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## Pest categorisation of *Diabrotica undecimpunctata howardi*

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### Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Diabrotica undecimpunctata howardi* (Coleoptera: Chrysomelidae) for the EU. This subspecies occurs in North and Central America. Adults oviposit on annual plants in the families Asteraceae, Chenopodiaceae, Cucurbitaceae, Fabaceae, Poaceae, Polygonaceae and Solanaceae. Adults feed on tender plant parts in hosts in 40 additional botanical families. Preimaginal development takes place on the roots of the host plant, where larvae feed and pupate. *D. undecimpunctata howardi* is a multivoltine species. Overwintering adults, which may enter a facultative diapause, abandon crops in autumn and reinvade them in spring. *D. undecimpunctata howardi* is not known to occur in the EU and is regulated in Annex IIA of Commission Implementing Regulation 2019/2072. This species is a competent vector of *Erwinia tracheiphila* (Smith) Bergey et al., which can cause bacterial wilt, a serious disease of cucurbits. The bacterium, which is restricted to temperate midwestern and eastern North America, is not regulated in the EU. Within Commission Implementing Regulation 2019/2072, potential entry pathways for *D. undecimpunctata howardi*, such as Asteraceae, Poaceae and Solanaceae plants for planting with foliage and soil/growing medium, and soil/growing media by themselves can be considered as closed. However, plants for planting of the families Chenopodiaceae, Cucurbitaceae, Fabaceae and Polygonaceae are not specifically regulated. Should *D. undecimpunctata howardi* arrive in the EU, climatic conditions and availability of susceptible hosts provide conditions suitable for establishment and further spread. Economic impact is anticipated in maize and outdoor cucurbit production. *D. undecimpunctata howardi* satisfies the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest. This species does not meet the criteria of being present in the EU, nor plants for planting being the main pathway for spread, for it to be regarded as a potential regulated non-quarantine pest.

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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<sup>1</sup> 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<sup>2</sup> 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<sup>3</sup>, 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.

<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> 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**

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

##### **(b) Bacteria**

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

##### **(c) Fungi**

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

##### **(d) Virus and virus-like organisms**

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

#### **Annex IIB**

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

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

**(b) Bacteria**

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

**(c) Fungi**

*Glomerella gossypii* Edgerton

*Hypoxyton mammatum* (Wahl.) J. Miller

*Gremmeniella abietina* (Lag.) Morelet

**1.1.2.2. Terms of Reference: Appendix 2**

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

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

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

- |  |   |
|--|---|
| 1) <i>Carneocephala fulgida</i> Nottingham | 3) <i>Graphocephala atropunctata</i> (Signoret) |
| 2) <i>Draeculacephala minerva</i> Ball     |   |

Group of Tephritidae (non-EU) such as:

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

**(c) Viruses and virus-like organisms**

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

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

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

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

## **Annex IIAI**

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

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

- |  |  |
|--|--|
| 1) <i>Margarodes vitis</i> (Phillipi)        | 3) <i>Margarodes prieskaensis</i> Jakubski |
| 2) <i>Margarodes vredendalensis</i> de Klerk |  |

### **1.1.2.3. Terms of Reference: Appendix 3**

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

## **Annex IAI**

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

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

### **(b) Fungi**

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

### **(c) Viruses and virus-like organisms**

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

#### (d) Parasitic plants

*Arceuthobium* spp. (non-EU)

#### **Annex I A I I**

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

*Meloidogyne fallax* Karssen

*Rhizoecus hibisci* Kawai and Takagi

*Popillia japonica* Newman

##### (b) Bacteria

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

##### (c) Fungi

*Melampsora medusae* Thümen

*Synchytrium endobioticum* (Schilbersky) Percival

#### **Annex I B**

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

*Leptinotarsa decemlineata* Say

*Liriomyza bryoniae* (Kaltenbach)

##### (b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

## 1.2. Interpretation of the Terms of Reference

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

Following the adoption of Regulation (EU) 2016/2031<sup>4</sup> 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<sup>5</sup>.

## 2. Data and methodologies

### 2.1. Data

#### 2.1.1. Literature search

A literature search on *Diabrotica undecimpunctata howardi* 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, as well as from citations within the references and grey literature.

<sup>4</sup> Regulation (EU) 2016/2031 of the European Parliament and of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) No 228/2013, (EU) No 652/2014 and (EU) No 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC.

<sup>5</sup> Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019.



### 2.1.2. Database search

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

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

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States (MS) and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020. TRACES is a European Commission online platform used for the importation of plants into the European Union (It is also used for animals, animal products, food and feed of non-animal origin).

## 2.2. Methodologies

The Panel performed the pest categorisation for *Diabrotica undecimpunctata howardi*, 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 regulated non-quarantine pest (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 an 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 an 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
<b>Identity of the pest (Section 3.1)</b>	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?

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
<b>Absence/ presence of the pest in the EU territory (Section 3.2)</b>	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)
<b>Regulatory status (Section 3.3)</b>	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?
<b>Pest potential for entry, establishment and spread in the EU territory (Section 3.4)</b>	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!
<b>Potential for consequences in the EU territory (Section 3.5)</b>	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?
<b>Available measures (Section 3.6)</b>	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?
<b>Conclusion of pest categorisation (Section 4)</b>	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 of *Diabrotica undecimpunctata howardi* is well established.

The '12-spotted cucumber beetle' or 'southern corn rootworm', *Diabrotica undecimpunctata howardi* Barber 1947, is an insect in the order Coleoptera, Family Chrysomelidae. *Chrysomela duodecimpunctata* Fabricius 1775 and *Crioceris sexpunctata* Fabricius 1792 are two junior synonyms.

The EPPO code<sup>6</sup> (Griessinger and Roy, 2015; EPPO, 2019) for this subspecies is DIABUH (EPPO, online).

According to Derunkov et al. (2015), the New World genus *Diabrotica* Chevrolat, 1836 contains over 400 described species. An extensive review of North and Central American *Diabrotica* spp. (Derunkov and Konstantinov, 2013) resulted in an online identification guide of 112 taxa including *D. undecimpunctata howardi* (Derunkov et al., 2013).

##### 3.1.2. Biology of the pest

Adults of *D. undecimpunctata howardi* (Figure 1) only survive over winter in southern areas of its distribution (North America, see 3.2.1). They overwinter near agricultural fields close to the crops where they will develop during the following season. No specific association with any particular plant is reported. These are diapausing adults that remain hidden until the diapause is broken. Overwintering adults usually break diapause in February (Meinke and Gould, 1987). In the spring, adults move to newly emerged crops to oviposit in the soil, close to the base of the host plants, mostly grass crops, in particular maize, but also weeds as well as peanuts, alfalfa and cucurbits (Jackson et al., 1995; Hirsh and Barbercheck, 1996; Fabrick et al., 2002). As *D. undecimpunctata howardi* is multivoltine (Meinke and Gould, 1987), subsequent generations reinvade the USA 'Corn Belt' each year (Lampman et al., 1987; Pereira et al., 2017). Oviposition occurs preferentially in cool, moist soils covered with organic residue (Campbell and Emery, 1967; Brust and House, 1990). Indeed, in a study where the effects of no-tillage and irrigation were compared with conventional tillage in maize, 80% and 62% increase in oviposition, respectively, were observed (Brust and House, 1990).

In a laboratory study (Jackson et al., 1995), egg hatching in the range 0°–15°C ranged from 87 to 88%. Continuous exposure to 0°C for 3 weeks reduced egg hatching to 7% and a 4-week exposure to 0°C and 3°C reduced hatching to 0 and 3%, respectively. Contrary to this wide temperature tolerance, eggs are quite demanding for moisture and less than 2-day-old eggs failed to hatch when exposed to relative humidity values below 100% (Krysan, 1976). Likewise, larval and pupal survival was high when 'plant-available water' (PAW) ranged from 70 to 100% but became almost nil when PAW decreased below 55% (Lumms et al., 1983). Upon hatching, which may take from 5 to 11 days, larvae feed on the roots of the host plant (Figure 2). They complete development (three instars) in 10–16 days and then pupate in an earthen cocoon in the soil, from where they emerge 5–12 days later. The whole immature development may take from 20 to 39 days (Porter et al., 2010). Adult survival, oviposition and longevity were studied at five constant temperature regimes ranging from 7 to 35°C. Longest longevity occurred at 18°C (20% survival after 16 weeks), whereas no survival was observed in individuals kept at 35°C for 4 weeks. Fecundity at 7°C was below one egg per female, whereas 44.3–375.7 eggs were observed at test temperatures above 18°C, with maximum oviposition (373.7 eggs) occurring at 29.5°C (Campbell and Emery, 1967).

<sup>6</sup> 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 harmonised system to facilitate the management of plant and pest names in computerised databases, as well as data exchange between IT systems (Griessinger and Roy, 2015; EPPO, 2019).



**Figure 1:** Adult *Diabrotica undecimpunctata howardi*. (R.L. Croissant, Bugwood.org)



**Figure 2:** Damage to corn roots due to feeding by *Diabrotica undecimpunctata howardi*. (R.L. Croissant, Bugwood.org)

### 3.1.3. Intraspecific diversity

The species *D. undecimpunctata* is divided into four subspecies. In addition to *D. undecimpunctata howardi*, *D. undecimpunctata duodecimnotata* Harold, *D. undecimpunctata tenella* LeConte and *D. undecimpunctata undecimpunctata* Mannerheim have been described (Derunkov et al. 2013). *D. undecimpunctata undecimpunctata* was subjected to a separate pest categorisation by the EFSA plant health panel (EFSA PLH Panel, 2020).

### 3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

**Yes**, detection and identification methods for *D. undecimpunctata howardi* are available.

#### Detection

Adults can be detected during visual inspections, for example of developing cucurbit crops (Gill et al., 2020).

The major attractants of *D. undecimpunctata howardi* adults, veratrole and phenylacetaldehyde, which are present in corn husk and silk volatiles, and phenylacetaldehyde and several di- and trimethoxybenzenes, which have been detected in *Cucurbita maxima* blossoms (Lampman et al., 1987) could be used to detect/monitor *D. undecimpunctata howardi* populations.

## Symptoms

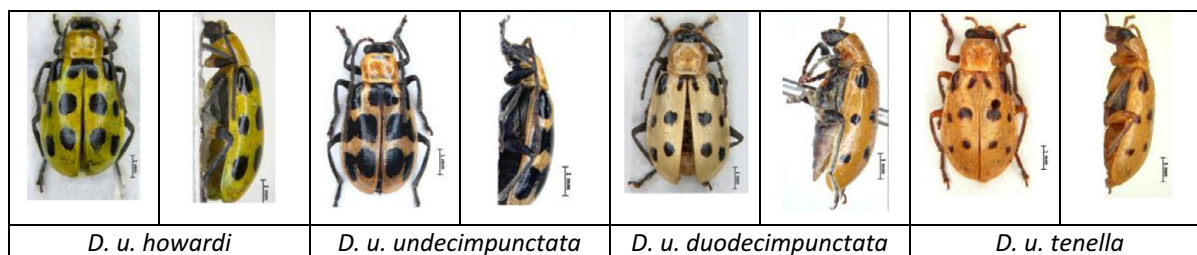
According to EPPO online, infested maize plants usually show the effect of larval infestation of the roots when they are 20–50 cm tall. Plants grow poorly, becoming stunted and yellow, but may survive and still produce grain. If the stem is attacked, internal drilling causes the bud to wither and die. Infested cucurbits show adult feeding holes in the leaves and scars on runners and young fruits. Scarring in the crown of the plant is also typical of adult damage. Photographs of root and leaf damage are provided in Gill et al. (2020).

## Identification

According to Derunkov et al. (2013), the description of *D. undecimpunctata howardi* adults is as follows:

Body length 5.2–7.5 mm. Body width 2.8–3.9 mm. Head basic colour black. Antennae filiform, bi- or tricolored, antennomeres 1–3 sulfur yellow, antennomeres 4–11 black. Maxillary palpi and labrum black. Pronotum yellow or sulfur yellow, subquadrate, bifoveate, with small round foveae, shagreened with minute wrinkles. Scutellum black. Elytra green, yellow or rufous, maculate with 12 round black maculae. Elytral epipleura completely yellow, sutural angle of elytra round, punctation scattered, fine. Abdomen yellow. Tarsi black. Tibiae and femora bicoloured: yellow, from 1/2 to 2/3 is darkened with black or brown. Aedeagus symmetric, with four internal sac sclerites.

Moreover, *D. undecimpunctata howardi* adults can be separated from other subspecies by the following features: abdomen and legs, usually only femora, partly pale in *D. undecimpunctata howardi*, entirely black in *D. undecimpunctata undecimpunctata* and abdomen black in the middle in *D. undecimpunctata duodecimnotata*; spots on elytra in *D. undecimpunctata howardi* are smaller than in *D. undecimpunctata undecimpunctata*, but larger than in *D. undecimpunctata duodecimnotata* and *D. undecimpunctata tenella*. *D. undecimpunctata howardi* is larger and more robust than *D. undecimpunctata tenella* (Figure 3, Derunkov A et al., 2013).

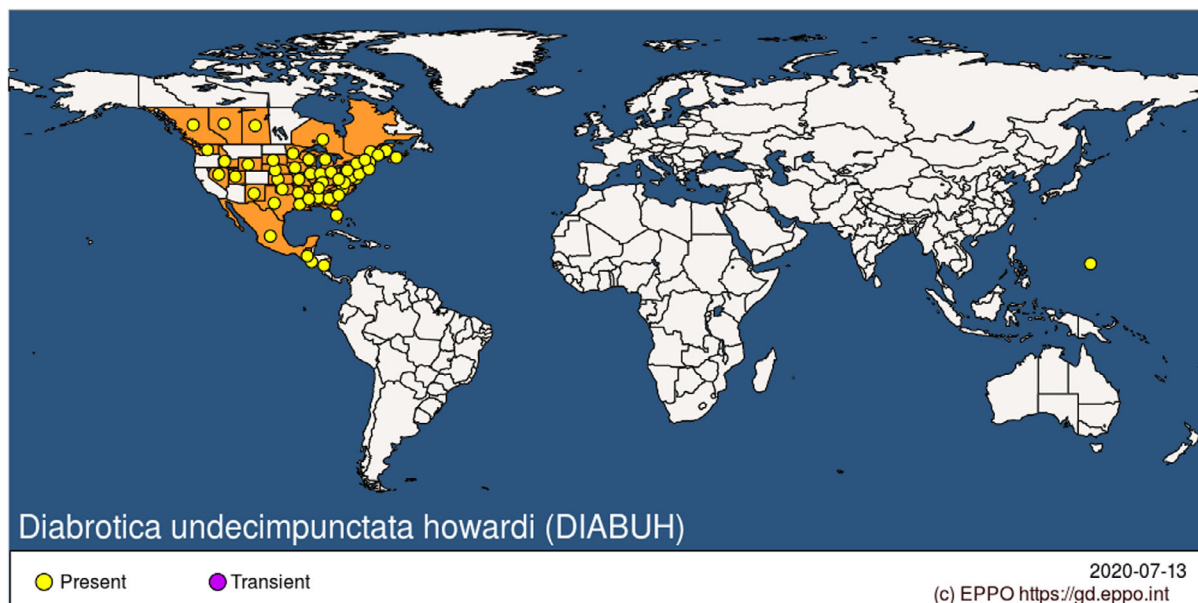


**Figure 3:** Dorsal (right) and lateral (left) views of the four different subspecies of *Diabrotica undecimpunctata* (Source: Derunkov A et al., 2013).

## 3.2. Pest distribution

### 3.2.1. Pest distribution outside the EU

The distribution of *D. undecimpunctata howardi* and *D. undecimpunctata undecimpunctata* was not distinguished in the older literature and is reported to range in North and Central America, from Canada to Nicaragua. In fact, *D. undecimpunctata howardi* can be found over most of this area, whereas *D. undecimpunctata undecimpunctata* is mostly restricted to the west of North America (EPPO, online; EFSA PLH Panel, 2020). The current distribution of *D. undecimpunctata howardi* according to EPPO (EPPO, online) is provided in Figure 4 and Table 2. However, *D. undecimpunctata howardi* is present all year round only south and east of the Midwestern United States where it can survive over winter (see Section 3.1.2). A georeferenced map obtained from the Global Biodiversity Information Facility provided exact location of 306 records of *D. undecimpunctata howardi*, in Canada, Mexico and the USA (GBIF Secretariat 2019).



**Figure 4:** Distribution of *Diabrotica undecimpunctata howardi* extracted from the EPPO Global Database accessed on 1 October 2020

**Table 2:** Distribution of *Diabrotica undecimpunctata howardi* (Source: EPPO, online)

Continent	Country	Subnational area e.g. State	Status
America	Canada		Present, no details
		Alberta, British Columbia New Brunswick, Nova Scotia, Ontario, Québec, Saskatchewan	Present, no details
	El Salvador		Present, no details
	Guatemala		Present, no details
	Mexico		Present, no details
	Nicaragua		Present, no details
	United States of America		Present restricted distribution
		Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming	Present, no details
Oceania	Guam		Present, few occurrences

### 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**, *D. undecimpunctata howardi* is not known to occur in the EU.

*D. undecimpunctata howardi* is not known to occur in the EU. The NPPO of Slovenia declared to EPPO in July 2017 that *D. undecimpunctata howardi* was absent from its territory on the basis that there are no records of it in the country (EPPO 2020).

### 3.3. Regulatory status

#### 3.3.1. Commission Implementing Regulation 2019/2072

*Diabrotica undecimpunctata howardi* is listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, the implementing act of Regulation (EU) 2016/2031. Details are presented in Tables 3 and 4.

**Table 3:** *Diabrotica undecimpunctata howardi* in Commission Implementing Regulation 2019/2072

Annex II	List of Union quarantine pests and their respective codes
<b>Part A</b>	Pests not known to occur in the Union territory
	Quarantine pests and their codes assigned by EPPO
<b>C</b>	Insects and mites
<b>25</b>	<i>Diabrotica undecimpunctata howardi</i> Barber

#### 3.3.2. Legislation addressing the hosts of *Diabrotica undecimpunctata howardi*

Regulated hosts and commodities that may involve *D. undecimpunctata howardi* in Annexes of Commission Implementing Regulation 2019/2072 are shown in Table 4.

**Table 4:** Regulated hosts and commodities that may involve *Diabrotica undecimpunctata howardi* in Annexes of Commission Implementing Regulation 2019/2072

Annex VI	List of plants, plant products and other objects, whose introduction into the Union from certain third countries is prohibited		
	Description	CN Code	Third country, group of third countries or specific area of third country
14.	Plants for planting of the family <i>Poaceae</i> , other than plants of ornamental perennial grasses of the subfamilies <i>Bambusoideae</i> and <i>Panicoideae</i> and of the genera <i>Buchloe</i> , <i>Bouteloua</i> Lag., <i>Calamagrostis</i> , <i>Cortaderia</i> Stapf., <i>Glyceria</i> R. Br., <i>Hakonechloa</i> Mak. ex Honda, <i>Hystrix</i> , <i>Molinia</i> , <i>Phalaris</i> L., <i>Shibataea</i> , <i>Spartina</i> Schreb., <i>Stipa</i> L. and <i>Uniola</i> L., other than seeds	ex 0602 90 50 ex 0602 90 91 ex 0602 90 99	Third countries other than: Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey and Ukraine
15.	Tubers of <i>Solanum tuberosum</i> L., seed potatoes	0701 10 00	Third countries other than Switzerland

16.	Plants for planting of stolon- or tuber-forming species of <i>Solanum</i> L. or their hybrids, other than those tubers of <i>Solanum tuberosum</i> L. as specified in entry 15	ex 0601 10 90 ex 0601 20 90 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than Switzerland
17.	Tubers of species of <i>Solanum</i> L., and their hybrids, other than those specified in entries 15 and 16	ex 0601 10 90 ex 0601 20 90 0701 90 10 0701 90 50 0701 90 90	Third countries other than: (a) Algeria, Egypt, Israel, Libya, Morocco, Syria, Switzerland, Tunisia and Turkey, or (b) those which fulfil the following provisions: (i) they are one of following: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, and Ukraine and (ii) they are either recognised as being free from <i>Clavibacter sepedonicus</i> (Spieckermann and Kottho) Nouioui et al., in accordance with the procedure referred to in Article 107 of Regulation (EU) No 2016/2031, or their legislation, is recognised as equivalent to the Union rules concerning protection against <i>Clavibacter sepedonicus</i> (Spieckermann and Kottho) Nouioui et al. in accordance with the procedure referred to in Article 107 of Regulation (EU) No 2016/2031 have been complied with
18.	Plants for planting of <i>Solanaceae</i> other than seeds and the plants covered by entries 15, 16 or 17	ex 0602 90 30 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than: Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey and Ukraine

**Annex VII List of plants, plant products and other objects, originating from third countries and the corresponding special requirements for their introduction into the Union territory**

	Plants, plant products and other objects	CN code	Origin	Special requirements
6.	Plants for planting, of the family <i>Poaceae</i> of ornamental perennial grasses of the subfamilies <i>Bambusoideae</i> , <i>Panicoideae</i> and of the genera <i>Buchloe</i> Lag., <i>Bouteloua</i> Lag., <i>Calamagrostis</i> Adan., <i>Cortaderia</i> Stapf, <i>Glyceria</i> R. Br.,	ex 0602 90 50 ex 0602 90 91 ex 0602 90 99	Third countries other than Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia,	Official statement that the plants: (a) have been grown in nurseries; (b) are free from plants debris, flowers and fruits; (c) have been inspected and prior to export; (d) are found to be free from symptoms of harmful bacteria, viruses and virus-like organisms; and (e) are found to be free from signs or symptoms of harmful nematodes, insects, mites and fungi, or have been subjected to appropriate treatment to



	<p><i>Hakonechloa</i> Mak. ex Honda, <i>Hystrix</i> L., <i>Molinia</i> Schnrak, <i>Phalaris</i> L., <i>Shibataea</i> Mak. Ex Nakai, <i>Spartina</i> Schreb., <i>Stipa</i> L. and <i>Uniola</i> L., other than seeds</p>		<p>Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo- Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, and Ukraine</p>	<p>eliminate such organisms EN L 319/98 Official Journal of the European Union 10.12.2019</p>
9.	<p>Herbaceous perennial plants for planting, other than seeds, of the families Caryophyllaceae (except <i>Dianthus</i> L.), Compositae (except <i>Chrysanthemum</i> L.), Cruciferae, Leguminosae and Rosaceae (except <i>Fragaria</i> L.)</p>	<p>ex 0602 10 90 ex 0602 90 30 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99 ex 0704 10 00 ex 0704 90 10 ex 0704 90 90 ex 0705 11 00 ex 0705 19 00 ex 0705 21 00 ex 0705 29 00 ex 0709 99 10 ex 0910 99 31 ex 0910 99 33</p>	<p>Third countries other than Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo- Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo- Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, and Ukraine</p>	<p>Official statement that the plants: (a) have been grown in nurseries, (b) are free from plant debris, flowers and fruits, (c) have been inspected at appropriate times and prior to export, (d) are found to be free from symptoms of harmful bacteria, viruses and virus-like organisms, and (e) are either found to be free from signs or symptoms of harmful nematodes, insects, mites and fungi, or have been subjected to appropriate treatment to eliminate such organisms.</p>

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	
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	
Plants, plant products and other objects	CN code and its respective description under Council Regulation (EEC) No 2658/87	Country of origin or dispatch
<i>All plants, within the meaning of point 1 of Article 2 of Regulation (EU) 2016/2031, other than those specified in parts A and C of this Annex</i>	<p>...</p> <p>Cucumbers and gherkins, fresh or chilled:  <b>0707 00 05</b>  <b>0707 00 90</b></p> <p>Leguminous vegetables, shelled or unshelled, fresh or chilled:  <b>0708 10 00</b>  <b>0708 20 00</b>  <b>0708 90 00</b></p> <p>Asparagus, celery other than celeriac, spinach, New Zealand spinach and orache spinach (garden spinach), globe artichokes, olives, pumpkins, squash and gourds (<i>Cucurbita</i> spp.), salad vegetables, (other than lettuce (<i>Lactuca sativa</i>) and chicory (<i>Cichorium</i> spp.)), chard (or white beet) and cardoons, capers, fennel and other vegetables, fresh or chilled, other than planted in a growing substrate:  0709 20 00  ex 0709 40 00  ex 0709 70 00  0709 91 00  0709 92 10  0709 92 90  0709 93 10  0709 93 90  ex 0709 99 10  ex 0709 99 20  0709 99 40  ex 0709 99 50  ex 0709 99 90</p> <p>Melons, fresh or chilled:  <b>0807 11 00</b>  <b>0807 19 00</b></p> <p>...</p>	Third countries other than Switzerland

### 3.3.3. Legislation addressing the organisms vectored by *D. undecimpunctata howardi* (Commission Implementing Regulation 2019/2072)

*D. undecimpunctata howardi* and *Acalymma vittatum* (F), another American Chrysomelidae, are the reported vectors of the bacterial wilt disease of cucurbits caused by the pathogen *Erwinia tracheiphila* (Smith) Bergey et al. (EPPO code: ERWITR). The bacterial wilt is a serious disease of cucumber and muskmelon and, to a lesser extent, squash and pumpkin in temperate midwestern and eastern North America (Yao et al., 1996; Shapiro et al., 2018, Saalau Rojas, 2013). This pathogen is not currently regulated by the EU. There is uncertainty as to whether *E. tracheiphila* occurs in the EU or not.

### 3.4. Entry, establishment and spread in the EU

#### 3.4.1. Host range

Krysan (1986) and Clark et al. (2004) report that the larvae of *D. undecimpunctata howardi* feed on the roots of annual plant species within the families Asteraceae, Chenopodiaceae, Cucurbitaceae, Fabaceae, Poaceae, Polygonaceae, and Solanaceae (Table 5). However, adults feed on a much broader range of plants and have been found on the leaves, stems and flowers of members of about 50 different botanical families (Appendix A). Old references in Clark et al. (2004) point at this species also being fungivorous.

**Table 5:** Hosts plants (roots) of *D. undecimpunctata howardi* larvae. Based on Clark et al. (2004)

Family	Species
Asteraceae	<i>Ambrosia</i> , <i>Artemisia californica</i> , <i>Aster sagittifolius</i> , <i>A. salicifolius</i> <i>Baccharis halimifolia</i> , <i>B. neglecta</i> , <i>B. salicifolia</i> , <i>Bidens laevis</i> , <i>Boltonia asteroides</i> , <i>Calendula</i> sp., <i>Callistephus chinensis</i> , <i>Carduus spinosissimus</i> , <i>Coreopsis aristosa</i> , <i>Cosmos</i> sp., <i>Dahlia variabilis</i> , <i>Echinacea pallida</i> , <i>Erigeron philadelphicus</i> , <i>Eupatorium serotinum</i> , <i>Flourensia cernua</i> , <i>Galinsoga ciliata</i> , <i>Gutierrezia microcephala</i> , <i>G. sarothrae</i> , <i>Helianthus annuus</i> , <i>H. grosseserratus</i> , <i>Ionactis linariifolius</i> , <i>Krigia amplexicaulis</i> , <i>Lactuca sativa</i> , <i>Leucanthemum maximum</i> , <i>Parthenium argentatum</i> , <i>P. integrifolium</i> , <i>Rudbeckia hirta</i> , <i>Senecio</i> sp., <i>Solidago altissima</i> , <i>S. canadensis</i> , <i>S. missouriensis</i> , <i>S. rigida</i> , <i>Symphotrichum ericoides</i> , <i>S. turbinellum</i> , <i>Taraxacum taraxacum</i> , <i>Vernonia interior</i> and <i>Zinnia</i> sp.
Chenopodiaceae	<i>Beta vulgaris</i> , <i>Chenopodium album</i> , and <i>Spinacia oleracea</i>
Cucurbitaceae	<i>Citrullus colocynthis</i> , <i>C. lanatus</i> , <i>Cucumis anguria</i> , <i>C. hardwickii</i> , <i>C. melo</i> , <i>C. sativus</i> , <i>Cucurbita cylindrata</i> , <i>C. digitata</i> , <i>C. ecuadorensis</i> , <i>C. ficifolia</i> , <i>C. foetidissima</i> , <i>C. gracilior</i> , <i>C. lundelliana</i> , <i>C. martinii</i> , <i>C. maxima</i> , <i>C. melopepo</i> , <i>C. mixta</i> , <i>C. moschata</i> , <i>C. okechobeensis</i> , <i>C. palmata</i> , <i>C. palmeri</i> , <i>C. pedatifolia</i> , <i>C. pepo</i> , <i>C. sororia</i> , <i>C. texana</i> , <i>Echinocystis lobata</i> , <i>Lagenaria siceraria</i> and <i>Sicyos angulatus</i>
Fabaceae	<i>Amorpha canescens</i> , <i>A. fruticosa</i> , <i>Arachis hypogaea</i> , jackbean [ <i>Canavalia</i> ], <i>Cercis canadensis</i> , <i>Dalea purpurea</i> , <i>Daubentonia longifolia</i> , <i>Erythrina herbacea</i> , <i>Glycine max.</i> , <i>Lathyrus hirsutus</i> , <i>Lathyrus odoratus</i> , <i>L. sativus</i> , <i>L. tingitanus</i> , <i>Medicago arabica</i> , <i>M. hispida</i> , <i>M. polymorpha</i> , <i>M. sativa</i> , sweetclover, <i>Phaseolus lunatus</i> , <i>P. vulgaris</i> , <i>Pisum sativum</i> , <i>Prosopis glandulosa</i> , <i>P. chilensis</i> , <i>Robinia pseudoacacia</i> , <i>Trifolium incarnatum</i> , <i>Trifolium pratense</i> , <i>T. repens</i> , <i>Trigonella foenum-graecum</i> , <i>Vicia atropurpurea</i> , <i>V. benghalensis</i> , <i>V. cracca</i> , <i>V. dasycarpa</i> , <i>V. faba</i> , <i>V. hirsute</i> , <i>V. monantha</i> , <i>V. sativa</i> , <i>V. villosa</i> , <i>Vigna catjang</i> , <i>Vigna unguiculata</i> , <i>V. sinensis</i> and <i>Wisteria</i> sp.
Poaceae	<i>Zea mays</i> , <i>Saccharum officinarum</i> , <i>Avena sativa</i> , <i>Bouteloua eriopoda</i> , <i>Bromus catharticus</i> , Bermuda grass, <i>Digitaria sanguinalis</i> , <i>Echinochloa crus-galli</i> , <i>Festuca</i> sp., <i>Hordeum vulgare</i> , <i>Oryza sativa</i> , <i>Panicum dichotomiflorum</i> , <i>P. miliaceum</i> , <i>Pennisetum americanum</i> , <i>Phleum</i> sp., <i>Secale cereale</i> , <i>Sorghum vulgare</i> , <i>Sorghum bicolor</i> , <i>S. halepense</i> , <i>S. sudanense</i> , <i>Triticum aestivum</i>
Polygonaceae	<i>Eriogonum</i> sp., <i>Fagopyrum</i> sp., <i>Polygonum perfoliatum</i> and <i>Rheum rhabarbarum</i>
Solanaceae	<i>Atropa belladonna</i> , <i>Capsicum frutescens</i> , <i>Datura stramonium</i> , <i>Lycopersicon esculentum</i> , <i>Nicotiana tabacum</i> , <i>Physalis pubescens</i> , <i>Solanum carolinense</i> , <i>S. elaeagnifolium</i> , <i>S. melongena</i> and <i>S. tuberosum</i>

Although the high polyphagy of *D. undecimpunctata howardi* would make the regulation of the hosts/commodities included in their host range an endless task, as a quarantine pest listed in Annex II, Part A of Commission Implementing Regulation 2019/2072 the pest freedom status of any commodity introduced into the EU from the areas where the pest is known to occur should be granted by the compulsory phytosanitary certificate (Commission Implementing Regulation 2019/2072). Current regulations (see Tables 3 and 4) are not comprehensive of the true host range of *D. undecimpunctata howardi* (i.e. those where oviposition takes place and immature stages complete development), as plants for planting of the families Chenopodiaceae (*Beta vulgaris*, *Spinacia oleracea*), Cucurbitaceae (*Citrullus* spp. *Cucumis* spp.) and Fabaceae (*Arachis hypogaea*, *Vicia* spp., *Medicago sativa*, *Phaseolus vulgaris*, *Pisum sativum*) other than seeds from third countries (where *D. undecimpunctata howardi* occurs) are not specifically regulated although all plants for planting from third countries require a phytosanitary certificate.

### 3.4.2. Entry

*Is the pest able to enter into the EU territory? If yes, identify and list the pathways.*

**Yes**, the pest could enter into the EU in plants for planting (any life stage), flowers and fruit (adults) and soil/growing medium (immature stages, either by themselves, accompanying plants for planting, or attached to machinery).

Adults of *D. undecimpunctata howardi* are unlikely to be carried by either plants for planting, flowers or fruit, which are the adult feeding hosts (Appendix A), because 1) they would be expected to fly off such plant parts when disturbed during harvesting and processing for shipment, and 2) they only feed on soft skinned young fruit (i.e. melons) not ready for harvest. *D. undecimpunctata howardi* is more likely to move in international trade as immature stages (eggs, larvae and pupae) on roots of true hosts or in soil, either as a commodity on its own, or when accompanying plants for planting. However, whether there is any import into the EU of susceptible plants for planting with soil (keep in mind that all plant hosts where larvae feed are annual) is uncertain but is quite unlikely.

A search of Europhyt interceptions database did not reveal any interception of *D. undecimpunctata howardi* for the period 1995–2020 (accessed on 2 October 2020). There were no interceptions recorded in the TRACES database from May to October 2020 (accessed on 2 October 2020).

*D. undecimpunctata howardi* has been intercepted in Bermuda and Hawaii (EPPO, online). No further details are available.

Potential entry pathways are shown in Table 6.

**Table 6:** Potential pathways for *D. undecimpunctata howardi* and existing mitigations (if any)

Pathway	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI) or special requirements (Annex VII) within Implementing Regulation 2019/2072]
Plants for planting with foliage and soil/growing medium	Eggs larvae and pupae on roots/in soil Adults on foliage	Annex VII of Regulation 2019/2072 requires a general freedom from symptoms of quarantine pests Annex VI (14.) bans the introduction of Poaceae from the countries where <i>D. undecimpunctata howardi</i> occurs Annex VI (15.-18.) bans the introduction of Solanaceae from the countries where <i>D. undecimpunctata howardi</i> occurs Annex VII (6.) excludes countries where <i>D. undecimpunctata howardi</i> occurs from the introduction into the EU of annual (..) plants for planting of the family Poaceae other than and seed Annex VII (9.) excludes the countries where <i>D. undecimpunctata howardi</i> occurs from the introduction into the EU of annual (..) plants for planting of the family Asteraceae other than seed
Fruits	Adults on fruit	Annex VII of Regulation 2019/2072 requires a general freedom from symptoms of quarantine pests Article 72(1) of Regulation (EU) 2016/2031 requires a phytosanitary certificate
Soil and growing media	Immature stages	Annex VI (19. and 20.) bans the introduction of soil and growing media as such into the Union from third countries other than Switzerland
Soil on machinery	Immature stages	Annex VII (2.) Official statement that machinery or vehicles are cleaned and free from soil and plant debris

The plants for planting with foliage and growing medium pathway is regulated because plants for planting require a phytosanitary certificate and, therefore, should be free from quarantine pests even if they are not specifically regulated in relation to *D. undecimpunctata howardi*.

Likewise, the fruit pathway is regulated because fruits require a phytosanitary certificate and, therefore, should be free from quarantine pests even if they are not specifically regulated in relation to *D. undecimpunctata howardi*.

The soil/growing media pathway can be considered as closed because soil can only enter the EU from Switzerland (Annex VI). *D. undecimpunctata howardi* is not known to occur in Switzerland.

Import records do not provide sufficient detail to identify whether host plants of the pest are imported as plants for planting into the EU.

### 3.4.3. Establishment

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

**Yes.** Taking into account its distribution in the Americas within climate zones that also occur in the EU, and the availability of hosts outdoors in Europe, *D. undecimpunctata howardi* has the potential to establish in the EU.

#### 3.4.3.1. EU distribution of main host plants

As noted above (Section 3.4.1), both adults and larvae of *D. undecimpunctata howardi* are polyphagous. However, they show a preference for maize and cucurbits. Many of the various cultivated varieties of *Cucurbita pepo* (marrows, courgettes and zucchini) are grown within the EU. Marrows are grown more in northern Europe, whilst courgettes and zucchini are grown more in central and southern Europe. *Cucurbita maxima* (pumpkin) is grown outdoors across the EU. *Cucumis sativus* (cucumbers and gherkins) are grown both outdoors and in greenhouses in Europe. *Cucumis melo* (melons: cantaloupe, musk, winter) can be grown outdoors and in greenhouses in all Mediterranean countries but only in greenhouses in northern Europe (de Rougemont, 1989). The area of cucurbit production in the EU is shown in Table 7.

**Table 7:** Crop production area 2015–2019 in EU28 (cultivation/harvested/production) of maize and cucurbit hosts of *Diabrotica undecimpunctata howardi* (1,000 ha) Source Eurostat Crop production in EU standard humidity [apro\_cpsh1] (accessed on 20/06/2020)

Crop	Code	2015	2016	2017	2018	2019
Maize (green)	G3000	6,267.95	6,256.88	6,183.91	6,355.91	6,408.21
Watermelons	V3520	76.39	75.29	76.47	73.54	76.13
Muskmelons	V3510	73.73	73.27	72.60	70.30	70.28
Courgettes and marrows	V3420	39.99	41.52	42.41	42.52	42.32
Cucumbers	V3200	33.51	32.43	31.91	32.76	35.04
Cucumbers – under glass	V3200S	14.76	:	:	:	:
Gherkins	V3300	12.24	11.81	12.24	12.53	11.96

: data not available.

#### 3.4.3.2. Climatic conditions affecting establishment

In a study conducted to identify suitable areas for the occurrence of four *Diabrotica* spp. (Marchioro and Krechmer, 2018) and including 266 unique georeferenced records for *D. undecimpunctata howardi*, the authors concluded that this species is widely distributed throughout tropical, subtropical, Mediterranean and semi-arid areas in the USA and Mexico. These authors intersected pest occurrence data in grids with Köppen–Geiger climate types to predict optimal areas for this species in areas outside their present distribution range. Their results showed that most of the EU would be suitable for the occurrence of this species, with the exception of northern Finland and Sweden. By comparing these data with the occurrence of maize in the same areas, authors concluded that suitable areas for establishment of *D. undecimpunctata howardi* included most of the EU, with the exception of some alpine areas and most of the Scandinavian Peninsula and Finland, where maize cannot be cultivated but in the south of Finland and Sweden. Given that additional hosts (i.e. cucurbits) are also widely cultivated in the EU, *D. undecimpunctata howardi* has the potential to establish in the EU. In the warmer southern EU, there could be several generations per year as there is in the USA (Lampman et al., 1987; Pereira et al., 2017). Established populations in warmer southern EU areas could expand during the spring and summer to form transient populations in more northern areas although frosts and freezing temperatures would prevent successful overwintering.

### 3.4.4. Spread

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

Yes, adults are strong flyers, which can also be passively dispersed long distances by air currents.

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

No, plants for planting is not the main spread mechanism used by *D. undecimpunctata howardi*.

The adults are strong fliers and can disperse rapidly, travelling readily from field to field during the summer (EPPO online). Moreover, adults can be carried long distances by high-altitude air currents (EPPO 2020).

### 3.5. Impacts

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

**Yes**, the introduction of *D. undecimpunctata howardi* into the EU would most likely have an economic impact on maize and cucurbit production.

*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?*

**Yes**, the presence of *D. undecimpunctata howardi* on plants for planting would most likely have an economic impact on its intended use.

Heavy infestations of adults emerging in the spring and feeding on young cucurbit plants can destroy stems and cotyledons resulting in the loss of a whole crop (Davidson and Lyon, 1987; Lapman et al. 1987). Spring feeding by adults may cause floral damage on anthers and filaments of the flowers of host plants, reducing pollen production and resulting in reduced fruit set and production (Marshall, 2013).

In maize, adult beetles feed on leaves, pollen and tassels, but they prefer silks. When there are more than 8–10 adults per plant during the green silk stage and the silks are chewed back to within 1.3 cm of the shuck, poorly filled ears may result from poor pollination. When this amount of feeding occurs, or if excessive leaf damage occurs, it is profitable to control the beetles (Porter et al., 2010). In the Gulf Coast region of the USA, *D. undecimpunctata howardi* is a significant pest of maize, peanuts, cucurbits and legumes (Jackson et al., 1995; Porter et al., 2010) but in inland areas of Texas, USA, where maize is planted in fields that were not grassy or weedy the previous year *D. undecimpunctata howardi* is considered a minor maize pest.

In addition to direct feeding damage resulting in lost yields, *D. undecimpunctata howardi* is a vector of bacterial wilt disease of cucurbits, a serious disease of cucumber and muskmelon and, to a lesser extent, squash and pumpkin in temperate midwestern and eastern North America (Yao et al., 1996; Shapiro et al., 2018) (see 3.3.3).

The impacts reported from North America could occur in the EU if *D. undecimpunctata howardi* were to establish, with maize and cucurbit production most likely to be affected.

### 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. The plants for planting excluding seeds with soil/growing medium pathway is partly closed (i.e., Asteraceae, Poaceae and Solanaceae). However, plants for planting excluding seeds of the families Chenopodiaceae, Cucurbitaceae, Fabaceae, and Polygonaceae are not specifically regulated.

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

**Yes**, sourcing plants from pest free areas (PFA) would reduce the risk of the pest being present on plants.

### 3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to plants for planting and soil (see Section 3.3). Therefore, the entry pathways can be considered as partially closed (i.e. soil and Asteraceae, Poaceae and Solanaceae plants for planting only). Extending these measures to plants for planting of the families Chenopodiaceae, Cucurbitaceae, Fabaceae and Polygonaceae) would further reduce the risk of entry of *D. undecimpunctata howardi* into the EU.

#### 3.6.1.1. Additional control measures

A number of hosts are currently prohibited for import (see Table 4). The prohibition could be extended to all hosts (i.e. plants for planting with foliage and soil/growing medium of the families Chenopodiaceae, Cucurbitaceae, Fabaceae and Polygonaceae) from countries where *D. undecimpunctata howardi* occurs (i.e. extension of regulations in Annex VI). If prohibition is not going to be extended, then potential additional measures are listed in Table 8.

**Table 8:** Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/ establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/ establishment/ spread/impact)
<a href="#">Growing plants in isolation</a>	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses	Spread, impact
<a href="#">Chemical treatments on consignments or during processing</a>	Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage The treatments addressed in this information sheet are: a) fumigation; b) spraying/dipping pesticides; c) surface disinfectants; d) process additives; e) protective compounds	Entry
<a href="#">Soil treatment</a>	The control of soil organisms by chemical and physical methods listed below: a) fumigation; b) heating; c) solarisation; d) flooding; e) soil suppression; f) augmentative biological control; g) biofumigation	Spread, impact
<a href="#">Physical treatments on consignments or during processing</a>	This information sheet deals with the following categories of physical treatments: irradiation/ionisation; mechanical cleaning (brushing, washing); sorting and grading, and; removal of plant parts (e.g. debarking wood). This information sheet does not address: heat and cold treatment (information sheet 1.14); roguing and pruning (information sheet 1.12)	Entry, spread
<a href="#">Controlled atmosphere</a>	Treatment of plants by storage in a modified atmosphere (including modified humidity, O <sub>2</sub> , CO <sub>2</sub> , temperature, pressure)	Entry, spread

#### 3.6.1.2. Additional supporting measures

No additional supporting measures are suggested.

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

- Immature stages (i.e. eggs) could be hidden on the roots of/in the soil attached to host plants hampering their detection by external visual inspection.
- Adults could be present as hitchhikers on non-host plants.
- Adults can actively fly.

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

- Immature stages (i.e. eggs) could be hidden on the roots of/in the soil attached to host plants hampering their detection by external visual inspection.

**3.7. Uncertainty**

There are no uncertainties affecting the conclusions of this categorisation.

**4. Conclusions**

*D. undecimpunctata howardi* satisfies the criteria that are within the remit of EFSA to assess for this species to be regarded as a potential Union quarantine pest. This species does not meet the criteria of being present in the EU nor plants for planting being the main pathway for spread for it to be regarded as a potential regulated non-quarantine pest. Pest categorisation conclusions are presented in 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
<b>Identity of the pests (Section 3.1)</b>	The identity of <i>Diabrotica undecimpunctata howardi</i> is well established	The identity of <i>Diabrotica undecimpunctata howardi</i> is well established	
<b>Absence/presence of the pest in the EU territory (Section 3.2)</b>	<i>D. undecimpunctata howardi</i> is not known to occur in the EU territory	<i>D. undecimpunctata howardi</i> is not known to occur in the EU territory. Therefore, it does not meet the criterion of being present in the EU to qualify for RNQP status	
<b>Regulatory status (Section 3.3)</b>	<i>D. undecimpunctata howardi</i> is currently regulated as a quarantine pest	<i>D. undecimpunctata howardi</i> is currently regulated as a quarantine pest. There are no grounds to consider the revoking of this status	
<b>Pest potential for entry, establishment and spread in the EU territory (section 3.4)</b>	<p><i>D. undecimpunctata howardi</i> could enter into, establish in, and spread within the EU territory. Main pathways are:</p> <ul style="list-style-type: none"> <li>• Plants for planting of the families Chenopodiaceae, Cucurbitaceae, Fabaceae, Poaceae, Polygonaceae, and Solanaceae</li> <li>• Soil and growing medium as such or attached to machinery.</li> </ul> <p>The regulation covers 2 out of 6 families with hosts. The families Chenopodiaceae, Cucurbitaceae, Fabaceae and Polygonaceae are</p>	<i>D. undecimpunctata howardi</i> could spread within the EU territory. Adults are good flyers. Immature stages could spread with plants for planting. Although the latter is considered as the main entry pathway in international trade, natural spread would be the main pathway should the pest be introduced into 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 Union regulated non-quarantine pest	Key uncertainties
	not specifically regulated for import into the EU		
<b>Potential for consequences in the EU territory (Section 3.5)</b>	Should <i>D. undecimpunctata howardi</i> be introduced into the EU, an economic impact would most likely follow	Should <i>D. undecimpunctata howardi</i> be introduced into the EU, its presence on plants for planting would most likely have an economic impact on their intended use	
<b>Available measures (Section 3.6)</b>	There are measures to prevent the entry, establishment and spread of <i>D. undecimpunctata howardi</i> within the EU territory, such as sourcing plants for planting from PFA	There are measures to prevent the presence of <i>D. undecimpunctata howardi</i> on plants for planting, such as sourcing plants for planting from PFA	
<b>Conclusion on pest categorisation (Section 4)</b>	<i>D. undecimpunctata howardi</i> fulfils all criteria assessed by EFSA above for consideration as a quarantine pest	<i>D. undecimpunctata howardi</i> does not meet the criteria of being present in the EU nor plants for planting being the main pathway for spread for it to be regarded as a potential regulated non-quarantine pest.	
<b>Aspects of assessment to focus on/scenarios to address in future if appropriate</b>	<i>D. undecimpunctata howardi</i> is a vector of the bacterial wilt of cucurbits caused by <i>Erwinia tracheiphila</i> . The pathogen occurs in temperate midwestern and eastern North America and can cause yield losses of up to 75%. There is uncertainty on whether the disease occurs in the EU		

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## Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
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	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.
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 – Families on which adult *Diabrotica undecimpunctata howardi* feed

Families on which larvae feed are marked with an asterisk (\*). Hence true hosts are found within those families highlighted with \*.

Family	
Alismataceae	Iridaceae
Amaranthaceae	Lamiaceae
Amaryllidaceae	Liliaceae
Apiaceae	Linaceae
Asclepiadaceae	Magnoliaceae
Asteraceae*	Malvaceae
Balsaminaceae	Nelumbonaceae
Betulaceae	Nyctaginaceae
Bignoniaceae	Onagraceae
Brassicaceae	Oxalidaceae
Cactaceae	Phytolaccaceae
Cannabaceae	Plantaginaceae
Cannaceae	Poaceae*
Caprifoliaceae	Polygonaceae*
Chenopodiaceae*	Rosaceae
Convolvulaceae	Rubiaceae
Cornaceae	Rutaceae
Cucurbitaceae*	Salicaceae
Cyperaceae	Smilacaceae
Ericaceae	Solanaceae*
Fabaceae*	Theaceae
Fagaceae	Verbenaceae
Grossulariaceae	Vitaceae