Pest categorisation of *Thrips palmi*

EFSA Panel on Plant Health (EFSA PLH Panel), Claude Bragard, Katharina Dehnen-Schmutz, Francesco Di Serio, Paolo Gonthier, Marie-Agnès Jacques, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Christer Sven Magnusson, Panagiotis Milonas, Juan A. Navas-Cortes, Stephen Parnell, Roel Potting, Philippe Lucien Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen, Lucia Zappalà, Chris Malumphy, Ewelina Czwienczek and Alan MacLeod

**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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**Keywords:** Thysanoptera, melon thrips, European Union, pest risk, plant health, plant pest, virus vector

**Requestor:** European Commission

**Question number:** EFSA-Q-2018-00754

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Suggested citation: EFSA Panel on Plant Health (EFSA PLH Panel), Bragard C, Dehnen-Schmutz K, Di Serio F, Gonthier P, Jacques M-A, Jaques Miret JA, Fejer Justesen A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Malumphy C, Czwienczek E and MacLeod A, 2019. Scientific Opinion on the pest categorisation of *Thrips palmi*. EFSA Journal 2019;17(2):5620, 39 pp. https://doi.org/10.2903/j.efsa.2019.5620

ISSN: 1831-4732

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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 Margarodidae (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 IIA I**

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

- **Aleurocanthus spp.**
- **Anthonomus bisignifer** (Schenkling)
- **Anthonomus signatus** (Say)
- **Aschistonyx eppoi** Inouye
- **Carposina niponensis** Walsingham
- **Enarmonia packardi** (Zeller)
- **Grapholita inopinata** Heinrich
- **Hispronomonus phyctis**
- **Leucaspis japonica** Ckll.
- **Listronotus bonariensis** (Kuschel)

**(b) Bacteria**

- **Citrus variegated chlorosis**
- **Erwinia stewartii** (Smith) 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

**(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**

**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)
- **Gonioptrus scutellatus** Gyll.
- **Ips amitinus** Eichhof
- **Ips cembrae** Heer
- **Ips duplicatus** Sahlberg
- **Ips sexdentatus** Börner
- **Ips typographus** Heer
- **Stemochetis mangiferae** Fabricius

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(b) Bacteria

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

(c) Fungi

*Glomerella gossypii* Edgerton

*Hypoxylon mammatum* (Wahl.) J. Miller

*Gremmeniella abietina* (Lag.) Morelet

1.1.2.2. Terms of Reference: Appendix 2

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

**Annex IAI**

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

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

1) *Carneocephala fulgida* Nottingham

2) *Draeculacephala minerva* Ball

Group of Tephritidae (non-EU) such as:

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

2) *Anastrepha ludens* (Loew) 13) *Pardalaspis quinaria* Bezzi

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

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

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

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

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

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

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

10) *Dacus zonatus* Saund.

11) *Epochra canadensis* (Loew)

(b) Viruses and virus-like organisms

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

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

2) Andean potato mottle virus 5) Potato virus T

3) Arracacha virus B, oca strain 6) non-EU isolates of potato viruses A, M, S, V, X and Y (including Yo, Yn and Yc) and Potato leafroll virus

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

1) Blueberry leaf mottle virus 8) Peach yellows mycoplasm

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

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

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

5) Peach rosette mosaic virus 12) Non-EU viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L.
Annex IIAI

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

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

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

1.1.2.3. Terms of Reference: Appendix 3

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

Annex IIAI

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

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

(b) Fungi

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

(c) Viruses and virus-like organisms

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

*Arceuthobium* spp. (non-EU)

**Annex I A II**

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

*Meloidogyne fallax* Karssen

*Rhyzoecus 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 SANTE) of the European Commission and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of
interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the 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? |
Thrips palmi: Pest categorisation

| 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 | 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)](image-url)

*T. palmi* is primarily a subtropical and tropical species. Tsumuki et al. (1987) analysed the cold hardness 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 characterized 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          | Absent, intercepted only                                                     |                                                   |
| Belgium          | Absent, confirmed by survey                                                  |                                                   |
| Bulgaria         | Absent, confirmed by survey                                                  |                                                   |
| Croatia          | Absent, confirmed by survey                                                  |                                                   |
| Cyprus           | Absent, intercepted only                                                     |                                                   |
| 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           | Absent, confirmed by survey                                                  |                                                   |
| Hungary          | Absent, confirmed by survey                                                  |                                                   |
| Ireland          | Absent, confirmed by survey                                                  |                                                   |
| Italy            | Absent, confirmed by survey                                                  |                                                   |
| Latvia           | Absent, confirmed by survey                                                  |                                                   |
| Lithuania        | Absent, confirmed by survey                                                  |                                                   |
| Luxembourg       | Absent, confirmed by survey                                                  |                                                   |
| Malta            | Absent, confirmed by survey                                                  |                                                   |
| Netherlands      | Absent, pest eradicated                                                      | Vierbergen (1996), Vierbergen et al. (2012)       |
| Poland           | Absent, pest no longer present                                               |                                                   |
| Portugal         | Absent, confirmed by survey                                                  |                                                   |
| Romania          | Absent, confirmed by survey                                                  |                                                   |
| Slovak Republic  | Absent, confirmed by survey                                                  |                                                   |
| Slovenia         | Absent, invalid record                                                       |                                                   |
| Spain            | Absent, intercepted only                                                     |                                                   |
| Sweden           | Absent, confirmed by survey                                                  |                                                   |
| 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.
3.3.2. Legislation addressing the hosts of *Thrips palmi*

*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 |
| 24              | *Thrips palmi* Karny |

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

| Annex IV, Part A | Special requirements |
|------------------|----------------------|
| 36.1             | Plants, plant products and other objects |
|                  | 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 *Thrips palmi* 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 *Thrips palmi* 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 *Thrips palmi* 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 *Thrips palmi* Karny and have been officially inspected and found free from *Thrips palmi* 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 *Thrips palmi* Karny; are grown in vitro in a sterile medium under sterile conditions that preclude the possibility of infestation with *Thrips palmi* Karny; and are shipped in transparent containers under sterile conditions. |

| 36.2             | Cut flowers of Orchidaceae and fruits of *Momordica* L. and *Solanum melongena* L., originating in third countries |
|                  | Official statement that the cut flowers and the fruits: |
|                  | — originate in a country free from *Thrips palmi* Karny, |
|                  | or |
|                  | — immediately prior to their export, have been officially inspected and found free from *Thrips palmi* 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 (TSVV), although this report is uncertain, because no experimental data were provided by the authors (Persley et al., 2006).

Tomato spotted wilt virus (TSVV) 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.

### 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 : |
3.4.3.2. Climatic conditions affecting establishment

*Thrips 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).

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.

RNQPs: 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.
Thrips 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 (Ananthakrishnan, 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 *Thrips 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 *Solanum 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, O₂, CO₂, 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 T. palmi under the calyx. The ideal temperature was 45° for subsequent fruit conservation, because higher temperatures could induce fruit damage Entry (reduces population at source) | 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 Orius spp.) and pathogens (Lecanicillium muscarum, Beauveria bassiana) of T. palmi, a few of which are commercially available. Some of them are reported to be effective against T. palmi. (Cannon et al., 2007) Mass trapping with sticky traps and sticky ribbons has been used with effect against T. palmi 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 T. palmi 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 *Thrips palmi* (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) | *Thrips palmi* Karny is an established insect species in the order Thysanoptera (thrips), family Thripidae | *Thrips palmi* 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) | *Thrips palmi* 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 | *Thrips palmi* 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 |
**Table: Thrips palmi: Pest categorisation**

| 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)** | Biotic and abiotic conditions are conducive for establishment of this pest in the EU, mainly under glasshouse conditions. The main pathways are:  
- plants for planting with foliage,  
- plants for planting with soil,  
- cut flowers especially with foliage,  
- host fruits  
Only a small area might be suitable for the establishment of *T. palmi* outdoors but establishment in glasshouses in the EU is possible. | Although *T. palmi* 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. | None |
| **Potential for consequences in the EU territory (Section 3.5)** | Should *T. palmi* enter and establish in the EU, economic impacts on many hosts (especially protected Cucurbitaceae and Solanaceae crops as well as ornamentals) would be expected. | The presence of the pest on plants for planting has an economic impact on its intended use. | None |
| **Available measures (Section 3.6)** | 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 *Momordica* and *S. melongena*, from pest-free areas (PFA)). | There are measures available to prevent pest presence on plants for planting (e.g. source plants from PFA). | None |
| **Conclusion on pest categorisation (Section 4)** | *Thrips palmi* satisfies all of the criteria assessed by EFSA to satisfy the definition of a Union quarantine pest. | *Thrips palmi* 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. | None |
| **Aspects of assessment to focus on / scenarios to address in future if appropriate** | Given the number of interceptions, there is no doubt that entry into the EU is possible. *T. palmi* 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 *T. palmi* 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)). | |
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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  ρNQP 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     | 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 | Java    | Present, no details |
|           | Sumatra | Present, no details |
| Iraq      | Present, no details |
| Japan     | 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  | 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 |
| 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              | *Mangifera indica*               | Incidental | Main        | Regulated             |
| Asteraceae        | daisy              | *Chrysanthemum*                  |       |        |                       |
|                   | Florist’s Chrysanthemum | *Dendranthema x grandiflorum* | Minor |        | Regulated             |
|                   | sunflower          | *Helianthus annuus*              | Minor | Main   | Regulated             |
|                   | lettuce            | *Lactuca sativa*                 |       |        |                       |
| Brassicaceae      | shepherd's purse   | *Capsella bursa-pastoris*        | Wild/Weed |             |                       |
| Caryophyllaceae   | sticky mouse-ear chickweed | *Cerastium glomeratum* |       |        |                       |
| Cucurbitaceae     | wax gourd          | *Benincasa hispida*              | Minor |        |                       |
|                   | watermelon         | *Citrullus lanatus*              | Minor | Other  |                       |
|                   | melon              | *Cucumis melo*                   | Major | Main   | Regulated             |
|                   | cucumber           | *Cucumis sativus*                | Major | Main   |                       |
|                   | pumpkin            | *Cucurbita moschata*             | Other |        |                       |
|                   | pumpkin            | *Cucurbita maxima*               |       |        | Regulated             |
|                   | marrow             | *Cucurbita pepo*                 | Minor | Main   |                       |
|                   | balsam pear        | *Momordica charantia*            | Main  |        | Regulated – T.p.      |
|                   | curcubits          | *Cucurbitaceae*                  | Minor | Main   |                       |
| Fabaceae          | leguminous plants  | Fabaceae                         |       |        |                       |
|                   | soyabean           | *Glycine max*                    | Minor | Main   |                       |
|                   | common bean        | *Phaseolus vulgaris*             | Minor | Main   | Regulated             |
|                   | pea                | *Pisum sativum*                  | Minor |        |                       |
|                   | common vetch       | *Vicia sativa*                   | Wild/Weed |             |                       |
|                   | cowpea             | *Vigna unguiculata*              | Minor | Main   |                       |
| Lauraceae         | avocado            | *Persea americana*               | Main  |        | Regulated             |
| Liliaceae         | onion              | *Allium cepa*                    | Main  |        | Regulated             |
| Malvaceae         | cotton             | *Gossypium*                      | Main  |        | Regulated             |
|                   | Upland cotton      | *Gossypium hirsutum*             | Minor |        |                       |
| Moraceae          | figs               | *Ficus*                          | Minor |        | Regulated             |
| Orchidaceae       | orchids            | Orchidaceae                      | Minor | Main   | Regulated – T.p.      |
| Pedaliaceae       | sesame             | *Sesamum indicum*                | Minor | Main   |                       |
| Poaceae           | rice               | *Oryza sativa*                   | Main  |        | Regulated             |
| Primulaceae       | Persian cyclamen   | *Cyclamen persicum*              | Minor |        |                       |
| Rutaceae          | peppers            | *Citrus*                         | Incidental | Main        | Regulated             |
| Solanaceae        | bell pepper        | *Capsicum annuum*                | Major | Main   | Regulated             |
|                   | tobacco             | *Nicotiana tabacum*              | Minor | Main   | Regulated             |
|                   | nightshades        | Solanaceae                       | Minor | Main   | Regulated             |
|                   | tomato             | *Solanum lycopersicum*           | Major | Main   | Regulated – T.p.      |
|                   | aubergine          | *Solanum melongena*              | Major | Main   | Regulated             |
|                   | potato              | *Solanum tuberosum*              | 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

| 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 |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 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              | 6    | 7    | 5    | 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   | 1   | 12   | 2    | 98   |
| Singapore          | 10   | 4    | 6    | 8    | 1    | 3    | 4    | 14   | 1    | 1    | 14   | 1    | 2    | 1    | 4    | 1    | 1    | 1    | 70   |
| Ghana              | 1    | 1    | 6    | 3    | 14   | 1    | 1    | 1    | 1    | 14   | 1    | 2    | 1    | 4    | 1    | 2    | 40   |
| Pakistan           | 13   | 16   | 13   | 3    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 45   |
| Sri Lanka          | 3    | 11   | 3    | 11   | 2    | 9    | 1    | 4    | 44   |
| Bangladesh         | 1    |      |      | 1    | 1    | 9    | 2    | 12   | 11   | 2    | 1    | 1    | 1    | 40   |
| Mauritius          | 12   | 16   | 5    | 1    | 2    | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 40   |
| Cambodia           | 8    | 7    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 16   |
| Laos               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 15   |
| Vietnam            | 3    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 14   |
| Mexico             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 11   |
| Burkina Faso       | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 6    |
| Togo               | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 4    |
| Brazil             | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    |
| China              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 3    |
| United States      | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    |
| Cameroon           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| Cote D’Ivoire     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| Cuba               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| Dominica           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| Israel             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| Japan              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| Morocco            | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| Philippines        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 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 | *Momordica* spp. | *Solanum melongena* | 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   |
| 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.

| Year | 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    | 1    | 1    | 61   |
| Brazil     | 1    | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    |
| Laos       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |      | 2    |
| India      | 1    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    |
| USA        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 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  |

![Graph showing the number of interceptions by year and third country for Thrips palmi.]
### Appendix F – EU interceptions of *Thrips palmi* on *Momordica* spp. by year and third country

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

| 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          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    | 1    | 7    | 1    | 2    | 6    | 5    | 2    |      |      |      | 1    | 52    |
| Ghana             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 36    |
| India             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 23    |
| Mauritius         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 19    |
| Pakistan          |      |      |      |      |      |      |      |      |      |      | 6    | 7    | 2    |      |      | 1    |      |      |      |      |      |      |      |      |      |      |      |      | 11    |
| Bangladesh        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 7     |
| Mexico            |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 6     |
| Malaysia          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 3     |
| Sri Lanka         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2     |
| Vietnam           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2     |
| Burkina Faso      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1     |
| Cameroon          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1     |
| Laos              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1     |
| Morocco           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1     |
| Philippines       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1     |
| Togo              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 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   |