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Pest categorisation of *Grapholita inopinata*

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, Ewelina Czwienczek and Alan MacLeod

Abstract

The EFSA Panel on Plant Health (PLH) performed a pest categorisation of *Grapholita inopinata*, (Lepidoptera: Tortricidae), the Manchurian fruit moth, for the territory of the EU. *G. inopinata* is a well-defined species that is recognised as a major pest of *Malus* spp. in Far East Russia, Eastern Siberia and northern China. *G. inopinata* is less common in Japan where it is not a serious pest. *G. inopinata* is not known to occur in the EU. *G. inopinata* is listed in Annex IIAI of 2000/29 EC as a harmful organism regulated on *Cydonia, Malus, Prunus* and *Pyrus* from non-European countries. Adult *G. inopinata* emerge in the summer, mate and lay eggs on host leaves and fruit. Larvae burrow into the fruit to develop. Larvae exit fruit and overwinter under bark, under leaf litter or in the soil. Import of host fruit provides a potential pathway into the EU. Restrictions on the import of host plants for planting close other potential pathways. *G. inopinata* occurs in a range of climates in Asia, some of which also occur in the EU. Wild and commercially grown hosts are available within the EU. *G. inopinata* has the potential to establish within the EU. There could be one or two generations per year as in its native range. Impacts could occur in pome fruit orchards. The level of impacts would be uncertain. Phytosanitary measures are available to reduce the likelihood of introduction of *G. inopinata*. *G. inopinata* meets all the criteria assessed by EFSA PLH to satisfy the definition of a Union quarantine pest. *G. inopinata* does not meet the criteria of occurring within the EU, nor plants for planting being the principal means of spread, so does not satisfy all the criteria for it to be regarded as a Union regulated non-quarantine pest (RNQP).

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Keywords: Apple borer, Manchurian fruit moth, 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 Lucien 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.

[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

Grapholita inopinata (Heinrich) is one of a number of pests listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a quarantine pest or those of a regulated non-quarantine pest (RNQP) for the area of the 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.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *Grapholita inopinata* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database (13/9/2018), using the scientific name of the pest as the search term. Relevant papers were reviewed and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, 2018) and relevant publications.

Data about the import of commodity types that could potentially provide a pathway for the pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network hosted by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States (MS) and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

The Panel performed the pest categorisation for *G. inopinata* 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).

This work was initiated following an evaluation of the EU plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union quarantine pest and for a Union RNQP in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific terms of reference received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

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

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, *Grapholita inopinata* is a clearly defined insect species in the order Lepidoptera (moths and butterflies), family Tortricidae.

G. inopinata (Heinrich, 1928) has the common name Manchurian fruit moth. Synonyms include *Cydia inopinata* (Heinrich), *Cydia prunifoliae* (Kozhanchikov) and *Laspeyresia prunifoliae* (Kozhanchikov) (CABI, 2018).

3.1.2. Biology of the pest

In the northern area of its distribution in Far East Russia and Eastern Siberia, *G. inopinata* has one generation per year (Lopatina, 1978). In the southern area of its distribution in China and Japan, there are two generations per year (Smith et al., 1997; Tanaka et al., 2005). In Russia, mated females lay eggs singly during July on the underside of the leaves and on the surface of fruit of hosts, such as apples (Hang et al., 2000; Byun et al., 2012; Akulov and Kirichenko, 2014). A single female may lay up to 145 eggs. Eggs hatch after 6 or 7 days and larvae burrow into the fruit, feeding on the pulp as they tunnel beneath the surface and make their way towards the seeds where a larva will feed on a single seed (Lopatina, 1978). The larvae develop for 6–8 weeks before coming out through their original entry holes. There are four larval instars (Lopatina, 1978). Most fruit are infested by a single larva but up to five larvae have been recorded in a single fruit. In Siberia, most larvae exit infested fruit between late August and late September. Larvae overwinter in cocoons made under cracks of bark, in the soil and amongst leaf litter or under snow (Byun et al., 2012). Larvae and pupae are very resistant to cold and survive at temperatures of −29°C (Akulov and Kirichenko, 2014) and lower (e.g. −38 to −41°C; Lopatina, 1978). Adults emerge in late spring/early summer. Mating begins 2 days after adult emergence (Lopatina, 1978).

In China, where there are two generations, adults emerge in late May to late June. The second generation of adults emerges during August and September. Larvae from the second generation mature and begin overwintering in late September (Liu et al., 2010).

In Japan, where there are also two generations per year, the first adult generation peaks in mid- to late June, the second adult generation peaks in August (Tanaka et al., 2005). However, peak emergence in Japan will vary according to latitude. For example, in Nagano Prefecture (Central Honshu) the second generation peaks between late September and late October (Tanaka et al., 2007) which is later than those further south.

3.1.3. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, adults can be detected and populations monitored using sex pheromone traps (Tanaka et al., 2007; Akulov and Kirichenko, 2014). Light traps are not effective at trapping adults (Lopatina, 1978).

Infested fruit turn reddish brown in the area of infestation; such a symptom can be detected through visual inspections. Fruit suspected of being infested can be cut open to detect larvae.

Detection

Light green eggs are laid on the surface of fruit, or on the underside of leaves. Eggs on leaves are more difficult to detect (Lopatina, 1978). Using a hand lens (x10) will aid in detecting eggs. Larval feeding just beneath the surface of fruits, such as apple, is detectable due to the damaged part becoming discoloured (Liu et al., 2010, 2011; Akulov and Kirichenko, 2014). Fruit suspected on being infested should be cut open and inspected. Liu et al. (2011) provide a simple field key to distinguish 14 species of fruit boring insect pests (including *G. inopinata*) for northern China based on the host fruit, the age of the fruit, the position of the bore and recognisable pest features.

Identification

Smith et al. (1997) and CABI (2018) provide basic morphological descriptions of life stages (egg, larva, pupa and adult). Akulov and Kirichenko (2014) provide a more detailed description of larvae and adults.

3.2. Pest distribution

G. inopinata occurs over a broad climatic range in eastern Asia, from the subtropical climate in southern China to the continental climate of Eastern Siberia (Akulov and Kirichenko, 2014) (Figure 1).

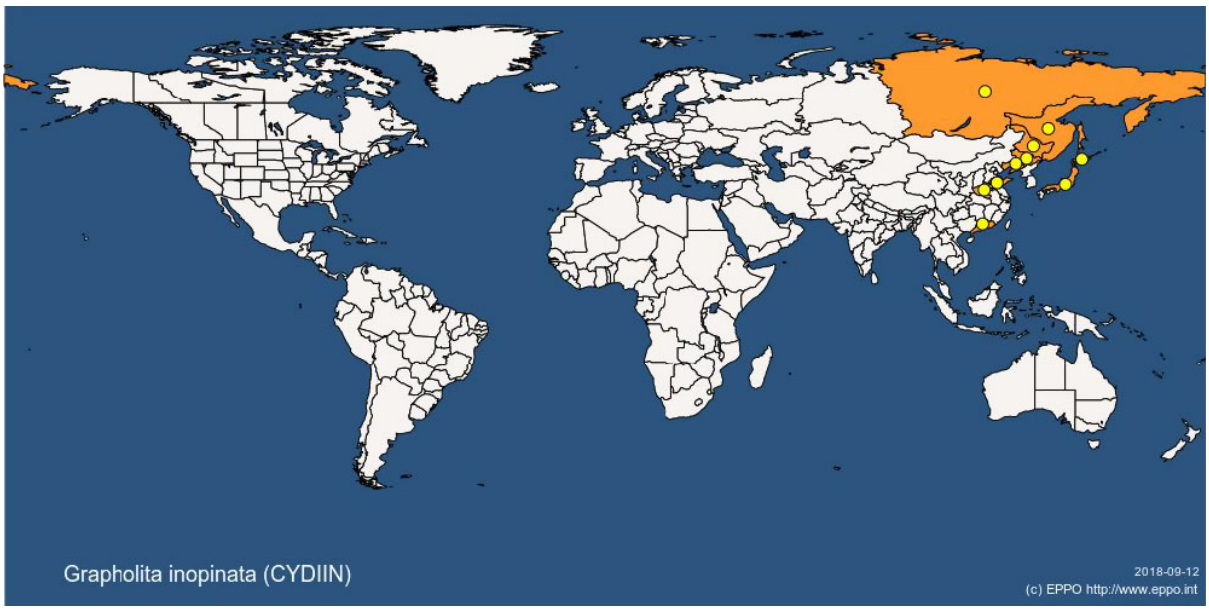

Figure 1: Global distribution of *Grapholita inopinata* (extracted from the EPPO Global Database accessed on 12/9/2018)

3.2.1. Pest distribution outside the EU

The distribution of *G. inopinata* outside of the EU is detailed in Table 2.

Table 2: Distribution of *Grapholita inopinata* outside the EU (Source: EPPO Global database, 2018)

Region	Country	Sub-national distribution (e.g. states/provinces)	Occurrence
Asia	China		Present, restricted distribution
		Guangdong	Present, no details
		Heilongjiang	Present, no details
		Henan	Present, no details
		Jilin	Present, no details
		Liaoning	Present, no details
		Shandong	Present, no details
	Japan		Present, no details
		Hokkaido	Present, no details
		Honshu	Present, no details
	North Korea		Absent, no longer present
	Russia		Present, restricted distribution
		Eastern Siberia	Present, no details
		Far East	Present, no details

G. inopinata is generally considered to occur in east and north-east Asia and has been reported from the Korean Peninsula (e.g. Zhu et al., 1969; Akulov and Kirichenko, 2014). However, CABI (2018) cite Bae and Park (1997) reporting *G. inopinata* as absent from Korea. EPPO (2018) also regards *G. inopinata* as not occurring in Korea. Byun et al. (2012) could not find specimens in collections examined and suggested that the distribution of *G. inopinata* in Korea is 'uncertain'.

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?

No, *Grapholita inopinata* is not known to occur in the EU.

G. inopinata is not known to occur in the EU. Slovenia declares that *G. inopinata* is absent from its territory on the basis that there are no records of it in the country (EPPO, 2018).

3.3. Regulatory status

As noted in Section 1.2 (interpretation of ToR) *G. inopinata* is an organism that is listed in 2000/29 EC. Details of the listing relating to *G. inopinata* and its hosts are presented in Tables 3 and 4.

3.3.1. Council Directive 2000/29/EC

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

Table 3: *Grapholita inopinata* in Council Directive 2000/29/EC

Annex II, Part A	**Harmful organisms whose introduction into, and spread within, all member states shall be banned if they are present on certain plants or plant products**	
Section I	**Harmful organisms not known to occur in the community and relevant for the entire community**	
(a)	**Insects, mites and nematodes, at all stages of their development**	
	Species	**Subject of contamination**
15.	*Grapholita inopinata* Heinrich	Plants of *Cydonia* Mill., *Malus* Mill., *Prunus* L. and *Pyrus* L., other than seeds, originating in non-European countries

3.3.2. Legislation addressing the hosts of *Grapholita inopinata*

Table 4: Regulated hosts and commodities that may involve *Grapholita inopinata* in Annexes III and V of Council Directive 2000/29/EC

Annex III, Part A	**Plants, plant products and other objects the introduction of which shall be prohibited in all Member States**	
	Description	**Country of origin**
9.	Plants of … *Cydonia* Mill., …, *Malus* Mill., *Prunus* L., *Pyrus* L., and …, intended for planting, other than dormant plants free from leaves, flowers and fruit	Non-European countries
18.	Plants of *Cydonia* Mill., *Malus* Mill., *Prunus* L. and *Pyrus* L. and their hybrids, and … intended for planting, other than seeds	Without prejudice to the prohibitions applicable to the plants listed in Annex III A (9), where appropriate, non-European countries, other than Mediterranean countries, Australia, New Zealand, Canada, the continental states of the USA
Annex V	**Plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community—in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community**	
Part B	**Plants, plant products and other objects originating in territories, other than those territories referred to in part A**	
I	**Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community**	
1	Plants, intended for planting, other than seeds […] *Prunus* L.….	
2	Parts of plants, other than fruits and seeds, of: — *Prunus* L., originating in non-European countries	
3	Fruits of: — *Cydonia* Mill.,…, *Malus* Mill., …, *Prunus* L., …, *Pyrus* L., …, originating in non-European countries	

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

G. inopinata is primarily a pest of apples (e.g. *Malus domestica, Malus prunifolia, Malus baccata*). Literature also reports quince (*Cydonia oblonga*) and pears (*Pyrus communis, Pyrus pyrifolia*) as hosts. The literature focusses on *Malus* spp. as hosts. Takizawa (1936) reported rearing *G. inopinata* on *Pyrus montana* (= *P. pyrifolia*) and *Pyrus betulifolia* and also on *Prunus davidiana*, *P. nakaii* and *P. triflora.* However, there are no records of *Prunus* as a natural host. Appendix A lists *G. inopinata* hosts and how literature regards the status of *G. inopinata* on each host (e.g. major host, minor host).

The legislation detailed in Section 3.3.2 does include the major hosts of *G. inopinata*. The legislation also includes measures on *Prunus*, which does not appear to be a natural host.

3.4.2. Entry

Is the pest able to enter into the EU territory?

Yes, *G. inopinata* could enter the EU as larvae in infested fruit; as overwintering larvae on parts of plants (cut branches) or plants for planting, or as larvae with soil around plants for planting.

Potential pathways into the EU are:

- plants for planting of *Malus, Cydonia* and *Pyrus*
- cut branches with leaves of *Malus, Cydonia* and *Pyrus*
- fruits of *Malus, Cydonia* and *Pyrus*.

Plants for planting with soil are a potential pathway. Overwintering larvae could be sheltering under bark or in the soil. However, plants for planting are likely to be sourced when dormant, i.e. without leaves and from fruit tree nursery sites rather than fruit producing orchards. If the plants for planting are dormant and have not yet been fruit bearing, there is little likelihood that eggs would be present on leaves or larvae in soil around the plants. As such there is little likelihood of plants for planting being a main pathway although the pathway cannot be ruled out entirely. For example, a nursery site may be located close to orchards. More importantly though, as noted in Section 3.3.2, plants for planting of *Cydonia*, *Malus* and *Pyrus* are banned from many countries, including all those where *G. inopinata* occurs (2000/29 EC, Annex III A 18). Hence plants for planting of these hosts can be considered as closed potential pathways.

The main potential pathway is:

- Infested host fruit

Fruits of the major host (apples) imported into the EU 28 from China, Japan and Russia, 2013–2017 are shown in Table 5. In Siberia, apples are often harvested in mid-September and *G. inopinata* larvae can still be present in fruit at that time.

Table 5: EU 28 import of fresh apples (CN 0808 10) from China, Russia and Japan, 2013–2017. Source: EUROSTAT. Accessed on 28 October 2018. Units, 100 kg

	2013	2014	2015	2016	2017
China	77,549	16,398	8,897	20,231	9,860
Russian Federation	965	2,908	9,821	1,378	412
Japan	2	2	2	8	104

An interrogation of EUROSTAT seeking import data for pears and quince combined (CN 0808 20) from China, Russia and Japan, 2013–2017 revealed that no such imports occurred. (Search conducted on 28 October 2018). However, a search for pear alone (0808 30) indicated that there were imports. The majority from China (Table 6). 300 kg of quince were imported from China and Japan in 2016 and 2017 (Table 7).

Table 6: EU 28 import of fresh pears (CN 0808 20) from China, Russia and Japan, 2013–2017. Source: EUROSTAT. Accessed on 28 October 2018. Units, 100 kg

	2013	2014	2015	2016	2017
China	103,517	63,020	94,541	113,851	111,976
Russian Federation	471	1,871	721	52	11
Japan	1	0	6	2	48

Table 7: EU 28 import of fresh quince (CN 0808 40) from China, Russia and Japan, 2013–2017. Source: EUROSTAT. Accessed on 28 October 2018. Units, 100 kg

	2013	2014	2015	2016	2017
China	:	:	:	:	2
Russian Federation	:	:	:	:	0
Japan	:	:	:	1	0

: data not available.

Apples, pears and quince provide potential pathways which are regulated. Fruits of quince (*Cydonia*), pear (*Pyrus*) and apples (*Malus*) from non-European countries require inspection before being permitted to enter the EU (2000/29 EC, Annex V, B 3.). Because *G. inopinata* larvae are internal feeders, they can be difficult to detect if symptoms are not detected. In addition, because the larvae feed inside the fruit, they would not be affected by packinghouse measures such as washing, brushing, and waxing, which treat the fruit surface only.

There are no records of *G. inopinata* in the EUROPHYT interceptions database (searched 12 September 2018) nor are there any records of *G. inopinata* in the EUROPHYT outbreaks database (searched 12 September 2018).

3.4.3. Establishment

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

Yes. Considering its distribution in eastern Asia within climate zones that also occur in the EU, and the availability of hosts outdoors in Europe, *G. inopinata* has the potential to establish in the EU.

3.4.3.1. EU distribution of main host plants

G. inopinata hosts such as apples and pears occur widely over the EU, growing as commercial crops and in small orchards and home gardens (de Rougemont, 1989). Hosts also occur as wild plants (e.g. crabapples). Table 8 shows the harvested area of key *G. inopinata* hosts grown in the EU. Appendix B provides the harvested area of apples and pears for individual EU member states.

Table 8: Harvested area of *Grapholita inopinata* hosts in EU (28) Member States 2013–2017 (ha). Source: EUROSTAT (apples F1110; pear F1250)

	2013	2014	2015	2016	2017
Apple	536,770	524,500	538,500	523,700	523,610
Pear	120,400	117,010	117,800	117,260	116,240

3.4.3.2. Climatic conditions affecting establishment

G. inopinata is distributed in areas of eastern China, Japan, eastern Siberia and Far East Russia (see Figure 1) within a variety of Köppen–Geiger climate zones. The global Köppen–Geiger climate zones (Kottek et al., 2006) describe terrestrial climate in terms of average minimum winter temperatures and summer maxima, amount of precipitation and seasonality (rainfall pattern). In eastern Asia, *G. inopinata* occurs in, for example, climate zone Cfa (humid, sub-tropical) which also occurs in the EU in Bulgaria, Romania, southern France, Spain and Italy. *G. inopinata* also occurs in climate zone Dfb (continental, uniform precipitation, warm summer) which occurs in the EU, e.g. in Austria, Czech Republic, Germany, Poland, Romania, Slovakia and other eastern EU Member States (MacLeod and Korycinska, 2019).

Recognising that *G. inopinata* occurs within a range of climatic zones, the pest exhibits some adaptability to environmental conditions. It is possible that if *G. inopinata* were to be introduced into the EU, it could adapt to EU climates closely related to those in its native range.

We assume that climatic conditions in the EU will not limit the ability of *G. inopinata* to establish.

3.4.4. Spread

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

Yes, adults could disperse and spread via flight. Larvae could disperse short distances by crawling.

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

No. Plants for planting are not likely to provide the main means of spread (see Section 3.4.2).

Adults and larvae are free living and could disperse naturally locally. Given that adults can fly, they would be able to spread further and faster than larvae. Akulov and Kirichenko (2014) report that adults are capable of 'flying excessively long distances' although no figures are given.

The adults have been observed flying after sunset for about one hour and a half (Lopatina, 1978).

3.5. Impacts

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

Yes, larval damage to host fruit could reduce yield and quality.

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

Yes. Although probably unlikely to be closely associated with plants for planting, the occurrence of *G. inopinata* on plants for planting could have an impact. Infested fruit plants, planted in orchards would be introducing a potentially serious pest that could affect future fruit yield and quality.

In East Asia, *G. inopinata* is one of the most serious fruit crop pests; in northeast China more than a third of the apple harvest can be damaged; 35–100% of *M. baccata* can be damaged in Siberia and 'massive damage' can be caused to *M. prunifolia* and large fruited varieties of *M. domestica* (Akulov and Kirichenko, 2014). Lopatina (1978) reported 78% of crabapple fruit were damaged by *G. inopinata*. Liu et al. (2010) report that fruit borers cause 15–20% loss in China. In a major apple growing area of China (Henan Province), fruit boring pests, including *G. inopinata* were generally well controlled in orchards during the 1980s and up to the mid-1990s, with infestation of fruit from all borers generally below 3% (Hang et al., 2000). However, as average winter and spring temperatures increased there was more damage caused to apples by fruit boring pests, including *G. inopinata*. Infestation rates by all fruit boring pests reached 15–20% in many orchards and up to 50% in inadequately managed orchards (Hang et al., 2000). Other factors that contributed to increased fruit borer damage included fruit growers neglecting physical pest control measures such as removal of waste from orchards; the development of pesticide resistance, and growers focussing only on what had been regarded as the key pest (*Carposina sasakii*). Hang et al. (2000) provided advice to restore control of apple fruit boring pests in China. Apple production in China now involves labour intensive wrapping of fruit to protect it from pests such as *G. inopinata* and to produce high quality apples (Kaya et al., 2006).

In Japan, there is little evidence that *G. inopinata* is a pest of economic importance. Tanaka et al. (2007) note that it was first reported damaging *M. prunifolia* in 1952 but that there was no subsequent spread and that there were no further reports of damage. During surveys to determine the occurrence of *G. inopinata* in apple growing regions, Tanaka et al. (2005) collected 9,192 fruits (5,042 *Malus toringo,* 1,246 *M. domestica,* 1,917 *M. prunifolia* and 987 other fruits of *Malus tschonoskii*, *Prunus persica*, *Prunus nipponica*, *Sorbus commixta*) from 'non-controlled apple orchards' and found two larvae of *G. inopinata*' one larva in *M. toringo*, one in *M. prunifolia*. 590 other species of

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

Lepidoptera larvae were detected in the survey. In a larger survey in 'controlled apple orchards', 50,275 apple fruits were collected and inspected. No *G. inopinata* were detected; three *Grapholita molesta* were detected.

3.6. Availability and limits of mitigation measures

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

Yes, existing measures designed to prevent entry are shown in 3.3.2. In summary, host plants for planting are prohibited, host fruit is inspected.

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

Yes, sourcing plants for planting from pest free areas (PFA) would mitigate the risk. If PFA is not possible, meticulous examination of soil free dormant plants for planting would mitigate the risk associated with plants for planting.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to the key main *G. inopinata* hosts (see Section 3.3.2). The potential pathway via plants for planting is regulated and considered closed (see Section 3.4.2). The pathway of fruit is open and regulated, with inspections required (Section 3.4.2).

Smith et al. (1997) judged that phytosanitary measures already applied to protect the EU and EPPO region from *Carposina niponensis* (=*sasakii*) would be sufficient to also adequately protect against *G. inopinata*. Nevertheless, additional control measures could be considered (see below).

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 9. Control measures are measures that have a direct effect on pest abundance. The control measures in Table 9 were selected from a longer list of possible control measures provided in EFSA PLH Panel (2018).

Table 9: Possible additional control measures to consider to reduce the likelihood of pest entry

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component affected
Physical treatments on consignments or during processing	Irradiation or ionisation treatments can be applied to fruits to destroy contaminating pests	Entry via fruit
Controlled atmosphere	Treatment of plants (fruit) by storage in a modified atmosphere (including modified humidity, O_2, CO_2, temperature, pressure)	Entry via fruit
Use of resistant and tolerant plant species/varieties	Resistant plants are used to restrict the growth and development of a specified pest and/or the damage they cause when compared to susceptible plant varieties under similar environmental conditions and pest pressureIt is important to distinguish resistant from tolerant species/varieties	Entry via fruit

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 10. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance. The supporting measures in Table 10 were selected from a longer list of possible supporting measures provided in EFSA PLH Panel (2018).

Table 10: Possible additional supporting measures to consider to reduce the likelihood of pest entry

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk element and pathway affected
Surveillance at origin (work in progress)	Required to provide evidence if sourcing fruit from pest free areas, or areas where plants are isolated from pest populations	Entry via fruit
Inspection and trapping	If fruit is sourced from PFA, PFPP or PFPS, inspection and trapping will be required to show pest freedom	Entry via fruit
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by a National Plant Protection Organization in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. Key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent the pursued phytosanitary objective. Traceability aims to provide access to all trustful pieces of information that may help to prove the compliance of consignments with phytosanitary requirements of importing countries	Entry via fruit

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

- Given the potential occurrence of wild hosts around orchards, it can be difficult to produce fruit in isolation.
- Changing environmental conditions led to the re-emergence of *G. inopinata* as a pest in parts of China.
- Because *G. inopinata* larvae are internal feeders they can be difficult to detect.
- As internal feeders, larvae are not affected by packinghouse measures such as washing, brushing, and waxing, which treat the fruit surface only.
- *G. inopinata* can survive temperatures as low as −41°C

3.7. Uncertainty

By its very nature of being a rapid process, there are uncertainties in a pest categorisation. However, the uncertainties listed below are insufficient to affect the conclusions of the categorisation.

- Fruit of *P. davidiana*, *P. nakaii* and *P. triflora*, have been used to rear *G. inopinata* although *Prunus* does not appear to be a natural host, i.e. in nature adult *G. inopinata* do not appear to lay eggs on *Prunus* spp. Whether *G. inopinata* could adapt to *Prunus* spp. in the EU is uncertain.
- The magnitude of potential impacts is uncertain. Management practices that control lepidopteran pests in EU orchards (i.e., the codling moth, *Cydia pomonella*) might be effective at limiting impacts from *G. inopinata* were it to establish.
- There may be differences in susceptibility to *G. inopinata* damage amongst fruit varieties grown in the EU compared to varieties grown in Russia (Far East and Siberia) China and Japan.

4. Conclusions

G. inopinata meets the criteria assessed by EFSA for consideration as a potential quarantine pest for the EU territory (Table 11).

Table 11: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants for *Grapholita inopinata* (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the pest is well established. *Grapholita inopinata* is a clearly defined insect species. Its taxonomy appears stable	The identity of the pest is well established. *Grapholita inopinata* is a clearly defined insect species. Its taxonomy appears stable	None
Absence/ presence of the pest in the EU territory (Section 3.2)	The pest is not known to occur in the EU. Therefore, the criterion of either absence or presence with restricted distribution for Union quarantine pest status is satisfied	The pest is not known to occur in the EU. Therefore, the criterion of widespread distribution within the EU for RNQP is not satisfied	None
Regulatory status (Section 3.3)	*Grapholita inopinata* is listed in Annex II AI of Council Directive 2000/29/EC, being regulated on plants of *Cydonia, Malus, Prunus and Pyrus,* other than seeds, originating in non-European countries	*Grapholita inopinata* is currently regulated as a quarantine pest in the EU. The EFSA PLHP are not aware of any grounds to consider its status as such should be revoked	None
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	The pest could enter and establish in the EU. The main pathways are infested *Malus* fruit from Far East Russia, Siberia and China	Spread via plants for planting is not the main means of spread	*Prunus* is not reported to be a natural host. Whether infested *Prunus* fruit could provide a pathway is uncertain
Potential for consequences in the EU territory (Section 3.5)	The establishment of *G. inopinata* in the EU could have an economic impact especially on hosts such as apples and pears	Although unlikely to be closely associated with plants for planting, the occurrence of *G. inopinata* on plants for planting would have an impact, i.e. introducing a potentially major pest into a production site	The magnitude of potential impacts is uncertain
Available measures (Section 3.6)	There are measures available to prevent the likelihood of entry into the EU (i.e. inspect imported fruits; apply treatments to fruit)	There are measures available to prevent pest presence on plants for planting (e.g. source plants from PFA)	None
Conclusion on pest categorisation (Section 4)	*Grapholita inopinata* meets all of the criteria assessed by EFSA PLHP to satisfy the definition of a Union quarantine pest	*Grapholita inopinata* does not meet the criteria of (a) occurring within the EU, and (b) plants for planting being the principal means of spread. Hence it does not satisfy all of the criteria that are within the remit of EFSA to assess for it to be regarded as a Union regulated non-quarantine pest	None
Aspects of assessment to focus on/ scenarios to address in future if appropriate	No particular aspect of this categorisation stands out as regards requiring particular attention in any future risk assessment		

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Abbreviations

CN	Combined nomenclature (8 digit code building on HS codes to provide greater resolution)
DD	Degree days
DG	SANTÉ Directorate General for Health and Food Safety
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
HS	Harmonized System (6 digit World Customs Organization system to categorize goods)
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PFA	Pest Free Areas
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
RNQP	regulated non-quarantine pest
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Glossary

(terms are as defined in ISPM 5 unless indicated by +)

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)
Control measures+	Measures that have a direct effect on pest abundance
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)
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 (RNQP)	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)
Supporting measures+	Organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance

Appendix A – *Grapholita inopinata* hosts

Host plants recorded in CABI (2018), EPPO (2018) and other literature are listed below. CABI and EPPO use different terms to describe the relationship between pest and plant (CABI: Main, Other, Wild; EPPO: Major, Minor, Incidental, Wild/Weed, Unclassified).

Plant name	Common name	Host status (reference)
Malus domestica	Apple	Main host (CABI, 2018); Major host (EPPO, 2018)
Malus baccata (= *M. pallasiana*)	Siberian crabapple	Main host (CABI, 2018); Wild host (EPPO, 2018); Native host (Smith et al., 1997)
Malus prunifolia	Chinese crabapple	
Malus toringo	Japanese crabapple	Wild host (Tanaka et al., 2007)
Cydonia oblonga	Quince	Other host (CABI, 2018); Minor host (EPPO, 2018)
Pyrus betulifolia	Birchleaf pear	Experimental host (Takizawa, 1936)
Pyrus communis	European pear	Other host (CABI, 2018); Minor host (EPPO, 2018)
Pyrus pyrifolia	Asian pear	Other host (CABI, 2018)
Prunus davidiana	Chinese wild peach	Experimental host (Takizawa, 1936)
Prunus nakaii [(a)]		Experimental host (Takizawa, 1936)
Prunus triflora [(a)]		Experimental host (Takizawa, 1936)

(a): Not an accepted species name (Royal Botanic Gardens Kew, 2018).

Appendix B – Harvested area of key hosts in individual EU Member States

Apples area (cultivation/harvested/production) (1,000 ha)
Source: EUROSTAT F1110. Accessed 26 July 2018

Country	2013	2014	2015	2016	2017
European Union	536.77	524.50	538.50	523.70	523.61
Belgium	7.06	7.07	6.87	6.49	6.16
Bulgaria	4.81	3.95	4.77	4.11	3.97
Czech Republic	8.98	8.96	8.31	7.49	7.35
Denmark	1.38	1.38	1.39	1.35	1.28
Germany	31.74	31.74	31.74	31.74	33.98
Estonia	0.90	0.90	0.60	0.51	0.69
Ireland	0.62	0.64	0.64	0.70	0.70
Greece	12.95	12.26	11.85	9.94	9.67
Spain	30.79	30.73	30.72	30.87	30.55
France	50.68	50.17	49.65	49.65	50.31
Croatia	5.80	5.94	5.76	5.89	5.80
Italy	53.01	52.00	52.16	56.16	57.26
Cyprus	0.63	0.61	0.61	0.53	0.50
Latvia	2.80	2.70	2.40	2.40	3.30
Lithuania	11.67	11.27	10.68	9.70	9.82
Luxembourg	0.24	0.24	0.26	0.26	0.27
Hungary	33.36	33.26	32.80	32.80	32.09
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	7.91	7.85	7.60	7.30	7.00
Austria	6.97	6.76	6.62	6.67	6.67
Poland	162.40	163.10	180.40	164.76	:
Portugal	13.66	13.85	14.01	14.98	14.79
Romania	60.28	56.13	55.88	55.53	55.80
Slovenia	2.64	2.55	2.47	2.42	2.36
Slovakia	3.65	2.56	2.38	2.31	2.18
Finland	0.59	0.60	0.63	0.62	0.63
Sweden	1.26	1.29	1.33	1.54	1.58
United Kingdom	20.00	16.00	16.00	17.00	16.60

Pears area (cultivation/harvested/production) (1,000 ha)
Source: EUROSTAT F1250. Accessed 16 July 2018

Country/year	2013	2014	2015	2016	2017
European Union	120.40	117.01	117.80	117.26	154.21
Belgium	8.92	9.08	9.34	9.69	10.02
Bulgaria	0.45	0.34	0.53	0.41	0.45
Czech Republic	0.90	0.88	0.79	0.74	0.71
Denmark	0.35	0.36	0.34	0.30	0.30
Germany	1.93	1.93	1.93	1.93	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	4.82	4.97	4.95	4.08	3.78
Spain	24.24	23.64	22.88	22.55	21.89
France	5.35	5.36	5.37	5.30	5.25
Croatia	0.80	1.04	0.90	0.93	0.90
Italy	31.53	30.15	30.86	32.29	31.73

Country/year	2013	2014	2015	2016	2017
Cyprus	0.09	0.08	0.07	0.07	0.07
Latvia	0.20	0.20	0.20	0.20	0.20
Lithuania	0.86	0.90	0.87	0.80	0.82
Luxembourg	0.02	0.02	0.02	0.02	0.02
Hungary	3.00	2.89	2.88	2.88	2.87
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	8.51	8.60	9.23	9.40	9.70
Austria	0.48	0.44	0.45	0.46	0.46
Poland	9.50	9.20	9.20	7.49	:
Portugal	12.01	12.01	12.12	12.62	12.56
Romania	3.91	3.46	2.91	3.15	3.14
Slovenia	0.22	0.21	0.20	0.20	0.20
Slovakia	0.17	0.13	0.11	0.11	0.11
Finland	0.00	0.00	0.04	0.04	0.04
Sweden	0.14	0.13	0.13	0.12	0.12
United Kingdom	2.00	1.00	1.48	1.50	1.50