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Pest categorisation of *Thrips palmi*

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Abstract

The EFSA Panel on Plant Health (PLH) performed a pest categorisation of *Thrips palmi* (Thysanoptera: Thripidae), for the EU. *T. palmi* is listed in Annex IAI of 2000/29 EC. Using molecular methods, cryptic speciation has been shown although no new species from the group have been formally described. Here, we consider *T. palmi sensu lato* as a defined species native to southern Asia, which has spread to tropical and subtropical countries in Asia, the Pacific, North, Central and South America, Africa and Australia. *T. palmi* has been reported from many different hosts in 20 botanical families; Cucurbitaceae, Solanaceae and Orchidaceae are of primary importance. *T. palmi* has been intercepted many times on plants from these families. Wild and cultivated hosts are widespread in the EU. However, as a subtropical and tropical species, only a small area of the EU provides climatic conditions where establishment may be possible outdoors. Several host plants are cultivated in glasshouses where conditions may be more favourable for establishment in year-round crops. There have been past outbreaks of *T. palmi* in EU glasshouses and outdoors in Portugal. *T. palmi* causes feeding and oviposition damage and populations in Asia are competent vectors of tospoviruses. Impacts could occur on many hosts, especially Cucurbitaceae, Solanaceae and ornamental plants particularly in glasshouses. Phytosanitary measures aim to prevent the entry of *T. palmi* specifically on cut flowers of Orchidaceae and fruits of *Momordica* and *Solanum melongena*. The species meets all the criteria assessed by the PLH Panel to satisfy the definition of a Union quarantine pest, while it does not satisfy all the criteria for it to be regarded as a Union regulated non-quarantine pest (RNQP).

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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/EC¹ 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) 2016/2031² 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.

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

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

(b) Bacteria

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

(c) Fungi

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

(d) 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 mycoplasma
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

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

(b) Bacteria

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

(c) Fungi

Glomerella gossypii Edgerton

Hypoxyton 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) <i>Carneocephala fulgida</i> Nottingham | 3) <i>Graphocephala atropunctata</i> (Signoret) |
| 2) <i>Draeculacephala minerva</i> Ball | |

Group of Tephritidae (non-EU) such as:

- | | |
|--|---|
| 1) <i>Anastrepha fraterculus</i> (Wiedemann) | 12) <i>Pardalaspis cyanescens</i> Bezzi |
| 2) <i>Anastrepha ludens</i> (Loew) | 13) <i>Pardalaspis quinaria</i> Bezzi |
| 3) <i>Anastrepha obliqua</i> Macquart | 14) <i>Pterandrus rosa</i> (Karsch) |
| 4) <i>Anastrepha suspensa</i> (Loew) | 15) <i>Rhacochlaena japonica</i> Ito |
| 5) <i>Dacus ciliatus</i> Loew | 16) <i>Rhagoletis completa</i> Cresson |
| 6) <i>Dacus curcurbitae</i> Coquillet | 17) <i>Rhagoletis fausta</i> (Osten-Sacken) |
| 7) <i>Dacus dorsalis</i> Hendel | 18) <i>Rhagoletis indifferens</i> Curran |
| 8) <i>Dacus tryoni</i> (Froggatt) | 19) <i>Rhagoletis mendax</i> Curran |
| 9) <i>Dacus tsuneonis</i> Miyake | 20) <i>Rhagoletis pomonella</i> Walsh |
| 10) <i>Dacus zonatus</i> Saund. | 21) <i>Rhagoletis suavis</i> (Loew) |
| 11) <i>Epochra canadensis</i> (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 mycoplasma |
| 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 phony rickettsia | 11) Strawberry witches' broom mycoplasma |
| 5) Peach rosette mosaic virus | 12) Non-EU viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L. |
| 6) Peach rosette mycoplasma | |
| 7) Peach X-disease mycoplasma | |

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

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

(b) Fungi

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

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

Meloidogyne fallax Karssen

Popillia japonica Newman

Rhizoecus hibisci Kawai and Takagi

(b) Bacteria

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

Thrips palmi Karny is one of a number of pests listed in the Appendices to the Terms of Reference (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 (MS) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores. Because the taxonomy of *T. palmi* has not been resolved, the name of *T. palmi* in this categorisation includes all forms of *T. palmi* (*sensu lato*).

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *T. palmi* was conducted at the beginning of the categorisation in the ISI Web of Science and Scopus bibliographic databases, using the scientific name of the pest as search term. 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 Plan Protection Organization (EPPO) Global Database (EPPO, online) and relevant publications.

Data about the 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 (Statistical Office of the European Communities).

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of

interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the MS and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

The Panel performed the pest categorisation for *T. palmi* following guiding principles and steps presented in the European Food Safety Authority (EFSA) guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018) 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 RNQP in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific ToR received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

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

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

Thrips palmi Karny (Thysanoptera: Thripidae), commonly known as melon thrips, oriental thrips and southern yellow thrips, was first described in 1925 from Sumatra and Java (Indonesia) (Karny, 1925). The

species has previously had the common name 'palm thrips'; however, no palm species are known to host this pest and the origin of this name is in honour of Dr B.T. Palm, a well-known specialist of this group.

T. palmi has been referred to using at least six other names, which should be considered synonyms: *Thrips clarus* Moulton, 1928; *Thrips gossypicola* Priesner, 1939; *Thrips gracilis* Ananthakrishnan & Jagadish, 1968; *Thrips leucadophilus* Priesner, 1936; *Thrips nilgiriensis* Ramakrishna, 1928 and *Chloethrips aureus* Ananthakrishnan & Jagadish, 1967.

Both International Plant Protection Convention (IPPC) (FAO, 2016) and EPPO (EPPO, 2018a) diagnostic protocols can be used to identify *T. palmi*. *T. palmi* identification is hampered by its small size and great similarity with other yellow species of *Thrips*. The species was redescribed by Bhatti (1980). Bournier (1983), Sakimura et al. (1986) and zur Strassen (1989) provide detailed descriptions of *T. palmi*. Sakimura et al. (1986) gave a list of major diagnostic characters to distinguish *T. palmi* from the other known species of the same genus.

3.1.2. Biology of the pest

At 25°C, the life cycle from egg to egg lasts 17.5 days (OEPP/EPPO, 1989). The life cycle differs little from that of most phytophagous Thripidae (Figure 1): the adults emerge from the pupae in the soil and move to the leaves or flowers of the plant, where they lay their eggs in an incision made with the ovipositor. There are two larval stages, which are active feeders and may potentially be found on any above-ground part of the plant.

The specialised mouthparts of larvae (two instars) and adults are adapted for sucking cell contents. As a consequence, injured tissues become silvery and may later become necrotic fully grown second-stage larvae move to the soil, where they pupate (propupa and pupa stages), thus completing the cycle. The life cycle and population dynamics of *T. palmi* in Japan have been reviewed by Kawai (1990).

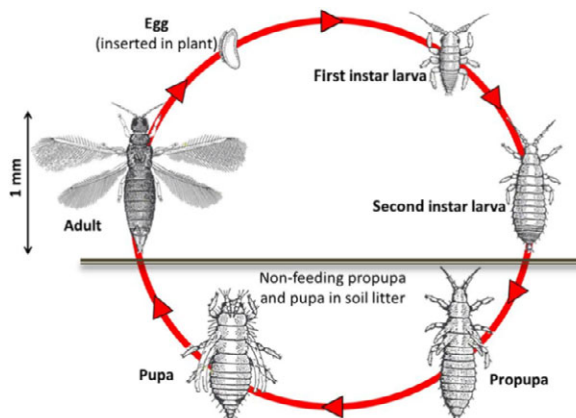


Figure 1: Life cycle of Thripidae (e.g. *Thrips palmi*)

T. palmi is primarily a subtropical and tropical species. Tsumuki et al. (1987) analysed the cold hardiness of *T. palmi* in Japan and concluded that it could not survive outdoor winter conditions in southern Honshu. In the southern Honshu cities of Hiroshima, Takamatsu and Osaka, mean minimum winter (December–February) temperatures are 2.5, 3.2 and 3.3°C (derived from data available from the Japanese Meteorological Agency (<https://www.data.jma.go.jp/obd/stats/data/en/normal/normal.html>)); only in a small part of southern Japan, on Kyushu Island (32°N), it is possible for *T. palmi* to survive throughout the winter outdoors (Yoshihara, 1982). The mean minimum winter temperature in Fukuoka on Kyushu is 5.3°C (derived from data available from the Japanese Meteorological Agency).

Sakimura et al. (1986) set the outdoor northern limit to 34°N, which corresponds to the very south of Honshu. However, Nagai and Tsumuki (1990) reported no reduction of adult populations at temperatures as low as from –3 to –7°C on weeds in an unheated glasshouse between mid-January and mid-February in Japan.

Studying *T. palmi* development under temperature controlled conditions, McDonald et al. (1999) calculated the threshold temperatures for the development of eggs, larvae, propupae and pupae as 9.4, 11.5, 7.2 and 10.1°C, respectively. They estimated 194 degree days (DD) above 10.1°C was required to complete development from egg to adult. Yadav and Chang (2014) estimated a development threshold of 11.3°C and 196 DD for egg to adult development. Kawai (1985) estimated a threshold of 11.6°C and a thermal constant of 189.1 DD.

Parthenogenesis (arrhenotoky) in *T. palmi* has been reported by Yoshihara and Kawai (1982). The oviposition behaviour of the species was observed in Taiwan (Wang et al., 1989); a preoviposition period of 1–3 days for virgin females and 1–5 days for mated ones was recorded. Virgin females laid 3–164 eggs (1.0–7.9 eggs per day) during their lifespan, while mated females laid 3–204 eggs (0.8–7.3 eggs per day). At 25°C, the net reproductive rate (28.0), female fecundity (59.6 eggs/female) and daily oviposition rate (3.8 eggs/day) reached maxima (Kawai, 1985). At the optimum temperature for population growth (25–30°C), the number of generations was estimated at 25–26/year (Huang and Chen, 2004). Significant differences in population growth among crops were highlighted (Kawai, 1986). The survival rates of the larval and pupal stages fed on cucumber, kidney bean, eggplant and balsam pear were high, whereas the survival rates of those fed on okra and chrysanthemum were low. The larvae fed on tomato and strawberry were unable to pupate. Duration of the larval and pupal stages fed on chrysanthemum and okra was longer than the duration of those fed on other crops. The longevity of the adults fed on cucumber, pumpkin, eggplant and kidney bean was increased, whereas the longevity of those fed on chrysanthemum, tomato and strawberry was decreased. The fecundity of adult females (n. eggs/female) fed on cucumber was maximum (60), while the fecundity of those fed on melon, eggplant and pumpkin amounted to 20. The differences in the generation time were not significant between crops, unlike the differences in the net reproductive rate. The intrinsic rate of natural increase of *T. palmi* fed on cucumber was maximum and the value was 0.134, while that of *T. palmi* fed on melon, eggplant and pumpkin ranged from 0.08 to 0.11 (Kawai, 1986).

3.1.3. Intraspecific diversity

Using molecular methods (such as DNA barcoding using the Cytochrome oxidase I gene), genetic diversity was proved (Glover et al., 2010; Rebijith et al., 2011, 2014; Iftikhar et al., 2016). Although this could be taken as evidence of speciation, so far no link between genetic diversity and biological performance (e.g. invasiveness, host range, virus transmission) has been established.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, both morphological and molecular-based identification methods are available. Colour traps can be used to catch adults although they are not specific. The aggregation pheromone has been synthesized and it may help in pest detection and management. Silvery feeding scars on the leaf surface, especially alongside the midrib and veins, scarred and deformed fruit can be detected through visual inspections.

Detection

Thrips palmi may be found in different locations according to the life stages present: eggs in leaf, flower and fruit tissue; larvae (I and II instars) and adults on the same types of tissue; propupae and pupae in the soil. On plant material, at inspection, silvery feeding scars on the leaf surface, especially alongside the midrib and veins, can be seen (Cannon et al., 2007). Heavily infested plants are characterised by a silvered or bronzed appearance of the leaves, stunted leaves and terminal shoots, scarred and deformed fruits (Smith et al., 1997; Seal et al., 2013). Detection may be hampered in the following circumstances: (i) low-level infestation, which may produce little or no detectable symptoms; (ii) the presence on the plant of the eggs within the plant tissue only (FAO, 2016). On fruit such as aubergine, the larvae are usually hidden under the calyx, but scarring damage caused by feeding activity will often be visible beyond the cover of the calyx. The potential presence of pupae in growing medium accompanying growing plants also poses a risk and a barrier to detection.

Motiles may be individually removed from the plant (leaves, flowers or fruit); they may be shaken or beaten from plant parts onto a white plastic tray. Plant parts may be sealed in a plastic bag for 24 h, with a piece of filter paper to absorb condensation; most motiles will leave the plant parts and can then be collected from the inside of the bag. A Berlese funnel can be used to process plant material such as flowers, turf, leaf litter, moss and even dead branches of trees. Thrips may be monitored (winged adults only) using coloured sticky traps (blue or white traps are good for *T. palmi*, though yellow traps will also work). *T. palmi* aggregation pheromone (R-lavandulyl 3-methyl-3-butenoate) was synthesised and its potential for both commercial and quarantine pest detection and management evaluated (Akella et al., 2014). There are no recognised methods for extracting thrips pupae from the soil (FAO, 2016).

Identification

Detailed descriptions of *T. palmi* are given by Bournier (1983), Sakimura et al. (1986), zur Strassen (1989) and Mound and Masumoto (2005). Despite this, some misidentifications are recorded. Chang (1991) noted that, in 1979, *T. palmi* had been misidentified in Taiwan, as an outbreak of *Thrips flavus* on cucurbits. Johnson (1986) observed that, in Hawaii, *T. palmi* was initially thought to be *Thrips nigropilosus* until identified by Nakahara et al. (1984). Similarly, *T. palmi* was misidentified in India as *Frankliniella schultzei* and under that name considered to be the main vector of tomato spotted wilt disease (TSWD) on groundnut (Palmer et al., 1990).

Sakimura et al. (1986) and zur Strassen (1989) provide diagnostic characters to distinguish *T. palmi* from the other known species of the genus *Thrips* widespread in Europe; however, morphology-based identification has limitations.

Adults are 1.0–1.3 mm long (males are slightly smaller than females), almost entirely pale yellow except antennal segment III usually dark at apex, IV and V usually dark with base pale, VI and VII dark; forewings are pale (CABI, 2018). It is similar in structure to the common Eurasian species *flavus* but has ocellar setae pair III wider apart and arising just outside the ocellar triangle (Mound et al., 2016). In common with other, similar thrips species, *T. palmi* has two larval stages and two pupal stages. Identification keys for juveniles are available only for second instar larvae (Vierbergen et al., 2010). However, identification based on morphological features may be very difficult, especially in the presence of larval instars; therefore, molecular-based identification methods have been developed and implemented (Brunner et al., 2002; Toda and Komazaki, 2002; Kox et al., 2005; Walsh et al., 2005; Yeh and Wu, 2015; FAO, 2016; Sabahi et al., 2017; Tyagi et al., 2017; Blaser et al., 2018; Chakraborty et al., 2018; Przybylska et al., 2018).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Thrips palmi is known to have originated in southern Asia and to have spread from there during the latter part of the 20th century. It is now widespread in southern Asia and the Pacific region, as well as throughout the Caribbean. It has also been recorded locally in North, Central and South America, Africa and Australia (Figure 2) in tropical and subtropical regions. More detailed locations are shown in Appendix A. The species continues to expand its range, although it does appear to be restricted by certain climatic conditions (cooler temperatures and aridity) (McDonald et al., 1999, 2000). It has the potential to infest hosts grown in glasshouses; under field conditions, its distribution likely will be limited to tropical (Capinera, 2015) and subtropical areas.

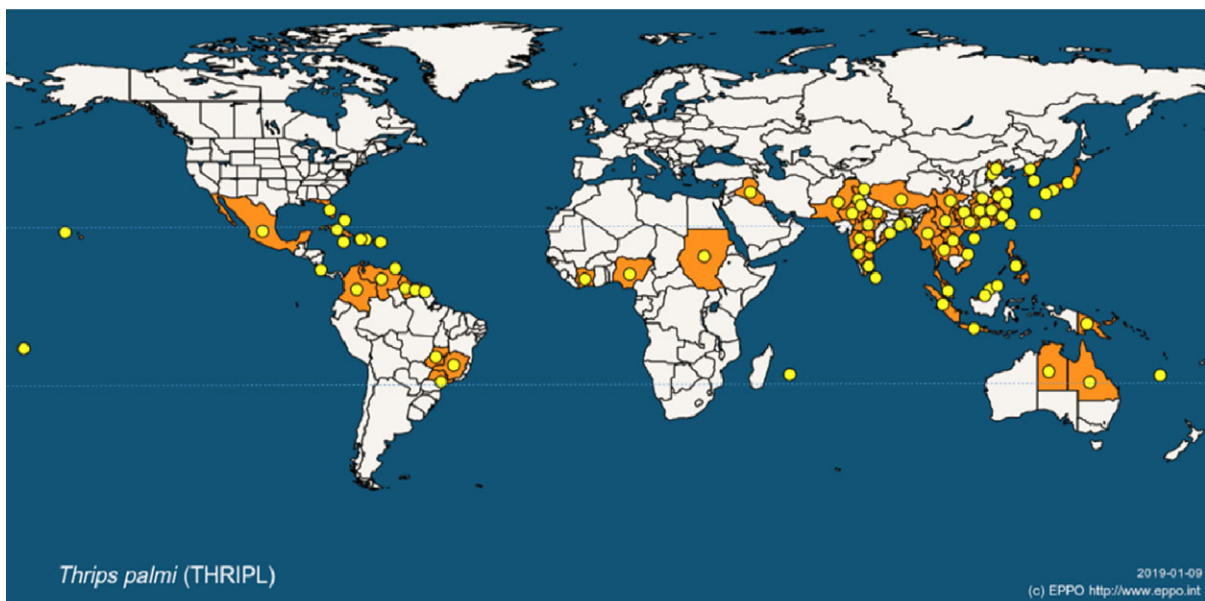


Figure 2: Global distribution of *Thrips palmi* (EPPO global database) with the Tropic of Cancer (23.5°N) and Tropic of Capricorn (23.5°S) marked

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, *T. palmi* is not known to occur in the EU. It was intercepted several times in Belgium, the Czech Republic, Finland, and France; outbreaks were recorded in the Netherlands, Germany, Portugal and the UK, though the pest was always successfully eradicated.

Table 2: Current distribution of *Thrips palmi* in the 28 EU MS based on information from the EPPO Global Database and other sources

Country	EPPO Global Database Last update: 30 May 2018 Date accessed: 10 December 2018	Other sources
Austria		
Belgium	Absent, intercepted only	
Bulgaria		
Croatia	Absent, confirmed by survey	
Cyprus	Absent, confirmed by survey	
Czech Republic	Absent, intercepted only	
Denmark	Absent, confirmed by survey	
Estonia	Absent, confirmed by survey	
Finland	Absent, intercepted only	
France	Absent, intercepted only	
Germany	Absent, pest eradicated	JKI (2016)
Greece		
Hungary	Absent, confirmed by survey	
Ireland	Absent, confirmed by survey	
Italy		
Latvia	Absent, confirmed by survey	
Lithuania	Absent, confirmed by survey	
Luxembourg		
Malta	Absent, confirmed by survey	
Netherlands	Absent, pest eradicated	Vierbergen (1996), Vierbergen et al. (2012)
Poland		
Portugal	Absent, pest no longer present	
Romania		
Slovak Republic	Absent, confirmed by survey	
Slovenia	Absent, invalid record	
Spain		
Sweden		
United Kingdom	Absent, pest eradicated	MacLeod et al. (2004), Cannon et al. (2007)

It is worth mentioning that almost 90% of all *T. palmi* EU interceptions are made on three groups of hosts: orchids (41.4%), *Momordica* spp. (24.5%) and *Solanum melongena* (23.8%) (details in Section 3.4.2 and in Appendices D–G).

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

Thrips palmi is listed in Council Directive 2000/29/EC. Details are presented in Tables 3 and 4.

Table 3: *Thrips palmi* 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
	Species
24	<i>Thrips palmi</i> Karny

3.3.2. Legislation addressing the hosts of *Thrips palmi*

Table 4: Regulated hosts and commodities that involve *Thrips palmi* in Annex IV of Council Directive 2000/29/EC

Annex IV, Part A		
	Plants, plant products and other objects	Special requirements
36.1	Plants, intended for planting, other than: — bulbs, — corms, — rhizomes, — seeds, — tubers, originating in third countries	Without prejudice to the requirements applicable to the plants in Annex IV, Part A, Section I (27.1), (27.2), (28), (29), (31), (32.1) and (32.3), official statement that the plants have been grown in nurseries and: (a) originate in an area, established in the country of export by the national plant protection service in that country, as being free from <i>Thrips palmi</i> Karny in accordance with relevant International Standards for Phytosanitary Measures, and which is mentioned on the certificates referred to in Articles 7 or 8 of this Directive under the rubric 'Additional declaration', or (b) originate in a place of production, established in the country of export by the national plant protection service in that country, as being free from <i>Thrips palmi</i> Karny in accordance with relevant International Standards for Phytosanitary Measures, and which is mentioned on the certificates referred to in Articles 7 or 8 of this Directive under the rubric 'Additional declaration', and declared free from <i>Thrips palmi</i> Karny on official inspections carried out at least monthly during the three months prior to export, or (c) immediately prior to export, have been subjected to an appropriate treatment against <i>Thrips palmi</i> Karny and have been officially inspected and found free from <i>Thrips palmi</i> Karny. Details of the treatment shall be mentioned on the certificates referred to in Article 7 or 8 of this Directive, or (d) originate from plant material (explant) which is free from <i>Thrips palmi</i> Karny; are grown in vitro in a sterile medium under sterile conditions that preclude the possibility of infestation with <i>Thrips palmi</i> Karny; and are shipped in transparent containers under sterile conditions.
36.2	Cut flowers of Orchidaceae and fruits of <i>Momordica</i> L. and <i>Solanum melongena</i> L., originating in third countries	Official statement that the cut flowers and the fruits: — originate in a country free from <i>Thrips palmi</i> Karny, or — immediately prior to their export, have been officially inspected and found free from <i>Thrips palmi</i> Karny.

T. palmi is a highly polyphagous pest; some of its hosts are specifically regulated for this pest in 2000/29 EC, Annex IV (Consult the Appendix B). However, given the large number of hosts on which it

feeds, the large amount of relevant legislation that can be extracted from Annexes III and V is not reported here and reference is made in Appendix B.

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

T. palmi is reported to be able to transmit the following tospoviruses (Pappu et al., 2009; Seepiban et al., 2011; EFSA PLH Panel, 2012):

- Groundnut bud necrosis virus (GBNV)
- Capsicum chlorosis virus (CaCV)
- Melon yellow spot virus (MYSV)
- Calla lily chlorotic spot virus (CCSV)
- Watermelon silver mottle virus (WSMoV)
- Watermelon bud necrosis virus (WBNV)
- Tomato necrotic ringspot virus (TNRV)
- Tomato spotted wilt virus (TSWV), although this report is uncertain, because no experimental data were provided by the authors (Persley et al., 2006).

Tomato spotted wilt virus (TSWV) is regulated in Directive 2000/29/EC in Annex I, Part B (Harmful organisms whose introduction into, and whose spread within, certain PZs shall be banned). With the exception of TSWV, the other viruses are not currently regulated in the EU.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

T. palmi has been reported from many different hosts, belonging to 20 botanical families. Cucurbitaceae and Solanaceae are the most frequently pointed as hosts of *T. palmi* (MacLeod et al., 2004; CABI, 2018; EPPO, 2018b). There are some discrepancies in the different sources regarding the hosts of *T. palmi*, indeed the same host (e.g. Orchidaceae) is listed as minor on one database (EPPO) and as main on another one (CABI). Besides, *T. palmi* has been reported infesting *Ficus* species in the Netherlands (CABI, 2018) with some authors demonstrating that it could feed on these plants (Loomans et al., 1999) and others that it did not breed on *Ficus* (O'Donnell and Parrella, 2005). In Portugal, the species was first detected in flowers of kiwi (*Actinidia chinensis*) at two locations in the NW of the country, not followed by permanent establishment (EPPO, 2018b). A full list of host plants of *T. palmi*, mainly on the basis of EPPO global database (EPPO, 2018a) and CABI (2018), is available in Appendix B.

The existing plant health directive does not explicitly list all *T. palmi* hosts, although it links *T. palmi* to plants for planting and to three groups of specific hosts (cut flowers of Orchidaceae and fruits of *Momordica* and *S. melongena*). However, as a pest listed in Annex I/AI of 2000/29 EC, *T. palmi* is a pest whose introduction and spread in the EU are banned irrespective of what it is found on. As a pest that spends one part of its life cycle in the soil, the prohibition of soil from third countries not belonging to continental Europe (See Annex III, point 14) will assist in inhibiting the entry of *T. palmi* into the EU with host plants for planting not specifically listed in the plant health directive, 2000/20 EC.

3.4.2. Entry

Is the pest able to enter into the EU territory?

Yes, *T. palmi* has been intercepted in the EU on many occasions since 1995 (see details on interceptions below).

Bartlett (1993) predicted that *T. palmi* would enter Europe via trade in contaminated plants. There are many herbaceous ornamental plants and fruits and vegetable plant commodities which are liable to carry *T. palmi* (Vierbergen, 1995; MacLeod et al., 2005).

Potential pathways include:

- host plants for planting with foliage
- host plants for planting with soil
- host cut flowers especially with foliage
- host fruits

Pathways that are specifically regulated with reference to *T. palmi* are plants for planting, fruits of *Momordica* and *S. melongena* and cut flowers of Orchidaceae.

Below, Tables 5 and 6 show the details of EU imports of orchids and eggplants (*S. melongena*), commodities on which high number of interceptions occurred. Countries where *T. palmi* is present are marked (*). See also Appendices C–G.

Table 5: EU imports of orchid cut flowers (HS 0603 13) (Source Eurostat) (Hundreds of kg)

Source	2013	2014	2015	2016	2017	5 year mean	% of 5 year mean
Thailand*	31,988	44,825	30,435	28,487	24,810	32,109	94.2
Malaysia*	2,637	1,265	720	966	733	1,264	3.7
Taiwan*	84	531	17	205	303	228	0.7
South Africa	54	67	86	240	305	150	0.4
Kenya	3	155	418	–	0	115	0.3
Singapore*	–	12	313	96	88	102	0.3
16 other countries	92	116	115	228	115	133	0.4
Sum	34,859	46,970	32,104	30,224	26,355	34,102	100.0

Table 6: EU imports of fresh or chilled eggplants (HS 0709 30) (Source Eurostat) (Hundreds of kg)

Source	2013	2014	2015	2016	2017	5 year mean	% of 5 year mean
Turkey	46,316	51,930	46,435	64,812	83,727	58,644	73.7
Kenya	12,062	12,754	17,062	16,574	17,854	15,261	19.2
Mexico*	5	988	1,026	915	4,144	1,416	1.8
Suriname*	1,312	897	1,007	1,045	1,346	1,121	1.4
Tunisia	794	2,334	1,544	11	8	938	1.2
Israel	948	422	51	707	1,243	674	0.8
Malaysia*	451	348	349	319	369	367	0.5
Thailand*	256	169	191	372	362	270	0.3
South Africa	197	198	238	308	345	257	0.3
Cambodia*	613	363	14	7	11	202	0.3
31 other countries	416	231	89	556	636	386	0.5
Sum	63,370	70,634	68,006	85,626	110,045	79,536	100.0

There are more host plants providing more pathways. An interrogation of Europhyt for notifications of non-compliance regarding *T. palmi* and other Thysanoptera (i.e. interceptions of Thysanoptera) indicates that, during the years 1995–2018, there were over 2,100 notifications of *T. palmi* on a range of plant material from 28 third countries; Appendix D). As noted above (section 3.1), thrips can be difficult to identify and Europhyt records indicate over 2,700 other interceptions of Thysanoptera on *T. palmi* hosts but not specifically identified as *T. palmi*, but as *Thrips* sp., Thripidae or Thysanoptera, from countries where *T. palmi* had been previously intercepted. Hence, it is possible that *T. palmi* has been intercepted in the EU from 28 countries on over 4,800 occasions, but specimens were not identified to species level (Figure 3). It is evident that when making notifications to Europhyt, the proportion of diagnoses that are identified to species varies between MS.

An increase in *T. palmi* notifications was first noted in the EU in 1996. The majority of interceptions were on orchids from Thailand at that time (MacLeod and Baker, 1998). Phytosanitary measures were strengthened on the pathway which led to a decline in interceptions over the following few years (MacLeod, 2015). However, interceptions on *S. melongena* from Suriname and a resurgence of interceptions on orchids from Thailand contributed to another peak in interceptions in 2005 (Figure 3). Since 2005, there has been a decline in the number of *T. palmi* interceptions in the EU. However, as the number of consignments imported into the EU potentially carrying *T. palmi* is not recorded nor the total number of consignments examined which did not result in a notification of *T. palmi*, interception data cannot be more meaningfully interpreted. Recording sampling effort and the number of consignments entering the EU could provide significant information that could significantly help the interpretation of interception data in future. Moreover, it would better inform risk reduction decision-

making and would allow the measure of the efficacy of the risk reduction options affecting entry (MacLeod et al., 2005).

Recognising the many countries in which *T. palmi* occurs and its many hosts, there are many routes that *T. palmi* could be transported on into the EU.

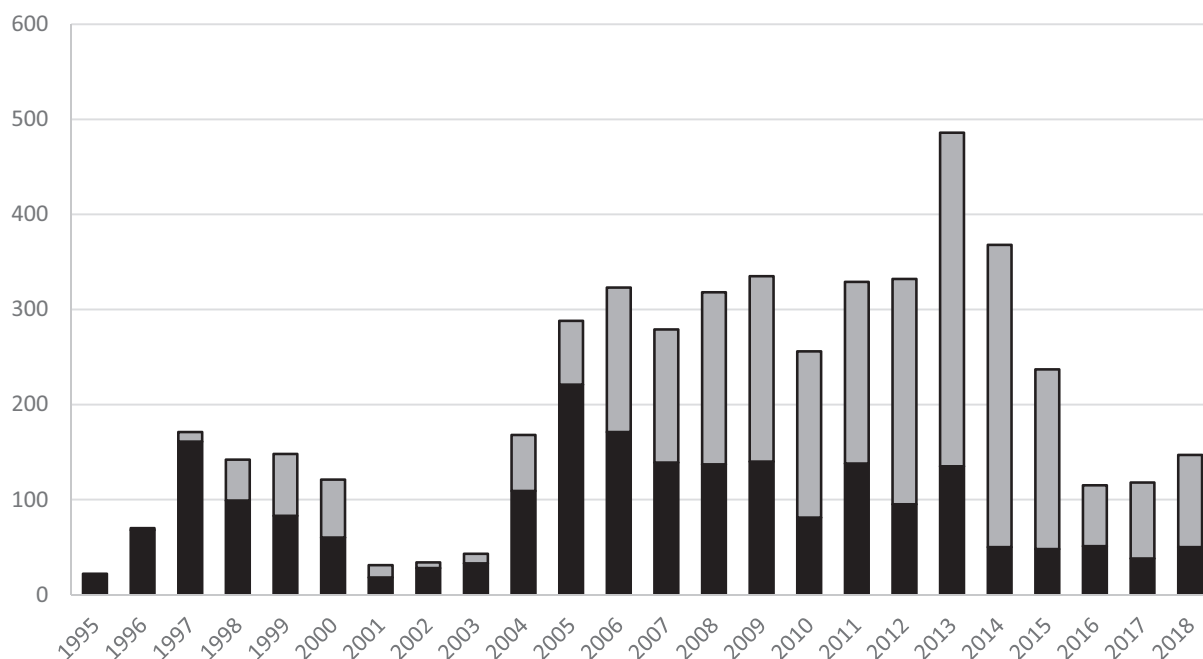


Figure 3: EU interceptions of *Thrips palmi* (black) and Thysanoptera not identified to species from countries where *T. palmi* is known to occur and have previously been intercepted (grey), 1995–2018

3.4.3. Establishment

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

Yes, biotic and abiotic conditions are conducive for establishment of this pest in the EU, mainly under glasshouse conditions.

3.4.3.1. EU distribution of main host plants

Thrips palmi is a polyphagous plant pest mainly attacking Cucurbitaceae and Solanaceae (Cannon et al., 2007; CABI, 2018; EPPO, 2018a,b). However, the species has been reported to infest hosts belonging to 20 botanical families. Most of these species occur widely over the EU, growing both in open field and in protected conditions, e.g. glasshouses. Some hosts also occur as wild plants (e.g. *Capsella bursa-pastoris*). Table 7 shows the harvested area of key *T. palmi* hosts grown in the EU.

Table 7: Harvested area of *T. palmi* main hosts in EU (28) Member States 2013–2017 (ha)

Host	Eurostat code	2013	2014	2015	2016	2017
Potatoes (including seed potatoes)	R1000	1,741.18	1,662.80	1,656.13	1,689.38	1,746.40
Leguminous plants harvested green	G2000	:	3,812.82	3,526.85	3,853.89	3,863.36
Fresh vegetables (including melons)	V0000	:	2,069.41	2,071.15	2,166.95	:
Lettuces	V2300	96.95	96.03	93.95	91.10	:
Tomatoes	V3100	230.58	248.09	254.43	246.85	252.58
Cucumbers	V3200	35.02	37.31	33.51	31.70	:
Eggplants	V3410	:	22.26	22.27	21.53	:

Host	Eurostat code	2013	2014	2015	2016	2017
Peppers (Capsicum)	V3600	57.74	56.82	58.61	57.14	
Onions	V4210	:	172.70	172.94	179.72	:
Avocados	F2300	:	:	12.22	12.24	12.73

'-' data not available.

Source: EUROSTAT

3.4.3.2. Climatic conditions affecting establishment

T. palmi occurs across the globe (Figure 2) mostly throughout tropical and subtropical areas. Climates in these regions do not widely occur in the EU although Köppen–Geiger climate type Cfa (Figure 4) (humid subtropical), which occurs in south-eastern China and southern Florida where *T. palmi* is also found, does occur in areas of the EU such as South and East Europe (MacLeod and Korycinska, 2019). In Florida, field populations of *T. palmi* have only been reported south of Orlando and its field distribution seems to be limited to tropical areas (Capinera, 2015).

Unfavourable outdoor conditions in most of the territory of the EU may be the reason for the low number of incursions reported outdoors in the EU (van der Gaag et al., 2019) despite the relatively high number of interceptions. Nevertheless, several host plants, e.g. eggplant, cucumber, sweet pepper, chrysanthemum, are cultivated in glasshouses in the EU, in conditions that are more similar to the humid tropics and subtropics and similar to those occurring in the native and current distribution range of *T. palmi*. Where such crops are produced year round, i.e. continuous cropping, establishment of *T. palmi* may be possible. Outbreaks have occurred and been eradicated in EU glasshouses, e.g. in the Netherlands (Vierbergen, 1996), UK (MacLeod et al., 2004) and Germany (JKI, 2016).

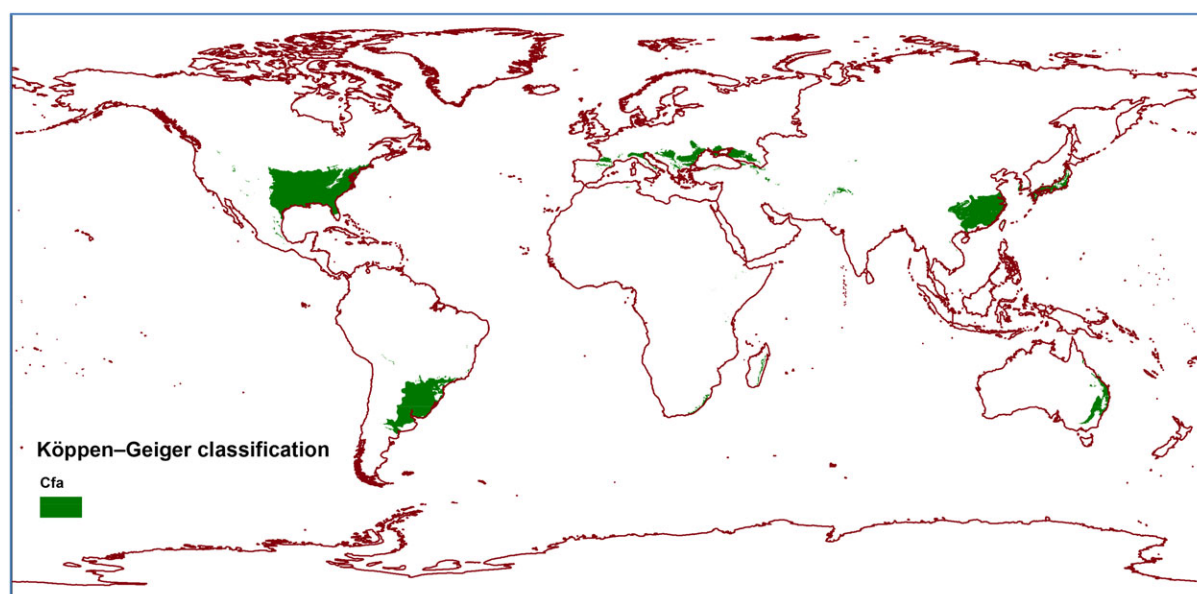


Figure 4: Köppen–Geiger climate type Cfa (Cook et al., 2013)

3.4.4. Spread

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

Yes. Although *T. palmi* has only moderate dispersal potential by itself, movement of infested material (either fruit, plants for planting packing material and soil) would be the main means of spread.

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

The main means of spread is unknown. Spread could occur via plants for planting and other means.

T. palmi has only moderate dispersal potential by itself, but is liable to be carried on fruits, or plants for planting of host species, or in packing material. Live plants are considered the most important pathways for this pest (van der Gaag, 2019). As the pest spends one part of its life cycle (see Section 3.2.1) in the soil, plants for planting with soil is a potential pathway for further spread within the EU. *T. palmi* has been intercepted in several EPPO countries on consignments from, e.g. Guadeloupe, Martinique, Mauritius, Thailand (EPPO, 2018a).

3.5. Impacts

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

Yes, should *T. palmi* enter and establish in the EU, economic impacts on many hosts would be expected.

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

Yes, the presence of the pest on plants for planting has an economic impact on its intended use.

T. palmi was largely restricted to its native region of southern Asia before 1980, but since then it has spread throughout tropical and subtropical areas around the world, as well as temperate greenhouse production systems (Murai, 2002; Cannon et al., 2007). It occurs in two states of the United States: Hawaii and Florida (Johnson, 1986; Tsai et al., 1995), and is present in at least 15 provinces in China (Han, 1997). Reviews on the pest status of *T. palmi* have been published (Walker, 1994; Cannon et al., 2007; Reitz Stuart et al., 2011). One of the first published records of this species as a pest was an account from southern India of damage to sesame seed pods as a result of feeding on young ovary walls (Ananthkrishnan, 1955). In the Philippines, Medina (1980) reported that an outbreak of *T. palmi* in 1977 had destroyed almost 80% of the watermelon plantations in central Luzon and Laguna. Adults and larvae of *T. palmi* feed preferably on foliage causing bronzing and premature abscission. Heavy infestations may result in scarred and/or deformed fruit with no marketable value (Seal and Sabines, 2012).

Increasingly, *T. palmi* has become an important pest around the world as it has spread within tropical regions of Africa, Australia, South America, Hawaii and the Caribbean, and to subtropical Florida and Japan (MacLeod et al., 2004). Since 1978, *T. palmi* has become the most serious pest of cucumber, aubergine and sweet pepper in glasshouses and open fields in south and western Japan, regularly causing crop losses (Kawai, 1990). In Homestead, south Florida, it has caused economic damage to all vegetable crops except tomato, emerging in recent years as a key pest of field cucumbers and posing serious threat to cucumber growers in the region (Kakkar et al., 2016). In Hawaii (USA), *T. palmi* damages ornamental orchids. In Guadeloupe, *T. palmi* has had disastrous economic effects on cucurbit crops (melons, cucumbers) and solanaceous crops (aubergines, *Capsicum*) (EPPO, 2018a). Aubergine exports fell from 5,000 tonnes in 1985 to 1,600 tonnes in 1986. In Martinique, 37% of the vegetable crops and 90% of aubergine crops of the two main cooperatives were attacked (Guyot, 1988). Nakahara et al. (1986) suggested that *T. palmi* entered and established in Hawaii via trade in cut flowers.

Johnson (1986) pointed out that *T. palmi* could establish itself in the continental USA, given the extensive flow of air traffic between Hawaii and the mainland, especially California, but it was not until 1991 that *T. palmi* was found in the USA, not in California as predicted by Johnson, but in Florida (FAO, 1991). Heavy infestations were detected on potato, aubergine, *Capsicum*, *Phaseolus vulgaris*, yellow squash and several weeds. The likely economic impact of this pest if it became established in glasshouses in the UK was considered to be very severe, with a benefit to cost ratio for one eradication campaign being as high as 110:1 (MacLeod et al., 2004).

Besides the feeding and oviposition damage, *T. palmi* populations in Asia are competent vectors of tospoviruses (Pappu et al., 2009; EFSA PLH Panel, 2012) (see Section 3.3.3), but populations in the United States of Florida and Hawaii do not transmit tospoviruses. This could be a result of a competent vector species not being introduced with its viruses, or that populations of *T. palmi* in the US are derived from genetically distinct lineages that are not able to vector tospoviruses (Brunner et al., 2004; Morse and Hoddle, 2006). Included in this scenario is that this cosmopolitan pest species is composed of cryptic species that vary in their vector competence (Reitz Stuart et al., 2011).

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

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, existing measures aim to prevent the entry of *T. palmi* on plants for planting, cut flowers of Orchidaceae and fruits of *Momordica* L. and *Solanum melongena* L. (see Section 3.3). Additional measures are also available (see below).

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

Yes, plants for planting, cut flowers of Orchidaceae and fruits of *Momordica* L. and *Solanum melongena* L., should be sourced from pest free areas (see below).

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to plants for planting, cut flowers of Orchidaceae and fruits of *Momordica* L. and *S. melongena* L., specifically in relation to *T. palmi* (see Section 3.3). As a pest listed in Annex I/AI of 2000/29 EC, *T. palmi* is a pest whose introduction and spread in the EU are banned irrespective of what it is found on. As a pest that spends one part of its life cycle in the soil, the prohibition of soil from third countries not belonging to continental Europe (See Annex III, point 14) will assist in inhibiting the entry of *T. palmi* into the EU with host plants for planting not specifically listed in the Plant Health Directive, 2000/29 EC. As *T. palmi* is a polyphagous, highly invasive species, numerous other plants or plant products could represent potential pathways. These measures could be extended to other potential hosts (such as other cut flowers and other host fruits).

Additional and supporting measures are shown in Sections 3.6.1.1 and 3.6.1.2.

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 8.

Table 8: Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/ establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)
Growing plants in isolation	As a highly polyphagous pest, it may be difficult to grow plants outdoors that are isolated from other potential hosts. However, if plants can be grown under physical protection, e.g. within a glasshouse, then some protection can be provided	Entry (limits infestation at source)
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage The treatments addressed in this information sheet are: a) fumigation; b) spraying/dipping pesticides; c) surface disinfectants; d) process additives; e) protective compounds Double insecticide dips applied after harvest on orchid blossoms reduced > 95% infestation (Mann et al., 1995)	Entry (reduces population at source) Spread (causes mortality within established populations, reducing pressure to spread) However, insecticide-resistant populations have been often reported, making chemical control ineffective
Soil treatment	The control of soil organisms by chemical and physical methods listed below: a) fumigation; b) heating; c) solarisation; d) flooding; e) soil suppression; f) augmentative biological control; g) biofumigation	Entry (reduces population at source) Spread (causes mortality within established populations, reducing pressure to spread)

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)
Controlled atmosphere	Treatment of plants and plant products by storage in a modified atmosphere (including modified humidity, O ₂ , CO ₂ , temperature, pressure)	Entry (reduces population at source)
Roguing and pruning	Roguing is defined as the removal of infested plants and/or uninfested host plants in a delimited area, whereas pruning is defined as the removal of infested plant parts only, without affecting the viability of the plant	Entry (reduces population at source) Spread (causes mortality within established populations, reducing pressure to spread)
Heat and cold treatments	Controlled temperature treatments aimed to kill or inactivate pests without causing any unacceptable prejudice to the treated material itself. The measures addressed in this information sheet are: autoclaving; steam; hot water; hot air; cold treatment Jacqua and Etienne (1987) dipped aubergine fruit in water at various temperatures after harvest to eliminate <i>T. palmi</i> under the calyx. The ideal temperature was 45° for subsequent fruit conservation, because higher temperatures could induce fruit damage	Entry (reduces population at source)
Chemical treatments on crops including reproductive material	Use of chemical compounds that may be applied to plants or to plant products	Establishment and spread (causes mortality within established populations, reducing pressure to spread) However, insecticide-resistant populations have been often reported, making chemical control ineffective
Biological control and behavioural manipulation	Other pest control techniques not covered by 1.03 and 1.13 a) biological control b) mass trapping There are several known predators (mainly <i>Orius</i> spp.) and pathogens (<i>Lecanicillium muscarium</i> , <i>Beauveria bassiana</i>) of <i>T. palmi</i> , a few of which are commercially available. Some of them are reported to be effective against <i>T. palmi</i> . (Cannon et al., 2007) Mass trapping with sticky traps and sticky ribbons has been used with effect against <i>T. palmi</i> in some crops, such as sweet pepper (Nonaka and Nagai, 1984)	Establishment and spread (use of mass trapping in isolated populations reduces population build-up, reducing pressure to spread)
Post-entry quarantine and other restrictions of movement in the importing country	This information sheet covers post-entry quarantine of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; prohibition of import of relevant commodities into the domestic country Relevant commodities are plants, plant parts and other materials that may carry pests, either as infection, infestation or contamination This measure is appropriate for pests infesting plants for planting that are difficult to detect. Given that <i>T. palmi</i> pupae develop in the soil and adults are detectable upon emergence, this measure could be considered The eradication programme in the Netherlands was based on the use of aerosol 'space' treatments, together with foliar and soil applications of chemical compounds (Loomans and Vierbergen, 1997)	Spread (causes mortality within established populations, reducing pressure to spread)

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 9.

Table 9: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/establishment/spread/impact)
Inspection and trapping	Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5) The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques Both white and blue sticky traps as well as water-tray traps have been successfully used to monitor <i>T. palmi</i> (CABI, 2018)	Entry
Laboratory testing	Cryptic speciation was proved to occur in this species; therefore, morphology-based identification has limitations and warrants integration of molecular data. Besides molecular techniques may also be useful when immature stages are recovered (see Section 3.1.4)	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	In third countries: Sourcing plants from a pest-free place of production, site or area, surrounded by a buffer zone, would minimise the probability of spread into the pest-free zone In the EU: delimiting a buffer zone around an outbreak 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	Entry
Phytosanitary certificate and plant passport	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)	Entry
Surveillance	ISPM 5 defines surveillance as an official process which collects and records data on pest occurrence or absence by survey, monitoring or other procedures	Spread (from interceptions in the EU)

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

- *T. palmi* is not easily detectable because of its small size.
- Eggs are inserted into plant tissues.
- It can be easily confused with several small yellow species of thrips.
- Cryptic speciation was reported (Section 3.3.1) and it may make identification using morphological data questionable.
- Juvenile instars are difficult to identify.
- The pupal phase in the soil as well as the endophytic eggs may hamper detection.
- The pest feeds on many plants.
- Hosts are widely available throughout the EU.

3.7. Uncertainty

- Species identification needs high expertise and misidentifications might occur.
- The report of cryptic speciation in *T. palmi* makes its identification, using morphological-based methods, uncertain. Besides, identification keys for juveniles are available only for second instar larvae. The damage by *T. palmi* is similar to that caused by many other species of thrips.
- There are contrasting data in the literature about species cold tolerance, raising uncertainty over the extent of possible establishment in the EU.

4. Conclusions

T. palmi meets the criteria assessed by EFSA for consideration as a potential Union quarantine pest (it is absent from the EU, potential pathways exist, and its establishment would cause an economic impact). The criterion of the pest being present in the EU, which is a prerequisite for RNQP and PZ QP status, is not met.

Table 10 provides a summary of the conclusions of each part of this pest categorisation.

Table 10: 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)	<i>Thrips palmi</i> Karny is an established insect species in the order Thysanoptera (thrips), family Thripidae	<i>Thrips palmi</i> Karny is established an insect species in the order Thysanoptera (thrips), family Thripidae	Cryptic species have been reported
Absence/ presence of the pest in the EU territory (Section 3.2)	The pest is not known to occur in the EU. Therefore, the criterion of either absence or presence with restricted distribution and under official control for Union quarantine pest status is satisfied	The pest is not known to occur in the EU. Therefore, the criterion of widespread distribution within the EU for RNQP is not satisfied	None
Regulatory status (Section 3.3)	<i>Thrips palmi</i> is listed in Annex IAI of Council Directive 2000/29/EC as a harmful organism not known to occur in any part of the community and relevant for the entire community and whose introduction into and spread within all member states is banned	<i>Thrips palmi</i> is currently regulated as a quarantine pest in the EU. The EFSA PLH Panel is not aware of any grounds to consider its status as such should be revoked	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
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	<p>Biotic and abiotic conditions are conducive for establishment of this pest in the EU, mainly under glasshouse conditions</p> <p>The main pathways are:</p> <ul style="list-style-type: none"> • plants for planting with foliage, • plants for planting with soil, • cut flowers especially with foliage, • host fruits <p>Only a small area might be suitable for the establishment of <i>T. palmi</i> outdoors but establishment in glasshouses in the EU is possible</p>	<p>Although <i>T. palmi</i> has only moderate dispersal potential by itself, movement of infested material (either fruit, plants for planting or packing material) would be the main means of spread. Besides, one part of its life cycle is spent in the soil</p>	None
Potential for consequences in the EU territory (Section 3.5)	<p>Should <i>T. palmi</i> enter and establish in the EU, economic impacts on many hosts (especially protected Cucurbitaceae and Solanaceae crops as well as ornamentals) would be expected</p>	<p>The presence of the pest on plants for planting has an economic impact on its intended use</p>	None
Available measures (Section 3.6)	<p>There are measures available to prevent the likelihood of entry into the EU (e.g. source plants for planting, cut flowers of Orchidaceae and fruits of <i>Momordica</i> and <i>S. melongena</i>, from pest-free areas (PFA))</p>	<p>There are measures available to prevent pest presence on plants for planting (e.g. source plants from PFA)</p>	None
Conclusion on pest categorisation (Section 4)	<p><i>Thrips palmi</i> satisfies all of the criteria assessed by EFSA to satisfy the definition of a Union quarantine pest</p>	<p><i>Thrips palmi</i> does not meet the criteria of (a) occurring within the EU, and (b) plants for planting being the principal means of spread. Hence, it does not satisfy all of the criteria that are within the remit of EFSA to assess for it to be regarded as a Union regulated non-quarantine pest</p>	None
Aspects of assessment to focus on/ scenarios to address in future if appropriate	<p>Given the number of interceptions, there is no doubt that entry into the EU is possible. <i>T. palmi</i> is regarded as a tropical and subtropical species and literature provides a variety of temperature thresholds for its development. Nevertheless, it has been reported surviving at below 0°C. This could be due to differing thermal biology between cryptic 'molecular' species. This raises uncertainty as to where the species sensu lato may be able to establish in the EU. Any future assessment should focus on identifying whether establishment is possible outdoors, and if so where. Whether establishment is possible in glasshouses could also be assessed. However, unless molecular characterisation of the complex <i>T. palmi</i> is achieved, a detailed assessment will be challenging. Although focusing on the establishment, resolving the taxonomy of the species complex could help all parts of any potential assessments (i.e. entry, establishment, spread, impact and evaluation of risk reduction options (RROs))</p>		

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
CaCV	Capsicum chlorosis virus
CCSV	Calla lily chlorotic spot virus
DD	Degree days
FAO	Food and Agriculture Organization
GBNV	Groundnut bud necrosis virus
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MYSV	Melon yellow spot virus
MS	Member State
PFA	Pest-free areas
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
RNQP	Regulated non-quarantine pest
RROs	Risk reduction options
TFEU	Treaty on the Functioning of the European Union
TNRV	Tomato necrotic ringspot virus
ToR	Terms of Reference
WBNV	Watermelon bud necrosis virus
WSMoV	Watermelon silver mottle virus

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017)
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017)

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

Appendix A – Detailed *Thrips palmi* global distribution

(Source: EPPO Global database online, accessed on 9 November 2018.)

Continent	Country	State	Status	
Africa	Cote d'Ivoire		Present, restricted distribution	
	Mauritius		Present, no details	
	Nigeria		Present, no details	
	Reunion		Present, no details	
	Sudan		Present, no details	
America	Antigua and Barbuda		Present, no details	
	Bahamas		Present, few occurrences	
	Barbados		Present, no details	
	Brazil			Present, restricted distribution
		Goias		Present, no details
		Minas Gerais		Present, no details
	Sao Paulo		Present, no details	
	Colombia		Present, no details	
	Costa Rica		Present, restricted distribution	
	Cuba		Present, restricted distribution	
	Dominica		Present, no details	
	Dominican Republic		Present, no details	
	French Guiana		Present, no details	
	Grenada		Present, widespread	
	Guadeloupe		Present, widespread	
	Guyana		Present, no details	
	Haiti		Present, widespread	
	Jamaica		Present, no details	
	Martinique		Present, widespread	
	Mexico		Present, few occurrences	
	Netherlands Antilles		Present, restricted distribution	
	Puerto Rico		Present, restricted distribution	
	Saint Lucia		Present, no details	
	St Kitts-Nevis		Present, restricted distribution	
	St Vincent and the Grenadines		Present, no details	
	Suriname		Present, no details	
	Trinidad and Tobago		Present, widespread	
United States of America			Present, restricted distribution	
	Florida		Present, no details	
	Hawaii		Present, no details	
Venezuela		Present, no details		
Virgin Islands (British)		Present, no details		
Asia	Bangladesh		Present, no details	
	Brunei Darussalam		Present, widespread	
	China			Present, no details
		Anhui		Present, no details
		Beijing		Present, no details
		Fujian		Present, no details
		Guangdong		Present, no details
		Guangxi		Present, no details
		Guizhou		Present, no details
Hainan		Present, no details		

Continent	Country	State	Status
		Hebei	Present, no details
		Hubei	Present, no details
		Hunan	Present, no details
		Jiangsu	Present, no details
		Jiangxi	Present, no details
		Sichuan	Present, no details
		Xianggang (Hong Kong)	Present, few occurrences
		Xizhang	Present, no details
		Yunnan	Present, no details
		Zhejiang	Present, no details
	India		Present, no details
		Andhra Pradesh	Present, no details
		Delhi	Present, no details
		Haryana	Present, no details
		Jammu & Kashmir	Present, no details
		Karnataka	Present, no details
		Madhya Pradesh	Present, no details
		Maharashtra	Present, no details
		Orissa	Present, no details
		Punjab	Present, no details
		Rajasthan	Present, no details
		Tamil Nadu	Present, no details
		Uttar Pradesh	Present, no details
		West Bengal	Present, no details
	Indonesia		Present, no details
		Java	Present, no details
		Sumatra	Present, no details
	Iraq		Present, no details
	Japan		Present, widespread
		Honshu	Present, widespread
		Kyushu	Present, widespread
		Ryukyu Archipelago	Present, widespread
		Shikoku	Present, widespread
	Korea Dem. People's Republic		Present, no details
	Korea, Republic		Present, restricted distribution
	Lao		Present, no details
	Malaysia		Present, widespread
		Sabah	Present, no details
		Sarawak	Present, no details
		West	Present, no details
	Myanmar		Present, no details
	Pakistan		Present, no details
	Philippines		Present, no details
	Singapore		Present, no details
	Sri Lanka		Present, no details
	Taiwan		Present, widespread
	Thailand		Present, no details
	Viet Nam		Present, no details

Continent	Country	State	Status
Oceania	American Samoa		Present, no details
	Australia		Present, restricted distribution
		Northern Territory	Present, no details
		Queensland	Present, few occurrences
	French Polynesia		Present, no details
	Guam		Present, no details
	Micronesia		Present, no details
	New Caledonia		Present, widespread
	Palau		Present, no details
	Papua New Guinea		Present, no details
Samoa		Present, no details	
Wallis and Futuna Islands		Present, no details	

Appendix B – Detailed *Thrips palmi* host plant list

(Source: EPPO Global database online and CABI online, accessed on 9 November 2018)

Family	Common name	Scientific name	EPPO	CABI	Reg. status*
Anacardiaceae	MANGO	<i>Mangifera indica</i>	Incidental	Main	Regulated
Asteraceae	daisy	<i>Chrysanthemum</i>		Main	Regulated
	Florist's Chrysanthemum	<i>Dendranthema x grandiflorum</i>	Minor		Regulated
	sunflower	<i>Helianthus annuus</i>	Minor	Main	Regulated
	lettuce	<i>Lactuca sativa</i>		Main	Regulated
Brassicaceae	shepherd's purse	<i>Capsella bursa-pastoris</i>	Wild/Weed		
Caryophyllaceae	sticky mouse-ear chickweed	<i>Cerastium glomeratum</i>	Wild/Weed		
Cucurbitaceae	wax gourd	<i>Benincasa hispida</i>	Minor		
	watermelon	<i>Citrullus lanatus</i>	Minor	Other	
	melon	<i>Cucumis melo</i>	Major	Main	Regulated
	cucumber	<i>Cucumis sativus</i>	Major	Main	
	pumpkin	<i>Cucurbita moschata</i>		Other	
	pumpkin	<i>Cucurbita maxima</i>			Regulated
	marrow	<i>Cucurbita pepo</i>	Minor	Main	
	balsam pear	<i>Momordica charantia</i>		Main	Regulated – T.p.
	cucurbits	Cucurbitaceae	Minor	Main	
Fabaceae	leguminous plants	Fabaceae		Main	
	soyabean	<i>Glycine max</i>	Minor	Main	
	common bean	<i>Phaseolus vulgaris</i>	Minor	Main	Regulated
	pea	<i>Pisum sativum</i>	Minor		
	common vetch	<i>Vicia sativa</i>	Wild/Weed		
	cowpea	<i>Vigna unguiculata</i>	Minor	Main	
Lauraceae	avocado	<i>Persea americana</i>		Main	Regulated
Liliaceae	onion	<i>Allium cepa</i>		Main	Regulated
Malvaceae	cotton	<i>Gossypium</i>		Main	Regulated
	Upland cotton	<i>Gossypium hirsutum</i>	Minor		
Moraceae	figs	<i>Ficus</i>	Minor		Regulated
Orchidaceae	orchids	Orchidaceae	Minor	Main	Regulated – T.p.
Pedaliaceae	sesame	<i>Sesamum indicum</i>	Minor	Main	
Poaceae	rice	<i>Oryza sativa</i>		Main	Regulated
Primulaceae	Persian cyclamen	<i>Cyclamen persicum</i>	Minor		
Rutaceae		<i>Citrus</i>	Incidental	Main	Regulated
Solanaceae	peppers	<i>Capsicum</i>		Main	Regulated
	bell pepper	<i>Capsicum annuum</i>	Major	Main	Regulated
	tobacco	<i>Nicotiana tabacum</i>	Minor	Main	Regulated
	nightshades	<i>Solanaceae</i>	Minor	Main	Regulated
	tomato	<i>Solanum lycopersicum</i>		Main	Regulated
	aubergine	<i>Solanum melongena</i>	Major	Main	Regulated – T.p.
	potato	<i>Solanum tuberosum</i>	Minor	Main	Regulated
herbaceous ornamental plants			Major		
vegetable plants			Major		

*: The table shows *T. palmi* hosts and identifies also hosts regulated in the Directive 2000/29/EC. Those that are specifically regulated with respect to *T. palmi* are called 'Regulated-T.p.', the other hosts are regulated for other reasons.

Appendix C – EUROPHYT *Thrips palmi* notifications by source country 1995–2018

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Sum
Thailand	10	32	133	89	51	40	16	19	15	47	78	90	59	64	73	29	20	8	14	11	17	18	6	5	944
Dominican Republic		6	7	2	9	12	1	9	4	19	29	27	36	50	27	8	30	21	30	17	4	5	8	10	371
Suriname					4	5			6	27	82	9	17	5	15	25	16	2	9	3	3	4	1	15	248
India			5		6					5	7	16	14	10	7	6	15	23	23	1	1	2	1	2	144
Malaysia		3	4	1	1				2		7	7	8	1	1		9	8	7	3	11	11	12	2	98
Singapore		10	4	6	8	1			3	4	14	5	4	4	3		1			1	1	1			70
Ghana							1		1	6	3	14	1		1	1	14	1	2	1	4				50
Pakistan																	13	16	13	3					45
Sri Lanka														3	11	3	11	2	9			1	4		44
Bangladesh					1										1	9	2	12	11	2	1			1	40
Mauritius	12	16	5	1	2	1													1		2				40
Cambodia																			8	7			1		16
Laos																				1	3	9		2	15
Vietnam			3														6		1				3	1	14
Mexico																								11	11
Burkina Faso										1								2	3						6
Togo									1										2		1				4
Brazil					1	1																			2
China												2											1		3
United States		1													1										2
Cameroon																			1						1
Cote D'Ivoire												1													1
Cuba																							1		1
Dominica									1																1
Israel											1														1
Japan																								1	1
Morocco																	1								1
Philippines																			1						1
Sum	22	68	161	99	83	60	18	28	33	109	221	171	139	137	140	81	138	95	135	50	48	51	38	50	2,175

Appendix D – Third country sources of *Thrips palmi* interceptions on orchids, *Momordica* spp. and *Solanum melongena*

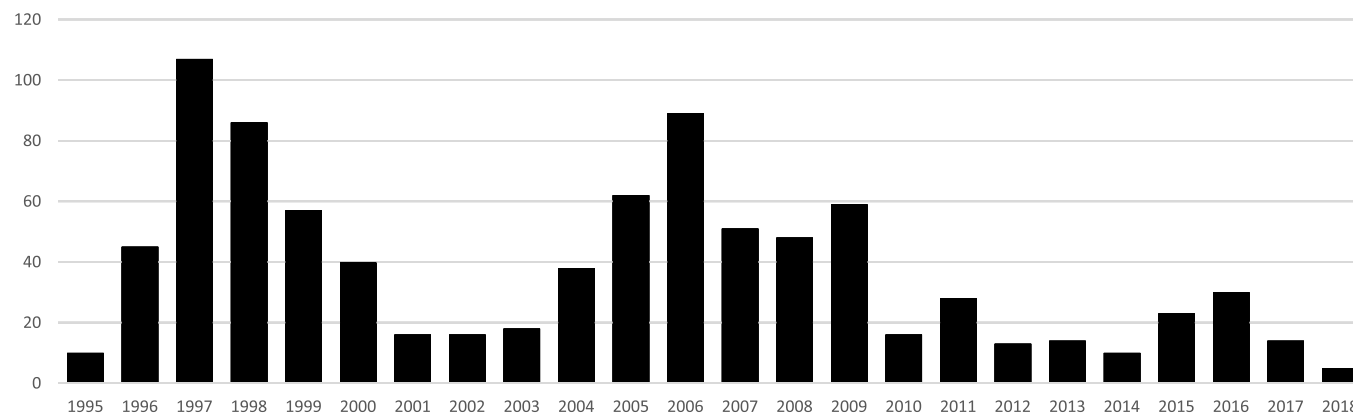
Note that these hosts represent 89.7% of all *T. palmi* interceptions in the EU to November 2018.

Source	Orchids	<i>Momordica</i> spp.	<i>Solanum melongena</i>	Sum
Thailand	751	73	52	876
Dominican Republic		196	146	342
Suriname		21	203	224
India	1	100	23	124
Malaysia	77	3	3	83
Singapore	61			61
Pakistan		34	11	45
Ghana		5	36	41
Bangladesh		29	7	36
Sri Lanka		33	2	35
Mauritius			19	19
Cambodia		15		15
Mexico		5	6	11
Vietnam		9	2	11
Laos	2	6	1	9
Brazil	2			2
Burkina Faso			1	1
Cameroon			1	1
Cote D'Ivoire		1		1
Dominica		1		1
Morocco			1	1
Philippines			1	1
Togo			1	1
United States	1			1
Sum	895	531	516	1,942

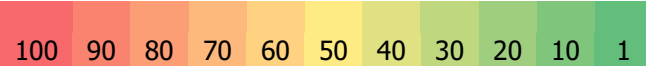
Appendix E – EU interceptions of *Thrips palmi* on orchids by year and third country

Colour gradient indicates numbers of interceptions across third countries and year; darkest red highlighting the highest numbers of interceptions to darkest green highlighting the lowest numbers of interceptions.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Sum
Thailand	10	32	99	79	47	38	16	16	13	36	50	79	43	44	54	16	18	8	10	6	13	17	5	2	751
Malaysia		3	4	1	1				2		3	5	4	1	1		9	5	4	3	9	11	9	2	77
Singapore		10	4	6	7	1			3	2	9	5	4	3	3		1			1	1	1			61
Brazil					1	1																			2
Laos																						1		1	2
India					1																				1
USA															1										1
Sum	10	45	107	86	57	40	16	16	18	38	62	89	51	48	59	16	28	13	14	10	23	30	14	5	895



Appendix F – EU interceptions of *Thrips palmi* on *Momordica* spp. by year and third country

Source																					sum	
	1996	1997	1998	1999	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		2018
Dominican Republic	3	6	2	6	5	3	15	20	18	17	17	15	4	15	9	17	11	3	3	5	2	196
India				4			5	6	16	8	9	5	6	13	17	10	1					100
Thailand		20	7				6	6	5	6	9	7	6							1		73
Pakistan														12	10	10	2					34
Sri Lanka												5	3	11	2	8			1	3		33
Bangladesh				1								1	6	1	9	9	1	1				29
Suriname							1	6	1	2	1	2	2		1	1	1	1			2	21
Cambodia																8	6			1		15
Vietnam		3												4						2		9
Laos																		2	4			6
Ghana							2					1						2				5
Mexico																					5	5
Malaysia															1	2						3
Cote D'Ivoire									1													1
Dominica						1																1
Sum	3	29	9	11	5	4	29	38	41	33	36	36	27	56	49	65	22	9	1	12	9	531

Appendix G – EU interceptions of *Thrips palmi* on *Solanum melongena* by year and third country

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	sum
Suriname					4	5			6	25	75	8	11	4	8	22	16	1	8	2	2	4	1	1	203
Dominican Republic		3	1		3	12	1	2	1	4	9	9	18	12	10	3	14	12	12	6	1	2	3	8	146
Thailand			8	2	1	2				2	17	1	2	6	5	2				1	2			1	52
Ghana									1	3	2	13				1	13	1				2			36
India													4	1	1		2	6	9						23
Mauritius	6	7	2		1														1			2			19
Pakistan																		1	6	3	1				11
Bangladesh																1	1	3	2						7
Mexico																								6	6
Malaysia											1								1				1		3
Sri Lanka														1						1					2
Vietnam																	1		1						2
Burkina Faso										1															1
Cameroon																				1					1
Laos																					1				1
Morocco																	1								1
Philippines																				1					1
Togo									1																1
Sum	6	10	11	2	9	19	1	2	9	35	104	31	35	24	24	29	49	30	39	11	9	6	5	16	516