energy,...) in authorized facilities and official restriction on the movement of waste. Removal of pruning material to reduce pathogen inoculum source and to avoid vector egg hatching	Establishment and spread	All phytoplasmas categorised here

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/ establishment/ spread/impact)	Agents
Roguing and pruning	Roguing is defined as the removal of infested plants and/or uninfested host plants in a delimited area, whereas pruning is defined as the removal of infested plant parts only, without affecting the viability of the plant. Roguing of infested plants to reduce pathogen inoculum source. Pruning of symptomatic parts to reduce pathogen inoculum source in the case of woody hosts	Establishment and spread	All pests categorised here apart from '*Ca*. P. hispanicum', as it infects only *Fragaria* among the host plants.
Heat and cold treatments	Controlled temperature treatments aimed to kill or inactivate pests without causing any unacceptable prejudice to the treated material itself. The measures addressed in this information sheet are: autoclaving; steam; hot water; hot air; cold treatment Hot treatment of propagation material to reduce/eliminate pathogen load and, possibly, vector egg viability. Heat treatment can reduce phytoplasma inoculum on woody host	Entry, establishment and spread	All pests categorised here apart from '*Ca*. P. hispanicum', as it infects only *Fragaria* among the host plants.
Chemical treatments on crops including reproductive material	Insecticide treatments of crops in the presence of the vector and according to its biology, to reduce risk of infection	Establishment and spread	Competent vectors present in the EU: PYLR, '*Ca*. P. trifolii', '*Ca.* P. aurantifolia'–related strains.
Use of resistant and tolerant plant species/varieties	Resistant plants are used to restrict the growth and development of a specified pest and/or the damage they cause when compared to susceptible plant varieties under similar environmental conditions and pest pressure. It is important to distinguish resistant from tolerant species/varieties. Use of tolerant/resistant varieties, when available, may help reducing the economic damage	Establishment, spread and impact	Known tolerant/ resistant varieties are available to: PYLR, '*Ca*. P. fraxini', '*Ca*. P. ziziphi'.
Post-entry quarantine and other restrictions of movement in the importing country	This information sheet covers post-entry quarantine of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; Prohibition of import of relevant commodities into the domestic country. Relevant commodities are plants, plant parts and other materials that may carry pests, either as infection, infestation, or contamination. Identifying phytoplasma–infected plants limits the risks of entry, establishment and spread in the EU	Entry, establishment and spread	All phytoplasmas categorised here

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 17.

Table 17: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/ establishment/ spread / impact)	Agent
Inspection and trapping	Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5). The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques. As phytoplasma symptoms are usually specific, visual inspection of entry material may reduce the risk of entry of infected and symptomatic plants	Entry	All phytoplasmas categorised here, with the exception of '*Ca*. P. hispanicum'
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols. Diagnostic protocols describe the minimum requirements for reliable diagnosis of regulated pests. As universal phytoplasma primers are available, molecular detection of the pathogens according to a sampling strategy may identify the phytoplasmas independently of the presence of symptoms in the host	Entry	All phytoplasmas categorised here
Delimitation of Buffer zones	ISPM 5 defines a buffer zone as "an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimize the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate" (ISPM 5). The objectives for delimiting a buffer zone can be to prevent spread from the outbreak area and to maintain a pest free production place, site or area. If the presence of the pathogen is restricted, a buffer zone (based on the flight capability of the vector) may help reduce the risk of contamination of infected entry material	Spread	All phytoplasmas categorised here

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

- Asymptomatic infection is reported for some agents (PYLR on *Pyrus*, '*Ca*. P. australiense' on *Carica papaya*, '*Ca*. P. fraxini' on *Fraxinus*, '*Ca*. P. aurantifolia'-related strains on *Prunus* and *Pyrus*, and '*Ca*. P. ziziphi' on *Ziziphus* spp.);
- The asymptomatic phase of phytoplasma infection hampers visual detection;
- The low concentration and uneven distribution in the woody hosts impairs reliable detection;
- There is a wide host range for some phytoplasmas ('*Ca*. P. aurantifolia'–related strains, '*Ca*. P. australiense', '*Ca*. P. hispanicum', '*Ca*. P. fraxini', '*Ca*. P. trifolii', and '*Ca*. P. ziziphi);
- There is a lack of information on competent vectors for some agents (NAGYIII and Buckland valley grapevine yellows phytoplasmas).

3.6.1.4. Biological or technical factors limiting the ability to prevent the presence of the pest on plants for planting

Although Annex IV AI, at point 19.2, requires an*"official statement that no symptoms of diseases caused by the relevant harmful organisms"* (in our case non-European virus-like organisms, here non-EU phytoplasmas) *"have been observed on the plants at the place of production since the beginning of the last complete cycle of vegetation"*, this measure is considered to have limited impact in preventing import of infected plants of host plants intended for planting. This is because symptoms in the infected woody plants often appear one year after inoculation by the insect vector.

3.7. Uncertainty

For each phytoplasma, the specific uncertainties are reported in the conclusion tables below. Uncertainties affecting all the phytoplasmas characterised here are:

- The categorised pests are referred to in Council Directive 2000/29/EC as "virus-like organisms of the host plant" and not as "phytoplasmas", which could have led to inconsistencies in disease naming in official databases and legislation;
- Disease names are based on symptomatology on the host where the disease was first described, but phytoplasma symptoms are not species-specific, therefore issues in the classification could have led to inconsistencies in disease naming in official databases and legislation;
- Lack of biological information (competent vectors, host range, epidemiological details);
- Volume of imported plants for planting of the unregulated hosts;
- Distribution of the pests both in and outside the EU.

4. Conclusions

The Panel conclusions on this pest categorisation of non-EU phytoplasmas of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. are:

- All the phytoplasmas categorised here meet all the criteria evaluated by EFSA to qualify as potential Union quarantine pests.
- All the phytoplasmas categorised here do not meet the criteria evaluated by EFSA to qualify as potential RNQPs because they are non-EU phytoplasmas.

These conclusions are associated with uncertainty for phytoplasmas for which information on distribution, biology and epidemiology is limited. As a consequence, the categorisation presented here might change for some phytoplasmas as new data become available. However, the following general conclusions can be drawn:

- The identity of all the phytoplasmas categorised here is established and diagnostic techniques are available.
- All these phytoplasmas could enter the EU, especially by movement of infected plants for planting. Were this to happen, they could become established, spread and lead to impacts on the host plants, but often also on other hosts.
- For all the phytoplasmas categorised here, phytosanitary measures are available to reduce the likelihood of entry, establishment and spread in the EU.

The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) are reported for each of the phytoplasmas categorised here in Tables 18–26.

4.1. 'Candidatus Phytoplasma aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)

Table 18: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of '*Ca*. P. aurantifolia'–related strains is established and diagnostic techniques are available.	The identity of '*Ca*. P. aurantifolia'–related strains is established and diagnostic techniques are available.	None
Absence/presence of the pest in the EU territory (Section 3.2)	'*Ca*. P. aurantifolia'–related strains have been reported in the EU. Reports from EU MS (Greece, Italy, Portugal, UK) refer to few infected plants. '*Ca*. P. aurantifolia'–related strains are not considered to be widely present in the EU.	'*Ca*. P. aurantifolia'–related strains are known to be present in the EU, but only from some MS with a restricted distribution.	Reports from the EPPO GD in Greece and Portugal have no further details. Reports from two EU MS refer to few infected plants (Italy) or a single location (UK).
Regulatory status (Section 3.3)	'*Ca*. P. aurantifolia'–related strains can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. aurantifolia'–related strains can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. aurantifolia'–related strains are not explicitly mentioned in Directive 2000/29/EC.
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	'*Ca*. P. aurantifolia'–related strains are able to enter in the EU. The plant pathways (both host plants and other hosts) are partially regulated by existing legislation. The vector pathway is open. If '*Ca*. P. aurantifolia'–related strains were to enter the EU, they could become established and spread.	Plants for planting are the main means of spread for '*Ca*. P. aurantifolia'–related strains.	The susceptibility of *Malus* and *Vitis* needs to be confirmed. The host range is not fully known. The vector ability of EU phloem feeder insects is uncertain.
Potential for consequences in the EU territory (Section 3.5)	The introduction and spread of '*Ca*. P. aurantifolia'–related strains would have a negative impact on *Malus, Prunus, Pyrus* and *Vitis* industries, as well as on other crops (e.g. *Citrus*).	The presence of the '*Ca*. P. aurantifolia'–related strains on plants for planting would have a negative impact on their intended use.	Impacts on *Malus* and *Vitis* industries need to be confirmed.
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of establishment and spread of '*Ca*. P. aurantifolia'–related strains in the EU.	Certification of plants for planting material for susceptible hosts is by far the most efficient control measure.	None

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Conclusion on pest categorisation (Section 4)	'*Ca*. P. aurantifolia'–related strains meet all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest.	'*Ca*. P. aurantifolia'–related strains are a non-EU phytoplasma and thus do not meet all the EFSA criteria to qualify as a potential Union RNQP.	
Aspects of assessment to focus on / scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

4.2. '*Candidatus* Phytoplasma australiense' (reference strain)

Table 19: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma australiense' (reference strain)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of '*Ca*. P. australiense' is established and diagnostic techniques are available	The identity of '*Ca*. P. australiense' is established and diagnostic techniques are available	None
Absence/presence of the pest in the EU territory (Section 3.2)	'*Ca*. P. australiense' is not known to be present in the EU.	'*Ca*. P. australiense' is not known to be present in the EU.	None
Regulatory status (Section 3.3)	'*Ca*. P. australiense' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. australiense' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. australiense' is not explicitly mentioned in Directive 2000/29/EC.
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	'*Ca*. P. australiense' is able to enter in the EU. The plant pathways (both host plants and other hosts) are partially regulated by existing legislation. The vector pathway is open. If '*Ca*. P. australiense' were to enter the EU territory, it could become established and spread.	Plants for planting are the main means of spread for '*Ca*. P. australiense'.	The susceptibility of *Prunus* needs to be confirmed. The host range is not fully known. The potential vector ability of EU phloem feeder insects is uncertain.

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Potential for consequences in the EU territory (Section 3.5)	The introduction and spread of '*Ca*. P. australiense' would have a negative impact on *Vitis*, *Fragaria*, *Prunus* and *Rubus* industries, as well as other crops (see section 3.4.1).	The presence of the '*Ca*. P. australiense' on plants for planting would have a negative impact on their intended use.	None
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread of '*Ca*. P. australiense' in the EU.	Certification of plants for planting material for susceptible host is by far the most efficient control measure.	None
Conclusion on pest categorisation (Section 4)	'*Ca*. P. australiense' meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest.	'*Ca*. P. australiense' is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP.	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available.		

4.3. '*Candidatus* Phytoplasma fraxini' (reference strain)

Table 20: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma fraxini' (reference strain)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of '*Ca*. P. fraxini' is established and diagnostic techniques are available	The identity of '*Ca*. P. fraxini' is established and diagnostic techniques are available	None
Absence/presence of the pest in the EU territory (Section 3.2)	'*Ca*. P. fraxini' has been reported in the EU, but with a restricted distribution, as the pest has been reported only twice in Italy	'*Ca*. P. fraxini' is known to be present in the EU, but with a restricted distribution.	The reports from Italy were published by the same research group and were never confirmed.
Regulatory status (Section 3.3)	'*Ca*. P. fraxini' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. fraxini' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. fraxini' is not explicitly mentioned in Directive 2000/29/EC.

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	'*Ca*. P. fraxini' is able to enter in the EU. The plant pathways (both host and others) are partially regulated by existing legislation. The vector pathway is open. If '*Ca*. P. fraxini' were to enter the EU territory, it could become established and spread	Plants for planting are the main means of spread for '*Ca*. P. fraxini'	The host range is not fully known. The potential vector ability of EU phloem feeder insects is uncertain
Potential for consequences in the EU territory (Section 3.5)	The introduction and spread of '*Ca*. P. fraxini' would have a negative impact on *Fragaria, Prunus* and *Vitis* industries, as well as other crops (see section 3.4.1)	The presence of the '*Ca*. P. fraxini' on plants for planting would have a negative impact on their intended use	None
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of establishment and spread of '*Ca*. P fraxini' in the EU	Certification of plants for planting material for susceptible hosts is by far the most efficient control measure	None
Conclusion on pest categorisation (Section 4)	'*Ca*. P. fraxini' meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	'*Ca*. P. fraxini' is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP	
Aspects of assessment to focus on/scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

4.4. '*Candidatus* Phytoplasma hispanicum' (reference strain)

Table 21: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma hispanicum' (reference strain)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of '*Ca*. P. hispanicum' is established and diagnostic techniques are available.	The identity of '*Ca*. P. hispanicum' is established and diagnostic techniques are available.	The phytoplasma listed as Strawberry witches' broom mycoplasm (SYWB00) in Annex IAI was detected before the development of molecular identification tools, therefore its designation as related strain of '*Ca*. P. hispanicum' is uncertain

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Absence/presence of the pest in the EU territory (Section 3.2)	'*Ca*. P. hispanicum' is not known to be present in the EU	No, '*Ca*. P. hispanicum' is not known to be present in the EU	None
Regulatory status (Section 3.3)	'*Ca*. P. hispanicum' can be considered as regulated in Annex IAI as "Strawberry witches' broom mycoplasm"	'*Ca*. P. hispanicum' can be considered as regulated in Annex IAI as "Strawberry witches' broom mycoplasm"	'*Ca*. P. hispanicum' is not explicitly mentioned in Directive 2000/29/EC. There is uncertainty on the assignation of the Strawberry witches' broom mycoplasm (regulated in Annex IAI) to '*Ca*. P. hispanicum'
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	'*Ca*. P. hispanicum' is able to enter in the EU. The plant pathways (both host plants and other hosts) are partially regulated by existing legislation. The vector pathway is regulated by current regulation. If '*Ca*. P. hispanicum' were to enter the EU, it could become established and spread	Plants for planting are the main means of spread for '*Ca*. P. hispanicum'	The presence of the phytoplasma in Canada and Japan is uncertain. The host range is not fully known. There is uncertainty on the vector ability of *B. cockerelli.* The potential vector ability of EU phloem feeder insects is unclear
Potential for consequences in the EU territory (Section 3.5)	The introduction and spread of '*Ca*. P. hispanicum' would have a negative impact on *Fragaria* industry, as well as other crops (see section 3.4.1)	The presence of the '*Ca*. P. hispanicum' on plants for planting would have a negative impact on their intended use	None
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread of '*Ca*. P. hispanicum' in the EU	Certification of plants for planting material for susceptible host is by far the most efficient control measure	None
Conclusion on pest categorisation (Section 4)	'*Ca*. P. hispanicum' meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	'*Ca*. P. hispanicum' is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP	
Aspects of assessment to focus on/scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

4.5. '*Candidatus* Phytoplasma pruni'-related strain (North American grapevine yellows, NAGYIII)

Table 22: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma pruni'-related strain (North American grapevine yellows, NAGYIII)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of NAGYIII is established and diagnostic techniques are available	The identity of NAGYIII is established and diagnostic techniques are available	None
Absence/presence of the pest in the EU territory (Section 3.2)	NAGYIII is not known to be present in the EU.	NAGYIII is not known to be present in the EU.	None
Regulatory status (Section 3.3)	NAGYIII can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	NAGYIII can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	NAGYIII is not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	NAGYIII is able to enter in the EU. The pathway of *Vitis* plant for planting is closed by existing legislation. Other potential pathways (other hosts and vectors) may be open. If NAGYIII were to enter the EU territory, it could become established and spread.	Plants for planting are the main means of spread of NAGYIII.	The geographical distribution and the host range are not fully known. The potential vector ability of EU phloem feeder insects is unclear. There is uncertainty about the presence of other unknown vectors
Potential for consequences in the EU territory (Section 3.5)	The introduction and spread of NAGYIII would have a negative impact on *Vitis* industry	The presence of the NAGYIII on plants for planting would have a negative impact on their intended use.	The magnitude of the impact of NAGYIII under EU conditions is unclear
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread of NAGYIII in the EU.	Certification of plants for planting material for susceptible host is by far the most efficient control measure.	None
Conclusion on pest categorisation (Section 4)	NAGYIII meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	NAGYIII is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP	
Aspects of assessment to focus on/scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

4.6. '*Candidatus* Phytoplasma pyri'-related strain (peach yellow leaf roll, PYLR)

Table 23: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma pyri'-related strain (peach yellow leaf roll, PYLR)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of PYLR is established and diagnostic techniques are available	The identity of PYLR is established and diagnostic techniques are available	None
Absence/ presence of the pest in the EU territory (Section 3.2)	PYLR is not known to be present in the EU.	PYLR is not known to be present in the EU.	None
Regulatory status (Section 3.3)	PYLR can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	PYLR can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	PYLR is not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	PYLR is able to enter in the EU. The pathway of *Prunus* plant for planting is partially regulated by existing legislation. Other potential pathways (other hosts) may be open. The vector pathway is open. If PYLR were to enter the EU territory, it could establish and spread. The PYLR vector, *Cacopsylla pyricola*, is already present in the EU.	Plants for planting are the main means of spread for PYLR.	The presence of PYLR in *Pyrus* has not been definitively assessed. The host range is not fully known. The potential vector ability of EU phloem feeder insects is uncertain, as well as the existence of other unknown vectors.
Potential for consequences in the EU territory (Section 3.5)	The introduction and spread of PYLR would have a negative impact on *Prunus* industry.	The presence of the PYLR on plants for planting would have a negative impact on their intended use.	The magnitude of the impacts of PYLR under EU conditions.
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread of PYLR in the EU.	Certification of plants for planting material for susceptible hosts is by far the most efficient control measure.	None
Conclusion on pest categorisation (section 4)	PYLR meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest.	PYLR is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP.	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

4.7. '*Candidatus* Phytoplasma trifolii' (reference strain)

Table 24: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma trifolii' (reference strain)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of '*Ca*. P. trifolii' is established and diagnostic techniques are available	The identity of '*Ca*. P. trifolii' is established and diagnostic techniques are available	None
Absence/ presence of the pest in the EU territory (Section 3.2)	Yes, '*Ca*. P. trifolii' has been reported in the EU. Reports from EU MS (Austria, Czech Republic, Italy, Spain) refer to few infected plants. '*Ca*. P. trifolii' is not considered to be widely present in the EU	Yes, '*Ca*. P. trifolii' is known to be present in the EU, but only from some MS with a restricted distribution	Reports from four EU MS refer to few infected plants
Regulatory status (Section 3.3)	'*Ca*. P. trifolii' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. trifolii' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. trifolii' is not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	'*Ca*. P. trifolii' is able to enter in the EU. The plant pathways (both host plants and other hosts) are partially regulated by existing legislation. The vector pathway is open. If '*Ca*. P. trifolii' were to enter the EU territory, it could become established and spread	Plants for planting are the main means of spread for '*Ca*. P. trifolii'	The susceptibility of *Prunus* and *Vitis* needs to be confirmed. The host range is not fully known. The vector ability of EU phloem feeder insects is uncertain
Potential for consequences in the EU territory (section 3.5)	The introduction and spread of '*Ca*. P. trifolii' would have a negative impact on the *Fragaria* industry, as well as other crops (see section 3.4.1)	The presence of the '*Ca*. P. trifolii' on plants for planting would have a negative impact on their intended use	Impacts on *Prunus* and *Vitis* industries need to be confirmed
Available measures (Section 3.6)	Phytosanitary measures are available to reduce the likelihood of establishment and spread of '*Ca*. P. trifolii' in the EU	Certification of plants for planting material for susceptible host is by far the most efficient control measure	None
Conclusion on pest categorisation (Section 4)	'*Ca*. P. trifolii' meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	'*Ca*. P. trifolii' is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

4.8. '*Candidatus* Phytoplasma ziziphi' (reference strain)

Table 25: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for '*Candidatus* Phytoplasma ziziphi' (reference strain)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of '*Ca*. P. ziziphi' is established and diagnostic techniques are available	The identity of '*Ca*. P. ziziphi' is established and diagnostic techniques are available	None
Absence/ presence of the pest in the EU territory (Section 3.2)	'*Ca*. P. ziziphi' has been reported in the EU (one MS). Reports from Italy refer to few infected plants. '*Ca*. P. ziziphi' is not considered to be widely present in the EU	'*Ca*. P. ziziphi' is known to be present in the EU, but only from Italy and with a restricted distribution	Reports from Italy involve mixed infections with '*Ca*. P. solani' and '*Ca*. P. asteris' and lack further characterisation beside PCR and RFLP analyses
Regulatory status (Section 3.3)	'*Ca*. P. ziziphi' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. ziziphi' can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	'*Ca*. P. ziziphi' is not explicitly mentioned in Directive 2000/29/EC.
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	'*Ca*. P. ziziphi' is able to enter in the EU. The pathways of *Malus* and *Prunus* plants are closed by existing legislation. The pathways for other hosts are partially regulated by existing legislation. The vector pathway is open. If '*Ca*. P. ziziphi' were to enter the EU territory, it could become established and spread	Plants for planting are the main means of spread for '*Ca*. P. ziziphi'.	The host range is not fully known. The vector ability of EU phloem feeder insects is uncertain
Potential for consequences in the EU territory (Section 3.5)	The introduction and spread of '*Ca*. P. ziziphi' would have a negative impact on *Malus* and *Prunus* industries, as well as other crops (see section 3.4.1)	The presence of the '*Ca*. P. ziziphi' on plants for planting would have a negative impact on their intended use	None
Available measures (section 3.6)	Phytosanitary measures are available to reduce the likelihood of establishment and spread of '*Ca*. P. ziziphi' in the EU	Certification of plants for planting material for susceptible hosts is by far the most efficient control measure	None
Conclusion on pest categorisation (Section 4)	'*Ca*. P. ziziphi' meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest	'*Ca*. P. ziziphi' is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

4.9. Unclassified Buckland valley grapevine yellows phytoplasma

Table 26: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for Buckland valley grapevine yellows phytoplasma

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the Buckland valley grapevine yellows phytoplasma is established and diagnostic techniques are available	The identity of the Buckland valley grapevine yellows phytoplasma is established and diagnostic techniques are available	None
Absence/ presence of the pest in the EU territory (Section 3.2)	The Buckland valley grapevine yellows phytoplasma is not known to be present in the EU	The Buckland valley grapevine yellows phytoplasma is not known to be present in the EU	None
Regulatory status (Section 3.3)	The Buckland valley grapevine yellows phytoplasma can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	The Buckland valley grapevine yellows phytoplasma can be considered as regulated in Annex IAI as "Non-European viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L., and *Vitis* L."	The Buckland valley grapevine yellows phytoplasma is not explicitly mentioned in Directive 2000/29/EC
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	The Buckland valley grapevine yellows phytoplasma is able to enter in the EU. The pathway of *Vitis* plant for planting is closed by existing legislation. Other potential pathways (other hosts and vectors) may be open. If the Buckland valley grapevine yellows phytoplasma were to enter the EU territory, it could establish and spread	Plants for planting are the main means of spread for the Buckland valley grapevine yellows phytoplasma	The host range is not fully known. The existence of competent vectors is unclear. The potential vector ability of EU phloem feeder insects is uncertain
Potential for consequences in the EU territory (section 3.5)	The introduction and spread of Buckland valley grapevine yellows phytoplasma would have a negative impact on the *Vitis* industry	The presence on plants for planting would have a negative impact on their intended use	The magnitude of the impacts of the Buckland valley grapevine yellows phytoplasma under EU conditions is unclear
Available measures (section 3.6)	Phytosanitary measures are available to reduce the likelihood of entry and spread of Buckland valley grapevine yellows phytoplasma in the EU	The certification of plants for planting material for susceptible hosts is by far the most efficient control measure	None
Conclusion on pest categorisation (Section 4)	The Buckland valley grapevine yellows phytoplasma meets all the criteria evaluated by EFSA to qualify as a potential Union quarantine pest.	The Buckland valley grapevine yellows phytoplasma is a non-EU phytoplasma and thus does not meet all the EFSA criteria to qualify as a potential Union RNQP.	

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Aspects of assessment to focus on/ scenarios to address in future if appropriate	The main knowledge gaps are listed in this table. Given the limited information available, the development of a full PRA would not allow solving the uncertainties of the present categorisation until more data become available		

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Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017)

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

Abbreviations

AshY	Ash yellows
AWB	Alfalfa witches'-broom
BLL	Brinjal little leaf
BLTV	Beet leafhopper-transmitted virescence
Ca. P.	*Candidatus* Phytoplasma
CABI	Centre for Agriculture and Bioscience International
CPC	Crop Protection Compendium
CrWB	Crotalaria witches'-broom
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
GD	Global Database
ILEY	Illinois elm yellows
IPPC	International Plant Protection Convention
IRPCM	International Research Programme on Comparative Mycoplasmology
ISPM	International Standards for Phytosanitary Measures
LAMP	Loop mediated isothermal amplification
MLO	Mycoplasma-like organism
MS	Member State
NAGYIII	North American Grapevine Yellows
PCR	Polymerase Chain Reaction
PD	Pear decline
PDTWII	Pear decline Taiwan II
PHYPAA	*Candidatus* Phytoplasma australasia
PHYPAF	*Candidatus* Phytoplasma aurantifolia

PHYPAU	*Candidatus* Phytoplasma australiense
PHYPFR	*Candidatus* Phytoplasma fraxini
PHYPPH	*Candidatus* Phytoplasma phoenicium
PHYPTR	*Candidatus* Phytoplasma trifolii
PHYPZI	*Candidatus* Phytoplasma ziziphi
PHYP01	Tomato big bud
PHYP07	*Candidatus* Phytoplasma hispanicum
PHYP39	Sweet potato little leaf
PHYP61	Willow witches' broom phytoplasma
PHYP62	Brinjal little leaf phytoplasma and Eggplant little leaf phytoplasma
PHYP75	Strawberry multiplier disease phytoplasma
PLH	Plant Health
PYLR	Peach yellow leaf roll
PWB	Potato witches'-broom
PZ	Protected Zone
RFLP	Restriction Fragment Length Polymorphism
RNQP	Regulated Non-Quarantine Pest
RRO	Risk reduction option
SPLL	Sweet potato little leaf
SYWB00	Strawberry witches' broom mycoplasm
TBB	Tomato big bud
TFEU	Treaty on the Functioning of the European Union
The host plants	*Cydonia, Fragaria, Malus, Prunus, Pyrus, Ribes, Rubus* and *Vitis*
ToR	Terms of Reference
WoS	Web of Science

Appendix A – Symptoms on plants other than *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.

Table A.1 provides a synopsis of symptoms caused by the phytoplasmas categorised here on plants other than the host plants.

Table A.1: Summary of symptoms of the categorised non-EU phytoplasmas on plants other than the host plants

Phytoplasma name, reference strain/related strain name	Symptoms on plants other than *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.
'*Ca.* P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	*Allium cepa*: phyllody and virescence in onion inflorescence, axillary growth, yellowing and proliferation (Sharif et al., 2019); *Amaranthus* spp.,: excessive stem and bud proliferation, mosaics and unusual coloration (Ochoa-Sanchez et al., 2009); *Apium graveolens*: stunting, chlorosis and reddening of the leaf tips (Tran-Nguyen et al., 2003); *Beta vulgaris* ssp. esculenta: narrow, misshapen and crinkled leaves with margins unevenly undulated, branching, shortening of internodes and growth of auxiliary buds, witches broom appearance, yellowing, stunting, and gradual reddening (Mirzaie et al., 2007); *Brassica chinensis*: phyllody (Davis and Tsatsia, 2009); *Brassica juncea*: stunting and curly leaf edges (Omar, 2017); *Brassica oleracea*: thicker leaves, protracted thick shoots and failure to head formation (Sharif et al., 2019), phyllody-like symptoms leading to floral abnormalities (Cai et al., 2016); *Calendula officinalis*: leaf size reduction, yellowing, phyllody, virescence, proliferation and sterility in the flower, proliferation of axillary buds along the stem, witches' broom and stunting (Esmailzadeh-Hosseini et al., 2011a); *Callistephus chinensis*: emergence of new yellow leaves during the vegetative growth stage, followed by the leaf petiole turning upright with the clustering of leaves, and then the affected plant stops growing and it becomes stunted, at the later stage of plant growth, some flowers show green petals instead of their normal color (Win et al., 2011); *Capsicum annuum*: phyllody, abnormal flower development, yellowing, reduced leaf size and short internodes (Sharma et al., 2015), little leaf, chlorosis and phyllody (Tran-Nguyen et al., 2003); *Capsicum* spp. and *Solanum* [Cyphomandra] *betaceum*: stunting, severe leaf mottling and bunching of small mottled leaves (Harling et al., 2009); *Cardaria draba*: dwarfing, virescence, phyllody and infertile flowers (Esmailzadeh-Hosseini et al., 2011b); *Carica papaya*: shortening of internodes of the inner crown leaves, giving a bunchy appearance to the crown, leaf yellowing and crinkling, mosaic, stunting a marked reduction in latex flow, small fruits, no flowering or fruit production in the advanced stages, young plants with a bending of the apical growing point, and chlorosis of the crown leaves, followed by basipetal necrosis of the young leaf (Acosta et al., 2013); *Celosia argentea*: stunting (shortening of internodes), twisting and flat stem (the fasciation of a stem), discoloration of petals, deformed flowers, and witches' broom (Madhupriya et al., 2017b), Little leaf and witches' broom (Davis and Tsatsia, 2009)); *Cicer arietinum*: leaf deformation, 'little leaf', leaf and stem discoloration, stunting and dwarfism (Saqib et al., 2005), floral virescence, phyllody and extensive proliferation of the branches (Akhtar et al., 2009); *Cichorium intybus*: little leaf and phyllody (Tran-Nguyen et al., 2003); *Corchorus olitorius*: phyllody, abnormal development of flowers, yellowing, reduced leaf size and short internodes (Ozdemir and Cagirgan, 2015);

	Conocarpus erectus: leaf roll, little leaf, stem fasciation and plant exudation on leaves (Azimi et al., 2017); *Crotalaria aegyptiaca*: significant proliferation of shoots, reduced stem height, and an increased number of leaves compared to healthy plants; at the same time witches' broom symptoms were observed with the progress of the disease symptoms (Al-Subhi et al., 2017); *Crotalaria juncea*: chlorotic leaves, internodes shortening, leaves reduced in size, and shoot proliferation (Win et al., 2011); *Daucus carota*: phyllody, hairy roots, shoot proliferation, and yellowish and purplish leaves (Sharif et al., 2019); *Dendrocalamus strictus*: typical witches' broom phenotype with severe proliferative branching at nodal regions and reduction in leaf size (Yadav et al., 2016). *Fallopia japonica*: proliferation, shortened internodes and small leaves (Reeder et al., 2010); *Gerbera jamesonii*: green deformed flowers with many small petals; the infected plants did not die after the infection, but continued to grow new suckers that produced green deformed flowers (Siddique, 2005); *Glycine max*: shoot proliferation, reduced size of the leaflets and petiole, proliferation of axillary shoots with shortened internodes, phyllody, and virescence (Murithi et al., 2015); *Gypsophila paniculata*: small, narrow basal leaves, often yellow in color; shoot proliferation, excessive leaf growth (witches' broom or 'asparagus fern') and poor flower set (Gera et al., 2007); *Helianthus* spp.: phyllody-like symptoms leading to floral abnormalities (Mulpuri and Muddanuru, 2016) *Jasminum sambac*: witches broom yellowing, dieback of branches, reduced leaf size, short internodes and proliferation of axillary shoots as well as reduced overall size, resulting in a bushy plant; flowers of the diseased plants were also reduced in size and tended to bloom and then decline much faster than those of asymptomatic plants (Al-Zadjali et al., 2007); *Lactuca sativa*: leaf yellowing, chlorosis, and little leaf (Arocha et al., 2009b); *Linum usitatissimum*: floral virescence, phyllody, little leaf, stunting and stem fasciation (Akhtar et al., 2013); *Malvaviscus arborus*, *Codiaeum variegatum*, *Hibiscus rosa-sinensis*, *Passiflora edulis*: little leaf, chlorosis, and leaf yellowing and deformation (Arocha et al., 2009a); *Manihot esculenta*: leaf yellowing, chlorosis, shortening of internodes, and slight stunting (Arocha et al., 2009a); *Manilkara zapota*: leaf yellowing and witches' broom (Acosta et al., 2009); *Matthiola incana*: plants were stunted and rosetted, but the main symptoms, appearing at the flowering stage, were malformation of white flowers and virescence (Davino et al., 2007); *Medicago sativa*: stunting, yellows, witches' broom and phyllody (Omar, 2017), witches' broom, little leaf, leaf deformation, leaf reddening, stunting and flower malformation (Hosseini et al., 2013a); proliferation of shoots and yellowing of leaves in 1- to 2-year-old plants and tillering of stems in 4- to 5-year-old plants (Khan et al., 2001); *Mirabilis jalapa*: small yellow leaves with very short internodes and small-sized flowers (Sobolev et al., 2007); *Parthenium hysterophorus*: severe stunting, excessive proliferation of shoots, inflorescence-clustering, green petal, small leaves and witches'-broom (Li et al., 2011), phyllody, yellowing of leaves (Bekele et al., 2011); *Petroselinum crispum*: excessive development of short spindly shoots from crown buds, little leaf, yellowing, witches' broom, stunting, flower virescence and phyllody (Salehi et al., 2016a); *Phaseolus vulgaris*: leaf yellowing, chlorosis, and little leaf (Arocha et al., 2009b); *Praxelis clematidea*: phyllody and witches' broom (Yang et al., 2017); *Prosopis farcta*: small laves, shortened internodes, proliferation of axillary buds and bushy growing habit (Esmailzadeh-Hosseini et al., 2011b);

	Rosa spp.: leaf chlorosis, little leaf, yellowing, virescence, shortening of internodes, stunting, bud-proliferation, phyllody, and witches' broom (Madhupriya et al., 2017a); *Sesamum indicum*: phyllody, virescence and witches' broom symptoms (Khan et al., 2007); *Solanum lycopersicum*: stunting, purpling, adventitious root formation, dwarfed, misshapen leaves, enlargement and elongation of stems and pedicels, and a proliferation of erect, enlarged, malformed buds accompanied by enlarged, malformed sepals and virescent petals (Testen et al., 2015), small leaves of lateral shoots, purplish top leaves, phyllody, enlarged pistils, hypertrophic calyxes and small and polygonal fruit (Xu et al., 2013), stunting, proliferation of auxiliary shoots, purplish- or yellowish-colored leaves of reduced size, and greening of flower petals or phyllody (Dong et al., 2013); *Solanum tuberosum*: yellowing of leaves, stunting and little leaf (Hodgetts et al., 2009); *Stylosanthes* spp.: floral virescence, phyllody and abortion (De La Rue et al., 2003); *Trifolium repens*: little leaf and leaf reddening (Hosseini et al., 2013b); *Vicia faba*: phyllody (Omar, 2017); *Zinnia elegans*: phyllody, virescence, witches' broom, little leaf and yellowing (Hemmati and Nikooei, 2017)
'*Ca.* P. australiense' (reference strain)	*Coprosma* spp.: abnormal interveinal chlorosis and yellowing of leaves, abnormal leaf reddening, slowing of growth, and shoot dieback (Liefting et al., 2007); *Cordyline australis*: sometimes plant death (Liefting et al., 2007); *Liquidambar styraciflua*: chronic patchy chlorosis of the crown and dieback of apical and lateral branches (Habili et al., 2007); *Phormium* spp.: intense yellowing of older leaves and vascular damage in the rhizome, followed by plant collapse and death (Liefting et al., 2007); *Senna surattensis*: stem fasciation and shoot proliferation (Wu et al., 2012)
'*Ca.* P. fraxini' (reference strain)	*Fraxinus* spp: slow growth, progressive loss of vitality, dieback and premature death (Sinclair et al., 1996; Filgueira et al., 2018); . *Liquidambar styraciflua*: crown deformation, yellowing, small leaves, tufted foliage, epicormic growth, and abnormal elongation of apical shoot (Franco-Lara et al., 2017); *Medicago sativa*: witches' broom, shoot proliferation, severely reduced leaf size, chlorosis, general stunting and flower abortion (Conci et al., 2005); *Phoenix dactylifera*: streak yellows (Zamharir and Eslahi, 2019)
'*Ca.* P. hispanicum' (reference strain)	*Brassica oleracea*: plant stunting, inflorescence malformation, reddening of the leaves and phloem necrosis (Eckstein et al., 2013); *Carica papaya*: foliar chlorosis, curvature of the apex, shortening of the internodes leading to bunching of the crown leaves, necrosis of the young apical parts, leaf drop, and dieback (Melo et al., 2013); *Opuntia ficus-indica*: cladode, mosaic, yellowing, proliferation and deformation of fruits in the whole plant or part of it (Suaste Dzul et al., 2012); *Solanum tuberosum*: purple discoloration (purple top) or yellowing of upper leaflets, apical leafroll, axillary buds, formation of aerial tubers, storage tubers from affected plants do not sprout, or the sprouting is of extremely weak stems deficient in chlorophyll giving the appearance of white threads (Santos-Cervantes et al., 2010)
'*Ca.* P. trifolii' (reference strain)	*Allium sativum*: plant stunting, leaf yellowing, leaf malformation, and bright and "waxy" appearance of the leaves (Reveles-Torres et al., 2018); *Carthamus tinctorius*: floral virescence, phyllody and proliferation, proliferation of axillary buds along the stem and little leaf symptoms (Salehi et al., 2009); *Centaurea solstitialis*: witches' broom, fasciations, abortion of buds and flower virescence (Faggioli et al., 2004); *Cota tinctoria*: witches' broom, stunting, twisting of the shoots and little leaf (Hemmati et al., 2018);

	Phaseolus vulgaris: leafy petals (phyllody) and aborted seed pods resembling thin, twisted, and corrugated leaf-like structures. Deformed sterile pods that were small, sickle-shaped, upright, and leathery were also observed. The infected plants generally exhibited chlorosis, stunting, or bud proliferation from leaf axils (Lee et al., 2004); *Phoenix dactylifera*: streak yellows in date palm leaves, elongated internodes, abnormal branches, and date leaf drying (Ghayeb Zamharir and Eslahi, 2019); *Physalis ixocarpa*: yellowing, stunted growth, foliar deformation, and phyllody (Mauricio-Castillo et al., 2018); *Portulaca grandiflora*: bud proliferation, downward curling, and diminishing size of leaves, followed by overall stunted growth and yellowing of the whole plant from April to June, some plants also formed rosettes and a proliferation of axillary shoots resulting in a witches'-broom appearance (Samad et al., 2008); *Rhododendron* hybrids: shortened axillary shoots, reduced leaves with vein clearing and yellowing, undeveloped flowers, and general stunting (Pribylova et al., 2009); *Salix* spp.: witches' broom, little leaf, and yellowing (Shahryari and Allahverdipour, 2018); *Solanum lycopersicum*: twisting, corrugated, yellowing, or reddening leaves. The sepals of the flowers acquired hypertrophied form, were fused, and created a bell-shaped sterile bud: phyllody of green or anthocyanin color. The stems of the plants were lignified, and necrosis of the phloem was observed on stem cuts (Khalil et al., 2019); severe fruit deformation, flower sterility, aerial rooting, purplish leaves and leaf rolling (Usta et al., 2018); severe dwarfing, yellowing, and decreased flowering (Salas-Munoz et al., 2016); stunting, yellowing or purplish leaves, proliferation of laterals buds, hypertrophic calyxes and virescent flowers (Choueiri et al., 2007); *Solanum melongena*: little leaf, phyllody, flower virescence, giant calyx, big bud and witches' broom (Rao and Kumar, 2017); small yellowish leaves that roll upward, stunted growth with shortened internodes and profuse branching that sometimes gave bushy structure to the plants. Infected plants of both species did not produce flowers (Siddique et al., 2001); *Solanum peruvianum*: BLTVA strain induced two types of symptoms. Type I plants displayed growth vigor and leaf pigmentation similar to the healthy plants, but produced branched inflorescences bearing a greatly increased number of flowers or buds, flowers could occasionally show partly attached sepals or inflated buds reminiscent of big bud symptoms, or some signs of floral reversion. When the symptoms were more pronounced, buds were replaced by meristematic, cauliflower-like structures, corresponding to a continuous branching and a perpetually delayed flower development. Type II plants showed a reduction in growth vigor, chlorosis at the margin of the leaflets and/or paleness of the leaves, and absence of flowers due to early growth arrest of the buds (buds remain smaller than 1 mm) (Garcion et al., 2014); *Solanum tuberosum*: potato witches'-broom disease including witches'-broom, little leaf, stunting, yellowing and swollen shoots formation in tubers (Hosseini et al., 2011); *Suaeda aegyptiaca*: witches' broom, yellowing and little leaf (Seyahooei et al., 2017); *Ulmus americana*: general yellowing of individual tree canopies, epinasty of foliage throughout the canopy, phloem discoloration, and on a subset of trees, a strong odor of methyl salicylate (Flower et al., 2018)
***'Ca.* P. ziziphi' (reference strain)**	*Dianthus chinensis*: white leaves and stunt symptoms (Zhang et al., 2010); *Diospyros kaki*: stem fasciation (Wang et al., 2015a); *Euonymus* spp.: abnormal branches, small leaves and phyllody (Ren et al., 2017); *Liquidambar* spp: crown deformation, yellowing, small leaves, tufted foliage, epicormic growth, abnormal elongation of apical shoots (Franco-Lara et al., 2017); *Orychophragmus* (Wang et al., 2015b): warfing and yellowing symptoms (Wang et al., 2015a); *Spirea salicifolia*: yellowed, dwarfed, deformed leaves (Li et al., 2010); *Ziziphus* spp.: *Z. nummularia* shows rosetting, proliferation of axillary shoots, witches' broom-like appearance and little leaves malformed and golden yellow, while *Z. jujuba* exhibits severe rosetting, but little leaves remain green (Khan et al., 2008)

Appendix B – Distribution maps

The available distribution maps of the non-EU phytoplasmas of the host plants (Source: EPPO, 2019) are provided in Figures B.1–B.3.

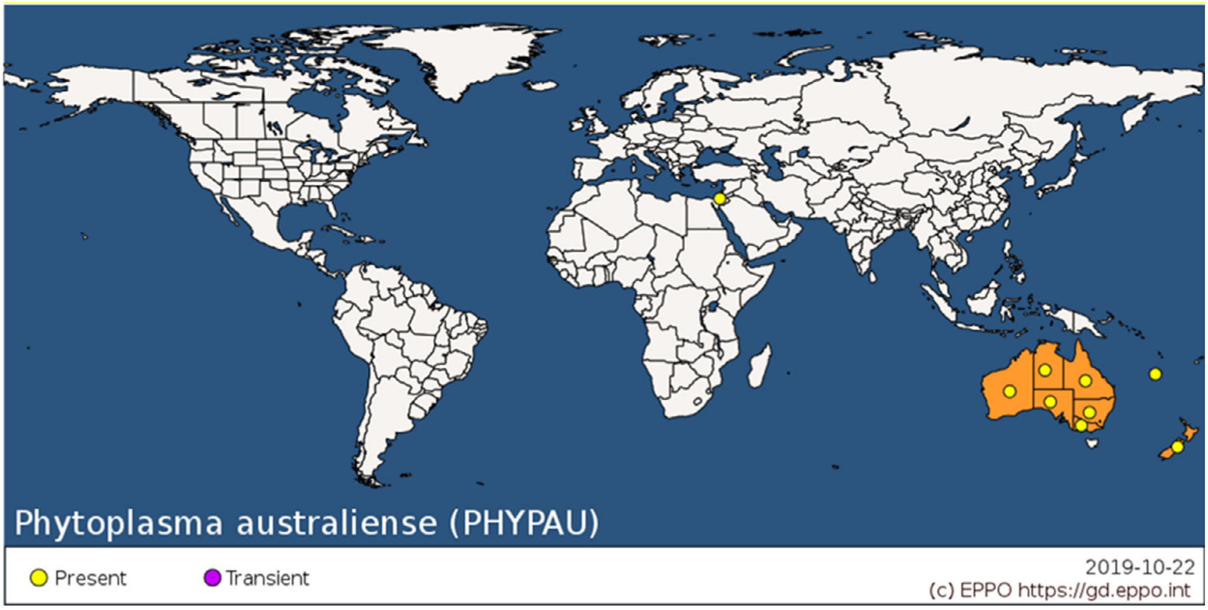

Figure B.1: EPPO distribution map for '*Candidatus* Phytoplasma australiense'

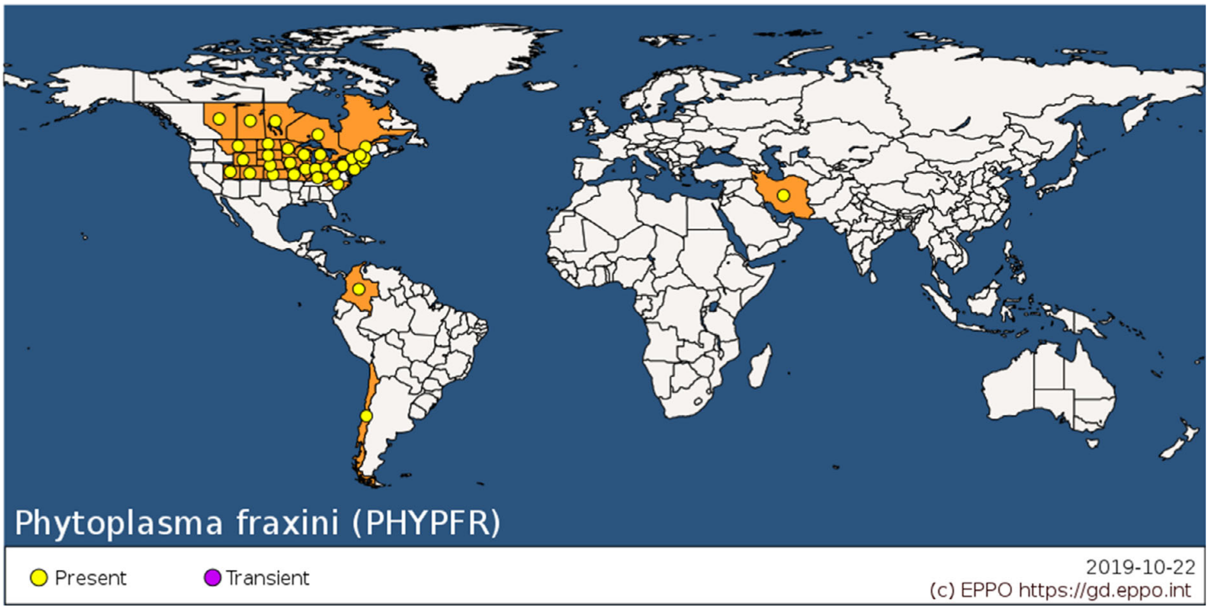

Figure B.2: EPPO distribution map for '*Candidatus* Phytoplasma fraxini'

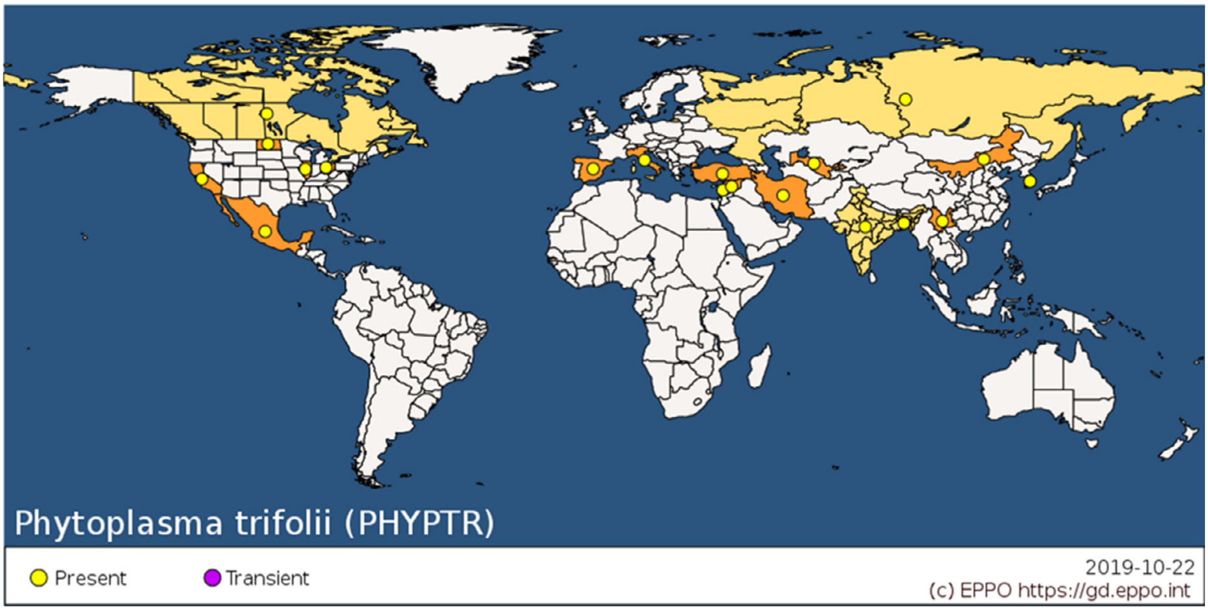

Figure B.3: EPPO distribution map for '*Candidatus* Phytoplasma trifolii'

Appendix C – List of other natural hosts

Table C.1 provides a list of natural hosts other than the target host plants for the phytoplasmas categorised here.

Table C.1: List of other natural hosts for the phytoplasmas categorised here

Phytoplasma name, reference strain/related strain name	Other natural hosts
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)	*Acacia salicina* (Azimi et al., 2018), *Achyranthes aspera* (Davis et al., 2003b), *Adenium obesum* (Win et al., 2012), *Aeschynomene americana* (Wilson et al., 2001), *Aeschynomene indica* (Schneider et al., 1999), *Allium cepa* (Sharif et al., 2019), *Alternanthera ficoidea* (Azimi et al., 2018), *Alysicarpus rugosus* (Davis et al., 1997b), *Alysicarpus vaginalis* (Davis et al., 2003b), *Amaranthus* spp. (Ochoa-Sanchez et al., 2009), *Apium graveolens* (Tran-Nguyen et al., 2003), *Arachis hypogaea* (EPPO, 2019), *Arachis pintoii* (Schneider et al., 1999), *Araujia sericifera* (Streten et al., 2005b), *Beta vulgaris* ssp. *esculenta* (Mirzaie et al., 2007), *Boeharvia* spp. (Padovan and Gibb, 2001), *Bougainvillea glabra* (Gopala and Rao, 2018), *Brassica chinensis* (Davis and Tsatsia, 2009), *Brassica juncea* (Omar, 2017), *Brassica oleracea* (Sharif et al., 2019), *Brugmansia candida* (Davis et al., 1997b), *Cajanus cajan* (Davis et al., 1997b), *Cajanus marmoratus* (Padovan and Gibb, 2001), *Calendula arvensis* (Tolu et al., 2006), *Calendula officinalis* (Esmailzadeh-Hosseini et al., 2011a), *Callistephus chinensis* (Win et al., 2011), *Callitris baileyi* (Streten et al., 2005b), *Canavalia* spp. (Cai et al., 2016), *Capsicum annuum* (Sharma et al., 2015), *Cardaria draba* (Esmailzadeh-Hosseini et al., 2011b), *Carica papaya* (Yang et al., 2016a), *Catharanthus roseus* (Davis et al., 2003b), *Celosia argentea* (Madhupriya et al., 2017b), *Celosia christata* (Azimi et al., 2018), *Cenchrus ciliaris* (Tran-Nguyen et al., 2000), *Centrosema pascuorum* (Wilson et al., 2001), *Chenopodium carinatum* (Streten et al., 2005b), *Chenopodium* spp. (Tolu et al., 2006), *Chrysanthemum morifolium* (Gopala and Rao, 2018), *Chrysanthemum* spp. (Kumar et al., 2012), *Cicer arietinum* (Saqib et al., 2005), *Cichorium intybus* (Tran-Nguyen et al., 2003), *Cinnamomum cassia* (Yang et al., 2016b), *Citrus* spp. (EPPO, 2019), *Cleome viscosa* (Li et al., 2014a), *Codiaeum variegatum* (Arocha et al., 2009a), *Conocarpus erectus* (Azimi et al., 2017), *Conyza* spp. (Streten et al., 2005b), *Corchorus aestuans* (Li and Chen, 2018), *Corchorus olitorius* (Ozdemir and Cagirgan, 2015), *Crotalaria* spp. (Wang et al., 2008), *Cucumis sativus* (Tazehkand et al., 2010), *Cucurbita maxima* (Schneider et al., 1999),

Phytoplasma name, reference strain/related strain name	Other natural hosts
	Cucurbita pepo (Al-Subhi et al., 2018), *Cyanthillium cinereum* (Davis et al., 2003b), *Cynodon dactylon* (Tran-Nguyen et al., 2000), *Datura stramonium* (Streten et al., 2005b), *Daucus carota* (Al-Subhi et al., 2018), *Dendrocalamus strictus* (EPPO, 2019), *Desmodium triflorum* (Davis et al., 2003b), *Emilia sonchifolia* (Davis et al., 2005), *Eragrostis falcata* (Tran-Nguyen et al., 2000), *Eriachne obtusa* (Tran-Nguyen et al., 2000), *Erimophyla* spp. (Streten et al., 2005b), *Eruca sativa* (Al-Subhi et al., 2018), *Erysimum cheiri* (Tazehkand et al., 2010), *Euphorbia millii* (Davis et al., 1997b), *Fallopia japonica* (EPPO, 2019), *Foeniculum vulgare* (Bhat et al., 2008), *Gerbera jamesonii* (Siddique, 2005), *Glycine max* (Murithi et al., 2015), *Gomphocarpus physocarpus* (Streten et al., 2005b), *Gossypium hirsutum* (Schneider et al., 1997), *Guizotia abyssinica* (Davis et al., 1997b), *Gypsophila paniculata* (Gera et al., 2007), *Helianthus* spp. (Mulpuri and Muddanuru, 2016), *Hibiscus rosa-sinensis* (Arocha et al., 2009a), *Hibiscus trionum* (Streten et al., 2005b), *Indigofera colutea* (Padovan and Gibb, 2001), *Indigofera hirsuta* (Padovan and Gibb, 2001), *Indigofera linifolia* (Padovan and Gibb, 2001), *Ipomea* spp. (Davis et al., 2006), *Ipomoea aquatica* (Cai et al., 2016), *Ipomea batatas* (EPPO, 2019), *Jacksonia scoparia* (Streten et al., 2005b), *Jasminum sambac* (Al-Zadjali et al., 2007), *Lactuca sativa* (Cai et al., 2016), *Linum usitatissimum* (Akhtar et al., 2013), *Macroptilium atropurpureum* (Davis et al., 1997b), *Macroptilium lathyroides* (Davis et al., 1997b), *Malvaviscus arborus* (Arocha et al., 2009a), *Manihot esculenta* (Arocha et al., 2009a), *Manilkara zapota* (Arocha et al., 2009a), *Matthiola incana* (Davino et al., 2007), *Medicago polymorpha* (Streten et al., 2005b), *Medicago sativa* (Al-Subhi et al., 2018), *Melaleuca citrine* (Azimi et al., 2018), *Mirabilis jalapa* (Sobolev et al., 2007; Kumar et al., 2012), *Mitracarpus hirtus* (Wilson et al., 2001), *Mucuna pruriens* (Davis et al., 1997b), *Nicotiana tabacum* (Schneider et al., 1999), *Opuntia* spp. (Li et al., 2012), *Pachyrhizus erosus* (Davis et al., 2003b), *Parthenium hysterophorus* (Gopala and Rao, 2018), *Passiflora edulis* (Arocha et al., 2009a), *Pelargonium capitatum* (Lee et al., 2010), *Petroselinum crispum* (Salehi et al., 2016a), *Phaseolus vulgaris* (Arocha et al., 2009b), *Phlox* spp. (Davis et al., 1997b), *Phoenix dactilifera* (Omar et al., 2018b), *Phyllanthus amarus* (Tran-Nguyen et al., 2012), *Physalis ixocarpa* (Arocha et al., 2010),

Phytoplasma name, reference strain/related strain name	Other natural hosts
	Physalis minima (Padovan and Gibb, 2001), *Picris hieracioides* (Mitrovic et al., 2011), *Pilotus distans* (Schneider et al., 1999), *Pisum sativum* (Al-Subhi et al., 2018), *Plantago lanceolata* (Streten et al., 2005b), *Podocarpus macrophyllus* (Arocha et al., 2010), *Polygala paniculata* (Davis et al., 2005), *Praxelis clematidea* (Yang et al., 2017), *Prosopis farcta* (Esmailzadeh-Hosseini et al., 2011b), *Rhynchosia minima* (Wilson et al., 2001), *Rosa* spp. (Arocha et al., 2010), *Rynchosia minima* (Davis et al., 1997b), *Saccharum officinarum* (Tran-Nguyen et al., 2000), *Sarcochilus hartmanii* x *Sarcochilus falcatus* (Gowanlock et al., 1998), *Sarcochilus hartmanii* (Davis et al., 1997b), *Scaevola taccada* (Al-Zadjali et al., 2012), *Senna obtusifolia* (Padovan and Gibb, 2001), *Sesamum indicum* (Madhupriya et al., 2015; Al-Subhi et al., 2018), *Sesuvium portulacastrum* (Davis et al., 2003b), *Sida cordifolia* (Davis et al., 1997b), *Solanum lycopersicum* (Al-Subhi et al., 2018), *Solanum melongena* (Davis et al., 1997b), *Solanum nigrum* (Streten et al., 2005b), *Solanum tuberosum* (Omar et al., 2018a), *Spinacia olearia* (Al-Subhi et al., 2018), *Stylosanthes* spp. (Streten and Gibb, 2006), *Tephrosia purpurea* (Yadav et al., 2014), *Tridax procumbens* (Padovan and Gibb, 2001), *Trifolium repens* (Hosseini et al., 2013b), *Vicia faba* (Omar, 2017), *Vigna lanceolata* (Padovan and Gibb, 2001), *Vigna luteola* (Davis et al., 1997b), *Vigna mungo* (EPPO, 2019), *Vigna radiata* (Wilson et al., 2001; Salehi et al., 2016b), *Vigna trilobata* (Davis et al., 1997b), *Vigna unguiculata* (Win and Jung, 2012), *Washingtonia robusta* (Omar et al., 2018b), *Zinnia elegans* (Hemmati and Nikooei, 2017)
'*Ca.* P. australiense' (reference strain)	*Apium graveolens* (EPPO, 2019), *Carica papaya* (EPPO, 2019), *Catharanthus roseus* (Streten and Gibb, 2006), *Cenchrus setiger* (Liu et al., 2018), *Cenchrus setiger* (Tran-Nguyen et al., 2000), *Coprosma robusta* (Beever et al., 2004), *Cordyline australis* (Andersen et al., 2001), *Cucumis myriocarpus* (Saqib et al., 2006), *Cucurbita maxima* (Streten et al., 2005a), *Cucurbita moschata* (Liu et al., 2018), *Gomphocarpus fruticosa* (Streten et al., 2005b), *Gomphocarpus physocarpus* (Streten et al., 2005b), *Liquidambar styraciflua* (Habili et al., 2007), *Medicago sativa* (Liu et al., 2018), *Paulownia* spp. (Bayliss et al., 2005), *Phaseolus* spp. (Streten and Gibb, 2006), *Phormium cookianum* (EPPO, 2019), *Phormium tenax* (EPPO, 2019), *Senna surattensis* (Wu et al., 2012),

Phytoplasma name, reference strain/related strain name	Other natural hosts
	Solanum pseudocapsicum (EPPO, 2019), *Solanum tuberosum* (EPPO, 2019), *Trifolium pratense* (Saqib et al., 2006),
'*Ca.* P. fraxini' (reference strain)	*Artemisia annua* (Conci et al., 2005), *Conyza bonariense* (Conci et al., 2005), *Erigeron bonariensis* (Flores et al., 2015), *Fraxinus* spp. (EPPO, 2019), *Liquidambar styraciflua* (Franco-Lara et al., 2017), *Medicago sativa* (Conci et al., 2005), *Paeonia lactiflora* (Arismendi et al., 2011) *Phoenix dactylifera* (Ghayeb Zamharir and Eslahi, 2019), *Syringa* spp. (EPPO, 2019), *Ugni molinae* (Arismendi et al., 2011), *Vernonia brasiliana* (da Silva Fugita et al., 2017)
'*Ca.* P. hispanicum' (reference strain)	*Brassica oleracea* (Eckstein et al., 2013), *Carica papaya* (Davis et al., 2016), *Catharanthus roseus* (Davis et al., 2016), *Celosia argentea* (Perez-Lopez et al., 2016), *Celosia spicata* (Perez-Lopez et al., 2016), *Ipomea batatas* (Davis et al., 2006) *Opuntia ficus-indica* (Suaste Dzul et al., 2012), *Solanum tuberosum* (Davis et al., 2016)
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	None reported
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	None reported
'*Ca.* P. trifolii' (reference strain)	*Allamanda cathartica* (Khasa et al., 2016), *Allium sativum* (Reveles-Torres et al., 2018), *Amaranthus blitoides* (Alfaro-Fernandez et al., 2017), *Apium graveolens* (Alfaro-Fernandez et al., 2017), *Araucaria heterophylla* (Gupta et al., 2010), *Asclepias curassavica* (Babaie et al., 2007), *Azadirachta indica* (Venkataravanappa et al., 2018), *Brassica olearacea* (Salehi et al., 2007), *Calotropis gigantea* (Priya et al., 2010), *Cannabis sativa* (Kumar et al., 2017), *Capsicum annuum* (Oksal et al., 2017), *Carthamus tinctorius* (Salehi et al., 2009), *Celosia argentea* (Babaie et al., 2007), *Centaurea solstitialis* (Faggioli et al., 2004), *Cicer arietinum* (Girsova et al., 2017), *Cota tinctoria* (Hemmati et al., 2018), *Croton bonplandianum* (Priya et al., 2016), *Cucumis sativus* (Zibadoost et al., 2015), *Datura inoxia* (Raj et al., 2009), *Hibiscus rosa-sinensis* (Khasa et al., 2016), *Lactuca sativa* (Gopala et al., 2018), *Lespedeza cyrtobotrya* (Jung et al., 2012), *Lupinus polyphyllus* (Girsova et al., 2017), *Medicago sativa* (EPPO, 2019), *Melilotus albus* (EPPO, 2019), *Nicotiana tabacum* (EPPO, 2019), *Phaseolus vulgaris* (Lee et al., 2004), *Phoenix dactylifera* (Ghayeb Zamharir and Eslahi, 2019), *Physalis ixocarpa* (Mauricio-Castillo et al., 2018), *Portulaca grandiflora* (Samad et al., 2008), *Portulaca oleracea* (Kumar et al., 2017), *Potentilla fructicosa* (Hiruki and Wang, 1999),

Phytoplasma name, reference strain/related strain name	Other natural hosts
	Rhododendron hybrids (Pribylova et al., 2009), *Salix alba* (Ghayeb-Zamharir, 2018), *Salix babylonica* (Shahryari and Allahverdipour, 2018), *Salix bebbiana* (Khadhair and Hiruki, 1995), *Salix discolor* (Khadhair and Hiruki, 1995), *Salix exigua* (Khadhair and Hiruki, 1995), *Salix petiolaris* (Khadhair and Hiruki, 1995), *Saponaria officinalis* (Khasa et al., 2016), *Sesamum indicum* (Sertkaya et al., 2007), *Setaria adhaerens* (Alfaro-Fernandez et al., 2017), *Solanum lycopersicum* (EPPO, 2019), *Solanum* spp. (EPPO, 2019), *Solanum tuberosum* (EPPO, 2019), *Suaeda aegyptiaca* (Seyahooei et al., 2017), *Trifolium* spp. (EPPO, 2019), *Typha angustifolia* (Azimi et al., 2018), *Ulmus americana* (Flower et al., 2018), *Vaccinium myrtillus* (Borroto Fernandez et al., 2007), *Vicia faba* (Girsova et al., 2017), *Withania somnifera* (Samad et al., 2006), *Zea mays* (Zibadoost et al., 2015)
'*Ca.* P. ziziphi' (reference strain)	*Amaranthus retroflexus* (Yang et al., 2011), *Camellia japonica* (Trivellone, 2019), *Cichorium intybus* (Trivellone, 2019), *Dianthus chinensis* (Zhang et al., 2010), *Diospyros kaki* (Wang et al., 2015a), *Euonymus bungeanus* (Ren et al., 2017), *Gleditsia sinensis* (Trivellone, 2019), *Hovenia dulcis* (Jung et al., 2012), *Ligustrum* spp. (Jung et al., 2012), *Liquidambar styraciflua* (Franco-Lara et al., 2017), *Medicago sativa* (Trivellone, 2019), *Olea europaea* (Trivellone, 2019), *Orychophragmus violaceus* (Wang et al., 2015b), *Robinia pseudoacacia* (Ren et al., 2017), *Sophora japonica* cv. golden (Ren et al., 2017), *Spiraea salicifolia* (Li et al., 2010), *Trifolium subterraneum* (Trivellone, 2019), *Ulmus parvifolia* (Trivellone, 2019), *Ziziphus mauritania* (Jin and Gao, 1984), *Zizyphus jujuba* (Jung et al., 2003), *Zizyphus nummularia* (Khan et al., 2008)
Buckland valley grapevine yellows phytoplasma	None reported

Appendix D – Impacts on other natural hosts

Table D.1 provides a summary of reported impacts on hosts other than the target host plants for the phytoplasmas categorised here.

Table D.1: Synopsys of reported impacts on other natural hosts for the phytoplasmas categorised here

Phytoplasma name, reference strain/related strain name	Impacts
'*Ca*. P. aurantifolia'-related strains (pear decline Taiwan II, PDTWII; Crotalaria witches' broom phytoplasma, CrWB; sweet potato little leaf, SPLL)'	'*Ca*. P. aurantifolia'-related strain (16SrII-D) disease incidence in Egypt ranged between 1% (squash fields) and 15% (eggplant and tomato fields) of the inspected fields (Omar and Foissac, 2012). Disease incidence in Saudi Arabia ranged from about 3% in alfalfa crop fields 1 year after cultivation to about 77% in 3-year-old fields. In Saudi Arabia carrot fields disease incidence ranged from about 3% to 100% after 7 months of cultivation, and in faba bean up to about 47% (Omar, 2017). Annual losses due to alfalfa witches broom are estimated at more than US$ 23 million (Khan et al., 2001). Incidence of diseased tomato plants in each field in Tanzania (0.2 to 0.4 ha) was low, approximately 1% (Testen et al., 2015). Incidence of diseased soybean plants in Tanzanian field was up to 50% (Murithi et al., 2015). During 2011-2013, 7-55% incidence of sesame phyllody and witches' broom symptoms were observed on sesame plants in nine states of India (Madhupriya et al., 2015). Incidence of diseased tomato plants in China was up to 10% of the affected fields (Dong et al., 2013). Incidence of diseased chilli and tamarillo plants in Indonesia was up to 100% of plants affected (Harling et al., 2009). The incidence of tenweeks stock symptomatic plants in Sicily (Italy) was about 65% (Davino et al., 2007). The incidence of *Gypsophila* symptomatic plants in Arava valley (Israel) was about 80% (Gera et al., 2007). Up to 35% of the *Beta vulgaris* plants in the surveyed fields in Iran were infected, and approximately 10% of the infected plants with severely dwarfed and yellowish foliage died (Mirzaie et al., 2007). All of the *Stylosanthes* taxa analysed in a field trial in Australia were found to be susceptible to phytoplasma disease except *Stylosanthes hamata* cv. Verano and "*Stylosanthes seabrana*" cv. Unica (De La Rue et al., 2003). The incidence of papaya diseased plants in Australian plantation was about 16% (Padovan and Gibb, 2001)
'*Ca.* P. australiense' (reference strain)	The phytoplasma also infects several horticultural, forage crops, and ornamental (both herbaceous and woody plants) species. In case of papaya becoming cultivated in Southern EU, it should be considered that papaya cultivation may be severely affected by this pathogen. In Malaysia, especially the new variety, named *C. papaya* L. var. Eksotika, is threatened by papaya dieback disease which affects approximately 800 hectares of plantation, destroyed approximately 1 million trees nationwide with total losses estimated at US$ 58 million between 2003 and 2018 (Sekeli et al., 2018). The papaya dieback disease is most severe in southern and central Queensland and can cause complete destruction of papaya plantations. In 2002, 100% losses were experienced on some properties in West Australia, causing many growers to discontinue papaya production (reviewed in (Streten and Gibb, 2006))
'*Ca.* P. fraxini' (reference strain)	'*Ca*. P. fraxini' phytoplasma strains have been consistently reported in *Fraxinus* spp, and *Syringa* spp. Infected *Fraxinus* spp. exhibit severe decline symptoms and may die because of the infection. Tolerant *Fraxinus* genotypes are available both for scions and rootstocks (Sinclair et al., 1997).

Phytoplasma name, reference strain/related strain name	Impacts
	The phytoplasma also infects forest trees and shrubs, forage crops, and ornamental (both herbaceous and woody plants) species.
'*Ca.* P. hispanicum' (reference strain)	The phytoplasma also infects horticultural (*Solanum, Brassica* and *Ipomea*) and ornamental (*Celosia* spp., *Catharanthus roseus*) plants, and it has also been reported in *Opuntia ficus-indica* and *Carica papaya*.
'*Ca.* P. pruni'-related strain (North American grapevine yellows, NAGYIII)	The phytoplasma is not reported to infect other hosts.
'*Ca.* P. pyri'-related strain (peach yellow leaf roll, PYLR)	The phytoplasma is not reported to infect other hosts
'*Ca.* P. trifolii' (reference strain)	Incidence of the disease caused by '*Ca*. P. trifolii' in *Solanum lycopersicum* varied between 0.2 and 40% in Mexico, Lebanon, and Syria, depending on the region and weather conditions (Salas-Munoz et al., 2016) (Choueiri et al., 2007); (Khalil et al., 2019). Up to 15% of the 'Galilea' and 'Gardinian' tomato varieties may be infected in commercial fields (Salas-Munoz et al., 2016); (Anfoka et al., 2003), and infected plants showed about 70% fruit yield reduction (Khalil et al., 2019). A strain-dependent resistance/tolerance of the PI128655 accession of *Solanum peruvianum* (USDA-ARS Plant Genetic Resource Unit) to two BLTVA is known, but the same plant accession is not resistant to all BLTVA strains (Garcion et al., 2014). Severe disease symptoms are reported in Lebanon on *Capsicum annum* (20 to 27% of the pepper fields with 1–4% of the plants affected) (Choueiri et al., 2007), and on chili plants (Rao and Kumar, 2017). '*Ca*. P. trifolii' infection shows incidences of 40% in *Allium sativum* (Reveles-Torres et al., 2018), 12% of *Physalis ixocarpa* plants (from 25 ha of commercial crops) (Mauricio-Castillo et al., 2018), and up to 4% in *Apium graveolens* (Alfaro-Fernandez et al., 2017). *Ulmus americana* can also be infected with rapid onset of symptoms (up to 60 infected trees across two elm research plantations) (Flower et al., 2018)
'*Ca.* P. ziziphi' (reference strain)	Approximately 5% of Chinese pink Dianthus with symptoms resembling infections of phytoplasmas were observed (Zhang et al., 2010). The pest kills 3-5% or even more jujube trees each year in many orchards (Zhao et al., 2009b), but several resistant accessions of *Ziziphus jujuba* are available (Liu et al., 2004; Tian et al., 2000). The 'Lizao' and 'Dongzao' jujube varieties appear to be susceptible to phytoplasma infection (Tian et al., 2000; Peng et al., 2013). Production of phytoplasma-free plants of Chinese jujube can be achieved by cryopreservation (Wang et al., 2015a,b)
Buckland valley grapevine yellows phytoplasma	The phytoplasma is not reported to infect other hosts