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Pest categorisation of the Andean Potato Weevil (APW) complex (Coleoptera: Curculionidae)

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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of the species within the Andean Potato Weevil (APW) complex (Coleoptera: Curculionidae) for the EU. The complex consists of 14 species, 12 belong to the genus *Premnotrypes*, plus *Phyrdenus muriceus* and *Rhigopsidius tucumanus*. These weevils co-occur in the Andean region, usually above 2,100 m. Eggs are deposited in plant debris close to potato plants. Upon hatching larvae immediately bore into potato tubers where they complete development. Except for *R. tucumanus*, which pupates inside the tuber, mature larvae leave the tuber and pupate in the soil. Adults can survive feeding on different plants but cannot deposit fertile eggs unless fed on potato foliage. *P. muriceus* can also complete development feeding on tomato and eggplant roots and occurs at lower altitudes from southern USA to central Argentina. Within the APW complex only species in the genus *Premnotrypes* are regulated in Annex IIA of Commission Implementing Regulation 2019/2072 as *Premnotrypes* spp. (non-EU). Within this regulation potential pathways, such as solanaceous plants for planting with foliage and growing medium, seed and ware potatoes, and soil, can be considered as closed. There are no records of interception of any of these weevils in EUROPHYT. Should these species be introduced into the EU, climatic conditions and wide availability of potato crops in the EU territory would provide conditions for establishment, spread and economic impact. Phytosanitary measures are available to reduce the likelihood of entry. The species within the APW complex satisfy with no uncertainties the criteria that are within the remit of EFSA to assess, for them to be regarded as potential Union quarantine pests. Although human-assisted movement of seed potatoes is considered the main mechanism for spread of these species, these weevils do not meet the criterion of occurring in the EU for them to be regarded as potential Union regulated non-quarantine pests.

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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 established the previous European Union plant health regime. The Directive laid down the phytosanitary provisions and the control checks to be carried out at the place of origin on plants and plant products destined for the Union or to be moved within the Union. In the Directive's 2000/29/EC annexes, the list of harmful organisms (pests) whose introduction into or spread within the Union was prohibited, was detailed together with specific requirements for import or internal movement.

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

1.1.2. Terms of reference

EFSA is requested, pursuant to Article 22(5.b) and Article 29(1) of Regulation (EC) No 178/2002³, 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 pest categorisations should be delivered by end 2020.

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

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

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

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

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

1.1.2.1. Terms of Reference: Appendix 1

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

Annex IIAI

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

<i>Aleurocanthus</i> spp.	<i>Numonia pyrivorella</i> (Matsumura)
<i>Anthonomus bisignifer</i> (Schenkling)	<i>Oligonychus perditus</i> Pritchard and Baker
<i>Anthonomus signatus</i> (Say)	<i>Pissodes</i> spp. (non-EU)
<i>Aschistonyx eppoi</i> Inouye	<i>Scirtothrips aurantii</i> Faure
<i>Carposina niponensis</i> Walsingham	<i>Scirtothrips citri</i> (Moultex)
<i>Enarmonia packardi</i> (Zeller)	<i>Scolytidae</i> spp. (non-EU)
<i>Enarmonia prunivora</i> Walsh	<i>Scrobipalopsis solanivora</i> Povolny
<i>Grapholita inopinata</i> Heinrich	<i>Tachypterellus quadrigibbus</i> Say
<i>Hishomonus 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> Kugelan	<i>Ips sexdentatus</i> Börner
<i>Gilpinia hercyniae</i> (Hartig)	<i>Ips typographus</i> Heer
<i>Gonipterus scutellatus</i> Gyll.	<i>Sternochetus mangiferae</i> Fabricius
<i>Ips amitinus</i> Eichhof	

(b) Bacteria

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

(c) Fungi

Glomerella gossypii Edgerton

Hypoxyton mammatum (Wahl.) J. Miller

Gremmeniella abietina (Lag.) Morelet

1.1.2.2. Terms of Reference: Appendix 2

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

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

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

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

Group of Tephritidae (non-EU) such as:

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

(c) Viruses and virus-like organisms

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

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

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

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

Annex IIAI

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

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

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

1.1.2.3. Terms of Reference: Appendix 3

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

Annex IAI

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

<i>Acleris</i> spp. (non-EU)	<i>Longidorus diadecturus</i> Eveleigh and Allen
<i>Amauromyza maculosa</i> (Malloch)	<i>Monochamus</i> spp. (non-EU)
<i>Anomala orientalis</i> Waterhouse	<i>Myndus crudus</i> Van Duzee
<i>Arrhenodes minutus</i> Drury	<i>Nacobbus aberrans</i> (Thorne) Thorne and Allen
<i>Choristoneura</i> spp. (non-EU)	<i>Naupactus leucoloma</i> Boheman
<i>Conotrachelus nenuphar</i> (Herbst)	<i>Premnotrypes</i> spp. (non-EU)
<i>Dendrolimus sibiricus</i> Tschetverikov	<i>Pseudopityophthorus minutissimus</i> (Zimmermann)
<i>Diabrotica barberi</i> Smith and Lawrence	<i>Pseudopityophthorus 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>Hirschmanniella gracilis</i> (de Man) Luc and Goodey	<i>Xiphinema americanum</i> Cobb sensu lato (non-EU populations)
<i>Liriomyza sativae</i> Blanchard	<i>Xiphinema californicum</i> Lamberti and Bleve-Zacheo

(b) Fungi

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

(c) Viruses and virus-like organisms

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

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex I A 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. *Ralstonia solanacearum* (Smith) Yabuuchi et al. *sepedonicus* (Spieckermann and Kotthoff) Davis et al.

(c) Fungi

Melampsora medusae Thümen

Synchytrium endobioticum (Schilbersky) Percival

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

Leptinotarsa decemlineata Say

Liriomyza bryoniae (Kaltenbach)

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Premnotrypes spp. (non-EU) is one of a number of pest groups listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine which, if any, members of the group fulfil the criteria of being a quarantine pest or those of a regulated non-quarantine pest (RNQP) for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States (MS) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

Following the adoption of Regulation (EU) 2016/2031⁴ on 14 December 2019 and the Commission Implementing Regulation (EU) 2019/2072 for the listing of EU regulated pests, the Plant Health Panel interpreted the original request (ToR in Section 1.1.2) as a request to provide pest categorisations for the pests in the Annexes of Commission Implementing Regulation (EU) 2019/2072⁵.

Premnotrypes Pierce (1914) (Coleoptera, Curculionidae, Entiminae, Premnotrypini) is the dominant genus within the Andean Potato Weevil (APW) complex, a group of tuber-boring weevils native of the Andes (2,100 m above sea level (asl)) from Argentina to Venezuela. Two additional species in two separate genera in the same family, *Phyrdenus muriceus* Germar, 1824 (Cryptorrhynchinae, Cryptorrhynchini) and *Rhigopsidius tucumanus* Heller, 1906 (Rhytirrhinae, Rhytirrhini), are usually recognised as part of the APW complex. Some authors also include species in genera such as *Scotoeoborus*, *Adioristus*, *Hyperodes*, *Listroderes* and *Naupactus* (Yaya, 1971; Delgado, 1975; Valencia and O'Brien, 1976; Alcázar and Cisneros, 1999) in the complex. However, they appear not to be able to complete their life cycles solely in potato (Alcázar and Cisneros, 1999). Therefore, for the purposes of this categorisation, they will not be further considered.

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

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

Recognising that the intention of listing *Premnotrypes* (non-EU) as quarantine pests within EU plant health legislation is due to the threat they present to EU potatoes (Smith et al., 1997) from Andean weevils that complete their development on potatoes, the EFSA PLH Panel has interpreted the terms of reference such that the group under scrutiny in this opinion is the APW complex consisting of 12 species of *Premnotrypes*, *Phyrdenus muriceus* and *Rhigopsidius tucumanus*, as detailed in Table 2 (Section 3.1.1 Identity and taxonomy). The group will, for brevity, be referred to as 'APW complex'.

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on the APW complex was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific names *Phyrdenus*, *Premnotrypes* and *Rhigopsidius* as search terms. Relevant papers were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, 2020) and relevant publications.

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

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

2.2. Methodologies

The Panel performed the pest categorisation for the APW complex, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018) and in the International Standard for Phytosanitary Measures No 11 (FAO, 2013) and No 21 (FAO, 2004).

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

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

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

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

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism	Is the pest present in the EU territory? If not, it cannot be a RNQP. (A regulated non-quarantine pest must be present in the risk assessment area)
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future	The protected zone system aligns with the pest free area system under the International Plant Protection Convention (IPPC) The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone)	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?

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
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential RNQP were met, and (2) if not, which one(s) were not met

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

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?

Yes, the identity of the 14 species included in the Andean Potato Weevil complex has been established. Taxonomic keys for their identification to species level exist.

The first described species in the APW complex (Coleoptera: Curculionidae) was *Phyrdenus muriceus* (Germar) in 1824 (originally named *Cryptorrhynchus muriceus* Germar). Subsequently, *Rhigopsidius tucumanus* Heller was described in 1906. Both species were collected in Argentina. Later, 12 additional species, nowadays included in the genus *Premnotrypes*, were described (Alcázar and Cisneros, 1999) (Table 2). Farmers collectively call the species in the APW complex 'gorgojo de los Andes' (= Andean weevil) or 'gusanos blancos' (= white grubs) (Alcázar and Cisneros, 1999). *P. muriceus* is also known as 'gorgojo del tomate' (= tomato weevil). The EPPO codes⁶ (Griessinger and Roy, 2015; EPPO, 2019) for those species that have one are given in the Table 2 (EPPO GD, 2020).

⁶ An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed the EPPO code remains the same. This provides a harmonised system to facilitate the management of plant and pest names in computerised databases, as well as data exchange between IT systems (Griessinger and Roy, 2015; EPPO, 2019).

Table 2: Scientific names of the 14 species included in the APW complex and countries where they were originally collected (based on Alcázar and Cisneros, 1999)

Species	Junior synonyms	Countries where originally collected	EPPO code
Subfamily Chryptorrhynchinae; tribe Chryptorrhynchini			
<i>Phyrdenus muriceus</i> Germar, 1824	<i>Cryptorrhynchus muriceus</i> , <i>Phyrdenus bullatus</i>	Argentina, Bolivia	PHRDMU
Subfamily Premnotrypinae; tribe Premnotrypini			
<i>Premnotrypes clivosus</i> Kuschel		Bolivia	
<i>P. fractirostris</i> Marshall, 1936		Peru	
<i>P. latithorax</i> (Pierce, 1914)	<i>Trypopremnon latithorax</i>	Bolivia, Chile, Peru	PREMLA
<i>P. piercei</i> Alcalá, 1979		Peru	
<i>P. pusillus</i> Kuschel, 1956		Peru	
<i>P. sanfordi</i> (Pierce, 1918)	<i>Trypopremnon sanfordi</i>	Peru	PREMSA
<i>P. solani</i> Pierce, 1914		Peru	PREMSO
<i>P. solaniperda</i> Kuschel, 1956		Bolivia, Peru	
<i>P. solanivorax</i> (Heller, 1935)	<i>Plastoleptops solanivora</i>	Peru	
<i>P. suturicallus</i> Kuschel, 1956		Peru	PREMSU
<i>P. vorax</i> (Hustache, 1933)	<i>Solanophagus vorax</i>	Colombia, Ecuador, Peru, Venezuela	PREMVO
<i>P. zischkai</i> Kuschel, 1956		Bolivia	
Subfamily Rhytirrhininae; tribe Rhytirrhinini			
<i>Rhigopsidius tucumanus</i> Heller, 1906	<i>R. piercei</i>	Argentina, Bolivia, Chile, Peru	RHGPTU

3.1.2. Biology of the pest

According to Alcázar and Cisneros (1999), the most widespread and important pests of the APW complex in the Andes by far are *Premnotrypes latithorax*, *P. suturicallus*, and *P. vorax*. They are allopatric species in Peru (Table 2). Their life cycles and the seasonal histories in Peru were studied in their respective areas of distribution (*P. vorax* in Cajamarca, *P. suturicallus* in Huancayo and *P. latithorax* in Cusco). These species show similar behaviour. It is expected that the same may apply to the other nine species of the genus. However, some differences have been observed for *Phyrdenus muriceus* and *Rhigopsidius tucumanus*.

***Premnotrypes* spp.** Adults remain hidden during the day beneath soil clods, stones, dry leaves or any other shelter including soil cracks near potato plants. In the evening, weevils climb to the foliage to eat the border of the leaves and to mate (Alcázar and Cisneros, 1999). After copulation, there is a pre-oviposition period of around 10 days, which may extend for up to 1 month (Gallegos et al., 1997; Kühne, 2007). Females lay their eggs, up to more than 600 for *P. suturicallus*, along their lifetime, which may extend for more than one year for *P. solanivorax* and *P. vorax* (Kühne, 2007). Eggs are laid inside straw or other plant debris near host plants (Gallegos et al., 1997). Kühne (2007) reported maximal fecundity of *P. suturicallus* between 11°C and 15°C, with oviposition severely reduced above 20°C. According to the review performed by Kühne (2007), several authors provide information on host plants other than *Solanum tuberosum*. However, in many cases, these records are based on casual observations rather than systematic studies. Moreover, reports of larvae on plants other than potatoes should be taken with caution as it is difficult to distinguish APW complex larvae from those of other weevil species co-occurring in the same ecosystems. The most detailed study on this subject corresponds to *P. latithorax* (Durán Auccatinco, 2001). This author studied the development of this species in different crop plants and weeds. Severe reductions in fecundity and egg hatching (below 1% usual values) were reported for adults feeding on hosts different from potato plants and even when fed on potato tubers. Importantly, none of the alternative potential hosts artificially infested with neonate larvae produced any adult, with the exception of the weed *Brassica campestris*, where very few adults (3% of those obtained in potatoes) of reduced size, and therefore, reduced fitness, were obtained. These findings point at these weevils as oligophagous insects restricted to tuber-forming species in the genus *Solanum*. Conclusive evidence for the occurrence of parthenogenesis in these species is missing and females and males have been described (Kühne, 2007). As eggs hatch about

one month after oviposition, neonate larvae make their way into the soil seeking potato tubers. However, when potato plants are not available, they can feed on the roots of other hosts. For instance, *P. vorax* can feed on *Plantago lanceolata* (Plantaginaceae), *Rumex acetosella*, *R. crispus* (Polygonaceae), *Rhaphanus raphanistrum*, *Brassica napus* and *B. campestris* (Brassicaceae) among others. Although some authors claim that full immature development (egg to pupa) is possible on these species (Gallegos et al., 1997), others conclude otherwise (Alcázar and Cisneros, 1999). When potatoes are present, though, the larva bores into the tuber and remains there feeding until it is ready to pupate, about 40 days later after completion of the fourth larval instar (with an additional instar for *P. vorax*). Then the larva abandons the tuber and digs into the soil (up to 30 cm deep) to make a pupal cell and prepare a tunnel for its emergence as an adult (Gallegos et al., 1997; Alcázar and Cisneros, 1999). Up to 1% of the larvae do not abandon the tuber and this may contribute to the passive spread of this herbivore with seed potatoes (Kühne, 2007). The weevil in the pupal cell is called an overwintering weevil. Overwintering weevils can be identified by the presence of the deciduous pieces of the mandibles. These pieces are detached when weevils become active and emerge from the soil about 2 months after pupation. Emergence coincides with the onset of rains in the APW complex native range. Although this synchronisation is evident for weevils in the field, rain is not the only stimulus to emergence. Adults also emerge from stores where rain is not a factor. In this case, the emergence period can extend for about 2 months. Because the period of initial larval infestation of tubers in the fields extends over several weeks, most of the larvae reach maturity and abandon the tuber for pupation before harvest. These overwintering specimens will re-infest the fields the following year. In that case, pupation cells are scattered over the field. Larvae that reach maturity at harvest, when tubers are piled, concentrate underneath the piles. Finally, the last group of larvae abandons the tubers during storage. Here, during the first 30 days, 97% of larvae leave the tubers for pupation. As a consequence, these areas also become sources of new infestations (Alcázar and Cisneros, 1999). In Colombia, adult *P. vorax* emerge during the whole year with peaks in April-May and October-December, which may be indicative of the occurrence of more than one generation per year (Alcázar and Cisneros, 1999), while in Peru emergence takes place mainly between October and January. In Bolivia, the onset of emergence of *P. latithorax* in stores begins sporadically in September with a peak in October (Kühne, 2007). Emerging adults remain in the field if potato plants are available. Otherwise, they migrate to nearby potato fields not farther than a few hundred meters away (Gallegos et al., 1997; Kühne, 2007).

Development times of several species of the APW complex have been estimated with no temperature control. Kühne (2007) determined the effect of temperature on development and survival of the different life stages and fecundity of *P. suturicallus* under controlled conditions. Highest survival rates for all life stages occurred between 11 and 15°C. Larvae were the most susceptible stage to high temperatures with no survival at 25°C. Development time from egg to female at 50% egg production increased from 70 days at 23°C to 500 days at 5°C. Highest fecundity occurred at 13°C with over 250 eggs per female and lowest at 20°C. Therefore, *P. suturicallus* appears to be adapted to cold climate conditions. Under field conditions, population development was studied along an altitude gradient from sea level to 4,100 m. Only few individuals survived at an altitude of 2,400 m (corresponding to 16.7°C) making it the lower distribution limit of *P. suturicallus*. These field studies confirmed the cold adaptation of the weevil as found under laboratory conditions. Other *Premnotrypes* species may show similar adaptations.

Rhigopsidius tucumanus. Its behaviour differs from that of *Premnotrypes* spp. in that pupation occurs inside the tuber. As a result, adults emerging from the planted seed tubers initiate field infestations. Females lay eggs in the soil near the potato plants.

Phyrdenus muriceus. Its behaviour differs from *Premnotrypes* spp. in that adults of this species can also feed and complete development on the roots and lower stems of *Solanum lycopersicum* (tomatoes) and *S. melongena* (eggplant) (Espul and Magistretti, 1969; Edelstei and Walker, 2015). Although some authors report that adults can fly (Ratkovitch, 1949; Alcázar and Cisneros, 1999; Kühne, 2007), which would make this species unique within the APW complex, others report otherwise (Espul and Magistretti, 1969; SINAVIMO, 2020). Contrary to the other species in the complex, which are distributed in the Andes at altitudes above 2,100 m, this species also occurs at lower altitudes, extending from southwestern US to central Argentina (Wibmer and O'Brien, 1986; Eppo, 2005; Rouaux, 2015) and may present several overlapping generations in one year (Espul and Magistretti, 1969).

3.1.3. Intraspecific diversity

No reports of intraspecific variation of the species under scrutiny have been found.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, detection methods and identification keys are available for the 14 species included in the Andean Potato Weevil complex.

Identification

Alcázar and Cisneros (1999) provide a key for the determination of the 14 species included in the APW complex. The characterisation of the three genera included in the group (*Phyrdenus*, *Premnotrypes* and *Rhigopsidius*) has a first premise that the adult weevils originate from larvae that developed in potato tubers. Although, there are contradictory reports about the ability of *P. muriceus* to fly (see above), this is the only species in the APW complex with non-vestigial hindwings. *R. tucumanus* can be further distinguished from *Premnotrypes* spp. because the prosternum is grooved for reception of beak. Moreover, *R. tucumanus* mandibles lack a deciduous piece which is present in *Premnotrypes* spp. The 12 species within the genus *Premnotrypes* are distinguished based on different morphological features, including the male aedeagus.

Detection

- Trapping

Although several authors mention the existence of pheromones, either sexual or aggregative referring to observations of groups of adults clumped together (Kühne, 2007), no effective traps exploiting either these type of semiochemicals or food-attractants (i.e., damaged potato foliage) have been developed.

- Symptoms
 - Adults leave half-moon shaped feeding traces on the leaf edge. The only exception is *Phyrdenus muriceus*, which makes round holes.
 - Larvae tunnel into potato tubers, causing little externally visible damage, which makes their detection by external inspection unlikely.

Morphology

Morphological descriptions of all *Premnotrypes* species (Figure 1) included in the APW complex can be found in Kuschel (1956). Agostini de Manero and Vilte (1982) and Morrone and Loiacono (1992) provide descriptions of *R. tucumanus* (Figure 2) and Fiedler (1941) of *Phyrdenus muriceus* (Figure 3).

- Adults

According to Kühne (2007), adults of all species within the APW complex are brown, which together with the presence of tubercles, scales and lines on their elytra, makes them difficult to distinguish from the brownish background of the soil. The elytra are fused making them flightless, except for *Phyrdenus muriceus* (Ratkovitch, 1949). These weevils measure approximately 5–9 mm long and 2.5–4.5 mm wide. *Premnotrypes pusillus* is the smallest species with 3.8–4.9 × 1.9–2.5 mm, whereas *R. tucumanus* is the largest species in the complex (Figure 2). The species within the complex exhibit sexual dimorphism, with females being larger than males and ventrally showing differences at the end of the abdomen related to the external genitalia.

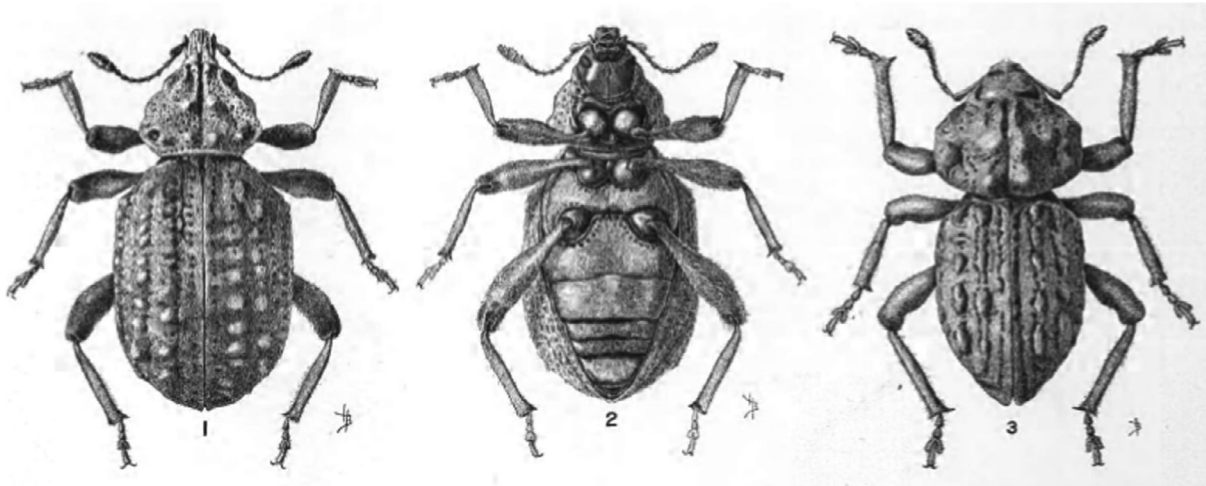


Figure 1: *Premnotrypes solani* (1 and 2) and *P. latithorax* (3). Original plate from Pierce (1914). Real body length: 7 mm

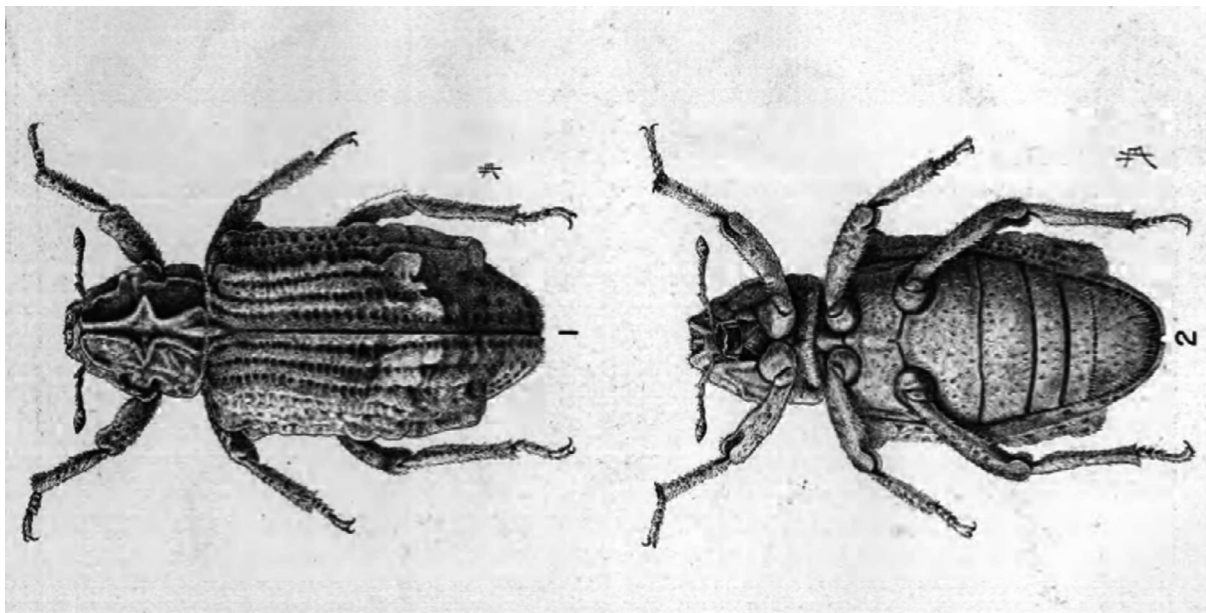


Figure 2: *Rhigospidius tucumanus*. Original plate from Pierce (1914). Real body length: 9 mm



Figure 3: *Phyrdenus muriceus*. Image from Barriga-Tuñón (2016). Real body length: 6 mm

- Eggs

Eggs are white to creamy in colour and cylindrical to oval in shape (from 0.8 × 1.8 mm, long × large). Those of *Rhigospidius tucumanus* tend to be more roundish (Kühne, 2007).

- Larvae

Typical Curculionidae larvae, legless, creamy-white and presenting setae over the whole body.

- Pupae

Pupae are exarate. Therefore, external morphology can be easily observed when removing the pupal chamber where pupation takes place (in the soil except for *R. tucumanus*, which pupates in the tuber)

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

All species of the APW complex are native to the Andes, where they commonly occur between 2,800 and 4,700 m asl in an area extending from Chile to Venezuela (Figures 4, 5 and 6). Only *Phyrdenus muriceus* occurs at relatively lower altitudes, not more than 2,000 m in the mesothermic valleys of Bolivia (Figure 6). This species also occurs in most of the Americas from southern US (Florida and Arizona) to central Argentina. Most species in the APW complex co-occur in Peru and Bolivia (Figure 4), which are considered as the centre of origin of these weevils (Alcázar and Cisneros, 1999).

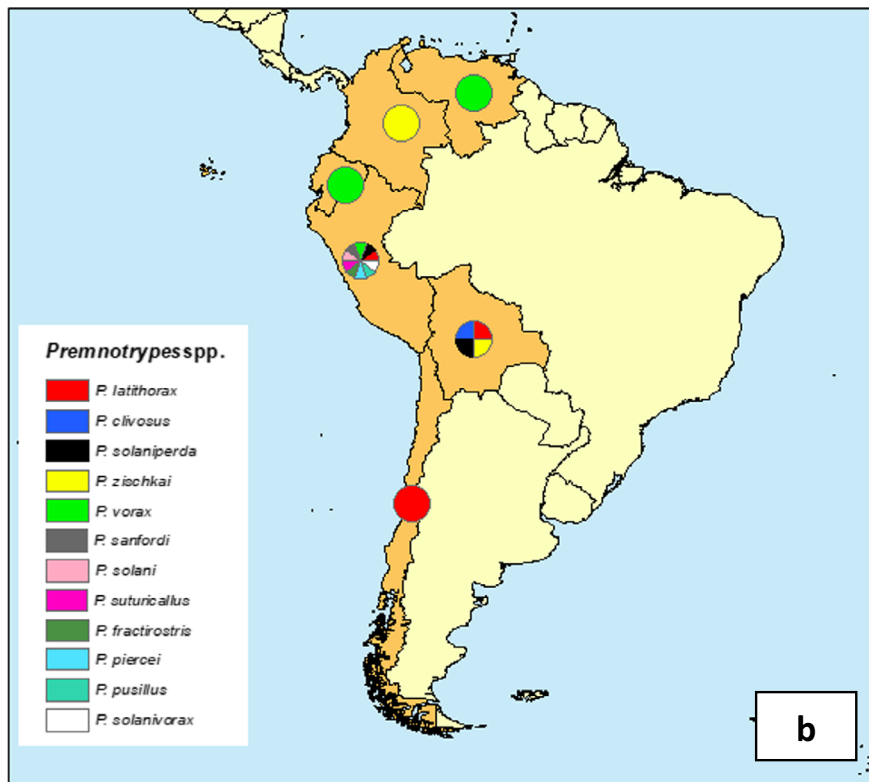
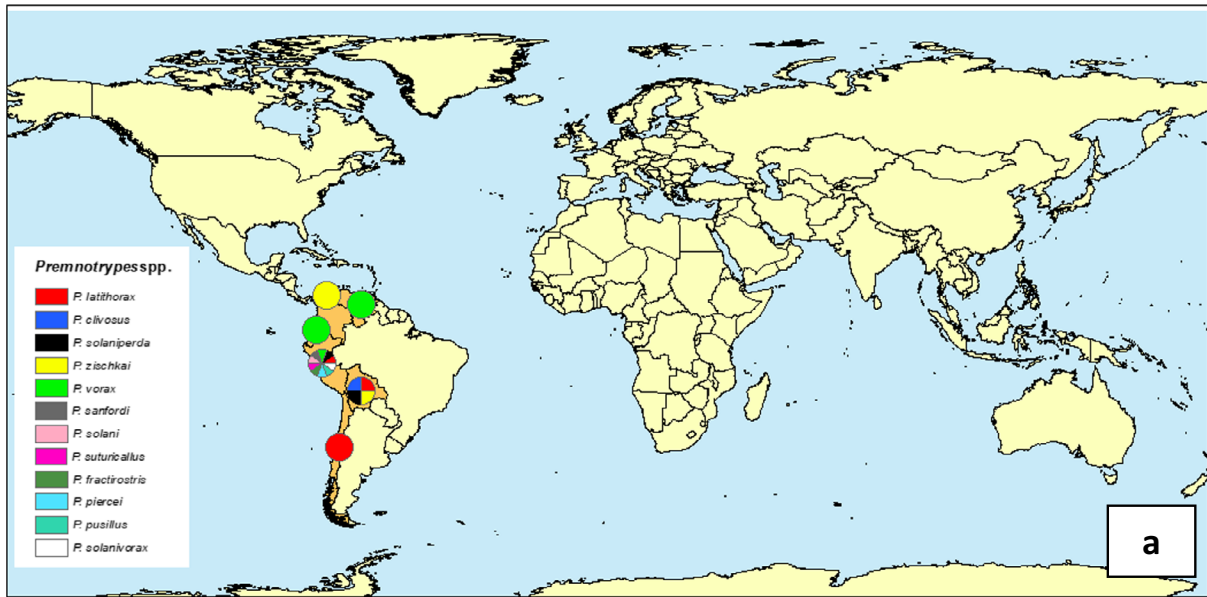


Figure 4: Geographical distribution of the weevil species within the genus *Premnotrypes* included in the APW complex (from Alcázar and Cisneros, 1999 and EPPO Global Database accessed on Feb/10/2020): (a) world distribution; (b) South-American distribution (detail)

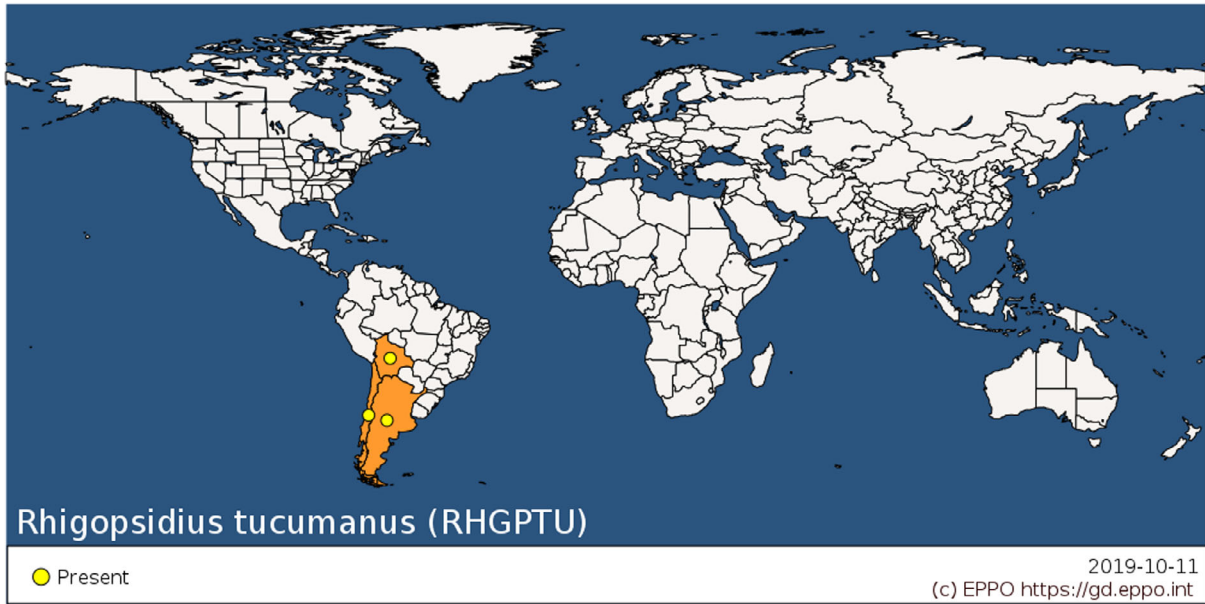


Figure 5: Global distribution map for *Rhigopsidius tucumanus* (extracted from the EPPO Global Database accessed on Feb/10/2020)

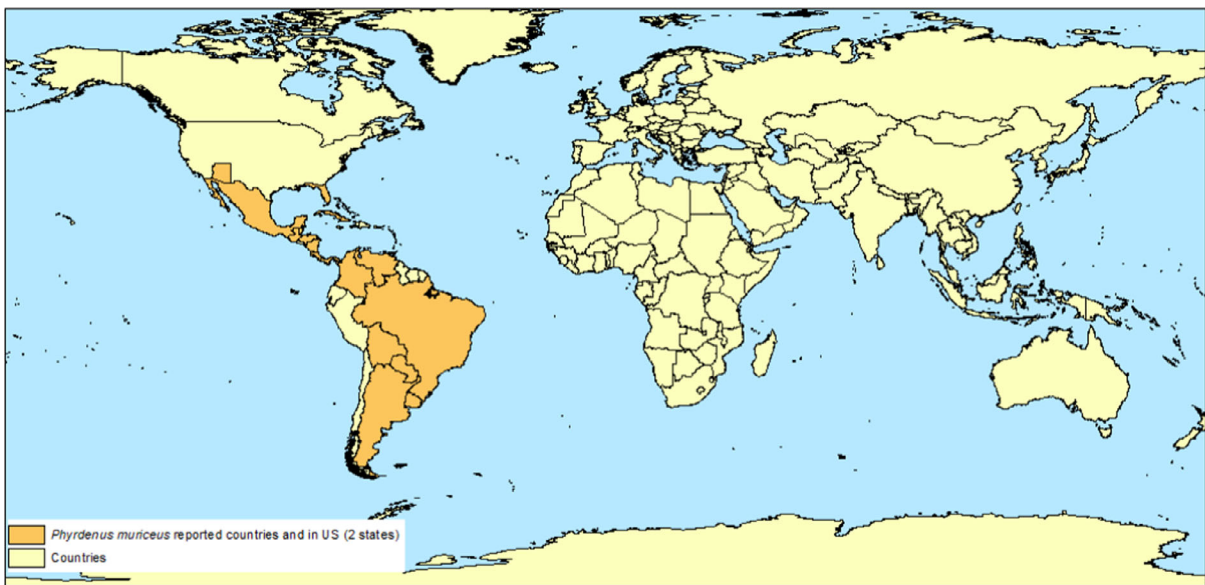


Figure 6: Global distribution of *Phyrdenus muriceus* (based on EPPO (2015) and literature cited in the text)

Table 3: Global distribution of species in the Andean potato weevil complex

		<i>Phyrdenus muriceus</i>	<i>Rhigopsidius tucumanus</i>	<i>Premnotrypes divosus</i>	<i>P. fractirostris</i>	<i>P. latithorax</i>	<i>P. piercei</i>	<i>P. pusillus</i>	<i>P. sanfordi</i>	<i>P. solani</i>	<i>P. solaniperda</i>	<i>P. solanivorax</i>	<i>P. suturicallus</i>	<i>P. vorax</i>	<i>P. zischkai</i>
North America	USA ⁽¹⁾	✓													
	Mexico	✓													
Central America	Belize	✓													
	Costa Rica	✓													
	Guatemala	✓													
	Honduras	✓													
	Nicaragua	✓													
	Panama	✓													
	Caribbean	Cuba	✓												
South America	Argentina	✓	✓												
	Brazil	✓													
	Bolivia	✓	✓	✓		✓					✓				✓
	Chile		✓			✓									
	Columbia	✓												✓	
	Ecuador													✓	
	Paraguay	✓													
	Peru		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Uruguay	✓													
	Venezuela	✓												✓	

(1): Arizona and Florida.

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, the weevils included in the APW complex are not known to occur in the EU territory.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

Premnotrypes spp. is listed in Commission Implementing Regulation 2019/2072. Details are presented in Tables 4 and 5.

Table 4: *Premnotrypes spp.* in Commission Implementing Regulation 2019/2072

Annex II Part A	List of Union quarantine pests and their respective codes Quarantine Pests and their codes assigned by EPPO
C.	Insects and mites
56.	<i>Premnotrypes spp.</i> (non-European) [1PREMG}

3.3.2. Legislation addressing the hosts of the species included in the APW complex

Table 5: Regulated hosts and commodities that may involve species included in the APW complex in Annexes of Commission Implementing Regulation 2019/2072 Annex VI

Annex VI	List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited		
	Description	CN Code	Third country, group of third countries or specific area of third country
15.	Tubers of <i>Solanum tuberosum</i> L., seed potatoes	0701 10 00	Third countries other than [...]
16.	Plants for planting of stolon- or tuber-forming species of <i>Solanum</i> L. or their hybrids, other than those tubers of <i>Solanum tuberosum</i> L. as specified in entry 15	ex 0601 10 90 ex 0601 20 90 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than [...]
17.	Tubers of species of <i>Solanum</i> L., and their hybrids, other than those specified in entries 15 and 16	ex 0601 10 90 ex 0601 20 90 0701 90 10 0701 90 50 0701 90 90	Third countries other than [...]:(b) those which fulfil the following provisions: (i) [...] (ii) they are either recognized as being free from <i>Clavibacter sepedonicus</i> [...], or their legislation, is recognised as equivalent to the Union rules concerning protection against <i>Clavibacter sepedonicus</i>
18.	Plants for planting of Solanaceae other than seeds and the plants covered by entries 15, 16 or 17	ex 0602 90 30 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than: [...]
19.	Soil as such consisting in part of solid organic substances	ex 2530 90 00 ex 3824 99 93	Third countries other than [...]

3.3.3. Legislation addressing the organisms vectored by APW complex in Regulation (EU) Commission Implementing Regulation 2019/2072

None of the species included in the APW complex is known to vector any plant pathogenic organism.

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

According to the review performed by Kühne (2007), several authors have provided information on host plants other than *Solanum tuberosum* for the species in the APW complex. However, as explained above (see section 3.1.2), these weevils are most probably oligophagous and restricted to tuber-forming *Solanum* species. The main exception to this is *Phyrdenus muriceus*, which can complete development on *S. melongena* and *S. lycopersicum* as well. Consequently, present regulations addressing the APW complex (see 3.3) are comprehensive of their host range.

3.4.2. Entry

Is the pest able to enter into the EU territory?

Yes, species in the APW complex could enter into the EU. The main pathways would be *Solanum* spp. plants for planting (including tubers but excluding true seeds) and soil imported from APW-infested countries. These pathways can be considered as closed with current regulations in place.

The species included in the APW complex are mostly restricted to *Solanum tuberosum*. They can complete development feeding exclusively on this host. Eggs are laid on straw and plant debris in the vicinity of the host. Larvae feed on the tubers and mostly abandon the host to pupate in the soil. The exception is *R. tucumanus*, which pupate in the tuber. *Phyrdenus muriceus* can additionally complete the life cycle feeding on the roots and lower stems of *S. lycopersicum* and *S. melongena*. Adults of the species in the APW complex feed on the leaves of their *Solanum* spp. hosts but also on other wild hosts (see Section 3.1.2). Although there is suspicion that some species within the complex may have colonised areas beyond their respective native ranges (Table 2), there is no strong evidence of it. A search of Europhyt interceptions database did not reveal any interceptions of members of the APW complex (accessed 8 May 2020). Table 6 identifies potential pathways and life stages associated with each pathway.

Table 6: Potential pathways for species within the APW complex and existing mitigations (if any)

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI) or special requirements (Annex VII) within Implementing Regulation 2019/2072]
Plants for planting with foliage and growing medium	Eggs (on plant debris) Larvae (on roots, in tubers, and in growing medium) Pupae (in tubers and in growing media) Adults (on foliage)	Annex VI (18.) . Introduction into the EU of plants for planting of Solanaceae other than seeds (...) from third countries other than Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia, Norway, Russia (...), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey and Ukraine is prohibited Annex VII (1.) . The growing medium attached to or associated with plants, intended to sustain the vitality of the host plants (<i>Solanum</i> spp.) are mostly covered by the CN codes listed in Annex VII of Regulation 2019/2072 and require a general freedom from symptoms of quarantine pests
Seed potatoes (<i>Solanum tuberosum</i>)	Larvae (in tubers) Pupae (in tubers or in soil)	Annex VI (15.) Introduction into the EU of seed potatoes from third countries other than Switzerland is prohibited
Ware potatoes (<i>Solanum tuberosum</i>)	Larvae (in tubers) Pupae (in tubers or in soil)	Annex VI (17.) Introduction of tubers of species of <i>Solanum</i> L. and their hybrids other than <i>S. tuberosum</i> seed potatoes is prohibited from countries other than (a) Algeria, Egypt, Israel, Libya, Morocco, Syria, Switzerland, Tunisia and Turkey, or (b) those which fulfil the following provisions: (i) they are one of following: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (...), San Marino, Serbia, and Ukraine, and (ii) — they are either recognized as being free from <i>Clavibacter sepedonicus</i> (Spieckermann and Kottho) Nouioui et al., in accordance with the procedure referred to in Article 107 of Regulation (EU) No 2016/2031, or — their legislation, is recognised as equivalent to the Union rules concerning protection against <i>Clavibacter sepedonicus</i> (Spieckermann and Kottho) Nouioui et al. in accordance with the procedure referred

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI) or special requirements (Annex VII) within Implementing Regulation 2019/2072]
		to in Article 107 of Regulation (EU) No 2016/2031 have been complied with Annex VII (14.) Official statement that the consignment or lot does not contain more than 1% by net weight of soil and growing medium
Soil & growing media	Pupae	Annex VI (19. and 20.) bans the introduction of soil and growing media as such into the Union from third countries other than Switzerland
Soil on machinery	Pupae	Annex VII (2.) Official statement that machinery or vehicles are cleaned and free from soil and plant debris

The plants for planting with foliage and growing medium pathway can be considered as closed because plants for planting of Solanaceae from countries where the species included in the APW complex occur is prohibited (Annex VI).

The ware potatoes pathway can be considered as closed because ware potatoes from countries where the species included in the APW complex occur is prohibited (Implementing Regulation 2019/2072, Annex VI). However, a search of Eurostat returns imports into Spain (from Peru) and into the Netherlands (from the USA) recorded under the code CN 0701 90, which corresponds to potatoes (fresh or chilled, excluding seed). If the imports were of *Solanum tuberosum* then they would be in breach of EU phytosanitary legislation.

Enquiries to the NPPO of Spain (Alejandro Lorca; Coordinador General de Inspección de Sanidad Vegetal, pers. comm.) revealed that the imports actually correspond to *Ullucus tuberosus*, a solanaceous root vegetable. Upon entry to Spain 15% of the imports of this species were declared as CN 0701 9090 90 (potatoes, 'other', Appendix B). The remaining imports of *U. tuberosus* were recorded with CN code 0714 90 90 00 (roots or tubers with high starch content, 'other', Appendix B). Eurostat does not allow public searches of 10-digit codes. Recognising that the CN system is hierarchical, the code 0701 90 includes commodities at lower levels. *U. tuberosus* is now listed in 2016/2031 as a high risk plant whose import into the EU is prohibited. Because of the categorisation of *U. tuberosus* as a high risk plant, imports of *Ullucus* were discontinued at the end of 2019.

Enquiries to the Dutch NPPO suggest that the records in EUROSTAT are highly likely to be wrong, i.e. a misclassification during data entry. There are no records of potato imports from USA in the Dutch import inspection database.

The soil/growing media pathway can be considered as closed because soil can only enter the EU from Switzerland (Annex VI). None of the species within the APW complex are known to occur in Switzerland.

3.4.3. Establishment

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

Yes, species in the APW complex considered in this opinion could establish in the EU; potatoes are widely available and species within the APW occur in at least one climatic region which also occurs widely in the EU.

3.4.3.1. EU distribution of main host plants

Members of the APW complex complete their development in potato tubers. Potatoes are grown widely over the EU both as a commercial crop and in home-gardens (de Rougemont, 1989). Table 7 shows the area of potatoes cultivated in the EU in recent years. *P. muriceus* can successfully develop and reproduce on tomatoes and eggplants as well (Espul and Magistretti, 1969; Edelstei and Walker, 2015). These two crops are also widely grown in the EU either in open field or in greenhouses (Table 7 and Appendix A).

Table 7: Tomato (V3100), potato (R1000) and eggplant (V3410) crop production 2015–2019 (extracted from Eurostat 21/4/2020) Area (cultivation/harvested/production) (1,000 ha)

Crops	Code	Countries	2015	2016	2017	2018	2019
Potato	R1000	EU 28	1,656.13	1,689.38	1,746.18	1,702.53	1,772.04
Tomato	V3100	EU 28	254.43	247.00	241.07	239.71	:
Eggplant	V3410	EU 28	22.27	21.58	20.73	21.44	:

As noted above (Section 3.1.2; pest biology), the life cycle of the species within the APW complex is closely synchronised with the phenology of potato crops in the Andes. Kühne et al. (2007) suggest that the distribution of these species is connected to the occurrence of potato production. Adults are observed in potato fields from the time of crop emergence to harvest. Where there is continuous, year-round, potato production, e.g. in Colombia, Ecuador and Venezuela, there can be two or three generations of APW per year, while in Peru and Bolivia, without irrigation, there is one potato crop per year and there is a single generation of the species within the APW complex.

3.4.3.2. Climatic conditions affecting establishment

In the Andes, potatoes are grown at elevations above 2,000 m asl (Zimmerer, 1998) and species in the APW complex are found between approximately 2,100 m and 4,700 m; they most commonly occur at altitudes over 2,800 m. *P. muriceus*, though, can also be found at lower altitudes from southern USA to Argentina (Figure 6; Alcázar and Cisneros, 1999).

The highest diversity of species in the APW complex is found in the central highlands of Peru (Alcázar and Cisneros, 1999). Being close to the equator the mean monthly temperatures recorded in Peru do not vary much over the year and the standard drop of approximately 6°C per 1,000 m of ascent applies on the eastern side of the Andes (Gosling et al., 2011). The eastern side of the Andes receives regular precipitation from water vapour originating in the Amazon basin (Garreaud, 2009; Viale et al., 2019).

The Köppen–Geiger climate zone type Cfb (warm temperate, fully humid, warm summer) (Kottek et al., 2006), which occurs over much of central Europe, can be found in such conditions. Figure 7 provides a map of Peru showing all climate types between 2,100 and 4,700 m; Figure 8 indicates all climate types in South America between the same altitudes.

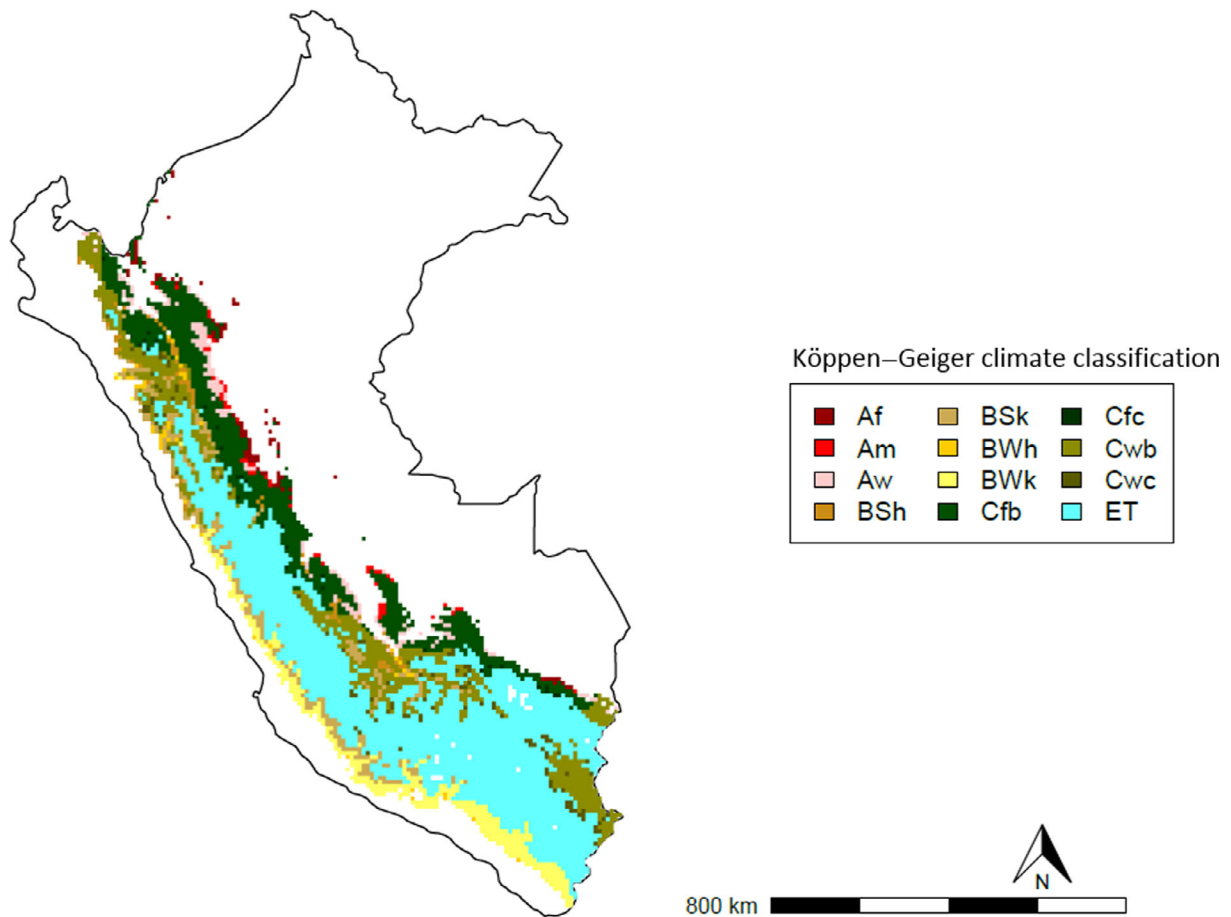


Figure 7: Occurrence of Köppen–Geiger climate classifications at altitudes between 2,100 and 4,700 m in Peru

Five climate types found in Europe are found in Peru at altitudes between 2,100 and 4,700 m. They are BSh, BSk, Cfb, Cfc and ET (Figure 9).

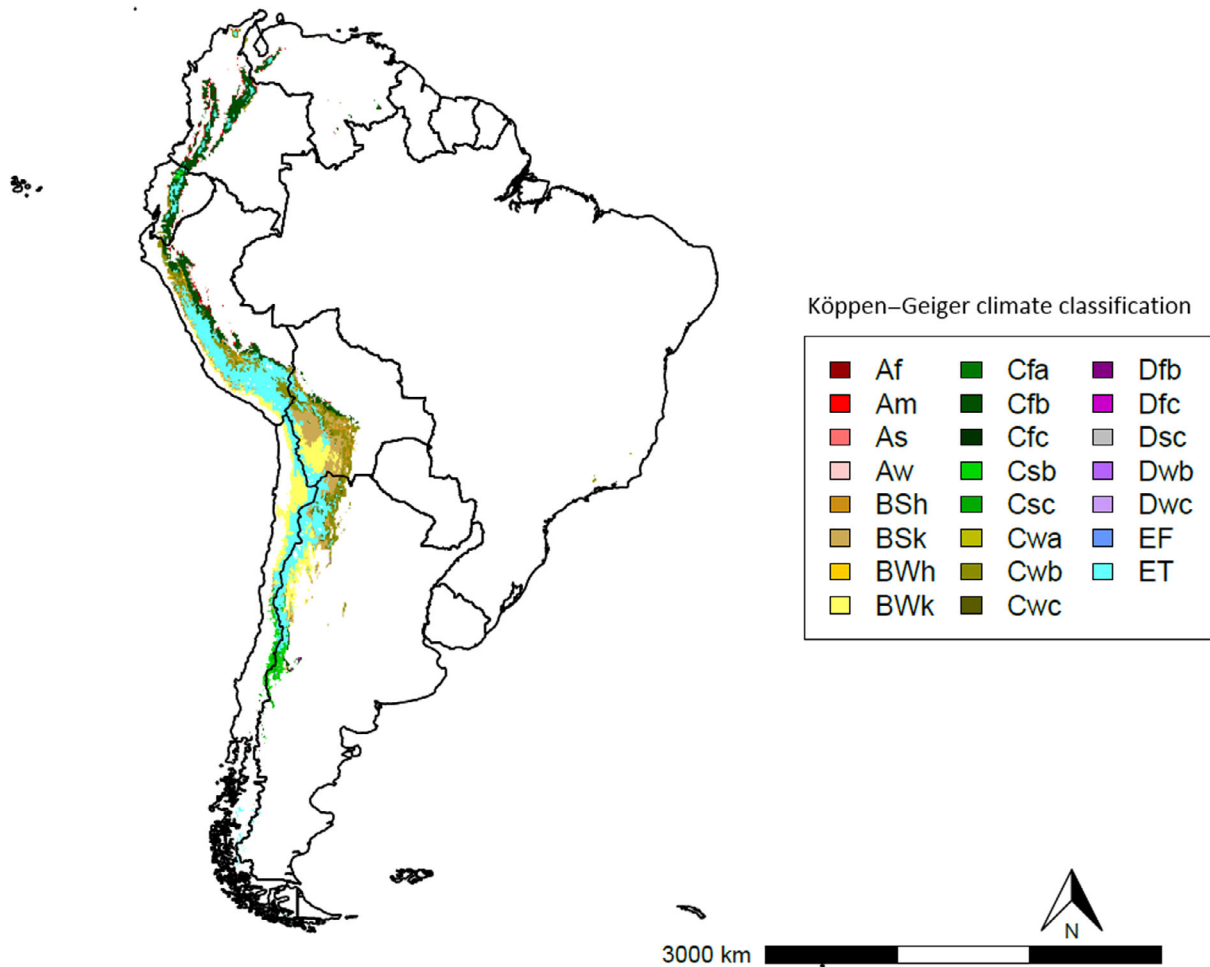


Figure 8: Occurrence of Köppen–Geiger climate classifications at altitudes between 2,100 and 4,700 m in South America

Climate type Cfb occurs widely across the EU including many areas where potatoes are grown. Climate type Cfc occurs in mountainous regions of the EU such as the Pyrenees, the French and Italian Alps, and in the Apennines (Figure 9).

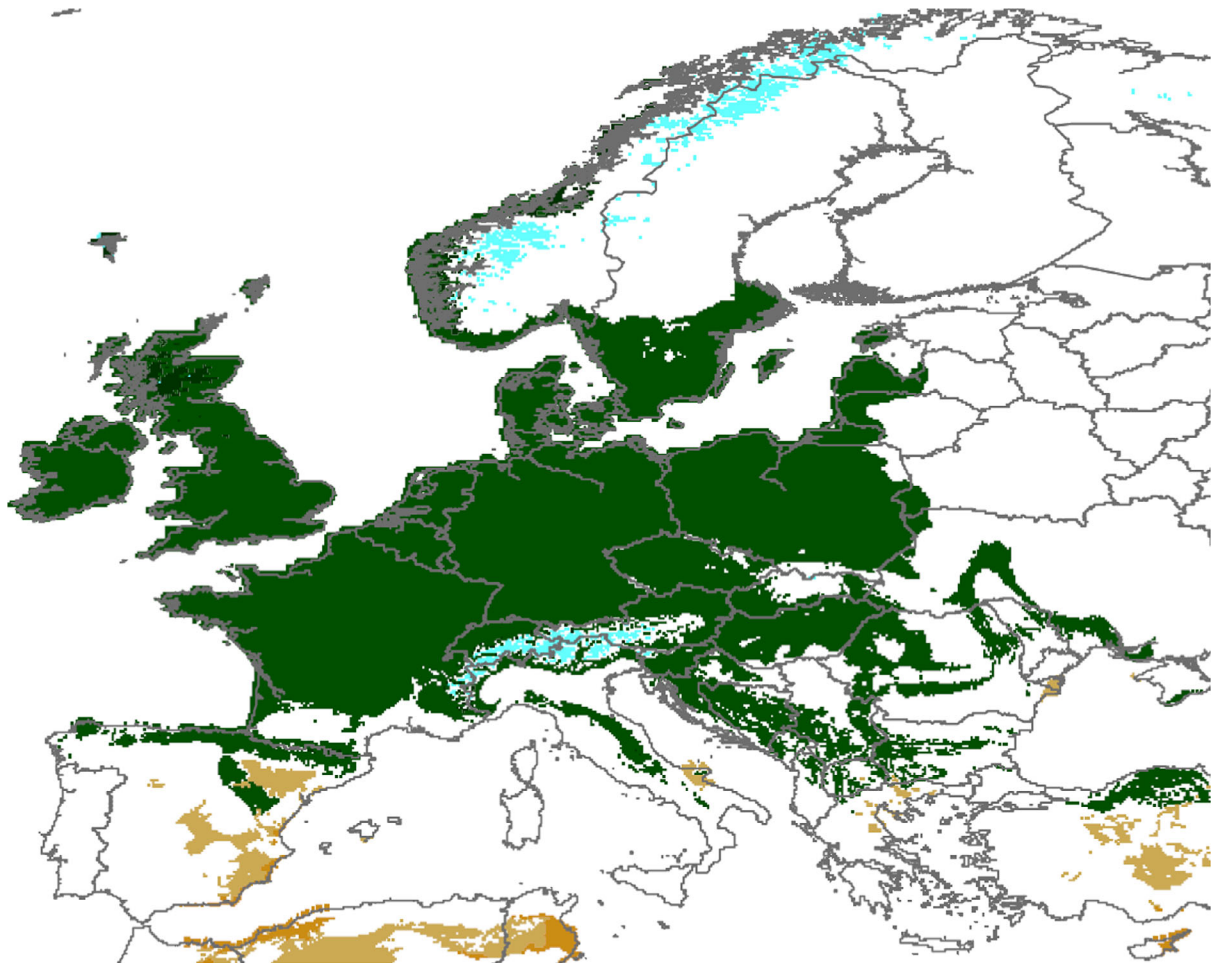
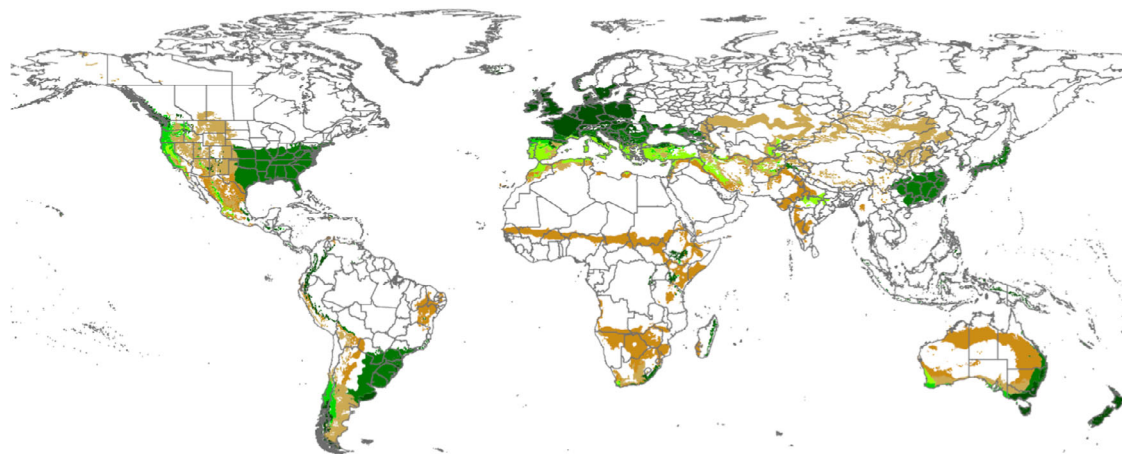


Figure 9: Occurrence of Köppen–Geiger climate types BSh, BSk, Cfb, Cfc and ET in Europe

Regarding *P. muriceus*, European type climate zones occur in the countries of South, Central and North America where *P. muriceus* is found (Figure 10).










Key	Climate category	Descriptions
	BSh	Dry, hot semi-arid steppe, sub-tropical steppe, low-altitude dry
	BSk	Dry, cold semi-arid steppe, mid-altitude steppe, dry
	Cfa	Temperate, uniform precipitation through year; humid sub-tropical, mild, no dry season, hot summer
	Cfb	Temperate, uniform precipitation through year, temperate oceanic; mild, no dry season, warm summer
	Cfc	Temperate, uniform precipitation through year, sub-polar oceanic; mild, no dry season, cool summer
	Csa	Temperate, dry hot summer; Mediterranean; mild with dry, hot summer
	Csb	Temperate, dry, warm summer; Mediterranean; mild with dry, warm summer

Figure 10: World distribution of Köppen–Geiger climate zones in countries where *Phyrdenus muriceus* occurs and which also occur in the EU (Map from MacLeod and Korycinska, 2019)

3.4.4. Spread

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

Yes, the species within the APW complex could spread within the EU territory following establishment. Spread would be mostly with seed potatoes

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

Yes, spread is mainly via seed potatoes

Adults emerging from infested potatoes can move to nearby potato fields not farther than a few hundred meters away (Gallegos et al., 1997; Kühne, 2007). Although *P. muriceus* is the only species within the APW complex which may be able to fly (Ratkovitch, 1949), it is supposed to behave similarly to the other species in the complex and not to actively spread more than these few hundred meters. In addition, these species can use irrigation furrows to passively move within a plot (Espul and Magistretti, 1969; SINAVIMO, 2020). Consequently, plants for planting (i.e., seed potatoes) are considered as the main way these species spread in a territory. Ware potatoes could also provide a plausible pathway, especially for *R. tucumanus*, as this species pupates within the tuber.

3.5. Impacts

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

Yes, the introduction of any of the species within the APW complex would most probably have an economic impact on the EU territory.

*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?*⁷

Yes, the presence of the pest on seed potatoes would most probably have an economic impact as regards to their intended use.

According to different authors, the species within the APW complex are the most serious pests of potatoes in the Andes, causing on average up to 30% yield loss (Ewell et al. 1994, Raman 1994, Crissman et al. 1998). Franco et al. (2000) report quality losses in tuber during storage of 100, 80 and 20% for *P. latithorax*, *R. tucumanus* and *P. muriceus*, respectively. In the case of *P. vorax* in Ecuador, Gallegos et al. (1997) estimated yield losses ranging from 22% to 50% and management costs representing up to 21% of total production costs.

The economic importance of *P. muriceus* in tomatoes and eggplants is due to larvae feeding on the roots of recently transplanted plants. Occasionally, if populations are high, up to 80% of these young plants can be killed (Espul and Magistretti, 1969; Espul, 1977; Pérez et al., 2002; Cordo et al., 2004; Rouaux, 2015). This species is considered to be an emerging pest causing significant losses in organic eggplant, potato and tomato production in Argentina (Eliceche et al., 2020).

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 risk of entry. The pathways identified (plants for planting including, seed and ware potatoes, and soil; see Section 3.4.2) are regulated and can be considered as closed for the species included in the APW complex.

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

Yes, sourcing of plants from PFA would reduce the risk of the pest being present on plants for planting.

3.6.1. Identification of additional measures

Because the entry pathways are regulated and can be considered as closed, the additional measures in the tables below could be applied to mitigate the risk of spread and impact in case members of the pest complex arrive in the EU.

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 8.

⁷ See Section 2.1 on what falls outside EFSA's remit.

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

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)
Roguing and pruning	Removal of volunteers (Plantwise Knowledge Bank, 2015)	Establishment, spread, impact
Crop rotation, associations and density, weed/volunteer control	Crop rotation (Gallegos et al., 1997; Plantwise Knowledge Bank, 2015), associations and density, weed/volunteer control (Plantwise Knowledge Bank, 2015) are used to make the habitat less conducive to species in the APW complex	Establishment, spread, impact
Timing of planting and harvesting	Delaying planting time affects survival of overwintering population (Gallegos et al., 1997); use of sectorial fallow systems decreases the impact of overwintering populations (Kühne, 2007)	Impact
Chemical treatments on crops including reproductive material	Gallegos et al. (1997), Kühne (2007)	Impact
Biological control and behavioural manipulation	Use of entomopathogenic fungi (Kühne, 2007; Canales, 2014), entomopathogenic nematodes (Kühne, 2007; Eliceche et al., 2020); poultry (Canales, 2014) Use of trap plants (Gallegos et al., 1997)	Impact

3.6.1.2. Additional supporting measures

Because the entry pathways are regulated and can be considered as closed, no additional supporting measures are presented.

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

- Immature stages (mostly larvae but also pupae for *R. tucumanus*) can be hidden inside tubers.
- Adults of the species within the APW complex can survive feeding on many weeds.

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

- Immature stages other than pupa can remain hidden in seed potatoes, making their detection by visual external inspection highly unlikely.
- *Rhigospidius tucumanus* pupates in tubers and, therefore, pupae could be hidden within seed potatoes and remain undetected by visual external inspection.

3.7. Uncertainty

There are no uncertainties affecting the conclusions of this categorisation. However, the complex could include more species than the ones actually considered in this pest categorisation. The reason being that new undescribed species belonging to the APW complex may exist, especially in Peru and Bolivia. Moreover, some authors include the genera *Scotoeoborus*, *Adioristus*, *Hyperodes*, *Listroderes*, and *Naupactus* (which cannot complete their development on potatoes) in the APW complex.

4. Conclusions

The species included in the APW complex satisfy the criteria that are within the remit of EFSA to assess for them to be regarded as potential Union quarantine pests. These species do not meet the criterion of being present in the EU for them to be regarded as potential RNQPs. Pest categorisation conclusions are presented in Table 9.

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

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pests (Section 3.1)	The Andean Potato Weevil (APW) complex is made of 14 species belonging to the genera <i>Phyrdenus</i> , <i>Premnotrypes</i> , and <i>Rhigopsidius</i> . The identity of these species is well established	The APW complex is made of 14 species belonging to the genera <i>Phyrdenus</i> , <i>Premnotrypes</i> , and <i>Rhigopsidius</i> . The identity of these species is well established	New undescribed species belonging to the APW complex may exist, especially in Peru and Bolivia. Some authors include the genera <i>Scotoeberus</i> , <i>Adioristus</i> , <i>Hyperodes</i> , <i>Listroderes</i> , and <i>Naupactus</i>) in the APW complex. However, as these species cannot complete their life cycles in potato, they have not been further considered in this categorisation
Absence/presence of the pest in the EU territory (Section 3.2)	None of the species included in the APW complex is known to occur in the EU	None of the species included in the APW complex is known to occur in the EU. Therefore, the criterion of the pest being present in the EU territory for RNQPs is not met	
Regulatory status (Section 3.3)	Some members of the APW complex i.e. <i>Premnotrypes</i> spp. are regulated as quarantine pests	Some members of the APW complex i.e. <i>Premnotrypes</i> spp. are regulated as quarantine pests	
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	The species in the APW complex could enter into, establish in and spread within the EU territory. Main entry pathways are: <ul style="list-style-type: none"> Plants for planting with growing medium Seed and ware potatoes Soil and growing medium as such or attach to machinery These pathways, though, can be considered as closed by present legislation	The species in the APW complex could spread within the EU territory mostly with seed potatoes	
Potential for consequences in the EU territory (Section 3.5)	The introduction of the species in the APW complex into the EU territory would most likely have an economic impact	The presence of the species within the APW complex in seed potatoes would most likely have an economic impact on its intended use	
Available measures (Section 3.6)	There are measures to prevent the entry, establishment and spread of the species in the APW complex within the EU territory, like sourcing potatoes from PFA	There are measures to prevent the presence of the species in the APW complex in seed potatoes, like sourcing these plants for planting from PFA	

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
Conclusion on pest categorisation (Section 4)	The species within the APW complex fulfill all criteria assessed by EFSA above for consideration as quarantine pests	Although the criterion of plants for planting being the main means of spread for consideration as a RNQP is met. the criterion of the pest being present in the EU territory, which is a pre-requisite for consideration as a potential RNQP, is not met	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	<i>Phyrdenus muriceus</i> host range and geographic distribution are much wider than those corresponding to the other species within the APW complex. This species is considered to be an emerging pest causing significant losses in organic eggplant, potato and tomato production in Argentina (Eliceche et al., 2020). These differences could be taken into account in a separate categorisation		

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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)
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017)
Measures	Control (of a pest) is defined in ISPM 5 (FAO 2017) as 'Suppression, containment or eradication of a pest population' (FAO, 1995). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance
Pathway	Any means that allows the entry or spread of a pest (FAO, 2017)
Phytosanitary measures	

	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017)
Protected zones (PZ)	A Protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017)
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2017)

Abbreviations

APW	Andean Potato Weevil complex
asl	above sea level
DG SANTÉ	Directorate General for Health and Food Safety
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Appendix A – Crop production data (Eurostat)

Potatoes (R1000) area (cultivation/harvested/production) (1,000 ha) Eurostat data accessed on 22/4/2020

Country/Year	2015	2016	2017	2018	2019
European Union – 28 countries (2013–2020)	1,656.13	1,689.38	1,746.18	1,702.53	1,772.04
Austria	20.37	21.22	22.99	23.76	23.97
Belgium	78.69	89.21	92.85	93.33	98.19
Bulgaria	11.02	8.38	12.81	14.10	10.00
Croatia	10.05	9.87	9.83	9.27	9.30
Cyprus	4.74	5.04	4.22	4.22	3.97
Czech Republic	22.68	23.41	23.42	22.89	22.89
Denmark	42.00	46.10	49.70	52.00	56.70
Estonia	3.80	3.71	3.45	3.27	3.40
Finland	21.90	21.70	21.20	21.40	21.40
France	167.26	179.00	194.06	199.56	197.00
Germany	236.70	242.50	250.50	252.20	271.60
Greece	20.75	19.13	18.82	16.83	16.84
Hungary	18.74	16.41	14.66	13.51	13.15
Ireland	8.52	9.04	9.18	8.23	8.67
Italy	50.42	48.14	48.57	46.43	46.81
Latvia	10.20	10.90	21.50	9.90	10.00
Lithuania	23.03	21.64	18.88	18.69	18.22
Luxembourg	0.57	0.62	0.62	0.63	0.60
Malta	0.69	0.77	0.69	0.69	0.69
Netherlands	155.66	155.59	160.79	164.60	165.73
Poland	292.50	300.70	321.26	290.97	310.00
Portugal	24.62	23.30	23.74	20.80	21.65
Romania	196.07	186.24	171.39	173.30	183.57
Slovakia	8.07	8.26	7.45	7.76	8.19
Slovenia	3.32	3.16	3.17	2.81	2.80
Spain	71.68	72.14	70.88	67.49	68.54
Sweden	23.11	24.21	24.57	23.91	23.65
United Kingdom	129.00	139.00	145.00	140.00	144.10

': data not available.

Tomatoes (V3100) area (cultivation/harvested/production) (1,000 ha) Eurostat data accessed on 22/4/2020

Country/Year	2015	2016	2017	2018	2019
European Union – 28 countries (2013–2020)	254.43	247.00	241.07	239.71	:
Austria	0.19	0.18	0.18	0.20	0.20
Belgium	0.51	0.51	0.52	0.55	0.57
Bulgaria	3.28	4.20	5.01	4.52	5.50
Croatia	0.42	0.37	0.45	0.49	0.42
Cyprus	0.27	0.22	0.26	0.26	0.27
Czech Republic	0.20	0.34	0.24	0.30	0.16
Denmark	0.03	0.03	0.03	0.03	0.03
Estonia	0.00	0.01	0.00	0.00	0.00
Finland	0.11	0.11	0.11	0.10	0.10
France	5.69	5.65	5.75	5.74	4.66
Germany	0.33	0.34	0.37	0.40	0.39

Country/Year	2015	2016	2017	2018	2019
Greece	15.25	14.01	13.32	16.02	16.02
Hungary	2.26	2.08	2.19	2.50	2.37
Ireland	0.01	0.01	0.01	0.01	0.01
Italy	107.18	96.78	92.67	97.17	:
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.49	0.57	0.55	0.57	0.56
Luxembourg	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	1.76	1.78	1.79	1.79	1.80
Poland	13.80	12.42	12.64	13.11	:
Portugal	18.66	20.85	20.87	15.83	16.13
Romania	24.84	22.71	22.21	22.97	22.98
Slovakia	0.57	0.68	0.60	0.59	0.48
Slovenia	0.19	0.21	0.20	0.19	0.22
Spain	58.13	62.72	60.85	56.13	56.94
Sweden	0.04	0.04	0.04	0.04	0.04
United Kingdom	0.23	0.20	0.20	0.18	0.17

': data not available.

Eggplants (V3410) area (cultivation/harvested/production) (1,000 ha) Eurostat data accessed on 22/4/2020

Country/Year	2015	2016	2017	2018	2019
European Union – 28 countries (2013–2020)	22.27	21.58	20.73	21.44	:
Austria	0.01	0.01	0.01	0.01	0.01
Belgium	0.02	0.02	0.02	0.02	0.02
Bulgaria	0.49	0.31	0.48	0.44	0.00
Croatia	0.00	0.00	0.00	0.00	0.00
Cyprus	0.03	0.04	0.03	0.03	0.03
Czech Republic	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
France	0.71	0.73	0.73	0.80	:
Germany	0.00	0.00	0.00	0.00	0.00
Greece	1.88	1.75	1.70	1.67	1.67
Hungary	0.09	0.05	0.05	0.05	0.04
Ireland	0.00	0.00	0.00	0.00	0.00
Italy	10.15	10.13	9.45	9.76	:
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.11	0.11	0.10	0.11	0.13
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	0.06	0.10	0.14	0.11	0.11
Romania	4.88	4.56	4.42	4.80	4.81
Slovakia	0.00	0.00	0.01	0.01	0.00
Slovenia	0.02	0.02	0.02	0.02	0.03
Spain	3.84	3.75	3.58	3.62	3.47

Country/Year	2015	2016	2017	2018	2019
Sweden	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	0.00	0.00	0.00

∅: data not available.

Appendix B – CN code and descriptions

CN code and descriptions (<https://www.findhs.codes/CNCodes/Chapter07/edible-vegetables-and-certain-roots-and-tubers>)

Imports of *Ullucus tuberosus* were classified as 0701 9090 90 and 0714 90 90 00).

0701	Potatoes, fresh or chilled:
0701 1000	- Seed
0701 90	- Other (fresh or chilled potatoes excl. seed)
0701 9010	- - Potatoes for manufacture of starch
0701 9050	- - Other
0701 9050 00	- - - Fresh or chilled new potatoes from 1 January to 30 June
0701 9090	- - - Other (potatoes, fresh or chilled (excl. new potatoes from 1 January to 30 June, seed potatoes and potatoes for manufacture of starch)
0701 9090 10	- - - - so-called 'New' from 1 July to 31 December
0701 9090 90	- - - - Other
0714	Manioc, arrowroot, salep, Jerusalem artichokes, sweet potatoes and similar roots and tubers with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets; sago pith:
0714 10 00	- Manioc (cassava)
0714 20	- Sweet potatoes:
0714 20 10	- - Fresh, whole, intended for human consumption
0714 20 90	- - Other
0714 30	- Yams (<i>Dioscorea</i> spp.)
0714 40	- Taro (<i>Colocasia</i> spp.)
0714 50	- Yautia (<i>Xanthosoma</i> spp.)
0714 90	- Other:
0714 90 20	- - Arrowroot, salep and similar roots and tubers with high starch content
0714 90 90	- - Other