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Pest categorisation of *Diabrotica barberi*

EFSA Panel on Plant Health (PLH),
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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Diabrotica barberi* (Coleoptera: Chrysomelidae), the northern corn rootworm, for the EU. *D. barberi* is a univoltine species occurring in mid-western and eastern USA and Canada, where it reproduces on maize (*Zea mays*), the preferred larval host. A small proportion of individuals can develop to a lesser extent on spelt (*Triticum spelta*), rice (*Oryza sativa*), millet (*Panicum miliaceum*) and a few North American wild grasses. Eggs are laid in the soil of maize fields, where they overwinter and can enter a diapause which can extend for more than one winter. Larvae hatch in late spring and early summer. Adult emergence peaks in the summer to feed on maize tassels, silks and ear tips. Adults abandon maize fields looking for other feeding hosts and return to maize for oviposition during late summer and autumn. *D. barberi* is considered a key pest of maize, together with other rootworm species of the same genus. *D. barberi* is regulated in the EU by Directive 2000/29/EC (Annex IAI). Within this Directive, a general prohibition of soil from most third countries prevents the entry of *D. barberi* larvae. However, adults carried on sweetcorn or green maize are potential pathways for entry into the EU. Climatic conditions and the wide availability of maize provide conditions to support establishment in the EU. Following establishment, impact on maize yields is anticipated. Phytosanitary measures are available to inhibit entry of this pest. *D. barberi* satisfies the criteria, which are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest. *D. barberi* does not meet the criteria of occurring in the EU nor plants for planting being the principal means of spread for it to be regarded as a potential Union regulated non-quarantine pest.

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Keywords: maize, northern corn rootworm, pest risk, plant health, plant pest, quarantine

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1. Introduction

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

1.1.1. Background

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

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

1.1.2. Terms of reference

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

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

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

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

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

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

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

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

1.1.2.1. Terms of Reference: Appendix 1

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

Annex IIAI

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

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

(b) Bacteria

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

(c) Fungi

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

(d) Virus and virus-like organisms

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

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

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *Diabrotica barberi* 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.

2.1.2. Database search

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

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 *D. barberi*, 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 in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific ToR received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

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

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

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

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

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

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

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 *D. barberi* is established and taxonomic keys are available for its identification to species level.

The northern corn rootworm, *D. barberi* Smith & Lawrence 1967 (Coleoptera: Chrysomelidae: Galerucinae) is a well-defined species occurring in Northern America. The species was originally described by Say in 1824 as *Gelleruca longicornis* (Chiang, 1973). The genus *Diabrotica* includes about 100 species native of the New World (Krysan, 1986; Derunkov et al., 2013). *D. barberi* had been considered a subspecies of *Diabrotica longicornis* (Say) 1823 (i.e. *D. longicornis barberi* Smith & Lawrence). However, the taxon was elevated to species level based on laboratory and field studies, including the examination of more than 3,500 museum specimens (Krysan et al., 1983).

3.1.2. Biology of the pest

Diabrotica barberi is a univoltine species. Larvae hatch by late spring and early summer and develop on the roots of maize (Branson and Krysan, 1981; Hesler, 1993), where they have three instars (Hammack et al., 2003). Males emerge earlier than females (Naranjo and Sawyer, 1988). Upon emergence from the soil, adults feed on maize tassels, silks and ear tips. Adult populations peak in the fields while maize is flowering (Lance et al., 1989). Maize leaves are not the preferred food of adult *D. barberi* (Ludwig and Hill, 1975; Hesler, 1993) and feeding on flower parts such as tassels and silks provides higher fecundity and longevity (Lance and Fisher, 1987). As the floral structures of maize dry and deteriorate, female *D. barberi* abandon maize fields (Lance et al., 1989) and become increasingly abundant on the flowers of weeds, prairie forbs and crops other than maize within the families Asteraceae, Cucurbitaceae, Fabaceae and Poaceae (Clark et al., 2004). Adult *D. barberi* also feed on apple fruits, especially where the skin has been broken by other insects (Hesler, 1993). Egg-laden *D. barberi* adult females actively seek maize when searching for oviposition sites during late summer and autumn (Lance et al., 1989). Eggs are laid in clutches of 25–31 eggs (Naranjo and Sawyer, 1988) in the soil of maize fields, where they overwinter and can enter a diapause which can extend for more than one cold season (Krysan et al., 1984; Fisher et al., 1994). Temperatures in the range 6–15°C foster diapause development. Maximum egg hatch was observed for eggs exposed to 8–12°C for 160–205 days (Fisher et al., 1994). Hatching of eggs maintained at 0°C ranged from 20% to 6.3% for 15 and 135 days, respectively, and reached 8% after 180 days of exposure to this temperature (Fisher et al., 1994). Laboratory studies (Jackson and Elliott, 1988; Woodson and Jackson, 1996) showed that development from egg to adult can be completed at temperatures in the range 15–31.5°C. Survival was lower at 15 and 31.5°C for both males and females, with optimal temperature for growth between 18 and 30°C. A development threshold of 10.2°C and a thermal constant of 525 and 865 DD from either egg hatch or oviposition to adult emergence, respectively, were calculated. According to Naranjo and Sawyer (1988), mean female and male longevity were similar, ranging from ca. 90 days at 17.5°C to 42 days at 30°C. During this time, females may lay an egg clutch every 6–7 days with a total fecundity of 118–274 eggs.

Diabrotica barberi and the closely related *D. virgifera virgifera* LeConte are sympatric and can be found in the same maize fields in mixed infestations. However, *D. virgifera virgifera* has displaced *D. barberi*, or at least reduced its abundance, in some areas (Capinera, 2008). This displacement has been attributed to greater insecticide resistance and higher reproductive rate of *D. virgifera virgifera* relative to *D. barberi* (Capinera, 2001).

3.1.3. Intraspecific diversity

Based on the genetic variation of mitochondrial DNA (mtDNA) and the nuclear ribosomal internal transcribed spacer, ITS1, found in specimens collected in 10 states of the USA (extending from Pennsylvania to the Great Plains), two distinct clades have been identified. They can be described as the eastern population and the western population (Roehrdanz et al., 2003). However, these authors did not present any evidence for differences in pest status of these populations, which will be dealt with together in this categorisation.

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. barberi* are available.

Detection

Symptoms:

According to Smith et al. (1997), 'larval feeding on the roots causes root pruning. As a result, the force needed to pull the plant from the soil decreases (this can serve as an index of damage), and the plants have a greater tendency to lodge. The older larvae burrow in the cortical parenchyma of the roots, and then dig channels in the central vascular tissue. Tunnels in maize roots are thus a characteristic symptom, though they may be due to other species. Adult feeding does not cause any particularly characteristic symptom'.

Pheromone trapping:

Yellow sticky traps have been used to monitor this species. Their attractiveness could be enhanced by use of some semiochemicals (Capinera, 2001). The 2R,8R stereoisomers of 8-methyl-2-decyl propanoate proved attractive for *D. barberi* when tested in South Dakota (Guss et al., 1985). Furthermore, cucurbitacin and a few additional chemicals isolated from Cucurbitaceae (i.e. eugenol, isoeugenol, 2-methoxy-4-propylphenol, cinnamyl alcohol) could also be used (Capinera, 2001)

Identification:

Immature stages:

Smith et al. (1997) report that 'larvae are small, wrinkled, yellowish-white, with a brown head capsule, reaching 10–18 mm in length'. However, attempts to distinguish larvae belonging to the genus *Diabrotica* using external characters have proven to be difficult (Krysan, 1986). Mendoza and Peters (1964) devised a key to differentiate mature larvae of the economically important *D. undecimpunctata howardi* Barber, *D. v. virgifera* and *D. barberi*.

Adult morphology:

According to Derunkov et al. (2013), body length and width are 4.8–5.6 and 2.0–2.5 mm, respectively (Diabrotica ID, online). Head basic colour is yellow. Antennae are filiform, bi- or tricolored, with antennomere 1 yellow, testaceous or greenish brown and antennomeres 2-11, Brussels brown. The pronotum is Paris green, green or yellow. The scutellum is yellow. Elytra are green, with five distinct sinuate sulci. Elytral epipleura are green. The abdomen is yellow, pale olivine or green. Tarsi are black, amber brown or chestnut. Tibiae are bicoloured yellow. Femora are uniform yellow or olive ocher. The aedeagus is symmetric, with four internal sac sclerites. According to the same authors, '*D. barberi* is similar to *D. longicornis* and *D. virgifera*. They can be separated by the following features: in *D. barberi* the head, tibia and tarsi are paler than in *D. longicornis*; femora unicolourous green or flavous in *D. barberi*, while femora of *D. virgifera* as a rule bicoloured, with outer edges dark, chestnut or piceous; distance from apex to ventral flange of aedeagus in *D. virgifera* is 1.5–2.0 times that of *D. barberi*. The shapes of the internal sac sclerites (especially sclerite 4B) differentiates all three species very well.'

Molecular methods:

Szalanski and Powers (1996) developed a PCR-RFLP-based diagnostic method for adults and larvae of three *Diabrotica* species including, *D. barberi*. Other authors have focused on using molecular markers to establish the phylogeny of the genus *Diabrotica* (e.g. Clark et al., 2001a,b). These studies could also be used for diagnostic purposes.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

D. barberi is present in the Nearctic region only (Figure 1 from the Great Plains region to North Dakota and Oklahoma, and east to the Atlantic Ocean, and Canada (Manitoba, New Brunswick, Ontario and Québec) (EPPO, online, accessed 04/06/2019). This species is native to this region. It was first discovered attacking maize in Colorado and has since spread eastward, mostly to the maize-growing region in the mid-western states. This range expansion is primarily attributed to a change in crop production practices: continuous monoculture of maize in the same fields (Capinera, 2008).

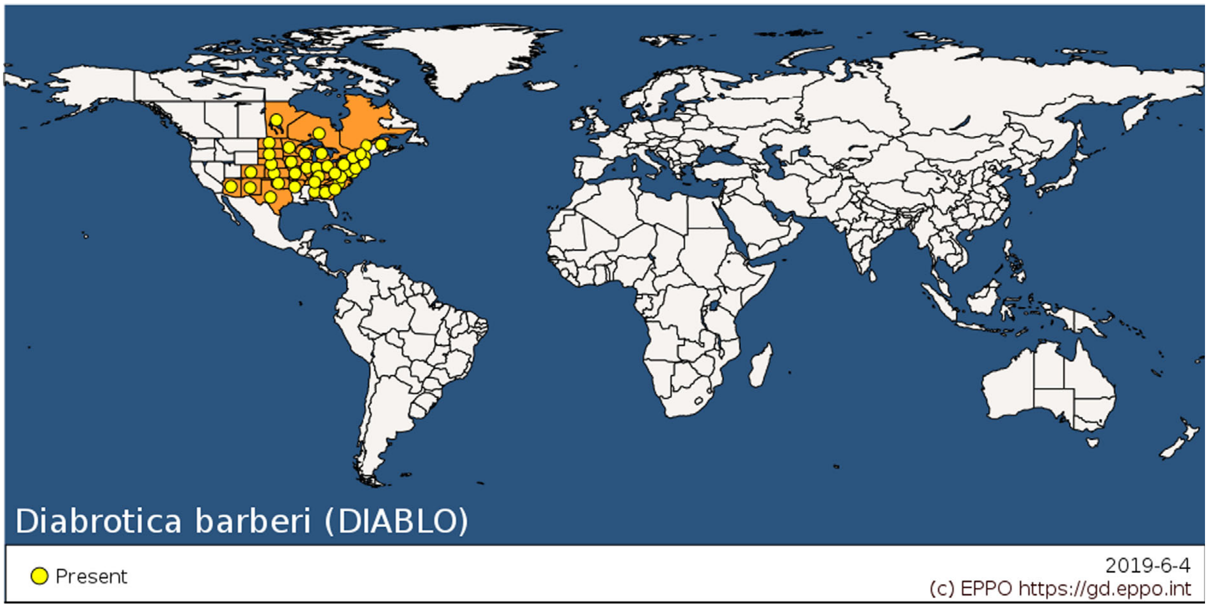

Figure 1: Global distribution map for *Diabrotica barberi* (extracted from the EPPO Global Database accessed on 04/06/2019).

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. barberi* is not known to be present in the EU

D. barberi is not known to be present in the EU. The NPPO of Slovenia informed EPPO that *D. barberi* is not present there due to no pest records (EPPO global database, 2019).

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

Diabrotica barberi is listed in Council Directive 2000/29/EC in Annex IAI. Details are presented in Tables 2 and 3.

Table 2: *Diabrotica barberi* in Council Directive 2000/29/EC

Annex I Part A	**Harmful organisms whose introduction into, and spread within, all member states shall be banned**
Section I	Harmful organisms not known to occur in any part of the community and relevant for the entire community
(a)	Insects, mites and nematodes, at all stages of their development
	Species
10.1	*Diabrotica barberi* Smith and Lawrence

3.3.2. Legislation addressing the hosts of *Diabrotica barberi*

Table 3: Regulated hosts and commodities that may involve *Diabrotica barberi* in Annexes III, IV and V of Council Directive 2000/29/EC

Annex III Part A	**Plants, plant products and other objects the introduction of which shall be prohibited in all member states**	
	Description	**Country of origin**
14	Soil and growing medium as such, which consists in whole or in part of soil or solid organic substances such as parts of plants, humus including peat or bark, other than that composed entirely of peat	Turkey, Belarus,[...] Moldavia, Russia, Ukraine and third countries not belonging to continental Europe, other than the following:[...] Egypt, Israel, Libya, Morocco, Tunisia
Annex IV Part A	**Special requirements which must be laid down by all member states for the introduction and movement of plants, plant products and other objects into and within all member states**	
Section I	**Plants, plant products and other objects originating outside the community**	
	Plants, plant products and other objects	Special requirements
	Seeds of *Zea mays* L.	Official statement that: (a) the seeds originate in areas known to be free from *Erwinia stewartii* (Smith) Dye; or (b) a representative sample of the seeds has been tested and found free from *Erwinia stewartii* (Smith) Dye in this test.
Annex V	**Plants, plant products and other objects which must be subject to a plant health inspection (...) in the country of origin or the consignor country, if originating outside the community before being permitted to enter the community**	
Part A	Plants, plant products and other objects originating in the community	
	–	
Part B	Plants, plant products and other objects originating in territories, other than those territories referred to in part A	
Section I	Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community	
1	Plants, intended for planting, other than seeds but including seeds of [...] *Zea mays* L.	

3.3.3. Legislation addressing the organisms vectored by *Diabrotica barberi* (Directive 2000/29/EC)

Diabrotica barberi is an efficient vector of the Squash mosaic virus (SqMV, Secoviridae) in the field, with transmission percentages up to 16.7 % (Langham et al., 1997). This virus is present in Greece, Italy and The Netherlands (EPPO, online, accessed 14/06/2019) but is not considered as a quarantine pest in the EU or the EPPO region (EPPO, online).

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

A distinction between breeding and adult feeding hosts has to be made. Larvae are stenophagous and mostly feed on maize roots. Adults are polyphagous and can feed on maize flowers and leaves but also on different hosts belonging to different botanical families (Clark et al., 2004) and come back to maize for oviposition (Ludwig and Hill, 1975). Although maize is the only crop regularly attacked by *D. barberi*, development can also occur to a lesser extent on millet (*Panicum miliaceum* L.), rice (*Oryza sativa* L.) and spelt (*Triticum spelta* L.). Moreover, some survival occurs on some rangeland forage grasses and in some cases, adults from larvae reared on these hosts can lay viable eggs (Chiang, 1973; Capinera, 2001).

- Breeding hosts: maize (main host), millet, rice, spelt.
- Adult feeding hosts: Asteraceae, Cucurbitaceae, Fabaceae and Poaceae (including maize).

3.4.2. Entry

Is the pest able to enter into the EU territory?
Yes, soil/growing media; forage / green maize and maize cobs could provide potential pathways.

- soil/growing media — Closed due to legislation (2000/29 EC, Annex III, A 14.).
- fresh maize cobs (sweetcorn) — Open pathway
- forage/green maize — Open pathway

Adults could be carried on consignments of fresh sweetcorn (corn cobs) and forage/green maize (Smith et al., 1997). These pathways are not specifically regulated although as an Annex I/AI pest the entry of *D. barberi* into the EU is prohibited regardless of the commodity where they are found. Other plants on which adults feed on pollen could provide potential pathways if transported when in flower. However, pollen hosts are generally wild plants and weeds and are not judged to provide a realistic pathway.

In future, following the implementation of the Plant Health Regulation (EC 2016/2031), consignments of almost all fruits and vegetables, including sweetcorn, will require a phytosanitary certificate indicating that it has been inspected and is free from harmful organisms prior to entry into the EU.

There are no data in Eurostat for the import of fresh or chilled sweetcorn (CN 0709 9060) prior to 2000 or after 2011. Figure 2 shows the amount of fresh or chilled sweetcorn imported from USA between 2000 and 2011. Eurostat reports imports of sweetcorn from Canada in 2000 (20 tonnes) and in 2008 (4 tonnes). However, 99.95% of sweetcorn imports from either USA or Canada were from USA between 2000 and 2011.

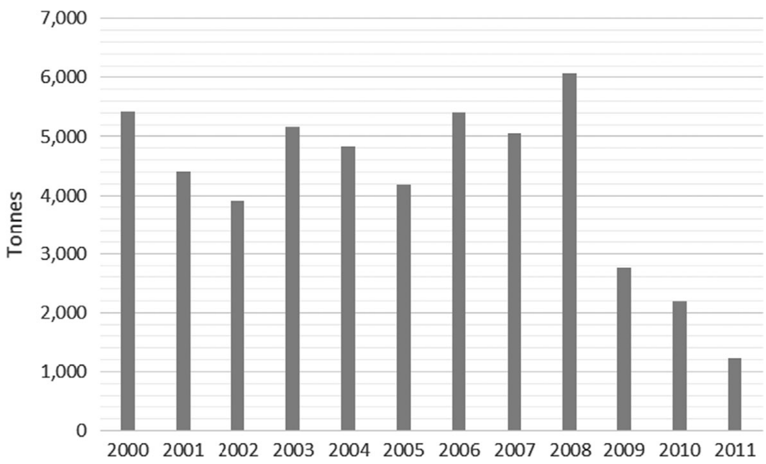

Figure 2: EU 28 annual import of fresh or chilled sweetcorn (CN 0709 9060) 2000–2011

Import code CN 2308 0090 is described as 'Maize stalks, maize leaves, fruit peel and other vegetable materials, waste, residues and by-products for animal feeding, whether or not in the form of pellets, n.e.s. (excl. acorns, horse-chestnuts and pomace or marc of fruit)'. It is unknown whether or not maize stalk and leaves with the potential to convey adult *D. barberi* would form a proportion of this category. Nevertheless, import volumes are shown in Figure 3.

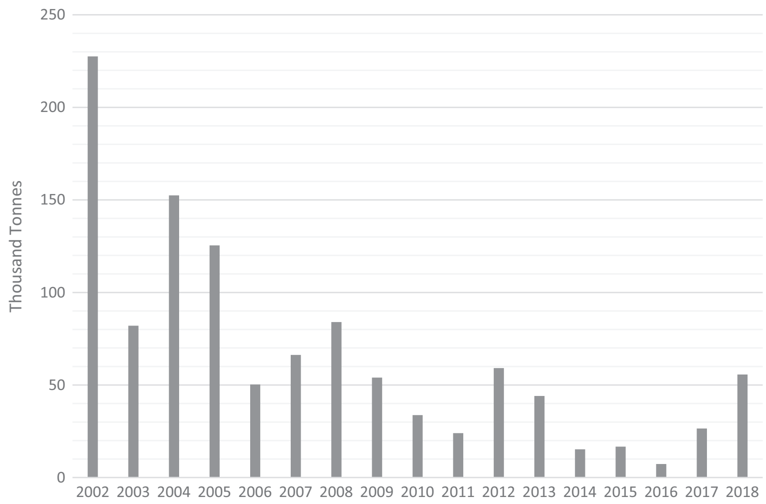

Figure 3: EU 28 annual import of CN 2308 0090 (Maize stalks, maize leaves, fruit peel and other vegetable materials, waste, residues and by-products for animal feeding) from USA, 2002–2018. (thousand tonnes)

Regarding plants for planting, maize seed for planting is not considered a possible pathway (Smith et al., 1997). While in principle growing maize plants could have adults on aerial parts and immature stages associated with the roots, and in growing media, and so could provide a pathway, maize plants for planting are traded as seed, not as growing plants. In addition, soil and growing media are prohibited, other than from specified countries, as noted above (Table 3).

Europhyt records of pest interceptions from 1994 to 4 June 2019 were searched. There were no reports of interception of *D. barberi*.

3.4.3. Establishment

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

Yes, biotic and abiotic conditions are conducive for establishment of *D. barberi* in large parts of the EU where maize is cultivated.

3.4.3.1. EU distribution of main host plants

The main host of *D. barberi*, *Z. mays*, occurs in large parts of the EU in cultivated areas (Table 6).

Maize, grown as grain or sweetcorn and as green maize (forage) occurs widely across the EU in many member states (Appendix A). Table 4 shows the EU maize area 2014–2018.

Table 4: EU 28 area of grain and green maize (cultivation/harvested/production 1,000 ha) (EUROSTAT, accessed 29 June 2019)

	2014	2015	2016	2017	2018
Grain maize and corn-cob-mix (Eurostat code C1500)	9,610.16	9,255.56	8,563.21	8,271.64	8,286.69
Green maize (Eurostat code G3000)	6,147.80	6,267.95	6,256.88	6,183.30	6,363.05
Sum	15,757.96	15,523.51	14,820.09	14,454.94	14,649.74

3.4.3.2. Climatic conditions affecting establishment

D. barberi is distributed across mid and eastern North America (Figure 1) within a variety of Köppen–Geiger climate zones. The global Köppen–Geiger climate zones (Kottek et al., 2006) describe terrestrial climate in terms of average minimum winter temperatures and summer maxima, amount of precipitation and seasonality (rainfall pattern). In North America, *D. barberi* occurs in, e.g. climate zone Cfa (warm temperate climate, fully humid, hot summer) which also occurs in the EU in Bulgaria, Romania, southern France, Spain and Italy. *D. barberi* also occurs in climate zone Dfb (snow climate, fully humid, warm summer) which occurs in the EU, e.g. in Austria, Czech Republic, Germany, Poland, Romania, Slovakia and other eastern EU MS (MacLeod and Korycinska, 2019) where large areas of maize are also grown. See Appendix B.

Recognising that *D. barberi* occurs across a range of climatic zones, the pest exhibits some adaptability to environmental conditions. It is possible that if *D. barberi* were to be introduced into the EU, it could adapt to other EU climates closely related to those in its native range. In addition, the distribution of *D. barberi* in USA overlaps with the related maize pest *D. virgifera virgifera* which, following its introduction into Europe in the early 1990s (Kiss et al., 2005; Ciosi et al., 2008), has spread widely (Carrasco et al., 2010) and is now well established across much of Europe and the EU (see EPPO GD, 2019). Were *D. barberi* to be introduced, it could do the same. As *D. virgifera virgifera* has displaced *D. barberi*, or at least reduced its abundance, in some areas of the USA (Capinera, 2008), competition between these species in the EU could occur as well.

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

3.4.4. Spread

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

Yes, adults can fly and typically abandon maize fields to feed on other plant species and return to maize to oviposit. Adult flight would be the major means of spread.

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

No, spread is mainly natural

While larvae of *D. barberi* move relatively little, adults typically abandon maize fields to feed on other plant species, and return to lay eggs (Chiang, 1973; Ludwig and Hill, 1975). Although, adults of the genus *Diabrotica* can migrate over long distances, moving with weather features such as cold fronts Smith et al. (1997), a study on aldrin resistance in *D. barberi* populations in the USA (Patel & Apple, 1966) showed that beetles are not expected to move more than 3/4 mile against prevailing winds.

3.5. Impacts

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

Yes, the introduction of *D. barberi* would most probably have an economic impact in the EU through reduction of maize yields.

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

Maize plants for planting are not anticipated to be a pathway for spread. Nevertheless, should *D. barberi* be present on other plants for planting, an economic impact on the intended use of the plants would be expected.

In maize, an average yield reduction of around 0.9% per *D. barberi* larva per root mass has been observed (Chiang, 1973). Taking also into account the extent of lodging due to *D. barberi* injury to the roots, a yield reduction of 4.64 % for every adjusted root damage rating unit on a 1–6 scale was established (Hills and Peters, 1971). The annual impact of the three most relevant maize rootworm species in the USA, *D. v. virgifera*, *D. barberi* and *D. undecimpunctata howardi* Barber, was estimated in the range of $1.0 to 1.2 billion in terms of costs of control and yield loss to American maize producers (Metcalf, 1986; Sappington et al., 2006).

Lodging makes harvest more difficult and can result in yield losses.

If *D. barberi* was introduced in the EU impact could also be expected as a result of the infection and spread of Squash mosaic virus (SqMV: Secoviridae) which it vectors.

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

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 Section 3.3) can mitigate the risks of entry via soil, within the EU. Fresh maize cobs (sweetcorn) and foliage/green maize remain an open pathway and additional measures are available (see 3.6.1). Plants other than maize on which adults feed on pollen could provide potential pathways if transported when in flower. However, pollen hosts are generally wild plants and weeds and are not judged to provide a realistic pathway.

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 including sweetcorn and green maize from PFA would mitigate the risk.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to soil and *Z. mays* plants for planting. However, the maize cobs and green maize pathways are not regulated (see Section 3.3).

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 5.

Table 5: 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)
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants or to plant products (i.e. maize combs, green maize) after harvest, during process or packaging operations and storage (i.e. spraying/dipping pesticides)	Entry
Controlled atmosphere	Treatment of plants (i.e. maize combs, green maize) by storage in a modified atmosphere (including modified humidity, O_2, CO_2, temperature, pressure)	Entry
Crop rotation, associations and density, weed/volunteer control	Cropping practices can affect *D. barberi* biology: • Crop rotation, e.g. with soybean, which normally results in destruction of rootworms, remains a preferred management practice for this beetle (Capinera, 2001) • Crop rotation has selected for D. *barberi* individuals that have an extended egg diapause and can overwinter 2 or more years (Krysan et al., 1984; Krysan and Miller, 1986). The occurrence of prolonged diapause in *D. barberi* eggs helps account for larval root damage observed in first-year maize fields (Chiang, 1973; Krysan et al., 1984, 1986; French and Hammack, 2010; French et al., 2014)	Establishment & spread
Chemical treatments on crops including reproductive material	Soil/seed-applied systemic insecticides have been applied to protect maize crops from rootworm larvae. Adult control is occasionally needed to protect maize silks and ear tips from injury (Capinera, 2001; French et al., 2014)	Establishment & spread

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/ spread/impact)
Use of resistant and tolerant plant species/ varieties	• Some maize cultivars are tolerant to *D. barberi* damage as they can regenerate a root system after damage (Chiang, 1973) • Seed companies have developed maize hybrids containing genes from the soil bacterium *Bacillus thuringiensis* Berliner (Bt) that code for production of insecticidal proteins that have high levels of antibiosis to neonates of the rootworm complex. Several Bt toxins registered in the United States are active against *Diabrotica* species and are produced either singly or in pyramids (Oyediran et al., 2016)	Establishment & spread
Timing of planting and harvesting	Cropping practices can affect *D. barberi* biology: • Late planting of maize does not require insecticide applications but may result in heavier infestations the following year	Establishment & spread
Biological control and behavioural manipulation	Although a revision performed in 2009 found 290 publications on natural enemy–subtribe Diabroticina associations in the New World (Toepfer et al., 2009), research is still needed to properly exploit these natural enemies for biological control of *D. barberi*	Establishment & spread

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 6.

Table 6: 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	Imported host plants (i.e. green maize, maize combs) could be inspected for compliance from freedom of *D. barberi*	Entry
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols	Entry
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by a National Plant Protection Organization in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade	Entry, establishment and spread
Delimitation of Buffer zones	Sourcing plants from a pest-free place of production, site or area, surrounded by a buffer zone, would minimize the probability of spread into the pest-free zone	Entry
Sampling	According to ISPM 31, it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment	Entry

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/establishment/spread/impact)
Phytosanitary certificate and plant passport	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5)	Entry
Certification of reproductive material (voluntary/official)	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	Entry, establishment and spread
Surveillance	ISPM 5 defines surveillance as an official process which collects and records data on pest occurrence or absence by survey, monitoring or other procedures	Establishment, spread

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

No major issues with the present regulations in place

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

No major issues with the present regulations in place

3.7. Uncertainty

By its very nature of being a rapid process, uncertainty is high in a categorisation. However, the uncertainties in this case are insufficient to affect the conclusions of the categorisation.

4. Conclusions

Diabrotica barberi satisfies the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest. *D. barberi* does not meet the criteria of occurring in the EU nor plants for planting being the principal means of spread for it to be regarded as a potential Union regulated non-quarantine pest (Table 7).

Table 7: 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)	The identity of *D. barberi* is established and taxonomic keys are available for its identification to species level	The identity of *D. barberi* is established and taxonomic keys are available for its identification to species level	

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
Absence/presence of the pest in the EU territory (Section 3.2)	*D. barberi* is not known to be present in the EU	*D. barberi* is not known to be present in the EU. Therefore, it does not fulfil this criterion to be regulated as a regulated non-quarantine pest (RNQP)	
Regulatory status (Section 3.3)	The pest is currently listed in Annex IAI of 2000/29 EC	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)	The pest could enter into, become established in, and spread within, the EU territory. The main pathways are: • Soil • Maize combs (sweetcorn) • Green maize • Plants for planting excluding seeds imported from infested areas	Adults can fly and typically abandon maize fields to feed on other plant species and return to oviposit. This could be the major means of spread	Details of pollen hosts as possible pathways unknown Pathway volumes unknown
Potential for consequences in the EU territory (Section 3.5)	The pests' introduction would most probably have an economic impact in the EU	Should *D. barberi* be present on plants for planting, an economic impact on its intended use would be expected	
Available measures (Section 3.6)	There are measures available to prevent the entry into, establishment within or spread of the pest within the EU (i.e. sourcing plants from PFA)	There are measures available to prevent pest presence on plants for planting (i.e. sourcing plants from PFA, PFPP). However, maize is not planted but seeded	
Conclusion on pest categorisation (Section 4)	All criteria assessed by EFSA above for consideration as a potential quarantine pest are met with no uncertainties	The criterion of the pest being present in the EU territory, which is a prerequisite for consideration as a potential regulated non-quarantine, is not met. The criterion of plants for planting being the main means of spread is not met either	
Aspects of assessment to focus on/scenarios to address in future if appropriate			

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Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017)
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017)
Measures	Control (of a pest) is defined in ISPM 5 (FAO 2017) as 'Suppression, containment or eradication of a pest population' (FAO, 1995). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance.
Pathway	Any means that allows the entry or spread of a pest (FAO, 2017)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017)
Protected zones (PZ)	A protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union.
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017)
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2017)
Sympatric	Organisms occurring within the same or overlapping geographic areas.
Univoltine	Producing one brood in a season and especially a single brood of eggs capable of overwintering

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

Appendix A – Detailed area of maize in EU member states

Area of grain maize and corn-cob-mix cultivation/harvested/production (Eurostat code C1500) in EU member states 2014–2018 (1,000 ha)

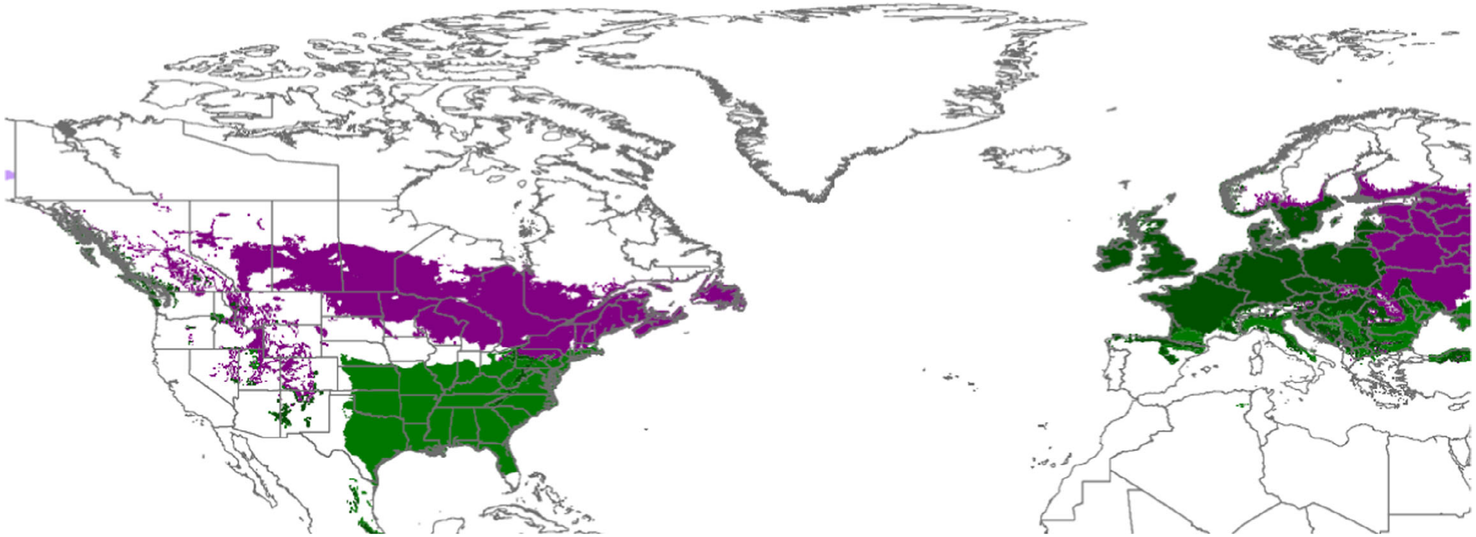
	2014	2015	2016	2017	2018	5 year mean	% of 5 year mean
EU 28	9,610.16	9,255.56	8,563.21	8,271.64	8,286.69	8797.452	100.0
Romania	2,513.56	2,608.06	2,584.22	2,405.24	2,415.25	2505.266	28.5
France	1,848.07	1,639.49	1,458.32	1,435.70	1,423.92	1561.1	17.7
Hungary	1,191.42	1,146.13	1,011.56	988.82	943.98	1056.382	12.0
Italy	869.95	727.37	660.73	645.74	614.31	703.62	8.0
Poland	678.25	670.30	593.50	562.11	645.41	629.914	7.2
Germany	481.30	455.50	416.30	432.00	410.90	439.2	5.0
Bulgaria	408.40	498.64	406.94	398.15	444.50	431.326	4.9
Spain	418.55	398.26	359.28	333.63	326.60	367.264	4.2
Croatia	252.57	263.97	252.07	247.12	235.00	250.146	2.8
Austria	216.32	188.73	195.25	209.48	209.90	203.936	2.3
Slovakia	216.19	191.44	184.81	187.81	178.56	191.762	2.2
Greece	159.78	152.05	139.48	132.49	133.37	143.434	1.6
Portugal	107.64	97.91	88.61	86.52	90.46	94.228	1.1
Czech Republic	98.75	79.97	86.41	86.00	81.85	86.596	1.0
Belgium	62.83	58.40	52.10	49.00	53.99	55.264	0.6
Slovenia	38.33	37.74	36.39	38.29	36.75	37.5	0.4
Netherlands	18.00	15.80	12.27	12.25	13.77	14.418	0.2
Lithuania	19.00	11.71	12.43	9.93	13.39	13.292	0.2
Denmark	10.10	9.00	5.70	5.10	6.30	7.24	0.1
UK	0.00	4.00	5.00	5.00	7.20	4.24	0.0
Sweden	0.95	1.33	1.71	1.19	1.17	1.27	0.0
Luxembourg	0.22	0.14	0.13	0.08	0.09	0.132	0.0

Area of green maize (forage maize) cultivation/harvested/production (Eurostat code G3000) in EU member states 2014–2018 (1,000 ha)

	2014	2015	2016	2017	2018	5 year mean	% of 5 year mean
EU 28	6,147.80	6,267.95	6,256.88	6,183.30	6,363.05	6243.796	100.0
Germany	2,092.60	2,100.40	2,137.60	2,095.90	2,195.90	2124.48	34.0

	2014	2015	2016	2017	2018	5 year mean	% of 5 year mean
France	1,411.80	1,475.23	1,433.16	1,406.01	1,422.20	1429.68	22.9
Poland	541.21	555.20	597.00	596.01	601.58	578.2	9.3
Italy	342.74	336.93	325.04	342.10	355.33	340.428	5.5
Czech Republic	237.24	244.96	234.40	223.21	224.11	232.784	3.7
Netherlands	226.00	223.86	203.81	203.51	203.25	212.086	3.4
UK	171.00	179.00	186.00	197.40	224.00	191.48	3.1
Denmark	178.20	182.40	182.40	166.70	179.60	177.86	2.8
Belgium	178.12	173.34	168.74	171.28	179.74	174.244	2.8
Greece	82.84	90.18	118.69	125.55	125.83	108.618	1.7
Spain	112.97	107.92	106.24	107.36	107.42	108.382	1.7
Austria	83.46	91.99	84.64	82.19	83.35	85.126	1.4
Slovakia	85.79	89.52	78.05	81.44	73.11	81.582	1.3
Portugal	85.39	80.78	80.26	78.43	79.03	80.778	1.3
Hungary	85.08	89.98	76.41	69.05	64.22	76.948	1.2
Romania	48.27	46.34	51.42	50.10	47.06	48.638	0.8
Slovenia	29.49	28.73	28.69	29.19	29.82	29.184	0.5
Croatia	28.79	32.60	30.98	28.29	25.00	29.132	0.5
Bulgaria	25.13	26.56	31.10	29.93	27.24	27.992	0.4
Lithuania	28.50	29.25	26.59	24.34	28.25	27.386	0.4
Latvia	21.20	25.40	25.90	22.10	25.50	24.02	0.4
Sweden	15.67	15.65	15.74	16.80	17.17	16.206	0.3
Luxembourg	14.75	14.45	14.94	15.19	15.87	15.04	0.2
Ireland	13.87	12.85	10.92	11.88	17.76	13.456	0.2
Estonia	7.40	8.50	7.96	9.18	10.55	8.718	0.1
Cyprus	0.31	0.30	0.20	0.17	0.16	0.228	0.0

Appendix B – Distribution of EU climates in North America in which *Diabrotica barberi* occurs



Climate classification		Climate description (Kottek et al., 2006)
	Cfa	Warm temperate climate, fully humid, hot summer
	Cfb	Warm temperate climate, fully humid, warm summer
	Dfb	Snow climate, fully humid, warm summer

Source: map derived from data in MacLeod and Korycinska (2019).