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Pest categorisation of *Anthonomus grandis*

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Abstract

The European Commission requested EFSA to conduct a pest categorisation of *Anthonomus grandis* (Coleoptera: Curculionidae), an oligophagous pest weevil feeding on Malvaceae, including *Gossypium* spp., *Hampea* spp., *Cienfuegosia* spp. and *Hibiscus pernambucensis*. Marginal reproduction has also been observed on the ornamental *Hibiscus syriacus*. *A. grandis* is a taxonomic entity with reliable methods available for identification. It is regulated in the EU by Council Directive 2000/29/EC where it is listed in Annex IIB as a harmful organism whose introduction into EU Protected Zones (PZ) (Greece and the Spanish Communities of Andalusia, Catalonia, Extremadura, Murcia and Valencia) is regulated. *A. grandis* is native to tropical regions of Mesoamerica and has spread to other cotton-growing areas in the Americas, from the USA to Argentina, causing significant damage to this crop. An eradication programme is in progress in the USA and has been successful in 16 previously infested states. In the EU, phytosanitary measures are in place in order to limit entry via traded commodities. Cotton seeds and fruit, as well as unginned cotton are currently regulated for the PZ but remain a potential pathway. Furthermore, ornamental Malvaceae (e.g. *Hibiscus* spp.) originating in infested areas may provide additional pathways. The EFSA Plant Health Panel concludes that *A. grandis* could establish and spread in the cotton-growing areas of southern EU. Considering the criteria within the remit of EFSA to assess the status as a potential Union quarantine pest (QP), as a potential protected zone quarantine pest (PZQP), or as a potential regulated non-quarantine pest (RNQP), *A. grandis* satisfies with no uncertainties the criteria to be regarded as a Union QP. However, it does not meet the criterion of occurrence in the EU territory (for PZQP) plus that of plants for planting being the principal means of spread (for RNQP).

Keywords: European Union, pest risk, plant health, plant pest, quarantine, cotton, boll weevil

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1. Introduction

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

1.1.1. Background

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

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

1.1.2. Terms of Reference

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

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

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

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

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

[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

Anthonomus grandis is one of a number of pests listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a quarantine pest or those of a regulated non-quarantine pest (RNQP) for the area of the European Union (EU) excluding Ceuta, Melilla and the outermost regions of Member States (MSs) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

Unusually for a pest that is not present in the EU, *A. grandis* is specifically regulated in some protected zones (PZ), (Greece and the Spanish Autonomous Communities of Andalusia, Catalonia, Extremadura, Murcia and Valencia). The categorisation will explore whether the pest fulfils the criteria set in Regulation (EU) 2016/2031 regarding union quarantine pests (QPs), RNQP and protected zone quarantine pests (PZQP).

2. Data and methodologies

2.1. Data

2.1.1. Literature search

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

2.1.2. Database search

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

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

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network launched by the Directorate General for Health and Consumers (DG SANCO), and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant

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

2.2. Methodologies

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

In accordance with the guidance on a harmonised framework for pest risk assessment in the EU (EFSA PLH Panel, 2010), this work was initiated following an evaluation of the EU's plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union QP and for a Union RNQP in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required as per the specific terms of reference received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

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

It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regards to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, while addressing social impacts is outside the remit of the Panel, in agreement with EFSA guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010).

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

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/ presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism.	Is the pest present in the EU territory? If not, it cannot be a regulated non-quarantine pest. (A regulated non-quarantine pest must be present in the risk assessment area).

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future.	The protected zone system aligns with the pest free area system under the International Plant Protection Convention (IPPC). The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone).	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met.	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential regulated non-quarantine pest were met, and (2) if not, which one(s) were not met.

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

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible? (Yes or No)

YES, the identity of *Anthonomus grandis* (Coleoptera: Curculionidae) is well established

Anthonomus grandis (Coleoptera: Curculionidae) was described by Boheman in 1843 (Boheman, 1843) and is considered the valid name for this species (ITIS, 2017), which is also known as Mexican cotton boll weevil in English, picudo del algodón in Spanish, bicudo-do-algodoeiro in Portuguese and charançon américain du cotonnier in French. This species had been traditionally segregated into three subspecies based on adult morphological and behavioural characteristics (Burke et al., 1986) (see Section 3.1.3). Species-specific taxonomic keys for the different stages of this weevil are available (see Section 3.1.4).

3.1.2. Biology of the pest

In the USA, *A. grandis* adults usually migrate from cotton fields at the end of the season and hibernate in forest litter or on various malvaceous hosts, including volunteer and regrowth cotton in warmer areas. They may also survive in larval cells in cotton bolls where they enter diapause until the summer rains (100–175 mm) free them. About 95% of hibernating adults die because of biotic (natural enemies) and abiotic (temperature, moisture) factors (Rummel and Curry, 1986; EPPO, 1992; de Ribeiro et al., 2010). In the spring, as temperature rises, the adult resumes development and is able to disperse long distances to colonise cotton fields, predominantly during squaring-flowering stages (Neff and Vanderzant, 1963; Smith et al., 1965). In Texas, peak emergence of overwintered adults occurs in mid-May. The emerging adults cut their way out of the flowers or bolls. They feed on developing cotton foliage and female ovary development depends on a pollen diet (Rummel and Curry, 1986). Although adults can feed on pollen of a great variety of plant species (Jones and Coppedge, 1999; Pimenta et al., 2016), larvae can only complete their life cycle on a small number of plant species of the tribe Gossypieae (Malvaceae), to which cotton (*Gossypium* spp.) belongs (Lukefahr et al., 1986; Gabriel, 2002). When male boll weevils start feeding on cotton squares, their aggregation pheromone production increases, intensifying the attraction and aggregation of more males and females in the area (White and Rummel, 1978; Leggett, 1986). After feeding for 3–7 days, adults mate and within the subsequent 20 min females can start ovipositing at a rate of one egg per hour in daylight. Eggs are laid singly in cotton flower buds. In cases of high weevil populations and shortage of buds, more than one egg may be laid in one bud. However, this is of minor significance since only one weevil matures in a flower. Late in the season, eggs are laid both in flower buds and in young bolls. Under favourable conditions, the life cycle of *A. grandis* is completed in 17–21 days and as many as seven generations may develop in a year in the extreme southern part of the Cotton Belt in the USA (e.g. southern Texas). Eggs hatch in 3–5 days. The larvae feed for 7–12 days inside the flower or boll and then pupate. This stage lasts 3–5 days. In Arizona, high temperatures during June–August were reported to suppress boll weevil populations.

3.1.3. Intraspecific diversity

The species *A. grandis* had previously been segregated on the basis of several adult characteristics (including morphological and behavioural traits) into three subspecies (Warner, 1966; Cross, 1973; Burke et al., 1986; Barr et al., 2013):

- The south-eastern boll weevil (*Anthonomus grandis grandis*), feeding on commercial cotton,
- The Thurberia or Arizona wild cotton boll weevil (*Anthonomus grandis thurberiae*), feeding on *Gossypium thurberi* Todaro (wild cotton, also known as *Gossypium thurberiae*), which could be found in southern Arizona and northern regions of Sonora, Mexico, and was not regarded as a significant pest of commercial cotton, and

- The Mexican boll weevil, an intermediate form found on *Gossypium hirsutum* and different wild hosts including *Gossypium davidsonii* Kell, *Gossypium barbadense* L., *Hampea rovirosae* Standley and also *G. thurberi*.

Recent analyses of nucleotide sequences from a segment of the mitochondrial cytochrome *c* oxidase subunit I (*COI*) gene of Mexican and USA *A. grandis* populations (Alvarado et al., 2017) showed that boll weevils partitioned into two clusters: 'western' and 'eastern'. Importantly, no evidence was found for host plant-associated genetic differentiation in either group. The level of genetic divergence and lack of shared *COI* haplotypes, combined with five apparent fixed nucleotide differences between the two groups and earlier evidence of reproductive isolation, together provide strong support for reinstating the subspecies names, *Anthonomus grandis thurberiae* Pierce and *A. grandis grandis* Boheman, for the western and the eastern lineages, respectively.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, *A. grandis* can be detected in the field by visual inspection and use of its aggregation pheromone (grandlure). Damage symptoms can be easily seen. The species can be identified by examining morphological features, for which keys exist.

Morphology:

Larva: Ahmad and Burke (1972) provide a detailed description and a key for this stage. Mature white legless larvae are 5.6–8.1 mm in length, robust, thickest through middle abdominal segments, distinctly curved, tapered towards posterior end (CABI, 2017).

Pupa: Burke (1968) provides a description and key to the pupa, which is white and 6.6–7.4 mm long. Anderson (1968) described the pupae of *A. g. grandis* and *A. g. thurberiae*, and identified diagnostic features to distinguish them (CABI, 2017).

Adult: Dietz (1891) provides a key to North American *Anthonomus* spp., including *A. grandis*. Jones and Burke (1997) keyed the *A. grandis* species group. Adults measure about 5 mm without the rostrum, which is 3 mm long and round. They are elongated oval, grey-brown to almost black reddish-brown in colour. Antennae are slightly paler (CABI, 2017).

Symptoms:

The early stage of *A. grandis* attack is recognisable by a small puncture (either egg or feeding scars) at the side of the cotton flower bud which induces its abscission 5–8 days later: the bracteoles spread out, and buds turn brown and fall off. In later attacks, flowers turn yellow and fall to the ground, as do small bolls. Punctured large bolls usually remain on the plant and will be of poor quality (White and Rummel, 1978; EPPO, 1992; Showler, 2008; Neves et al., 2013).

Pheromone:

A. grandis adults can be trapped with the synthetic aggregation pheromone 'grandlure' (Benedict et al., 1985). This is used either to ensure compliance with eradication programmes (Suh et al., 2011) or early in the season to time the first insecticide applications (Henneberry et al., 1988). However, captures decline considerably during the squaring-flowering stage of cotton (Lloyd, 1986; Rummel and Curry, 1986; Neves et al., 2013) suggesting that host plant volatiles produced at the reproductive stage may modulate boll weevil attraction to its pheromone (Silva et al., 2015).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Anthonomus grandis is indigenous to Mesoamerica (probably from southern Mexico and Guatemala) (EPPO, 1992). Around 1892, this weevil invaded southern Texas (Burke et al., 1986) and subsequently spread throughout southeastern USA to the Atlantic coast causing enormous economic losses in cotton (*G. hirsutum* L.). The enormous economic impact of the invasion prompted pioneering research efforts in pest management, which lead to the successful eradication of the boll weevil in all cotton-producing areas of the USA in 2015, with the exception of relatively small populations in southern Texas (TBWEF, 2017; NCC, 2016). *A. grandis* also invaded South America during last century (Figure 1). The pest was

first reported from Venezuela in 1949 and has since dispersed southward to the primary cotton-producing regions of Argentina, Brazil, Colombia, Bolivia, Paraguay and Venezuela, (Ramalho and Wanderley, 1996; Durán Parada, 2000; Scataglini et al., 2006; Stadler and Buteler, 2007).

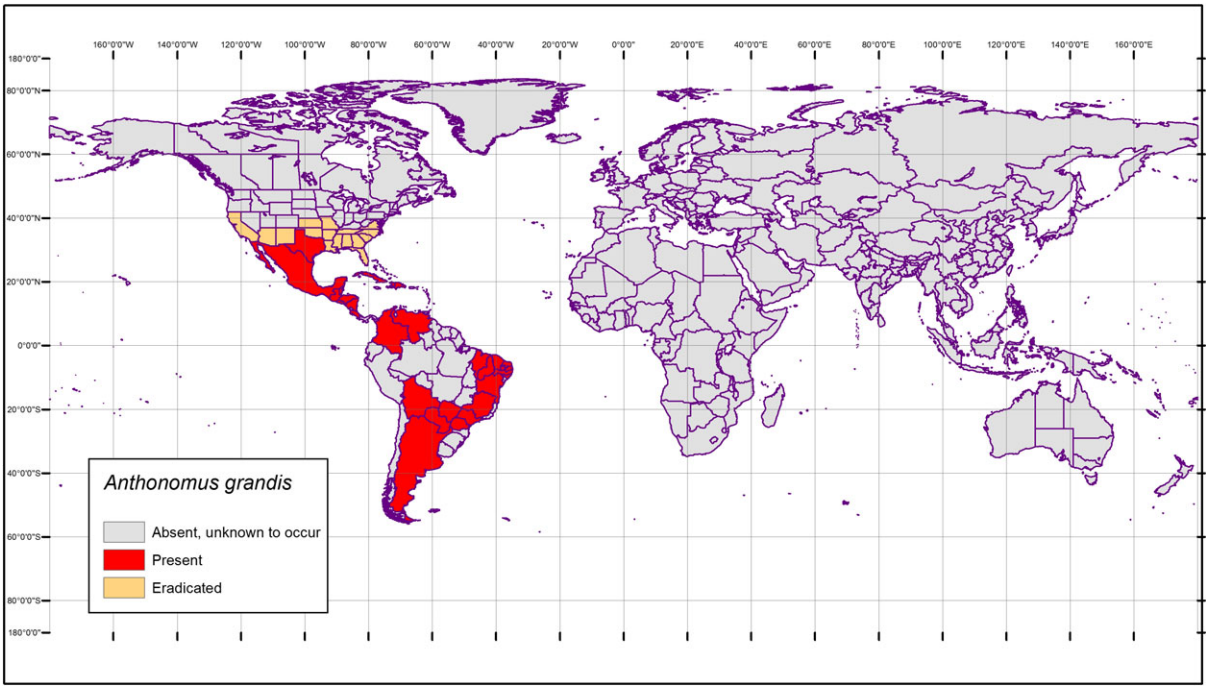

Figure 1: Global distribution of *Anthonomus grandis* based on data presented in Table 2

Table 2: *Anthonomus grandis* world distribution

Country	Sub-country records	Source
Argentina	Restricted distribution	EPPO (2017)
Belize	Present	EPPO (2017)
Bolivia	Restricted distribution (piedmont areas)	Durán Parada (2000); Scataglini et al. (2006)
Brazil	Alagoas (present)	EPPO (2017)
	Bahia (present)	EPPO (2017)
	Ceara (present)	EPPO (2017)
	Maranhão (present)	EPPO (2017)
	Mato Grosso do Sul (present)	EPPO (2017)
	Minas Gerais (present)	EPPO (2017)
	Paraiba (present)	EPPO (2017)
	Parana (present)	EPPO (2017)
	Pernambuco (present)	EPPO (2017)
	Piraui (present)	EPPO (2017)
	Rio Grande do Norte (present)	EPPO (2017)
	São Paulo (present)	EPPO (2017)
Colombia	Restricted distribution	EPPO (2017)
Costa Rica	Present	EPPO (2017)
Cuba	Widespread	EPPO (2017)
Dominican Republic	Widespread	EPPO (2017)
Ecuador	Absent, invalid record	EPPO (2017)
El Salvador	Present	EPPO (2017)
Guatemala	Present	EPPO (2017)

Country	Sub-country records	Source
Haiti	Widespread	EPPO (2017)
Honduras	Present	EPPO (2017)
Martinique (French DOM)	Present	EPPO (2017)
Mexico	Widespread (native), under eradication in some northern states close to the US border	EPPO (2017); NCC (2016)
Nicaragua	Present	EPPO (2017)
Paraguay	Restricted distribution	EPPO (2017)
Peru	Unreliable record not supported by evidence	Alvarado et al. (2017)
Saint Kitts and Nevis	Present	EPPO (2017)
US	Alabama (eradicated)	EPPO (2017)
	Arizona (eradicated)	EPPO (2017)
	Arkansas (eradicated)	NCC (2016)
	California (eradicated)	EPPO (2017)
	Florida (eradicated)	EPPO (2017)
	Georgia (eradicated)	EPPO (2017)
	Kansas (eradicated)	NCC (2016)
	Louisiana (eradicated)	NCC (2016)
	Mississippi (eradicated)	NCC (2016)
	Missouri (eradicated)	NCC (2016)
	New Mexico (eradicated)	NCC (2016)
	North Carolina (eradicated)	EPPO (2017)
	Oklahoma (eradicated)	NCC (2016)
	South Carolina (eradicated)	EPPO (2017)
	Tennessee (eradicated)	NCC (2016)
	Texas (present; under eradication)	NCC (2016); TBWEF (2017)
	Virginia (eradicated)	EPPO (2017)
Venezuela	Widespread	EPPO (2017)

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, *A. grandis* is not known to occur in the EU territory (EPPO, 2017).

EPPO Global database (2017) reports that *A. grandis* is absent from EU. The absence from Greece, Italy and Spain has been confirmed by surveys conducted by the respective NPPOs to comply with PZ requirements.

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

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

Table 3: Pest in Council Directive 2000/29/EC

Annex II, Part B	HARMFUL ORGANISMS WHOSE INTRODUCTION INTO, AND WHOSE SPREAD WITHIN, CERTAIN PROTECTED ZONES SHALL BE BANNED IF THEY ARE PRESENT ON CERTAIN PLANTS OR PLANT PRODUCTS		
(a)	Insects, mites and nematodes, at all stages of their development		
	Species	Subject of contamination	Protected zone(s)
1.	*Anthonomus grandis* (Boh.)	Seeds and fruits (bolls) of *Gossypium* spp. and unginned cotton	EL, E (Andalucia, Catalonia, Extremadura, Murcia, Valencia)

3.3.2. Legislation addressing plants and plant parts on which *Anthonomus grandis* is regulated

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

Annex V	**PLANTS, PLANT PRODUCTS AND OTHER OBJECTS WHICH ARE POTENTIAL CARRIERS OF HARMFUL ORGANISMS OF RELEVANCE FOR CERTAIN PROTECTED ZONES, AND WHICH MUST BE ACCOMPANIED BY A PLANT PASSPORT VALID FOR THE APPROPRIATE ZONE WHEN INTRODUCED INTO OR MOVED WITHIN THAT ZONE**
Part A	Plants, plant products and other objects originating in the Community
Section II	Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for certain protected zones, and which must be accompanied by a plant passport valid for the appropriate zone when introduced into or moved within that zone
1.9.	Fruits (bolls) of *Gossypium* spp. and unginned cotton
Part B	Plants, plant products and other objects originating in territories, other than those territories referred to in part A
Section II	Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for certain protected zones
6.	Seeds and fruits (bolls) of *Gossypium* spp. and unginned cotton.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

Anthonomus grandis is an oligophagous species feeding on a few genera within the tribes Gossypieae and Hibisceae (family Malvaceae). Its main host is cultivated cotton, mostly *G. hirsutum*. Both *A. grandis* subspecies (*A. grandis grandis* and *A. grandis thurberiae*) have been found on a few additional species of tribe Gossypieae including *G. barbadense*, wild *Gossypium* spp., *Hampea* and *Cienfuegosia*. *A. grandis grandis* only has been found on the Hibisceae *Hibiscus pernambucensis* (Alvarado et al., 2017). Marginal reproduction has also been observed on the ornamental *Hibiscus syriacus* (EPPO, 2017). Both wild EU Malvaceae and non-indigenous ornamental *Hibiscus* spp. might be attacked and act as reservoirs (EPPO, 1992) sustaining overwintering adults feeding on their pollen (Pimenta et al., 2016).

Current EU legislation regulates *A. grandis* in seeds and fruit of *Gossypium* spp. and unginned cotton. However, there are other hosts (e.g. ornamental Malvaceae like *Hibiscus* spp.), which remain unregulated and could potentially provide additional pathways for entry into the EU.

3.4.2. Entry

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

Yes, *A. grandis* could enter the EU in cotton seeds or bolls, unginned cotton, and probably on ornamental Malvaceae

In international trade, boll weevils may be carried with:

- cotton seeds or bolls (fruit),
- unginned (raw) cotton, and
- ornamental Malvaceae plants for planting (e.g. *Hibiscus* spp.)

originating from the infested areas in the Americas.

The first two pathways are regulated only for the EU PZ by existing EU legislation. Moreover, ornamental Malvaceae plants for planting may provide a plausible pathway for *A. grandis* into the EU. The Netherlands NPPO kindly provided detailed trade inspection data regarding plants for planting from 2012 to 2014. These data show that *Hibiscus* spp. were imported several times from Costa Rica in 2012 and 2013, indicating that this possible pathway into the EU exists.

No records of interception of *A. grandis* in the Europhyt database exist.

3.4.3. Establishment

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

YES, the pest would be able to establish in the EU

3.4.3.1. EU distribution of main host plants

According to EUROSTAT, cotton is grown in three EU countries. The average cultivated area in these countries in 2011–2016 was: 1.55×10^3, 340.84×10^3, and 79.72×10^3 ha in Bulgaria, Greece and Spain, respectively. According to FAOSTAT (online), cotton is also grown in two additional EU Ms: Italy and Romania.

3.4.3.2. Climatic conditions affecting establishment

Although *A. grandis* is considered as a subtropical pest (EPPO, 2014), it has been found in many climatic zones in the Americas, from northern Argentina to southern USA, including California. Therefore, this species is not restricted to humid regions and can survive in hot, arid regions (e.g. southwestern USA). As a consequence, EU Mediterranean countries where cotton is grown may provide conditions for establishment (EPPO, 1992, 2014).

3.4.4. Spread

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

Yes, as a free living organism, flying adults may spread over long distances within the EU following introduction.

A. grandis is able to disperse long distances to colonise cotton fields, predominantly during squaring-flowering stages (Neff and Vanderzant, 1963; Smith et al., 1965). Plants for planting are not the main means of spread of this species.

3.5. Impacts

Sources: impact reports and other literature

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

Yes, *A. grandis* is considered a key pest of cotton. Unless control measures are adopted, damage can lead to total crop loss.

The cotton boll weevil, *A. grandis*, has been the most important cotton insect pest in the US. Due to the Boll Weevil Eradication Program, boll weevil populations have been almost completely eradicated from this country (Table 2). In South America, nevertheless, the insect populations are still causing great damage to the cotton crops, destroying cotton plant floral buds and bolls. Due to their high reproductive rate in tropical areas and to the endophytic behaviour of earlier developmental stages, infestation levels increase fast and unless control measures are adopted, damage can lead up to total loss of production (Martins et al., 2007; Firmino et al., 2013).

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, the combination of different measures can even allow eradication, as achieved in most of the cotton producing states of USA.

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

- High reproductive rate, especially in tropical climates (extremely uncommon in continental EU),
- Early stages remain hidden within flower and fruit (bolls),
- Adults can fly long distances from overwintering sites to cotton fields,
- The aggregation pheromone, which can be used for monitoring and mass trapping, becomes less attractive during cotton squaring,
- Ploughing the cotton stalk residue places the boll weevil larvae and pupae in a dark and generally moist environment which may be conducive for over-wintering in warm areas, and
- Ineffectiveness of chemical control and its harmful side-effects.

3.6.2. Control methods

Different control methods can be used in combination (Integrated Pest Management (IPM)) with the final goal of achieving the eradication of the weevil. These techniques are:

- Biotechnological control: use of transgenic Bt-cotton (cotton encoding one of the *Bacillus thuringiensis* Berliner (Bt) subsp. *kurstaki* cry genes); use of the sterile insect technique (SIT); use of pheromones (e.g. the aggregation pheromone grandlure) either for monitoring or for mass-trapping;
- Biological control: conservation biological control; inundative biological control with the entomopathogenic bacterium *B. thuringiensis* and the entomopathogenic fungus *Beauveria bassiana*;
- Chemical control: use of different pesticides, often timed according to pheromone captures;
- Cultural control: suppression of overwintering sites (e.g. cotton regrowth), destruction of fallen lower buds; delayed planting;
- Use of resistant cultivars.

3.7. Uncertainty

1) The actual status of ornamental Malvaceae (e.g. *Hibiscus* spp.) imported from infested areas in the Americas, which could constitute an open pathway. The genus *Hibiscus* has been reported as a marginal host and there is high uncertainty on the exact meaning of 'marginal' and whether plants belonging to this genus could support full development of *A. grandis*.
2) The actual status of wild Malvaceae in the EU, which could act as reservoir for the pest. There is high uncertainty as the main hosts of *A. grandis* belong to the tribe Gossypiae (fam. Malvaceae) and this tribe is distributed pantropically, mostly in arid habitats (Hinsley, 2014), not in Europe.

4. Conclusions

Considering the criteria within the remit of EFSA to assess the status as a potential Union QP, as a potential PZQP, or as a potential RNQP, *A. grandis* satisfies with no uncertainties the criteria to be regarded as a Union QP (Table 5). However, it does not meet the criterion of occurrence in the EU territory (for PZQP) plus that of plants for planting being the principal means of spread (for RNQP).

Table 5: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the pest is established. Both conventional taxonomic keys based on morphology and molecular methods can be used to identify *A. grandis*.	The identity of the pest is established. Both conventional taxonomic keys based on morphology and molecular methods can be used to identify *A. grandis*.	The identity of the pest is established. Both conventional taxonomic keys based on morphology and molecular methods can be used to identify *A. grandis*.	None
Absence/presence of the pest in the EU territory (Section 3.2)	The pest is not known to occur in the EU territory.	The pest is not known to occur in the EU territory. Therefore, it does not meet a criterion required for a protected zone quarantine pest (PZQP).	The pest is not known to occur in the EU territory. Therefore, it does not meet a criterion required for a regulated non-quarantine pest (RNQP).	None
Regulatory status (Section 3.3)	The pest is not known to occur in the EU. However, it is under official surveillance in EU protected zone areas (Greece and the Spanish Autonomous Communities of Andalucia, Catalonia, Extremadura, Murcia, and Valencia).	Because the pest is currently not known to occur in the EU, it does not meet a criterion required PZQP.	Because the pest is not currently regulated as a quarantine pest, there are no grounds to consider its status could be revoked.	None
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	The pest is able to enter into, become established in, and spread within, the EU territory. Seeds and fruit of cotton and unginned cotton are the main pathways, which are presently regulated but not closed. Ornamental Malvaceae plants for planting originating in infested countries may represent an additional plausible pathway. Spread is mainly via natural spread of flying adult weevils.	The pest is able to enter into, become established in, and spread within, the EU territory, including the protected zone areas.	Spread is mainly via natural spread of flying adult weevils. Plants for planting is not the main pathway.	The actual status of ornamental Malvaceae and that of wild Malvaceae in the EU

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 protected zone quarantine pest (articles 32–35)	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Potential for consequences in the EU territory (Section 3.5)	The pests' introduction would most probably have economic and environmental impacts on the EU territory. Cotton cultivation and wild Malvaceae could be impacted.	The pests' introduction would most probably have economic and environmental impacts on the EU territory, including the protected zone areas.	The presence of the pest on plants for planting would most probably have an economic impact. However, as plants for planting is not the main means of spread of this pest, this impact could be irrelevant.	The actual status of ornamental Malvaceae and that of wild Malvaceae in the EU
Available measures (Section 3.6)	There are measures available to prevent the entry into, establishment within and spread of the pest within the EU. These measures (biotechnical, cultural, chemical and biological control methods) have even allowed the pest to be successfully eradicated in many USA states.	There are measures available to prevent the entry into, establishment within and spread of the pest within the EU. These measures have even allowed the pest to be successfully eradicated in many US states. In case that either EU wild Malvaceae or ornamental Malvaceae in the EU become a suitable host, more than 24 months may be needed for eradication.	There measures available to prevent pest presence on plants for planting. These measures have even allowed the pest to be successfully eradicated in many US states.	The actual status of ornamental Malvaceae and that of wild Malvaceae in the EU
Conclusion on pest categorisation (Section 4)	All criteria assessed by EFSA above for consideration as a potential quarantine pest are met.	Not all criteria assessed by EFSA above for consideration as potential PZQP were met. The pest is not known to occur in the EU territory.	Not all criteria assessed by EFSA above for consideration as a potential RNQP pest were met. The pest is not known to occur in the EU territory and plants for planting is not the main pathway to spread.	None
Aspects of assessment to focus on/scenarios to address in future if appropriate	• Host status of ornamental Malvaceae imported into the EU • Host status of wild Malvaceae occurring in the EU			

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Abbreviations

Bt	*Bacillus thuringiensis*
COI	cytochrome *c* oxidase subunit I
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization of the United Nations
IPM	Integrated Pest Management

IPPC	International Plant Protection Convention
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zones
PZQP	protected zone quarantine pest
QP	quarantine pest
RNQP	regulated non-quarantine pest
SIT	sterile insect technique
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference