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Pest categorisation of *Exomala orientalis*

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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Exomala orientalis* (Coleoptera: Rutelidae) (Oriental beetle) for the EU. Larvae feed on the roots of a variety of hosts including most grasses and many vegetable crops. Maize, pineapples, sugarcane are among the main host plants. Larvae are particularly damaging to turfgrass and golf courses. The adults feed on flowers and other soft plant tissues (e.g. *Alcea rosea*, *Dahlia*, *Iris*, *Phlox* and *Rosa*). Eggs are laid in the soil. Larvae feed on host roots and overwinter in the soil. Adults emerge from pupae in the soil in May-June and are present for about 2 months. *E. orientalis* usually completes its life cycle in 1 year although individuals can spend two winters as larvae. Commission Implementing Regulation (EU) 2019/2072 (Annex IIA) regulates *E. orientalis.* The legislation also regulates the import of soil attached to plants for planting from third countries; therefore, entry of *E. orientalis* eggs, larvae and pupae is prevented. *E. orientalis* is native to Japan or the Philippine islands. It is also found in East Asia and India, Hawaii and north-eastern USA. It is assumed to have reached USA via infested nursery stock. Plants for planting (excluding seeds) and cut flowers provide potential pathways for entry into the EU. *E. orientalis* has been intercepted only once in the EU, on *Ilex crenata* bonsai. Climatic conditions and the availability of host plants provide conditions to support establishment in the EU. Impacts on maize, grassland and turfgrass would be possible. There is uncertainty on the extent of the impact on host plants which are widely commercially grown (e.g. maize) Phytosanitary measures are available to reduce the likelihood of entry. *E. orientalis* satisfies the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest. Of the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union regulated non-quarantine pest, *E. orientalis* does not meet the criterion of occurring in the EU.

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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 established the previous European Union plant health regime. The Directive laid 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 was prohibited, was 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 applied 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 pest 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

Aleurocanthus 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

Anomala orientalis 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 (RQNP) for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States (MS) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

A taxonomic revision now places *Anomala orientalis* in the genus *Exomala* (Baraud, 1991; Zorn and Bezděk, 2016). The current preferred name is therefore *Exomala orientalis* (Waterhouse).

Following the adoption of Regulation (EU) 2016/2031[1] on 14 December 2019 and the Commission Implementing Regulation (EU) 2019/2072 for the listing of EU regulated pests, the Plant Health Panel interpreted the original request (ToR in Section 1.1.2) as a request to provide pest categorisations for the pests in the Annexes of Commission Implementing Regulation (EU) 2019/2072.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *Exomala orientalis* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name *E. orientalis* and the synonyms as search terms. 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, 2020) and relevant publications.

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

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

2.2. Methodologies

The Panel performed the pest categorisation for *E. orientalis*, 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 RNQP. (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 RNQP 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. The identity is established and taxonomic keys are available for its identification.

Exomala orientalis (Waterhouse, 1875) is the preferred name of an insect of the order Coleoptera, family Rutelidae originally described as *Phyllopertha orientalis* Waterhouse 1875. Synonyms include *Anomala orientalis* Heyden 1887, *Blitopertha orientalis* Reitter 1903, *Exomala flavipennis (*Reitter, 1903), *Exomala orientalis* (Reitter, 1903), *Exomala tanbaensis* (Niijima and Kinoshita, 1923), *Exomala xanthrogasta* (Harold, 1881). Controversy and confusion have surrounded the generic placement of *E. orientalis*. This species was described in the genus *Phyllopertha* and has been transferred in and out of the genera or subgenera *Anomala*, *Exomala* Reitter, and *Blithopertha* Reitter. Based primarily on the form of the male copulatory apparatus, Baraud (1991) elevated *Exomala* from a subgenus of *Blithopertha* to generic rank. Since the time of Baraud's publication, the species has been referred to as *Anomala orientalis* as well as *Exomala orientalis*; besides Japanese and some Korean literature refer to the species as *Blithopertha orientalis* (CABI, 2020). The common name is Oriental beetle. No matter this controversy in nomenclature, taxonomic keys are available for the identification of this species (Dunlap et al., 2015). The EPPO code (Griessinger and Roy, 2015; EPPO, 2020) for this species is ANMLOR.[4] (EPPO, 2020).

3.1.2. Biology of the pest

In north-eastern USA, *E. orientalis* usually completes its life cycle in 1 year, although individuals may spend two winters as larvae. Adults emerge towards the end of June (1 month earlier in Korea than in New York State) and are present for about 2 months. The adults are weak fliers, but they may fly short distances during the day. The adults are active in the evening from sunset, especially around 20.00 (Choo et al., 2002b). Mate acquisition and copulation occur on the soil surface near the female emergence site, with both sexes engaging in pheromone-mediated behaviours after having emerged from the soil. A highly stereotyped female pheromone release or calling behaviour has been observed, consisting of the insertion of the female's head into the soil and the elevation of the tip of her abdomen into the air. Mating and copulation occur without an obvious complex courtship, but observations of post-mating behaviours suggested that mate guarding occurs (Facundo et al., 1999a). The interval between mating and oviposition can be as short as 1 day, but is normally about 5 days. From early July until early September, females burrow into the soil where they deposit eggs, singly, at a depth of 2.5–23 cm (average 12 cm) beneath the surface. Although single females are known to lay up to 63 eggs, the probable field average is around 25. Eggs hatch in a few days and the larvae, which prefer unshaded, frequently mown lawns, burrow to 10–20 cm from the soil surface and continue feeding on tender young grass roots and humus until temperatures drop to freezing. Their depth in the soil depends on the moisture content, the larvae burrowing deeper into the soil as the surface layer dries out during the summer. They can attain relatively high densities, far exceeding 100–150 larvae/m^2. Growth is rapid and there are three larval instars. From mid-October, larvae descend in the soil to a depth of 20–42 cm, where they overwinter in a comparatively inactive state – a few in the first instar, about 40% in the second and the rest in the last instar. Towards the end of April, they return to the surface and feed until early June, when each larva prepares a cell by packing the soil at a depth of 12 cm below the surface. Larvae become prepupae in this cell; all feeding ceases, the legs lose their function and become shrivelled and the colour changes to a yellowish-white. After about 7 days, the insect enters the pupal stage, during which it lies in the cast skin of the third

[4] An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed the EPPO code remains the same. This provides a harmonized system to facilitate the management of plant and pest names in computerized databases, as well as data exchange between IT systems (Griessinger and Roy, 2015; EPPO, 2019).

instar larva and remains in the cell for 10–15 days. Pupae have been found in the field from early June to mid-August. The adult emerges by splitting the pupal cell, but it remains in the cell for a few days until it has hardened.

From laboratory studies in Hawaii (Bianchi, 1935; Van Zwaluwenburg, 1937), *E. orientalis* was reported to have an average pre-oviposition period of 7.1 days and to lay eggs for 8.3 days; eggs hatched in 14.8–18 days at 25.5°C and 100% to 96% relative humidity. Exposure to a constant temperature of 37.5°C for 144 h killed all eggs; 38% of eggs kept submerged for 10 days after laying hatched. The average number of eggs laid per female was 32.1. At temperatures of 21 and 26°C, pupal development in males took 11.4–9.1 days, and in females 11.1–8.7 days the reverse relationship to that commonly found in Coleoptera). In optimum conditions, total development from egg to adult took 164.5 days. For additional information see Hallock (1930), Bianchi (1935), Van Zwaluwenburg (1937), Tashiro (1987).

3.1.3. Intraspecific diversity

No intraspecific diversity is reported.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, the identity is established and taxonomic keys are available for its identification, although the species has high morphological variability.

Although detection and identification methods exist, many occurrences of *E. orientalis* may go unreported due to the high morphological variability (Hinson, 2014).

The symptoms of *E. orientalis* larval infestation in turf grass are expressed as dead patches (Choo et al., 2002b), but normally these are not easily seen during the years of infestation. The larvae feed on grass roots within 2.5 cm of the soil surface. Densities of 40–60 grubs per 0.1 m^2 are fairly common and cause severe damage. Early turf symptoms include gradual thinning, yellowing, wilting in spite of adequate soil moisture, and the appearance of scattered and irregular dead patches. As the damage continues, the dead patches join together and increase in size.

Infested turf feels spongy underfoot because the grubs pull up the underlying soil (Potter, 1998). In dry and hot summers, and in autumn, the damaged turf becomes whitish and wilted. These plants die relatively quickly and in the cases of high grub density, dead and black or white patches appear. In the following spring, *E. orientalis*-damaged grass has reduced growth and greening because of a lack of vitality and destroyed roots.

Adults of *E. orientalis* prefer the soft plant tissue between the veins of leaves for feeding. The rougher tissue of the veins is not consumed by the beetle which leaves the skeleton of the leaf. Severely affected leaves turn brown and fall off (Smith et al., 1997).

Eggs are milky-white, ovoid and smooth, about 1 mm in diameter and found in soil. Larvae are 1.5 mm long but when fully grown after 2 months, reach approximately 25 mm. They possess two longitudinal rows of pointed spines (11–15 in each row) on the underside of the last segment, and can be distinguished from other white grubs (Melolonthinae) by the smaller size and transverse, rather than V- or Y-shaped anal opening. The prepupa is quiescent, wrinkled and flaccid. The mature pupa is approximately 10 mm long by 5 mm wide. Adults are 13.5 mm long by 7.5 mm wide and straw coloured to brownish-black. There are symmetrical, triangular black markings on the thorax although their colour and number are variable.

The species sex pheromone has been identified and synthesised (Leal et al., 1994; Zhang et al., 1994) and pheromone traps are useful detection instruments for *E. orientalis* adults as well as to monitor the adults providing a warning of potential outbreaks (Leal, 1993; Facundo et al., 1994; Leal et al., 1994; Zhang et al., 1994; Alm et al., 1999; Polavarapu et al., 2002). Besides, wire-mesh emergence cones, direct observation have been used for monitoring *E. orientalis* adult emergence or activity (Facundo et al., 1999b) and soil sampling is recommended for monitoring the larvae (Hellman, 1989; Potter, 1998). Indirect methods using the entrance and exit holes made by *E. orientalis* adults, which are active from sunset into the night, are practical for monitoring populations on the grass at golf courses (Choo et al., 2002b). These entrance and exit holes are discrete and characteristic for *E. orientalis* adults (Choo et al., 1999). Another indirect detection method of *E. orientalis* used in Korea is to check the presence of magpie damaging the grass by feeding on the larvae in the vicinity of

Japanese chestnut trees. The flowers of Japanese chestnut are a preferred feeding source of adult *E. orientalis*. The presence of the late-blooming variety of Japanese chestnut around the green and magpie damage on the grass are correlated with *E. orientalis* infestations (Choo et al., 2002b). It would need to be investigated further on whether this method is also applicable in Europe. Over 95% accuracy was obtained between real numbers and estimated numbers of *E. orientalis* larvae at a density of over 303 larvae/m^2 when areas of 20 by 20 cm were sampled in golf courses (Lee et al., 2002).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

E. orientalis is probably native to Japan or the Philippine Islands (Tashiro, 1987; Hinson, 2014; CABI, 2020). In 1908, it was introduced to the Hawaiian Island of Oahu, where it became a serious pest of sugarcane (*Saccharum officinarum*). Before 1920, it was accidentally introduced from Japan in the United States, presumably by infested nursery stock (Ritcher, 1966; Tashiro, 1987; Capinera, 2002). Twelve years later, it was limited to an area within 145 km of New York City. It is currently distributed throughout the eastern United States (Jameson et al., 2013). Figure 1 shows the global distribution of *E. orientalis*; for details of distribution see Table 2.

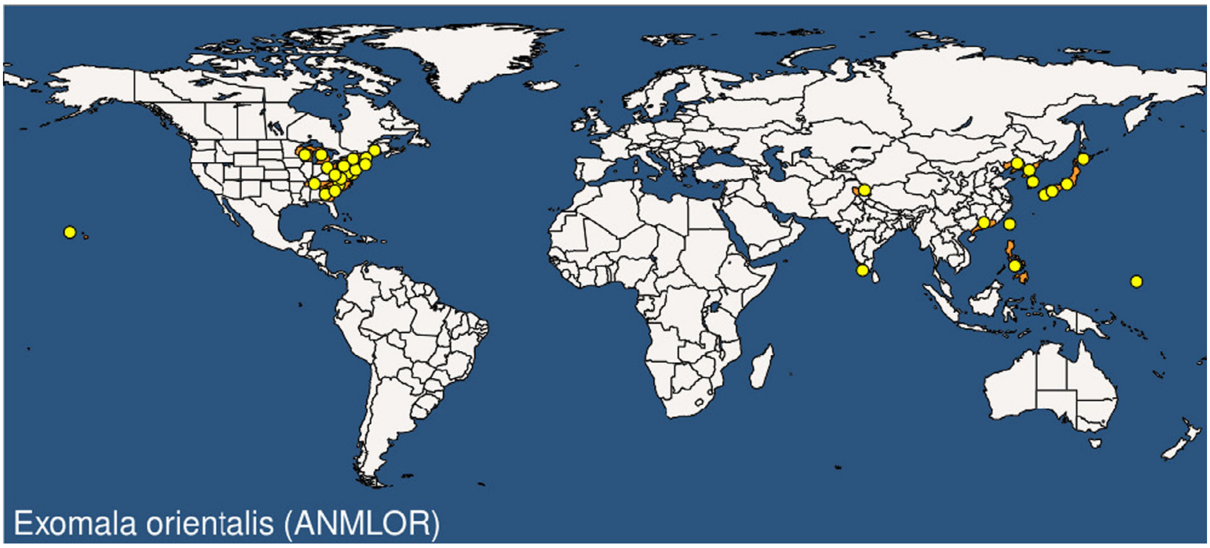


Figure 1: Global distribution map for *Exomala orientalis* (extracted from the EPPO Global Database accessed on 20/03/2020, last updated by EPPO on 20/3/2019)

Table 2: Distribution of *Exomala orientalis* (Source: EPPO Global database, 2020)

Continent	Country	Subnational area, e.g. state	Status
Asia	China		Present, no details
		Guangdong, Liaoning	Present, no details
	India		Present, few occurrences
		Jammu & Kashmir, Kerala	Present, no details
	Japan		Present, widespread
		Hokkaido, Honshu, Kyushu, Shikoku	Present, widespread
	North Korea		Present, no details
	South Korea		Present, no details
	Philippines		Present, no details
	Taiwan		Present, few occurrences

Continent	Country	Subnational area, e.g. state	Status
Oceania	Micronesia		Present, no details
North America	USA		Present, restricted distribution
		Connecticut, Delaware, Georgia, Hawaii Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, West Virginia	Present, no details

3.2.2. Pest distribution in the EU

Source: EPPO GD.

> *Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?*
>
> **No,** *E. orientalis* is not present in the EU territory

Exomala orientalis is not known to occur in the EU territory. In the Netherlands the pest's absence is confirmed by surveys; in Slovenia *E. orientalis* is declared absent with no pest records (EPPO, 2020).

3.3. Regulatory status

3.3.1. Commission Implementing Regulation (EU) 2019/2072

As noted in interpretation of ToR, *Exomala orientalis* is listed in Commission Implementing Regulation (EU) 2019/2072 using the synonym *Anomala orientalis.* Details are presented in Table 3.

Table 3: *Exomala orientalis* (as *Anomala orientalis*) in Commission Implementing Regulation (EU) 2019/2072

Annex II **Part A**	**List of Union quarantine pests and their respective codes** ***Part A: Pests not known to occur in the Union territory***
C	Insects and mites
8	*Anomala orientalis* Waterhouse [ANMLOR]

3.3.2. Legislation addressing the hosts of *Exomala orientalis*

Exomala orientalis is polyphagous pest listed in Annex II A. Therefore, it is banned from introduction into the EU irrespective of the plant where it may be found on (Table 4).

Table 4: List of *Exomala orientalis* hosts regulated in Annex XI of Commission Implementing Regulation (EU) 2019/2074

Annex XI	List of plants, plant products and other objects subject to phytosanitary certificates and those for which such certificates are not required for their introduction into the Union territory	
Part A	List of plants, plant products and other objects, as well as the respective third countries of origin or dispatch, for which, pursuant to Article 72(1) of Regulation (EU) 2016/2031 phytosanitary certificates are required for their introduction into the Union territory	
Plants, plant products and other objects	CN code and its respective description under Council Regulation (EEC) No 2658/87	Country of origin or dispatch
3. Parts of plants, other than fruits and seeds, of:		

Zea mays L.	Other vegetables, fresh or chilled: Sweetcorn: **ex 0709 99 60** Maize (corn), other: **1005 90 00** Vegetable products of maize (*Zea mays*), not elsewhere specified or included, fresh: **ex 1404 90 00**	Third countries other than Switzerland
Part B	List of the respective CN codes of plants, as well as the respective third countries of their origin or dispatch, for which, pursuant to Article 73 of Regulation (EU) 2016/2031, phytosanitary certificates are required for their introduction into the Union territory	
All plants, within the meaning of point 1 of Article 2 of Regulation (EU) 2016/2031, other than those specified in part A of this Annex	Locust beans for sowing, and sugar cane, fresh or chilled, not ground; fruit stones and kernels for sowing and other fresh vegetable products not elsewhere specified or included: **ex 1212 92 00** **ex 1212 93 00** **ex 1212 94 00** **ex 1212 99 41** **ex 1212 99 95**	Third countries other than Switzerland

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

E. orientalis is a polyphagous pest, whose larvae feed on the roots of most grasses (especially lawns and turf grasses), ornamental plants and many vegetable crops, and have been recorded in particular damaging Highbush blueberries (*Vaccinium corymbosum*), maize (*Zea mays*), pineapples (*Ananas comosus*) and sugarcane (*Saccharum officinarum*) (Bianchi, 1935; Westcott, 1964; Arnett, 1985; Alm et al., 1995; Choo et al., 2002b; Rodriguez-Saona et al., 2009). It also infests strawberry beds and nursery stock, as well as the roots of potted plants that are grown outdoors (Potter, 1998).

Little is known about the host range of *E. orientalis* adults. The adults feed on flowers of *Alcea rosea*, *Dahlia* spp., *Iris* spp., *Phlox* spp., roses (Friend, 1929), *Castanea crenata*, *Euonymus japonicus* and *Nandina domestica* (Choo et al., 2002b).

3.4.2. Entry

Is the pest able to enter into the EU territory?

Yes, *Exomala orientalis* could enter the EU via plants for planting with soil attached and soil/growing medium (closed pathway).

E. orientalis is exotic in the USA and it entered directly from Japan with infested nursery stock (Friend, 1929). The major means of spread of *E. orientalis* is via the shipment of nursery stock (Alm et al., 1999). As pests of nursery stock, the larvae have been shipped to new locations in containers or balled and burlaped plants (Alm et al., 1995), i.e. most likely in soil with plants for planting. *E. orientalis* is an A1 quarantine pest in the EPPO region (Smith et al., 1992) and is also of quarantine significance for OIRSA (Organismo Internacional Regional de Sanidad Agropecuaria) which is one of the Central American organisations.

According to the Europhyt database, between 1995 and 2019 *E. orientalis* was intercepted only once in 2001 by the Netherlands NPPO on *Ilex crenata* bonsai from Japan.

Table 5: Potential pathways for *Exomala orientalis* and existing mitigations (if any)

Pathways	Life stage	Relevant mitigations [prohibitions (Annex VI) or special requirements (Annex VII)] from third countries
Plants for planting (excluding seeds)	Adults	
Cut flowers and branches with foliage	Adults	
Plants for planting already planted (i.e., with soil attached)	Eggs, larvae and pupae	Annex VII of Regulation 2016/2031 regulates the introduction of soil and growing medium when attached to plants for planting into the Union from third countries other than Switzerland
Soil/growing medium	Eggs, larvae and pupae	Annex VI of Regulation 2016/2031 prohibits the introduction of soil and growing medium as such into the Union from third countries other than Switzerland

The soil/growing medium pathway can be considered as closed, as soil from third countries other than Switzerland is banned from entering into the EU (Annex VI), and regulated when attached to plants for planting or machinery (Annex VII) (Table 5). The plants for planting (excluding seeds), cut flowers and branches with foliage, pathways are not specifically regulated for this pest.

3.4.3. Establishment

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

Yes, biotic and abiotic conditions are conducive for the establishment of *E. orientalis* in some parts of the EU where potential hosts occur (either cultivated or not).

3.4.3.1. EU distribution of main host plants

Maize, turfgrass and sugarcane are among the main host plants (see Section 3.4.1) Maize is widely cultivated in Europe (see Table 6). The largest maize production areas are in southern- and central European countries. Some maize production can also be found in northern European countries such as Denmark and Sweden (see Appendix B). No specific data on turfgrass production were found in the EUROSTAT database. However, permanent grassland areas which could potentially support the establishment of the pest exist in almost all EU member states (see Appendix B). FAO stat data (accessed on 24/2/2020) suggest that significant sugarcane production can be found only in French overseas departments (outermost regions of Europe); these are outside the risk assessment area.

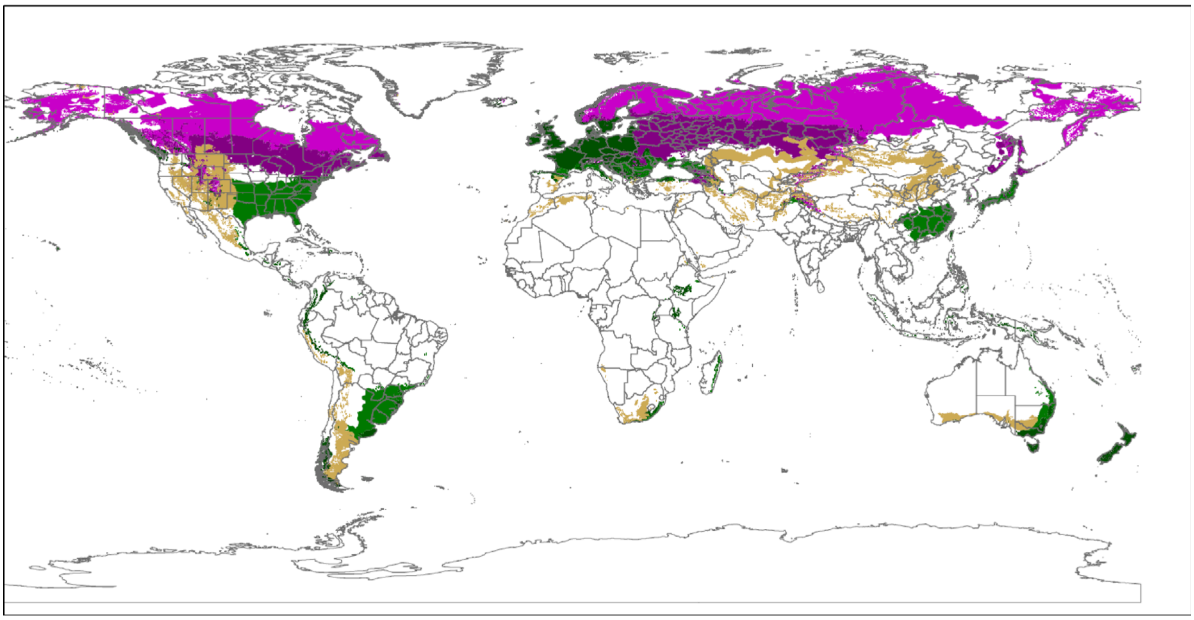
Table 6: EU 28 crop production (2015–2019) of maize (grain maize and corn-cob-mix and green maize), permanent grassland and blueberries (in 1,000 ha). Source: Eurostat, data extracted on 23/2/2020 (maize and permanent grassland) and 23/3/2020 (blueberries)

Crop/year	2015	2016	2017	2018	2019
Grain maize and corn-cob mix	9,255.56	8,563.21	8,271.64	8,282.57	8,904.30
Green maize	6,267.95	6,256.88	6,183.30	6,355.91	:
Permanent grassland	60,517.92	60,499.23	:	:	:
Blueberries	:	13.28	16.86	19.37	:

':' data not available.

3.4.3.2. Climatic conditions affecting establishment

The native range of *E. orientalis* in Japan and its distribution outside of its native range e.g. North America, Korea (see Figure 2) cover a variety of Köppen–Geiger climate zones. These climate zones also occur in the EU where hosts such as maize are grown and where areas of permanent grassland can be found. Therefore, the climatic conditions will not prevent establishment of *E. orientalis* in the EU.



Key	Climate category	Descriptions
	BSk	Dry, cold semi-arid steppe, mid-altitude steppe, dry
	Cfa	Temperate, uniform precipitation through year; Humid sub–tropical, mild, no dry season, hot summer
	Cfb	Temperate, uniform precipitation through year, temperate oceanic; mild, no dry season, warm summer
	Cfc	Temperate, uniform precipitation through year, sub-polar oceanic; mild, no dry season, cool summer
	Dfb	Continental, uniform precipitation through the year, warm summer
	Dfc	Continental, uniform precipitation through the year, cold summer

Figure 2: Köppen–Geiger climate type zones. Climate types in its native range and current distribution (see Figure 1) match climate types also occurring in the EU (Map based on MacLeod and Korycinska, 2019)

3.4.4. Spread

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

Yes, although *E. orientalis* adults rarely make long flights, the species can spread through movement of flowers as adults, or in soil accompanying consignments as larvae.

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

Yes, wide-scale and international spread of *E. orientalis* seems to be mostly dependent on human-mediated movement of plants.

The natural spread of *E. orientalis* has been slow, presumably because it is not a strong flier (Hallock, 1933; Bianchi, 1935). The adults may remain hidden in flowers, whereas the larvae may be present in the soil accompanying consignments (Smith et al., 1992). *E. orientalis* larvae can be introduced into new habitats with nursery stocks in soil. Because the adults feed on the flowers of some plants, the possibility of introduction with flowers cannot be ruled out.

Sources: EPPO GD; CABI, Fauna Europaea and/or Literature.

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory? **Yes**, the introduction of *E. orientalis* could have an economic impact in the EU through qualitative and quantitative effects on maize and other hosts production as well as turfgrass and grassland. However, the extent of impact on maize is uncertain. *RNQPs: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?*[5] **Yes**, should *E. orientalis* be present in plants for planting, an economic impact on their intended use would be expected.

Losses mainly arise from the larvae of *E. orientalis* feeding on the roots, which may be severely damaged, with crops turning brown and dying. In lawns, feeding by the overwintering larvae may kill the grass in June, but more often in August and September, with areas from a few square centimetres to 1–2 ha turning brown (CABI, 2020). It is considered the most serious grub pest of turf and woody ornamental plantings in Long Island, northern New Jersey and Connecticut, USA (Facundo et al., 1999b). It is also the major white grub species in ornamental nurseries and blueberries (Polavarapu, 1996). Economic losses by *E. orientalis* larvae are serious in turf grasses. Turf grasses cover an estimated 10.1–12.1 million ha in the USA, and turf grass culture is at least a US$25 billion per year industry (Potter and Braman, 1991). Damage by *E. orientalis* in turf grasses is increasing also in Korea. When scarab larvae were sampled at 15 golf courses in 11 provinces of Korea, the most abundant species was the *E. orientalis* (Choo et al., 1998a, 1999). Primary injury from larvae consuming turf roots is followed by secondary damage from wild birds searching for and feeding on grubs in the infested area (Choo et al., 2002b). If it is introduced into new regions, *E. orientalis* can cause considerable losses to horticulture, especially to grass (Smith et al., 1997).

Information on the impact of *E. orientalis* infestation is available for turf grasses, golf courts, cranberry and blueberry (Wenninger and Averill, 2006; Rodriguez-Saona et al., 2009); however, no quantitative data are available for maize, therefore leaving some uncertainties on the extent of the impact.

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 existing measures (see Sections 3.3 and 3.4.2) can mitigate the risks of entry, establishment, and spread within the EU. As a pest listed in Annex IIA, its introduction and spread in the EU is banned irrespective of what it may be found on. *RNQPs: Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?* Yes, sourcing plants and plant parts from PFA (pest free areas) would mitigate the risk.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to soil. Some host plants are listed in the import prohibitions of Annex VI (e.g. *Fragaria, Rosa* and Poaceae from specified third countries) or in specific requirements in Annex VII of 2016/2031 (see Sections 3.3 and 3.4.2).

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 7.

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

Table 7: Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)
Growing plants in isolation	To prevent introduction of the pest to the production place, plants could be grown in a dedicated greenhouse	Entry
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage The treatments addressed in this information sheet are: a) fumigation; b) spraying/dipping pesticides	Entry
Soil treatment	The control of larvae in the soil may be possible with a chemical or physical treatment of the soil	Entry, Impact
Crop rotation, associations and density, weed/volunteer control	Crop rotation with non-host crops may be possible. Due to the polyphagous nature of the pest, weed control may have an effect in managing the pest	Impact
Chemical treatments on crops including reproductive material	Chemical control of adult *E. orientalis* may not be practical in most situations (Alm et al., 1995). There are two methods concerning grub chemical control: the curative approach and preventive control. Curative control is applied in the late summer, after the eggs have hatched and the grubs are present. Preventive control is applied as insurance, before a possible grub problem develops. Preventive control requires the use of an insecticide with a relatively long residual activity (Potter, 1998)Checking for the occurrence of *E. orientalis* by observing the entrance and exit holes in the green of golf courses can aid in spraying decisions	Establishment, Spread, Impact
Use of resistant and tolerant plant species/varieties	All species of cool-season turf grasses and many warm-season grasses are susceptible to attack by white grubs Among cool-season grasses, tall fescue (*Festuca arundinacea*) is generally more tolerant to grub damage than Kentucky bluegrass (*Poa pratensis*), creeping bentgrass (*Agrostis stolonifera*) or perennial ryegrass (*Lolium perenne*) (Alm et al., 1995; Potter, 1998)	Establishment, Spread, Impact
Biological control and behavioural manipulation	Biological control agents consist of natural enemies (predators and parasitoids) and microbial agents. The most effective predators are *Cophinopoda chinensis*, *Philonicus albiceps* and *Promachus yesonicus* (Choo et al., 2000), while *Scolia manilae* [*Campsomeris marginella modesta*], *Tiphia vernalis* and *Tiphia popilliavora* are effective parasitoids that successfully controlled *E. orientalis*, especially in Hawaii (Pemberton, 1964, Tashiro, 1987; Alm et al., 1995; Choo et al., 2000). *Paenibacillus popilliae* was the most effective bacterial disease in the larva of *E. orientalis* (Dutky, 1941; Tashiro, 1987; Choo et al., 2000, 2002a). *Bacillus thuringiensis* serovar japonensis strain Buibui was effective against *E. orientalis* larvae (Suzuki et al., 1992; Alm et al., 1997; Koppenhöfer et al., 1999). Protozoan (Gregarinidae) were found in infested *E. orientalis* larvae (Hanula and Andreadis, 1988). The entomopathogenic fungi, *Beauveria bassiana, B. brongniartii,* and *Metarhizium anisopliae*, and the entomopathogenic nematodes, *Steinernema* spp. and *Heterorhabditis bacteriophora* were found effective in controlling *E. orientalis* larvae (Choo et al., 2000, 2002a; Koppenhöfer et al., 2013) A combination of biological control agents or insecticides and entomopathogenic nematodes against *E. orientalis* was proved to have an additive or synergistic effects (Choo et al., 1998b)	Establishment, Spread, Impact

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/ establishment/ spread/impact)
	An alternative to insecticides for pest control is the use of mating disruption (Cardé, 2007; Rodriguez-Saona and Stelinski, 2009). Previous studies demonstrated the feasibility of using microencapsulated sprayable formulations of (*Z*)-7-tetradecen-2-one, the major component of the oriental beetle's sex pheromone, for oriental beetle mating disruption in blueberries (Polavarapu et al., 2002) and turfgrass (Koppenhöfer et al., 2005). Specialized Pheromone and Lure Application Technologies were developed (Mafra-Neto et al., 2014)	

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 8.

Table 8: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/ establishment/ spread/impact)
Inspection and trapping	Trap/pheromone available for pest (Alm et al., 1999) Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5) The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques	Entry
Certified and approved pre mises	Approval of dedicated production place (e.g. greenhouse); crop rotation field 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
Surveillance	Surveillance to guarantee that plants originate from a Pest Free Area could be an option	Entry

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

Mobility of adults.

Egg, larval and pupal stages in the soil.

Control with insecticides is usually complicated by the insect's biology.

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

Egg, larval and stages in the soil in case of growing medium, attached to or associated with plants, intended to sustain the vitality of the plants.

3.7. Uncertainty

Quantitative information on impacts is limited to turfgrass, golf courses, ornamentals and blueberry. There is uncertainty on the extent of the impact on host plants which are widely commercially grown in the EU (e.g. maize).

4. Conclusions

E. orientalis satisfies the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest. *E. orientalis* does not meet the criteria of occurring in the EU for it to be regarded as a potential Union RQNP (Table 9).

Table 9: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pests (section 3.1)	Yes, the identity of *Exomala orientalis* is well established and there are taxonomic keys available for its identification to species level In the current EU legislation *Exomala orientalis* is referred to with its synonym *Anomala orientalis*	Yes, the identity of *Exomala orientalis* is well established and there are taxonomic keys available for its identification to species level	
Absence/ presence of the pest in the EU territory (section 3.2)	No, *E. orientalis* is not known to be present in the EU	No, *E. orientalis* is not known to be present in the EU. Therefore, it does not fulfil this criterion to be regulated as a RNQP	
Regulatory status (section 3.3)	The pest is listed in Commission Implementing Regulation (EU) 2019/2072, Annex II, Part A, list of Union quarantine pests and their respective codes of Pests not known to occur in the Union territory	There are no grounds to consider its status as a quarantine pest is to be revoked	
Pest potential for entry, establishment and spread in the EU territory (section 3.4)	*E. orientalis* could enter into, become established in, and spread within, the EU territory. The main pathways are: • Plants for planting (excluding seeds) with and without soil • Cut branches and flowers with foliage Imported from infested areas	Although adults can fly, natural spread is not considered its main dispersal mode but human-assisted transport (including plants for planting)	

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
Potential for consequences in the EU territory (section 3.5)	The pests' introduction would most probably have an economic impact in the EU	Should *E. orientalis* be present on plants for planting, an economic impact on its intended use would be expected	Quantitative information on economic impact on widely commercially grown crops is missing
Available measures (section 3.6)	There are measures available to prevent the entry into, establishment within or spread of the pest within the EU	There are measures available to prevent pest presence on plants for planting (i.e., sourcing plants from PFA, PFPP)	
Conclusion on pest categorisation (section 4)	All criteria assessed by EFSA above for consideration as a potential quarantine pest are met with no uncertainties	Although the criterion of plants for planting being the main means of spread for consideration as a RNQP is met. the criterion of the pest being present in the EU territory, which is a pre-requisite for consideration as a potential RNQP, is not met	
Aspects of assessment to focus on/ scenarios to address in future if appropriate			

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Abbreviations

DG SANTÉ	Directorate General for Health and Food Safety
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
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

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017)
Greenhouse	The term 'greenhouse' is used in the current opinion as defined by EPPO (https://gd.eppo.int/taxon/3GREEL) as a walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment. A similar definition is also given in EFSA Guidance Document on protected crops (2014) https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2014.3615
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017)
Measures	Control (of a pest) is defined in ISPM 5 (FAO 2017) as "Suppression, containment or eradication of a pest population" (FAO, 1995) Control measures are measures that have a direct effect on pest abundance Supporting measures are organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance
Pathway	Any means that allows the entry or spread of a pest (FAO, 2017)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017)
Protected zones (PZ)	A protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017)
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2017)

Appendix A – Host plants for Exomala orientalis

Host category	Host	Common name	Family	Reference
Main	*Agrostis stolonifera*	Creeping bentgrass	Poaceae	CABI, 2020
Major	*Ananas comosus*	Pineapple	Bromeliaceae	EPPO, 2020
Major	*Saccharum officinarum*	Sugar cane	Poaceae	EPPO, 2020
Major	*Zea mays*	*Maize*	Poaceae	EPPO, 2020
Minor		*Herbaceous plants*		EPPO, 2020
Minor		*Vegetable plants*		EPPO, 2020
Minor			Poaceae	EPPO, 2020
Wild host	*Castanea crenata*	Japanese chestnut	Fagaceae	CABI, 2020
Wild host	*Dahlia*		Asteraceae	CABI, 2020
Wild host	*Euonymus japonicus*	Japanese spindle tree	Celastraceae	CABI, 2020
Wild host	*Festuca arundinacea*	Tall fescue	Poaceae	CABI, 2020
Wild host	*Fragaria ananassa*	Strawberry	Rosaceae	CABI, 2020
Wild host	*Lolium perenne*	Perennial ryegrass	Poacease	CABI, 2020
Wild host	*Petunia*		Solanaceae	CABI, 2020
Wild host	*Poa pratensis*	Smooth meadow-grass	Poaceae	CABI, 2020
Wild host	*Rubus ideaus*	Raspberry	Rosaceae	CABI, 2020
Wild host	*Vaccinum macrocarpon*	Cranberry	Ericaceae	CABI, 2020
Wild host	*Vaccinum myrtillus*	Blueberry	Ericaceae	CABI, 2020
Wild host	*Zea mays*	Maize	Poaceae	CABI, 2020
Wild host	*Zoysia japonica*		Poaceae	CABI, 2020
Wild host	*Zoysia matrella*		Poaceae	CABI, 2020
Unclassified	*Rosa*	Rose	Rosaceae	EPPO, 2020
Unclassified	*Vaccinium*		Ericaceae	EPPO, 2020
Other	*Iris*	Iris	Iridaceae	CABI, 2020
Other	*Nandina domestica*	Nandina	Berberidaceae	CABI, 2020
Other	*Phlox*		Polemoniaceae	CABI, 2020
Other	*Rosa hybrida*		Rosaceae	CABI, 2020

Appendix B – EU28 crop production

Standard humidity Eurostat (Area (cultivation/harvested/production) (1,000 ha) (accessed 23/2/2020).

Grain maize and corn-cob-mix

Country/Year	2015	2016	2017	2018	2019
EU-28	9,255.56	8,563.21	8,271.64	8,282.57	8,904.30
Austria	188.73	195.25	209.48	209.90	220.69
Belgium	58.40	52.10	49.00	53.99	48.87
Bulgaria	498.64	406.94	398.15	444.62	560.26
Croatia	263.97	252.07	247.12	235.35	256.00
Cyprus	0.00	0.00	0.00	0.00	0.00
Czechia	79.97	86.41	86.00	81.85	74.83
Denmark	9.00	5.70	5.10	6.30	5.40
Estonia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
France	1,639.49	1,458.32	1,435.70	1,426.26	1,518.93
Germany)	455.50	416.30	432.00	410.90	416.00
Greece	152.05	139.48	132.49	113.45	113.22
Hungary	1,146.13	1,011.56	988.82	939.08	1,027.15
Ireland	0.00	0.00	0.00	0.00	0.00
Italy	726.99	660.73	645.74	614.31	632.17
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	11.71	12.43	9.93	13.39	12.77
Luxembourg	0.14	0.13	0.08	0.09	0.14
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	15.80	12.27	12.25	13.76	19.01
Poland	670.30	593.50	562.11	645.41	660.75
Portugal	97.91	88.61	86.52	83.36	83.36
Romania	2,608.06	2,584.22	2,405.24	2,443.95	2,650.59
Slovakia	191.44	184.81	187.81	179.03	197.53
Slovenia	37.74	36.39	38.29	37.08	38.88
Spain	398.26	359.28	333.63	322.37	359.16
Sweden	1.33	1.71	1.19	1.11	1.69
United Kingdom	4.00	5.00	5.00	7.00	6.90

':' data not available.

Green maize

Country/Year	2015	2016	2017	2018	2019
EU-28	6,267.95	6,256.88	6,183.30	6,355.91	:
Austria	91.99	84.64	82.19	83.35	85.68
Belgium	173.34	168.74	171.28	179.74	175.88
Bulgaria	26.56	31.10	29.93	27.24	28.00
Croatia	32.60	30.98	28.29	25.35	30.00
Cyprus	0.30	0.20	0.17	0.12	0.14
Czechia	244.96	234.40	223.21	224.11	231.37
Denmark	182.40	182.40	166.70	179.60	178.20
Estonia	8.50	7.96	9.18	10.55	13.72
Finland	0.00	0.00	0.00	0.00	0.00
France	1,475.23	1,433.16	1,406.01	1,415.73	1,422.00
Germany)	2,100.40	2,137.60	2,095.90	2,195.90	2,222.70
Greece	90.18	118.69	125.55	129.64	129.64

Country/Year	2015	2016	2017	2018	2019
Hungary	89.98	76.41	69.05	66.40	64.31
Ireland	12.85	10.92	11.88	17.76	16.48
Italy	342.57	325.04	342.10	355.33	362.80
Latvia	25.40	25.90	22.10	25.50	26.90
Lithuania	29.25	26.59	24.34	28.25	31.40
Luxembourg	14.45	14.94	15.19	15.88	15.73
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	223.86	203.81	203.51	203.22	188.10
Poland	555.20	597.00	596.01	601.58	:
Portugal	80.78	80.26	78.43	74.33	73.69
Romania	46.34	51.42	50.10	47.76	47.75
Slovakia	89.52	78.05	81.44	73.11	74.23
Slovenia	28.73	28.69	29.19	29.82	28.59
Spain	107.92	106.24	107.36	107.34	109.25
Sweden	15.65	15.74	16.80	17.29	20.30
United Kingdom	179.00	186.00	197.40	221.00	217.00

':' data not available.

Permanent grassland

Country/Year	2014	2015	2016	2017	2018
EU-28	59,569.06	60,517.92	60,499.23	:	:
Austria	492.04	475.96	478.43	467.84	479.64
Belgium					
Bulgaria	1,363.98	1,368.67	1,384.09	1,392.35	1,399.04
Croatia	980.51	957.79	948.57	978.16	990.09
Cyprus	192.60	254.77	225.60	234.70	212.70
Czechia	4,650.70	4,677.10	4,694.50	4,715.00	4,713.40
Denmark	317.50	314.90	304.28	313.87	311.76
Estonia	3,999.82	3,975.30	3,999.28	4,027.07	4,064.21
Finland	2,137.38	2,049.68	2,021.11	2,020.08	2,171.27
France	6,248.41	6,399.05	6,471.39	6,570.34	7,037.37
Germany)	9,366.43	9,528.15	9,296.13	9,299.84	9,593.99
Greece	350.05	618.07	600.00	607.56	607.56
Hungary	3,564.02	3,579.16	3,662.83	:	:
Ireland	1.76	1.93	1.38	1.65	1.59
Italy	657.10	648.30	635.10	634.90	634.80
Latvia	567.10	797.97	775.60	795.11	794.97
Lithuania	66.83	66.92	67.12	67.41	67.71
Luxembourg	760.92	761.48	783.25	803.81	799.28
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	757.80	766.03	729.89	715.38	763.79
Poland	1,297.11	1,306.86	1,283.65	1,258.81	1,258.81
Portugal	3,119.80	3,092.80	3,175.50	3,170.73	3,149.87
Romania	1,836.70	1,856.82	1,876.94	1,876.94	1,876.94
Slovakia	4,626.95	4,655.33	4,521.38	4,420.17	4,288.41
Slovenia	279.90	278.68	276.25	279.22	277.17
Spain	511.38	520.58	521.44	517.68	523.55
Sweden	32.60	27.80	25.60	24.70	24.10
United Kingdom	435.68	449.84	451.94	452.94	455.14

':' data not available.

Blueberries

Country/Year	2015	2016	2017	2018	2019
EU-28	:	13.28	16.86	19.37	:
Austria	:	0.09	0.10	0.13	:
Belgium	:	0.00	0.02	0.03	0.00
Bulgaria	:	0.00	0.00	0.00	0.00
Croatia	:	0.06	0.06	0.06	:
Cyprus	:	2.71	2.84	3.04	:
Czechia	:	0.00	0.00	0.00	0.00
Denmark	:	0.00	0.00	0.00	0.00
Estonia	:	0.00	0.00	0.00	0.00
Finland	:	2.26	3.26	3.72	4.03
France	:	0.00	0.00	0.00	:
Germany)	:	0.12	0.17	0.25	:
Greece	:	0.00	0.00	0.00	:
Hungary	:	0.00	0.00	0.00	0.00
Ireland	:	0.20	0.20	0.50	:
Italy	:	0.07	0.08	0.07	:
Latvia	:	0.00	0.00	0.00	0.00
Lithuania	:	0.01	0.01	0.02	0.00
Luxembourg	:	0.00	0.00	0.00	0.00
Malta	:	0.78	0.83	0.93	:
Netherlands	:	0.14	0.16	0.20	0.20
Poland	:	5.04	7.07	8.09	:
Portugal	:	1.52	1.70	1.93	1.90
Romania	:	0.13	0.13	0.18	0.00
Slovakia	:	0.05	0.05	0.06	:
Slovenia	:	0.00	0.03	0.03	0.00
Spain	:	0.08	0.08	0.09	:
Sweden	:	0.02	0.05	0.04	:
United Kingdom	:	0.00	0.00	0.00	0.00

':' data not available.