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Pest categorisation of *Hishimonus phycitis*

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Abstract

The Panel on Plant Health performed a pest categorisation of *Hishimonus phycitis* (Hemiptera: Cicadellidae) for the EU. *H. phycitis* is a well-defined species, occurring in tropical and subtropical Asian countries from Iran to Malaysia. *H. phycitis* is polyphagous. Hosts of particular relevance to the EU include *Citrus* spp. and *Solanum melongena*. While harmful in its own right as a leafhopper extracting host nutrients through feeding, it is regarded in the Middle East more significantly as a vector of Witches' broom disease of lime phytoplasma, which limits production of *Citrus aurantifolia*, and in India as a vector of brinjal little-leaf phytoplasma impacting *S. melongena* yields. *H. phycitis* is currently regulated by Council Directive 2000/29/EC, listed in Annex II/AI as *Hishomonus phycitis* (sic). Eggs planted on host plants for planting could provide a pathway for entry into the EU. The EU has eco-climatic conditions that are also found in countries where *H. phycitis* occurs although it is unknown whether *H. phycitis* occurs in those areas. There is therefore considerable uncertainty around EU establishment. Any establishment is likely to be limited to the warmest areas around the Mediterranean. As a free-living organism with adults capable of flight, spread within the EU would be possible but confined to the limited area where establishment could occur. Measures are available to inhibit entry via traded commodities (e.g. prohibition on the introduction of *Citrus* plants for planting; sourcing other hosts from pest free areas). *H. phycitis* does satisfy all of the criteria that are within the remit of EFSA to assess to be regarded as a Union quarantine pest. It is uncertain if eggs of *H. phycitis* would carry phytoplasmas into the EU as transovarial transmission from infected females to eggs has not been demonstrated.

Keywords: leafhopper, pest risk, phytoplasma, plant pest, quarantine, vector, Witches' broom disease of lime

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1. Introduction

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

1.1.1. Background

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

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

1.1.2. Terms of Reference

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

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

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

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

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

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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

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

(b) Bacteria

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

(c) Fungi

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

(d) Virus and virus-like organisms

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

Annex IIB

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

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

(b) Bacteria

Curtobacterium flaccumfaciens pv. flaccumfaciens (Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton

Gremmeniella abietina (Lag.) Morelet

Hypoxylon mammatum (Wahl.) J. Miller

1.1.2.2. Terms of Reference: Appendix 2

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

Annex IAI

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

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

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

Group of Tephritidae (non-EU) such as:

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

(c) Viruses and virus-like organisms

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

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

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

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

Annex IIAI

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

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

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

1.1.2.3. Terms of Reference: Appendix 3

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

Annex IAI

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

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

(b) Fungi

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

(c) Viruses and virus-like organisms

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

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex IAII

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

Meloidogyne fallax Karssen

Rhizoecus hibisci Kawai and Takagi

Popillia japonica Newman

(b) Bacteria

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

Ralstonia solanacearum (Smith) Yabuuchi et al.

(c) Fungi

Melampsora medusae Thümen

Synchytrium endobioticum (Schilbersky) Percival

Annex I B

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

Leptinotarsa decemlineata Say

Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

The subject of this pest categorisation is misspelt in Appendix II/AI of 2000/29 EC as *Hishomonus phycitis* (sic); the same spelling is used in Appendix 1 of the current Terms of Reference (ToR). So as to avoid the perpetuation of the spelling error, this pest categorisation will use the scientifically recognised name *Hishimonus phycitis. H. phycitis* is one of a number of pests listed in the Appendices to the ToR to be subject to pest categorisation to determine whether it fulfils the criteria of a quarantine pest or those of a regulated non-quarantine pest (RNQP) for the area of the European Union (EU) excluding Ceuta, Melilla and the outermost regions of Member States (MSs) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

Hishimonus phycitis is a vector of Witches' broom disease of lime phytoplasma (WBDL phytoplasma), listed in Appendix II/AI of 2000/29 EC as Witches' broom (MLO) (mycoplasma-like-organism) and subject to its own pest categorisation (EFSA PLH Panel, 2017).

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *Hishimonus phycitis* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as the search term. Relevant papers were reviewed, and further references and information were obtained from experts, from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the EPPO Global Database (EPPO, 2017) and from the literature.

Data about import of commodity types that could potentially provide a pathway for the pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT and FAO Stat. FAO Stat was also used as a source of information about the area of hosts grown in third countries where *H. phycitis* occurs.

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network launched by the Directorate General for Health and Consumers (DG SANCO), 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 MSs and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

The Panel performed the pest categorisation for *H. phycitis*, following guiding principles and steps presented in the EFSA guidance on the harmonised framework for pest risk assessment (EFSA PLH Panel, 2010) and as defined in the International Standard for Phytosanitary Measures No 11 (FAO, 2013) and No 21 (FAO, 2004).

In accordance with the guidance on a harmonised framework for pest risk assessment in the EU (EFSA PLH Panel, 2010), this work was initiated following an evaluation of the EU's 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 as per 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. Note that a pest that does not qualify as a quarantine pest may still qualify as a regulated non-quarantine pest which 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 regards 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, while addressing social impacts is outside the remit of the Panel, in agreement with EFSA guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010).

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).

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
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future.	The protected zone system aligns with the pest free area system under the International Plant Protection Convention (IPPC). The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone).	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential regulated non-quarantine pest were met, and (2) if not, which one(s) were not met.

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

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

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

Yes, the identity of *Hishimonus phycitis* (Distant, 1908) is established, it is an insect in the family Cicadellidae.

This leafhopper was first described from India and placed in the genus *Eutettix* by Distant (1908). The species was later assigned to the genus *Hishimonus* by Nielson (1968) and the current valid name is *Hishimonus phycitis* (Distant).

Junior synonym: *Eutettix phycitis* Distant

Zahniser and Dietrich (2013) provide a key to tribes of the Deltocephalinae, within which *Hishimonus* sits in the tribe Opsiini. Viraktamath and Anantha Murthy (2014) provide a key to species of *Hishimonus* from India.

3.1.2. Biology of the pest

The following description of the life cycle of *H. phycitis* is based mainly on studies by Bindra and Singh (1968) and Srinivasan and Chelliah (1980) who examined development on *Solanum melongena* in India where adults and nymphs can be found all year round.

Eggs are laid singly in the underside of leaves, in oviposition scars cut by females in leaf vascular tissue and on young shoots (Abbaszadeh et al., 2011). Most eggs are laid during the day. At temperatures between 31 and 35°C, eggs take approximately 8 days to develop; at temperatures between 27 and 30°C, eggs develop in about 9 days, while at temperatures around 13.5°C egg development takes approximately 23 days.

There are five nymphal instars. Nymphal development takes approximately 14 days at temperatures averaging 28.0°C but slows to approximately 69 days at temperatures averaging 15.6°C.

Adults live for between 3 and 6 weeks. During the warmer months in India, females average a 4-day pre-oviposition (maturation) period followed by a 20-day oviposition period then an 8-day post-oviposition period.

Fecundity is highest when average temperatures are between 30 and 33°C. At these temperatures, females can usually lay around 80–140 eggs although some can lay up to almost 340 eggs. During cooler parts of the year when temperatures vary between 13 and 23°C, fecundity is lower with females laying between 10 and 80 eggs each.

In a study comparing the development of *H. phycitis* on healthy *S. melongena* leaves with development on leaves infected with brinjal little-leaf phytoplasma (one of the most important pathogens affecting *S. melongena* in India, where infected plants suffer severe stunting, shortened internodes, a proliferation of shoots and reduction in leaf size (Rathnamma, 2014)), Srinivasan and Chelliah (1980) found development was significantly faster on infected leaves. This may have been due to infected leaves containing more total carbohydrates, sugars and organic acids than the healthy ones, and also to a phytohormone-mediated effect (Lazebnik et al., 2014). Mean fecundity (51.1 viable eggs per female) was also significantly higher for females that developed on diseased leaves compared to females that developed on healthy leaves where mean fecundity was 31.2 viable eggs per female.

As in India, in Oman, adults can be found all year-round (Razvi et al., 2007; Queiroz, 2014). During a survey over 4 years, maximum abundance occurred during periods with a mean minimum temperature between 17 and 20°C and maximum temperatures between 25 and 30°C (Razvi et al., 2007). In southern Iran, there was a higher incidence of infested hosts in well irrigated *Citrus aurantifolia* orchards, compared to poorly irrigated orchards (Abbaszadeh et al., 2011).

Like other Hemiptera, *H. phycitis* uses its piercing and sucking mouthparts to extract nutrients from the vascular tissue of its hosts. Phytoplasmas are acquired passively during feeding in the phloem of infected plants (Weintraub and Beanland, 2006). Feeding can be persistent and last several hours. *H. phycitis* vectors plant pathogenic phytoplamas such as brinjal little-leaf phytoplasma (Azadvar and Baranwal, 2012), sesame phyllody phytoplasma (Nabi et al., 2015) and lime Witches' broom phytoplasma (Bové and Garnier, 2000; Bagheri et al., 2009) (see Section 3.5 Impacts and EFSA PLH

Panel (2017)). Following ingestion, the phytoplasma reproduces within the infected vector and the vector remains infected throughout its life. While transovarial transmission of phytoplasmas has been reported in some leafhoppers and psyllids, Queiroz (2014) did not find WBDL phytoplasma in *H. phycitis* eggs, nymphs or newly emerged adults. It remains unknown whether there is transovarial transmission to eggs.

When disturbed, adult leafhoppers quickly move sideways or jump using a catapult action to leap up and move away or to launch into flight to escape (Burrows, 2007). Juveniles are mobile and can move quickly but cannot fly. Adults are weak flyers (Shabani et al., 2013).

3.1.3. Intraspecific diversity

In southern Iran, *H. phycitis* samples were recorded from 14 plant genera but the life cycle could only be completed on two, *Citrus* and *Ziziphus*. Plants such as cotton (*Gossypium*) and eggplant (*S. melongena*), regarded as hosts in other countries, were readily available but no samples of *H. phycitis* were found on the plants. *H. phycitis* populations in Iran may therefore have a different host range to those reported elsewhere (Abbaszadeh et al., 2011).

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, the organism can be detected in the field by visual inspection, often after damage symptoms are seen. The species can be identified by examining morphological features, for which keys exist.

Symptoms of leafhopper damage include host leaves with yellow spots, or leaves that curl up at the margin and sometimes drop. As a pest that feeds on nutrients from the vascular tissue, sooty mould can develop on the expelled exudate.

Adults are small, 3–4 mm long and greenish yellow; the abdomen and legs are brownish. Nymphs are yellow with brown spots on the abdomen. However, coloration of the species varies considerably (Viraktamath and Anantha Murthy, 2014). A detailed description is provided by Distant (1908). Taxonomic keys are available in Dai et al. (2013) and Viraktamath and Anantha Murthy (2014). Sweep nets, suction devices and yellow sticky traps can be used to detect and monitor populations in the field (Southwood, 1978; Pedigo and Buntin, 1994).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Hishimonus phycitis is a tropical and subtropical species that was first described from India and Sri Lanka (Distant, 1908). It also occurs in south-east Asia. It spread to Oman and from there into Iran and the United Arab Emirates (Bové and Garnier, 2000). Table 2 details the distribution.

A 1967 catalogue of Homoptera (Metcalf, 1967) and leafhopper checklists by Datta (1988) and Knight (2010) list *H. phycitis* as occurring in Australia, each cite Hill (1943). However, all misquote Hill (1943). In his introduction, Hill (1943) summarises records of diseases similar to Australia's big bud of tomato in other parts of the world, including the USSR, South India and the USA. Hill (1943) clearly states that *Eutettix phycitis* (= *H. phycitis)* and *Empoasca devastans* transmit the disease to a range of plants in India. The text by Hill (1943) is primarily about transmission of this disease in Australia by *Thamnotettix argentata* (= *Orosius argentatus*). *H. phycitis* is only mentioned in the introduction and in relation to its occurrence in India. A review of *Hishimonus* in Australia by Fletcher and Dai (2013) makes no mention of *H. phycitis*.

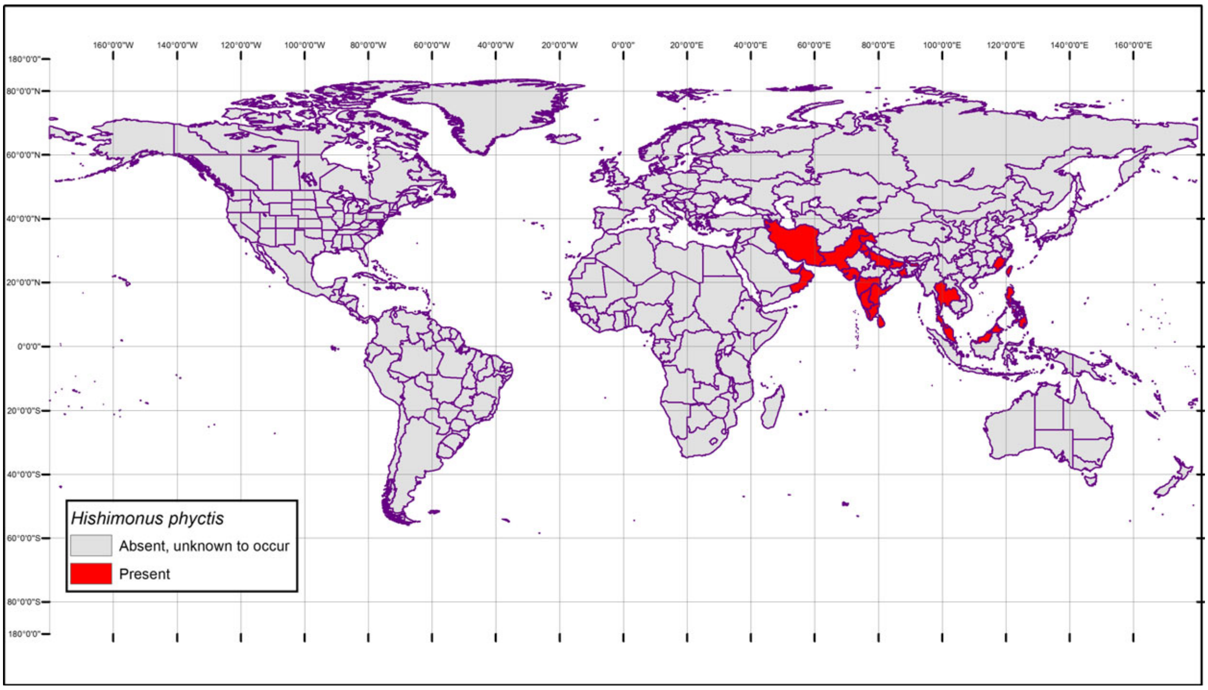

Figure 1: Global distribution of *Hishimonus phycitis*

Table 2: *Hishimonus phycitis* world distribution

Region	Country	Subnational distribution (e.g. States/Provinces)	Reference
North America	No records, assumed to be absent		
Central America and Caribbean	No records, assumed to be absent		
South America	No records, assumed to be absent		
Europe	No records, assumed to be absent		
Africa	No records, assumed to be absent		
Asia	China	Fuzhou (Fujian), Hainan, Hong Kong, Macao,	CABI (2015) Dai et al. (2013)
	India	Andhra Pradesh, Bihar, Delhi, Gujarat, Haryana, Jammu and Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal	CABI (2015)
	Iran		Salehi et al. (2007); Abbaszadeh et al. (2011)
	Malaysia		Knight (1970)
	Oman		CABI (2015)
	Pakistan		CABI (2015)
	Philippines		CABI (2015)
	Sri Lanka		CABI (2015)
	Taiwan		Dai et al. (2013)
	Thailand		CABI (2015); Dai et al. (2013)

Region	Country	Subnational distribution (e.g. States/Provinces)	Reference
	United Arab Emirates		CABI (2015); El Shereiqi and Gassouma (1993); Bové and Garnier (2000)
Oceania	Not known to occur. (Previous reports by Metcalf (1967) Datta (1988) and Knight (2010) are erroneous)		

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory?

No. *Hishimonus phycitis* is not known to occur in the EU (EPPO global database; CABI, 2015)

EPPO Global database (2017) reports *H. phycitis* is absent from the Netherlands; its absence has been confirmed by surveys between 2007 and 2015. The surveys were conducted for the National Plant Protection Organisation of the Netherlands. EPPO (2017) provides no information about other EU MSs.

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

The organism subject to pest categorisation is listed in Council Directive 2000/29/EC as *Hishomonus phycitis* (sic). Details are presented in Tables 3 and 4.

Table 3: *Hishimonus phycitis* in Council Directive 2000/29/EC

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	
(a)	Insects, mites and nematodes, at all stages of their development	
	Species	Subject of contamination
16.	*Hishomonus phycitis*	Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds.

3.3.2. Legislation addressing plants and plant parts on which *Hishimonus phycitis* is regulated

Table 4: Regulated hosts and commodities that may involve *Hishimonus phycitis* in Annexes III, IV and V of Council Directive 2000/29/EC

Annex III, Part A	Plants, plant products and other objects the introduction of which shall be prohibited in all Member States	
16	Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds	Third countries
Annex IV, Part A	Special requirements which must be laid down by all member states for the introduction and movement of plants, plant products and other objects into and within all member states	
Section I	Plants, plant products and other objects originating outside the community	
	Plants, plant products and other objects	Special requirements
16.1.	Fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, originating in third countries	The fruits shall be free from peduncles and leaves and the packaging shall bear an appropriate origin mark

Annex V	Plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community—in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community
Part A	Plants, plant products and other objects originating in the Community
Section I	**Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community and which must be accompanied by a plant passport**
1.6	Fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf. and their hybrids with leaves and peduncles.

3.3.3. Legislation addressing the organisms vectored by *Hishimonus phycitis* (Directive 2000/29/EC)

Table 5: Regulated organisms vectored by *Hishimonus phycitis* in Annexes II of Council Directive 2000/29/EC

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**	
(d)	Virus and virus-like organisms	
	Species	Subject of contamination
15.	Witches' broom (MLO)	Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds

Note that Witches' Broom (MLO) is assumed to refer to Witches' broom disease of lime phytoplasma (WBDL phytoplasma).

H. phycitis also vectors brinjal little-leaf phytoplasma (Azadvar and Baranwal, 2012) and sesame phyllody phytoplasma (Un Nabi et al., 2015). These phytoplasmas are not regulated within 2000/29 EC.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

Hishimonus phycitis is a polyphagous pest that feeds on a range of plants (Table 6). However, complete development is not possible on all plants on which *H. phycitis* feeds (Bindra and Singh, 1968; Abbaszadeh et al., 2011).

Table 6: Plants reported as *Hishimonus phycitis* hosts (e.g. oviposition and nymphal development occurs)

Family	**Binomial name**	**Common name**	**Example references**
Amaranthaceae	*Amaranthus tricolor*	Amaranthus	Bindra and Singh (1968)
Brassicaceae	*Lepidium sativum*	Garden cress	Bindra and Singh (1968)
Malvaceae	*Gossypium arboretum*	Tree cotton	Bindra and Singh (1968)
Pedaliaceae	*Sesamum indicum*	Sesame	Bindra and Singh (1968); Un Nabi et al. (2015)
Solanaceae	*Solanum melongena*	Aubergine, brinjal, eggplant	Bindra and Singh (1968); Srinivasan and Chelliah (1980)
	Withania somnifera	Indian ginseng	Bindra and Singh (1968)
Rutaceae	*Citrus aurantifolia*	Key lime, Mexican lime	Abbaszadeh et al. (2011)
	C. sinensis	Sweet orange	Abbaszadeh et al. (2011)
	C. paradisi	Grapefruit	Abbaszadeh et al. (2011)
	C. limetta	Sweet lemon	Abbaszadeh et al. (2011)
	C. reticulata	e.g. mandarin, tangerine	Abbaszadeh et al. (2011)
	C. limon	Lemon	Abbaszadeh et al. (2011)

Family	Binomial name	Common name	Example references
	C. aurantium	Sour orange	Abbaszadeh et al. (2011)
	C. jambhiri	Rough lemon	Abbaszadeh et al. (2011)
	C. volkameriana	Volkamer lemon	Abbaszadeh et al. (2011)
Rhamnaceae	*Ziziphus spina-christii*	Christ's Thorn Jujube	Abbaszadeh et al. (2011)

Comparing the hosts on which *H. phycitis* is regulated (*Citrus*, *Fortunella* and *Poncirus,* Section 3.3) with the known hosts listed in Table 5, it is clear that not all hosts are regulated (Table 6).

Plants whose status as a host is uncertain, e.g. due to only adults being found feeding on the plant, are listed in Table 7.

Table 7: Plants on which *Hishimonus phycitis* feeds but which are unknown to be hosts

Family	Binomial name, Authority	Common name	Example references
Apiaceae	*Daucus carota* var. *sativa*	Carrot	Bindra and Singh (1968)
Brassicaceae	*Raphanus sativus*	Radish	Bindra and Singh(1968)
Cucurbitaceae	*Citrullus lanatus*	Watermelon	Bindra and Singh (1968)
Fabaceae	*Crotalaria juncea*	Indian hemp	Bindra and Singh (1968)
	Cyamopsis tetragonoloba	Guar, cluster bean	Bindra and Singh (1968)
	Medicago sativa	Alfalfa, lucerne	Bindra and Singh (1968)
	Sesbania cannabina	–	Bindra and Singh (1968)
	Vigna aconitifolia	Mat bean, moth bean	Bindra and Singh (1968)
Poaceae	*Saccharum officinarum*	Sugarcane	Rao et al. (2014)
Solanaceae	*Solanum lycopersicum*	Tomato	Bindra and Singh (1968)

3.4.2. Entry

Is the pest able to enter into the EU territory? (Yes or No) If yes, identify and list the pathways!

Yes, *H. phycitis* could enter the EU, e.g. as eggs on host plants for planting.

- Plants for planting (e.g. *Amaranthus*, *Solanum melongena*, *Citrus* spp.)

Existing legislation closes the potential pathway of *Citrus* plants for planting.

As leafhoppers move and leap away when disturbed, it is unlikely that mobile stages would remain on host plant material as it was handled along a pathway. It is more likely that eggs could be transported than the mobile nymphs and adults.

Eggs are laid inserted into host plant tissue such as the underside of leaves and young shoots (Abbaszadeh et al., 2011; Olivier et al., 2012). Young host plants with shoots, or older hosts with leaves, imported and contaminated with eggs could therefore potentially provide a pathway into the EU, e.g. ornamental *Amaranthus tricolor* plants for planting. Shabani et al. (2013) suggests *H. phycitis* entered Iran via *Citrus* plants for planting from Oman.

Trade data detailing imports of plants for planting into the Netherlands (2012–2014) shows that *Amaranthus* were imported twice from Sri Lanka in 2014, indicating that at least one possible pathway into the EU exists.

Up to July 2017, there were zero records of interception of *H. phycitis* in the Europhyt database.

3.4.3. Establishment

Is the pest able to become established in the EU territory? (Yes or No)

Yes, *H. phycitis* could establish in the EU, but only in a very limited area.

3.4.3.1. EU distribution of main host plants

Commercially important *Citrus* hosts are grown for fruit production in the Mediterranean region. The area of cultivated *Citrus* in the EU is summarised in Table 8 and detailed further by EU MS in Appendix A. *S. melongena* is cultivated as a small field crop and in market-gardens and home-gardens throughout the Mediterranean and central Europe (de Rougemont, 1989). The area of *S. melongena* cultivated in the EU is also shown in Table 8 and detailed in Appendix A.

Table 8: EU area cultivated with citrus (*Citrus* and small citrus fruits) and eggplant (*S. melongena*) in the EU between 2011 and 2015 (in 1000 ha) - Source: Eurostat, extracted on 14/08/2017, last updated 11/08/2017

Cultivated crop	2011	2012	2013	2014	2015	Mean of EU citrus-growing area (in 1,000 ha)
Citrus	726.56	702.30	712.35	684.32	685.94	702.29
Eggplant	22.00	20.12	20.34	22.25	22.23	21.39

FAO Stat indicate that *Sesamum indicum* is grown for oil production in small areas of Cyprus (< 5 ha), Greece (normally < 100 ha per year) and Italy (< 200 ha).

3.4.3.2. Climatic conditions affecting establishment

Considering the geographic distribution of *H. phycitis* as shown in Figure 1, the pest could be regarded as a tropical or subtropical species suggesting that establishment in the EU is most unlikely. However, some regions of some of the countries in which *H. phycitis* occurs have Köppen–Geiger climate zones that occur in parts of Europe. For example, climate zone classification BSh (Arid, temperate, hot) occurs in approximately 0.1% of the EU and also occurs in the Indian states of Andhra Pradesh, Gujarat, Haryana, Karnataka, Maharashtra, Punjab and Uttar Pradesh, states where *H. phycitis* occurs. However, detailed pest distribution within the Indian states is lacking and it is unknown whether *H. phycitis* occurs within this climate zone in the Indian states. Climate zone classification Cfa (temperate, without dry season, hot summer) occurs in approximately 4% of the EU and also in Fujian, a Chinese province where *H. phycitis* occurs. Again it is unknown whether *H. phycitis* occurs within the Cfa climate zone of Fujian. Parts of Pakistan share climate zones that occur in the EU although there is insufficient detailed information about the distribution of *H. phycitis* within Pakistan as to be able to judge in which climate zones within Pakistan *H. phycitis* occurs.

Climate niche modelling by Shabani et al. (2013) used pest occurrence in Oman and Iran and indicated that the highest environmental suitability occurred in the regions of Bushehr and Hormuzgan of Iran, and regions with a desert climate (Köppen–Geiger classification of BWh). Lower suitability was predicted in regions of Fars and Kerman Provinces areas with (Köppen–Geiger classification of BSk, a climate classification that only occurs in Spain). The modelling by Shabani et al. (2013) indicated that regions of southern Iran, north-eastern Saudi Arabia, Qatar, Bahrain, the United Arab Emirates and Dubai that were adjacent to the Persian Gulf, and regions of northern Oman adjacent to the Gulf of Oman were suitable habitats for *H. phycitis.* These are all regions with a Köppen–Geiger classification of BWh which does not occur in the EU. However, Shabani et al. (2013) did not take into account the occurrence of *H. phycitis* in Pakistan, India or elsewhere where there are other climate types.

A table of Köppen–Geiger climate zones found in the EU and in countries or subnational regions where *H. phycitis* occurs is provided in Appendix B. At a country scale, the known area of current distribution of *H. phycitis* includes ecoclimatic zones that also occur in the risk assessment area. Where establishment to occur, it would most likely be restricted to limited parts of southern EU MSs especially warmer areas around the Mediterranean coast.

In southern Iran, there is a higher incidence of infested hosts in well irrigated *C. aurantifolia* orchards, compared to poorly irrigated orchards (Abbaszadeh et al., 2011). Given that *Citrus* orchards are usually watered, the actual microclimate encountered by *H. phycitis* in *Citrus* orchards may be more humid than the prevailing humidity in the region. The microclimate around irrigated hosts in the EU could perhaps positively affect likelihood of establishment in the EU.

3.4.3.3. Spread

Is the pest able to spread within the EU territory following establishment? (Yes or No) How?

Yes. As a free living organism with adults capable of flight, spread within the EU following introduction would be possible.

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

No. Mobile adults would be able to spread naturally, without the need for plants for planting.

Local spread will occur primarily via natural dispersal of adults. Long distance spread will be facilitated by spread via plants for planting. As noted above, Shabani et al. (2013) suggested *H. phycitis* entered Iran via *Citrus* plants from Oman.

As a vector of WBDL phytoplasma information from literature describing the spread of WBDL in lime orchards (*C. aurantifolia*) can inform spread of the pest, although a delay and variation in hosts expressing symptoms prevents the spread of the disease being a direct measure of pest spread.

Bové and Garnier (2000) report that WBDL spreads rapidly within affected orchards. For example in one orchard of 251 *C. aurantifolia* trees, from an initial 19 symptomatic trees (7.6%), 1 year later there were 103 symptomatic trees (41%).

WBDL was first noted in UAE in 1989 and by 1993 most citrus growing regions were affected (Bové and Garnier, 2000). The corresponding area can be informed by FAO Stat data. The area of *Citrus* harvested in UAE in 1989 was 1,528 ha and in 1993 it was 1,387 ha. The majority of this area is assumed to be lime although FAO Stat group lemon and lime together.

3.5. Impacts

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

Yes. As an organism extracting nutrients from the vascular tissue of its hosts *H. phycitis* is a direct plant pest. However, the most important impacts are caused by the pathogens transmitted by the pest, such as WBDL phytoplasma (Bové and Garnier, 2000), brinjal little-leaf phytoplasma (Azadvar and Baranwal, 2012) and sesame phyllody phytoplasma (Un Nabi et al., 2015). Importantly, it is unknown whether any of these phytoplasmas would be carried within eggs of *H. phycitis* (assumed to be the most likely route of entry).

RNQPs: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?[4]

Yes. As a direct pest, the presence on plants for planting (e.g. as eggs on ornamental cuttings) could influence subsequent yield and quality.

In the Middle East, the greatest impact of *H. phycitis* results from it being a vector of pathogens such as Witches' broom disease of lime phytoplasma, the causal agent of WBDL. WBDL is a very destructive disease of *C. aurantifolia* especially in Oman, UAE and Iran, countries dominated by an arid climate (BWh), a climate type that does not occur in the EU. Over 70% of adults and nymphs, collected in a lime orchard in Hormozgan Province, Iran, tested positive for Witches' broom (MLO)/WBDL (Salehi et al., 2007), 65% of individuals tested positive in a study in Oman (Queiroz, 2014).

Over 50% of the cultivated area of lime has been lost in Oman since it was reported in the 1970s (Al-Yahyai et al., 2015) and hundreds of thousands of lime trees have been destroyed in Iran due to WBDL phytoplasma (Khan et al., 2017). Chung et al. (2006) estimated that 98% of lime trees in Oman are infected with WBDL phytoplasma. WBDL kills lime trees in three to five years (Chung et al., 2006).

Najafiniya and Azadvar (2016) report WBDL phytoplasma affects sweet orange and grapefruit in Iran. Although climate type BWh does not occur in the EU, potentially *Citrus* grown in the warmer and driest regions of the EU could be impacted by WBDL. A specific pest categorisation has been conducted on WBDL phytoplasma by EFSA PLH Panel (2017).

In India, where *H. phycitis* was first reported, the leafhopper is regarded as an important pest of *S. melongena*, primarily due to its ability to vector brinjal little-leaf disease which can cause'substantial loss in crop yield' in years of heavy incidence (Srinivasan and Chelliah, 1980). *H. phycitis* is also a vector of sesame phyllody phytoplasma, which in India can cause yield losses of up to 80% in

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

Sesamum indicum. Sesame is grown to a limited degree in the EU (Cyprus, Greece and Italy). In glasshouse trials in India, Ghosh et al. (1999) reported that *H. phycitis* failed to transmit WBDL phytoplasma.

In a scenario where *H. phycitis* is introduced into the EU as eggs on plants for planting, and assuming that there is no transovarial transmission of phytoplasmas, *H. phycitis* arrives without the pathogen(s) that cause significant impact in regions where *H. phycitis* occurs. Without transmitting phytoplasmas, the direct impact from *H. phycitis* is much lower. Nevertheless, like other Hemiptera, *H. phycitis* uses its piercing and sucking mouthparts to extract nutrients from the vascular tissue of its hosts; damage to leaves causes yellow spots or causes leaves to curl, sooty mould can develop on the expelled exudate. Heavy sooty mould colonisation can reduce the photosynthetic ability of leaves. Sooty mould would presumably reduce the quality of ornamental hosts, such as *Amaranthus*; however, in a commercial crop, pest-control treatments will normally prevent sooty moulds from developing (Adlam, 2014).

3.6. Availability and limits of mitigation measures

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

Yes. Entry into the EU is prohibited on *Citrus* plants for planting given the prohibition of *Citrus* from outside the EU. The likelihood of pest entry can further be mitigated if other host plants for planting, currently unregulated, are sourced from pest free areas. Host plants for planting, such as *Amaranthus*, should be inspected prior to export to the EU and found free from *H. phycitis* and from symptoms of *H. phycitis.*

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

Yes – as above.

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

- Eggs are difficult to detect on infested plants.
- If introduced mobile/winged adults could disperse quite quickly.

3.6.2. Control methods

Current control applied in countries where *H. phycitis* occurs focusses on limiting spread of the pathogens that *H. phycitis* vectors as well as suppressing *H. phycitis* populations. Controlling the insect vectors and removing symptomatic branches may help reduce disease levels and pathogen inoculum (Al-Sadi et al., 2017).

Control methods include:

- use of certified planting material,
- monitoring for early detection,
- suppression of adults via chemical controls (periodic spray of systemic pesticides),
- removal of newly emerged symptomatic branches on trees,
- elimination of infected trees showing clear symptoms,
- chemical or mechanical control of weeds,

The above measures, when used in a system of IPM were reported to be very effective for reducing the spread rate of WBDL (Najafiniya and Azadvar, 2016).

3.7. Uncertainty

There is uncertainty around the following

- Whether or not *H. phycitis* occurs in climate zones that also occur in Europe – this strongly influences the conclusion regarding establishment. This is further complicated given that *Citrus* orchards are commonly irrigated i.e. more humid than the wider local environment. The microclimate experienced by *H. phycitis* in *Citrus* areas might actually better match EU climates where *Citrus* is grown than is currently recognised.

- The complete host range of *H. phycitis* is uncertain. Some literature recognises that some of the plants used as food sources do not support complete development of *H. phycitis*. Nevertheless, if concern is mainly around *H. phycitis* acting as a vector of pathogenic phytoplasmas, then the plants fed upon by *H. phycitis*, and which could potentially become infested are still relevant for risk management and decision makers.
- All information about the impact of *H. phycitis* actually related to impacts caused by three of the phytoplasmas vectored by *H. phycitis*. There is uncertainty around whether *H. phycitis* eggs arriving in the EU are likely to vector phytoplasmas – this affects the magnitude of potential impacts.

4. Conclusions

The conclusions of the pest categorisation are summarised in Table 9.

Table 9: 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)	The identity of the pest is established; *Hishimonus phycitis* (Distant, 1908). It is an insect in the family Cicadellidae. Taxonomic keys are available to identify the pest.	The identity of the pest is established; *Hishimonus phycitis* (Distant, 1908). It is an insect in the family Cicadellidae.	None
Absence/ presence of the pest in the EU territory (Section 3.2)	The pest is not known to occur in the EU	*H. phycitis* is not known to be established in the EU. (A criterion to satisfy the definition of a regulated non-quarantine pest is that the pest must be present in the risk assessment area - this criterion is not met by *H. phycitis*).	None
Regulatory status (Section 3.3)	*H. phycitis* is currently regulated by Council Directive 2000/29/EC within which it is listed as *Hishomonus phycitis* (sic), a harmful organisms whose introduction into, and spread within, all member states shall be banned if present on certain plants or plant products (i.e. it is a II/AI pest)	*H. phycitis* is currently regulated by Council Directive 2000/29/EC within which it is listed as *Hishomonus phycitis* (sic), a harmful organisms whose introduction into, and spread within, all member states shall be banned if present on certain plants or plant products (i.e. it is a II/AI pest)	None
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	*H. phycitis* could enter the EU, e.g. as eggs on host plants for planting; *H. phycitis* could potentially establish in the EU, but only in a very limited area. As a free living organism with adults capable of flight, spread within the EU would be possible but clearly confined to the limited area where establishment could occur.	Whilst plants for planting are likely to provide the principle pathway into the EU, once within the EU, plants for planting would not be the principle mechanism for further spread. As a mobile insect, capable of flight, spread would occur naturally.	There is great uncertainty about the likelihood of establishment given that the pest occurs in the tropics and sub-tropics and greatest damage occurs in arid and tropical climates.

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Potential for consequences in the EU territory (Section 3.5)	*H. phycitis* is a pest causing direct impact by extracting nutrients from the vascular tissue of its hosts during feeding. However, the impact of direct feeding alone on yield or quality is minor compared to the impact caused by the pathogens transmitted by the pest, such as Witches' broom disease of lime phytoplasma, brinjal little-leaf phytoplasma and sesame phyllody phytoplasma.	As a direct pest, the presence on plants for planting could influence subsequent yield and quality.	Greatest damage is caused by the phytoplasmas that are vectored by *H. phycitis*, rather than the direct feeding damage by *H. phycitis* alone. There is therefore uncertainty around the magnitude of impact likely to occur in the EU if *H. phycitis* establishes without any pathogenic phytoplasmas. Note that greatest phytoplasma damage to *Citrus* occurs in arid climates that do not occur in the EU whilst greatest damage to *S. melongena* occurs in tropical climates that do not occur in the EU.
Available measures (Section 3.6)	Measures are available to inhibit entry via traded commodities (e.g. prohibition on the introduction of *Citrus* plants for planting; source other hosts from pest free areas).	Plants for planting are not the principle means of spread. Nevertheless, measures are available to inhibit spread via plants for planting (e.g. source hosts from pest free areas).	None
Conclusion on pest categorisation (Section 4)	*H. phycitis* satisfies all of the criteria that are within the remit of EFSA to assess to be regarded as a Union quarantine pest.	*H. phycitis* does not meet the criteria of (a) occurring in the EU territory, and (b) plants for planting being the principal means of spread.	None
Aspects of assessment to focus on/ scenarios to address in future if appropriate	Any future assessment should focus on assessment and potential impact in the absence of phytoplasmas. More precise information regarding current pest distribution would better inform the assessment of establishment. It would be very useful to determine whether there is transovarial transmission of phytoplasmas.		

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization of the United Nations
IPPC	International Plant Protection Convention
MS	Member State
PLH	EFSA Panel on Plant Health
RNQP	Regulated Non-Quarantine Pest
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Appendix A – Cultivated area of hosts of Hishimonus phycitis (Citrus spp. and *Solanum melongena*) in EU members 2011–2015

A.1. Citrus and small citrus fruit

Table A.1: Area cultivated with citrus (Citrus and small citrus fruits) in the EU between 2011 and 2015 (in 1,000 ha) – Source: Eurostat, extracted on 14/8/2017, last updated 11/8/2017

Countries	2011	2012	2013	2014	2015	Mean EU citrus-growing area (in 1,000 ha)
European Union (28 countries)	726.56	702.30	712.35	684.32	685.94	702.29
Spain	437.82	426.26	420.39	415.67	410.19	422.07
Italy	198.30	182.97	198.51	174.93	183.47	187.64
Greece	59.10	57.43	57.24	57.67	55.45	57.38
Portugal	21.93	22.26	22.17	22.21	22.71	22.26
France	5.69	5.78	6.61	6.26	6.32	6.13
Croatia	NA	3.70	4.26	4.32	4.36	4.16*
Cyprus	3.72	3.90	3.17	3.25	3.44	3.50

Only citrus-producing Member States are reported above.
NA: not available.
*Calculated on 4 years (2012–2015).

A.2. *Solanum melongena* (aubergine/eggplant)

Table A.2: Area cultivated with eggplants in the EU between 2011 and 2015 (in 1,000 ha) – Source: Eurostat, extracted on 14/8/2017, last updated 11/8/2017

Countries	2011	2012	2013	2014	2015	Mean EU *S. melongena* – growing area (in 1,000 ha)
European Union (28 countries)	22.00	20.12	20.34	22.25	22.23	21.39
Spain	3.67	3.89	3.67	3.41	3.84	3.70
Slovenia	0.00	0.00	0.00	0.00	0.02	0.004
Romania	5.39	4.91	4.73	4.89	4.82	4.95
Portugal	0.10	0.09	0.09	0.10	0.06	0.09
Netherlands	0.10	0.11	0.10	0.10	0.11	0.10
Italy	9.42	8.30	8.43	10.33	10.15	9.33
Hungary	0.05	0.07	0.04	0.04	0.09	0.06
Greece	2.50	2.23	2.22	2.29	1.88	2.22
France	0.72	0.47	0.70	0.71	0.71	0.66
Cyprus	0.02	0.02	0.03	0.04	0.03	0.03
Bulgaria	0.00	0.00	0.30	0.31	0.49	0.22
Belgium	0.02	0.02	0.02	0.02	0.02	0.02
Austria	0.01	0.01	0.01	0.01	0.01	0.01

Only eggplant-producing Member States are reported above.

Appendix B – Comparison of EU climate with climates in countries where *H. phycitis* occurs

B.1. Appendix level 1

		Climate classification																	
Primary class		**A (Tropical)**	**B (Arid)**				**C (Temperate)**							**D (Cold)**					**E (Polar)**
2nd and 3rd class		Af, Am, Aw	BSh	BSk	BWh	BWk	Cfa	Cfb	Cfc	Csa	Csb	Cwa	Cwb	Dfa	Dfb	Dfc	Ds	Dw	ET
EU grid cells in each class		–	2	16	–	–	92	1064	13	198	103	–	–	–	327	453	–	–	27
Sum of cells in each class in countries where pest occurs		682	221	169	552	64	63	11	–	119	1	138	5	2	10	14	68	15	18
Country	Subnational																		
China	Fujian						45												
China	Hainan	9										2							
China	Hong Kong											1							
India	Andhra Pradesh	71	21																
India	Bihar											33							
India	Delhi											1							
India	Gujarat	12	44		11														
India	Haryana		10									6							
India	Jammu and Kashmir							5				5	2		2	3		15	8
India	Karnataka	43	24																
India	Kerala	14																	
India	Maharashtra	87	19																
India	Meghalaya											10							
India	Punjab		6									10							
India	Tamil Nadu	42																	
India	Uttar Pradesh		5							36		49							
India	West Bengal	23										7							

Primary class		Climate classification																	
		A (Tropical)	**B (Arid)**				**C (Temperate)**							**D (Cold)**					**E (Polar)**
Iran			61	150	211	54	2			80				2			61		
Malaysia		105																	
Oman					108														
Pakistan			31	19	197	10	12	3		3	1	13			8	11	7		10
Philippines		90											1						
Sri Lanka		23																	
Taiwan		2					4	3				2	2						
Thailand		170										1							
UAE					25														