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.

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**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 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 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, 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.

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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

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

(b) Bacteria

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

(c) Fungi

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

(d) Virus and virus-like organisms

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

Annex IIB

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

| Insects | Mites | Nematodes |
|---------|-------|-----------|
| Anthonomus grandis (Boh.) | Ips cembrae Heer | |
| Cephalcia lariciphiila (Klug) | Ips duplicatus Sahlberg | |
| Dendroctonus micans Kugelan | Ips sexdentatus Börner | |
| Gilphinia hercyniae (Hartig) | Ips typographus Heer | |
| Gonipterus scutellatus Gyll. | Sternochetae mangiferae Fabricius | |
| Ips amitinus Eichhof | | |
(b) Bacteria

*Curtobacterium flaccumfaciens pv. flaccumfaciens* (Hedges) Collins and Jones

(c) Fungi

*Glomerella gossypii* Edgerton  
*Hypoxylon mammatum* (Wahl.) J. Miller  
*Gremmeniella abietina* (Lag.) Morelet

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  
3) *Graphocephala atropunctata* (Signoret)

2) *Draeculacephala minerva* Ball

Group of Tephritidae (non-EU) such as:

1) *Anastrepha fraterculus* (Wiedemann)  
12) *Pardalisps cyanescens* Bezzi

2) *Anastrepha ludens* (Loew)  
13) *Pardalisps quinquaria* Bezzi

3) *Anastrepha obliqua* Macquart  
14) *Pterandrus rosa* (Karsch)

4) *Anastrepha suspensa* (Loew)  
15) *Rhacochaena japonica* Ito

5) *Dacus ciliatus* Loew  
16) *Rhagoletis completa* Cresson

6) *Dacus curcurbitae* Coquillet  
17) *Rhagoletis faust* (Osten-Sacken)

7) *Dacus dorsalis* Hendel  
18) *Rhagoletis indifferens* Curran

8) *Dacus tryoni* (Froggatt)  
19) *Rhagoletis mendax* Curran

9) *Dacus tsuneonis* Miyake  
20) *Rhagoletis pomonella* Walsh

10) *Dacus zonatus* Saund.  
21) *Rhagoletis suavis* (Loew)

11) *Epochra canadensis* (Loew)

(c) Viruses and virus-like organisms

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

1) Andean potato latent virus  
4) Potato black ringspot virus

2) Andean potato mottle virus  
5) Potato virus T

3) Arracacha virus B, oca strain  
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  
8) Peach yellows mycoplasm

2) Cherry rasp leaf virus (American)  
9) Plum line pattern virus (American)

3) Peach mosaic virus (American)  
10) Raspberry leaf curl virus (American)

4) Peach phyto rickettsia  
11) Strawberry witches’ broom mycoplasma

5) Peach rosette mosaic virus  
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.*

6) Peach rosette mycoplasm

7) Peach X-disease mycoplasm
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) 3) Margarodes prieskaensis Jakubski
2) Margarodes vredendalensis de Klerk

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

(b) Fungi

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

(c) Viruses and virus-like organisms

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

Arceuthobium spp. (non-EU)

Annex I A II

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

Meloidogyne fallax Karssen

Popillia japonica Newman

(b) Bacteria

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

Ralstonia solanacearum (Smith) Yabuuchi et al.

(c) Fungi

Melampsora medusae Thümen

Synchytrium endobioticum (Schilbersky) Percival

Annex I B

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

Leptinotarsa decemlineata Say

Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. 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 SANTE) 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 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? |
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 Cicadoidae, 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 Drosopoulus 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 Pylelini | | | |
| 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 | 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 (Stal, 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 molicella 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**

| Species                          | Reported disease/s | Reference                  | Identification/description references |
|---------------------------------|--------------------|----------------------------|---------------------------------------|
| 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)              |
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 disease/s(1) Reference Identification/description references

| Species                      | Reported disease/s | Reference          | Identification/description references |
|------------------------------|--------------------|--------------------|---------------------------------------|
| Cuerna occidentalis          | PD                 | Frazier (1944)     | Wilson and Turner (2010)               |
| Homalodisca ignorata         | CLS, CVC           | EFSA (2018)        | Wilson and Turner (2010)               |
| Homalodisca insolita         | PPD                | EFSA (2018)        | Wilson and Turner (2010)               |
| Homalodisca vitripennis      | ALS, BLS, CVC, OLS, PD, PPD, RS | EFSA (2018) | Wilson and Turner (2010)               |
| Molomea consolida            | CVC                | de Remes Lenicov et al. (1999) | Wilson et al. (2009)                  |
| Oncometopia facialis         | CLS, CVC           | EFSA (2018)        | Wilson et al. (2009)                  |
| Oncometopia nigricans        | CVC, PD, PW, RS    | EFSA (2018)        | Wilson and Turner (2010)               |
| Oncometopia orbona           | PD, PPD (under the syn. O. undata) | EFSA (2018) | Wilson and Turner (2010)               |
| Tapajosa rubromarginata      | CVC                | EFSA (2018)        | Wilson et al. (2009)                  |

Subfamily Erroherominae: tribe Pagaronini

| Friscanus friscanus          | PD                 | EFSA (2018)        | Wilson and Turner (2010)               |
| Pagaronia confusa            | PD                 | EFSA (2018)        | Wilson and Turner (2010)               |
| Pagaronia furcata            | PD                 | EFSA (2018)        | Wilson and Turner (2010)               |
| Pagaronia trecedecempunctata | PD                 | EFSA (2018)        | Wilson and Turner (2010)               |
| Pagaronia triunata           | PD                 | EFSA (2018)        | Wilson and Turner (2010)               |

FAMILY MEMBRACIDAE

Subfamily Smiliinae: tribe Ceresini

| Cyphonia clavigera           | 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 southeastern 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); 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 Proconini. *Cicadella viridis* L. is the most common of a few species of Cicadellini reported in Europe (Fauna Europaea, [https://fauna-eu.org/t/](https://fauna-eu.org/t/)), whereas Proconini 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). Symptomatic plants can be 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 | | | | |
| **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 | | | |
| **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* |                            |                           |                        |                       | Nicaragua|
| *G. confluens*        |                            |                           |                        |                       | Canada   |
| *G. versuta*          |                            |                           |                        |                       | Mexico   |
| *Helochara delta*     |                            |                           |                        |                       | USA      |
| *Kolla paulula*       |                            |                          |                        |                       | USA      |
|                       |                            |                          |                        |                       | USA, China, Indonesia, Japan, Malaysia, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam |
| *Macugonalia cavinfrons* |                            |                           |                        |                       | 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             | Brazil, Paraguay |                  |
| Homalodisca ignorata    |                 |                 |                 | Costa Rica, El Salvador, Guatemala, Panama |                  |
| H. insolita             |                 | Mexico, USA     | USA             |                  |                  |
| H. vitripennis          |                 | Mexico, USA     | USA             | Hawaii (USA), Tahiti (France) |                  |
| Molomea consolda        |                 |                 |                 | 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 |
| (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 |
|------------------|--------------------------|
| Citrus variegated chlorosis | Plants of Citrus L., Fortunella Swingle, Poncirus Raf., and their hybrids, other than fruit and seeds |
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.
3.4.4. Spread

According to CABI (2018), adult *H. vitripennis* (the only vector of *X. fastidiosa* considered invasive up to now, see above) are strong flyers 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).

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

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.

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| 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 |
3.5. Impacts

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

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.
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.

| Supporting measure summary | Risk component (entry/establishment/spread/impact) |
|---------------------------|-----------------------------------------------|
| Inspection and trapping   | Entry                                         |
| 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. |                                                |
### 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.

| 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 |
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)

**Eradiation (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**

**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
| Abbreviation | Full Form |
|--------------|-----------|
| 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

Potential vectors of Xylella spp. (EFSA, 2018)

- **SO Heteroptera** (true bugs; 37,000 spp)
  - Phytophagy: Mostly mesophyll feeding
  - STOP

- **SO Coleorrhyncha** (moss bugs; 25 spp)
  - Phytophagy: Restricted to mosses
  - STOP

- **SO Sternorrhyncha** (aphids, psyllids, whiteflies, scales; 13,200 spp)
  - Phytophagy: Mostly phloem feeding
  - STOP

- **Order Rhynchota** (Hemiptera; Approx. 100,000)

  - **SO Fulgoromorpha** (Archaeorrhyncha; planthoppers; 12,000 spp)
    - Phytophagy: Mostly phloem feeding
    - STOP

  - **SO Cicadomorpha** (Clypeorrhyncha; cicadas, leafhoppers, treehoppers, spittlebugs; 30,000 spp)
    - **Sfam Cicadoidea** (cicadas; 4,000 spp)
    - **Sfam Cercopoidea** (froghoppers, spittlebugs; 3,000 spp)
    - **Sfam Membracoidea** (treehoppers, leafhoppers; 25,000 spp)

  - **Auchenorrhyncha**

- Unlikely vectors of Xylella spp.

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

1. Known vectors of Xylella spp.-caused diseases (PD, CVC, PLS...) outside the EU (Americas, Iran and Taiwan)

2. Does the vector occur in the EU?
   - Yes
     - List & STOP
   - No
     - 3. Does the vector occur in countries with climate types occurring in the EU?
       - Yes
         - 4. Does the host range include species occurring in the EU?
           - Yes
             - Proceed with the Pest Categorisation (49 spp. + Draeculacephala sp.)
           - No
             - List & STOP
       - No
         - List & STOP
Appendix C – Cicadomorpha species known as vectors of *Xylella* spp.-caused diseases worldwide

| Species                                      | Junior synonyms                                                                 | Reported disease(s) | 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, 1872;          | *Cercopis permutata* Lallemand, 1912                                            | PD                  | Severin (1950)             | No             |
| FAMILY CICADDILLIDAE                         |                                                                                  |                     |                            |                |
| Subfamily Clasteropterinae: tribe Clasteropterini |                                                                                  |                     |                            |                |
| *Clastoptera achatina* Germar, 1839          |                                                                                  | BLS                 | Sanderlin and Melanson (2010) | No             |
| *Clastoptera brunnea* Ball, 1919             | *Clastoptera lineaticollis* Ball 1919;                                          | PD                  | Severin (1950)             | No             |
| Subfamily Cicadellinae: tribe Cicadellini    |                                                                                  |                     |                            |                |
| *Bothrogonia ferruginea* (Fabricius, 1787)   | (listed as *Tettigella ferruginea* in EFSA, 2018)                               | 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

| Species | Junior synonyms | Reported disease/s(1) | Reference | Presence in EU |
|---------|-----------------|-----------------------|-----------|----------------|
| Plesiommata mollicella 1 | Fowler, 1900 | – | CVC | Dellapé (2013) | No |
| Sibovia sagata (Signoret, 1854) 2 | – | CVC | Müller (2013) | No |
| Sonesimia grossa (Signoret, 1854) 2 | – | CVC | Azevedo Filho et al. (2011); Gai (2006) | No |
| Xyphon flaviceps (Riley, 1880) 2 | – | PD | EFSA, 2018 | No |
| Xyphon fulida (Nottingham, 1932) (listed as X. fulgida in EFSA, 2018) 2 | Carneocephala fulida Nottingham, 1932 | PD | EFSA (2018) | No |
| Xyphon triguttata (Nottingham, 1932) (listed as X. triguttata in EFSA, 2018) 2 | – | PD | EFSA (2018) | No |

### Subfamily Cicadellinae: tribe Proconiini

| Species | Junior synonyms | Reported disease/s(1) | Reference | Presence in EU |
|---------|-----------------|-----------------------|-----------|----------------|
| Acrogonia citrina Marucci and Cavichioli, 2002 | – | CVC | de Oliveira-Molina et al. (2018) | No |
| Acrogonia virescens (Metcalf, 1949) 2 | A. bicolor Fabricius | CVC | Azevedo Filho et al. (2011); Gai (2006) | No |
| Cuerna costalis (Fabricius, 1803) 2 | – | PPD | EFSA (2018) | No |
| Cuerna occidentalis Osman and Beamer, 1944 | – | PD | Frazier (1944) | No |
| Homalodisca ignotata 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 2 | O. marginata (Walker, 1851); O. scutellata Walker, 1851; O. tenebrosa Walker, 1851 | CVC, PD, PW, RS | EFSA (2018) | No |
| Oncometopia orbina (Fabricius, 1798) | O. undata (Fabricius, 1794); O. plagiata (Walker, 1851) | PD, PPD (under the syn. O. undata) | EFSA (2018) | No |
| Tapatoposa 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 Errhomininae: tribe Pagaronini**                                                                                                  |
| *Friscanus friscanus*        | *Errhomenellus friscanus* Ball, 1909; *Memnonia simplex* Van Duzee, 1917; *Friscanus 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* | *P. tredecempunctata* Woodworth, 1913                                              | PD                    | EFSA (2018) | No             |
| *Pagaronia triunata*         | *P. 13-punctata var. triunata* Ball, 1902; *P. semipagana* Bliven, 1958           | PD                    | EFSA (2018) | No             |
| **FAMILY MEMBRACIDAE**                                                                                                                        |
| **Subfamily Smiliinae: tribe Ceresini**                                                                                                       |
| *Cyphonia clavigera*         | *Centrotus clavigera* F, 1803; *C. clauiger* F, 1803; *Bocydium clavigerum* Latreille, 1829; *Combophora claviger* Burmeister, 1833; *Cyphonia fusca* 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; Quebec); 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*     |                                                                       |                                                                      |                                                                  |               |         |
| *Acrogonia virescens*   |                                                                        |                                                                      |                                                                  |               |         |
| *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* |                                                                      |                                                                      |                                                                  |               |         |
| *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*    |                 |                             |                                                     |                                                                               |                       |
| *Dilobopterus costalimai*|                 |                             |                                                     |                                                                               |                       |
| *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*  |                 |                             |                                                     |                                                                               |                       |
| *Fingeriana dubia*       |                 |                             |                                                     |                                                                               |                       |
| *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*        |                 |                             |                                                     |                                                                               |                       |
| *Homalodisca ignorata*   |                 |                             |                                                     |                                                                               |                       |
| *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*  |                                            |                                                                       |                                    |                                                                               |                                                                         |
| *Macugonalia leucomelas* |                                            |                                                                       |                                    |                                                                               |                                                                         |
| *Molomea consolida*      |                                            |                                                                       |                                    |                                                                               |                                                                         |
| *Neokolla hieroglyphica* |                                            | Mexico, USA (Wilson et al., 2009)                                    |                                    |                                                                               |                                                                         |
| *Neokolla severini*      |                                            | Mexico (Baja California), USA (Wilson et al., 2009)                   |                                    |                                                                               |                                                                         |
| *Oncometopia facialis*   |                                            |                                                                       |                                    |                                                                               |                                                                         |
| *Oncometopia nigricans*  |                                            | USA (Wilson et al., 2009)                                            |                                    |                                                                               |                                                                         |
| *Oncometopia orbona*     |                                            | USA (Wilson et al., 2009)                                            |                                    |                                                                               |                                                                         |
| *Oragua discoidulla*     |                                            |                                                                       |                                    |                                                                               |                                                                         |
| *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)                                       | Argentina, Bolivia, Brazil, Paraguay (Wilson et al., 2009)                                        |         |
| *Parathona gratiosa*    |                                                                        |                                                                      |                      |                                                                                                  |         |
| *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 | Polyphygy |
|---------|---------------------------------------------------------------|----------------------------|-----------|
| **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 echioiodes* (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 illinoinsensis*) (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 viminalis*), 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                                                                 | Polyphygamous |
|------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------|
| *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, Echinoloha crusgalli* (EPPO, 2019) | Yes           |
| *Draeculacephala sp.* (24 spp.) | Peach                                                          | NA                                                                                       | 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 arborescens, 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 alfalfa (Hoffmann and Taboada, 1962)                    | Yes           |
| *N. severini*                | Grapevine                                                      | *Vinca minor, Vinca major, Ribes sp., Lonicera hispida, Eriodictyon sp., Artemisia vulgaris, Ceanothus sp., Psoralea tenuilora* (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                                                                 | Polyphyg |
|-------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------|
| *Plesiommata corniculata*     | Citrus, plum                                                  | Several host plants                                                                        | Yes      |
| *P. molicella*                | 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 dichotomiflorum* (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 peerwinkle 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); Asclepiadaceae: *Asclepias* sp. (milkweed); Asteraceae: *Ambrosia artemisiifolia* (ragweed), *Ambrosia trifida* (giant ragweed), *Dahlia* sp. (dahila), *Helianthus* sp. (sunflower), *Lactuca canadensis* (wild lettuce), *Solidago* sp. (goldenrod), *Xanthium* sp. (cocklebur); Bignoniaceae: *Campsis radicans* (trumpet creeper); Caprifoliaceae: *Loniceria japonica* (honesuckle), *Sambucus* sp. (elder); Chenopodiaceae: *Chenopodium album* (lambquarters); Elaeagnaceae: *Elaeagnus* sp. (elaeagnus); Euphorbiaceae: *Aleurites fordii* (tung); Fabaceae: *Albizia julibrissin* (silktree), *Cassia occidentalis* (coffeeweed), *Cercis* sp. (redbud), *Medicago sativa* (alfalfa), *Trifolium pratense* (red clover), *Vigna sinensis* (cowpea), *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**

| Species                | Host for which *Xylella* spp.-caused disease has been described | Associated host/food plants                                                                                                                                                                                                 | Polyphagy |
|------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| *Friscanus friscanus*   | Grapevine                                                     | Lupinus arboresus, 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 | BS | 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 Clasteropterini** |     |     |     |     |     |     |
| *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 | x | x | x | x |
| *Bucephalogonia xanthopis* | x | x | x | x | x | x |
| *Dechacona missionum* | x | x | x | x | x | x |
| *Dilobopterus costalimai* | x | x | x | x | x | x |
| *Draeculacephala minerva* | x | x | x | x | x | x |
| *Draeculacephala sp.* | x | x | x | x | x | x |
| *Ferraria trivittata* | x | x | x | x | x | x |
| *Fingeriana dubia* | x | x | x | x | x | x |
| *Graphocephala atropunctata* | x | x | x | x | x | x |
| *G. confinens* | 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 | x | x | x |
| *Macugonalia leucomelas* | x | x | x | x | x | x |
| *Neokolla hyeroglyphica* | x | x | x | 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 | x | x | x |
| *P. molicella* | x | x | x | x | x | x |
| *Sibovia sagata* | x | x | x | x | x | x |
| *Sonesimia grossa* | x | x | x | 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 | x | x | x |
| *A. virescens* | x | x | x | x | x | x |
| *Cuerna costalis* | x | x | x | x | x | x |
| *C. occidentalis* | x | x | x | x | x | x |
| *Homalodisca ignorata* | x | x | x | x | x | x |
| *H. insolita* | x | x | x | x | x | x |
| *H. vitripennis* | x | x | x | x | x | x |
## Species

| Species                          | BSk | Cfa | Cfb | Csa | Csb | Dfb |
|----------------------------------|-----|-----|-----|-----|-----|-----|
| *Molomea consolida*              |     | x   |     |     |     |     |
| *Oncometopia facialis*           | x   | x   |     |     |     |     |
| *O. nigricans*                   | x   | x   | x   | x   | x   | x   |
| *O. orbina*                      | x   | x   | x   | x   | x   | x   |
| *Tapajosa rubromarginata*        | x   | x   |     |     |     |     |

*Subfamily Errhorominae: tribe Pagaronini*

| Species                          | BSk | Cfa | Cfb | Csa | Csb | Dfb |
|----------------------------------|-----|-----|-----|-----|-----|-----|
| *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   |

*FAMILY MEMBRACIDAE*

*Subfamily Smilinae: tribe Ceresini*

| Species                          | BSk | Cfa | Cfb | Csa | Csb | Dfb |
|----------------------------------|-----|-----|-----|-----|-----|-----|
| *Cyphonia clavigera*             |     |     | 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).