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Pest categorisation of non-EU Tephritidae

EFSA Panel on Plant Health (PLH),
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, Eleftheria Maria Bali, Nikolaos Papadopoulos, Stella Papanastassiou, Ewelina Czwienczek and Alan MacLeod

Abstract

The Panel on Plant Health performed a group pest categorisation of non-EU Tephritidae, a large insect family containing well-studied and economically important fruit fly species and little studied species with scarce information regarding their hosts and species that do not feed on plants. Information was saught on the distribution of each species and their hosts. Tephritidae occur in all biogeographic regions except in extreme desert and polar areas, where their hosts are scarce or absent. Non-European Tephritidae are listed in 2000/29 EC as Annex 1/A1 pests whose introduction into the EU is prohibited. Non-EU Tephritidae are regularly intercepted in the EU. Interceptions mainly occur on fruits although there is potential for entry on other plant parts. Beginning with over 5,000 recognised species, factors relevant for pest categorisation were sequentially used to narrow down the list of species to create a list of Tephritidae not known to be established in the EU yet which occur in countries with some EU climate types and which feed on plants that occur in the EU. Following the introduction of pest species, impacts on cultivated host plants could result in yield and quality losses; harmful impacts on wild hosts are uncertain. Phytosanitary measures are available to prevent the entry of non-EU Tephritidae. Results are presented in a series of appendices listing species screened during the process. Of 4,765 species regarded as non-EU Tephritidae, 257 species satisfy the criteria assessed by EFSA such that they can be considered as potential quarantine pests for the EU. Lack of information of the distribution of hosts and/or impact on wild hosts means 1,087 species of non-EU Tephritidae do not satisfy all criteria to be considered as potential quarantine pests for the EU. Non-EU Tephritidae do not meet the criteria assessed by EFSA for consideration as regulated non-quarantine pests, as members of the group are not present in the EU and plants for planting are not the main means of spread.

Keywords: decision tree, fruit fly, invasive species, pest risk, plant health, plant pest, quarantine

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Correspondence: alpha@efsa.europa.eu

Panel members: Claude Bragard, Katharina Dehnen-Schmutz, Francesco Di Serio, Paolo Gonthier, Marie-Agnès Jacques, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe L Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen and Lucia Zappalà.

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1. Introduction

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

1.1.1. Background

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

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

1.1.2. Terms of Reference

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

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

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

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

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

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[1] Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. OJ L 169/1, 10.7.2000, p. 1–112.

[2] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants. OJ L 317, 23.11.2016, p. 4–104.

[3] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31/1, 1.2.2002, p. 1–24.

1.1.2.1. Terms of Reference: Appendix 1

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

Annex IIAI

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

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

(b) Bacteria

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

(c) Fungi

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

(d) Virus and virus-like organisms

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

Annex IIB

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

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

(b) Bacteria

Curtobacterium flaccumfaciens pv. flaccumfaciens (Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton

Gremmeniella abietina (Lag.) Morelet

Hypoxylon mammatum (Wahl.) J. Miller

1.1.2.2. Terms of Reference: Appendix 2

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

Annex IAI

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

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

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

Group of Tephritidae (non-EU) such as:

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

(c) Viruses and virus-like organisms

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

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

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

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

Annex IIAI

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

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

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

1.1.2.3. Terms of Reference: Appendix 3

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

Annex IAI

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

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

(b) Fungi

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

(c) Viruses and virus-like organisms

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

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex IAII

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

Meloidogyne fallax Karssen

Popillia japonica Newman

Rhizoecus hibisci Kawai and Takagi

(b) Bacteria

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

Ralstonia solanacearum (Smith) Yabuuchi et al.

(c) Fungi

Melampsora medusae Thümen

Synchytrium endobioticum (Schilbersky) Percival

Annex I B

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

Leptinotarsa decemlineata Say

Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Tephritidae (non-European Union (EU)) is one of a number of pest groups listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine which, if any, members of the group fulfil the criteria of quarantine pests or those of regulated non-quarantine pests for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

Twenty-three species of non-EU Tephritidae are given as examples in the EU plant health legislation, 2000/29 EC:

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

For this group pest categorisation, the terms of reference are clear in requesting all members of the wider group be considered, not only the species listed as examples, following the 'such as' notation in Annex I/AI of Directive 2000/29/EC. Although the term 'Tephritidae (non-European)' is used In Annex I AI of Directive 2000/29 EC, the phrase 'non-European' is understood to mean 'non-EU' and refers to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031. In this opinion, non-EU is interpreted as being species that are not known to be established in the EU, or if established in the EU, they are not widespread and are under official control (i.e. currently treated as Union Quarantine Pests).

Species that are widely distributed in the EU and which may have been present for decades or even centuries are excluded from detailed consideration in this categorisation and will not be regarded as non-EU Tephritidae. Nevertheless, we will begin by compiling a comprehensive global list of the 5,039 species of Tephritidae and filter out species using relevant factors to narrow down and focus the categorisation on the species with the highest potential to satisfy all criteria (which are within the remit of European Food Safety Authority (EFSA) to assess) necessary to allow a species to be regarded as a potential quarantine pest for the EU.

The new Plant Health Regulation (EU) 2016/2031[4], on the protective measures against pests of plants, will be applying from December 2019.

The regulatory status sections (Section 3.3) of the present opinion are still based on Council Directive 2000/29/EC, as the document was adopted in November 2019.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on members of the family Tephritidae was conducted at the beginning of the categorisation in the (a) ISI Web of Science, (b) Google Scholar, (c) PubMed and other bibliographic databases, using the scientific names of Subfamilies, Tribes, Genera and Species as search terms. Relevant papers and books were reviewed, and further references and information were obtained from experts, as well as from grey literature. The period devoted to literature search was from May 2018 to April 2019.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, 2019) and relevant publications.

The Delta system Database: '*Anastrepha* and *Toxotrypana* descriptions, illustrations and interactive keys' (Norrbom et al., 2019) was used in order to collect more specific information regarding host range and newly described taxa.

The Database: 'True Fruit flies (Diptera, Tephritidae) of the Afrotropical Region' (de Meyer and Heughebaert, 2014) was consulted to address issues regarding the taxonomy, feeding habits and distribution of the African tephritids.

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 seeking information, findings and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information (https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt_en). The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States (MS) and the phytosanitary measures taken to eradicate or avoid their spread. Additional information was retrieved from CABI Crop Protection Compendium (https://www.cabi.org/cpc) and USDA Compendium of Fruit Fly Host Information (https://coffhi.cphst.org/).

2.2. Methodologies

The Panel performed the pest categorisation for non-EU Tephritidae, following guiding principles and steps presented in the 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). Recognising that the definition of pest categorisation is 'The process for determining

[4] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) 228/2013, (EU) 652/2014 and (EU) 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC. OJ L 317, 23.11.2016, pp. 4–104.

whether a pest has or has not the characteristics of a quarantine pest or those of a regulated non quarantine pest' (ISPM 5, Glossary of phytosanitary terms), whether a species was known to feed on a plant, in order that it has potential to be regarded as a pest, had first to be determined.

This work was initiated following an evaluation of the EU plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union quarantine pest and for a Union regulated non-quarantine pest in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific 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 regulated non-quarantine pest. If one of the criteria is not met, the pest will not qualify. A pest that does not qualify as a quarantine pest may still qualify as a regulated non-quarantine pest that needs to be addressed in the opinion. For the pests regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone; thus, the criteria refer to the protected zone instead of the EU territory.

It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, whereas addressing social impacts is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/ presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism	Is the pest present in the EU territory? If not, it cannot be a regulated non-quarantine pest. (A regulated non-quarantine pest must be present in the risk assessment area)
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future	The protected zone system aligns with the pest-free area system under the International Plant Protection Convention (IPPC) The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone)	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?

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

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

For the purpose of this pest categorisation, a stepwise dichotomous decision tree was developed and used to narrow down the number of species to be considered more fully in the pest categorisation process (Figure 1). A similar approach was used by EFSA PLH Panel (2019) for the pest categorisation of non-EU Cicadomorpha vectors of *Xylella* spp. Data collected from National Plant Protection Organisations of the MS were also considered.

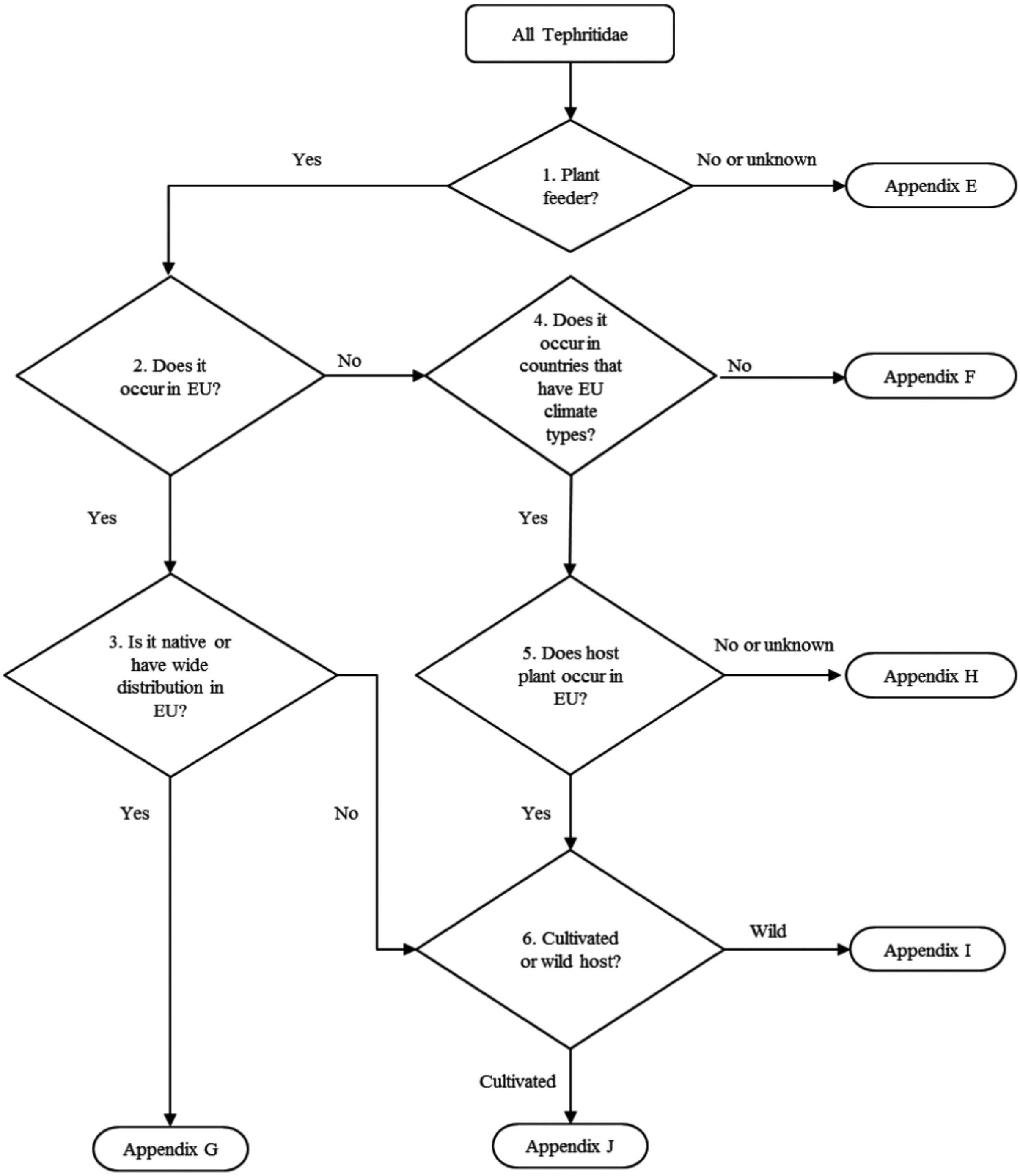

Figure 1: Decision tree illustrating the process for filtering species of Tephritidae to identify those most likely to satisfy the criteria for consideration as EU quarantine pests

Major steps in the process included:

- Compiling a list of all Tephritidae species with their synonyms and information regarding geographic distribution, feeding habits and hosts (where known),
- Using the information collected to sequentially filter out species following the decision tree, for example:
  - plant feeder – evidence from literature was used to identify species feeding on plant parts such as fruit, flowers, seeds or stems
  - countries with EU climate types – supplementary data in MacLeod and Korycinska (2019) were used to identify countries with or without Koppen–Geiger climate types that are also found in the EU.

The categorisation process began by developing a comprehensive list of species of Tephritidae. Species that were known not to feed on plants, or were not known to feed on plants were first screened out. These species do not fulfil any of the criteria allowing them to be considered as potential quarantine pests for the EU (Table 1), the major criterion being that they are not known to feed on plants. Such species form Appendix E. All other species are known to feed on plants and are allocated to Appendices F–J according to the replies to questions at decision points shown in Figure 1.

Appendix F consists of plant feeding species that occur in countries that do not share any Koppen–Geiger climate types with climate types in the EU. For the purposes of this categorisation, these species are assumed not to be able to establish in the EU, thus failing a criterion to be regarded as a potential quarantine pest and not considered further.

Species that are native or widely distributed in the EU fall outside the scope of this categorisation as they are not non-EU species of Tephritidae. Such species form Appendix G.

Plant feeding Tephritidae not known to be present in the EU but present in countries with some Koppen–Geiger zones that occur in the EU although their hosts are absent from the EU or it is unknown whether hosts occur in the EU form Appendix H. For species in Appendix H, the uncertainty around hosts occurring in the EU means that there is uncertainty regarding establishment, spread and impact which are important criteria to satisfy if a species is to be regarded as a potential quarantine pest.

Plant feeding Tephritidae not known to be present in the EU and occurring in countries with at least one climate type that is also found in the EU whose hosts either grow wild in the EU or it is unknown whether their hosts are cultivated in the EU form Appendix I. For species utilising wild hosts in Appendix I, there are fewer, if any, pathways, compared to pathways for commercially traded plants. If entry could occur, there is additional uncertainty over the magnitude and significance of any impact on wild hosts. Species that form Appendix I satisfy the criteria to be regarded as potential quarantine pests for the EU although there are uncertainties which weaken the case against them.

It is the species that form Appendix J which most strongly satisfy the criteria to be regarded as potential quarantine pests for the EU. Appendix J consists of plant feeding Tephritidae not known to be present in the EU, or present but not widely distributed and under official control, which occur in countries that have climate types that also occur in the EU and whose hosts are cultivated in the EU.

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, there are descriptions and taxonomic keys available for the identification of many Tephritidae to species level, especially those of economic importance.

The list of identified species has increased over the years, and it is estimated that a substantial number of species have yet to be identified.

Tephritidae is the most species-rich family of Diptera, with more than 5,000 described species, 500 genera, six subfamilies (Tachiniscinae, Blepharoneurinae, Phytalmyiinae, Trypetinae, Dacinae and Tephritinae) and many undescribed species worldwide (Uchôa, 2012).

Although the taxonomy of Tephritidae is thoroughly studied, there are still debates and disagreements over the taxonomic position of a few genera and several species. Several species and four genera of Tephritidae are characterised as '*incertae sedis*' and hence cannot be included in a specific subfamily. Also, there are '*incertae sedis*' (genera and/or species) within the subfamilies Phytalminae, Tachiniscinae, Tephritinae, Trypetinae, as well as within the Tephritinae tribe Schistopterini and genus *Terellia*.

Specific taxonomic issues within the subfamilies are listed below:

1) Subfamily Dacinae:

   a) In Tribe Dacini, there is an ongoing debate on whether *Zeugodacus* should be placed at genus or subgenus level. Also, there are some taxonomic issues on the subgenus level (Doorenweerd and Leblanc, 2018; Hancock and Drew, 2018a,b).
   b) In Tribe Ceratidini, there is an ongoing debate regarding the synonymisation of the genus *Carpomya* with the genera *Goniglossum*, *Norrbomella* and *Myiopardalis*. The current categorisation follows the paper of Korneyev that was published in 2017 (Korneyev et al., 2017) that accepts the above synonymisation understanding that 'taxonomic consequences and concepts of both genera likely will be influenced by the results of forthcoming phylogenetic analyses based on the sequences of multiple genes and we abstain from any taxonomic changes (including those by Freidberg, 2016) until their phylogenetic relationships are clearly resolved'. Hence, in the current list, the *Carpomya* genus includes *Goniglossum*, *Norrbomella* and *Myiopardalis*.

2) Subfamily Trypetinae:

   a) There is an ongoing debate about the taxonomic position of the genus *Hexachaeta* at the level of Tribe Toxotrypanini or Callistomyiini (Mengual et al., 2017).
   b) Norrbom and colleagues (Norrbom et al., 2018) have recently proposed to change the name of the Genus *Toxotrypana* to *Anastrepha*. However, in the current list, we have not included this change as it is not widely accepted by the scientific community yet.
   c) Korneyev (1997) and Han (1999) consider *Hemileophila, Drosanthus, Pseudhemilea, Yamanowotome* and *Hyleurinus* to be distinct valid genera. These authors also propose *Dryadodacryma* and *Hemileoides* to be moved to the unconfirmed generic list. However, in the current categorisation, they are still considered as synonyms.

Following the steps in the decision tree (Figure 1), the whole subfamily Tachiniscinae was excluded from further categorisation because they do not feed on plants. Likewise, all species in the subfamily Blepharoneurinae but one (*Blepharoneura diva*) that is reported to occur in cultivated Cucurbitaceae (reviewed in Condon and Steck, 1997), were excluded. For the same reason, all Phytalminae but one (*Dirioxa pornia*) and 7 species of Tephritinae were excluded from further categorisation. Most of the species that were categorised in detail belong to Dacinae and Trypetinae, which include major genera of economic importance such as *Anastrepha, Bactrocera, Ceratitis, Dacus, Rhagoletis, Zeugodacus*.

Within the major tephritid pests, there are populations that are morphologically indistinguishable but are biologically distinct, expressing different life-history traits (e.g. life span, reproduction patterns), behavioural (e.g. mating behaviour; host preference) and genetic traits. Such species complexes are the subject of ongoing efforts to resolve their taxonomy. The taxonomic uncertainty described above has many practical implications as far as management against these species is regarded as well as trading of fruit and vegetables (De Meyer et al., 2016). Intense efforts in the early 21st century addressed the species complexes of *Anastrepha fraterculus, Bactrocera cucurbitae, Bactrocera dorsalis,* and that of the *Ceratitis* FAR complex, consisting of *Ceratitis fasciventris*, *C. anonae* and *C. rosa*. Cryptic species complexes have also been described in the genus *Rhagoletis;* it is more pronounced within *Rhagoletis pomonella* (Green et al., 2013). There are additional taxonomic issues regarding cryptic species of non-economic importance such as that of the genus *Blepharoneura.*

Anastrepha fraterculus complex: Fruit flies of the genus *Anastrepha* are endemic to subtropical and tropical regions of the American continent (part of North America, Central and South America, most Caribbean Islands). Within the genus, *A. fraterculus* (commonly known as the 'South American fruit fly') is probably the most important species from an economic point of view as it exhibits extensive geographic range and is extremely polyphagous, infesting more than 90 different host fruits (Aluja, 1994). For the last 70 years, sufficient information has been documented to suggest that the nominal species *A. fraterculus* in fact represents a cryptic species complex (AF complex). Studies dating back to the 1940s have indicated morphological variation among populations that was primarily attributed to different geographic races (Stone, 1942a,b). It has also been proposed that the extensive list of host fruits may be related to the difficulty in recognising possible cryptic species within the nominal species *A. fraterculus*. More recent studies confirmed that the *A. fraterculus* complex is comprised of at least three different biological entities named *Anastrepha* sp. 1 aff. *fraterculus*, *A.* sp. 2*, A. sp. 3* (Steck and Sheppard, 1993; Yamada and Selivon, 2001; Selivon et al., 2004). *Anastrepha fraterculus* has been recently shown to consist of a complex of species of no monophyletic origin (Hendrichs et al., 2015). These species express distinct geographic and ecological dispersion in Central and South America. Although a large amount of data have been published in past years on the taxonomic status of the *A. fraterculus* species complex, the number of species this complex comprises, the distribution of each one, and their distinguishing features are not yet fully elucidated.

Bactrocera dorsalis complex: Fruit flies of the genus *Bactrocera* are native to Africa, tropical and subtropical Asia, Australasia and the western Pacific Islands, with the highest species diversity within Southeast Asia and Australasia. *Bactrocera* includes at least 68 economically important species whose larvae infest a large variety of fruit and cucurbit crops causing direct damage even to unripe fruit (Drew, 2004). The most invasive and economically important species belong to the *Bactrocera dorsalis* complex, which includes 75 described species, largely endemic to Southeast Asia. Most species within the complex were described in 1994 (Drew and Hancock, 1994) and since then substantial research has been undertaken in developing morphological and molecular diagnostic techniques for their recognition. Some members within the *B. dorsalis* group have different geographic and host ranges than *B. dorsalis* sensu stricto but their discrimination, based on morphological criteria alone, is extremely difficult (Clarke et al., 2005). Within the complex, polyphagous pests of international significance include *B. dorsalis* s. s., *B. papayae*, *B. carambolae* and *B. philippinensis* (Clarke et al., 2005). Recently, use of modern molecular biology tools and classical morphologically based taxonomy have resulted in *B. philippinensis*, *B. invadens*, *B. papayae* being synonymised with *B. dorsalis* concluding that they represent populations of the same species (Schutze et al., 2014; Hendrichs et al., 2015). Using existing molecular and chemical (pheromone and epicuticular chemical analysis) markers, *B. carambolae* can be distinguished from *B. dorsalis* and is considered as a valid species (Hendrichs et al., 2015; Vaníčková et al., 2017). Nevertheless, a debate is yet going on regarding this synonimisation (see Schutze et al. (2015, 2017) and Drew and Romig (2016) for further details).

Zeugodacus (Bactrocera) cucurbitae complex: Because the taxonomic status of *B. cucurbitae* has been found to be paraphyletic, the subgenus *Zeugodacus* has been elevated to species level (Virgilio et al., 2015). Hence, *Bactrocera cucurbitae* has been assigned to *Zeugodacus cucurbitae.* Geographically distant populations of *Z. cucurbitatae* have shown low molecular, cytological, morphological and behavioural differences, and hence, no species complex has been identified (Hendrichs et al., 2015).

Ceratitis FAR complex: There are four taxonomic entities that are included in this complex, all of African origin, *C. fasciventris, C. anonae, C. rosa* and *C. quilicii* (Hendrichs et al., 2015; Tanga et al., 2018; Virgilio et al., 2019). Males of the FAR complex can be morphologically distinguished; however, females and immature stages are very difficult to differentiate among the four species based on morphological characteristics. *C. quilicii* has been recently separated from *C. rosa* and raised to species level (DeMeyer et al. 2016).

Rhagoletis pomonella cryptic species group: genetic, ecological and behavioural differences of *R. pomonella* populations have been extensively studied in the frameworks of speciation processes and this case, nowadays, represents a major example of sympatric speciation (Feder et al., 2003a,b). The *R. pomonella* species group consists of several morphologically close species and populations that infest a defined set of related host species (Berlocher, 2000). For example, species such as *R. zephyria* considering larvae and adult morphology can be confused with *R. pomonella* (Green et al., 2013) and hence can be considered as part of the '*R. pomonella*' species complex. Distinguishing the above two taxa has major commercial implications since *R. zephyria* infests hosts of non-commercial value while *R. pomonella* is a major pest of apples and a zero-tolerance policy for larvae infestation has been established in parts of the USA and elsewhere.

Blepharoneura cryptic species: the genus *Blepharoneura* includes endemic Neotropical species that breed only in native Cucurbitaceae and has been used for the study of host-use evolution and sympatric speciation (Condon and Norrbom, 1994). Several sympatric, cryptic, *Blepharoneura* species infest specific part of single species of native Cucurbitaceae. Thus, distinct genetic lineages coexist in space: some sharing the same host parts, and some infesting different parts of the same host species (Condon et al., 2008; Marsteller et al., 2009). Members of this genus are divided in two species groups (complexes): *B. poecilosoma* and *B. femoralis* that are known to include 22 recently recognised species and estimated to include more than 200 species (Norrbom and Condon, 2010). The *femoralis* and *poecilosoma* groups can be diagnosed reliably only by morphological differences in genitalia. In the *femoralis* group, the aculeus is short and broad, usually with acute or blunt scales on the medial membrane. Its tip is truncate to subtriangular, with step-like or digitiform lobes. In the *poecilosoma* group, the aculeus lacks scales on the medial membrane and its tip is triangular. The sclerotised part of the glans is smaller and more cylindrical than in the *femoralis* group. The *femoralis* group is more variable in wing pattern (i.e. has a greater diversity of patterns) than the *poecilosoma* group.

3.1.2. Biology of the pest

The Tephritidae family includes species with extremely diverse feeding habits. Species with known biology are characterised as plant feeders, feeders of decaying material, or as predators. Plant feeders can be classified depending on the part of the plant they infest. They can be fruit feeders, flower feeders, seed feeders, stem and leaf miners. In the typical developmental cycle, female fruit flies insert their eggs beneath the skin of suitable hosts, especially in ripening or ripe fruits and vegetables. Some species oviposit in living, healthy leaves, stalks, flower heads or seeds of hosts. Some species form galls and some are leaf miners (Christenson and Foote, 1960).

There are three larval instars which actively feed. At completion of the third instar, which usually abandon the feeding substrate to jump to the soil (thus, they are called popping larvae) where they tunnel up to a few centimetres deep, the larval skin hardens to form a puparium with a fourth-instar larva inside. Eventually the larva within the puparium moults to form a pupa; pupation usually takes place in the soil. Shortly after emergence from puparia adults forage and feed on carbohydrate and protein compounds. Depending on the species, adults attain sexual maturity within a few days to a week or more, search for mates, and usually mate following sophisticated sexual behaviours. Soon after mating, females oviposit in suitable hosts starting a new cycle (Christenson and Foote, 1960). The duration of the biological cycle depends on species, host and the climatic conditions.

Certain fruit flies, especially those living in tropical and subtropical conditions, are multivoltine (several generations per year) and are not known to undergo diapause. In contrast, many Tephritidae restricted to regions with pronounced seasonal fluctuations in climate are strictly univoltine (one generation per year) and follow well-defined dormancy schedules including diapause (e.g. *Rhagoletis* spp.) (Christenson and Foote, 1960). Dormancy regulations are related to host plant availability and climatic conditions.

More specific information on the biology, feeding habits and taxonomy of the six subfamilies is given below:

Tachiniscinae (excluded from further pest categorisation as non-plant feeders (included within Appendix F) but included here for completeness).

Species of the subfamily Tachiniscinae are rare in collections and their biology is poorly known, but they have great importance for understanding the phylogeny of the Tephritidae (Korneyev and Norrbom, 2006). The representatives of Tachiniscinae are morphologically characterised by a short stiletto-like sting (aculeus) (autapomorphy) suggesting that members of this subfamily are parasitoids of other insects (Aluja and Norrbom, 1999). The subfamily Tachiniscinae consists of two tribes Tachiniscini and Ortalotrypetini, which were known to occur in the Afrotropical and Neotropical Regions and also in south eastern provinces of China, usually considered to belong to the Palaearctic Region (Korneyev, 2012). Tribe Ortalotrypetini includes the eastern Palaearctic and Oriental genera *Ortalotrypeta* and *Cyaforma* and the Neotropical genus *Neortalotrypeta.* Other genera belonging to this tribe are *Agnitrena* and *Ischyropteron* (Norrbom et al., 1999). Tribe Tachiniscini includes the Neotropical genera *Tachinisca*, and Afrotropical *Bibundia* and *Tachiniscidia*. Also the genera *Aliasutra* and *Protortalotrypeta*, with the latter being represented by the fossil species *Protortalotrypeta grimaldii* found in Dominican amber (Norrbom, 1994; David and Hancock, 2013), take position of a basal taxon in the tribe Tachiniscini but the polytomy remains unresolved, as the morphological data remain incomplete for the latter genus (Korneyev, 2012). Two more '*incertae sedis*' (of unknown taxonomic relationships) genera *Descoleia* and *Nosferatumyia* (type species *N.* no sp. n. from Madeira) also belong to the same subfamily (Korneyev and Norrbom, 2006). Representatives of the subfamily Tachiniscinae with studied biology and feeding habits are parasitoids of caterpillars of saturniid moths (Lepidoptera: Saturniidae) (Roberts, 1969).

Blepharoneurinae (other than *Blepharoneura diva* (Appendix J) all others are excluded due to lack of information on hosts (species within Appendix E–H).

The subfamily Blepharoneurinae includes five genera with complex phylogenetic relationships: *Baryglossa*, *Blepharoneura* Loew, *Ceratodacus* Hendel, *Hexaptilona* Hering and *Problepharoneura* (Norrbom and Condon, 2001). There are seven species described in the genus *Baryglossa*. *Blepharoneura* is an endemic Neotropical genus and it is divided in two species groups (complexes): *B. poecilosoma* and *B. femoralis* that is estimated to include more than 200 species, most of which are undescribed (Norrbom and Condon, 2010). This genus has been extensively used for the study of host-use evolution and sympatric speciation (Condon and Norrbom, 1994). *Ceratodacus* is characterised as an 'enigmatic genus' and limited information is available based on one existing and one fossil Neotropical species (Norrbom and Condon, 2001). *Hexaptilona* includes two species distributed in the Oriental and eastern Palaearctic region and *Problepharoneura* is known from a fossil species found in Dominican amber. Although the biology of the species of *Ceratodacus* and *Problepharoneura* is unknown, the species belonging to *Baryglossa*, *Blepharoneura* and *Hexaptilona* are known or suspected to 'breed' in plants of the family Cucurbitaceae (Norrbom and Condon, 2001). Flies belonging to the *Blepharoneura* genus, all feed only in native, Neotropical, Cucurbitaceae and almost all are specialists on specific plant parts (male or female flowers, fruit, seeds or stems) of a single cucurbit species (Winkler et al., 2018). An especially diverse group of Blepharoneura specialises on highly sexually dimorphic plants in the subtribe Guraniinae (*Gurania* and its close relative, *Psiguria*) (Norrbom and Condon, 2001; Ottens et al., 2017). As mentioned earlier, there is only one species (*Blepharoneura diva*) which has been reared from a cultivated *Cucurbita* sp. (Condon and Steck, 1997). There is a single record of successful rearing for *Baryglossa tersa* in flowers of a cucurbit plant (Munro 1957 from Norrbom and Condon, 2001). Additionally, no record of *Hexaptilona* rearing exists so far but personal observation by A. Freidberg concludes that *H. hexacinioides* can be developed in a cucurbit plant in Taiwan [reviewed in (Norrbom and Condon, 2001)]. To summarise, although there is a possibility that *Baryglossa* and *Hexaptilona* genera may be reared in Cucurbitaceae plants, lack of scientific records and evidence leads to exclude them both from more detailed consideration in the categorisation process (Appendix F).

Phytalmiinae (key pests in this subfamily include *Dirioxa pornia* which attacks a wide range of ripe fruit; *Clusiosoma* and *Rabaulia* spp. feed on *Ficus* (Appendix J).

The subfamily Phytalmiinae comprises predominantly species with saprophagous or generalised phytophagous larvae. Species of this subfamily are found to 'breed' under the bark of fallen trees (usually in early stages of decay), in termite galleries, occasionally in tissues of dead or living plants (large monocotyledonous grasses such as bamboos) and in fruits [reviewed in (Aluja and Norrbom, 1999)]. Even though many species are known, the detailed biology of only a few has been described (Dohm et al., 2014). This subfamily comprises four tribes: Acanthonevrini (with 74 genera), Epacrocerini (with 6 genera), Phascini (with 9 genera) and Phytalmiini (with 4 genera). The additional two genera *Colobostroter* and *Matsumurania* belong to Phytalmiinae but have not been classified at the tribal level. Species of the genus *Phytalmia* (tribe Phytalmiini) are known to breed in decaying wood of rain forest trees such as *Dysoxylum gaudichaudianum* [reviewed in (Dodson, 1999)]. Females of the tribe Phascini (except for genus *Paraphasca*) have the aculeus of the typically 'piercing' type, thus has been presumed to have phytophagous larvae (Korneyev, 2000), but no scientific information regarding the plant feeding habits of Phascini larvae are available. Tribe Acanthonevrini appears to be more interesting in terms of host infestation range. Several genera belonging to Acanthonevrini are known to exploit bamboo in various stages and conditions (shoots in progressed decay, semiaquatic breeding in internodes of shoots or dead culms) [reviewed in (Dohm et al., 2014)]. Acanthonevrini also harbour species breeding in fruits and dead wood. For example, *Dirioxa pornia* has been recently detected by quarantine authorities in Navel and Valencia oranges exported from Australia to New Zealand, USA and Japan, despite the fact that it is known to infest fruit which previously has suffered rind damage (Baker and Crisp, 2016). All other recorded host associations have been with *Bambusa*, such as the genera *Pseudacrotoxa* (reared from bamboo shoots) (Hardy, 1988), *Felderimyia* (upright or fallen bamboo culms), *Kambangania*, *Langatia* (upright or fallen bamboo culms), *Ptilona* (upright or fallen bamboo culms), *Rioxoptilona* and *Themara* (Dohm et al., 2014). For a detailed list of feeding sites for the above six Acanthonevrini subtribes, see Table 3 in Dohm et al. (2014). Although there is no host information available for Ectopomyia or Hexacinia considering their apparent relationship with the genus *Rioxa*, it is likely that they also 'breed' beneath tree bark (Chua, 2009). While larvae of some bamboo tephritids (including Gastrozonini) destroy thin bamboo shoots or branches, most act as secondary pests and do not cause substantial economic losses (Dohm et al., 2014) (species are within Appendices E, F and H).

Tephritinae

Tephritinae is the most specialised subfamily of Tephritidae (Korneyev, 2000). Species are widely distributed, and the majority of larvae develop in flowers commonly belonging to Asteraceae (Compositae). Some species are pests but most Tephritinae are used as biological control agents for various noxious weeds. This subfamily comprises of 11 tribes (Acrotaeniini, Cecidocharini, Dithrycini, Eutretini, Myopitini, Noeetini, Schistopterini, Tephrellini, Tephritini, Terelliini, Xyphosiini) and 214 genera. Also in this subfamily, there are some '*incertae sedis'* genera and species. Species of Myopitini tribe are well studied in terms of larval biology. For example, *Urophora* spp. attack the flower heads or the stem galls of Asteraceae plants and have been used for the biological control of the diffuse knapweed (*Centaura diffusa* Lam.). Tribe Tephrellini includes species that infest plants of the families Acanthaceae, Lamiaceae and Verbenaceae (Hancock, 1991). Some species of Tephrellini are found in seed capsules or induce galls on their hosts and a few have been recorded as pests (White and Elson-Harris, 1992). For example, larvae of *Aciura coryli* develop in the inflorescence of the Alibotush tea (*Sideritis scardica*) in Bulgaria. Generally speaking, the hosts of main concern in this subfamily are some ornamental cultivated plants such as *Dahlia*, *Echinops* and *Solidago* and some species of *Helianthus*, including the sunflower, *Helianthus annuus,* and the Jerusalem artichoke, *H. tuberosus* (Appendix J).

Trypetinae

The subfamily Trypetinae includes eight tribes: Adramini (23 genera), Callistomyini (6 genera), Carpomyini (12 genera), Rivelliomimini (3 genera), Toxotrypanini (3 genera), Trypetini (51 genera), Xarnutini (2 genera) and Zaceratini (2 genera). Additionally, 11 genera and some species are not included in any of the above tribes. The *incertae sedis* genera are *Breviculala, Esacidia, Lalokia, Malaisella, Monacidia, Ochrobapha, Platyparea, Poecilothea, Pycnella, Taomyia* and *Tarphobregma*. Most species with known biology within Trypetinae develop as larvae in fruit, some of them are leaf or stem miners and probably species with unknown biology fit one of these categories, as well (White and Elson-Harris, 1992) (Table 6, Annex I). Larvae of the genus *Trypeta* and a few other genera of the tribe Trypetini are known to develop in leaves of Asteraceae (leaf-miners) and some of them are pests (e.g. *Strauzia longipennis* is a pest of *Helianthus annuus*). Genera of major economic importance, such as *Rhagoletis, Anastrepha* and *Toxotrypana*, are included in this subfamily (Appendix J).

Dacinae

The subfamily Dacinae, similar to Trypetinae, includes species that infest a wide range of fruits. Dacinae comprises of three tribes (Ceratidini, Dacini and Gastrozonini) and 41 genera. Representatives of this subfamily originate from the Palaearctic region, although some species invaded other geographic regions as well (White and Elson-Harris, 1992). Similar to several genera of Acanthonevrini (Phytalmiinae), some Gastrozonini genera (*Acroceratitis, Acrotaeniosola, Anoplomus, Carpophthorella, Chaetellipsis, Cyrtostola, Enicoptera, Gastrozona, Ichneumonopsis, Paraxarnuta, Phaeospilodes, Pseudocrotoxa, Taeniostola* and *Xanthorrachis*) infest or can be reared in bamboos (*Bambusa, Dendrocalamus, Phyllostachys*) (White and Elson-Harris, 1992; Dohm et al., 2014). As mentioned earlier, the bamboo feeders like Gastrozonini and Phytalmiinae act as secondary pests and do not cause substantial economic losses as they infest cut shoots and not living tissues. The only exception is the species *Ichneumonopsis burmensis* which has been recorded in the pith of living bamboo shoots of *Melocalamus compactiflorus*. In the tribe Ceratidini, there are some species of major economic importance belonging to the genera *Ceratitis, Neoceratitis* and *Trirhithrum*. All the included genera of the tribe Dacini have at least one species of economic importance. Moreover, genera of major economic importance and a wide range of host fruits, such as *Ceratitis, Bactrocera, Dacus* and *Zeugodacus*, are included in this subfamily (Appendix J).

3.1.3. Intraspecific diversity

The intraspecific diversity is described in Section 3.1.1. There are no intraspecific diversity issues that allow different conclusions regarding the categorisation for any species group.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes. A variety of trapping systems and lures are available to capture adult flies (Australia PH, 2011). The detection of infested fruit is possible. In many cases fruit infested with eggs or larvae have symptoms of oviposition stings on the surface, e.g. discolouration and a slight depression in the fruit surface.

Distinct morphological keys and molecular identification tools are available to identify species.

Detection

In most cases, oviposition stings by Tephritidae fruit flies are usually visible and easily detected on fruits, although detection and recognition of oviposition stings vary greatly depending on the type of fruit. For example, it is easier to detect the oviposition stings in pale, smooth-skinned fruit such as apples than in softer fruit such as peaches and figs. In mature citrus, the infested fruits may develop a small brown depressed spot around the oviposition site, while on green citrus fruit, the skin changes its colour prematurely around the oviposition site. Infested fruits may prematurely drop, become deformed or rotten (because of larvae tunnelling and secondary infections) (Australia PH, 2011).

At low population densities, detection of infested fruits in the field is very laborious and challenging. Likewise, detection of a small proportion of infested fruits in packing and storage houses, as well as in cargo shipments, requires rigorous sampling and can be extremely difficult (Yahia et al., 2019).

Because of the above issues in detecting larvae in infested fruits, traps have been extensively used to detect adults. Adult trapping is crucial in identifying infestations, detecting low population densities, controlling detected populations and establishing guidelines for international transport of agricultural commodities (Shelly et al., 2014). Methods to estimate low density of fruit flies can be found in ISPM 30 (FAO, 2008). There is a long history of efforts to develop trapping systems for fruit flies, such as development of trapping devices, attractants/lures and killing/retentions systems. An efficient trapping strategy includes selection of the best trapping system, adoption of a specific trapping grid, density of trapping devices, adjustment of service intervals and lately spatial and temporal patterns of the landscape. There are many different types of traps that can be used for fruit flies. Most of them are designed and constructed to lure flies into a container with an attractant, kill them with an insecticide or drown them in a liquid and retain the dead flies in the trap body (Australia PH, 2011; http://fruitflyidentification.org.au/). Attracting and catching adults on sticky panels or in traps (e.g. delta traps) is also extensively used.

Adult fruit flies are lured using food attractants, pheromones and parapheromones, host odours, as well as visual stimuli. Sex pheromones and male lures have been explored as trap baits, in fruit fly detection efforts, for the major species of *Anastrepha*, *Bactrocera*, *Ceratitis*, *Dacus*, *Rhagoletis* and *Toxotrypana*. Compared to food-based baits relatively little research has been done in developing pheromonal baits (Shelly et al., 2014). This is due to inconsistency in the results of studies testing the effects of pheromone-based trapping (using live males or male pheromones), as well as to the chemical complexity of pheromones and the unknown levels of sexual communication. An exception is the use of sex pheromone to trap olive fruit flies (*Bactrocera oleae*), a species widespread in all olive cultivating areas of Europe. On the other hand, male lures (such as methyl eugenol – ME, cue-lure/raspberry ketone – CL/RK, trimedlure – TML) have been proven extremely effective and useful trap baits. For several species, male lures are strong attractants, most of them having simple chemical structure that allow a rather cheap production (Shelly et al., 2014). Table 2 gives an outline of trapping devices, and lures used for major fruit fly genera.

Table 2: Commonly used trapping devices, and lures for trapping major fruit fly genera. Information used was based on FAO/IAEA 2018 and Shelly et al. (2014)

Genus	Trapping devices	Retention/ killing	Attractant
Anastrepha	Multilure trap (with 2C and 3C attractants for female-biased captures, McPhail type trap	Drowning	Food-based lures, Ammonium acetate + Putrescine, Protein attractant
Bactrocera	Multilure trap (with 2C and 3C attractants for female-biased captures, ChamP trap, Yellow panel trap, Jackson trap (with TML for male capture), Steiner trap (with TML for male capture), Tephri trap (with 2C and 3C attractants for female-biased captures), Lynfield trap (with TML for male capture), McPhail type trap	Drowning, Sticking on panel	Cue-lure/raspberry ketone, Methyl eugenol, Ammonium bicarbonate + Spiroketal, Protein attractant, Ammonium acetate, Ammonium acetate + Putrescine + Trimethylamine, Zingerone

Genus	Trapping devices	Retention/ killing	Attractant
Dacus, Zeugodacus	Multilure trap (with 2C and 3C attractants for female-biased captures, McPhail type trap, ChamP trap, Easy trap (with 2C and 3C attractants for female-biased captures), Jackson trap (with TML for male capture), Lynfield trap (with TML for male capture), Maghreb-Med or Morocco trap, Steiner trap (with TML for male capture), Tephri trap (with 2C and 3C attractants for female-biased captures), Yellow panel trap	Drowning, Sticking on panel	Ammonium acetate + Putrescine + Trimethylamine, Protein attractant, Cue-lure
Ceratitis	Jackson trap (with TML for male capture), Multilure trap (with 2C and 3C attractants for female-biased captures, McPhail type trap, Open Bottom Dry Trap (with 2C and 3C attractants for female-biased captures), Steiner trap (with TML for male capture), Sensus trap (with CE for male captures and with 3C for female-biased captures), Easy trap (with 2C and 3C attractants for female-biased captures), Lynfield trap (with TML for male capture), Tephri trap (with 2C and 3C attractants for female-biased captures), Modified funnel trap	Drowning, Sticking on panel	α-copaene, Trimedlure, Capilure, Ammonium acetate + Putrescine + Trimethylamine, Ammonium acetate + Trimethylamine, Protein attractant
Rhagoletis	Rebell trap, Red sphere trap, Fluorescent yellow sticky trap, Yellow panel trap, McPhail type trap	Sticking on panel, drowning	Butyl hexanoate, Ammonium salt, Ammonium acetate, Ammonium bicarbonate

Identification

Both morphological keys and molecular techniques are available for the identification of fruit flies. Morphological identification is the most widely used method for Tephritidae adults.

Adults in the family Tephritidae have brightly coloured and/or patterned bodies and wings that are not metallic (except *Tachinisca cyaneiventris*, which has a purplish abdomen and several species occurring in Madagascar). The size of the adults varies in length from 2 mm (e.g. *Urophora quadrifasciata*) to 35 mm (e.g. *Toxotrypana*). Particular identification features include the shape of the subcosta (bent sharply forward subapically and usually weaker or fold-like beyond the bend) and the presence of an inclinate frontal setae. In most species, the basal cubital cell has a distal acute projection (Foote, 1993; Norrbom et al., 2010; Savaris et al., 2016). The wings of most species are pictured with yellow, brown or black stripes or spots, or a combination of both, in characteristic positions or with light or hyaline spots in a darker field (Christenson and Foote, 1960).

Online keys that include high resolution images are available (https://www.delta-intkey.com/anatox/index.htm, https://fruitflyidentification.org.au/about/ https://fruitflykeys.africamuseum.be/en/browse.html and other identification keys (e.g. White and Elson-Harris, 1992; White, 2006; EPPO, 2019). There are morphological keys (online or in print) for most of the known and described species of the Tephritidae family (e.g. Kovac et al., 2006; White, 2006; Hancock, 2014a,b, 2016; Korneyev et al., 2017). 'Molecular techniques are best used to support or complement morphological identification. They can be used to identify early larval stages (which are hard to identify reliably on morphological features) and eggs. They can also be used for incomplete adults that may be missing specific anatomical features required for morphological keys, or specimens that have not fully developed their features (especially colour patterns). It should be recognised, however, that the success of a molecular diagnosis can be impacted by factors such as life stage, specimen quality or any delays in processing. As a result, the suitability of each method has been identified' (Australia PH, 2011).

Most Tephritidae species, especially those referred to as pests, can be identified accurately and quickly by microscopic examination of the adult stage. However, some species mainly belonging to species complexes (see paragraph 3.1.3) require the use of molecular techniques (such as PCR, DNA barcoding and Allozyme Electrophoresis) for their correct identification.

Accurate identification is important for specimens intercepted during import inspections and for those detected, for example, in traps, but which cannot be attributed to specific imported commodities. Out of 323 interceptions of Tephritidae recorded in the 2017 Europhyt annual report, less than 60% were identified to species level (Europhyt, 2017). Intercepted specimens are usually larvae feeding on fruit and the larvae are (very) difficult to identify to species level. Molecular techniques may give an indication which species it is but may be unreliable depending on the number of species for which DNA barcodes are available. Recent efforts to develop larval morphological keys may increase the level of taxonomic resolution reported for intercepted immature stages of Tephritidae. Therefore, molecular tools are expected to contribute much more to reduce the proportion of interceptions that are not identified to species in future. In the meantime, the host and country or origin of the interception can provide clues and useful information for species diagnoses.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Species of the Tephritidae family have a worldwide distribution. They can be found in all biogeographic regions except in extreme desert and polar areas, where their hosts are scarce or absent (Savaris et al., 2016). Concerning the genera of economic importance, they originate from different biogeographic regions and species distributions depend on their ability to invade and adapt to different conditions (Figure 2). The geographic distribution of tephritid species is provided in Appendices (E–J).

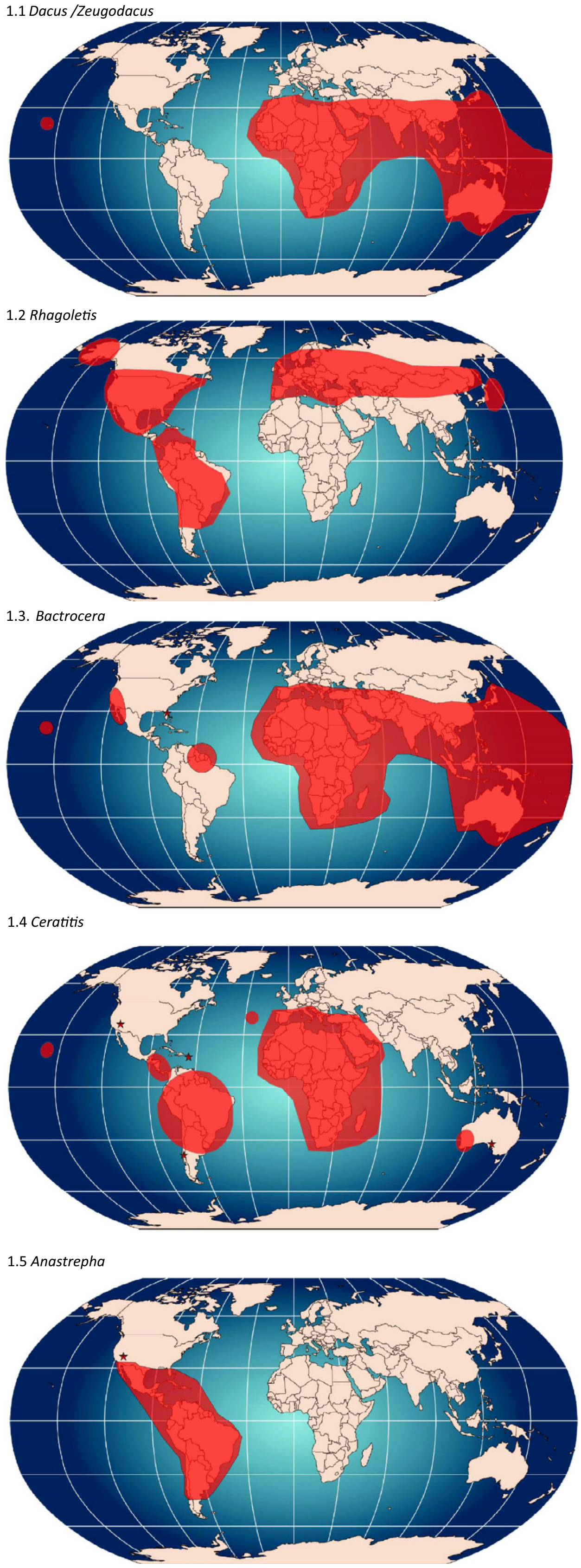

Figure 2: Global distribution maps for major fruit fly genera of economic importance. (Note: It is important to realise that the red areas are a composite of the distribution of individual species. The maps do not suggest that all species of each particular genus occur over the entire area shaded red)

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?
By definition, non-EU Tephritidae are not present in the EU, or if present are not widely distributed and are under official control.

Findings of tephritid species that are not widely distributed and are under official control includes *Bactrocera dorsalis* (an extremely polyphagous species with many wild and cultivated hosts). It originates from the oriental region and was recently detected in Italy (Campania) and Austria, phytosanitary measures were taken against it (Egartner and Lethmayer, 2017; Nugnes et al., 2018). The EPPO Global Database (accessed 20 October) reports its status in Italy as 'transient, under eradication'. Finds of *B. dorsalis* in Austria (Vienna) were the result of repeated introductions rather than outbreaks. *B. dorsalis* is not present in Austria. *Strauzia longipennis* (a pest of sunflowers) is native to North America and was detected for the first time in 2010 in Berlin and later confirmed as established in Germany (Everatt et al., 2015) only. Also, *Bactrocera zonata* has records of several detections in Austria (Egartner and Lethmayer, 2017).

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

The group Non-European Tephritidae are listed in Council Directive 2000/29/EC with 23 species provided as examples of members of the group. Details are presented in Table 3.

Table 3: Non-EU Tephritidae in Council Directive 2000/29/EC

Annex I Part A	**Harmful organisms whose introduction into, and spread within, all member states shall be banned**
Section I	Harmful organisms not known to occur in any part of the community and relevant for the entire community
(a)	Insects, mites and nematodes, at all stages of their development
	Species
25.	Tephritidae (non-European) such as: (a) *Anastrepha fraterculus* (Wiedemann) (b) *Anastrepha ludens* (Loew) (c) *Anastrepha obliqua* Macquart (d) *Anastrepha suspensa* (Loew) (e) *Dacus ciliatus* Loew (f) *Dacus curcurbitae* Coquillet (g) *Dacus dorsalis* Hendel (h) *Dacus tryoni* (Froggatt) (i) *Dacus tsuneonis* Miyake (j) *Dacus zonatus* Saund. (k) *Epochra canadensis* (Loew) (l) *Pardalaspis cyanescens* Bezzi (m) *Pardalaspis quinaria* Bezzi (n) *Pterandrus rosa* (Karsch) (o) *Rhacochlaena japonica* Ito (p) *Rhagoletis cingulata* (Loew) (q) *Rhagoletis completa* Cresson (r) *Rhagoletis fausta* (Osten-Sacken) (s) *Rhagoletis indifferens* Curran (t) *Rhagoletis mendax* Curran (u) *Rhagoletis pomonella* Walsh (v) *Rhagoletis ribicola* Doane (w) *Rhagoletis suavis* (Loew)

Recall that as described in the interpretation of Terms of Reference, the phrase 'non-European' is understood to mean 'non-EU' and refers to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

Note that taxonomic revisions now mean that some of the names listed in Table 3 are junior synonyms (Table 4).

Table 4: Tephritidae whose binomial names have changed resulting in new synonymy, since being listed in 2000/29 EC, and their currently recognised binomial names

Name in Annex 1/A1 of 2000/29 EC (junior synonym)	Current name (senior synonym)
(f) *Dacus curcurbitae* Coquillet	*Zeugodacus cucurbitae* (Coquillett)
(g) *Dacus dorsalis* Hendel	*Bactrocera dorsalis* (Hendel)
(h) *Dacus tryoni* (Froggatt)	*Bactrocera tryoni* (Froggatt)
(i) *Dacus tsuneonis* Miyake	*Bactrocera tsuneonis* (Miyake)
(j) *Dacus zonatus* Saund.	*Bactrocera zonata* (Saunders)
(k) *Epochra canadensis* (Loew)	*Euphranta canadensis* (Loew)
(l) *Pardalaspis cyanescens* Bezzi	*Neoceratitis cyanescens* (Bezzi)
(m) *Pardalaspis quinaria* Bezzi	*Ceratitis quinaria* (Bezzi)
(n) *Pterandrus rosa* (Karsch)	*Ceratitis rosa* Karsch
(o) *Rhacochlaena japonica* Ito	*Euphranta japonica* (Ito)

3.3.2. Legislation addressing the hosts of non-EU Tephritidae

Regulated hosts and commodities which could provide a pathway for entry into the EU appear in Annexes IV and V of Council Directive 2000/29/EC. Table 5 provides details of *Citrus* requirements in Annex IV.

Table 5: Regulated hosts and commodities that may involve non-EU Tephritidae in Annex IV of Council Directive 2000/29/EC

Annex IV Part A	**Special requirements which must be laid down by all member states for the introduction and movement of plants, plant products and other objects into and within all member states**	
Section I	**Plants, plant products and other objects originating outside the community**	
	Plants, plant products and other objects	**Special requirements**
16.5	Fruits of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, *Mangifera* L. and *Prunus* L.	Without prejudice to the provisions applicable to the fruits in Annex IV(A)(I)(16.1.), (16.2.), (16.3.), (16.4.), and (16.6.) official statement that: (a) the fruits originate in a country recognised as free from Tephritidae (non-European), to which those fruits are known to be susceptible, in accordance with relevant International Standards for Phytosanitary Measures, provided that this freedom status has been communicated in advance in writing by the national plant protection organisation of the third country concerned to the Commission, or (b) the fruits originate in an area established by the national plant protection organisation in the country of origin as being free from Tephritidae (non-European), to which those fruits are known to be susceptible, in accordance with relevant International Standards for Phytosanitary Measures, which is mentioned on the certificates referred to in Article 13(1)(ii) under the rubric 'Additional declaration', provided that this freedom status has been communicated in advance in writing by the national plant protection organisation of the third country concerned to the Commission, or

		(c) no signs of Tephritidae (non-European), to which those fruits are known to be susceptible, have been observed at the place of production and in its immediate vicinity since the beginning of the last complete cycle of vegetation, on official inspections carried out at least monthly during the three months prior to harvesting, and none of the fruits harvested at the place of production has shown, in appropriate official examination, signs of the relevant organism and information on traceability is included in the certificates referred to in Article 13(1)(ii), or (d) have been subjected to an effective treatment to ensure freedom from Tephritidae (non- European), to which those fruits are known to be susceptible, and the treatment data should be indicated on the certificates referred to in Article 13 (1)(ii), provided that the treatment method has been communicated in advance in writing by the national plant protection organisation of the third country concerned to the Commission

Collectively, Tephritidae are highly polyphagous and some of the hosts are specifically regulated within Annex V of 2000/29 EC, whereby they require inspection. However, given the large number of hosts on which Tephritidae feed, the large amount of relevant legislation that can be extracted from Annex V is not reported here, instead only a few examples are provided in Table 6.

Table 6: Examples of regulated hosts and commodities that may involve non-EU Tephritidae in Annex V of Council Directive 2000/29/EC

Annex V	**Plants, plant products and other objects which must be subject to a plant health inspection [...] in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community**
Part A	Plants, plant products and other objects originating in the community
	–
Part B	Plants, plant products and other objects originating in territories, other than those territories referred to in Part A
Section I	Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community
	Fruits of: — *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., *Microcitrus* Swingle, *Naringi* Adans., *Swinglea* Merr. and their hybrids, *Momordica* L., *Solanum lycopersicum* L., and *Solanaceae,* *Actinidia* Lindl., *Annona* L., *Carica papaya* L., *Cydonia* Mill., *Diospyros* L., *Fragaria* L., *Malus* Mill., *Mangifera* L., *Passiflora* L., *Persea americana* Mill., *Prunus* L., *Psidium* L., *Pyrus* L., *Ribes* L., *Rubus* L., *Syzygium* Gaertn., *Vaccinium* L. and *Vitis* L. — *Punica granatum* L. originating in countries of the African continent, Cape Verde, Saint Helena, Madagascar, La Reunion, Mauritius and Israel.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

Tephritidae includes hundreds of phytophagous species. Some are specialised and some are more generalist; there are saprophagous and saproxylophagous species, zoophages and gall inducers. Aluja and Norrbom (1999) provide a review. The larvae of many Tephritidae species develop in the seed-bearing organs of plants and around 35% of the species may attack commercial fruits. Additionally, larvae of approximately 40% of species develop in the flowers of the family Asteraceae (Compositae) with several species regarded as biological control agents. The feeding habits of larvae of the remaining Tephritidae species are associated with flowers of other plant families, leaves (leaf-miners), stems (stem-miners), roots, non-phytophagous insects and decaying material (White and Elson-Harris, 1992). Concerning the host range of plant feeding Tephritidae and especially fruit feeders, they can be divided into four categories (Aluja and Norrbom, 1999):

- Polyphagous
- Oligophagous
- Stenophagous
- Monophagus

Polyphagous fruit flies infest a broad range of host plants belonging to unrelated groups (e.g. several plant families). Among the most known polyphagous species of the family that do not occur in the EU are *Anastrepha ludens* and *Ceratitis rosa.*

Oligophagous fruit flies infest a limited range of closely related host plant species (e.g. all hosts are members of a single family). Most species of the subfamily Tephritinae are associated with hosts of the family Asteraceae and are characterised as oligophagous.

Stenophagous species infest a very narrow range of closely related host plant species (e.g. all hosts are members of a single genus). Such stenophagous species include *Rhagoletis mendax, R. indifferens.*

Monophagous species can breed in and feed on only one host plant species. For example, *Anastrepha spatulata* only infests *Schoepfia schreberi*, a wild plant of the family Olacaceae.

The immatures of more than half of the species in the Americas develop in flowers, seeds, stems or roots of plant species of the family Asteraceae (Foote, 1964, 1993; Prado et al., 2002; Norrbom and Prado, 2006; Norrbom et al., 2010; Savaris et al., 2016).

When narrowing down species to focus on in this categorisation, geographic distribution and climate were considered prior to hosts (Figure 1). The host plants of non-EU Tephritidae that occur in countries with Koppen–Geiger climates that also occur in the EU are shown in Appendices H–J.

3.4.2. Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways.
Yes, species of non-EU Tephritidae have been intercepted in the EU on many occasions since records

Most interceptions occur on commercial imports of fruits. Other pathways include passengers accidentally bringing infested plant material in personal baggage when travelling to the EU and pupae in soil (e.g. soil of host potted plants) from countries where the pest occurs.

Between May 1995 and September 2019, there were over 4,300 records of interception of non-EU Tephritidae in the Europhyt database. Over 50 plant genera have been found infested with Tephritidae although over 50% of all interceptions have been on two plant genera, *Mangifera* and *Capsicum* (Appendix B).

• Fruits	*Citrus*, *Fortunella* and *Poncirus* have specific requirements in relation to non-EU Tephritidae (2000/29 EC, Annex IV, 16.5) A plant health inspection is required for fruits of *Citrus, Fortunella, Poncirus, Microcitrus, Naringi, Swinglea* and their hybrids*; Momordica, Solanum lycopersicum*, and *Solanum melongena, Annona, Cydonia, Diospyros, Malus, Mangifera, Passiflora, Prunus, Psidium, Pyrus, Ribes, Syzygium* and *Vaccinium; Capsicum* and *Punica granatum.* Some inspection requirements depend on the origin of the fruit (Annex V requirements). The requirements are not specific to non-EU Tephritidae but are in place to protect against harmful organisms in general
• Plants for planting	While some host plants for planting are prohibited, e.g. *Citrus* and *Vitis* (2000/29 EC, Annex III), other host plants for planting are allowed into the EU with a phytosanitary certificate

During the period, May 1995–September 2019, Tephritidae were intercepted in the EU from 66 countries. Over 55% of Tephritidae interceptions were from seven countries; Thailand (19.7%), Pakistan (9.5%), India (6.8%), Vietnam (5.1%), the Dominican Republic (5.0%), Mali (4.8%) and Cameroon (4.8%) (Appendix C).

Data in Europhyt record the type of commodity that a pest is intercepted on using codes. Approximately 99.5% of non-EU Tephritidae were recorded in material classified as 140 (fruit and vegetables). However, the Europhyt data also indicate that approximately 0.5% of non-EU interceptions were recorded on other commodity types as listed in Table 7.

Table 7: Commodity types and hosts on which non-EU Tephritidae are recorded as being intercepted on in the EUROPHYT database, May–September 2019. Fruits and vegetables (140) are excluded

Code	Commodity descriptor	Host genus/species
020	Intended for planting: not yet planted	*Flacourtia, Olea europaea, Phalaenopsis*
021	Intended for planting: cuttings, budwood	*Mangifera indica*
026	Intended for planting, underground organs	*Mangifera indica*
120	Cut flowers and branches with foliage	*Averrhoa, Dendrobium, Eryngium, Momordica*
122	Leaves	*Mangifera indica*
130	Cut trees retaining foliage	*Annona squamosal*
150	Stored products capable of germinating	*Capsicum frutescens, M. indica, Voacanga africana*
220	Wood and bark	*Quercus alba*
102	Other living plants	*Mangifera indica, Psidium guajava*
103	Other plant products	*Annona squamosa, Mangifera indica*

While it is interesting to analyse interception data, there are limits as to the interpretation of such analysis. This is partly because the number of consignments imported into the EU potentially carrying non-EU Tephritidae and the total number of consignments examined is not centrally compiled or linked with interception data, preventing a more meaningful analysis. Europhyt data also hold reports of *C. capitata* 'interceptions' although *C. capitata* is not a non-EU tephritid. Reports of interception should therefore be interpreted with caution (MacLeod, 2015).

A summary of outbreaks of non-EU Tephritidae extracted from the Europhyt Oubreaks database is shown in Table 8.

Table 8: Outbreaks of Non-EU Tephritidae

When confirmed	Member State	Tephritidae	Status when notified
October 2013	Germany	*Rhagoletis suavis*	Present, only in certain areas (Kleinmachnow, Brandenburg)
September 2016	Germany	*Rhagoletis suavis*	Present, only in some parts (Berlin)
September 2017	Czech Republic	*Rhagoletis batava*	Present only in some parts of the country
November 2017	UK	*Rhagoletis* sp.	Transient, actionable, under surveillance
February 2018	Germany	*Strauzia longipennis*	Present only in some parts of the country
November 2018	Italy	*Bactrocera dorsalis*	Present in specific parts of the Member State
November 2019	France	*Bactrocera dorsalis*	Male found on a farm with a few fruit trees in Montpellier; no outbreak reported but surveillance intensified

Isolated findings of *B. dorsalis* are reported in Europhyt for France and Italy in 2019.

3.4.3. Establishment

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

Yes, many plant feeding non-EU Tephritidae occur in countries that also contain some climate types that also occur in the EU and hosts are also present.

For the purposes of this large group categorisation most of the species reaching Box 4 of the decision tree go into Box 5 (Figure 1), indicating some degree of climate matching. Around one-third of those with a climate match have hosts known to occur in the EU.

The distribution and abundance of an organism that cannot control or regulate its body temperature are largely determined by host distribution (Section 3.4.3.1) and climate (Section 3.4.3.2). Comparing climates from the known distribution of an organism with climates in the risk assessment area can inform judgements regarding the potential distribution and abundance of an organism in the risk assessment area (Sutherst and Maywald, 1985; Ehrlén and Morris, 2015). The global Köppen–Geiger climate zone categories, and subsequent modifications made by Trewartha, describe terrestrial climate in terms of factors such as average minimum winter temperatures and summer maxima, amount of precipitation and seasonality (rainfall pattern) (Trewartha and Horn, 1980; Kottek et al., 2006) and can inform judgements of aspects of establishment during pest categorisation (MacLeod and Korycinska, 2019).

3.4.3.1. EU distribution of main host plants

Many of the hosts are cultivated commercially or as small field crops and in market-gardens and home-gardens throughout the Mediterranean, central and northern Europe (de Rougemont, 1989). Here, we provide summary statistics on the area of EU production of major fruit crops potentially at risk (Table 9). However, it must be noted that ornamentals and wild plants can also be hosts but no statistics are provided.

Table 9: Area of major fruits across the EU 2014–2018 (cultivation/harvested/production) (1,000 ha)

Code[(a)]	Fruit	2014	2015	2016	2017	2018
O1000	Olives	:	5,033.40	5,039.24	5,050.53	:
W1000	Grapes	:	3,167.97	3,137.83	3,142.09	:
F1110	Apples	524.50	538.50	523.48	522.15	523.03
T1000	Oranges	286.84	286.02	278.67	272.42	271.68
F1240	Cherries	:	173.76	173.15	174.07	:
T2000	Small citrus	163.34	161.92	160.60	149.99	:
F1250	Plums	157.36	154.79	153.49	154.48	:
F1210	Peaches	:	157.81	156.39	154.06	151.29
F3900	Other berries	:	:	144.83	151.61	:
F2000	Tropical fruit	:	135.18	137.09	138.99	:
F1120	Pears	117.01	117.80	117.26	116.34	116.41
S0000	Strawberries	109.48	107.57	108.78	108.46	:
F1230	Apricot	:	69.50	72.52	72.23	:
T3000	Lemons & acid limes	65.90	66.47	73.21	75.10	:
F1220	Nectarine	72.06	70.94	68.46	67.69	64.60
T2900	Other small citrus	:	:	42.47	33.19	:

: Not available.

Data for the area of fruit crops in individual EU Member States are provided in Appendix D.

3.4.3.2. Climatic conditions affecting establishment

Collectively tephritids cover an almost world-wide distribution and contain species that exist and thrive in tropical and subtropical climates as well as species in temperate and cooler environments (see Figure 2).

The Köppen–Geiger climate types in the countries where plant feeding non-EU Tephritidae occur were compared to the climate types in the EU. Countries without any EU climate types are listed in Appendix K. Species whose distribution is restricted to countries without any EU climate types were excluded from further categorisation. Such an approach was necessary when dealing with so many species in a single categorisation. However, the PLH Panel was not able to find the detailed pest distributions of all remaining species within all countries. Hence we do not know whether a species in a country that shares an EU climate zone actually survives in that climate zone in that country. For species that require warm and humid environments, the microclimate around irrigated hosts in the warmer parts of the EU could perhaps positively affect likelihood of establishment in the EU.

Regarding establishment, two categories of major non-EU species can be formed. The first includes species that are of temperate origin that can become established in central and northern EU territories and highland areas of the coastal EU countries. The most important genus of the first category is *Rhagoletis* that includes mostly North American species that pose a threat to pome and stone fruit industries in the EU. The apple maggot fly, *Rhagoletis pomonella*, is on the top of invasive species of this genus for EU. A recent pest report (EFSA, 2019) assessing the importance of this pest for EU reveals that most parts of southern and central Europe are highly favourable for the establishment of *Rhagoletis pomonella*. Parts of Scandinavia and northern edges of UK are considered as not suitable for a permanent residence of this species.

The second category includes species of tropical origin that pose a potential threat for crops growing in warmer and frost-free areas of the EU, mainly along the Mediterranean coast. Species of the genera *Anastrepha, Bactrocera, Ceratitis, Dacus and Zeugodacus* are among the most important in this category. EFSA has recently published reports regarding the importance of the Mexican fruit fly *Anastrepha ludens,* the oriental fruit fly *Bactrocera dorsalis* and the peach fruit fly *Bactrocera zonata* (EFSA, 2019) that include predictions of the potential areas of establishment for these species. For *A. ludens, B. dorsalis and B. zonata* the area of potential distribution is limited to central and southern Spain, central and southern Portugal, Madeira, the Azores, southern Italy, Malta, southern Greece and Cyprus. Apparently, the above estimates are limited to the scenarios developed for the specific assessments; however, they provide a good framework for understanding the potential distribution of these species in the EU. In addition, Tanga et al. (2018) have recently published a thorough evaluation of the potential spread of *Ceratitis rosa* and *Ceratitis quilicii* demonstrating that *C. quilicii* has a broader distinct potential range of suitability in the southern regions of EU compared to *C. rosa.* According to this study, the risk of *C. rosa* establishment in EU territories is low to minimal.

3.4.4. Spread

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

Yes. Tephritidae are free living organisms with adults capable of flight. Larvae could be spread via infested hosts, especially fruit.

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

No. Spread would not mainly be via plants for planting.

Most fruit flies are strong and vigorous flyers. Long distances may be covered within a few days by especially active species. The weather strongly influences fruit fly movement. The influence of air movement on fruit fly flight does not appear to be an obligatory one, at least when low to moderate velocities are involved. Fruit flies are generally inactive at night and during periods of moderate to heavy rainfall. Movement and orientation in response to the fruiting or ripening of favourable hosts is a well-known common attribute of species which have been studied (Christenson and Foote, 1960).

3.5. Impacts

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

Yes, For example the introduction of non-EU Tephrtidae species attacking cultivated fruit would have economic impacts on the agricultural production of hosts in EU resulting from direct damage causing yield and/or quality losses and potential loss of export markets. Pests of wild plants could have environmental impacts. Increased use of pesticides to control the invasive flies could also lead to additional environmental impacts.

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?[5]

Yes. The occurrence of fruit fly species on host plants for planting could have an economic impact on the intended use of those plants. Infested plants would be introducing a potentially serious pest that could affect future yield and quality of other hosts.

Within Diptera, Tephritidae is the family of utmost agricultural relevance. Most species are phytophagous and a number of them are of significant economic importance, negatively affecting agricultural production and trade of fruits and vegetables worldwide (Uchôa, 2012; Papadopoulos, 2014). The list of tephritids of economic importance includes many key pests of significant fruit crops for which strict quarantine regulations are imposed by many countries (Aluja and Mangan, 2008; Papadopoulos et al., 2013; Savaris et al., 2016).

Without control, direct damage by fruit fly species has been reported to range from zero to 80% but can reach 100%, depending on the fruit or vegetable variety, location and season (Dhillon et al., 2005; Tange et al., 2018). In studies in Africa, average losses in mango due to tephritid damage varied

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

from 0.34 t ha^{-1} to 6.5 t ha^{-1} depending on cultivar; overall losses of approximately 17% were reported in early April and had exceeded 70% by mid-June with damage mostly caused by *Bactrocera dorsalis* and *Ceratitis cosyra* (Vayssieres et al., 2008). *Zeugodacus cucurbitae* (= *Bactrocera cucurbitae*) can cause large losses in cucurbits; Sapkota et al. (2010) reported *Z. cucurbitae* caused 26% of fruits to be damaged or dropped prematurely and 14% fruits were damaged during the harvesting stage. Allwood and Leblanc (1997) report *Bactrocera frauenfeldi* causing 4% yield loss in oranges and 17% loss in tangerines; they also reported *Bactrocera passiflorae* causing 20–25% yield loss in mango.

Fruit Production in EU provides an income for more than 1.5 million holdings, with more than €21 billion of aggregate value (De Cicco, 2019). Fruit flies already pose a significant burden on the EU fruit and vegetable production industry because of both direct effects and quarantine regulations that impede fruit trading. For example, interceptions of medfly infested Spanish clementines in the USA led to a drop of exports to the USA from 77,000t (2001) to 45,000t (2002) with an estimated loss of €80–107 million for the fruit exporting industry. If more fruit fly species establish in the EU, impacts on a wide range of sectors could be anticipated. There is an extensive literature that provide estimates of direct and indirect damage that fruit flies cause in many non-EU areas. For example, fruit flies threatened the approximately one billion (AUS$) fruit industry of Australia, and the cost associated with an uncontrolled infestation of fruit flies was estimated at AUS$100 million (White and Elson-Harris, 1992). In a single area of South Africa (West Cape), crop losses and control cost because of fruit flies exceeded US$ 7.5 million per annum (Barnes, 2016). Annual economic losses in Brazil may reach US$242 million because of fruit fly activity (Oliveira et al., 2014). 'Invasive fruit flies have driven Hawaii's farmers, for decades, to almost weekly spraying insecticides to large areas to avoid losses or simply to abandon specific crops. Resulting economic losses exceeded US$ 300 million each year in lost market for locally grown procedure' (Vargas et al., 2016).

Incursion of invasive tephritid species into Australia, America and Oceania is estimated to result in losses of billions of dollars because of direct and indirect damage. This is because an invasion event by one of the major fruit fly species elicits intense eradication campaigns that apply quarantine regulation at local scale and extensive use of insecticide spraying. Eradication campaigns are expensive exercises. A single eradication campaign against *B. dorsalis* in 2015 in Florida (USA) is estimated to cost several million USD (Alvarez et al., 2016). Intense insecticide spraying even on residential areas, apart from the direct negative health and environmental effects, raised huge public protests in California in 1980s during the large-scale medfly eradication campaign. On average, a single eradication campaign against fruit flies is estimated to cost approximately US$32 million (Papadopoulos et al., 2013) and may reach up to US$100 million (Carey, 2010; 1980-81 in the San Francisco Bay Area). Four eradication campaigns against the melon fly, involving Sterile Insect Releases, conducted in the Okinawa prefecture of Japan from 1973 to 1992 reached a total cost of US$ 177.2 million (Ito et al., 2003). USDA-APHIS is estimated to have spent approximately US$63 million for fruit fly exclusion and detection in 2010 (Anonymous, 2011). Despite direct losses on fruits and vegetables as well as management efforts, establishment of invasive fruit flies is expected to have huge impact on fresh fruit and vegetable trading because of embargos, loss of markets and quarantine regulations, and subsequent job losses (Siebert and Cooper, 1995).

We assume that non EU-Tephritidae that are able to establish and have hosts that are cultivated or commercially grown in the EU, would have an impact. For most Tephritidae that fit this category impacts would primarily affect host fruits with yield and/or quality losses. Pests of ornamental plants are assumed to cause impact via reductions in quality.

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, measures described in 3.3 (e.g. pest free area, place of production freedom, pest free consignment, treatment of consignment) are measures currently used to reduce likelihood of entry.

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

Yes, pest free area, place of production freedom.

3.6.1. Identification of additional measures

Current phytosanitary measures seek freedom of non-EU Tephritidae at a variety of spatial scales, from a pest-free area to consignment freedom (see Section 3.3.2).

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 10.

Table 10: 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	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses. Generally, not suitable for very mobile pests. Nevertheless, we are aware of area-wide control programmes where some areas have been declared as Pest-Free Area (ex. Argentina), from where fruit can be exported to fruit fly-free markets. Could also be done for glasshouse/protected crops	Entry
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 included are: a) fumigation; b) spraying/dipping pesticides; c) surface disinfectants; d) process additives; e) protective compounds Treatments are an option already (see Section 3.3.2) but only for *Citrus, Poncirus* and *Fortunella*. Hence could extend to other hosts	Entry
Controlled atmosphere	Treatment of plants by storage in a modified atmosphere (including modified humidity, O_2, CO_2, temperature, pressure)	Entry
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 included are: autoclaving; steam; hot water; hot air; cold treatment. Could expand existing measures to other hosts where appropriate	Entry
Conditions of transport	Specific requirements for mode and timing of transport of commodities to prevent escape of the pest and/or contamination a) physical protection of consignment b) timing of transport/trade The physical protection of the consignment once treated is basic. Furthermore, export from temperate countries can be easier during the cold months, when fruit remains pest free (contrarily to what may happen in summer)	Entry

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/ establishment/ spread/impact)
Timing of planting and harvesting	The objective is to produce phenological asynchrony in pest/crop interactions by acting on or benefiting from specific cropping factors such as cultivars, climatic conditions, timing of the sowing or planting and level of maturity/age of the plant seasonal timing of planting and harvesting For temperate countries, production during the winter months (e.g. citrus) is mostly pest free	Entry
Chemical treatments on crops including reproductive material	For exporting countries, some chemical treatments on susceptible cultivars may be necessary	Entry
Biological control and behavioural manipulation	Other pest control techniques a) biological control b) sterile insect technique c) mating disruption d) mass trapping Most often these measures are used in combination in area-wide control programmes	Spread/ establishment

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 11.

Table 11: 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)
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) a) export certificate (import) b) plant passport (EU internal trade)	Entry (if phytosanitary certificate) Spread (if plant passport) Applied to wider range of hosts than is currently required by 2000/29 EC (EFSA PLH Panel recognises that Regulation 2016–2031 will change the current requirements in 2000/29 EC)
Surveillance	Probably already in place at entry points, but in case not appropriate traps should be in place to detect pest entry	Establishment/spread

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

- Polyphagous species feed on many host species.
- The adult females of the tephritid fruit flies (e.g. *Anastrepha* spp., *Bactrocera* spp. and *Rhagoletis* spp.) are able to lay their eggs inside the fruit tissue, puncturing the skin and fruit pulp with their aculeus (ovipositor). After oviposition, the wounds over the fruit surface become healed making detection difficult during inspection.
- Eggs can mature and hatch inside the host tissue. The newly emerged larvae are now sheltered from the external environment, making difficult any effort with pesticides to control them (Uchôa, 2012). For the same reason, sometimes infested fruit may be difficult to detect.

- Dispersal can be rapid and over reasonable distance; can sometimes be assisted by air currents
- Hosts are widely available throughout the EU.
- Insecticide resistance. Frequent use of insecticides against some species has driven the development of pesticide resistance (e.g. *B. dorsalis* in China (Jin et al., 2011) Vontas et al., 2011 provides a brief review of pesticide resistance in major species of Tephritidae).
- Pupae in the soil may be difficult to detect.

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

While plants for planting are generally not traded bearing fruit, the factors listed in Section 3.6.1.3 are valid as limiting the ability to prevent the presence of the pests on plants for planting.

Fruit trees with fruit may be infested and difficult to detect.

3.7. Uncertainty

The Tephritidae is a large insect family with over 5,000 species described. The biology of many of them is little studied, much of the literature simply describes morphological features of specimens. The host range and distribution for many species are not fully known. As such, the groupings of species into Appendices E–J would be subject to change as further information comes to light. Where a plant host is known for a particular species, it was sometimes uncertain as to whether the host occurred in the EU. Reports of impact are available for major pests of cultivated plants but the impact of Tephritidae on wild hosts is not reported so is much more uncertain.

4. Conclusions

The species listed in Table 12 satisfy the criteria that are within the remit of EFSA to assess for them to be regarded as potential Union quarantine pests. They do not meet the criteria of occurring in the EU nor plants for planting being the principal means of spread for them to be regarded as a potential Union regulated non-quarantine pests. Information regarding these species hosts and distribution is provided in Appendix J. *Rhagoletis psalida* is grouped into Appendix J but scrutiny regarding the plant part on which larvae feed reveals that it is the fruit (not tubers) of *Solanum tuberosum* that are affected. In general, it is not common for potato producers to maintain a potato crop in the field until fruiting. As such impacts are unlikely and this species fails to satisfy the criterion regarding consequences of establishment.

Table 12: Non-EU Tephritidae from Appendix J with the greatest potential to satisfy criteria to meet quarantine pest status

Acidiella kagoshimensis (Miyake)	*Dacus ciliatus* Loew
Acidoxantha bombacis de Meijere	*Dacus demmerezi* (Bezzi)
Acroceratitis distincta (Zia)	*Dacus frontalis* Becker
Adrama apicalis Shiraki	*Dacus langi* Curran
Adrama austeni Hendel	*Dacus limbipennis* Macquart
Adrama determinata (Walker)	*Dacus longicornis* (Wiedemann)
Adrama selecta Walker	*Dacus lounsburyii* Coquillett
Anastrepha antunesi Lima	*Dacus punctatifrons* Karsch
Anastrepha bahiensis Lima	*Dacus sphaeroidalis* (Bezzi)
Anastrepha bezzii Lima	*Dacus umbeluzinus* (Munro)
Anastrepha bistrigata Bezzi	*Dacus vertebratus* Bezzi
Anastrepha chiclayae Greene	*Dacus viator* Munro
Anastrepha consobrina (Loew)	*Dioxyna chilensis* (Macquart)
Anastrepha coronilli Carrejo & Gonzalez	*Dirioxa pornia* (Walker)
Anastrepha curitis Stone	*Euleia separata* (Becker)
Anastrepha dissimilis Stone	*Euphranta camelliae* (Ito)
Anastrepha distincta Greene	*Euphranta canadensis* (Loew)
Anastrepha dryas Stone	*Euphranta cassiae* (Munro)

Anastrepha fraterculus (Wiedemann)	*Euphranta japonica* (Ito)
Anastrepha grandis (Macquart)	*Euphranta oshimensis* (Shiraki)
Anastrepha leptozona Hendel	*Eurosta solidaginis* (Fitch)
Anastrepha limae Stone	*Eutreta angusta Banks*
Anastrepha ludens (Loew)	*Eutreta caliptera (Say)*
Anastrepha mburucuyae Blanchard	*Eutreta christophe Bates*
Anastrepha minensis Lima	*Eutreta frontalis Curran*
Anastrepha mucronota Stone	*Eutreta hespera Banks*
Anastrepha nigripalpis Hendel	*Eutreta margaritata Hendel*
Anastrepha obliqua (Macquart)	*Eutreta parasparsa Blanchard*
Anastrepha ornata Aldrich	*Eutreta simplex Thomas*
Anastrepha pallida Norrbom	*Eutreta xanthochaeta Aldrich*
Anastrepha pallidipennis Greene	*Gastrozona nigrifemur* David & Hancock
Anastrepha parishi Stone	*Goedenia stenoparia* (Steyskal)
Anastrepha passiflorae Greene	*Gymnocarena apicata* Thomas
Anastrepha pseudoparallela (Loew)	*Gymnocarena diffusa* Snow
Anastrepha psidivora Norrbom	*Gymnocarena magna* Norrbom
Anastrepha punctata Hendel	*Gymnocarena mexicana* (Aczél)
Anastrepha schultzi Blanchard	*Gymnocarena tricolor* (Doane)
Anastrepha serpentina (Wiedemann)	*Insizwa oblita* Munro
Anastrepha sororcula Zucchi	*Marriottella exquisita* Munro
Anastrepha striata Schiner	*Monacrostichus citricola Bezzi*
Anastrepha suspensa (Loew)	*Neaspilota alba* (Loew)
Anastrepha turicai Blanchard	*Neaspilota reticulata* Norrbom and Foote
Anastrepha turpiniae Stone	*Neoceratitis asiatica* (Becker)
Anastrepha velezi Norrbom	*Neoceratitis cyanescens* (Bezzi)
Anastrepha zenildae Zucchi	*Neotephritis finalis* (Loew)
Asimoneura pantomelas (Bezzi)	*Paracantha trinotata* (Foote)
Austrotephritis protrusa (Hardy & Drew)	*Parastenopa limata* (Coquillett)
Bactrocera aethriobasis (Hardy)	*Paratephritis fukaii* Shiraki
Bactrocera aquilonis (May)	*Paratephritis takeuchii* Ito
Bactrocera bancroftii (Tryon)	*Paraterellia varipennis* Coquillett
Bactrocera bellisi Drew & Romig	*Philophylla fossata* (Fabricius)
Bactrocera breviaculeus (Hardy)	*Procecidochares atra* (Loew)
Bactrocera bryoniae (Tryon)	*Procecidochares australis* Aldrich
Bactrocera cacuminata (Hering)	*Procecidochares pleuralis* Banks
Bactrocera carambolae Drew & Hancock	*Ptilona confinis* (Walker)
Bactrocera caryeae (Kapoor)	*Ptilona persimilis* Hendel
Bactrocera correcta (Bezzi)	*Rhagoletis basiola* (Osten Sacken)
Bactrocera curvipennis (Froggatt)	*Rhagoletis berberis* Jermy
Bactrocera distincta (Malloch)	*Rhagoletis blanchardi* Aczel
Bactrocera dorsalis (Hendel)	*Rhagoletis boycei* Cresson
Bactrocera eximia Drew	*Rhagoletis chionanthi* Bush
Bactrocera frauenfeldi (Schiner)	*Rhagoletis conversa* (Brethes)
Bactrocera hyalina (Shiraki)	*Rhagoletis cornivora* Bush
Bactrocera jarvisi (Tryon)	*Rhagoletis electromorpha* Berlocher
Bactrocera kandiensis (Drew & Hancock)	*Rhagoletis fausta* (Osten Sacken)
Bactrocera kirki (Froggatt)	*Rhagoletis ferruginea* Hendel
Bactrocera kraussi (Hardy)	*Rhagoletis flavicincta* Enderlein
Bactrocera latifrons (Hendel)	*Rhagoletis indifferens* Curran
Bactrocera latilineola Drew & Hancock	*Rhagoletis juglandis* Cresson

Bactrocera malaysiensis Drew & Hancock	*Rhagoletis kurentsovi* Rohdendorf
Bactrocera mayi (Hardy)	*Rhagoletis lycopersella* Smyth
Bactrocera melas (Perkins & May)	*Rhagoletis mendax* Curran
Bactrocera mesomelas (Bezzi)	*Rhagoletis mongolica* Kandybina
Bactrocera minax (Enderlein)	*Rhagoletis nova* (Schiner)
Bactrocera mucronis (Drew)	*Rhagoletis persimilis* Bush
Bactrocera murrayi (Perkins)	*Rhagoletis pomonella* (Walsh)
Bactrocera musae (Tryon)	*Rhagoletis reducta* Hering
Bactrocera mutabilis (May)	*Rhagoletis ribicola* Doane
Bactrocera neohumeralis (Hardy)	*Rhagoletis sp. nr. mendax* Curran
Bactrocera nigrivenata (Munro)	*Rhagoletis striatella* Wulp
Bactrocera nigrofemoralis White & Tsuruta	*Rhagoletis suavis* (Loew)
Bactrocera nigrotibialis (Perkins)	*Rhagoletis tabellaria* (Fitch)
Bactrocera obliqua (Malloch)	*Rhagoletis tomatis* Foote
Bactrocera occipitalis (Bezzi)	*Rhagoletis turanica* (Rohdendorf)
Bactrocera opiliae (Drew & Hardy)	*Rhagoletis zephyria* Snow
Bactrocera passiflorae (Froggatt)	*Rhagoletis zoqui* Bush
Bactrocera penefurva Drew	*Rioxoptilona dunlopi* (van der Wulp)
Bactrocera pruniae Drew & Romig	*Sphaeniscus binoculatus* (Bezzi)
Bactrocera psidii (Froggatt)	*Sphenella nigricornis* Bezzi
Bactrocera pyrifoliae Drew & Hancock	*Strauzia gigantei* Steyskal
Bactrocera raiensis Drew & Hancock	*Strauzia intermedia* (Malloch)
Bactrocera thailandica Drew & Hancock	*Strauzia longipennis* (Wiedemann)
Bactrocera trilineola Drew	*Strauzia longitudinalis* (Loew)
Bactrocera trivialis (Drew)	*Strauzia rugosa* Stoltzfus
Bactrocera tryoni (Froggatt)	*Strauzia vittigera* (Loew)
Bactrocera tsuneonis (Miyake)	*Taomyia marshalli* Bezzi
Bactrocera tuberculata (Bezzi)	*Tephritis leavittensis* Blanc
Bactrocera verbascifoliae Drew and Hancock	*Tephritis luteipes* Merz
Bactrocera xanthodes (Broun)	*Tephritis ovatipennis* Foote
Bactrocera zonata (Saunders)	*Tephritis pura* (Loew)
Bistrispinaria fortis (Speiser)	*Toxotrypana curvicauda* Gerstaecker
Bistrispinaria magniceps Bezzi	*Toxotrypana recurcauda* Tigrero
Callistomyia flavilabris Hering	*Trupanea bisetosa* (Coquillett)
Campiglossa albiceps (Loew)	*Trupanea femoralis* (Thomson)
Campiglossa californica (Novak)	*Trupanea wheeleri* Curran
Campiglossa duplex (Becker)	*Trypanocentra nigrithorax* Malloch
Campiglossa reticulata (Becker)	*Trypeta flaveola Coquillett*
Campiglossa snowi (Hering)	*Urophora christophi* Loew
Carpomya incompleta (Becker)	*Xanthaciura insect* (Loew)
Carpomya pardalina (Bigot)	*Zacerata asparagi* Coquillett
Ceratitis anonae Graham	*Zeugodacus atrisetosus* Perkins
Ceratitis brachychaeta Freidberg	*Zeugodacus caudatus* Fabricius
Ceratitis bremii Guérin-Méneville	*Zeugodacus cucumis* French
Ceratitis catoirii Guérin-Méneville	*Zeugodacus cucurbitae* Coquillett
Ceratitis cosyra (Walker)	*Zeugodacus decipiens* (Drew)
Ceratitis ditissima (Munro)	*Zeugodacus depressus* Shiraki
Ceratitis fasciventris (Bezzi)	*Zeugodacus diversus* (Coquillett)
Ceratitis flexuosa (Walker)	*Zeugodacus hochii* (Zia)
Ceratitis malgassa Munro	*Zeugodacus mundus* (Bezzi)
Ceratitis pedestris (Bezzi)	*Zeugodacus papuaensis* (Malloch)

Ceratitis punctata (Wiedemann)	*Zeugodacus scutellaris* (Bezzi)
Ceratitis quilicii De Meyer, Mwatawala & Virgilio	*Zeugodacus scutellatus* (Hendel)
Ceratitis quinaria (Bezzi)	*Zeugodacus strigifinis* (Walker)
Ceratitis rosa Karsch	*Zeugodacus tapervitta* (Mahmood)
Ceratitis rubivora (Coquillett)	*Zeugodacus tau* (Walker)
Ceratitis silvestrii Bezzi	*Zeugodacus triangularis* (Drew)
Craspedoxantha marginalis (Wiedemann)	*Zeugodacus trichosanthes* (Drew & Romig)
Dacus axanus (Hering	*Zonosemata electa* (Say)
Dacus bivittatus (Bigot)	

Table 13: 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) for pests in Table 12 and from Appendix J

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 pests (Section 3.1)	The vast majority of species can be identified using conventional keys; molecular methods are also available	The vast majority of species can be identified using conventional keys; molecular methods are also available	Taxonomic issues are yet to be resolved particularly regarding species complexes
Absence/presence of the pest in the EU territory (Section 3.2)	The species are not known to occur in the EU, or if present are not widely distributed	Non-EU Tephritidae are not known to occur or are not widely distributed in the EU	
Regulatory status (Section 3.3)	Non-European Tephritidae are listed in 2000/29 EC as Annex 1/A1 pests whose introduction into the EU is prohibited	There are no Tephritidae species listed as RNQP in the annexes of 2016/2031	
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Pests could enter on host plant material, establish and spread. Host fruit is the primary pathway for the majority of Tephritidae of potential quarantine concern	Spread is not mainly via specific plants for planting	
Potential for consequences in the EU territory (Section 3.5)	Impacts on cultivated host plants could result in yield and quality losses; impacts on wild hosts are less clear	Presence of the pest on plants for planting would likely have an economic impact, as regards the intended use of those plants for planting	
Available measures (Section 3.6)	Phytosanitary measures are available to prevent the entry of Tephritidae into the EU; measures are also available to manage incursions within the EU	Measures are available to protect plants for planting (but plants for planting are not the main means of spread)	
Conclusion on pest categorisation (Section 4)	257 species of non-EU Tephritidae satisfy the criteria such that they can be considered as potential quarantine pests for the EU (Appendix J)	By definition, non-EU Tephritidae do not meet the corresponding occurrence criterion evaluated by EFSA to qualify as a potential Union RNQP. Plants for planting are generally not the main means of dispersal	

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
Aspects of assessment to focus on/scenarios to address in future if appropriate	If it is necessary to further narrow down the species of most quarantine concern, efforts should focus on the introduction potential and consequences of introduction of species in Appendix J		

The species appearing in Appendix I satisfy the criteria that are within the remit of EFSA to assess for them to be regarded as potential Union quarantine pests although there is uncertainty regarding impacts on hosts which are wild. They do not meet the criteria of occurring in the EU nor plants for planting being the principal means of spread for them to be regarded as a potential Union regulated non-quarantine pests. Information regarding these species hosts and distribution is provided in Appendix I.

Table 14: 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) for species in Appendix I

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 pests (Section 3.1)	The vast majority of species can be identified using conventional keys; molecular methods are also available	The vast majority of species can be identified using conventional keys; molecular methods are also available	Taxonomic issues are yet to be resolved particularly regarding species complexes
Absence/presence of the pest in the EU territory (Section 3.2)	The species are not known to occur in the EU	The species are not known to occur in the EU	
Regulatory status (Section 3.3)	Non-European Tephritidae are listed in 2000/29 EC as Annex 1/A1 pests whose introduction into the EU is prohibited	There are no Tephritidae species listed as RNQP in the annexes of 2016/2031	
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Pests could enter on host plant material, establish and spread	Spread is not mainly via specific plants for planting	For species with wild hosts there is uncertainty as to whether there are significant pathways allowing entry
Potential for consequences in the EU territory (Section 3.5)	Unspecified environmental impacts may result as a consequence of impacts to wild hosts	Presence of the pest on plants for planting would likely have an economic impact, as regards the intended use of those plants for planting. However, wild hosts are not usually traded as plants for planting	Significance of any impact on wild hosts
Available measures (Section 3.6)	Phytosanitary measures are available to prevent the entry of Tephritidae into the EU; measures are also available to manage incursions within the EU	Measures are available to protect plants for planting (but plants for planting are not the main means of spread)	

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
Conclusion on pest categorisation (Section 4)	Species of non-EU Tephritidae satisfy the criteria such that they can be considered as potential quarantine pests for the EU (Appendix J)	By definition, non-EU Tephritidae do not meet the corresponding occurrence criterion evaluated by EFSA to qualify as a potential Union RNQP. Plants for planting are generally not the main means of dispersal	
Aspects of assessment to focus on/scenarios to address in future if appropriate	If it is necessary to further narrow down the species of potential quarantine concern, efforts should focus on the environmental consequences of impacts on wild hosts of species in Appendix J		

The species appearing in Appendix F fail to clearly satisfy the criteria that are within the remit of EFSA to assess for them to be regarded as potential Union quarantine pests due to lack of climate matching. There is uncertainty regarding the ability to establish. They do not meet the criteria of occurring in the EU nor plants for planting being the principal means of spread for them to be regarded as a potential Union regulated non-quarantine pests. Information regarding these species distribution is provided in Appendix F. The species appearing in Appendix H fail to clearly satisfy the criteria that are within the remit of EFSA to assess for them to be regarded as potential Union quarantine pests. Either hosts do not occur in the EU or hosts are not known to occur in the EU, hence there is uncertainty regarding the ability to establish. They do not meet the criteria of occurring in the EU nor plants for planting being the principal means of spread for them to be regarded as a potential Union regulated non-quarantine pests. Information regarding these species hosts and distribution is provided in Appendix H.

Table 15: 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) for species in Appendices F and H

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 pests (Section 3.1)	The vast majority of species can be identified using conventional keys; molecular methods are also available	The vast majority of species can be identified using conventional keys; molecular methods are also available	Taxonomic issues are yet to be resolved particularly regarding species complexes
Absence/presence of the pest in the EU territory (Section 3.2)	The species are not known to occur in the EU	The species are not known to occur in the EU	
Regulatory status (Section 3.3)	Non-European Tephritidae are listed in 2000/29 EC as Annex 1/A1 pests whose introduction into the EU is prohibited	There are no Tephritidae species listed as RNQP in the annexes of 2016/2031	

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)	For species in Appendix F unsuitable EU climates excluded them from establishing; for species in Appendix H establishment is uncertain due to lack of information about occurrence of hosts	Spread is not mainly via specific plants for planting	Whether species in Appendix F can adapt to different climate types; For species in Appendix H, the occurrence of hosts in the EU is uncertain
Potential for consequences in the EU territory (Section 3.5)	Without establishment, there can be no impacts	Presence of the pest on plants for planting would likely have an economic impact, as regards the intended use of those plants for planting. However, it is unknown whether hosts occur in the EU	
Available measures (Section 3.6)	Phytosanitary measures are available to prevent the entry of Tephritidae into the EU; measures are also available to manage incursions within the EU	Measures are available to protect plants for planting (but plants for planting are not the main means of spread)	
Conclusion on pest categorisation (Section 4)	Species in Appendix F and H do not clearly satisfy the criteria of being able to establish, spread and cause impacts such that they can be considered as potential quarantine pests for the EU (Appendix J)	By definition, non-EU Tephritidae do not meet the corresponding occurrence criterion evaluated by EFSA to qualify as a potential Union RNQP. Plants for planting are generally not the main means of dispersal	
Aspects of assessment to focus on/scenarios to address in future if appropriate			

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Abbreviations

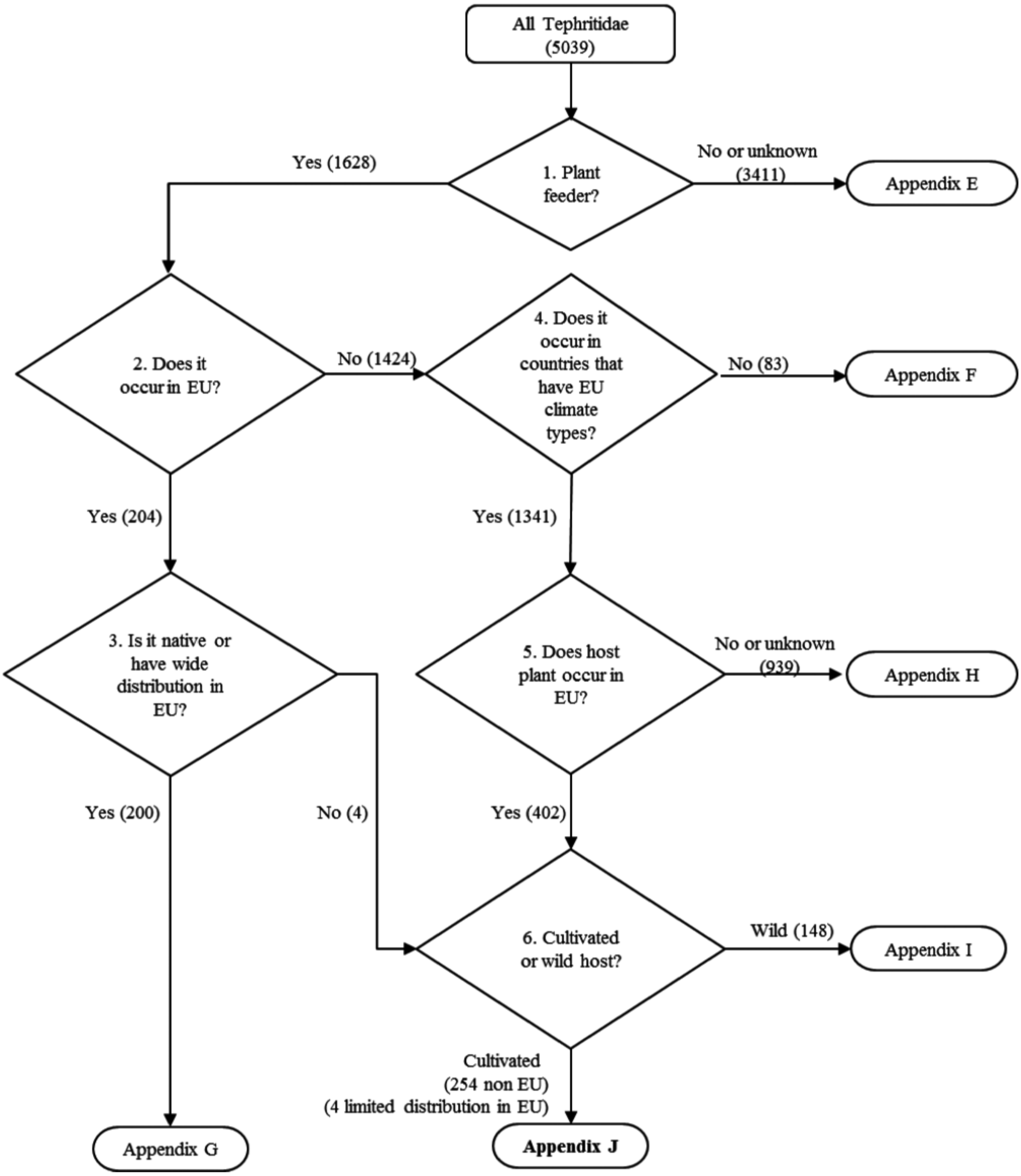
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention

ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

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 – Decision tree for categorisation of non-EU Tephritidae



Appendix B – Non-EU Tephritidae interceptions ranked by number of finds on host, May 1994–September 2019

Source: Europhyt. Data extracted 1 September 2019

Host	No. finds	Finds as % of total	Host	No. finds	Finds as % of total
Mangifera	1,916	43.6	*Cucumis*	3	0.1
Capsicum	736	16.8	*Quercus alba*	3	0.1
Momordica	398	9.1	*Eryngium*	2	0.0
Psidium	305	6.9	*Eugenia*	2	0.0
Annona	221	5.0	*Solanum* sp.	2	0.0
Syzygium	217	4.9	*Litchi*	2	0.0
Trichosanthes	125	2.8	*Malus*	2	0.0
Citrus	108	2.5	*Acca*	1	0.0
Ziziphus	59	1.3	*Apium graveolens*	1	0.0
Luffa	56	1.3	*Artocarpus heterophyllus*	1	0.0
Lagenaria	41	0.9	*Baccaurea*	1	0.0
Manilkara zapota	26	0.6	*Cyamopsis tetragonoloba*	1	0.0
Solanum melongena	20	0.5	*Dendrobium*	1	0.0
Passiflora	17	0.4	*Feijoa*	1	0.0
Averrhoa carambola	16	0.4	*Ficus*	1	0.0
Diospyros	15	0.3	*Flacourtia*	1	0.0
Vaccinium	14	0.3	Unspecified fruit	1	0.0
Citrullus	12	0.3	*Hylocereus undatus*	1	0.0
Fortunella	11	0.3	*Ocimum basilicum*	1	0.0
Prunus	11	0.3	*Olea europaea* subsp. *africana*	1	0.0
Cucurbitaceae	11	0.3	*Phalaenopsis*	1	0.0
Chrysophyllum	7	0.2	*Punica granatum*	1	0.0
Pyrus	6	0.1	*Solanum torvum*	1	0.0
Coccinia grandis	5	0.1	*Vitis vinifera*	1	0.0
Solanum aethiopicum	4	0.1	*Voacanga africana*	1	0.0
Benincasa	3	0.1	Sum	4,394	100.0

Appendix C – Top 25 third country sources of non-EU Tephritidae notifications, May 1994–September 2019

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Sum
Thailand	1		3	8	2		43	25		23	58	83	165	86	53	54	112	39	46	18	19	6	12	4	1	4	865
Pakistan				2	1			1		5	9	14	34	24	15	17	6	36	103	122	9	3	2	6	6	4	419
India					1	1		1	1	1	8	3	2	10	4	8	7	19	89	78	18	11	11	11	10	4	298
Vietnam								1		2	8	21	15	28	11	8	6	70	1	2	6	9	17	9	5	4	223
Dominican Republic					1		1	2	1	1	7	4	10	20	13	13	6	11	28	29	27	6	12	6	14	8	220
Mali	1		5	6	3			3		11	14	3	23	15	3	2	5	7	6	8	15	8	34	12	12	15	211
Cameroon		1		2				3	3	4	15	26	13	17	2	4	1	2	9	8	12	29	32	13	8	5	209
Sri Lanka													1	5	3	1	3	8	68	43	43	5	5	7	7	7	206
Côte d'Ivoire	1		1	1	2	1	1		1	3	12	3	6			1	4	8	15	19	45	11	8	22	18	7	190
Kenya	4		2	4				1		4	5	5	4	3	1			5	44	43	40	8	5	2	1		181
Ghana							1	4				1	14	2		2	4	5	23	24	32	41	1		3	1	158
Bangladesh										1					1	1		5	25	4	21	45	19	5	5	1	133
Uganda														1				2	3	5	4	26	17	17	12	4	91
Jamaica															1		3	3	26	25	21	4	2		1		86
Cambodia																		2	19	7	32	2	6	6	8	1	83
Senegal			1								3	7	2	9	3	1		1	1	3	11	13	8	8	6	6	83
Burkina Faso	2			2	1			4	1	1	5	1	1	3					1	3	2	14	11	9	8	10	79
Egypt	1						5			1	1			1		1	1	4	6		6	11	19	9	4		70
Brazil	1	2	1			1	2	2	2	1	2	1	1	4	1	2	3	1	2	4	11	7	2	1	6	3	63
Malaysia									1									3	6	4	8	6	13	5	7	2	55
Peru									2				11	3	4		3	4	3	3	9	3	2	4	1	3	55
South Africa		1			2	1		3	1	1	2	1	3	1	3		3	4	5	4	5	4	5	1		1	51
Laos																					1	22	9	1	5	3	41
Mauritius	1		2		1		5	3		1		1				1		1		1	4	1	4	5		1	32
Argentina					1		3	4			2			1			1		3		5	8			2		30
41 others	2	0	2	5	2	5	5	2	3	2	6	8	8	12	3	3	6	8	17	15	24	34	30	23	25	10	260
Sum	14	4	17	30	17	9	66	59	16	52	157	182	313	245	121	119	174	248	549	472	430	337	286	186	175	104	

Records for 1994 and 2019 are not full years.

Appendix D – Tables showing area of cultivation; area harvested or area of production of pome, stone and citrus fruit, berries, grapes and olives in EU member states 2014–2018

(Source: Eurostat data explorer v3.5.1-20190911-3531d-ESTAT_LINUX_PROD DATA-EXPLORER_PRODmanaged11)

Strawberries

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	109.48	107.57	108.78	108.46	:
Belgium	1.70	1.80	1.90	1.98	1.98
Bulgaria	0.67	0.76	0.68	0.66	0.73
Czech Republic	0.62	0.58	0.71	0.69	0.71
Denmark	1.08	1.09	1.17	1.16	1.16
Germany	15.35	14.72	14.30	14.16	14.00
Estonia	0.40	0.50	0.44	0.53	0.62
Ireland	0.19	0.19	0.19	0.19	0.19
Greece	1.35	1.28	1.49	1.47	1.47
Spain	7.79	7.21	6.87	6.82	7.03
France	3.26	3.29	3.34	3.37	3.35
Croatia	0.31	0.29	0.37	0.37	0.25
Italy	5.69	5.60	4.88	4.85	:
Cyprus	0.06	0.05	0.04	0.06	0.06
Latvia	0.40	0.40	0.50	0.50	0.50
Lithuania	1.00	1.01	0.78	0.84	0.83
Luxembourg	0.00	0.00	0.01	0.01	0.01
Hungary	0.66	0.74	0.79	0.79	0.82
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	1.81	1.77	1.72	1.69	1.62
Austria	1.13	1.14	1.14	1.14	1.21
Poland	52.90	52.30	50.78	49.84	49.18
Portugal	0.58	0.32	0.39	0.31	0.32
Romania	2.40	2.56	2.72	3.25	3.27
Slovenia	0.09	0.11	0.11	0.11	0.12
Slovakia	0.20	0.36	0.17	0.12	0.17
Finland	2.92	3.01	6.30	6.89	10.16
Sweden	1.94	1.99	2.01	1.97	2.07
United Kingdom	5.00	4.50	5.00	4.70	4.70

: Not available.

other berries

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	:	:	144.83	151.61	:
Belgium	0.34	0.38	0.39	0.41	0.45
Bulgaria	0.00	1.84	2.15	2.22	2.48
Czech Republic	1.07	1.02	0.90	0.87	0.89
Denmark	:	1.45	0.89	0.85	0.83
Germany	7.72	8.12	8.46	8.87	9.21
Estonia	1.30	1.20	1.09	1.36	1.28

	2014	2015	2016	2017	2018
Ireland	0.06	0.06	0.06	0.06	0.06
Greece	0.08	0.14	0.16	0.18	0.18
Spain	:	3.79	4.57	6.04	6.58
France	3.45	3.39	3.40	3.38	3.36
Croatia	0.54	0.68	1.04	1.17	1.30
Italy	:	0.90	1.28	0.37	:
Cyprus	0.00	0.00	0.00	0.00	0.00
Latvia	0.90	1.30	1.00	1.10	1.50
Lithuania	7.69	7.44	7.71	9.04	9.18
Luxembourg	:	0.00	0.01	0.01	0.01
Hungary	6.44	6.27	6.37	6.45	7.03
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	:	1.70	1.52	1.47	1.76
Austria	0.55	0.55	0.55	0.59	0.62
Poland	83.60	85.30	92.73	94.70	95.59
Portugal	1.38	2.29	2.66	3.05	3.28
Romania	0.47	0.46	0.58	0.55	0.47
Slovenia	:	0.14	0.17	0.23	0.26
Slovakia	0.00	:	0.24	0.32	0.39
Finland	2.60	2.01	2.47	2.55	2.55
Sweden	0.45	0.44	0.43	0.43	0.42
United Kingdom	5.00	5.00	4.00	5.34	5.32

: Not available.

Apples

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	524.50	538.50	523.48	522.15	523.03
Belgium	7.07	6.87	6.49	6.16	5.99
Bulgaria	3.95	4.77	4.11	3.97	3.98
Czech Republic	8.96	8.31	7.49	7.35	7.25
Denmark	1.38	1.39	1.35	1.28	1.42
Germany	31.74	31.74	31.74	33.98	33.98
Estonia	0.90	0.60	0.51	0.48	0.60
Ireland	0.64	0.64	0.70	0.70	0.70
Greece	12.26	11.85	10.04	9.60	9.60
Spain	30.73	30.72	30.87	30.55	29.92
France	50.17	49.65	49.65	50.31	50.65
Croatia	5.94	5.76	5.89	4.84	4.73
Italy	52.00	52.16	56.16	57.26	57.32
Cyprus	0.61	0.61	0.53	0.37	0.37
Latvia	2.70	2.40	2.40	3.30	3.20
Lithuania	11.27	10.68	9.70	9.82	10.13
Luxembourg	0.24	0.26	0.26	0.27	0.27
Hungary	33.26	32.80	32.49	32.17	31.80
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	7.85	7.60	7.30	7.00	6.60
Austria	6.76	6.62	6.67	6.67	6.74
Poland	163.10	180.40	164.76	162.53	166.15

	2014	2015	2016	2017	2018
Portugal	13.85	14.01	14.98	14.79	14.60
Romania	56.13	55.88	55.53	55.60	54.33
Slovenia	2.55	2.47	2.42	2.36	2.33
Slovakia	2.56	2.38	2.31	2.18	2.14
Finland	0.60	0.63	0.62	0.63	0.63
Sweden	1.29	1.33	1.54	1.40	1.41
United Kingdom	16.00	16.00	17.00	16.60	16.20

: Not available.

Pears

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	117.01	117.80	117.26	116.34	116.41
Belgium	9.08	9.34	9.69	10.02	10.18
Bulgaria	0.34	0.53	0.41	0.45	0.57
Czech Republic	0.88	0.79	0.74	0.71	0.75
Denmark	0.36	0.34	0.30	0.30	0.29
Germany	1.93	1.93	1.93	2.14	2.14
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	4.97	4.95	4.08	4.07	4.07
Spain	23.64	22.88	22.55	21.89	21.33
France	5.36	5.37	5.30	5.25	5.26
Croatia	1.04	0.90	0.93	0.71	0.76
Italy	30.15	30.86	32.29	31.73	31.76
Cyprus	0.08	0.07	0.07	0.07	0.06
Latvia	0.20	0.20	0.20	0.20	0.20
Lithuania	0.90	0.87	0.80	0.82	0.82
Luxembourg	0.02	0.02	0.02	0.02	0.02
Hungary	2.89	2.88	2.87	2.90	2.81
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	8.60	9.23	9.40	9.70	10.00
Austria	0.44	0.45	0.46	0.46	0.49
Poland	9.20	9.20	7.49	7.26	7.30
Portugal	12.01	12.12	12.62	12.56	12.51
Romania	3.46	2.91	3.15	3.12	3.10
Slovenia	0.21	0.20	0.20	0.20	0.21
Slovakia	0.13	0.11	0.11	0.11	0.12
Finland	0.00	0.04	0.04	0.04	0.05
Sweden	0.13	0.13	0.12	0.12	0.11
United Kingdom	1.00	1.48	1.50	1.50	1.50

: Not available.

Other pome fruit

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	:	:	:	:	:
Belgium	0.00	0.00	0.00	0.00	0.00

	2014	2015	2016	2017	2018
Bulgaria	0.00	0.09	0.03	0.00	0.08
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	:	0.00	0.00
Germany	0.00	0.00	0.00	0.09	0.09
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	0.00	0.00	0.00	0.00	0.00
Spain	:	3.94	3.87	3.85	3.63
France	:	:	:	:	:
Croatia	0.00	0.00	0.00	0.00	0.00
Italy	:	0.03	0.00	0.00	:
Cyprus	0.00	0.00	0.02	0.02	0.02
Latvia	0.00	0.10	0.20	0.30	0.20
Lithuania	0.45	0.28	0.29	0.29	0.32
Luxembourg	:	0.00	0.00	0.00	0.00
Hungary	0.18	0.19	0.18	0.30	0.34
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	:	:
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	0.62	0.82	1.02	1.32	1.37
Romania	1.44	1.27	1.26	1.39	1.27
Slovenia	:	0.00	0.00	0.00	0.00
Slovakia	0.00	:	:	0.03	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Peaches

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU - 28	:	157.81	156.39	154.06	151.29
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	2.87	3.55	3.66	3.73	3.40
Czech Republic	0.58	0.48	0.39	0.37	0.38
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.11	0.11
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	39.14	36.52	33.47	33.68	33.68
Spain	50.75	51.46	52.88	52.14	49.86
France	5.30	5.09	4.83	4.80	4.69
Croatia	0.92	0.95	0.79	0.71	0.64
Italy	48.06	46.25	47.03	45.49	45.86
Cyprus	0.27	0.28	0.24	0.21	0.20
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00

	2014	2015	2016	2017	2018
Hungary	5.44	5.41	5.42	5.34	4.94
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.17	0.17	0.16	0.16	0.18
Poland	:	2.40	2.23	2.13	2.12
Portugal	2.74	2.85	2.94	2.97	2.97
Romania	1.68	1.69	1.68	1.62	1.63
Slovenia	0.36	0.32	0.30	0.28	0.26
Slovakia	0.43	0.40	0.37	0.32	0.36
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Nectarines

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU - 28	72.06	70.94	68.46	67.69	64.60
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.27	0.16	0.16	0.16	0.13
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	7.49	7.92	7.59	7.70	7.70
Spain	35.45	35.05	32.45	32.08	30.44
France	5.11	4.80	4.57	4.52	4.41
Croatia	0.31	0.32	0.22	0.25	0.23
Italy	22.00	21.26	21.98	21.53	20.35
Cyprus	0.18	0.19	0.16	0.09	0.09
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	0.27	0.30	0.29	0.27	0.26
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	0.87	0.90	0.93	0.94	0.94
Romania	0.12	0.06	0.12	0.15	0.06
Slovenia	0.00	0.00	:	:	:
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Apricot

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU - 28	:	69.50	72.52	72.23	:
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	1.74	2.48	2.55	2.90	2.55
Czech Republic	1.21	1.16	1.15	1.10	1.15
Denmark	:	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.23	0.23
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	7.27	7.45	7.34	7.31	7.65
Spain	18.45	18.82	20.35	21.00	20.57
France	12.21	11.99	12.18	12.20	12.28
Croatia	0.30	0.34	0.28	0.28	0.25
Italy	17.63	17.19	18.92	17.36	:
Cyprus	0.22	0.26	0.22	0.19	0.18
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	4.57	4.71	4.91	4.97	5.43
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.77	0.74	0.79	0.79	0.83
Poland	1.20	1.10	0.99	0.96	0.97
Portugal	0.43	0.42	0.43	0.56	0.56
Romania	2.98	2.62	2.20	2.11	1.90
Slovenia	0.05	0.06	0.07	0.08	0.08
Slovakia	0.18	0.17	0.16	0.19	0.16
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Cherries

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	:	173.76	173.15	174.07	:
Belgium	1.27	1.31	1.32	1.40	1.38
Bulgaria	7.21	9.26	9.60	10.06	11.23
Czech Republic	2.45	2.28	2.19	2.11	2.07
Denmark	1.22	1.14	0.79	0.66	0.56
Germany	7.36	7.21	7.14	7.96	7.94
Estonia	0.00	0.00	0.00	0.01	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	13.60	14.63	15.57	15.83	15.83
Spain	25.59	26.49	26.95	27.59	27.50
France	8.22	8.15	8.14	8.01	8.03
Croatia	3.55	3.35	3.43	3.53	2.94
Italy	28.97	29.25	29.97	29.27	:

	2014	2015	2016	2017	2018
Cyprus	0.20	0.22	0.21	0.23	0.22
Latvia	:	0.10	0.10	0.10	0.10
Lithuania	0.83	0.78	0.72	0.73	0.76
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	16.06	15.64	15.49	15.65	15.91
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.79	0.84	0.82	0.81	0.79
Austria	0.24	0.23	0.24	0.25	0.30
Poland	38.60	39.10	36.81	36.44	36.91
Portugal	6.12	6.37	6.43	6.30	6.14
Romania	6.45	6.31	6.13	6.02	7.06
Slovenia	0.17	0.17	0.18	0.19	0.20
Slovakia	0.20	0.19	0.17	0.19	0.21
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.04	0.04	0.04	0.03	0.03
United Kingdom	1.00	0.70	0.70	0.70	0.76

: Not available.

Plums

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	157.36	154.79	153.49	154.48	:
Belgium	0.04	0.04	0.03	0.03	0.04
Bulgaria	4.88	6.83	6.71	6.82	7.36
Czech Republic	1.91	1.87	1.88	1.76	1.82
Denmark	0.06	0.06	0.06	0.06	0.07
Germany	4.35	4.34	4.35	4.83	4.82
Estonia	0.00	0.00	0.00	0.02	0.02
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	1.81	2.05	2.60	2.06	2.09
Spain	17.00	16.06	15.28	15.20	14.64
France	16.05	14.97	14.81	15.06	15.01
Croatia	4.85	5.12	4.83	4.36	4.28
Italy	12.27	11.63	11.57	11.68	:
Cyprus	0.52	0.58	0.45	0.38	0.38
Latvia	0.10	0.10	0.10	0.10	0.10
Lithuania	0.81	0.77	0.73	0.73	0.72
Luxembourg	0.04	0.03	0.04	0.04	0.04
Hungary	7.36	7.22	7.98	7.94	7.89
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.26	0.25	0.26	0.26
Austria	0.19	0.18	0.18	0.19	0.20
Poland	15.30	13.90	13.39	13.31	13.48
Portugal	1.69	1.79	1.80	1.78	1.76
Romania	66.55	65.67	65.11	66.68	66.40
Slovenia	0.03	0.04	0.04	0.04	0.05
Slovakia	0.52	0.56	0.58	0.52	0.61
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.04	0.04	0.04	0.04	0.04

	2014	2015	2016	2017	2018
United Kingdom	1.00	0.70	0.70	0.60	0.62

: Not available.

Tropical fruit

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	:	135.18	137.09	138.99	:
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	0.00	0.00	0.00
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	:	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	12.44	13.00	13.31	13.73	13.73
Spain	:	65.76	67.39	70.20	71.02
France	16.02	15.59	16.89	15.58	14.91
Croatia	0.28	0.31	0.35	0.27	0.28
Italy	:	30.74	28.90	28.91	:
Cyprus	0.71	0.68	0.78	0.73	0.73
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	:	0.00	0.00	0.00	0.00
Hungary	:	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	8.85	9.11	9.34	9.43	9.34
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	:	0.00	0.13	0.14	0.15
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Oranges

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	286.84	286.02	278.67	272.42	271.68
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	0.00	0.00	0.00
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00

	2014	2015	2016	2017	2018
Greece	36.37	36.97	31.71	29.60	29.60
Spain	147.42	145.86	142.17	140.51	139.65
France	0.80	0.81	1.03	1.00	1.01
Croatia	0.03	0.03	0.03	0.02	0.03
Italy	84.53	84.41	85.59	83.22	82.81
Cyprus	1.23	1.22	1.30	1.09	1.10
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	16.45	16.72	16.84	16.98	17.48
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	0.00	0.00	0.00	0.00	0.00
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Small citrus fruits

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	163.34	161.92	160.60	149.99	:
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	0.00	0.00	0.00
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	8.14	8.73	9.17	8.70	8.70
Spain	113.21	111.47	109.13	107.52	108.61
France	2.10	2.11	1.90	1.95	1.98
Croatia	2.15	2.15	2.10	2.02	1.89
Italy	34.77	34.37	34.63	26.25	:
Cyprus	0.56	0.60	1.17	1.05	1.09
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	2.41	2.50	2.51	2.51	2.52

	2014	2015	2016	2017	2018
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	0.00	0.00	0.00	0.00	0.00
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Other small citrus fruit

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	:	:	42.47	33.19	:
Belgium	:	0.00	0.00	0.00	0.00
Bulgaria	:	0.00	0.00	0.00	0.00
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	:	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	:	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	0.00	0.00	0.00	0.00	0.00
Spain	:	27.93	28.89	28.87	30.73
France	:	0.00	0.00	0.00	0.00
Croatia	2.15	2.15	2.10	2.02	1.89
Italy	:	9.14	8.99	0.00	:
Cyprus	0.34	0.36	1.00	0.81	0.84
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	:	0.00	0.00	0.00	0.00
Hungary	0.00	0.00	0.00	0.00	0.00
Malta	:	0.00	0.00	0.00	0.00
Netherlands	:	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	1.43	1.49	1.49	1.49	1.50
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	:	:	0.00	0.00	0.00
Slovakia	:	0.00	0.00	0.00	0.00
Finland	:	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Lemons and acid limes

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	65.90	66.47	73.21	75.10	:
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	0.00	0.00	0.00

	2014	2015	2016	2017	2018
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	4.20	4.28	3.94	4.06	4.11
Spain	38.72	38.48	41.22	43.08	46.01
France	0.91	0.92	0.93	0.96	1.00
Croatia	0.02	0.03	0.06	0.02	0.04
Italy	20.58	21.19	25.60	25.61	:
Cyprus	0.54	0.59	0.47	0.36	0.37
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	0.93	0.97	0.98	1.00	1.07
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	0.00	0.00	0.00	0.00	0.00
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Grapes

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	:	3,167.97	3,137.83	3,142.09	:
Belgium	0.00	0.18	0.24	0.24	0.30
Bulgaria	31.89	38.71	36.55	34.11	31.32
Czech Republic	15.78	15.81	15.80	15.81	15.94
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	:	:	:	:	:
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	110.90	108.53	98.09	101.75	99.95
Spain	947.28	941.06	935.11	937.76	940.33
France	757.34	752.33	751.69	750.46	752.84
Croatia	25.75	25.59	23.40	21.90	20.51
Italy	682.18	678.98	673.76	675.26	:
Cyprus	6.16	6.60	6.07	5.93	6.01
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	1.25	1.25	1.26	1.26	1.25
Hungary	70.72	72.20	68.12	67.08	65.71

	2014	2015	2016	2017	2018
Malta	:	0.68	0.68	0.68	0.42
Netherlands	0.00	0.15	0.14	0.16	0.17
Austria	44.79	43.78	46.49	48.05	48.65
Poland	0.70	0.60	0.62	0.67	0.73
Portugal	178.99	178.97	179.05	178.84	178.77
Romania	174.63	176.12	174.17	175.32	167.56
Slovenia	16.02	15.71	15.84	15.86	15.65
Slovakia	8.76	8.80	8.71	8.47	8.01
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.05	0.05	0.05	0.04	0.05
United Kingdom	2.00	1.80	1.79	1.99	2.17

: Not available.

Olives

Area (cultivation/harvested/production) (1,000 ha)

	2014	2015	2016	2017	2018
EU 28	:	5,033.40	5,039.24	5,050.53	:
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	0.00	0.00	0.00
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	939.66	974.11	969.07	939.20	940.52
Spain	:	2,526.50	2,521.69	2,554.83	2,579.00
France	17.21	17.21	17.38	17.38	17.40
Croatia	19.08	19.10	18.18	18.68	18.70
Italy	1,125.18	1,134.05	1,144.95	1,149.47	:
Cyprus	10.89	10.01	10.61	10.83	10.71
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	352.35	351.34	356.18	358.89	358.78
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	:	1.08	1.17	1.24	1.30
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

: Not available.

Appendix E – Tephritidae not known to feed on plants

3,411 species

Appendix F – Plant feeding Tephritidase occurring in countries with no Koppen–Geiger zones that occur in the EU

83 species

Appendix G – Plant feeding Tephritidae native to the EU or widely distributed within the EU

200 species

Appendix H – Plant feeding Tephritidae not known to be present in the EU but present in countries with some Koppen–Geiger zones that occur in the EU – hosts absent or unknown in EU

939 species

Appendix I – Plant feeding Tephritidae not known to be present in the EU; wild hosts are present; unknown whether some cultivated hosts are present in EU

148 species

Appendix J – Plant feeding Tephritidae not known to be present in the EU; their hosts are cultivated in the EU

258 species

Appendixes E–J can be found in the online version of this output ('Supporting information' section: https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2020.5931#support-information-section).

Appendix K – Countries or States/Provinces in large countries that have no Köppen–Geiger climate zones that also occur in the EU

(based on MacLeod & Korysinska (2019) and supplementary internet searches).

Continent	Country/region
North America	Bahamas
Central America & Caribbean	Antigua and Barbuda, Belize, Cuba, El Salvador, Guadeloupe, Jamaica, Montserrat, Netherlands Antilles, Nicaragua, Puerto Rico
South America	Brazil (Acre, Amapa, Amazonas, Distrito Federal, Goias, Litigated Zone, Maranhao, Mato Grosso, Para, Rondonia, Tocantins), Dominica, French Guiana, Guyana, Suriname, Trinidad and Tobago
Africa	Congo, Cote d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Gabon, Guinea, Guinea-Bissau, Liberia, Reunion, Sao Tome and Principe, Sierra Leone, Togo, Western Sahara
Asia	Bahrain, Bangladesh, Brunei, Cambodia, China (Hainan, Hong Kong), East Timor, India (Andaman and Nicobar Islands, Assam, Chandigarh, Dadra and Nagar Haveli, Goa, Kalimantan, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Pondicherry, Tripura, West Bengal), Indonesia (Bali, Nusa Tenggara), Kuwait, Malaysia (Sarawak, West Malaysia), Qatar, Saudi Arabia, Singapore, Thailand, United Arab Emirates
Oceania	Many islands including: Cook Islands, Kiribati, Samoa, Solomon Islands, Tonga, Vanuatu