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Pest categorisation of *Longidorus diadecturus*

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Abstract

The Panel on Plant Health performed a pest categorisation of *Longidorus diadecturus* (Nematoda: Longidoridae) for the EU. The nematode is a well-defined taxon and was described from Ontario, Canada and later reported from some states in the USA. The nematode is not present in the EU. It is regulated by Council Directive 2000/29/EC, listed in Annex I A I as *L. diadecturus* Eveleigh and Allen. It is a migratory ectoparasitic nematode species puncturing cells of plant roots thereby able to transmit the nepovirus *Peach rosette mosaic virus* (PRMV). The pest is found in soil associated with plant species belonging to different families. *L. diadecturus* is able to cause direct damage to plants, but its main damage is caused by vectoring PRMV. Soil is a potential pathway for this nematode for entry into the EU. The nematode is able to survive adverse conditions, but the virus may not persist inside the nematode for extended periods. Climatic conditions in the EU are similar to those found in the countries where the pest is currently present. Hosts of the nematode (and the associated virus) are, e.g. peaches and grapes; those crops are also widely cultivated in the EU. The nematode only moves short distances (around 1 m) but may be spread with soil moving activities. Measures are available to inhibit entry via soil as such. Entry of the nematode with soil attached to plants for planting that are not regulated is possible. *L. diadecturus* does satisfy all the criteria that are within the remit of EFSA to assess to be regarded as a potential Union quarantine pest.

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Keywords: European Union, pest risk, plant health, plant pest, quarantine, Peach Rosette Mosaic Virus, PRMV, virus vector, needle nematode

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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/EC¹ 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) 2016/2031² on protective measures against pests of plants, was adopted on 26 October 2016 and will apply from 14 December 2019 onwards, repealing Directive 2000/29/EC. In line with the principles of the above mentioned legislation and the follow-up work of the secondary legislation for the listing of EU regulated pests, EFSA is requested to provide pest categorizations of the harmful organisms included in the annexes of Directive 2000/29/EC, in the cases where recent pest risk assessment/ pest categorisation is not available.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 22(5.b) and Article 29(1) of Regulation (EC) No 178/2002³, 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

| | |
|---|---|
| <i>Aleurocantus</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 phycitis</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 |
| Leprosis | 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> Kugelán | <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>Carneiocephala 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) *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

| | |
|--|--|
| <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 pruinosus</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>Xiphinema americanum</i> Cobb sensu lato (non-EU populations) |
| <i>Hirschmanniella gracilis</i> (de Man) Luc and Goodey | <i>Xiphinema californicum</i> Lamberti and Bleve-Zacheo |
| <i>Liriomyza sativae</i> Blanchard | |

(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 II****(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. *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* (Kaltenbac**(b) Viruses and virus-like organisms**

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Longidorus diadecturus 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 (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 *L. diadecturus* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, Scopus and Google Scholar 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, 2017a,b) 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 launched by the Directorate General for Health and Consumers (DG SANCO) and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation as well as notifications of plant pests detected in the territory of the MSs and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

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

In accordance with the guidance on a harmonised framework for pest risk assessment in the EU (EFSA PLH Panel, 2010), this work was initiated following an evaluation of the EU 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, in agreement with EFSA guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010).

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

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

The needle nematode *L. diadecturus* Eveleigh and Allen is a nematode in the family Longidoridae. It was described from nematode populations recovered from soil around peach trees in southwestern Ontario (Essex County), Canada (Eveleigh and Allen, 1982).

3.1.2. Biology of the pest

Longidorus diadecturus is a migratory ectoparasitic nematode that, like other *Longidorus* species, feeds on root tips causing small galling and stunting of roots (Taylor and Brown, 1997). Its life cycle has six stages: the egg, four juvenile stages and the female adult. Males are not known and it is assumed that *L. diadecturus* reproduces parthenogenetically (Robbins et al., 1995). No further details of the life cycle of this nematode are known. Since this nematode belongs to the genus *Longidorus*, it is assumed that the life cycle is similar to that of other species of this genus. A first-stage juvenile is supposed to develop inside an egg, then hatches. It is also assumed that this nematode moults four times. At each moult, the old cuticle, including the lining of the oesophagus together with the odontostyle, is shed and the new cuticle is formed (Taylor and Brown, 1997).

L. diadecturus has been recognised as a vector of *Peach rosette mosaic virus* (PRMV) in one field in Ontario (Eveleigh and Allen, 1982). PRMV is also transmitted by *Xiphinema americanum* and is the only nepovirus that is transmitted by vectors belonging two different nematode genera – *Xiphinema* and *Longidorus* (Brown et al., 1988). Nematode-borne viruses are transmitted by juveniles and adult specimens through the stylet when feeding. Differences in virus transmission by different developmental stages of the vector have not been reported. The virus may not persist inside *Longidorus* species for extended periods. The virus does not multiply within the nematodes and may be lost during moulting (Taylor and Brown, 1997).

Uncertainties regarding persistence of PRMV within the nematode, transmission period and frequency of transmission exist and there are some uncertainties regarding the list of host plants to which *L. diadecturus* may transmit PRMV.

3.1.3. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, this nematode can be detected and identified using the key developed by Chen et al. (1997).

Nematodes can be isolated from the soil or growing media by different extraction techniques, e.g. the Flegg-modified Cobb technique, Oostenbrink elutriator or other elutriation methods (EPPO, 2013). It should be noted that this nematode is relatively large; females of this nematode are 3.3–4.0 mm long. Choice of extraction technique is therefore important.

For identification of *Longidorus* species, morphological and morphometric characteristics are traditionally used (Chen et al., 1997). The most important features for distinguishing and identifying species of the genus *Longidorus* are guide ring position, head width, tail length, body length, odontostyle length and body width (Ye and Robbins, 2004). The stylet is 168–187 μm long; the length of the odontostyle and odontophore is 109–121 μm and 55–66 μm , respectively (Robbins and Brown, 1991). Identification of this species is extremely difficult and time-consuming and can only be carried out by trained personnel.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Longidorus diadecturus is present in Essex County in Ontario, Canada, from where it was originally described by Eveleigh and Allen (1982). According to the EPPO GD, the nematode only occurs in Canada without further specifying its distribution. Additional information on the distribution of this nematode is provided by Robbins and Brown (1991). According to those authors, the nematode is also widely distributed in the central USA but also here no details on the distribution are given; therefore, this statement made bears some uncertainty. These authors report that nematode specimen from Iowa (USA) previously identified as *Longidorus macromucronatus* were identified by them as *L. diadecturus*. It is, however, not clear to which nematode populations and their respective origin this refers to. Other authors also report the inclusion of *L. diadecturus* populations/specimen from Arkansas (Neilson et al., 2004; Ye et al., 2004) and Arkansas and Oklahoma (Robbins et al., 1995) in their studies. Based on these reports, the nematode has a distribution which is restricted to Canada and with some uncertainty to the middle states of the USA (Figure 1).

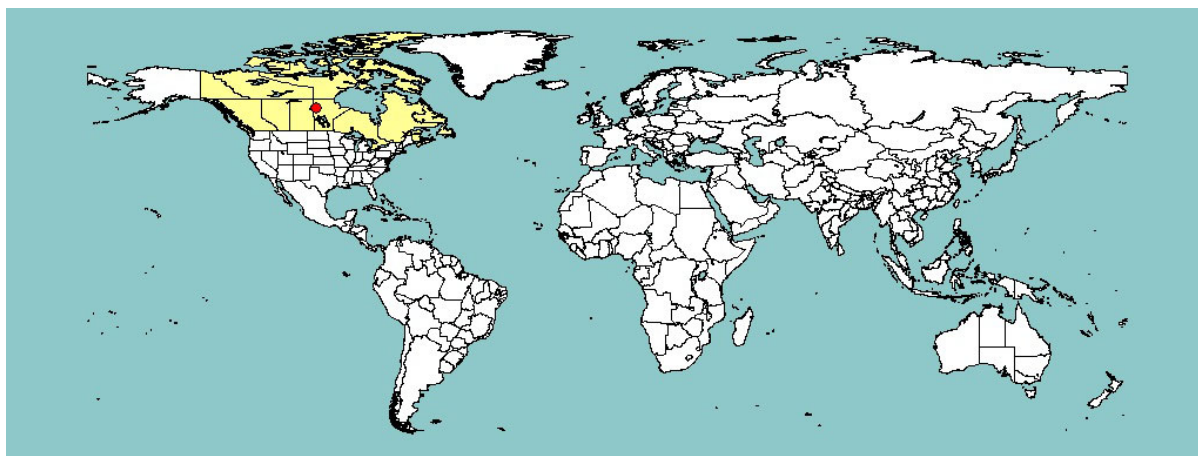


Figure 1: Global distribution map for *L. diadecturus* extracted from the EPPO PQR (accessed on 23/11/2017)

3.2.2. Pest distribution in the EU

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

No, *L. diadecturus* is not present in the EU.

There is no evidence that *L. diadecturus* occurs in the Pest Risk Assessment (PRA) area.

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

Longidorus diadecturus is listed in Council Directive 2000/29/EC. Details are presented in Table 2.

Table 2: *Longidorus diadecturus* 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 the community and relevant for the entire community |
| (a) | Insects, mites and nematodes, at all stages of their development |
| | Species |
| 13. | <i>Longidorus diadecturus</i> Eveleigh and Allen |

3.3.2. Legislation addressing the organisms vectored by *L. diadecturus* (Directive 2000/29/EC)

Longidorus diadecturus is a vector of PRMV listed in Council Directive 2000/29/EC. Details are presented in Table 3.

It should be noted that PRMV is also vectored by *X. americanum*.

Table 3: Peach rosette mosaic virus 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 the community and relevant for the entire community |
| (d) | Viruses and virus-like organisms |
| 5. | 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., such as: |
| | (e) Peach rosette mosaic virus |

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

Longidorus diadecturus was first described from soil around peach trees and identified as a vector of the nepovirus PRMV (Eveleigh and Allen, 1982). It is the only detailed report on the origin and natural association with a host plant of a *L. diadecturus* population. Besides being an efficient vector of PRMV for peach, the nematode also vectors PRMV to grape (*Vitis labrusca*) and cucumber (*Cucumis sativus*) as reported by Allen et al. (1982, 1984). PRMV was successfully transmitted to blueberry (*Vaccinium* spp.) by *L. diadecturus*, but detailed information except for the transmission rate of the virus was not presented (Allen et al., 1984). Since virus acquisition under experimental conditions involved feeding on *Chenopodium quinoa* (Allen et al., 1982; Allen, 1986) and *Petunia hybrida* (Allen, 1986), these plant species are also considered host plants. Ye et al. (2004) studied *L. diadecturus* populations from box elder (*Acer negundo*) and redbud (*Cercis canadensis*), and Neilson et al. (2004) included populations from elm (*Ulmus americana*), but no details on the origin of the nematode populations are given.

The pest is a migratory ectoparasitic nematode and may feed on several plant species. It may be considered a polyphagous pest such as other *Longidorus* or *Xiphinema* species. These nematodes genera can survive in a wide range of habitats; however, the extent of feeding on plants has not been studied in detail for *L. diadecturus*. Details on virus transmission to hosts other than those mentioned above have not been documented. It is, therefore, not clear whether peach should be considered the principal host plant of the nematode or only the plant first reported and which is an economically important crop plant suffering from virus infection transmitted by the nematode. There is some uncertainty concerning the host range of *L. diadecturus*.

3.4.2. Entry

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

Yes, soil and growing media, soil and growing media attached to planting material and soil and growing media attached to machinery and packaging material.

The pest does not invade plant tissue (only puncturing cells from the outside); it is, therefore, not found inside plants. The following pathways have been identified:

- Soil and growing media as such from areas where the nematode occurs. This pathway is closed because of Annex III, Part A, No. 14 of EU 2000/29.
- Soil and growing media attached to plants (hosts or non-host plants) from areas where the nematode occurs. This pathway is not closed as plants may be imported with soil or growing media attached to sustain their live in.
- Soil and growing media attached to (agricultural) machinery, tools, packaging materials. This pathway is not considered as an important pathway for entry because the volume of trade of used machinery is considered low. Furthermore, soil adhering to agricultural machinery during transport (if relevant) may dry and subsequently lead to decreased viability of the pest.

Until 14/8/2017, there were no records of interception of *L. diadecturus* in the Europhyt database. There were also no records for the search terms '*Longidorus* sp.', '*Longidorus*' and '*Longidoridae*'. Robbins and Brown (1991) reported that nematodes previously identified as *L. macromucronatus* were identified by them as *L. diadecturus*.

It should be noted that large plant-parasitic nematodes such as *Longidorus* spp. may not be detected using standard sampling and extraction techniques for nematodes (EPPO, 2013). This is partly due to their relatively large size which requires specific techniques for longidorid nematodes. Nematodes may be retained on sieves during the extraction process for smaller nematodes and discarded together with retained organic debris. The nematode may also be damaged during sampling (Taylor and Brown, 1997).

Plants for planting with soil attached are a potential pathway. The reasons for the lack of interception reports are not clear. It might be due to the absence of the nematode because only nematode-free material has been shipped or due to non-detection of the nematode because of choice of inappropriate detection methods. There is, therefore, some uncertainty concerning the lack of reports, which could be attributed to either the absence or non-detection of the nematode.

3.4.3. Establishment

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

Yes, the pest is able to establish in the EU territory.

3.4.3.1. EU distribution of main host plants

Longidorus diadecturus is migratory ectoparasite and can feed on several plant species from different families (Allen et al., 1982, 1984; Allen, 1986; Ye et al., 2004); a wide host range may therefore be assumed. The nematode is a plant browser and host–parasite relationships have not been studied in detail. Nevertheless, plants which have been found associated with *L. diadecturus* are present throughout the EU territory. The pest could find suitable host plants such as peach (and may therefore be able to establish in the EU (Table 4).

Table 4: EU area of peach production 2011–2016 (thousands of hectares). Only EU MS where peaches are grown are reported

| Country | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------|--------|--------|--------|-------|--------|--------|
| EU 28 | 168.83 | 166.04 | 163.50 | : | 157.55 | 157.52 |
| Austria | 0.19 | 0.19 | 0.18 | 0.17 | 0.17 | 0.16 |
| Bulgaria | 4.20 | 4.10 | 3.80 | 2.87 | 3.55 | 3.66 |
| Croatia | 1.43 | 1.44 | 1.00 | 0.92 | 0.78 | 0.79 |
| Cyprus | 0.32 | 0.34 | 0.25 | 0.27 | 0.28 | 0.21 |
| Czech Republic | 0.74 | 0.67 | 0.63 | 0.58 | 0.48 | 0.39 |
| France | 6.21 | 5.74 | 5.36 | 5.30 | 5.09 | 4.88 |
| Greece | 35.50 | 37.00 | 37.87 | 42.83 | 36.44 | 36.39 |
| Hungary | 5.53 | 5.49 | 5.37 | 5.44 | 5.41 | 5.41 |
| Italy | 54.86 | 50.64 | 49.65 | 48.06 | 46.25 | 45.32 |
| Poland | 3.50 | 3.40 | 2.60 | : | 2.40 | 2.23 |
| Portugal | 2.82 | 2.88 | 2.77 | 2.74 | 2.85 | 2.85 |
| Romania | 1.72 | 1.95 | 1.93 | 1.68 | 1.69 | 1.69 |
| Slovak Republic | 0.52 | 0.51 | 0.57 | 0.43 | 0.40 | 0.37 |
| Slovenia | 0.47 | 0.41 | 0.00 | 0.36 | 0.32 | 0.30 |
| Spain | 50.81 | 51.29 | 51.51 | 50.75 | 51.46 | 52.88 |

3.4.3.2. Climatic conditions affecting establishment

The climate in regions where the pest or its host plants occur in North America is comparable to large parts of the PRA area (where peaches are grown) according to the Köppen–Geiger map (Figure 2). The environmental conditions in the PRA area are assessed as suitable for pest establishment outdoors. It should be noted that the pest is only present in some parts of Canada and possibly few states in the USA (see Section 3.2.1).

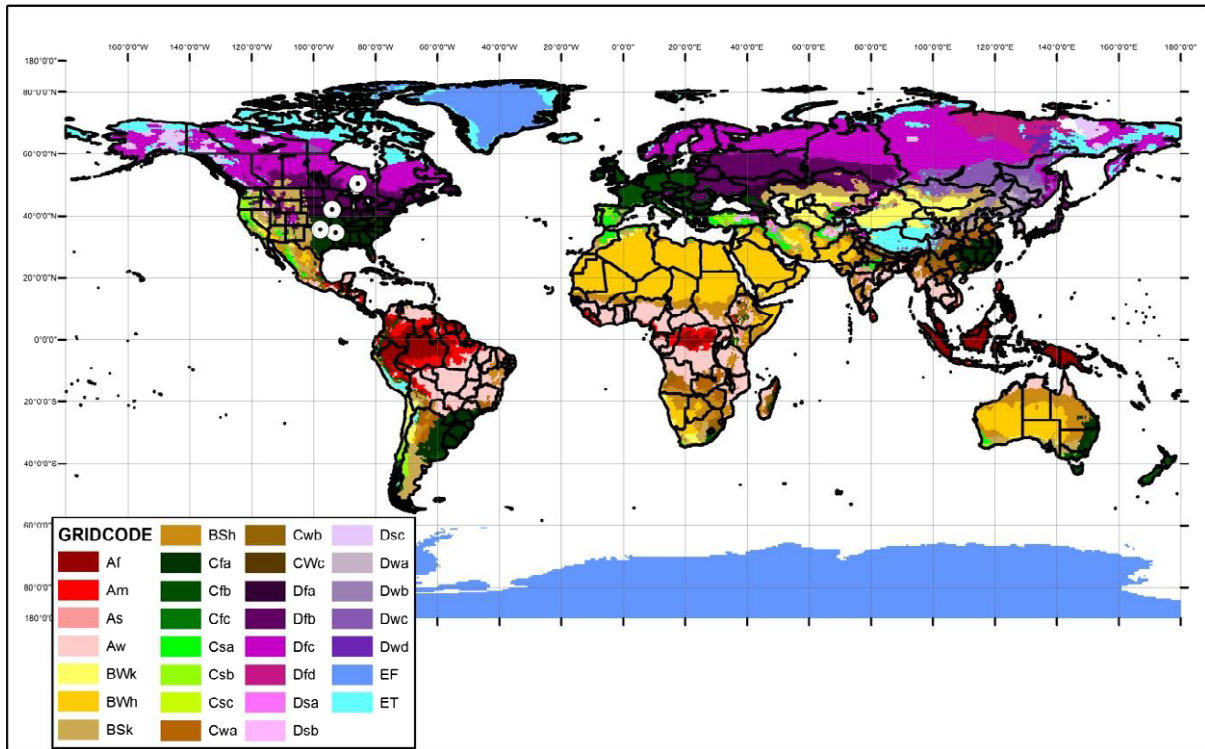


Figure 2: The current distribution of *Longidorus diadecturus* presented by white dots on the Köppen–Geiger climate classification map (Kottek et al., 2006)

3.4.4. Spread

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

Yes, soil and growing media, soil and growing media attached to planting material and soil and growing media attached to machinery.

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

No, the pest is not mainly spread via specific plants for planting.

The pest is classified as a migratory ectoparasitic nematode found in the soil; however, movement in soil is restricted to short (< 1 m) distances (Taylor and Brown, 1997). The pest punctures plant cells at the root tips with its stylet but does not invade plants. Spread may therefore mainly occur with moist soil or growing media (soil as such or soil associated with plants, machinery, tools, shoes, animals, packaging material) or run-off water but not by plants for planting without soil or growing medium. Soil attached to agricultural machinery, tools etc., may contribute to spread but this may be mostly relevant for within field spread or spread to adjacent fields.

3.5. Impacts

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

Yes, the nematode transmits a quarantine virus.

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

Yes, the pest is in soil associated with plants for planting.

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

The nematode and its associated virus PRMV are not present in the EU. *Longidorus* species may cause direct damage to the roots, leading to reduced root systems and stunted tap roots, symptoms which may be severe in some cases (Taylor and Brown, 1997). Galling of roots due to nematode attack, however, may be less severe compared to those caused by other longidorid nematodes such as *Xiphinema* species (Taylor and Brown, 1997). Above ground symptoms such as stunted plant growth and patchy fields may be related to the extent of damage on the root systems. Such damage is dependent on nematode densities and host status of the plants (Taylor and Brown, 1997). Direct damage is not reported for this nematode species.

The main damage is caused by the transmission of the nepovirus PRMV (Allen et al., 1982).

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, prohibition of import of soil and growing media and plants for planting with soil attached from areas where the pest is present would prevent introduction of this pest into and spread within the PRA area.

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

Yes, however, these measures are limited by the fact that all (host and non-host) plants for planting need to be addressed.

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

- Prohibition of import of plants for planting with soil attached – not all plants for planting with soil attached are addressed within the current legislation.
- Sampling for detection needs to address the size of the nematodes and appropriate techniques need to be chosen (not standard techniques for, e.g. root-knot nematodes).
- Diagnostic procedures based on morphological identification of the pest and lack of appropriate molecular tools for routine species identification may indirectly affect the effectiveness of measures to prevent the entry, establishment and spread of *L. diadecturus*. Species identification of *L. diadecturus* is based on accurate observations of morphological characteristics and the measurements of different parameters and is a challenge even for experienced, well-trained personnel (Taylor and Brown, 1997). There is no EPPO Diagnostic Protocol for this species. Although molecular identification is possible, no technique for routine molecular identification of *L. diadecturus* has been proposed.

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

- Phytosanitary certification – sampling and testing procedures influence the effectiveness of this measure. The following limitations have been recognised:
 - detection of nematodes in soil,
 - not all plants are included in certification schemes.
- Disinfection of soil by physical measures (heat, steam) or fumigants – the efficacy of this measure is limited because only upper soil layers can be effectively treated. The nematodes are vertically distributed depending on availability of roots of host plants and moisture regime (Taylor and Brown, 1997) and may not be affected by treatment. Migration is also possible and treated soil layers may be reinvaded.

3.6.3. Control methods

- Planting material should originate from pest-free areas; pest-free places/sites of production may also be suitable to obtain pest-free planting material.
- Use of certified plants for planting to prevent infestation of production sites within the PRA area by the *L. diadecturus* and its associated PRMV.

- Surveillance and soil testing to detect the presence of vector nematode, *L. diadecturus*. Soil sampling should be done before planting.
- Soil steaming is among the most effective but unfortunately the most expensive and energy wastefulness control methods to eliminate pests from the soil (Neshev et al., 2008). However, soil treatments do not eliminate nematodes under field conditions (because of the vertical distribution of the nematode and migration).

3.7. Uncertainty

- There are some uncertainties concerning the host range of *L. diadecturus*. The ectoparasitic nematode is considered polyphagous and it is assumed that host range is wider than reported.
- Uncertainties exist about the distribution of the nematode in North America.
- Direct and indirect damage (virus transmission) caused by *L. diadecturus* have not been specified. Uncertainties regarding persistence of PRMV within the nematode, transmission period and frequency of transmission exist and there are some uncertainties regarding the list of host plants to which *L. diadecturus* may transmit PRMV.
- There are some uncertainties regarding the importance of *L. diadecturus* as a vector of PRMV. This nepovirus can also be transmitted by *X. americanum* and the latter species may be a more important vector of the virus because persistence in *Xiphinema* species in general is reported to be longer.

None of these uncertainties affect the conclusions.

4. Conclusions

Longidorus diadecturus meets the criteria assessed by EFSA for consideration as a potential Union quarantine pest (Table 5).

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

| Criterion of pest categorisation | Panel’s conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest | Panel’s conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest | Key uncertainties |
|--|--|--|-------------------|
| Identity of the pest (Section 3.1) | The identity of the pest is established: <i>Longidorus diadecturus</i> Eveleigh and Allen. It is a nematode in the family Longidoridae. Taxonomic keys are available to identify the pest. | The identity of the pest is established: <i>Longidorus diadecturus</i> Eveleigh and Allen. It is a nematode in the family Longidoridae. Taxonomic keys are available to identify the pest. | None |
| Absence/ presence of the pest in the EU territory (Section 3.2) | The pest is not known to occur in the EU. | The pest is not known to occur in the EU. | None |
| Regulatory status (Section 3.3) | <i>Longidorus diadecturus</i> is currently regulated by Council Directive 2000/29/EC as a harmful organism whose introduction into, and spread within, all member states shall be banned. | <i>Longidorus diadecturus</i> is currently regulated by Council Directive 2000/29/EC as a harmful organism whose introduction into, and spread within, all member states shall be banned. | None |

| 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 |
|---|--|---|--|
| Pest potential for entry, establishment and spread in the EU territory (Section 3.4) | <i>Longidorus diadecturus</i> is able to enter and spread with soil, soil attached to plants for planting or to machinery, tools etc. Natural spread is only over short distances and slow. | <i>Longidorus diadecturus</i> can be spread in soil which may be associated with plants for planting. Plants for planting are not the main pathway. | None |
| Potential for consequences in the EU territory (Section 3.5) | <i>Longidorus diadecturus</i> would have direct impact on crops but virus transmission (PRMV) will be much more important for plant health status and production of peaches. | The pest is not directly on (or in) plants for planting but if viruliferous nematodes are present in soil attached to host plants of the nepovirus PRMV, then the use of those plants for planting may be affected. | Characteristic of virus transmission, e.g. virus retention by the nematode and efficiency of transmission. The pest is reported from peach but assumed to be polyphagous; therefore, the host range (so the impact as well) may be wider. |
| Available measures (Section 3.6) | Measures are available to inhibit entry via traded commodities (e.g. prohibition on the importation of soil and the introduction of plants for planting with soil or growing media attached). | The pest is not directly on (or in) plants for planting but measures on the importation of plants for planting with soil or growing media attached would mitigate impacts. | None |
| Conclusion on pest categorisation (Section 4) | <i>Longidorus diadecturus</i> does not satisfy all the criteria that are within the remit of EFSA to assess to be regarded as a Union quarantine pest. | <i>Longidorus diadecturus</i> does not meet the criteria of (a) occurring in the EU territory, and (b) plants for planting being the principal means of spread to qualify as a regulated non-quarantine pathogen. | None |
| Aspects of assessment to focus on/ scenarios to address in future if appropriate | <i>Longidorus diadecturus</i> is considered a polyphagous pest although its exact host range (i.e. plants on which the nematode can feed and reproduce) is not known. The pest may be associated with a large number of plants for planting. Prevention of entry of the pest may therefore only be achieved if all plants for planting with soil/growing media attached from areas where the pest occurs are prohibited. It is therefore not necessary to assess specific scenarios. | | |

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Abbreviations

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| DG SANCO | Directorate General for Health and Consumers |
| EPPO | European and Mediterranean Plant Protection Organization |
| FAO | Food and Agriculture Organization |
| IPPC | International Plant Protection Convention |
| MS | Member State |
| PLH | EFSA Panel on Plant Health |
| PRA | Pest Risk Assessment |
| PRMV | Peach Rosette Mosaic Virus |
| TFEU | Treaty on the Functioning of the European Union |
| ToR | Terms of Reference |