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Pest categorisation of non-EU Cicadomorpha vectors of *Xylella* spp.

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Abstract

The Panel on Plant Health performed a group pest categorisation of non-EU Cicadomorpha vectors of *Xylella* spp. known to be associated with plant diseases. Although all the insects considered in this categorisation are proven vectors of *Xylella* spp., additional vectors within the order Hemiptera most probably exist but have not been associated with any *Xylella* spp. disease yet. Currently, the group consists of 50 taxa (49 at species level and one at genus level) from the families Aphrophoridae, Cicadellidae and Membracidae (Arthropoda: Hemiptera: Cicadomorpha) for which reliable identification methods exist. Members of the group can be found in the Americas, Asia, Africa and Oceania. Only one of them, *Homalodisca vitripennis* is considered invasive. Species in the group are mostly polyphagous; many are known to feed on several plant families. Hosts can include broadleaf trees, herbaceous plants and grasses. Breeding takes place on herbaceous hosts and eggs are inserted into plant tissues. Nymphs emerge to feed on sap of the natal host. Adults move from breeding hosts to food hosts and can spread *Xylella* spp. causing a variety of diseases. Three of the species are listed in Annex IAI of Council Directive 2000/29/EC as examples of Cicadellidae (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*). Plants for planting, cut branches, flowers and fruit are potential pathways for entry into the EU. However, there are no records of EU interceptions of any members of the group. EU biotic and abiotic conditions are conducive for establishment and spread of these insects. Were members of the group to establish and spread, impact on several cultivated species (e.g. grapevine, citrus, *Prunus* spp.) and ornamentals (e.g. *Polygala myrtifolia*) could be expected as these insect species are efficient vectors of *Xylella* spp. Considering the criteria within the remit of EFSA to assess their regulatory plant health status, the group of non-EU Cicadomorpha vectors of *Xylella* spp. meets all the criteria assessed by EFSA for consideration as potential Union quarantine pests. The group does not meet all the criteria assessed by EFSA for consideration as regulated non-quarantine pests, as members of the group are not present in the EU.

Keywords: Pest risk, quarantine, spittlebug, planthopper, treehopper, olive quick decline syndrome, citrus variegated chlorosis, bacterial leaf scorch

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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

Aleurocantus 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 and 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

Popillia japonica Newman

Rhizoecus hibisci Kawai and Takagi

(b) Bacteria

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

Ralstonia solanacearum (Smith) Yabuuchi et al.

(c) Fungi

Melampsora medusae Thümen

Synchytrium endobioticum (Schilbersky) Percival

Annex I B

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

Leptinotarsa decemlineata Say

Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

The group of Cicadellidae (non-EU) known to be a vector of Pierce's disease (PD) (caused by *Xylella fastidiosa*) is among the pests listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether members of the group fulfil the criteria to be regarded as quarantine pests or those of regulated non-quarantine pests for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores. However:

A) *Xylella fastidiosa* is a xylem-limited bacterium transmitted to plants by phytophagous insects with hemipteroid piercing sucking mouthparts (i.e. Hemiptera). Although in principle transmission by any herbivorous hemipteran that probes xylem vessels may be possible, available scientific data show that the vectors are insects specialised in using xylem sap as a major (if not the only) food source, hereby named as xylem-sap feeding insects (Redak et al., 2004; Almeida et al., 2005, EFSA PLH Panel, 2015, 2018a, 2019a,b),

B) Xylem-sap feeding insects occur in at least three superfamilies within the order Hemiptera, suborder Cicadomorpha (Almeida et al., 2005), namely, Cicadoidea, Cercopoidea and Membracoidea, which may comprise more than 30,000 different species worldwide, including about 20,000 Cicadellidae species (Capinera, 2008) (Appendix A),

C) Pierce's disease of grape, together with citrus variegated chlorosis (CVC) are the most economically important diseases caused by *X. fastidiosa* and there is evidence that this species can cause additional diseases in alfalfa, almond, coffee, elm, oak, olives, maple, peach, pear, plum and sycamore (Redak et al., 2004; Chatterjee et al., 2008; EFSA PLH Panel, 2015, 2018a, 2019a,b; EFSA, 2018), and

D) Su et al. (2016) described a Gram-stain-negative bacterium (PLS229T) causing pear leaf scorch in Taiwan, which had been previously grouped into *X. fastidiosa* and will most probably become a recognised novel species, *Xylella taiwanensis* sp. nov.

Therefore, the group under scrutiny in this opinion is the non-EU species of Cicadomorpha proven to vector *Xylella* spp. and for which association with *Xylella* disease symptoms is reported. The group will, for brevity, be referred to as 'non-EU Cicadomorpha vectors of *Xylella* spp.' As a consequence, only reports of vectors of *Xylella* spp. including information about development of disease in plants after transmission were considered.

The term 'non-EU' in the name of the group is interpreted as meaning that the EU is not, or is not known to be, part of the native range of that species according to Fauna Europaea (https://fauna-eu.org/ – de Jong 2019). Therefore, this term will include non-native species naturalised in the EU according to DAISIE (www.europe-aliens.org) as far as they are not widespread within the EU and are under official control (i.e. regarded as a Union Quarantine Pest).

2. Data and methodologies

2.1. Data

2.1.1. Literature search

The starting point for our search was the existing *Xylella* spp. host plant database (EFSA, 2018), which was used to retrieve all vectors known to transmit *Xylella* spp. resulting in disease expression in host plants (Appendix B). This information was complemented with a literature search on these vectors, restricted to the period April 2017–December 2018, in the ISI Web of Science bibliographic database, using the scientific name of the pest and the common names of the diseases as search terms. This period was chosen to capture information not available when the previous EFSA opinions were prepared, as the search for that opinion was run on 16 May 2017 (EFSA, 2018). Relevant papers were reviewed and further references and information 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 European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, 2019), Hemiptera database, and relevant publications.

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

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States (MS) and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

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

This work was initiated following an evaluation of the EU plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union quarantine pest and for a Union regulated non-quarantine pest 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 regulated non-quarantine pest. 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 regulated non-quarantine pest 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 regulated non-quarantine pest. (A regulated non-quarantine pest 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?
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?

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
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential regulated non-quarantine pest were met, and (2) if not, which one(s) were not met.

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

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

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

Yes, the insects included in this group categorisation belong to the three families within the suborder Cicadomorpha of the order Hemiptera. There are descriptions and taxonomic keys available for their identification to species level.

Theoretically, up to approximately 105,000 species of Hemiptera could potentially transmit *Xylella* (see Section 1.2, Interpretation of ToR, and Appendix A). However, most of these species can be considered unlikely vectors of *Xylella* spp. as they are mostly phloem feeders (Appendix A). Although species within the Hemiptera which do not primarily feed on xylem may occasionally ingest xylem sap, as a means to compensate for either desiccation or osmotic stress caused by ingestion of phloem sap (Cull and van Emden, 1977; Powell and Hardie, 2002), and therefore, could transmit plant pathogenic *Xylella* spp. (Dellapé et al., 2016), so far, vectoring of *X. fastidiosa* by these species has not been proven. Important characteristics that determine whether a xylem-sap feeding Cicadomorpha species is an effective vector of *Xylella* spp. include the persistence of the bacterium in the adult hopper, and multiplication of the bacterium in the insect foregut (Almeida et al., 2005). The bacterial cells grow and form a microfilm on the cuticle of the anterior foregut in its vectors (Backus, 2016). However, it is not possible to predict with any degree of accuracy the likelihood of persistence and multiplication of the bacterium in any species in the potential vectoring families.

Up to now, insect species transmitting plant pathogenic *Xylella* spp. are among the 30,000–32,000 species belonging to taxonomic groups of xylem-sap feeding insects within the order Hemiptera, suborder Cicadomorpha. This includes three different superfamilies (Cercopoidea, Cicadoidea and Membracoidea) and 12 families worldwide (Appendix A). Although there are two reports of cicadas (Superfamily Cicadoidea, family Cicadidae) as vectors (Paiao et al., 2002; Krell et al., 2007), these insects have been excluded from any detailed discussion because it is not possible to assess the role of these insects in the spread of *Xylella* spp. due to the limited information available, which does not report any associated disease.

As mentioned earlier, for the purpose of this pest categorisation, a step-wise decision tree (Appendix B) was developed and used to narrow down the number of species for more detailed consideration in this categorisation. Starting with the list of all Cicadomorpha vectors of *Xylella* spp. associated with plant diseases (Appendix C; 51 records, 50 at species level and 1 at genus level only), species were excluded if (a) they occurred in the EU, (b) they occurred in countries that did not share any climate types that also occur in the EU, (c) their host plant range did not include species occurring in the EU (Appendix B). After the screening, only one species, the Aphrophoridae *Philaenus spumarius* L., was excluded as it is present in the EU. Additional species, such as *Neophilaenus campestris* (Fallen) and *Philaenus italosignus* Drosopoulos and Remane, are still under investigation as vectors in Europe (Cavalieri et al., 2018) and are excluded as they are present in the EU. Therefore, 49 species and one genus (non-EU) were eventually selected for categorisation (Table 2). They belong to three different families: Aphrophoridae (6 species; 12.0%), Cicadellidae (42 species and 1 genus; 86.0%) and Membracidae (1 species; 2.0%). Junior synonyms of these species are shown in Appendix C. One reference in the list corresponds to a generic epithet of the Cicadellidae family, namely, *Draeculacephala*. Although a species-specific reference for this genus has been found (*D. minerva*), there is uncertainty about the exact identity of this record.

Keys for the determination of the species considered in this opinion to species level exist (Table 2). Identification requires males, and often the male genitalia have to be 'cleared' (i.e. breaking off the abdomen and placing it in 10% KOH or NaOH) for examination (Wilson and Turner, 2010).

Table 2: Non-EU Cicadomorpha vectors of *Xylella* spp., reported disease/s associated, source and reference for their taxonomic description

Species	Reported disease/s[(1)]	Reference	Identification/ description references
FAMILY APHROPHORIDAE			
Subfamily Aphrophorinae: tribe Aphrophorini			
Aphrophora angulata Ball, 1899	PD	Severin (1950)	Soulier-Perkins (2019)
Aphrophora permutata Uhler, 1876	PD	Severin (1950)	Soulier-Perkins (2019)
Subfamily Aphrophorinae: tribe Clovinii			
Lepyronia quadrangularis (Say, 1825)	BLS	Sanderlin and Melanson (2010)	Soulier-Perkins (2019)
Subfamily Aphrophorinae: tribe Ptyelini			
Poophilus costalis (Walker, 1851)	PD	EFSA (2018)	Soulier-Perkins (2019)
Subfamily Aphrophorinae: tribe Clasteropterini			
Clasteroptera achatina Germar, 1839	BLS	Sanderlin and Melanson (2010)	Soulier-Perkins (2019)
Clasteroptera brunnea Ball, 1919	PD	Severin (1950)	Soulier-Perkins (2019)
FAMILY CICADELLIDAE			
Subfamily Cicadellinae: tribe Cicadellini			
Bothrogonia ferruginea (Fabricius, 1787) (listed as *Tettigella ferruginea* in EFSA, 2018)	PD	EFSA (2018)	Wilson et al. (2009)
Bucephalogonia xanthopis (Berg, 1879)	CLS, CVC	EFSA (2018)	Wilson et al. (2009)

Species	Reported disease/s[1]	Reference	Identification/ description references
Dechacona missionum Berg, 1879	CVC	EFSA (2018)	Wilson et al. (2009)
Dilobopterus costalimai Young, 1977	CLS, CVC	EFSA (2018)	Wilson et al. (2009)
Draeculacephala minerva Ball, 1927	ALS, PD	EFSA (2018)	Wilson and Turner (2010)
***Draeculacephala* sp.**	PPD	EFSA (2018)	Wilson and Turner (2010)
Ferrariana trivittata (Signoret, 1851)	CVC	Azevedo Filho et al. (2011); Gai (2006)	Wilson et al. (2009)
Fingeriana dubia Cavichioli, 2003	CVC	EFSA (2018)	Wilson et al. (2009)
Graphocephala atropunctata (Signoret, 1854)	PD	EFSA (2018)	Wilson et al. (2009)
Graphocephala confluens (Uhler, 1861)	PD	EFSA (2018)	Wilson and Turner (2010
Graphocephala versuta (Say, 1830)	PD, PPD	EFSA (2018)	Wilson and Turner (2010)
Helochara delta Oman, 1943	PD	EFSA (2018)	Wilson et al. (2009)
Kolla paulula (Walker, 1858)	PD	EFSA (2018)	Wilson et al. (2009)
Macugonalia cavifrons (Stål, 1862)	CVC	Müller (2013); de Oliveira-Molina et al. (2018)	Wilson et al. (2009)
Macugonalia leucomelas (Walker, 1851)	CVC	Azevedo Filho et al. (2011); Gai (2006)	Wilson et al. (2009)
Neokolla hyeroglyphica (Say, 1830)	PD	EFSA (2018)	Wilson and Turner (2010)
Neokolla severini DeLong, 1948	PD	EFSA (2018)	Wilson and Turner (2010)
Oragua discoidula Osborn, 1926	CVC	Lopes and Krugner (2016)	Wilson et al. (2009)
Parathona gratiosa (Blanchard, 1840)	CVC	(Azevedo Filho et al., 2011; Gai (2006)	Wilson et al. (2009)
Plesiommata corniculata Young, 1977	CVC, PLS Krügner et al., 2000;	(Azevedo Filho et al., 2011; Gai (2006)	Wilson et al. (2009)
Plesiommata mollicella Fowler, 1900	CVC	Dellapé (2013)	Wilson et al. (2009)
Sibovia sagata (Signoret, 1854)	CVC	Müller (2013)	Wilson et al. (2009)
Sonesimia grossa (Signoret, 1854)	CVC	Azevedo Filho et al. (2011); Gai (2006)	Wilson et al. (2009)
Xyphon flaviceps (Riley, 1880)	PD	EFSA (2018)	Wilson and Turner (2010)
Xyphon fulgida (Nottingham, 1932) (listed as *X. fulgidum* in EFSA, 2018)	PD	EFSA (2018)	Wilson and Turner (2010)
Xyphon triguttata (Nottingham, 1932) (listed as *X. triguttatum* in EFSA, 2018)	PD	EFSA (2018)	Wilson and Turner (2010)
Subfamily Cicadellinae: tribe Proconiini			
Acrogonia citrina Marucci et al., 2002;	CVC	de Oliveira-Molina et al. (2018)	Wilson et al. (2009)
Acrogonia virescens (Metcalf, 1949)	CVC	Azevedo Filho et al. (2011); Gai (2006)	Wilson et al. (2009)
Cuerna costalis (Fabricius, 1803)	PPD	EFSA (2018)	Wilson and Turner (2010)

Species	Reported disease/s(1)	Reference	Identification/ description references
Cuerna occidentalis Osman and Beamer, 1944	PD	Frazier (1944)	Wilson and Turner (2010)
Homalodisca ignorata Melichar, 1924	CLS, CVC	EFSA (2018)	Wilson and Turner (2010)
Homalodisca insolita Walker, 1858	PPD	EFSA (2018)	Wilson and Turner (2010)
Homalodisca vitripennis Germar, 1821	ALS, BLS, CVC, OLS, PD, PPD, RS	EFSA (2018)	Wilson and Turner (2010)
Molomea consolida Schröder, 1959	CVC	de Remes Lenicov et al. (1999)	Wilson et al. (2009)
Oncometopia facialis Signoret, 1854	CLS, CVC	EFSA (2018)	Wilson et al. (2009)
Oncometopia nigricans Walker, 1851	CVC, PD, PW, RS	EFSA (2018)	Wilson and Turner (2010)
Oncometopia orbona (Fabricius, 1798)	PD, PPD (under the syn. *O. undata*)	EFSA (2018)	Wilson and Turner (2010)
Tapajosa rubromarginata (Signoret, 1855)	CVC	EFSA (2018)	Wilson et al. (2009)
Subfamily Errhorominae: tribe Pagaroniini			
Friscanus friscanus (Ball, 1909)	PD	EFSA (2018)	Wilson and Turner (2010)
Pagaronia confusa Oman, 1938	PD	EFSA (2018)	Wilson and Turner (2010)
Pagaronia furcata Oman, 1938	PD	EFSA (2018)	Wilson and Turner (2010)
Pagaronia trecedecempunctata Ball, 1902	PD	EFSA (2018)	Wilson and Turner (2010)
Pagaronia triunata Ball, 1902	PD	EFSA (2018)	Wilson and Turner (2010)
FAMILY MEMBRACIDAE			
Subfamily Smiliinae: tribe Ceresini			
Cyphonia clavigera (Fabricius, 1803)	CVC	EFSA (2018)	Dmitriev (2019)

(1): ALS: almond leaf scorch; BLS: bacterial leaf scorch; CLS: coffee leaf scorch; CVC: citrus variegated chlorosis; OLS: oleander leaf scorch; PD: Pierce's disease PLS: plum leaf scald; PPD: phony peach disease; PW: periwinkle wilt; RS: ragweed stunt.

3.1.2. Biology of the pest

According to Brambila and Hodges (2008), although the suborder Cicadomorpha is considered a monophyletic group, it is extraordinarily diverse and ubiquitous. All of them are terrestrial herbivores, present piercing sucking mouthparts (rostrum or beak), and mostly feed from phloem tissue, while some feed from xylem tissue and others from the contents of mesophyll cells (Wilson et al., 2009). Cicadellidae, which represent the majority of the insects proven to effectively transmit plant pathogenic *Xylella* spp. within the suborder Cicadomorpha, are mostly polyphagous. However, for each single species oviposition is usually restricted to one or a few related host plants. Nymphs, which are often gregarious, feed and develop on these host plants and only the highly mobile adults are truly polyphagous (Menezes, 1982). Adults eventually return to the original host plant species for oviposition. This also applies to the vectors in the two additional Cicadomorpha families (Novotny, 1995; Gadelha et al., 2017). This behaviour may explain why some cicadellids which are proven natural vectors of PD in California are rarely found feeding on grapes and they are most common in riparian habitats adjacent to vineyards (Redak et al., 2004). Indeed, some of these vectors (i.e. *D. minerva* Ball and *Xyphon fulgida* (Nottingham)) inhabit permanent pastures alongside Californian vineyards, or live on weeds within them. Irrigation and weed control practices which result in foci of preferred host plants, including the Poaceae *Cynodon dactylon* and *Echinochloa crus-galli*, increase vector populations and the spread of *X. fastidiosa* (Purcell and Frazier, 1985). Highly relevant to the emergence of new *Xylella* spp.-caused diseases is that vectors are not specific (Almeida et al., 2005) and the same insect can transmit several isolates belonging to different *X. fastidiosa* subspecies (Almeida and Nunney, 2016). This is why *X. fastidiosa* isolates newly introduced to an area can be efficiently transmitted by indigenous vector species (e.g. *P. spumarius* and the emergence of the olive quick decline syndrome (OQDS) in Italy) (Saponari et al., 2013). Currently, only one *X. fastidiosa* vector species is considered invasive, the cicadellid *Homalodisca vitripennis* Germar (Almeida and Nunney, 2016). This species is native to south-eastern USA (Young, 1958; Turner and Pollard, 1959) and colonised California in the 1990's (Phillips et al., 2001) and the French Polynesia in 1999 (CABI, 2018). The expansion in the geographical range of *H. vitripennis* has not been associated with the spread of *X. fastidiosa* (Sorensen and Gill, 1996; Grandgirard et al., 2006): It is generally considered that the main long distance dispersal pathway for the pathogen is the movement of infected, and potentially asymptomatic, plant material from areas where the pathogen occurs (EFSA PLH Panel, 2015, 2019a,b; Almeida and Nunney, 2016); however, infective insect vectors as hitchhikers could also play a role (EFSA PLH Panel, 2015, 2019a,b).

Cicadellidae (leafhoppers, sharpshooters)

Cicadellidae, with more than 20,000 described species worldwide, is the largest family in Hemiptera and the tenth largest family of insects (Brambila and Hodges, 2008; Wilson et al., 2009). The species richness is highest in the tropics. Cicadellids are 3–22 mm long, with narrow and often colourful wings, with posterior tibia prismatic in cross section and with a row of spines. For defence, they mostly rely on agility, for they jump and fly (Brambila and Hodges, 2008). A trait unique to Cicadellidae among all insects is the production of brochosomes, small protein-lipid particles produced in the Malpighian tubules, which are actively spread by the insect over its body, wings, legs and eggs, with a probable protective function, as they repel water and honeydew and prevent fungal infections (Brambila and Hodges, 2008).

Most of the known vectors of *Xylella* spp. belong to the subfamily Cicadellinae, which is composed by two tribes of xylem-sap feeders: Cicadellini and Proconiini. *Cicadella viridis* L. is the most common of a few species of Cicadellini reported in Europe (Fauna Europaea, https://fauna-eu.org/t/), whereas Proconiini species are restricted to the tropics (Redak et al., 2004). The name 'sharpshooter' for this subfamily of xylem-sap feeding leafhoppers has increasingly been used especially in the USA. They are among the largest and most brightly coloured of the leafhoppers (Wilson et al., 2009) and have an inflated clypeus with strong muscles that operate the cibarial pump, allowing sap suction under high negative tensions in the xylem (Redak et al., 2004).

Aphrophoridae (spittlebugs; froghoppers)

According to Guillot (2005), Aphrophoridae is a large family of spittlebugs (1,300 spp., usually < 15 mm in length) distributed worldwide. Forewings are coriaceous. Hindlegs are long and adapted for leaping, hence their common name 'froghoppers'. The hind tibiae are long and have one or two stout spines and a single or double row of spines at the apex. Nymphs are mostly stationary and protected by a fluid, which is converted into foam ('spittle') with expelled air. Most species feed on sap from herbaceous plants but some feed on trees. After the nymph moults into the adult stage, the insect leaves the mass of 'spittle' and moves about actively. The EU proven vectors of *X. fastidiosa* (*N. campestris, P. italosignus* and *P. spumarius*) belong to this family (see Section 3.1.1).).

Membracidae (treehoppers)

Membracidae includes about 3,500 spp., (2–20 mm long, mostly under 12 mm long) and they are extremely diverse in tropical America, where they occur in rainforests, savannas and deserts. They typically feed in apical meristems and inflorescences of herbaceous and shrubby plants (Gadelha et al., 2017). Adults have cuticular expansions on the pronotum that often extend over the abdomen giving them the appearance of spines, horns, and other elaborate shapes (e.g. *Cyphonia clavigera* (F.), whose thorax extensions mimic an ant). Sexual dimorphism is common. Membracids feed primarily on trees and shrubs. Many species are gregarious, with young and adults feeding together. Treehoppers tend to be active during the day, when they are exposed to extreme heat and when predators tend to be inactive. The nymphs of some species are attended by ants. Parental care (egg guarding) is common. Treehoppers usually have one or more generations per year. Eggs are laid singly or in masses, either inserted directly into the living tissue of their host plant, or deposited on the surface of the plant. The females of some species coat their eggs with a frothy substance that hardens when dry. In temperate regions of North America, the eggs of most species remain in the plant through the winter and hatch in the spring at approximately the same time that the overwintering buds of the host plant break open and begin to grow. Adults locate a mate through the use of courtship calls inaudible to humans.

Females usually deposit their eggs a few days after mating, but in some species oviposition is delayed until the following spring, with the female hibernating through the winter (Dietrich, 2001–2008).

3.1.3. Intraspecific diversity

Are detection and identification methods available for the pest?

Yes, visual detection is possible. Adults are highly mobile and can be spotted as they jump. However, the sessile immature stages are not always easy to observe, especially the eggs. Members of Aphrophoridae are an exception, as the nymphs produce foam, which is visible.

There are keys available for identification at species level (see Table 2).

There are no reports of intraspecific diversity of the Cicadomorpha considered in this opinion.

3.1.4. Detection and identification of the pest

Adult Aphrophoridae, Cicadellidae and Membracidae are easily dislodged from the substrate where they live as they actually jump and fly away when disturbed (see above). Therefore, eggs and nymphs are the most likely stages to remain on infested traded commodities such as plants for planting, fruit and cut flowers. Consequently, these are the most likely stages to be found during import inspections.

Adults can be sampled using different devices including sweep nets, Malaise traps, sticky traps, light traps and vacuum samplers (Wilson et al., 2009). Yellow sticky traps can be used for surveillance and detection (CABI, 2018). Symptoms can be also used to detect infestations (EPPO, 2019). Although vector feeding causes no visible damage, xylem-feeding leafhoppers egest watery excrement, drying to a fine whitish powder where abundant. Froghopper nymphs form persistent bubbles or 'froth' that surrounds the body of the insect (the spittle). This secretion can be easily observed with the naked eye.

Details of the morphology and taxonomic determination of these species are provided in Table 2. Below, a short description of the main features of the different life stages of the insects included in this categorisation is provided.

Adults: according to EPPO (2019), 'adult sharpshooters are distinguished from other leafhopper subfamilies by the possession of highly 'inflated' or 'swollen' faces'. Sharpshooters are typically among the largest of leafhoppers. The only invasive species within the group under scrutiny, *H. vitripennis*, may exceed 15 mm. EPPO (2006) produced a mini-data sheet on this species. It feeds on stems rather than leaves, and egests copious amounts of the watery excrement described above. Many species of leafhoppers and planthoppers may have different wing forms (macropterous with fully developed wings and brachypterous with no functional wings for flying) which coexist in the same population (Wilson et al., 2009). Treehoppers typically have an enlarged thorax, which may extend anteriorly and posteriorly. In the case of the only treehopper known to vector *X. fastidiosa*, *C. clavigera* (6 mm long), these expansions result in a bizarre look that may not remain overlooked as it mimics an ant (Schulze et al., 2016).

Eggs: according to EPPO (2019), 'female sharpshooters and spittlebugs insert their eggs into plant tissues. The eggs of some sharpshooter species remain dormant over winter'. Therefore, eggs may be difficult to detect.

Nymphs: the gregarious behaviour of the immature stages frequently found within the families including species known to be a vector of plant pathogenic *Xylella* sp. may ease their detection. In the case of froghoppers, the presence of the froth mentioned above can make detection even easier. Nymphs generally resemble adults in form but usually differ markedly in coloration and markings.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Species belonging to the group of non-EU Cicadomorpha vectors of *Xylella* spp. are widespread in tropical, subtropical and temperate areas of the Americas, Africa, Asia and Oceania. The distribution of the 49 species and one genus is reported at a national level in Table 3. More detailed information on subnational distribution of these species and the corresponding references can be found in Appendix D.

Table 3: Distribution of non-EU Cicadomorpha vectors of *Xylella* spp. Subnational records and references are presented in Appendix D

Species	Africa	Asia	N America	C and S America	Oceania
FAMILY APHROPHORIDAE					
Subfamily Aphrophorinae: tribe Aphrophorini					
Aphrophora angulata			Canada, Mexico, USA	Colombia, Costa Rica, El Salvador, Guatemala, Nicaragua, Panama	
A. permutata			Canada, USA		
Subfamily Aphrophorinae: tribe Clovinii					
Lepyronia quadrangularis	South Africa		Canada, USA		
Subfamily Aphrophorinae: tribe Ptyelini					
Poophilus costalis	Angola, Benin, Cameroon, Democratic Republic Congo, Guinea, Ivory Coast, Malawi, Namibia, Somalia, South Africa, Togo, Uganda, Zimbabwe	China, India, Japan, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Thailand			
Subfamily Aphrophorinae: tribe Clasteropterini					
Clasteroptera achatina			Canada, Mexico, USA		
C. brunnea			Canada, USA		
FAMILY CICADELLIDAE					
Subfamily Cicadellinae: tribe Cicadellini					
Bothrogonia ferruginea		Burma, Cambodia, China, India, Japan, Iran, Korea, Laos, Vietnam			
Bucephalogonia xanthopis				Argentina, Bolivia, Brazil, Paraguay	
Dechacona missionum				Argentina, Paraguay, Peru	
Dilobopterus costalimai				Argentina, Brazil, Paraguay	
Draeculacephala minerva			Mexico	Belize, Costa Rica, El Salvador, Guatemala, Nicaragua, Panama	
***Draeculacephala* sp.** (24 spp.)			Nearctic	Neotropical	
Ferrariana trivittata				Argentina, Brazil, Bolivia, Colombia, Costa Rica, Panama, Paraguay, Peru	

Species	Africa	Asia	N America	C and S America	Oceania
Fingeriana dubia				Brazil	
Graphocephala atropunctata			Mexico	Nicaragua	
G. confluens			Canada		
G. versuta			Mexico	Costa Rica	
Helochara delta			USA		
Kolla paulula		Burma, Cambodia, China, India, Indonesia, Japan, Malaysia, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam			
Macugonalia cavifrons				Argentina, Brazil, Bolivia, Colombia, Paraguay, Peru, Venezuela	
M. leucomelas				Argentina, Brazil, Bolivia, Paraguay	
Neokolla hyeroglyphica			Mexico, USA		
N. severini			Mexico, USA		
Oragua discoidula				Argentina, Brazil, Colombia, Paraguay	
Parathona gratiosa				Argentina, Bolivia, Brazil, Paraguay	
Plesiommata corniculata			Mexico	Bolivia, Brazil, Colombia, Costa Rica, Grenada, Guyana, Panama, Paraguay, Suriname, Trinidad, Venezuela	
P. mollicella			Mexico	Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, French Guyana, Guatemala, Panama, Paraguay, Venezuela	
Sibovia sagata				Argentina, Bolivia, Brazil	
Sonesimia grossa				Argentina, Bolivia, Brazil, Paraguay	
Xyphon flaviceps				USA	
X. fulgida				USA	
X. triguttata				USA	

Species	Africa	Asia	N America	C and S America	Oceania
Subfamily Cicadellinae: tribe Proconiini					
Acrogonia citrina				Argentina, Brasil, Paraguay	
A. virescens				Brazil, Guyana, Peru, Paraguay	
Cuerna costalis			Canada, USA		
C. occidentalis			USA		
Homalodisca ignorata				Brazil, Paraguay	
H. insolita			Mexico, USA	Costa Rica, El Salvador, Guatemala, Panama	
H. vitripennis			Mexico, USA		Hawaii (USA), Tahiti (France)
Molomea consolida				Brazil	
Oncometopia facialis				Bolivia, Brazil, Colombia, Ecuador, Paraguay, Uruguay	
O. nigricans			USA		
O. orbona			USA		
Tapajosa rubromarginata				Argentina, Brazil	
Subfamily Errhorominae: tribe Pagaroniini					
Friscanus friscanus			USA		
Pagaronia confusa			USA		
P. furcata			USA		
P. 13-punctata			USA		
P. triunata			USA		
FAMILY MEMBRACIDAE					
Subfamily Smiliinae: tribe Ceresini					
Cyphonia clavigera				Brazil, Paraguay, Uruguay	

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?

No. None of the species subjected to categorisation in this opinion occurs in the EU (Table 3).

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

The group of non-EU Cicadomorpha vectors of *Xylella* spp. is listed in Council Directive 2000/29/EC under the name 'Cicadellidae (non-EU) known to be vector of PD (caused by *Xylella fastidiosa*)' are presented in Table 4.

Table 4: Non-EU Cicadomorpha vectors of *Xylella* spp. in Council Directive 2000/29/EC

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
(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)

3.3.2. Legislation addressing the organisms vectored by non-EU Cicadomorpha (Directive 2000/29/EC) (Table 5)

Table 5: *Xylella fastidiosa* in Council Directive 2000/29/EC

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:	
(d)	Peach phony rickettsia	
Section II	Harmful organisms known to occur in the community and relevant for the entire community	
(b)	**Bacteria**	
3	*Xylella fastidiosa* (Wells and Raju)	
Annex II Part A	Harmful organisms whose introduction into, and spread within, all member states shall be banned if they are present on certain plants or plant products	
Section I	Harmful organisms not known to occur in the community and relevant for the entire community	
(b)	**Bacteria**	
	Species	**Subject of contamination**
1.	Citrus variegated chlorosis	Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds

Annex IV Part A	Special requirements which must be laid down by all member states for the introduction and movement of plants, plant products and other objects into and within all member states	
Section I	Plants, plant products and other objects originating outside the community	
	Plants, plant products and other objects	**Special requirements**
23.2	Peach phony rickettsia	(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 three complete cycles of vegetation.

3.3.3. Legislation addressing the hosts of non-EU Cicadomorpha, vector of *Xylella* spp.

As the insects subjected to this categorisation are highly polyphagous, Annex I pests, this section is not relevant.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

The group of non-EU Cicadomorpha vector of *Xylella* spp. are mostly polyphagous (Appendix E). As stated above, for each species oviposition is usually restricted to one or a few related host plants. Nymphs feed and develop on these host plants and only the highly mobile adults are truly polyphagous (Menezes, 1982; Tolotti et al., 2018). The group is listed in Annex IAI, therefore their introduction and spread in the EU is banned irrespective of what they are found on. Some host plants are listed in the import prohibitions of Annex III or specific requirements in Annex IV of Council Directive 2000/29/EC.

3.4.2. Entry

Is the pest able to enter into the EU territory?

Yes, non-EU Cicadomorpha vector of *Xylella* spp. could enter into the EU, most likely through plants for planting.

As stated earlier, the cicadellid *H. vitripennis* is the only vector of *X. fastidiosa* considered invasive so far (Almeida and Nunney, 2016). This species is native to south-eastern USA (Young, 1958; Turner and Pollard, 1959) and colonised California in the 1990s and French Polynesia in 1999 (CABI, 2018). The suspected pathway is as viable egg masses on nursery stock of either crop or ornamental plants (CABI 2018). Therefore, the main pathways of entry are:

- Plants for planting, excluding seeds, of host plants (especially ornamental plants, CABI, 2018)
- Cut branches of host plants
- Cut flowers of host plants
- Fruits, including pods, of host plants.

For such a mobile group of insects, hitchhiking could also provide a pathway for entry (EFSA PLH Panel, 2015). However, as stated earlier, there is evidence that the expansion in the geographical range of the only invasive vector of *Xylella* spp., *H. vitripennis*, has not been associated with the spread of the bacterium (Sorensen and Gill, 1996; Grandgirard et al., 2006).

For the pathways listed above, Annex III of Directive 2000/29 EC includes prohibitions on the following plants for planting, which are hosts for some major diseases caused by *Xylella* spp.:

- *Citrus*, *Fortunella* and *Poncirus* from Third countries
- *Malus* and *Prunus* (other than dormant plants) from non-European countries other than Mediterranean countries, Australia, New Zealand, Canada, the continental states of the USA
- *Quercus* with leaves from non-European countries
- *Vitis* from Third countries other than Switzerland.

Likewise, Annex IV of Directive 2000/29 EC requires no symptoms of peach phony rickettsia (=phony peach disease (PPD), which is caused by *X. fastidiosa*) to have been observed on plants (i.e. *Prunus*) at the place of production or on susceptible plants in its immediate vicinity, since the beginning of the last three complete cycles of vegetation.

However, many potential pathways may remain open as no import requirements are currently specified for several potential hosts.

There are no records of interception or outbreaks of any of the three non-EU Cicadomorpha vectors of *Xylella* spp. listed in Annex IAI of Directive 2000/29/EC in the Europhyt database for the period 1995-2019 (accessed on 14 February 2019).

3.4.3. Establishment

Is the pest able to become established in the EU territory?

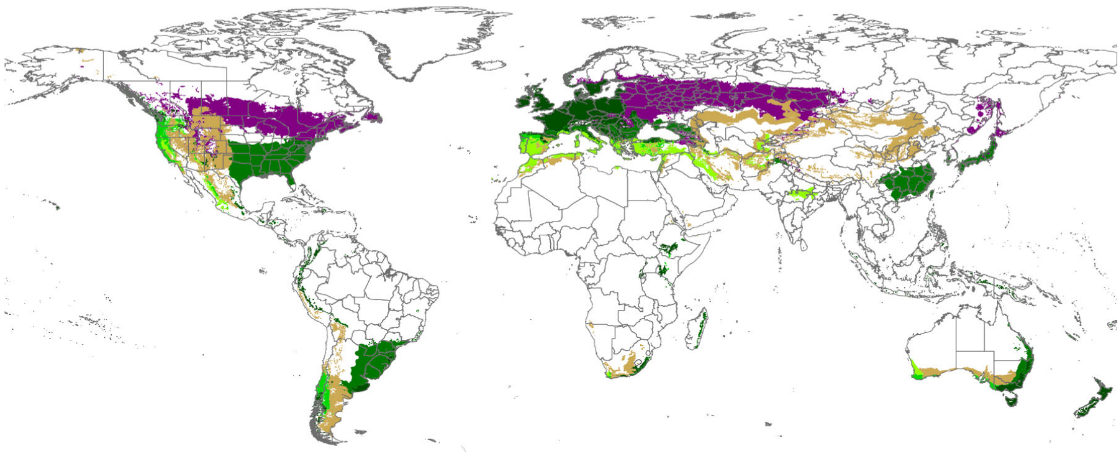
Yes, these insects can establish as host plants are available and climate is suitable in the EU.

3.4.3.1. EU distribution of main host plants

Non-EU Cicadomorpha vectors of *Xylella* spp. are mostly polyphagous (Table 6). Host/food plants of economic relevance (i.e. citrus, grapes, stone fruit) are present throughout the EU, especially in the southern MS. Most often, though, these species are found on herbaceous plants in pastures, cereal crops, and weedy vegetation (Redak et al., 2004), where these species usually breed. These hosts are widespread in the EU.

3.4.3.2. Climatic conditions affecting establishment

The species included in the group of non-EU Cicadomorpha vectors of *Xylella* spp. are found in countries that share climate types which also occur in the EU (Figure 1). Specifically in countries with the following climate types: temperate oceanic (Koppen–Geiger classification Cfb), humid subtropical (Cfa), cold semi-arid (BSk), warm summer humid continental (Dfb), Mediterranean, hot summer (Csa) and Mediterranean, warm summer (Csb) (Appendix F). For example, 49 of the 50 species are found in countries that contain a temperate oceanic climate; a climate type that occurs across almost 50% of the EU (MacLeod and Korycinska, 2019). However, although climates types found in the EU occur in countries where these pests occur, there is insufficient subnational detailed information on each species to determine whether the distribution within a country coincides with the climate types that are also found in the EU. There is therefore uncertainty around whether every species would find climatic conditions in the EU suitable for establishment. Nevertheless, for the purposes of a pest categorisation of a large group of pests, taking the distribution of species, shown in Table 3 into account they all occur in countries that have at least one climate type in common with the EU. This is sufficient information to conclude that climatic factors would not prevent establishment.



Climate type:	BSk	Cfa	Cfb	Csa	Csb	Dfb
% of EU grid cells (MacLeod and Korycinska, 2019)	1.5	6.3	48.6	10.1	3.9	8.7

Figure 1: Distribution of climate types occurring both in the EU and in third countries where Cicadomorpha proven to vector *Xylella* spp. occur

3.4.4. Spread

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

Yes. Adults of the species considered in this opinion are strong flyers. However, long distance movement is human assisted (i.e. via infested nursery plants).

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

Yes, plants for planting containing eggs are supposed to be the main means for spread.

According to CABI (2018), adult *H. vitripennis* (the only vector of *X. fastidiosa* considered invasive up to now, see above) are strong fliers and can move rapidly from plant to plant. Wingless nymphs and brachypterous adults cannot fly but can distribute themselves by walking and jumping through the canopy or dropping from plants and walking to new hosts. Most rapid and long-distance movement may occur as viable egg masses in nursery stock of either crop or ornamental plants. However, some species in the Auchenorrhyncha, including a major rice pest, the brown planthopper, *Nilaparvata lugens* (Stål) (Hemiptera: Fulgoromorpha: Delphacidae) can migrate long distances. *N. lugens* migrates from tropical southern China north to Japan in large numbers (Wilson et al., 2009).

3.5. Impacts

> *Would the pests' introduction have an economic or environmental impact on the EU territory?*
>
> **Yes**, in addition to feeding, which causes negligible damage, the introduction of these insects could further contribute to the spread of *Xylella* spp. in the EU
>
> *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?*[4]
>
> **Yes**, the presence of these insects on infected plants for planting could shorten the time necessary for the disease to spread within the orchard, cause damage and further contribute to the rapid spread of the disease at a wider regional/national scale.

Vectors of *X. fastidiosa*, the agent causing a variety of major plant diseases including almond leaf scorch, bacterial leaf scorch of elm, CVC, leaf scorch disease in pear, maple leaf scorch and PD could have major impacts as they spread the pathogen which can kill hosts relatively rapidly (Purcell and Saunders, 1999; Martelli et al., 2016).

Hundreds of millions of dollars have been spent dealing with *X. fastidiosa* in the USA. Tumber et al. (2014) estimated PD cost the Californian grape and wine industry US $104 million per year, as a result of production losses and disease management. In Brazil, overall yield losses and costs associated with the management of CVC were estimated at US $120 million per year (Bové and Ayres, 2007).

Given the wide range of plants that the vectors feed upon, and that there are no effective curative treatments for field crops (EFSA PLH Panel, 2019a,b) the introduction of *Xylella* spp. vectors into the EU could severely affect a wide variety of horticultural industries including ornamental production nurseries, summer fruit production and viticulture. Wider environmental impacts could also result (EFSA PLH Panel, 2018a).

P. spumarius has already caused significant damage to EU crops e.g. olives in Italy (EFSA PLH Panel, 2015, 2019a; Stokstad, 2015) by transmitting *X. fastidiosa*. Should any of the species subjected to this categorisation enter and establish in the EU, increasing problems with the diseases caused by *Xylella* spp. are anticipated. However, as there are no studies on (1) the relative efficiency of EU-vectors compared to non-EU-vectors in the transmission of *Xylella* spp. and (2) the intraguild interactions that may occur between EU and non-EU vectors, there is uncertainty on how the introduction of non-EU vectors into the EU would modify the transmission rate of the bacteria and, therefore, the epidemiology of the diseases caused by *Xylella* spp.

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**, see Sections 3.3 and 3.6.1.
>
> *RNQPs: Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?*
>
> **Yes**, sourcing plants for planting from a pest free area (PFA) would mitigate the risk.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to several host/food plants (see Sections 3.3 and 3.4.2).

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 6.

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

Table 6: Selected control measures (a full list is available in EFSA PLH Panel, 2018b) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)
Growing plants in isolation	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses	Entry/Spread
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants during process or packaging operations and storage (i.e. fumigation, spraying/dipping insecticides)	Entry and spread
Physical treatments on consignments or during processing	Use of physical treatments as irradiation/ionisation; mechanical cleaning (brushing, washing); sorting and grading, and; removal of plant parts, which could be lethal for the insects included in this categorisation	Entry and spread
Controlled atmosphere	Treatment of plants by storage in a modified atmosphere (including modified humidity, O_2, CO_2, temperature, pressure)	Entry and spread
Waste management	Treatment of the waste (deep burial, composting, incineration, chipping, production of bio-energy, etc.) in authorised facilities and official restriction on the movement of waste	Entry and spread
Roguing and pruning	Roguing of *X. fastidiosa*-infested plants is part of the official measures targeting this disease, which is vectored by the insects, considered in this categorisation	Entry, establishment and spread
Chemical treatments on crops including reproductive material	Application of insecticides in nurseries for plants for planting at regular intervals during the vegetation period and in orchards for reducing the population abundance	Entry, establishment and spread
Biological control and behavioural manipulation	Biological control (i.e. egg parasitoids and predators) can be used to decrease the densities of the insects considered in this categorisation	Establishment and spread
Post-entry quarantine and other restrictions of movement in the importing country	Post-entry regulations could allow detection of infested commodities hardly detectable when shipped into the EU (i.e. plants for planting with eggs of the insect species considered in this opinion)	Entry, establishment and spread

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 7.

Table 7: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018b) 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)
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. Chromatic traps have been used to capture the insects considered in this categorisation	Entry

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/establishment/spread/impact)
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	Entry
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by a National Plant Protection Organization in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. Key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent the pursued phytosanitary objective. Traceability aims to provide access to all trustful pieces of information that may help to prove the compliance of consignments with phytosanitary requirements of importing countries	Entry
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	Entry and spread
Sampling	According to ISPM 31, it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment. It is noted that the sampling concepts presented in this standard may also apply to other phytosanitary procedures, notably selection of units for testing. For inspection, testing and/or surveillance purposes the sample may be taken according to a statistically based or a non-statistical sampling methodology	Entry
Certification of reproductive material (voluntary/official)	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) a) export certificate (import) b) plant passport (EU internal trade)	Entry and spread
Surveillance	Chromatic traps, visual inspection, sweeping net	Entry, establishment and spread

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

- Eggs are usually inserted in the plant tissue of their host plants and are therefore difficult to detect
- Adults are highly mobile and can jump when disturbed. This behaviour might allow them to escape some control measures and encourage dispersal or inadvertent movement as hitchhikers.
- Roguing, if not preceded by an efficient treatment targeting adults can promote vector dispersal and therefore increase the incidence of the disease.

- Likewise, some agricultural practices for example watering, which might promote the prevalence of some preferred herbaceous hosts, followed by weeding (i.e. herbicide application) may promote vector dispersal and therefore increase the incidence of the disease.
- The foam produced by Aphrophoridae nymphs may protect them from some chemical treatments.

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

- Eggs are usually inserted in the plant tissue and are therefore difficult to detect and treat.

3.7. Uncertainty

One of the insects included in the group of non-EU Cicadomorpha vectors of *Xylella* spp. corresponds to a generic epithet of the Cicadellidae family, namely, *Draeculacephala*. Although there is a species-specific reference for this genus in the group (*D. minerva*), there is uncertainty about the exact identity of this generic record.

Although all the insects considered in this categorisation are proven vectors of *Xylella* spp. additional vectors within the order Hemiptera most probably exist.

EU type climates might not overlap with in-country (i.e. subnational) distribution of vectors

As there are no studies on (1) the relative efficiency of EU-vectors compared to non-EU-vectors in the transmission of *Xylella* spp., and (2) the intraguild interactions that may occur between EU and non-EU vectors, there is uncertainty on how the introduction of non-EU vectors into the EU would modify the transmission rate of the bacteria and, therefore, the epidemiology of the diseases caused by *Xylella* spp.

4. Conclusions

The group of non-EU Cicadomorpha vectors of *Xylella* spp. described in this categorisation meets all the criteria assessed by EFSA for consideration as potential Union quarantine pests. This group does not meet all the criteria assessed by EFSA for consideration as regulated non-quarantine pests, as the insects in this group are not present in the EU (Table 8).

Table 8: 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)

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)	Non-EU Cicadomorpha vectors of *Xylella* spp. belong to the three families within the suborder Cicadomorpha of the order Hemiptera. There are descriptions and taxonomic keys available for their identification to species level	Non-EU Cicadomorpha vectors of *Xylella* spp. belong to the three families within the suborder Cicadomorpha of the order Hemiptera. There are descriptions and taxonomic keys available for their identification to species level	One of the insects included in the group corresponds to genus *Draeculacephala*. The exact identity of this generic record is not known
Absence/ presence of the pest in the EU territory (Section 3.2)	Non-EU Cicadomorpha vectors of *Xylella* spp. are not present in the EU	Non-EU Cicadomorpha vectors of *Xylella* spp. are not present in the EU. Therefore, they do not meet the criterion of being present in the EU territory, a prerequisite for RNQP	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
Regulatory status (Section 3.3)	Non-EU Cicadomorpha vectors of *Xylella* spp. are not present in the EU. They are included in Annex IAI of Council Directive 2000/29/EC as 'Cicadellidae (non-EU) known to be a vector of Pierce's disease (caused by *Xylella fastidiosa*)'	Non-EU Cicadomorpha vectors of *Xylella* spp. are not currently regulated as RNQP. They are included in Annex IAI of CD 2000/29/EC as 'Cicadellidae (non-EU) known to be a vector of Pierce's disease (caused by *Xylella fastidiosa*)'	None
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Non-EU Cicadomorpha vectors of *Xylella* spp. are able to enter into the EU through plants for planting, cut branches, cut flowers and fruit. Establishment is possible as host and food plants are available and climatic conditions similar to their native range occur in the EU. Human-assisted spread (i.e. plant material infested with eggs) is their main means for spread	Non-EU Cicadomorpha vectors of *Xylella* spp. are mostly spread via plants for planting, which can be inadvertently infested with the eggs of these insects	Some species within Auchenorrhyncha are strong flyers and may regularly engage in long-distance migrations (i.e. *Nilaparvata lugens* in Asia) There is uncertainty about the overlapping of EU type climates with the actual distribution of the vectors at subnational level
Potential for consequences in the EU territory (Section 3.5)	The 49 species and 1 genus included in this categorisation as non-EU Cicadomorpha vectors of *Xylella* spp. would most probably impact several crops and affect it both cultivated and wild plants widely cultivated in the EU	The presence of non-EU Cicadomorpha vectors of *Xylella* spp. on plants for planting would most probably have an economic impact on its intended use	There is uncertainty on how the introduction of non-EU vectors would modify the transmission rate of the bacteria and, therefore, the epidemiology of the diseases caused by *Xylella* spp. in the EU
Available measures (Section 3.6)	There are measures available to prevent entry, establishment and spread of non-EU Cicadomorpha vectors of *Xylella* spp. in the EU which are described in Council Directive 2000/29/EC and in Section 3.6	There are measures available to prevent pest presence on plants for planting (e.g. plants for planting from pest free areas and grown in isolation) that could mitigate the risk in case the pest entered the EU	None
Conclusion on pest categorisation (Section 4)	Non-EU Cicadomorpha vectors of *Xylella* spp. meet all criteria assessed by EFSA above for consideration as potential quarantine pests	Non-EU Cicadomorpha vectors of *Xylella* spp. do not meet all criteria assessed by EFSA above for consideration as potential regulated non-quarantine pests, as they are not present in the EU	None
Aspects of assessment to focus on/ scenarios to address in future if appropriate	Because additional vectors within the order Hemiptera most probably exist, the list of non-EU Cicadomorpha vectors of *Xylella* spp. associated with plant diseases may change as research results become available.		

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Glossary

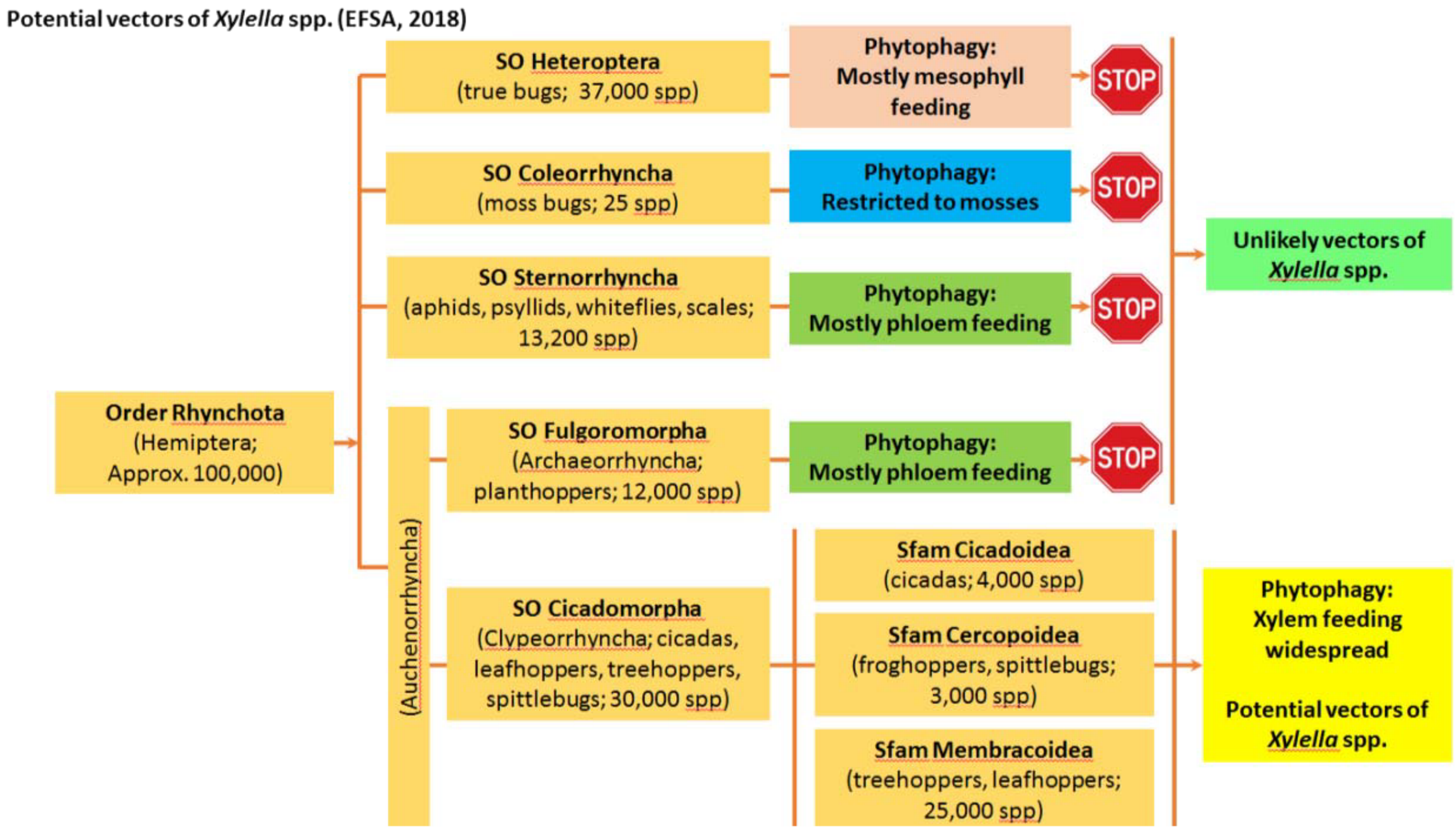
Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)
Entry (of a pest)	Movement of a pest into an area where it is not 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. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2017)

Abbreviations

ALS	almond leaf scorch
BLS	bacterial leaf scorch
CLS	coffee leaf scorch
CVC	citrus variegated chlorosis
DG SANTÉ	Directorate General for Health and Food Safety
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization

IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
OLS	oleander leaf scorch
OQDS	olive quick decline syndrome
PD	Pierce's disease
PFA	pest free area
PLH	EFSA Panel on Plant Health
PLS	plum leaf scald
PPD	phony peach disease
PW	periwinkle wilt
PZ	Protected Zone
RNQP	Regulated non-quarantine pests
RS	ragweed stunt
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Appendix A – Taxonomic affiliation of the potential vectors of *Xylella* spp.-caused diseases



Source: Capinera JL (2008)
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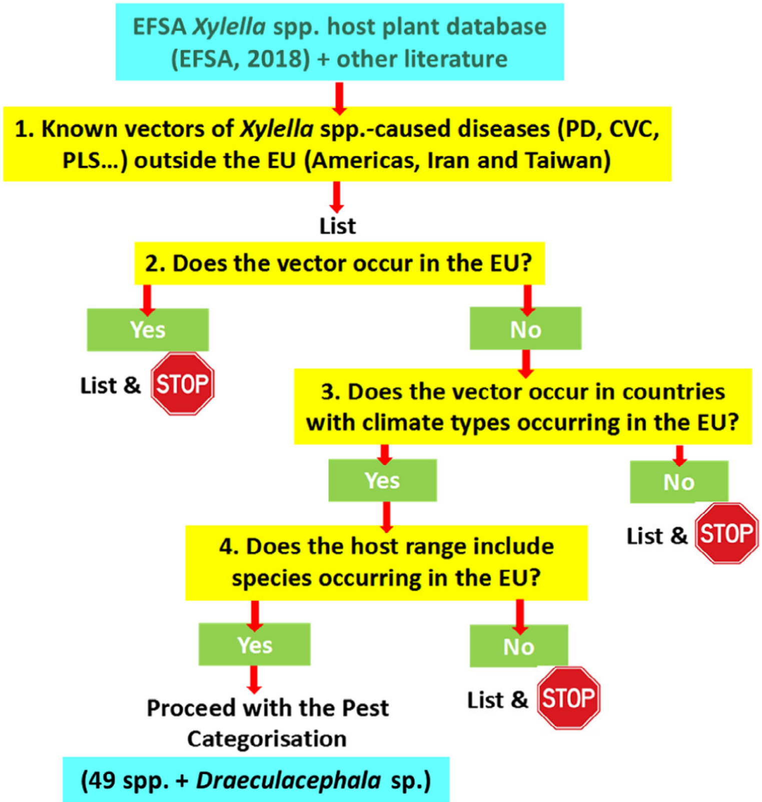
Appendix B – Decision tree used in this categorisation for the grouping of the different Cicadomorpha species known as vectors of *Xylella* spp.



Appendix C – Cicadomorpha species known as vectors of *Xylella* spp.-caused diseases worldwide

Species	Junior synonyms	Reported disease/s(1)	Reference	Presence in EU
FAMILY APHROPHORIDAE				
Subfamily Aphrophorinae: tribe Aphrophorini				
Aphrophora angulata Ball, 1899	*Cercopis angulata* Ball, 1899	PD	Severin (1950)	No
Aphrophora permutata Uhler, 1876	*Aphrophora permutata* Uhler, 1872; *Cercopis permutata* Lallemand, 1912	PD	Severin (1950)	No
Subfamily Aphrophorinae: tribe Cloviini				
Lepyronia quadrangularis (Say, 1825)	*Aphrophora quadrangularis* (Say, 1825); *Ptyelus quadrangularis* (Say, 1825); *Cercopis quadrangularis* Say, 1825; *Clastoptera quadrangularis* (Say, 1825)	BLS	Sanderlin and Melanson (2010)	No
Subfamily Aphrophorinae: tribe Philaenini				
Philaenus spumarius L, 1758	> 50 synonyms, see Nast (1972)	OQDS	EFSA (2018)	Yes
Subfamily Aphrophorinae: tribe Ptyelini				
Poophilus costalis (Walker, 1851)	*Gallicana flava* Metcalf and Horton, 1934; *Poophilus natalensis* (Stål, 1855); *Philaeunus natalensis* (Stål, 1855); *Ptyelus costalis* Walker, 1951; *P. concolor* Walker, 1851; *P. natalensis* Stål, 1855; *P. dolosus* Walker, 1858; *P. rotundatus* Signoret, 1858	PD	EFSA (2018)	No
Subfamily Clasteropterinae: tribe Clastopterini				
Clasteroptera achatina Germar, 1839	–	BLS	Sanderlin and Melanson (2010)	No
Clasteroptera. brunnea Ball, 1919	*Clastoptera lineaticollis* Ball 1919; *C. lineatocollis* Ball, 1927; *C. brunnea* Doering, 1929	PD	Severin (1950)	No
FAMILY CICADELLIDAE				
Subfamily Cicadellinae: tribe Cicadellini				
Bothrogonia ferruginea (Fabricius, 1787) (listed as *Tettigella ferruginea* in EFSA, 2018)	*Amblycephalus ferrugineus* Esaki and Ito, 1954; *Bhandara ferruginea* Jacobi, 1944; *Bothrogonia japonica* Ishihara, 1962; *B. sinica* Yang and Li, 1980; *B. meitana* Yang and Li, 1980; *B. eana* Yng and Li, 1980; *B. minana* Yang and Li, 1980; *B. shuana* Wilson, Turner and McKamey, 2009; *Cicada ferruginea* Fabricius, 1787; *Cicadella ferruginea* Kato, 1933; *C. ferruginae* Ota, 1937; *Megalotetettigella ferruginea* Ishihara, 1953; *Proconia ferruginea* Walker, 1851; *Tettigella ferrugineus* Ishihara, Miyatake, Hisamatsu, Edashige and Sasaki, 1953; *Tettigonia ferruginea* Germar, 1821; *T. apicalis* Walker, 1851; *T. confinis* Walker, 1851; *T. gemina* Walker, 1851; *T. duplex* Walker, 1851; *T. obscura* Walker, 1851; *Tettigoniella ferruginea* Distant, 1908; *T. freruginea* Li, 1940	PD	EFSA (2018)	No

Species	Junior synonyms	Reported disease/s(1)	Reference	Presence in EU
Bucephalogonia xanthopis (Berg, 1879)	–	CLS, CVC	EFSA (2018)	No
Dechacona missionum Berg, 1879	–	CVC	EFSA (2018)	No
Dilobopterus costalimai Young, 1977	–	CLS, CVC	EFSA (2018)	No
Draeculacephala minerva Ball, 1927	–	ALS, PD	EFSA (2018)	No
***Draeculacephala* sp.**	–	PPD	EFSA (2018)	No
Ferrariana trivittata (Signoret, 1851)	*F. pallipes* (Walker, 1851)	CVC	Azevedo Filho et al. (2011); Gai (2006)	No
Fingeriana dubia Cavichioli, 2003;	–	CVC	EFSA (2018)	No
Graphocephala atropunctata (Signoret, 1854)	*G. circellata* (Baker, 1898)	PD	EFSA (2018)	No
Graphocephala confluens (Uhler, 1861)	*G. pacifica* (DeLong and Severin, 1949), *G. surcula* (DeLong and Curries, 1960)	PD	EFSA (2018)	No
Graphocephala versuta (Say, 1830)	–	PD, PPD	EFSA (2018)	No
Helochara delta Oman, 1943	–	PD	EFSA (2018)	No
Kolla paulula (Walker, 1858)	*K. kinbergi* (Stål, 1859), *K. igniceps* (Walker, 1870)	PD	EFSA (2018)	No
Macugonalia cavifrons (Stål, 1862)	–	CVC	Müller (2013); de Oliveira-Molina et al. (2018)	No
Macugonalia leucomelas (Walker, 1851)	*M. albopunctata* (Taschenberg, 1884)	CVC	Azevedo Filho et al. (2011); Gai (2006)	No
Neokolla hyeroglyphica (Say, 1830)	*N. lugubris* (Signoret, 1854), *N. gothica* (Signoret, 1854), *N. similis* (Woodworth, 1890), *N. separanda* (Fowler, 1899), *N. amulae* (Fowler, 1899), *N. hieroglyphica atra* (Barber, 1921)	PD	EFSA (2018)	No
Neokolla severini DeLong, 1948	*Amphigonalia severini* (DeLong, 1948), *N. gothica* (Frazier 1944), *N. hamula* (DeLong and Curries, 1959)	PD	EFSA (2018)	No
Oragua discoidula Osborn, 1926	–	CVC	Lopes and Krugner (2016)	No
Parathona gratiosa (Blanchard, 1840)	*P. drewseni* (Stål, 1855)	CVC	Azevedo Filho et al. (2011); Gai (2006)	No
Plesiommata corniculata Young, 1977	–	CVC, PLS	Azevedo Filho et al. (2011); Gai (2006); Krügner et al. (2000)	No

Species	Junior synonyms	Reported disease/s[(1)]	Reference	Presence in EU
Plesiommata mollicella Fowler, 1900	–	CVC	Dellapé (2013)	No
Sibovia sagata (Signoret, 1854)	–	CVC	Müller (2013)	No
Sonesimia grossa (Signoret, 1854)	–	CVC	Azevedo Filho et al. (2011); Gai (2006)	No
Xyphon flaviceps (Riley, 1880)	–	PD	EFSA, 2018	No
Xyphon fulgida (Nottingham, 1932) (listed as *X. fulgidum* in EFSA, 2018)	*Carneocephala fulgida* Nottingham, 1932	PD	EFSA (2018)	No
Xyphon triguttata (Nottingham, 1932) (listed as *X. triguttatum* in EFSA, 2018)	–	PD	EFSA (2018)	No
Subfamily Cicadellinae: tribe Proconiini				
Acrogonia citrina Marucci and Cavichioli, 2002	–	CVC	de Oliveira-Molina et al. (2018)	No
Acrogonia virescens (Metcalf, 1949)	*A. bicolor* Fabricius	CVC	Azevedo Filho et al. (2011); Gai (2006)	No
Cuerna costalis (Fabricius, 1803)	–	PPD	EFSA (2018)	No
Cuerna occidentalis Osman and Beamer, 1944	–	PD	Frazier (1944)	No
Homalodisca ignorata Melichar, 1924	–	CLS, CVC	EFSA (2018)	No
Homalodisca insolita Walker, 1858	*H. atrata* (Fowler, 1899)	PPD	EFSA (2018)	No
Homalodisca vitripennis Germar, 1821	*H. coagulata* (Say, 1832)	ALS, BLS, CVC, OLS, PD, PPD, RS	EFSA (2018)	No
Molomea consolida Schröder, 1959	–	CVC	de Remes Lenicov et al. (1999)	No
Oncometopia facialis Signoret, 1854	–	CLS, CVC	EFSA (2018)	No
Oncometopia nigricans Walker, 1851	*O. marginata* (Walker, 1851); *O. scutellata* Walker, 1851; *O. tenebrosa* Walker, 1851	CVC, PD, PW, RS	EFSA (2018)	No
Oncometopia orbona (Fabricius, 1798)	*O. undata* (Fabricius, 1794); *O. plagiata* (Walker, 1851)	PD, PPD (under the syn. *O. undata*)	EFSA (2018)	No
Tapajosa rubromarginata (Signoret, 1855)	*T. tucumana* (Taschenberg, 1884); *T. rubromarginata similis* (Melichar, 1925)	CVC	EFSA (2018)	No

Species	Junior synonyms	Reported disease/s(1)	Reference	Presence in EU
Subfamily Errhorominae: tribe Pagaronini				
Friscanus friscanus (Ball, 1909)	*Errhomenellus friscanus* Ball, 1909; *Memmonia simplex* Van Duzee, 1917; *Fiscanus friscanus* Oman, 1938	PD	EFSA (2018)	No
Pagaronia confusa Oman, 1938	–	PD	EFSA (2018)	No
Pagaronia furcata Oman, 1938	–	PD	EFSA (2018)	No
Pagaronia trecedecempunctata Ball, 1902	*P. tredecempunctata* Woodworth, 1913	PD	EFSA (2018)	No
Pagaronia triunata Ball, 1902	*P. 13-punctata* var. *triunata* Ball, 1902; *P. semipagana* Bliven, 1958	PD	EFSA (2018)	No
FAMILY MEMBRACIDAE				
Subfamily Smiliinae: tribe Ceresini				
Cyphonia clavigera (Fabricius, 1803)	*Centrotus clavigera* F, 1803; *C. clauiger* F., 1803; *Bocydium clavigerum* Latreille, 1829; *Combophora claviger* Burmeister, 1833; *Cyphonia fuscata* Buckton, 1902	CVC	EFSA (2018)	No

(1): ALS: almond leaf scorch; BLS: bacterial leaf scorch; CLS: coffee leaf scorch; CVC: citrus variegated chlorosis; OLS: oleander leaf scorch; OQDS: olive quick decline syndrome; PLS: plum leaf scald; PPD: phony peach disease; PD: Pierce's disease; PW: periwinkle wilt; RS: ragweed stunt.

Appendix D – Distribution of non-EU Cicadomorpha vectors of *Xylella* spp

Species	Africa	Asia	North America	South America	Oceania
Fam. APHROPHORIDAE					
Aphrophora angulata			North Pacific (coastal areas extending from Colombia to Alaska) (Maw et al., 2000; NMNH, 2019)		
Aphrophora permutata			Canada, US (widespread from coast to coast and from Maine to Florida) It should occur in California (Severin, 1949; NMNH, 2019)		
Clastoptera achatina			Alabama, Florida, Georgia, Indiana, Kansas, Louisiana, Maryland, Michigan, Mississippi, New Jersey, Ohio, South Carolina, Tennessee, Virginia, and Washington, DC.; Canada; Mexico (Tedders, 1995; Hamilton, 1982; ISU, 2019)		
Clastoptera brunnea			Canada (British Columbia), US (California, Colorado, N. Dakota, Utah) (ISU, 2019)		
Lepyronia quadrangularis	South Africa (Western Cape) (Dmitriev, 2019)		Locally abundant in weedy areas east of the Rocky Mt (Doering, 1922) Canada (Alberta; Manitoba; Nova Scotia; Ontario; Québec); USA (North Carolina; Colorado; Connecticut; North Dakota; District of Columbia; Florida; Georgia; Illinois, Iowa; Kansas; Maine; Maryland; Massachusetts; Michigan; Minnesota; Mississippi; Nebraska; New Hampshire; New Jersey; New Mexico; New York; Ohio; Pennsylvania; South Dakota; Tennessee; Texas; Utah; Vermont; Virginia; West Virginia; Wisconsin. (Soulier-Perkins, 2019)		

Species	Africa	Asia	North America	South America	Oceania
Poophilus costalis	Angola, Benin, Cameroon, Democratic Republic of Congo, Guinea, Ivory Coast, Malawi, Namibia, Somalia, South Africa (Eastern Cape Province, KwaZulu-Natal), Togo, Uganda, Zimbabwe (Soulier-Perkins, 2018)	China (Fujian, Guangdong, Hainan, Xinjiang), India (Bihar, Darjeeling, Karnataka, Tamil Nadu, Uttar Pradesh, West Bengal), Japan, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Thailand (Soulier-Perkins, 2018)			
Fam. CICADELLIDAE					
Acrogonia citrina				Argentina (Dellapé and Paradell, 2013); Brasil (Marucci et al., 2002; Wilson et al., 2009); Paraguay (Dellapé et al., 2011)	
Acrogonia virescens				Brazil, Guyana, Peru, Paraguay (Young 1958; Wilson et al., 2009)	
Bothrogonia ferruginea		Burma, (Myanmar), Cambodia (Kampuchea), China (Manchuria), India, Japan (Honshu, Kyushu, Shikoku), Iran, Korea, Laos, Vietnam, (Nast, 1972; Wilson et al., 2009)			
Bucephalogonia xanthopis				Argentina, Bolivia, Brazil, Paraguay (Wilson et al., 2009)	
Cuerna costalis			Canada (Ontario); USA (Alabama, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Louisiana, Maryland, Mississippi, Missouri, Nebraska, New Mexico, New York, North Carolina, Ohio, Oklahoma, South Carolina, Tennessee, Texas, Virginia, DC, West Virginia) (Wilson et al., 2009)		

Species	Africa	Asia	North America	South America	Oceania
Cuerna occidentalis			USA (California) (Wilson et al., 2009)		
Dechacona missionum				Argentina, Paraguay, Peru (Wilson et al., 2009)	
Dilobopterus costalimai				Argentina, Brazil, Paraguay (Wilson et al., 2009)	
Draeculacephala minerva			Mexico, USA (Wilson et al., 2009).	Belize, Costa Rica, El Salvador, Guatemala, Nicaragua, Panama (Wilson et al., 2009).	
***Draeculacephala* sp. (24 spp.)**			Nearctic (Wilson et al., 2009)	Neotropical (Wilson et al., 2009)	
Ferrariana trivittata				Argentina, Brazil, Bolivia, Colombia, Costa Rica, Panama, Peru, Paraguay (Wilson et al., 2009)	
Fingeriana dubia				Brazil (Wilson et al., 2009)	
Friscanus friscanus			USA (California: restricted to the San Francisco Bay; not known to occur outside California) (Wilson et al., 2009)		
Graphocephala atropunctata			Mexico, USA (Wilson et al., 2009)	Nicaragua (Wilson et al., 2009)	
Graphocephala confluens			Canada, USA (Wilson et al., 2009)		
Graphocephala versuta			Mexico, USA (Wilson et al., 2009)	Costa Rica (Wilson et al., 2009)	
Helochara delta			USA (Wilson et al., 2009)		
Homalodisca ignorata				Brazil, Paraguay (Wilson et al., 2009)	
Homalodisca insolita			Mexico, USA (Wilson et al., 2009)	Costa Rica, El Salvador, Guatemala, Panama (Wilson et al., 2009)	
Homalodisca vitripennis			Mexico, USA (Wilson et al., 2009)		Hawaii, Tahiti (Wilson et al., 2009)

Species	Africa	Asia	North America	South America	Oceania
Kolla paulula		Burma (Myanmar), Cambodia (Kampuchea), China, India, Indonesia, Japan, Malaysia, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam (Wilson et al., 2009)			
Macugonalia cavifrons				Argentina, Brazil, Bolivia, Colombia, Paraguay, Peru, Venezuela (Wilson et al., 2009)	
Macugonalia leucomelas				Argentina, Brazil, Bolivia, Paraguay (Wilson et al., 2009)	
Molomea consolida				Brazil (Wilson et al., 2009)	
Neokolla hieroglyphica			Mexico, USA (Wilson et al., 2009)		
Neokolla severini			Mexico (Baja California), USA (Wilson et al., 2009)		
Oncometopia facialis				Bolivia, Brazil, Colombia, Ecuador, Paraguay, Uruguay (Wilson et al., 2009)	
Oncometopia nigricans			USA (Wilson et al., 2009)		
Oncometopia orbona			USA (Wilson et al., 2009)	Brazil (Wilson et al., 2009)	
Oragua discoidulla				Brazil, Paraguay, Argentina, Colombia (Wilson et al., 2009)	
Pagaronia 13-punctata			USA (California) (Oman, 1938)		
Pagaronia confusa			USA (California, maybe Nevada) (Oman, 1938)		
Pagaronia furcata			USA (California) (Oman, 1938)		

Species	Africa	Asia	North America	South America	Oceania
Pagaronia triunata			USA (California) (Oman, 1938)		
Parathona gratiosa				Argentina, Bolivia, Brazil, Paraguay (Wilson et al., 2009)	
Plesiommata corniculata			Mexico (Wilson et al., 2009)	Bolivia, Brazil, Colombia, Costa Rica, Grenada, Guyana, Panama, Paraguay, Suriname, Trinidad, Venezuela (Wilson et al., 2009)	
Plesiommata mollicella			Mexico (Wilson et al., 2009)	Argentina, Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, French Guiana, Guatemala, Panama, Paraguay, Venezuela (Wilson et al., 2009)	
Poophilus costalis	Angola, Benin, Cameroon, Democratic Republic of Congo, Guinea, Ivory Coast, Malawi, Namibia, Somalia, South Africa (Eastern Cape Province, KwaZulu-Natal), Togo, Uganda, Zimbabwe (Soulier-Perkins, 2018)	China (Fujian, Guangdong, Hainan, Xinjiang), India (Bihar, Darjeeling, Karnataka, Tamil Nadu, Uttar Pradesh, West Bengal), Japan, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Thailand (Soulier-Perkins, 2018)			
Sibovia sagata				Argentina, Bolivia, Brazil (Wilson et al., 2009)	
Sonesimia grossa				Argentina, Bolivia, Brazil, Paraguay (Wilson et al., 2009)	
Tapajosa rubromarginata				Argentina, Brazil (Wilson et al., 2009)	
Xyphon flaviceps			USA (Wilson et al., 2009)		
Xyphon fulgida			USA (Wilson et al., 2009)		

Species	Africa	Asia	North America	South America	Oceania
Xyphon triguttata			USA (Wilson et al., 2009)		
Fam. MEMBRACIDAE					
Cyphonia clavigera				Brazil, Paraguay, Uruguay, (Goding, 1914; Maes, 2018)	

Appendix E – Host/Food plants of non-EU Cicadomorpha vectors of *Xylella* spp.

Species	Host for which *Xylella* spp.-caused disease has been described	Associated host/food plants	Polyphagy
FAMILY APHROPHORIDAE			
Subfamily Aphrophorinae: tribe Aphrophorini			
Aphrophora angulata	Grapevine, Alfalfa	Willow (*Salix* sp.); cow parsnip *Heracleum lanatum* (Apiaceae) (Doering, 1930) (for a detailed list, see Delong and Severin, 1950 and Severin, 1950)	Yes
A. permutata	Grapevine	*Pinus* spp., one of the preferred weeds of the first-generation nymphs is bristly oxtongue, *Picris echioides* (Severin, 1950), *Chrysopis villosa* (Asteraceae) and *Lupinus* sp. (Fabaceae) (Doering, 1942). Grapevine is reported as unfavourable food plants for this insect (Severin, 1950)	Yes
Subfamily Aphrophorinae: tribe Clovinii			
Lepyronia quadrangularis	Pecan	Nymphs feed on the aerial parts of many different plants, including trees, broad-leaved herbaceous plants, brambles and grasses; 60 different hosts are recorded for this species (Doering, 1942), and this is probably only a partial list (Hamilton, 1982)	Yes
Subfamily Aphrophorinae: tribe Ptyelini			
Poophilus costalis	Grapevine	37 host plants belonging to 10 families and 31 genera, of which 31 host plants belong to the family Asteraceae (Shih et al., 2005)	Yes
Subfamily Aphrophorinae: tribe Clasteropterini			
Clasteroptera achatina	Pecan	Adults feed on hickories, including Pecan (*Carya illinoinensis*) (Baker1972), White-heart hickory (*Carya tomentosa*) (Doering, 1942), Shagbark hickory (*Carya ouata*) and Bitternut hickory (*Carya cordiformis*). They have also been collected on hazelnut (*Corylus* sp.), maple (*Acer* sp.) and linden (*Tilia* sp.) (Doering, 1942), but these are probably strays from hickories (Hamilton, 1982).	Yes
C. brunnea	Grapevine	Nymphs feed on the tips of Asteraceae such as big sagebrush (*Artemisia tridentata*), California mugwort (*Artemisia californica*), stinking rabbit brush (*Chrysothamnus nauseosus*), coyote brush (*Baccharis pilularis*), mule fat (*Baccharis viminea*), gum plant (*Grindelia camporum*) (Severin, 1950), and probably many other arid-adapted plants. Adults feed on big sagebrush (*Artemisia tridentata*), hoary sagebrush (*Artemisia cana*), stinking rabbit brush (*C. nauseosus*) and rabbit brush (*C. graveolens*), and *Hymenoclea salsola* (a relative of ragweed) (Doering, 1942; Hamilton, 1982)	Yes
FAMILY CICADELLIDAE			
Subfamily Cicadellinae: tribe Cicadellini			
Bothrogonia ferruginea	Grapevine	Pear, mulberry, tea, various berries, sugarcane (Ishihara, 1962)	Yes

Species	Host for which *Xylella* spp.-caused disease has been described	Associated host/food plants	Polyphagy
Bucephalogonia xanthopis	Citrus, coffee	*Vernonia condensata* Becker (Asteraceae) (Bento et al., 2008) and many other hosts (Redak et al., 2004)	Yes
Dechacona missionum	Citrus,	Common bean, *Phaseolus vulgaris* (Fabaceae) and rice (*Oryza* sp. (Poaceae) (Dmitriev, 2019)	Yes
Dilobopterus costalimai	Citrus, coffee	Several host plants (Redak et al., 2004)	Yes
Draeculacephala minerva	Almond, grapevine	*Vitis vinifera* and Poaceae such as *Cynodon dactylon*, *Echinochloa crusgalli* (EPPO, 2019)	Yes
***Draeculacephala* sp.** (24 spp.)	Peach	–	NA
Ferrariana trivittata	Citrus	Grass-feeding specialist that may feed on dicotyledons at times (Redak et al., 2004)	Yes
Fingeriana dubia	Citrus	Coffee (Cavichioli, 2003)	Yes
Graphocephala atropunctata	Grapevine	*Lupinus arboreus*, sagebrush (*Artemisia californica*), alfalfa (Nielson, 1968)	Yes
G. confluens	Grapevine	Poaceae (EPPO, 2018)	Yes
G. versuta	Grapevine	*Salix* sp., *Chrysothamnus* sp., *Fraxinus* sp., *Malus domestica*, *Quercus* sp., *Eucalyptus* sp. (Dmitriev, 2019)	Yes
Helochara delta	Grapevine, peach	Blackberry and ragweed or young cultivated plants, such as sunflower or cotton (Turner and Pollard, 1959)	Yes
Kolla paulula	Grapevine	Mainly weeds in and around fruit and ornamental crop orchards (Tuan et al., 2017); *Bidens pilosa* var. *radiata*) or trilobate wedelia (*Wedelia triloba*) (Tuan et al., 2016)	Yes
Macugonalia cavifrons	Citrus	*Citrus sinensis*, *Citrus unshiu* (Dellapé et al., 2013); *Lagerstroemia indica* L. (Lythraceae), *Duranta repens* L. (Verbenaceae), *Vernonia condensata* Baker (Asteraceae) and *Hibiscus* spp. (Malvaceae) (Kimura and Jr Leite, 2000; Esteves et al., 2019); *Zea mays* (Logarzo et al., 2012) (Marucci et al., 2002)	Yes
M. leucomelas	Citrus	*Waltheria indica* (Dmitriev, 2019) *Lagerstroemia indica* (Lythraceae), *Duranta repens* (Verbenaceae), *Vernonia condensata* Baker (Asteraceae) and *Hibiscus* spp. (Malvaceae), *Coffea arabica* (Kimura and Jr Leite, 2000)	Yes
Neokolla hyeroglyphica	Grapevine	Willow, poplar (Nielson, 1968) and alfalafa (Hoffmann and Taboada, 1962)	Yes
N. severini	Grapevine	*Vinca minor, Vinca major, Ribes* sp., *Lonicera hispidula, Eriodictyon* sp., *Artemisia vulgaris, Ceanothus* sp., *Psoralea tenuiflora* (Nielson, 1968)	Yes
Oragua discoidula	Citrus	Most probably polyphagous (Mejdalani et al., 2017)	Yes
Parathona gratiosa	Citrus	Weeds in citrus orchards (Ott et al., 2006);	Yes

Species	Host for which *Xylella* spp.-caused disease has been described	Associated host/food plants	Polyphagy
Plesiommata corniculata	Citrus, plum	Several host plants	Yes
P. mollicella	Citrus	*Brassica oleracea* (Brassicaceae), *Lycopersicon esculentum*, *Solanum* sp. (Solanaceae) (de Remes Lenicov et al., 2006 and other references therein); *Sorghum* (de Remes Lenicov et al., 2006)	Yes
Sibovia sagata	Citrus	Weeds in citrus orchards (Ott et al., 2006); Plum (Schneider et al., 2017); *Lantana* and basil (*Ocimum basilicum*) (Duarte and Ferreira, 2019)	Yes
Sonesimia grossa	Citrus	Plum (Schneider et al., 2017)	Yes
Xyphon flaviceps	Grapevine	*Cynodon* sp., *Trichostema lanceolatum*, *Chrysothamnus* sp. (Dmitriev, 2019)	Yes
X. fulgida	Grapevine	Many hosts (Dmitriev, 2019)	Yes
X. triguttata	Grapevine	*Cynodon* sp., *Trichostema lanceolatum*, *Chrysothamnus* sp. (Dmitriev, 2019)	Yes
Subfamily Cicadellinae: tribe Proconiini			
Acrogonia citrina	Citrus	Widely polyphagous (Redak et al., 2004)	Yes
A. virescens	Citrus	*Elaeis guineensis* (palm oil tree) (Arecaceae) (Dmitriev, 2019)	Yes
Cuerna costalis	Peach	Plum, cowpea, *Dahlia*, Grasses (Turner and Pollard, 1959)	Yes
C. occidentalis	Grapevine	*Artemisia* sp. (Asteraceae); *Symphoricarpos* sp. (Caprifoliaceae); *Arctostaphylos pungens* (Ericaceae); *Lotus* sp., *Lupinus* sp. (Fabaceae); Poaceae (Dmitriev, 2019)	Yes
Homalodisca ignorata	Citrus, coffee	Plum (Schneider et al., 2017) (Marucci et al., 2008)	Yes
H. insolita	Peach	Poaceae: *Digitaria sanguinalis* (crab grass), *Panicum dichotimoflorum* (fall panicum), *Panicum maximum* (Guinea grass), *Sorghum halepense* (Johnson grass) *Cenchrus echinatus* (southern sandbur); Rosaceae: *Prunus persica* (peach); Rutaceae: *Citrus sinensis* (orange) (Overall and Rebek, 2017; Dmitriev, 2019)	Yes
H. vitripennis	Almond, citrus, grapevine, oleander, peach, ragweed	Appears to be able to feed on most plant species. CABI lists *H. vitripennis* attacking species in 68 plant families (CABI, 2018).	Yes
Molomea consolida	Citrus	*C. sinensis* (Dmitriev, 2019); *Prunus salicina* (Schneider et al., 2017); *Zea mays* (Logarzo et al., 2012)	Yes
Oncometopia facialis	Citrus, coffee	Asteraceae: *Vernonia condensata*, *Vernonia polyanthes*, *Vernonia* sp.; Rutaceae: *Citrus sinensis* (orange), *Citrus* sp.; Verbenaceae: *Aloysia virgata* (sweet almond bush), *Lantana camara* (lantana) (Dmitriev, 2019)	Yes

Species	Host for which *Xylella* spp.-caused disease has been described	Associated host/food plants	Polyphagy
O. nigricans	Citrus, grapevine, peerwinkle ragweed	Lythraceae: *Lagerstroemia indica* (crapemyrtle) (Dmitriev, 2019); cotton, (*Gossypium hirsutum*), *Coleus* sp., okra, (*Hybiscus esculentus*), and wild periwinkle vine, (*Vinca major*) (Tipping et al. 2008)	Yes
O. orbona	Grapevine, peach	Amaranthaceae: *Amaranthus hybridus* (pigweed), *Amaranthus spinosus*; Anacardiaceae: *Mangifera indica* (mango), *Rhus* sp. (sumac); Aquifoliaceae: *Ilex* sp. (hollies); Asclepidaceae: *Asclepias* sp. (milkweed); Asteraceae: *Ambrosia artemisiifolia* (ragweed), *Ambrosia trifida* (giant ragweed), *Dahlia* sp. (dahlia), *Helianthus* sp. (sunflower), *Lactuca canadensis* (wild lettuce), *Solidago* sp. (goldenrod), *Xanthium* sp. (cocklebur); Bignoniaceae: *Campsis radicans* (trumpet creeper); Caprifoliaceae: *Lonicera japonica* (honeysuckle), *Sambucus* sp. (elder); Chenopodiaceae: *Chenopodium album* (lambsquarters); Elaeagnaceae: *Elaeagnus* sp. (elaeagnus); Euphorbiaceae: *Aleurites fordii* (tung); Fabaceae: *Albizia julibrissin* (silktree), *Cassia occidentalis* (coffeeweed), *Cassia tora*, *Cercis* sp. (redbud), *Medicago sativa* (alfalfa), *Trifolium pratense* (red clover), *Vigna sinensis* (cowpea); Fagaceae: *Quercus* sp. (oak); Hamamelidaceae: *Liquidambar styraciflua* (sweetgum); Juglandaceae: *Carya illinoensis* (pecan), *Juglans nigra* (black walnut); Liliaceae: *Yucca aloifolia* (aloe yucca); Lythraceae: *Lagerstroemia indica* (crapemyrtle); Malvaceae: *Althaea rosea* (hollyhock), *Gossypium herbaceum* (cotton), *Hibiscus esculentus* (okra), *Hibiscus* sp. (hibiscus), *Malva* sp. (mallow); Oleaceae: *Fraxinus* sp. (ash), *Ligustrum* sp. (privet); Onagraceae: *Oenothera laciniata* (evening primrose); Phytolaccaceae: *Phytolacca americana* (pokeweed); Poaceae: *Sorghum halepense* (Johnson grass), *Zea mays* (corn); Polygonaceae: *Rumex* sp. (dock); Rosaceae: *Cotoneaster* sp. (cotoneaster), *Malus sylvestris* (apple), *Prunus angustifolia* (chickasaw plum), *Prunus caroliniana* (laurelcherry), *Prunus persica* (peach), *Prunus* sp. (cultivated plum), *Pyracantha coccinea* (firethorn), *Rubus* sp. (blackberry); Salicaceae: *Salix nigra* (black willow); Smilacaceae: *Smilax* sp. (green brier); Theaceae: *Camellia japonica* (camellia); Ulmaceae: *Celtis* sp. (hackberry); Vitaceae: *Vitis* sp. (grapevine). (Dmitriev, 2019).	Yes
Tapajosa rubromarginata	Citrus, coffee	Asteraceae: *Vernonia condensata*, *Vernonia polyanthes*, *Vernonia* sp.; Rutaceae: *Citrus sinensis* (orange), *Citrus* sp.; Verbenaceae: *Aloysia virgata* (sweet almond bush), *Lantana camara* (lantana) (Dmitriev, 2019).	Yes
Subfamily Errhorominae: tribe Pagaroniini			
Friscanus friscanus	Grapevine	*Lupinus arboreus*, sagebrush (*Artemisia californica*), alfalfa (Nielson, 1968).	Yes
Pagaronia confusa	Grapevine	American (*Vicia americana*) and California vetch; mugwort (*Artemisia vulgaris*) (Nielson, 1968)	Yes
P. furcata	Grapevine	Poor survival on grape and alfalfa (Nielson, 1968). Most probably polyphagous.	Yes

Species	Host for which *Xylella* spp.-caused disease has been described	Associated host/food plants	Polyphagy
P. 13-punctata	Grapevine	California mugwort (*Artemisia vulgaris*), which may be its primary host (Nielson, 1968)	Yes
P. triunata	Grapevine	Grasses growing below pine and oak trees, *Acacia baileyana*, *Vicia americana*, *Lithocarpus densiflorus*, grape, alfalfa (Nielson, 1968).	Yes
FAMILY MEMBRACIDAE			
Subfamily Smiliinae: tribe Ceresini			
Cyphonia clavigera	Citrus	Weeds of Valencia Late sweet orange orchard (Dellapé et al., 2016)	Yes

Appendix F – EU climate types occurring in non-EU countries where non-EU Cicadomorpha vectors of *Xylella* spp. have been found

Species	BSk	Cfa	Cfb	Csa	Csb	Dfb
FAMILY APHROPHORIDAE						
Subfamily Aphrophorinae: tribe Aphrophorini						
Aphrophora angulata	x	x	X	x	x	x
A. permutata	x	x	X	x	x	x
Subfamily Aphrophorinae: tribe Cloviini						
Lepyronia quadrangularis	X	x	x	x	x	x
Subfamily Aphrophorinae: tribe Ptyelini						
Poophilus costalis	X	x	x	x	x	x
Subfamily Clasteropterinae: tribe Clastopterini						
Clasteroptera achatina	X	x	x	x	x	x
C. brunnea	X	x	x	x	x	x
FAMILY CICADELLIDAE						
Subfamily Cicadellinae: tribe Cicadellini						
Bothrogonia ferruginea	x					x
Bucephalogonia xanthopis	x	x	x			
Dechacona missionum	x	x	x			
Dilobopterus costalimai	x	x	x			
Draeculacephala minerva	x	x	x			
***Draeculacephala* sp.**	x	x	x	x	x	x
Ferrariana trivittata	x	x	x	x	x	x
Fingeriana dubia	x	x	x			
Graphocephala atropunctata		x	x			
G. confluens	x	x	x	x	x	x
G. versuta	x	x	x	x	x	x
Helochara delta	x	x	x	x	x	x
Kolla paulula	x	x	x	x	x	x
Macugonalia cavifrons	x	x	x			
Macugonalia leucomelas	x	x	x			
Neokolla hyeroglyphica	x	x	x			
Neokolla severini	x	x	x	x	x	x
Oragua discoidula	x	x	x	x	x	x
Parathona gratiosa	x	x	x	x	x	x
Plesiommata corniculata	x	x	x			
P. mollicella	x	x	x			
Sibovia sagata	x	x	x			
Sonesimia grossa	x	x	x			
Xyphon flaviceps	x	x	x	x	x	x
X. fulgida	x	x	x	x	x	x
X. triguttata	x	x	x	x	x	x
Subfamily Cicadellinae: tribe Proconiini						
Acrogonia citrina	x	x	x			
A. virescens		x	x			
Cuerna costalis	x	x	x	x		x
C. occidentalis	x	x	x			
Homalodisca ignorata		x	x			
H. insolita	x	x	x	x	x	x
H. vitripennis	x	x	x	x	x	x

Species	BSk	Cfa	Cfb	Csa	Csb	Dfb
Molomea consolida		x	x			
Oncometopia facialis	x	x	x			
O. nigricans	x	x	x	x	x	x
O. orbona	x	x	x	x	x	x
Tapajosa rubromarginata	x	x	x			
Subfamily Errhorominae: tribe Pagaronini						
Friscanus friscanus			x			
Pagaronia confusa	x	x	x	x	x	x
P. furcata	x	x	x	x	x	x
P. 13-punctata	x	x	x	x	x	x
P. triunata	x	x	x	x	x	x
FAMILY MEMBRACIDAE						
Subfamily Smiliinae: tribe Ceresini						
Cyphonia clavigera		x	x			
Number of species in country with climate type	44	48	49	27	26	28

BSk (cold semi-arid), **Cfa** (humid subtropical), **Cfb** (temperate oceanic), **Csa** (hot summer mediterranean), **Csb** (warm summer mediterranean), **Dfa** (hot summer humid continental), **Dfb** (warm summer humid continental).