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Pest categorisation of *Anisogramma anomala*

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Abstract

Following a request from the European Commission, the EFSA Plant Health (PLH) Panel performed a pest categorisation of *Anisogramma anomala*, a well-defined and distinguishable fungal species of the family Valsaceae. The pathogen is regulated in Annex IIAI of Council Directive 2000/29/EC as a harmful organism whose introduction into the EU is banned on plants of *Corylus* L., intended for planting, other than seeds, originating in Canada and the USA. The fungus is native to eastern North America and causes eastern filbert blight on cultivated hazel, *Corylus avellana*, as well as on wild hazel (*Corylus* spp.). In the 1960s, the disease spread on infected plant material to Oregon, where it then threatened US hazelnut production in the Willamette Valley. The pest could enter the EU via plants for planting. Hosts and favourable climatic conditions are common in the EU, thus facilitating establishment. The pest would be able to spread following establishment through infected plants for planting and ascospore dispersal. *A. anomala* leads to canopy and yield loss and can cause death of *Corylus* trees. Should the pathogen be introduced into the EU, impacts can be expected not just on hazel as a crop and as an ornamental but also in coppices and woodlands, where *Corylus* species provide an important habitat. In Oregon, scouting for cankers, therapeutic pruning and copious fungicide applications are reported to be necessary (but costly measures) to continue hazelnut production in the presence of the disease. Breeding for resistance led to the selection of resistant cultivars. The main knowledge gaps concern (i) the role of deadwood and cut branches as potential entry pathways and means of spread and (ii) the susceptibility of *C. avellana* cultivars and of *Corylus* spp. in the wild in the EU. The criteria assessed by the Panel for consideration as a potential quarantine pest are met. For regulated non-quarantine pests, the criterion on the pest presence in the EU is not met.

Keywords: *Corylus*, eastern filbert blight, forest pathology, hazelnut, pest risk, plant pest, tree health

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1. Introduction

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

1.1.1. Background

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

Following the evaluation of the plant health regime, the new basic plant health law, Regulation (EU) 2016/2031[2] on protective measures against pests of plants, was adopted on 26 October 2016 and will apply from 14 December 2019 onwards, repealing Directive 2000/29/EC. In line with the principles of the above mentioned legislation and the follow-up work of the secondary legislation for the listing of EU regulated pests, EFSA is requested to provide pest 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 178/2002[3], to provide scientific opinion in the field of plant health.

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

The list of the harmful organisms included in the annex to this mandate comprises 133 harmful organisms or groups. A pest categorisation is expected for these 133 pests or groups and the delivery of the work would be stepwise at regular intervals through the year as detailed below. First priority covers the harmful organisms included in Appendix 1, comprising pests from Annex II Part A Section I and Annex II Part B of Directive 2000/29/EC. The delivery deadline 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 deadline 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 criterion 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.

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

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

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

1.1.2.1. Terms of Reference: Appendix 1

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

Annex IIAI

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

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

(b) Bacteria

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

(c) Fungi

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

(d) Virus and virus-like organisms

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

Annex IIB

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

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

(b) Bacteria

Curtobacterium flaccumfaciens pv. flaccumfaciens (Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton

Gremmeniella abietina (Lag.) Morelet

Hypoxylon mammatum (Wahl.) J. Miller

1.1.2.2. Terms of Reference: Appendix 2

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

Annex IAI

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

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

1) *Carneocephala fulgida* Nottingham
2) *Draeculacephala minerva* Ball
3) *Graphocephala atropunctata* (Signoret)

Group of Tephritidae (non-EU) such as:

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

(c) Viruses and virus-like organisms

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

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

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

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

Annex IIAI

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

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

1) *Margarodes vitis* (Phillipi)

2) *Margarodes vredendalensis* de Klerk

3) *Margarodes prieskaensis* Jakubski

1.1.2.3. Terms of Reference: Appendix 3

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

Annex IAI

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

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

(b) Fungi

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

(c) Viruses and virus-like organisms

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

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex IAII

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

Meloidogyne fallax Karssen
Popillia japonica Newman
Rhizoecus hibisci Kawai and Takagi

(b) Bacteria

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

(c) Fungi

Melampsora medusae Thümen
Synchytrium endobioticum (Schilbersky) Percival

Annex I B

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

Leptinotarsa decemlineata Say
Liriomyza bryoniae (Kaltenbac

(b) Viruses and virus-like organisms

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Anisogramma anomala is one of a number of pests listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a quarantine pest or those of a regulated non-quarantine pest for the area of the European Union (EU).

2. Data and methodologies

2.1. Data

2.1.1. Literature search

A literature search on *A. anomala* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as the search term. Relevant papers were reviewed, and further references and information were obtained from experts, from citations within the references and grey literature.

2.1.2. Database search

Pest information, on host(s) and distribution, was retrieved from the EPPO Global Database (EPPO, 2017) (https://gd.eppo.int).

Data about the area of hosts grown in the EU were obtained from EUROSTAT (http://ec.europa.eu/eurostat/web/agriculture/data/database).

Information on EU Member State (MS) imports of *Corylus* plants for planting from North America was sought in the ISEFOR database (Eschen et al., 2017).

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 *A. anomala*, 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 started following an evaluation of the EU's 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 as per 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 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 which 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, while addressing social impacts is outside the remit of the Panel, in agreement with the 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

Anisogramma anomala (Peck) E. Müll. is a fungus of the family Valsaceae (Mycobank: http://www.mycobank.org; Bush, 2015) order Diaporthales.

The fungus has the following synonyms: *Apioporthe anomala*, *Cryptospora anomala*, *Cryptosporella anomala* and *Diatrype anomala* (Index Fungorum: http://www.indexfungorum.org/names/names.asp).

3.1.2. Biology of the pest

A. anomala is an obligate biotrophic fungus causing eastern filbert blight on cultivated common hazel, *Corylus avellana,* where 'filbert' is the commonly used term for commercial *C. avellana* in North America (EPPO, 2009). The fungus is a native and non-consequential pathogen on *Corylus americana* (American hazelnut), an understory tree in northeastern North America (Bush, 2015).

The fungus produces infectious ascospores in perithecia, which mature by late summer in ascostromata on diseased host branches (Gottwald and Cameron, 1979). Spore maturation begins in late summer, but the proportion of spores germinating increases through autumn (Pinkerton et al., 1998a). Ascospores are released when stromata are wet from rain but not from dew (Pinkerton et al., 1998b) and dispersal is triggered by precipitation (EPPO, 1997; Pinkerton et al., 1998a), with dissemination over long distances on air currents having been reported (Pinkerton et al., 1998a).

Although ascospore release can begin in late autumn (Pinkerton et al., 1998b), the major host, *C. avellana,* is not susceptible to infection until vegetative buds and shoots resume growth in the spring (Pinkerton et al., 1998a). It has been reported that eriophyid mites might facilitate infection of vegetative buds (Johnson et al., 1994). Infection occurs by means of ascospores infecting young vegetative tissue in the spring (Gottwald and Cameron, 1980b), after budburst, through leaf emergence and shoot elongation (Stone et al., 1992; Johnson et al., 1994). Once established, the fungus colonises the cambium layer resulting in the development of a canker (Gottwald and Cameron, 1980b). However, some 12–16 months are normal before symptoms appear in the disease cycle of *A. anomala* (Gottwald and Cameron, 1980b) and sometimes longer (up to 26–28 months) (Mehlenbacher et al., 1994). Death of the cambium in the area of the canker results in a sunken appearance as the surrounding cambium continues to grow (Gottwald and Cameron, 1980b).

Cankers expand at an average rate of 30 cm per year (Gottwald and Cameron, 1980a). Cankers girdle branches, causing dieback of tree canopies and death of mature trees in 5–15 years, while younger trees may be killed within 4–7 years (EPPO, 1997). New susceptible shoots may continue to develop from the root system.

3.1.3. Intraspecific diversity

Studies on the genetic diversity of *A. anomala* based on Single Sequence Repeats (SSR) markers revealed (i) distinct genetic differences between populations of genotypes collected from different regions and (ii) that tested isolates were more genetically diverse than initially hypothesised based on prior internal transcribed spacer region sequence studies (Muehlbauer et al., 2014). A preliminary study on 11 polymorphic SSR loci in 30 *A. anomala* genotypes revealed that genotypes grouped into two clades: one including genotypes from New Jersey and the other genotypes originating from areas surrounding the Great Lakes (Cai et al., 2013). Genotypes from Oregon clustered in this last clade (Cai et al., 2013).

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes

A full description of *A. anomala* useful for diagnostic purposes is available (Gottwald and Cameron, 1979; EPPO, 2009). *A. anomala* can be grown in culture only with difficulty (Stone et al., 1994). A real-time polymerase chain reaction (PCR) assay for the early detection of the pathogen in asymptomatic host tissues was developed by Molnar et al. (2013).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

A. anomala is native to a wide area east of the Rocky Mountains, where it occurs on the wild American hazelnut, *C. americana* (Molnar et al., 2013). The fungus is currently reported from both Canada and USA, including areas in the Pacific Northwest (Figure 1).

In Canada, the fungus is present in British Columbia, Manitoba, Nova Scotia, Ontario and Quebec.

In the USA, reports are from Connecticut, Delaware, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Washington and Wisconsin (EPPO, 2017).

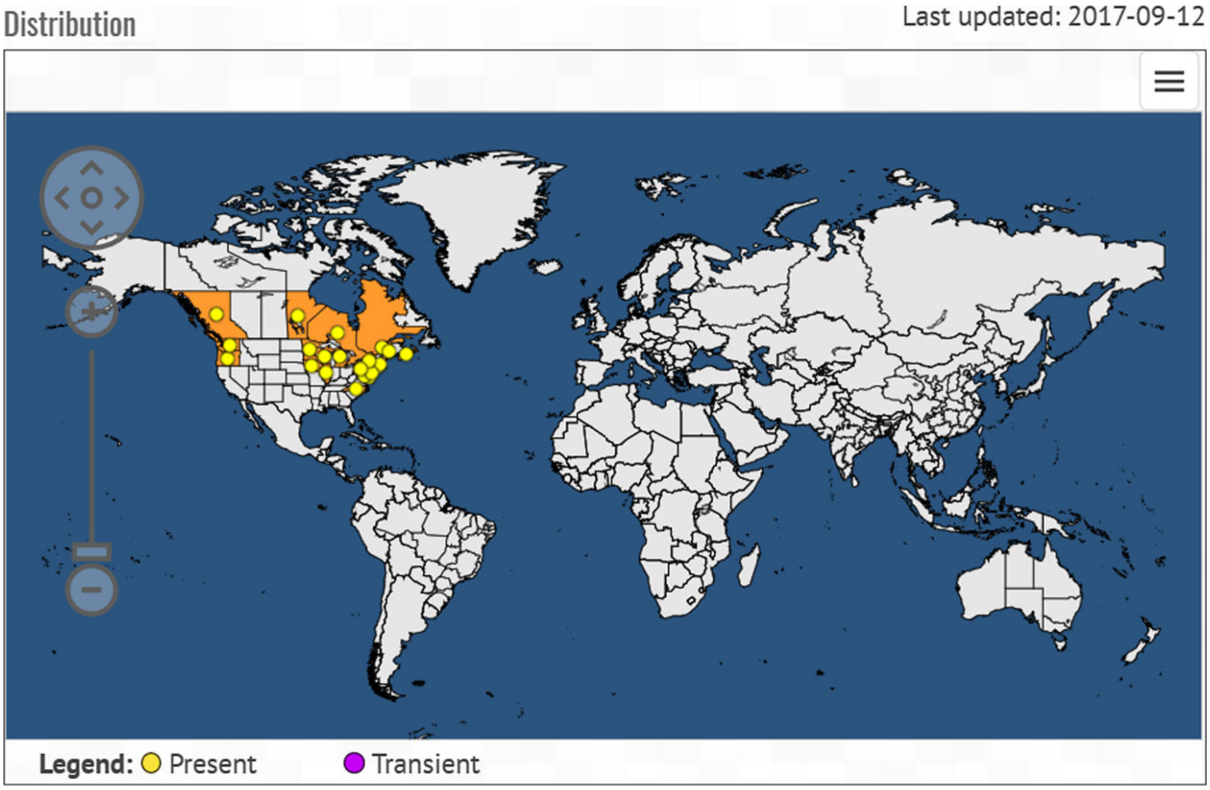

Figure 1: Global distribution map for *Anisogramma anomala* (extracted EPPO, 2017, accessed November 2017). There are no reports of transient populations

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 pest is not reported to be present in the EU.

Slovenia reported the pest as absent in 2017 (EPPO, 2017).

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

A. anomala is listed in Council Directive 2000/29/EC. Details are presented in Tables 2 and 3.

Table 2: *Anisogramma anomala* in Council Directive 2000/29/EC

Annex II, Part A	**Harmful organisms whose introduction into, and spread within, all member states shall be banned if they are present on certain plants or plant products**	
Section I	**Harmful organisms not known to occur in the community and relevant for the entire community**	
(c)	Fungi	
	Species	Subject of contamination
1.1	*Anisogramma anomala* (Peck) E. Müller	Plants of *Corylus* L., intended for planting, other than seeds, originating in Canada and the USA

3.3.2. Legislation addressing the hosts of *A. anomala*

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

Annex IV, Part A	**Special requirements which must be laid down by all Member States for the introduction and movement of plants, plant products and other objects into and within all Member States**	
Section I	**Plants, plant products and other objects originating outside the community**	
	Plants, plant products and other objects	Special requirements
11.3	Plants of *Corylus* L., intended for planting, other than seeds, originating in Canada and the United States of America	Official statement that the plants have been grown in nurseries and: (a) originate in an area, established in the country of export by the national plant protection service in that country, as being free from *Anisogramma anomala* (Peck) E. Müller, in accordance with relevant International Standards for Phytosanitary Measures, and which is mentioned on the certificates referred to in Articles 7 or 8 of this Directive under the rubric 'Additional declaration', or (b) originate in a place of production, established in the country of export by the national plant protection service in that country, as being free from *Anisogramma anomala* (Peck) E. Müller on official inspections carried out at the place of production or its immediate vicinity since the beginning of the last three complete cycles of vegetation, in accordance with relevant International Standards for Phytosanitary Measures, and which is mentioned on the certificates referred to in Articles 7 or 8 of this Directive under the rubric 'Additional declaration' and declared free from *Anisogramma anomala* (Peck) E. Müller

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

The fungus has been reported to be causing symptoms on various species of the genus *Corylus*. While *A. anomala* is indigenous on the common understorey shrub *C. americana* (EPPO, 1997), its major host is the cultivated hazel *C. avellana* (EPPO, 1997), which is native to Europe and adjacent areas in Asia (Martins et al., 2015). *C. maxima*, a species of hazel native to southeastern Europe and southwestern Asia, is also reported as a wild host (EPPO, 2017).

As the pathogen is regulated on plants of the genus *Corylus* (see Section 3.3), the hosts for which the pest is regulated are comprehensive of the host range. Wood and cut branches of *Corylus* spp. are not regulated but might provide a pathway of entry (see Entry Section 3.4.2).

3.4.2. Entry

Is the pest able to enter into the EU territory?

Yes, the pest could enter the EU through the movement of infected planting material

The introduction of the pathogen in western Washington (Davidson and Davidson, 1973) is thought to have occurred through the importation of infected *C. avellana* nursery stock or of wild *C. americana* seedlings from the Eastern regions of the USA (EPPO, 1997).

Therefore, the pathogen could enter the EU through the movement of:

- plants for planting.

In the ISEFOR database of plants for planting, there are some records of shipments of *Corylus* spp. plants for planting imported by the EU from the USA.

As of November 2017, there were no records of interception of *A. anomala* in the Europhyt database.

- Other pathways

Infected living wood of *Corylus* spp. can be a source of inoculum (in Oregon, infected wood in the affected area near Portland is burnt to prevent this from happening; Mehlenbacher et al., 1994). *A. anomala* is a biotrophic parasite and needs a living host to grow, but not necessarily to release ascospores (Heckert et al., 2014). The role of infected deadwood and cut branches as a potential pathway of entry is thus unclear. Information is lacking on EU import from North America of *Corylus* spp. cut branches for ornamental purposes (e.g. of the variety 'Contorta').

There is no evidence that the disease is a nut-borne disease, either in the kernel or as a surface contaminant (Mehlenbacher et al., 1994).

3.4.3. Establishment

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

Yes, the pest could establish in the EU, as hosts and favourable climatic conditions are widespread.

3.4.3.1. EU distribution of main host plants

The major host *C. avellana* is native to Europe and is widely distributed in the EU either as an understorey species in mixed deciduous forests or as a cultivated species, although its presence is mostly marginal (Figure 2).

According to EUROSTAT, about 94,000–96,000 ha of hazel were cultivated in the EU between 2012 and 2015. About 71–73% of this hazelnut crop area was located in Italy (between about 66,800 and 69,100 ha), and about 14–15% of it was located in Spain (between about 13,300 and 13,900 ha). Other EU MSs reporting significant (> 1,000 ha) hazelnut cultivation for the same period are Croatia, France and Poland, whereas Bulgaria, Greece, Hungary, Portugal, Romania and Slovenia reported cultivation areas smaller than 1,000 ha. Italy produces about 17% of the hazelnut crop worldwide (Molnar et al., 2010).

C. avellana is absent only in Iceland, in some Mediterranean islands (Cyprus, Malta and Balearics) and in the northernmost and southernmost areas of the continent (reviewed in: Enescu et al., 2016).

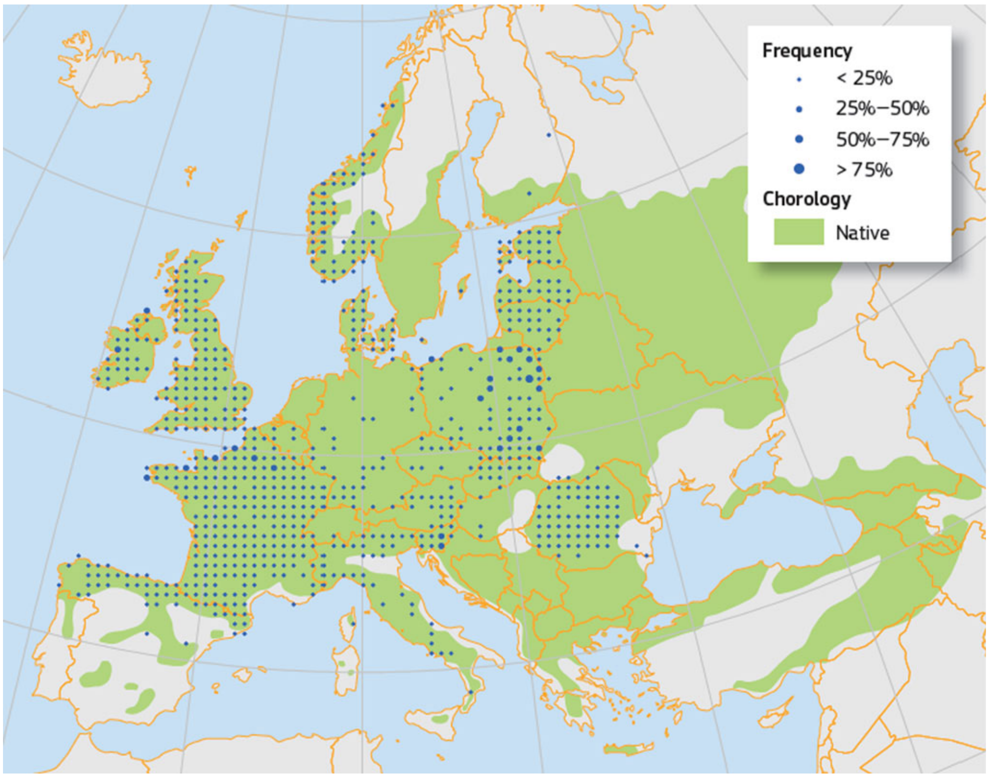

Figure 2: Plot distribution and simplified chorology map for *Corylus avellana*. Frequency of *C. avellana* occurrences within the field observations as reported by the National Forest Inventories. The chorology of the native spatial range for *C. avellana* is derived from several sources (cited in Enescu et al., 2016)

3.4.3.2. Climatic conditions affecting establishment

The distribution of *A. anomala* in North America (Figure 1; Section 3.2.1) covers areas with cold and temperate Köppen–Geiger climate types (Peel et al., 2007). These climate types overlap to a large extent with the distributions of *C. avellana* in Europe. Therefore, the Panel assumes climate will not be a limiting factor for the establishment of the pathogen in most of the EU.

3.4.4. Spread

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

Yes, by human movement of infected plants for planting and by dissemination of ascospores.

Although dissemination of ascospores over long distances on air currents has been reported (Pinkerton et al., 1998a), spread usually occurs locally (Gottwald and Cameron, 1980a) by means of spores released through precipitation (EPPO, 1997; Pinkerton et al., 1998a). In Oregon, the annual rate of disease spread has been reported as 2–3 km per year (Johnson et al., 1996), assumed to be through ascospore dispersal.

Despite quarantine laws established in the early 1900s to prevent the introduction of the pathogen into the western United States (Molnar et al., 2010; Bush, 2015), movement of infected plants from New England (USA) is thought to have been responsible for the introduction of *A. anomala* in the Pacific northwest (EPPO, 1997) and to have contributed to the current population structure of the fungus in North America (Cai et al., 2013; Muehlbauer et al., 2014).

Infected trees of *Corylus* spp. can be a source of inoculum (ascospores are produced in stromata associated with cankers on living wood; Johnson et al., 1994), but there is evidence that also cankered deadwood, prunings and cut branches can produce ascospores and thus be a potential means of spread (Heckert et al., 2014).

As noted in the Entry Section 3.4.2, there is no evidence that the disease is nut-borne (Mehlenbacher et al., 1994), and therefore, movement of nuts would not contribute to spread.

3.5. Impacts

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

Yes, the pest introduction could have an impact, where the host is cultivated and in the wild.

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 introduction of the pest could have an impact on the intended use of plants for planting.

A. anomala is responsible for canopy and yield loss (Figure 3) and can cause death of mature trees in 5–15 years with younger trees being killed within 4–7 years. As the canopy dies back, new shoots and suckers may emerge from the tree base and these in turn become infected and die.

A. anomala is considered to be the major limiting factor of hazelnut production in the eastern United States (Thompson et al., 1996). In fact, when *C. avellana* was introduced to North America and cultivation was attempted at the beginning of the 20th century, eastern filbert blight was identified and found to be so destructive that cultivation of European hazelnut was abandoned (Bush, 2015).

The pathogen was discovered in a commercial orchard in southwest Washington in the late 1960s (Davidson and Davidson, 1973). Most orchards within a 10-km radius of the putative introduction site of the disease are reported to have been destroyed (EPPO, 1997). Since then, the disease has spread southward throughout the Willamette Valley of Oregon where it threatens the long-term viability of the US hazelnut industry (Mehlenbacher et al., 1994; Mehlenbacher, 2005).

Should the pathogen be introduced into the EU, similar impacts can be expected not just on hazelnut as a nut crop (see Section 3.4.3.1 on the cultivated areas in the EU) but also in coppices and woodlands. However, wild hazel might be more resilient than cultivated hazel due to its higher genetic diversity, lower host density and variety of habitat conditions. *C. avellana* is commonly found in understorey of mixed-hardwood stands, along forest edges and in meadows and provides an important habitat and food resource for many organisms. *Corylus* plants are also a valued ornamental shrub often planted in gardens and parks (Enescu et al., 2016).

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

Figure 3: Symptoms of *Anisogramma anomala* on ornamental *Corylus avellana*. Picture of Tom Creswell, Purdue University, Bugwood.org, available online at https://www.forestryimages.org/browse/detail.cfm?imgnum=5505565

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, please see Section 3.6.1.

3.6.1. Phytosanitary measures

Phytosanitary measures are currently applied to plants for planting of *Corylus* spp. other than seeds (see Section 3.3.2). However, wood and cut branches of *Corylus* spp. are not regulated, but might provide a pathway of entry (see Section 3.4.2). The following phytosanitary measures are available for them: import banning of the commodity, chemical and heat treatment.

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

- A 12–16 month latent period is deemed normal in the disease cycle of *A. anomala* (Gottwald and Cameron, 1980b)
- Use of fungicides in nurseries may mask symptom development
- Long-distance spread of the disease due to human movement of infected planting material will make local attempts to limit spread of the disease ineffective
- In Oregon, eradication was attempted but without success as wild *Corylus* plants in nearby woodland provided an unmanageable source of inoculum (EPPO, 1997).

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

- The length of the latent period makes sanitation measures, including destruction of infested wood, of little importance (EPPO, 1997)

3.6.2. Control methods

- In Oregon, scouting for cankers, therapeutic pruning and copious fungicide applications are reported to be necessary (but costly measures) to continue hazelnut production in the presence of the disease (Johnson et al., 1996).
- Breeding for resistance led to the selection and release of resistant cultivars producing nuts of commercial quality (Mehlenbacher et al., 2007, 2009, 2011; Capik et al., 2013).

3.7. Uncertainty

There is a lack of knowledge on the level of susceptibility of European *Corylus* species other than *C. avellana*, including *C. maxima*, for which there is uncertainty on the distribution in the EU.

Similarly, there is uncertainty about the susceptibility of *C. avellana* cultivars and of *Corylus* spp. in the wild in the EU, although European *Corylus* spp. germplasm has been used for resistance breeding programmes in the US (Capik et al., 2013).

Whether infected deadwood and cut branches could play a role in entry or spread is unknown.

4. Conclusions

A. anomala meets the criteria assessed by EFSA for consideration as a potential quarantine pest (Table 4).

Table 4: 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 as a species is clear	The identity of the pest as a species is clear	None
Absence/ presence of the pest in the EU territory (Section 3.2)	The pest is not reported to be present in the EU	The pest is not reported to be present in the EU	There are no records from EU MSs available to the Panel of the absence of the pathogen other than Slovenia in 2017
Regulatory status (Section 3.3)	*A. anomala* is regulated by Council Directive 2000/29/EC (Annex IIAI) on plants of *Corylus* L., intended for planting, other than seeds, originating in Canada and the USA	*A. anomala* is regulated by Council Directive 2000/29/EC (Annex IIAI) on plants of *Corylus* L., intended for planting, other than seeds, originating in Canada and the USA	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)	Entry: the pest could enter the EU via plants for planting Establishment: hosts and favourable climatic conditions are widespread in the risk assessment (RA) area Spread: the pest would be able to spread following establishment by movement of ascospores and infected plants for planting	Entry: the pest could enter the EU via plants for planting Establishment: hosts and favourable climatic conditions are widespread in the RA area Spread: the pest would be able to spread following establishment by movement of ascospores and infected plants for planting	The role of infected deadwood and cut branches as a potential pathway of entry and means of spread is unclear
Potential for consequences in the EU territory (Section 3.5)	The pest introduction would have impacts on both cultivated and wild *Corylus* spp.	The pest introduction would have an impact on the intended use of *Corylus* spp. plants for planting	There is uncertainty about the susceptibility of *C. avellana* cultivars and of *Corylus spp.* in the wild in the EU
Available measures (Section 3.6)	Scouting for cankers, therapeutic pruning and copious fungicide applications are reported to be necessary (but costly measures) to continue hazelnut production in the presence of the disease Breeding for resistant cultivars has been shown to be successful in limiting the impacts of the disease	Breeding for resistant cultivars has been shown to be successful in limiting the impacts of the disease on the intended use of plants for planting	The transferability of these measures from North America to the EU is uncertain
Conclusion on pest categorisation (Section 4)	The criteria assessed by the Panel for consideration as a potential quarantine pest are met	The criterion on the pest presence in the EU is not met	
Aspects of assessment to focus on/ scenarios to address in future if appropriate	The main knowledge gaps concern: (i) the role of deadwood and cut branches as potential pathways and (ii) the level of susceptibility of the *C. avellana* cultivars and of *Corylus* spp. in the wild in the EU		

References

Bush E, 2015. *Anisogramma anomala* (eastern filbert blight). BugwoodWiki, Center for Invasive Species and Ecosystem Health at the University of Georgia, USA. Available online: https://wiki.bugwood.org/Anisogramma_anomala_(eastern_filbert_blight)

Cai G, Leadbetter CW, Muehlbauer MF, Molnar TJ and Hillman BI, 2013. Genome-wide microsatellite identification in the fungus *Anisogramma anomala* using Illumina sequencing and genome assembly. PLoS ONE, 8, e82408.

Capik JM, Muehlbauer M, Novy A, Honig JA and Molnar TJ, 2013. Eastern filbert blight-resistant Hazelnuts from Russia, Ukraine, and Poland. HortScience, 48, 466–473.

Davidson AD and Davidson RM, 1973. *Apioporthe* and *Monochaetia* cankers reported in Western Washington. Plant Disease Reporter, 57, 522–523.

EFSA PLH Panel (EFSA Panel on Plant Health), 2010. PLH Guidance on a harmonised framework for pest risk assessment and the identification and evaluation of pest risk management options by EFSA. EFSA Journal 2010;8(2):1495, 66 pp. https://doi.org/10.2903/j.efsa.2010.1495

Enescu CM, Houston Durrant T, de Rigo D and Caudullo G, 2016. *Corylus avellana* in Europe: distribution, habitat, usage and threats. In: San-Miguel-Ayanz J, de Rigo D, Caudullo G, Houston Durrant T and Mauri A (eds.), European Atlas of Forest Tree Species. Publ. Off. EU, Luxembourg. pp. e015486+.

EPPO (European and Mediterranean Plant Protection Organization), 1997. Data sheets on quarantine pests: *Anisogramma anomala*. In: Smith IM, McNamara DG, Scott PR and Holderness M (eds.), *Quarantine Pests for Europe*, 2nd Edition. CABI/EPPO, Wallingford. 1425 pp.

EPPO (European and Mediterranean Plant Protection Organization), 2009. PM 7/90(1): *Anisogramma anomala*. EPPO Bulletin, 39, 293–297.

EPPO (European and Mediterranean Plant Protection Organization), 2017. EPPO Global Database (available online). Available online: https://gd.eppo.int

Eschen R, Douma JC, Grégoire JC, Mayer F, Rigaux L and Potting RP, 2017. A risk categorisation and analysis of the geographic and temporal dynamics of the European import of plants for planting. Biological Invasions, 19, 3243–3257. https://doi.org/10.1007/s10530-017-1465-6

FAO (Food and Agriculture Organization of the United Nations), 2004. ISPM (International Standards for Phytosanitary Measures) 21—Pest risk analysis of regulated non-quarantine pests. FAO, Rome, 30 pp. Available online: https://www.ippc.int/sites/default/files/documents//1323945746_ISPM_21_2004_En_2011-11-29_Refor.pdf

FAO (Food and Agriculture Organization of the United Nations), 2013. ISPM (International Standards for Phytosanitary Measures) 11—Pest risk analysis for quarantine pests. FAO, Rome, 36 pp. Available online: https://www.ippc.int/sites/default/files/documents/20140512/ispm_11_2013_en_2014-04-30_201405121523-494.65%20KB.pdf

Gottwald TR and Cameron HR, 1979. Studies in the morphology and life history of *Anisogramma anomala*. Mycologia, 71, 1107–1126.

Gottwald TR and Cameron HR, 1980a. Disease increase and the dynamics of spread of canker caused by *Anisogramma anomala* in European filbert in the Pacific Northwest. Phytopathology, 70, 1087–1092.

Gottwald TR and Cameron HR, 1980b. Infection site, infection period and latent period of canker caused by *Anisogramma anomala* in European filbert. Phytopathology, 70, 1083–1087.

Heckert S, Pscheidt JW and Cluskey SA, 2014. Disease incidence and ascospore dispersal from cut hazelnut branches colonized by *Anisogramma anomala*. Plant Disease, 98, 834–838.

Johnson KB, Pinkerton JN, Gaudreault SM and Stone JK, 1994. Infection of European hazelnut by *Anisogramma anomala*: site of infection and effect on host developmental stage. Phytopathology, 4, 1465–1470.

Johnson KB, Mehlenbacher SA, Stone JK and Pscheidt JW, 1996. Eastern filbert blight of European hazelnut: it's becoming a manageable disease. Plant Disease, 80, 1308–1316.

Martins S, Simões F, Mendonça D, Matos J, Silva AP and Carnide V, 2015. Western European wild and landraces hazelnuts evaluated by SSR markers. Plant Molecular Biology Reporter, 33, 1712–1720.

Mehlenbacher SA, 2005. The hazelnut situation in Oregon. Acta Horticulturae, 686, 665–668.

Mehlenbacher SA, Pinkerton JN, Johnson KB and Pacheidt JW, 1994. Eastern filbert blight in Oregon. Acta Horticulturae, 351, 551–558.

Mehlenbacher SA, Azarenko AN, Smith DC and McCluskey R, 2007. 'Santiam' hazelnut. HortScience, 42, 715–717.

Mehlenbacher SA, Smith DC and McCluskey RL, 2009. 'Yamhill' hazelnut. HortScience, 44, 845–847.

Mehlenbacher SA, Smith DC and McCluskey RL, 2011. 'Jefferson' hazelnut. HortScience, 46, 662–664.

Molnar TJ, Goffreda JC and Funk CR, 2010. Survey of *Corylus* resistance to *Anisogramma anomala* from different geographic locations. HortScience, 45, 832–836.

Molnar TJ, Walsh E, Capik JM, Sathuvalli V, Mehlenbacher SA, Rossman AY and Zhang N, 2013. A real-time PCR assay for early detection of eastern filbert blight. Plant Disease, 97, 813–818.

Muehlbauer M, Molnar TJ, Honig J, Morey K and Zhang N, 2014. Genetic diversity of *Anisogramma anomala* and its implications for breeding Eastern Filbert Blight resistant hazelnuts. American Society of Horticultural Science Conference, Orlando (FL), July 27 - August 01, 2014. Abstract. Available online: https://ashs.confex.com/ashs/2014/webprogram/Paper19149.html

Peel MC, Finlayson BL and McMahon TA, 2007. Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences Discussions, 4, 439–473.

Pinkerton JN, Johnson KB, Stone JK and Ivors KL, 1998a. Factors affecting the release of ascospores of *Anisogramma anomala*. Phytopathology, 88, 122–128.

Pinkerton JN, Johnson KB, Stone JK and Ivors KL, 1998b. Maturation and seasonal discharge pattern of ascospores of *Anisogramma anomala*. Phytopathology, 88, 1165–1173.

Stone JK, Johnson KB, Pinkerton JN and Pscheidt JW, 1992. Natural infection period and susceptibility of vegetative seedlings of European hazelnut to *Anisogramma anomala*. Plant Disease, 76, 348–352.

Stone JK, Pinkerton JN and Johnson KB, 1994. Axenic culture of *Anisogramma anomala*: evidence for self-inhibition of ascospore germination and colony growth. Mycologia, 86, 674–683.

Thompson MM, Lagerstedt HB and Mehlenbacher SA, 1996. Hazelnuts. In: Janick J and Moore JN (eds.), *Fruit Breeding*. Vol 3. nuts, Wiley, New York, NY. pp. 125–184.

Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
MS	Member State
PCR	polymerase chain reaction
PLH	EFSA Panel on Plant Health
RA	risk assessment
RNQP	Regulated Non-Quarantine Pest
SSR	Single Sequence Repeats
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference