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Pest categorisation of *Lasiodiplodia pseudotheobromae*

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Abstract

The EFSA Plant Health Panel performed a pest categorisation of *Lasiodiplodia pseudotheobromae,* a clearly defined fungus of the family Botryosphaeriaceae, which was first described in 2008 as a cryptic species within the *L. theobromae* complex. The pathogen affects a wide range of woody perennial crops and ornamental plants causing root rot, damping-off, leaf spots, twig blight, cankers, stem-end rot, gummosis, branch dieback and pre- and post-harvest fruit rots. *Lasiodiplodia pseudotheobromae* is present in Africa, Asia, North and South America and Oceania and has also been reported from Spain with a restricted distribution. However, there is uncertainty on the status of the pathogen worldwide and in the EU because in the past, when molecular tools (particularly multigene phylogenetic analysis) were not available, the pathogen might have been misidentified as *L. theobromae*. *Lasiodiplodia pseudotheobromae* is not included in Commission Implementing Regulation (EU) 2019/2072 and there are no interceptions in the EU. Because of the very wide host range of the pathogen, this pest categorisation focused on those hosts for which there is robust evidence that the pathogen was formally identified by a combination of morphology, pathogenicity and multilocus sequence analysis. Plants for planting, including seeds, fresh fruits and bark and wood of host plants as well as soil and other plant-growing media are the main pathways for the further entry of the pathogen into the EU. Host availability and climate suitability factors occurring in parts of the EU are favourable for the further establishment of the pathogen. In the area of its present distribution, including Spain, the pathogen has a direct impact on cultivated hosts. multilocus measures are available to prevent the further introduction and spread of the pathogen into the EU. *Lasiodiplodia pseudotheobromae* satisfies the criteria that are within the remit of EFSA to assess for this species to be regarded as potential Union quarantine pest.

Keywords: Botryosphaeriaceae, *Lasiodiplodia theobromae*, pest risk, plant health, plant pest, quarantine

Requestor: European Commission

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1. Introduction

1.1. Background and terms of reference as provided by the requestor

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031, on the protective measures against pests of plants, is applying from 14 December 2019. Conditions are laid down in this legislation in order for pests to qualify for listing as Union quarantine pests, protected zone quarantine pests or Union regulated non-quarantine pests. The lists of the EU regulated pests together with the associated import or internal movement requirements of commodities are included in Commission Implementing Regulation (EU) 2019/2072. Additionally, as stipulated in the Commission Implementing Regulation 2018/2019, certain commodities are provisionally prohibited to enter in the EU (high risk plants, HRP). EFSA is performing the risk assessment of the dossiers submitted by exporting to the EU countries of the HRP commodities, as stipulated in Commission Implementing Regulation 2018/2018. Furthermore, EFSA has evaluated a number of requests from exporting to the EU countries for derogations from specific EU import requirements.

In line with the principles of the new plant health law, the European Commission with the Member States are discussing monthly the reports of the interceptions and the outbreaks of pests notified by the Member States. Notifications of an imminent danger from pests that may fulfil the conditions for inclusion in the list of the Union quarantine pest are included. Furthermore, EFSA has been performing horizon scanning of media and literature.

As a follow-up of the above-mentioned activities (reporting of interceptions and outbreaks, HRP, derogation requests and horizon scanning), a number of pests of concern have been identified. EFSA is requested to provide scientific opinions for these pests, in view of their potential inclusion by the risk manager in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary by the risk manager.

1.1.2. Terms of reference

EFSA is requested, pursuant to Article 29(1) of Regulation (EC) No 178/2002, to provide scientific opinions in the field of plant health.

EFSA is requested to deliver 53 pest categorisations for the pests listed in Annex 1A, 1B, 1D and 1 E (for more details see mandate M-2021-00027 on the Open.EFSA portal). Additionally, EFSA is requested to perform pest categorisations for the pests so far not regulated in the EU, identified as pests potentially associated with a commodity in the commodity risk assessments of the HRP dossiers (Annex 1C; for more details see mandate M-2021-00027 on the Open.EFSA portal). Such pest categorisations are needed in the case where there are not available risk assessments for the EU.

When the pests of Annex 1A are qualifying as potential Union quarantine pests, EFSA should proceed to phase 2 risk assessment. The opinions should address entry pathways, spread, establishment, impact and include a risk reduction options analysis.

Additionally, EFSA is requested to develop further the quantitative methodology currently followed for risk assessment, in order to have the possibility to deliver an express risk assessment methodology. Such methodological development should take into account the EFSA Plant Health Panel Guidance on quantitative pest risk assessment and the experience obtained during its implementation for the Union candidate priority pests and for the likelihood of pest freedom at entry for the commodity risk assessment of High Risk Plants.

1.2. Interpretation of the terms of reference

Lasiodiplodia pseudotheobromae is one of a number of pests listed in Annex 1C to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a potential Union quarantine pest for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores, and so inform EU decision-making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/2072. If a pest fulfils the criteria to be potentially listed as a Union quarantine pest, risk reduction options will be identified.

1.3. Additional information

The pest categorisation was initiated following the commodity risk assessments of *Persea americana* from Israel (EFSA PLH Panel, 2021a) and of *Juglans regia* from Türkiye (EFSA PLH Panel, 2021b).

2. Data and methodologies

2.1. Data

2.1.1. Information on pest status from NPPOs

In the context of the current mandate, EFSA is preparing pest categorisations for new/emerging pests that are not yet regulated in the EU. When official pest status is not available in the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online), EFSA consults the NPPOs of the relevant MSs. To obtain information on the official pest status for *L. pseudotheobromae*, EFSA has consulted the NPPOs of the Netherlands and Spain. The results of this consultation are presented in Section 3.2.2.

2.1.2. Literature search

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

2.1.3. Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online), the CABI databases and scientific literature databases as referred above in Section 2.1.1.

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 and TRACES databases were 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 as a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020.

GenBank was searched to determine whether it contained any nucleotide sequences *for Lasiodiplodia pseudotheobromae* which could be used as reference material for molecular diagnosis. GenBank® (www.ncbi.nlm.nih.gov/genbank/) is a comprehensive publicly available database that as of August 2019 (release version 227) contained over 6.25 trillion base pairs from over 1.6 billion nucleotide sequences for 450,000 formally described species (Sayers et al., 2020).

2.2. Methodologies

The Panel performed the pest categorisation for *Lasiodiplodia pseudotheobromae*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018), the EFSA guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2013).

The criteria to be considered when categorising a pest as a potential Union quarantine pest (QP) is given in Regulation (EU) 2016/2031 Article 3 and Annex I, Section 1 of the Regulation. Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. In judging whether a criterion is met the Panel uses its best professional judgement (EFSA Scientific Committee, 2017) by integrating a range of evidence from a variety of sources (as presented above in Section 2.1) to reach an informed conclusion as to whether or not a criterion is satisfied.

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, deemed to be a risk management decision, the Panel will present a summary of the observed impacts in the areas where the pest occurs, and make a judgement about potential likely impacts in the EU. Whilst the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Article 3 (d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as derived from 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 (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest clearly defined, 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 in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.
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 for entry and spread.
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Section 3.6)	Are there measures available to prevent pest entry, establishment, spread or impacts
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.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

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

Yes, the identity of *Lasiodiplodia pseudotheobromae* is clearly defined.

Lasiodiplodia pseudotheobromae A.J.L. Phillips, A. Alves & Crous is a fungus of the family Botryosphaeriaceae. The pathogen was first described in 2008 as a cryptic species within the *L. theobromae* complex (Alves et al., 2008). The pathogen was distinguished from *L. theobromae* based on phylogenetic analysis of several isolates obtained from a variety of hosts.

Members of the family Botryosphaeriaceae are cosmopolitan and occur on a variety of plants causing dieback and canker diseases (von Arx and Müller, 1954). Crous et al. (2006) showed that the genus *Botryosphaeria* comprised several phylogenetic lineages that correlated well with morphological features of the anamorphs. Thus, *Botryosphaeria* is now considered to be a relatively small genus consisting of only

B. dothidea and *B. cortices*. The remaining lineages within what was known as *Botryosphaeria* consist of the anamorph genera *Diplodia* (including *Sphaeropsis*), *Lasiodiplodia, Neofusicoccum, Pseudofusicoccum, Macrophomina, Neoscytalidium* and *Dothiorella* (Crous et al., 2006).

The type species of the genus *Lasiodiplodia, L. theobromae*, is geographically widespread and has been associated with approximately 500 hosts mainly in the tropics and subtropics (Punithalingam, 1980). It has also been associated with keratomycosis and phaeohyphomycosis in humans (Punithalingam, 1976; Rebell and Forster, 1976; Summerbell et al., 2004). *Lasiodiplodia theobromae* is a complex of so-called cryptic taxonomic entities. Various cultural (colony morphology, pigment production), physiological (temperature relationships), morphological (size, shape, septation of the conidia or septation of paraphyses) and phylogenetic features were found to be critical to distinguish closely related species within this complex (Pavlic et al., 2004; Slippers et al., 2004a,b; Phillips et al., 2005; Alves et al., 2006; Burgess et al., 2006).

A collection of isolates previously identified as *L. theobromae* was studied by Alves et al. (2008) based on sequence data from the ITS regions and the *tef1*-α gene. Phylogenetic analyses identified three well-supported clades within these isolates, one corresponding to *L. theobromae* and two others corresponding to potential cryptic species. The distinct phylogenetic position of the two latter clades was supported by differences in conidial morphology, and thus, those cryptic species were described as *L. pseudotheobromae* sp. nov. and *L. parva* sp. nov., respectively.

The EPPO Global Database (EPPO, 2022) provides the following taxonomic identification for *L. pseudotheobromae*:

Preferred name: *Lasiodiplodia pseudotheobromae*
Order: Botryosphaeriales
Family: Botryosphaeriaceae
Genus: *Lasiodiplodia*
Species: *Lasiodiplodia pseudotheobromae*

The EPPO code[1] (Griessinger and Roy, 2015; EPPO, 2019) for this species is LSDPPS (EPPO, online).

3.1.2. Biology of the pest

Species of the genus *Lasiodiplodia* are cosmopolitan in tropical and subtropical regions and occur on a wide range of monocotyledonous, dicotyledonous and gymnosperm hosts. Each species can exhibit diverse lifestyles as endophytes inhabiting asymptomatic plant tissues, pathogens that cause diseases in various host plants and saprobes that are commonly found on dead woody plant tissues (Johnson et al., 1992; Slippers and Wingfield, 2007; Alves et al., 2008; Abdollahzadeh et al., 2010; Liu et al., 2012; Chen et al., 2015; Dissanayake et al., 2015). Plant pathogenic *Lasiodiplodia* spp. are destructive pathogens that affect a wide range of hosts causing root rot, damping-off, stem canker, twig dieback, shoot blight, pod and seed decay and pre- and post-harvest fruit soft rot (Qiao et al., 2022).

Lasiodiplodia pseudotheobromae has a life cycle similar to that of *L. theobromae* (Figure 1). The pathogen overwinters on the previous year infected dead plant organs, on plant debris lying on the soil surface and in the soil mainly in the form of mycelium, pycnidia and chlamydospores (Ogundana, 1983; Michereff et al., 2005; Kuswinanti et al., 2019). The conidia (pycnidiospores) of the pathogen are dispersed over relatively short distances by water (rain, irrigation) and wind-driven rain to infect susceptible hosts (Ogundana, 1983; Vásquez-López et al., 2009; Picos-Muñoz et al., 2014). *Lasiodiplodia pseudotheobromae* could potentially be dispersed by insects similarly to *L. theobromae* (Kranz et al., 1977; Ploetz, 2003). The main means of entry into the host are through wounds created by pruning tools, insects and adverse climatic conditions (frost, hail), as well as during harvest, transportation, handling and storage of fruits (Ploetz, 2003). Nevertheless, direct penetration of the host tissues by the pathogen with or without the formation of appressoria has also been observed in the case of fruits (Navarro et al., 2022). The fungus colonises the vascular system and advances ahead of the visible symptoms (Burgess et al., 2006; Shahbaz et al., 2009). The pathogen may also remain quiescent or latent within the host tissues until environmental conditions and host physiology become conducive for its reactivation and the development of disease symptoms (Ventura et al., 2004).

[1] 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).

Lasiodiplodia species are commonly found to be associated with seeds (seed-borne) of their hosts. Although it has not been documented, seeds of host plants are possibly one of the main sources of primary inoculum of *L. pseudotheobromae,* similarly to the type species *L. theobromae* (Rees, 1988; Cilliers et al., 1993; Cardoso et al., 2006; Venkatesagowda et al., 2012; Dugan et al., 2015; Maciel et al., 2015; Ma et al., 2016; Norhayati et al., 2016; Parisi et al., 2018; de Araújo et al., 2019).

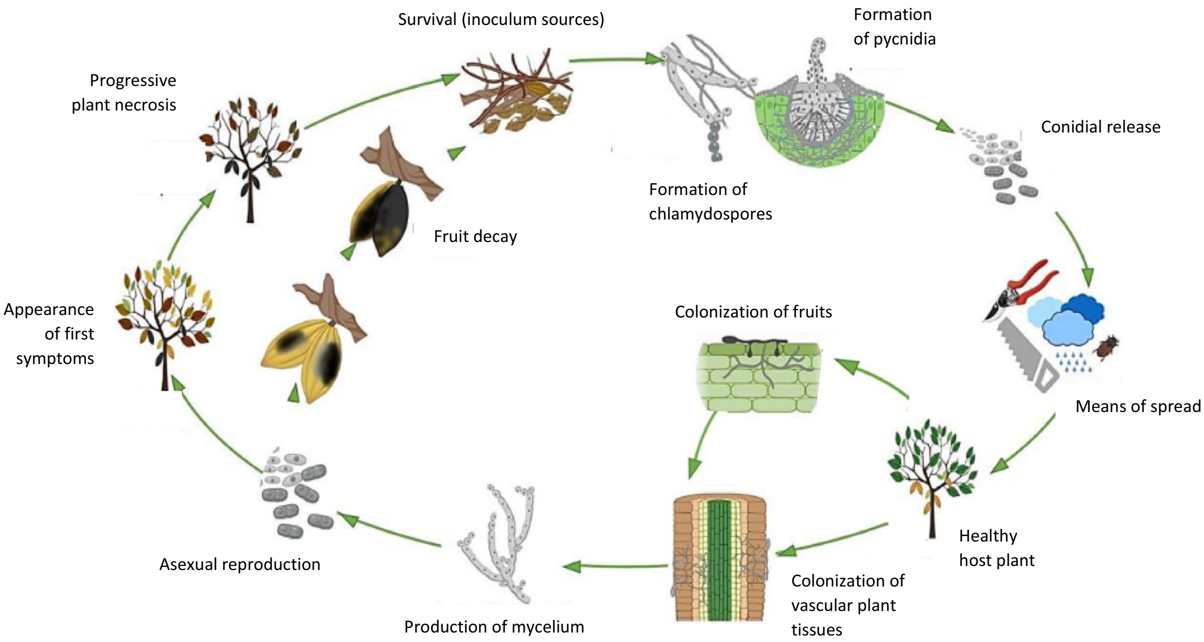

Figure 1: Life cycle of *Lasiodiplodia theobromae* on *Theobroma cacao* (adapted from Moreira-Morrillo et al., 2021, https://doi.org/10.17268/sci.agropecu.2021.068). *Lasiodiplodia pseudotheobromae* has a similar life cycle

The sexual morph of *L. pseudotheobromae* has been reported in nature from dead leaves of *Plukenetia volubilis* (Euphorbiaceae) in China (Xishuangbanna, Yunnan Province) (Tennakoon et al., 2016). The sexual–asexual connection in *L. pseudotheobromae* was confirmed by phylogenetic analysis of combined ITS and *tef1-*α sequence data (Tennakoon et al., 2016). However, the role of spores (ascospores) of the sexual morph in the epidemiology of the diseases caused by the pathogen is still unknown.

Colonies of *L. pseudotheobromae* on Potato Dextrose Agar (PDA) grow in the range of 10–35°C, with optimum temperature around 30°C and no growth at 5°C (Zhao et al., 2010; Chen et al., 2021; Liang et al., 2021). When grown on PDA at 35°C, a dark pink pigment is produced by the fungal colonies (Chen et al., 2021).

3.1.3. Host range/species affected

Lasiodiplodia pseudotheobromae has a relatively broad range of hosts among cultivated and wild woody plant species. Given that (i) *L. pseudotheobromae* is a cryptic species of the type species *L. theobromae* (see Section 3.1.1. Identity and Taxonomy), (ii) *L. theobromae sensu lato* has been reported on a wide range of monocotyledonous, dicotyledonous and gymnosperm cultivated and wild hosts worldwide and (iii) *Lasiodiplodia* species exhibit different lifestyles as endophytes, pathogens and saprobes, this pest categorisation will focus on those hosts that are relevant for the EU and for which there is robust evidence in the literature that (a) the pathogen was isolated and identified by both morphology and multilocus gene (e.g. ITS, *tef1-a, tub2*) sequencing analysis, (b) the Koch's postulates were fulfilled through pathogenicity tests and (c) impacts on affected crops were reported. Based on the above criteria, the Panel identified the following hosts (crops, ornamentals) as main hosts of *L. pseudotheobromae*: *Bougainvillea spectabilis* (Li et al., 2015)*, Celtis sinensis* (Liang et al., 2020)*, Citrus* spp. (Valle-De la Paz et al., 2019; Ahmed et al., 2020; Chen et al., 2021), *Diospyros kaki* (Nogueira Jùnior et al., 2017)*, Eucalyptus* spp. (Pillay et al., 2013), *Gossypium hirsutum* (Naz et al., 2021)*, Juglans regia* (Li et al., 2016)*, Juniperus chinensis* (Trakunyingcharoen et al., 2015)*,* *Lagerstroemia indica* (Dou et al., 2017)*, Magnolia candolei* (de Silva et al., 2019), *Malus domestica* (Xue et al., 2019)*, Mangifera indica* (Sakalidis et al., 2011b)*, Persea americana* (Rodriguez-Galvez et al., 2021)*, Pistacia vera* (López-Moral et al., 2020)*, Prunus persica* (Endes et al., 2016)*, P. salicina* (Endes and Kayim, 2022)*, Rosa* spp. (Wee et al., 2017), *Sansevieria trifasciata* (Kee et al., 2019), *Vaccinium* spp. (Wang et al., 2016), *Vachellia* (= *Acacia*) spp. (Jami et al., 2015), *Vitis vinifera* (Dissanayake et al., 2015; Correia et al., 2016) and *Zea mays* (Swamy et al., 2020). A full list of the cultivated and wild hosts of *L. pseudotheobromae* reported so far in the literature is included in Appendix A. However, the actual host range of *L. pseudotheobromae* is still unknown, whereas there is uncertainty around the reports where the identification of the pathogen was not based on multigene phylogenetic analysis. In addition, the reports of *L. theobromae* should be carefully revised as some of them might represent *L. pseudotheobromae*.

3.1.4. Intraspecific diversity

No intraspecific diversity has been reported so far in *L. pseudotheobromae*. Nevertheless, the ability of the pathogen to differentiate sexual reproductive stages enhances its genomic plasticity and adaptation to various adverse environmental conditions including fungicide exposure.

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?
Yes, there are methods available for the detection and identification of *L. pseudotheobromae* and its discrimination from other closely related *Lasiodiplodia* species or other fungi of the family Botryosphaeriaceae.

The symptoms of the diseases caused by *L. pseudotheobromae* include leaf spots, twig blight, cankers, stem-end rot, gummosis, branch dieback, root rot and pre- and post-harvest fruit rots (Sakalidis et al., 2011b; Ismail et al., 2012; Marques et al., 2013). Bark and/or xylem discoloration, browning of medullary tissue, decline in plant growth and drying of leaves on upper branches have also been observed. In severe cases, these symptoms may lead to plant death (Alves et al., 2004). Nevertheless, the above-mentioned symptoms are similar to those caused by other *Lasiodiplodia* species or other fungal pathogens. If fruiting structures (pycnidia with conidia and/or ascomata with ascospores) are detected on the symptomatic plant tissues using a magnifying lens, they are similar in morphology to those of other *Lasiodiplodia* species. In addition, the pathogen may remain quiescent or latent within the host tissues (see Section 3.1.2. Biology of the pest). Based on the above, it is unlikely that *L. pseudotheobromae* could be detected based only on visual inspection of its host plants.

Lasiodiplodia pseudotheobromae can be readily isolated on culture media and description of its cultural and morphological characteristics is available in the literature (Alves et al., 2008; Doilom et al., 2015; Tennakoon et al., 2016) (Figure 2).

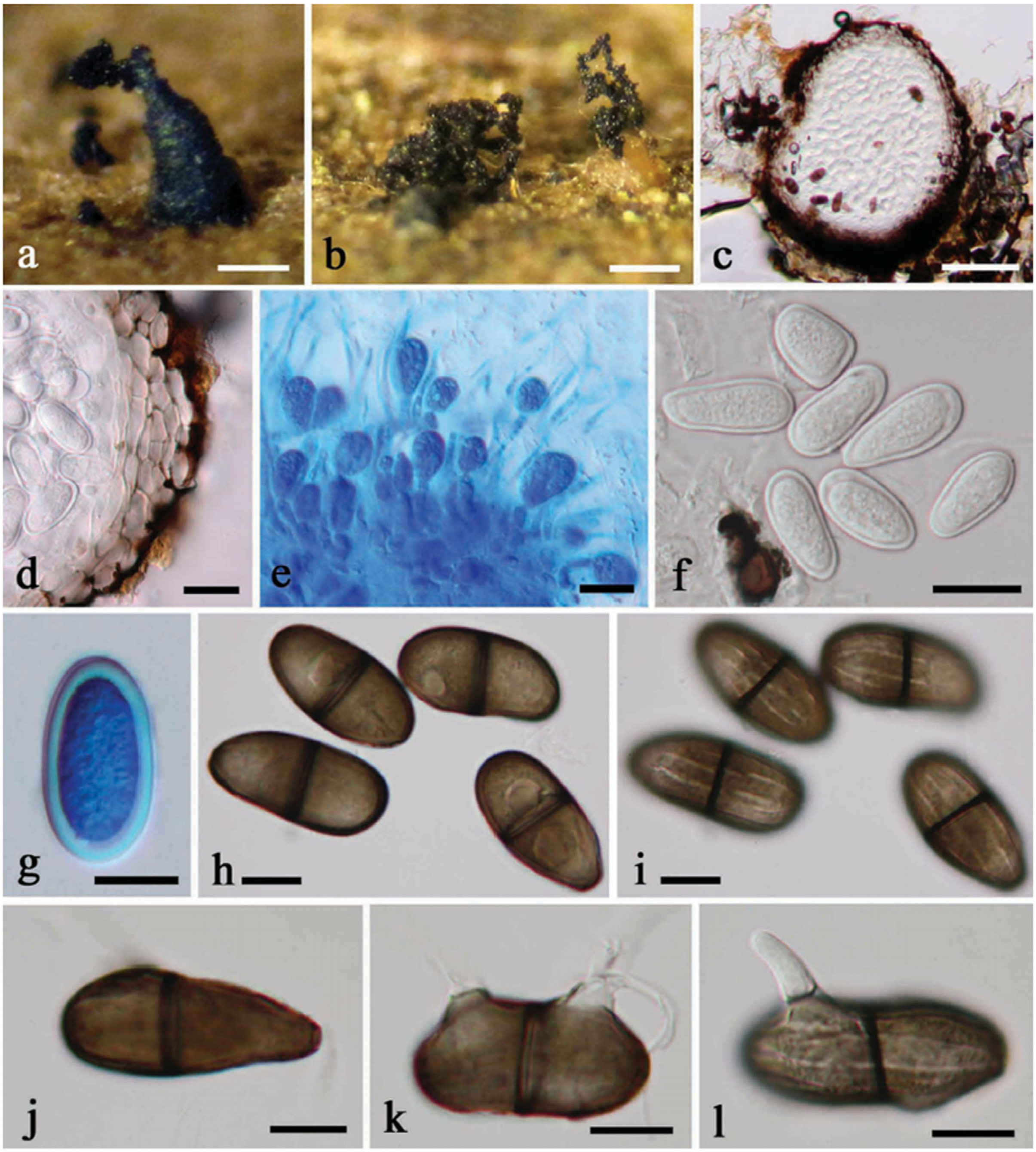

Figure 2: *Lasiodiplodia pseudotheobromae*. (a, b) Conidiomata and conidia on surface of dead twig of *Tectona grandis* (teak). (c) Section through conidioma. (d) Conidioma wall. (e) Conidia attached to conidiogenous cells with paraphyses. (f, g) Immature conidia. (h–j) Mature conidia in two different focal planes showing longitudinal striations. (k, l) Germinated mature conidia. Note (e, g) stained with lactophenol cotton blue. Scale bars: (a) = 300 μm. (b) = 200 μm. (c) = 100 μm. (d, f) = 20 μm. (e, g–l) = 10 μm (from Doilom et al., 2015; https://doi.org/10.11646/phytotaxa.233.1.1)

However, *Lasiodiplodia*, as well as other Botryosphaeriaceae genera, comprise cryptic species and they cannot be differentiated by morphology alone (Alves et al., 2008; Hyde et al., 2014). Recently, molecular methods and particularly DNA sequences of the internal transcribed spacers (ITS) of genomic rDNA (White et al., 1990; Pavlic et al., 2004; Alves et al., 2008), together with protein-coding genes such as translation elongation factor 1-alpha (*TEF1-α*) and β-tubulin (*β-tub*) have been used to reliably identify *Lasiodiplodia* species, including *L. pseudotheobromae* (Marques et al., 2013; Phillips et al., 2013; Slippers et al., 2013; Netto et al., 2014). Nevertheless, phylogenetic studies of

Botryosphaeriaceae emphasise that the use of only one gene region is not enough to separate sibling species in this family (Slippers and Wingfield, 2007; Phillips et al., 2013), and the concatenated alignment of at least two gene regions in the genome of these individuals is required (Phillips et al., 2013; Chen et al., 2014; Slippers et al., 2014; Machado et al., 2014a; Zhou et al., 2015; Rosado et al., 2016; Coutinho et al., 2017).

Nucleotide sequences of *L. pseudotheobromae* are available in GenBank (www.ncbi.nlm.nih.gov/genbank) and could be used as reference material for molecular diagnosis.

No EPPO Standard is available for the detection and identification of *L. pseudotheobromae*.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Lasiodiplodia pseudotheobromae has been reported to be present in Africa (Democratic Republic of Congo, Egypt, Guinea-Bissau, Mozambique, Namibia, Republic of Madagascar, South Africa, Tunisia), Asia (China, India, Iran, Korea, Laos, Malaysia, Pakistan, Thailand, Türkiye), North America (Mexico, Puerto Rico), South America (Brazil, Costa Rica, Peru, Republic of Ecuador, Suriname, Uruguay, Venezuela) and Oceania (Australia). The records are based on CABI (2022), Farr and Rossman (2022; https://nt.ars-grin.gov/fungaldatabases/; accessed on 12/10/2022) and other sources. The current geographical distribution of *L. pseudotheobromae* is shown in Figure 3. A complete list of the countries and states/provinces from where *L. pseudotheobromae* has been reported is included in Appendix B.

There is uncertainty with respect to the geographical distribution of *L. pseudotheobromae* outside the EU, as in the past, when molecular tools (particularly multigene phylogenetic analysis) were not available, the pathogen might have been misidentified as *L. theobromae* based on morphology and pathogenicity tests, which cannot reliably differentiate *Lasiodiplodia* species.

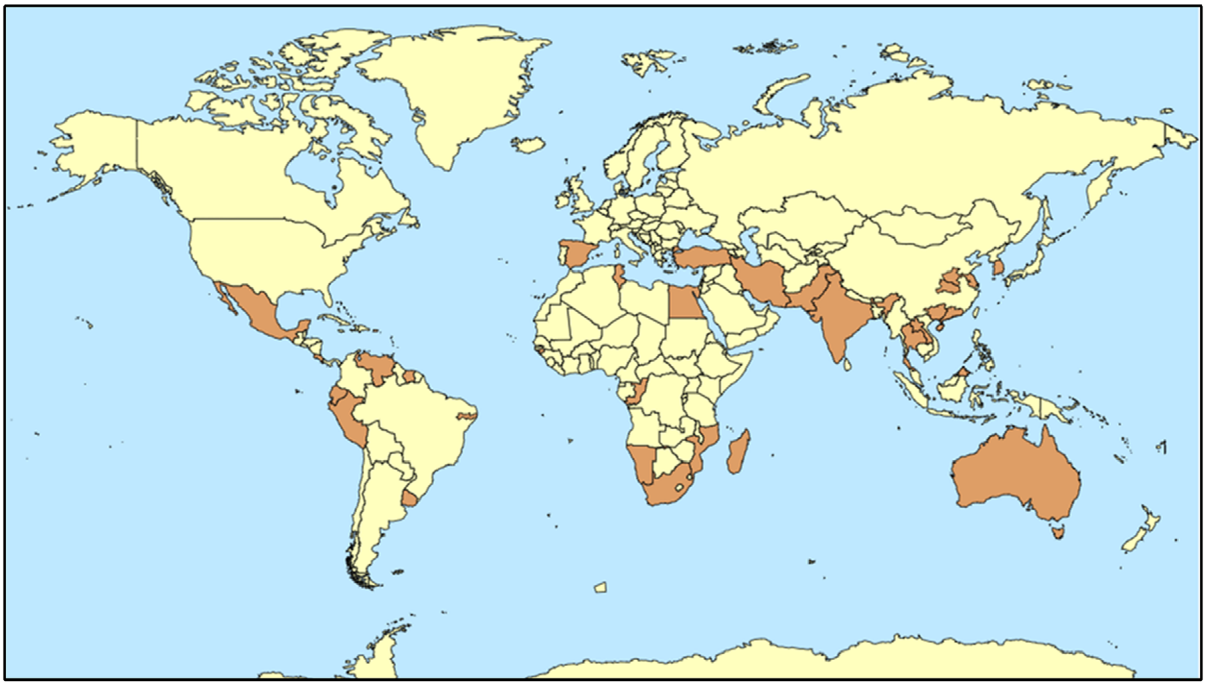

Figure 3: Global distribution of *Lasiodiplodia pseudotheobromae* [Data Source: CABI CPC (online; last accessed on 12/10/2022), Farr and Rossman (2022; last accessed on 12/10/2022) and other literature sources]

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed. Yes, the pathogen has been reported from Spain.

Lasiodiplodia pseudotheobromae has been reported from Spain (López-Moral et al., 2020) and the Netherlands (Alves et al., 2008; Zhao et al., 2010; Chen et al., 2011; Phillips et al., 2013). In Spain, the pathogen was isolated together with other Botryosphaeriaceae fungi from pistachio (*Pistacia vera*) trees growing in commercial orchards across southern Spain [Autonomous Communities of Andalusia (Córdoba, Granada, Málaga and Sevilla provinces) and Extremadura (Badajoz province)]. The affected trees exhibited symptoms of branch dieback, cankers and shoot and panicle blight. The Spanish NPPO confirmed that *L. pseudotheobromae* is present in Andalucia. The record from the Netherlands is based on one isolate of the pathogen (CBS 304.79) maintained in CBS-KNAW Culture Collection (https://wi.knaw.nl/page/fungal_table) and used in phylogenetic studies (Alves et al., 2008; Zhao et al., 2010; Chen et al., 2011; Phillips et al., 2013). Based on the available information, the isolate originated from branches of *Rosa* sp. (cv. Ilona). The NPPO of the Netherlands confirmed that *L. pseudotheobromae* was isolated from a greenhouse in the Rotterdam area in the late 1970 s and that no further information is available on the occurrence of the pest in the Netherlands. However, the absence of the pest is not confirmed by surveys.

There is uncertainty with respect to the geographical distribution of *L. pseudotheobromae* in the EU, as in the past, when molecular tools (particularly multigene phylogenetic analysis) were not available, the pathogen might have been misidentified as *L. theobromae* based on morphology and pathogenicity tests, which cannot reliably differentiate *Lasiodiplodia* species.

3.3. Regulatory status

3.3.1. Commission implementing regulation 2019/2072

Lasiodiplodia pseudotheobromae is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, an implementing act of Regulation (EU) 2016/2031, or in any emergency plant health legislation.

3.3.2. Hosts or species affected that are prohibited from entering the union from third countries

A list of hosts included in Annex VI of Commission Implementing Regulation (EU) 2019/2072 is provided in Table 2. Hosts of the genera *Acacia, Acer, Annona, Diospyros, Juglans, Malus, Persea* and *Prunus* are included in the Commission Implementing Regulation (EU) 2018/2019 on high-risk plants.

Table 2: List of plants, plant products and other objects that are *Lasiodiplodia pseudotheobromae* hosts whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI and Commission Implementing Regulation (EU) 2022/490)

A. Annex VI of Commission Implementing Regulation (EU) 2019/2072			
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**
1.	Plants of [. . .] *Pinus* L., [. . .], *Juniperus* L. other than fruit and seeds	ex 0602 20 20 ex 0602 20 80 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47	Third countries other than 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

		ex 0602 90 50 ex 0602 90 70 ex 0602 90 99 ex 0604 20 20 ex 0604 20 40	(Tsentralny federalny okrug), Northwestern Federal District (Severo- Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom
8.	Plants for planting of [. . .] *Malus* Mill., *Prunus* L., [. . .]. and *Rosa* L., other than dormant plants free from leaves, flowers and fruits	ex 0602 10 90 ex 0602 20 20 ex 0602 20 80 ex 0602 40 00 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo- Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom
9.	Plants for planting of [. . .] *Malus* Mill., *Prunus* L. and [. . .] and their hybrids, [. . .] other than seeds	ex 0602 10 90 ex 0602 20 20 ex 0602 90 30 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, New Zealand, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo- Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo- Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, Ukraine, the United Kingdom (1) and United States other than Hawaii
10.	Plants of *Vitis* L., other than fruits	ex 0602 10 10 ex 0602 20 10 ex 0604 20 90 ex 1404 90 00	Third countries other than Switzerland
11.	Plants of *Citrus* L., [. . .] and their hybrids, other than fruits and seeds	ex 0602 10 90 ex 0602 20 20 ex 0602 20 30 ex 0602 20 80 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99 ex 0604 20 90 ex 1404 90 00	All third countries
19.	Soil as such consisting in part of solid organic substances	ex 2530 90 00 ex 3824 99 93	Third countries other than Switzerland

20.	Growing medium as such, other than soil, consisting in whole or in part of solid organic substances, other than that composed entirely of peat or fibre of *Cocos nucifera* L., previously not used for growing of plants or for any agricultural purposes	ex 2530 10 00 ex 2530 90 00 ex 2703 00 00 ex 3101 00 00 ex 3824 99 93	Third countries other than Switzerland

B. Annex II of Commission Implementing Regulation (EU) 2022/490

Plants, plant products or other objects	CN code	Third countries of origin	Measures
Juglans regia L. up to 2-year old plants for planting which are bare-rooted, free of leaves, and with a maximum diameter of 2 cm at the base of the stem	ex 0602 20 20	Turkey	(a) Official statement that: (i) the plants are free from [……….] and *Lasiodiplodia pseudotheobromae*; (ii) the site of production has been found free from [……….] and *Lasiodiplodia pseudotheobromae* during official inspections carried out at appropriate times, since the beginning of the complete production cycle; (iii) a system has been put in place to ensure that grafting and pruning tools have been disinfected to be free from *Lasiodiplodia pseudotheobromae*, before they have been introduced into each site of production, and the grafted or pruned plants have been subjected to appropriate treatment to prevent entry of *Lasiodiplodia pseudotheobromae* via the cuts; and (iv) immediately prior to export, consignments of the plants have been subjected to an official inspection for the presence of *Lasiodiplodia pseudotheobromae* including random sampling and testing of the plants; (b) The phytosanitary certificates for those plants include under the heading 'Additional Declaration': (i) the following statement: 'The consignment complies with Implementing Regulation (EU) 2020/1213'; (ii) 'the specification of the registered sites of production.'

3.4. Entry, establishment and spread in the EU

3.4.1. Entry

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

Yes, the pathogen can enter further into the EU territory via host plants for planting (including seeds), fruits, parts of host plants (e.g. foliage, branches, bark, wood) and soil.

Comment on plants for planting as a pathway.

Plants for planting is a main pathway of the further entry of the pathogen into the EU.

The Panel identified the following main pathways for the further entry of *L. pseudotheobromae* into the EU territory:

1) host plants for planting, including seeds
2) fresh fruits of host plants,
3) bark and wood of host plants and
4) soil and other plant-growing media

originating in infested third countries.

Lasiodiplodia pseudotheobromae could potentially enter further into the EU territory on cut flowers and plant parts (e.g. stems, branches) of its hosts for ornamental or medicinal purposes. However, these are considered minor pathways for the further entry of the pathogen into the EU.

Lasiodiplodia pseudotheobromae and other fungi of the family Botryosphaeriaceae have been shown to be seed-transmitted. Although there is no evidence so far of *L. pseudotheobromae* being seed-borne, seeds of host plants are likely to be a pathway of further entry of the pathogen into the EU.

The pathogen is unlikely to enter further into the EU by natural means (e.g. rain, wind-driven rain, insects) because of the long distance between the infested third countries and the EU Member States. The pathogen is present in Türkiye and more specifically in the Adana province, which is located in south-central Türkiye (Endes et al., 2016). Therefore, entry of the pathogen from Türkiye into the EU via natural means seems unlikely.

Although there are no quantitative data available, conidia of the pathogen may also be present as contaminants on other substrates or objects (e.g. non-host plants, second hand agricultural machinery and equipment, crates, etc.) imported into the EU. Nevertheless, these are considered minor pathways for the further entry of the pathogen into the EU territory (Table 3).

Table 3: Potential pathways of further entry of *Lasiodiplodia pseudotheobromae* into the EU 27

Pathways (e.g. host/ intended use/source)	**Life stage**	**Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]**
Host plants for planting, other than seeds	Mycelium, pycnidia and possibly ascomata	• Annex VI (1) of Commission Implementing Regulation (EU) 2019/2072 prohibits the introduction into the Union from certain third countries of *Juniperus* plants. Among the third countries from where the introduction of *Juniperus* plants is not prohibited Türkiye has been reported to be infested by the pathogen (see Section 3.2.1). • Annex VI (8) of Commission Implementing Regulation (EU) 2019/2072 prohibits the introduction into the Union from certain third countries of plants for planting of *Malus, Prunus* and *Rosa,* other than dormant plants free from leaves, flowers and fruits. Among the third countries from where the introduction of plants for planting of *Malus, Prunus* and *Rosa* is not prohibited, Türkiye has been reported to be infested with the pathogen (see Section 3.2.1). In addition, this pathway is partially open, as dormant plants of the above plant genera free from leaves, flowers and fruits could still carry the pathogen. • According to Article 1 of Commission Implementing Regulation (EU) 2018/2019, the introduction into the Union of plants for planting, other than seeds, *in vitro* material and naturally or artificially dwarfed woody plants for planting of *Malus* Mill. and *Prunus* L. is prohibited pending a risk assessment. • Annex VI (9) of Commission Implementing Regulation (EU) 2019/2072 prohibits the introduction into the Union from certain third countries of plants for planting of *Malus* and *Prunus* other than seeds.

Pathways (e.g. host/ intended use/source)	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]
		Among the third countries from where the introduction of plants for planting of *Malus* and *Prunus* other than seeds is not prohibited, Australia, Tunisia and Türkiye have been reported to be infested with the pathogen (see Section 3.2.1). • Annex VI (10) of Commission Implementing Regulation (EU) 2019/2072 prohibits the introduction into the Union from third countries other than Switzerland of plants of *Vitis* other than fruits. • Annex VI (11) of Commission Implementing Regulation (EU) 2019/2072 prohibits the introduction into the Union from all third countries of plants of *Citrus* ant their hybrids, other than fruits and seeds. • Annex II of Commission Implementing Regulation (EU) 2022/490 sets special requirements for the introduction into the Union of *Juglans regia* L. up to 2-year-old plants for planting which are bare-rooted, free of leaves, and with a maximum diameter of 2 cm at the base of the stem from Türkiye (see Table 2B).
Seeds of host plants for sowing	Mycelium	• Annex XI, Part A (8) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from third countries other than Switzerland of seeds of *Citrus, Prunus* and *Zea mays* for sowing
Fresh fruits of host plants	Mycelium, pycnidia	• Annex XI, Part A (5) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from third countries other than Switzerland of fruits (fresh or chilled) of *Citrus*, *Annona, Carica papaya, Diospyros, Malus, Mangifera, Persea americana, Prunus, Psidium, Vaccinium* and *Vitis*. • Annex XI, Part C of Commission Implementing Regulation (EU) 2019/2072 does not require a phytosanitary certificate for the introduction into the Union from third countries of fruits of *Cocos nucifera*. Therefore, this is an open pathway of entry.
Parts of host plants, other than fruits and seeds	Mycelium, pycnidia, chlamydospores and possibly ascomata	• Annex XI, Part A (3) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from certain third countries of *Prunus* L. plant parts, other than fruit and seeds. Among the third countries from which a phytosanitary certificate is not required, Türkiye has been reported to be infested with *L. pseudotheobromae*. • Annex XI, Part A (3) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from third countries other than Switzerland of *Camellia* spp. L. plant parts, other than fruits and seeds. • Annex XI, Part A (3) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from certain third countries of *Juglans* L. plant parts, other than fruits and seeds (Table 3). Among the third countries from which a phytosanitary certificate is not required, some

Pathways (e.g. host/ intended use/source)	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]
		have been reported to be infested with the pathogen (see Section 3.2.1). • Annex XI, Part A (3) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from third countries other than Switzerland of foliage, branches and other parts of conifer (Pinales) plants, without flowers or flower buds. • Annex XI, Part A (3) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from the United States of foliage, branches, cut flowers and flower buds of *Rosa gymnocarpa* and *Vaccinium ovatum*. Phytosanitary certificate is not required for the introduction of the above-mentioned plant parts of *Rosa gymnocarpa* and *Vaccinium ovatum* from other third countries included those infested by the pathogen (see Section 3.2.1).
Bark of host plants	Mycelium, pycnidia and possibly ascomata	• Annex XI, Part A (11) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from certain third countries of isolated bark of Conifers (Pinales) and *Juglans*. Among the third countries from which a phytosanitary certificate is not required, some have been reported to be infested with the pathogen (see Section 3.2.1).
Wood of host plants	Mycelium	• Annex XI, Part A (12) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from certain third countries of wood of Conifers (Pinales), *Juglans* and *Prunus*, including wood which has not kept its natural round surface. Among the third countries from which a phytosanitary certificate is not required, some have been reported to be infested with the pathogen (see Section 3.2.1).
Soil associated or not with host and non-host plants for planting	Chlamydospores, mycelium, pycnidia and possibly ascomata (the last three life stages are most likely to be associated with the presence of infected plant debris in the soil)	Annex VI (19) of Commission Implementing Regulation (EU) 2019/2072 bans the introduction into the Union from third countries other than Switzerland of soil as such consisting in part of solid organic substances
Growing medium associated or not with host and non-host plants	Chlamydospores, mycelium, pycnidia and possibly ascomata (the last three life stages are most likely to be associated with the presence of infected plant debris in the growing medium)	• Annex VI (20) of Commission Implementing Regulation (EU) 2019/2072 bans the introduction into the Union from third countries other than Switzerland of growing medium as such, other than soil, consisting in whole or in part of solid organic substances, other than that composed entirely of peat or fibre of *Cocos nucifera* L., previously not used for growing of plants or for any agricultural purposes. • Annex VII (1) of Commission Implementing Regulation (EU) 2019/2072 requires official statement of special requirements for the introduction into the Union from

Pathways (e.g. host/ intended use/source)	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]
		third countries other than Switzerland of growing medium, attached to or associated with plants, intended to sustain the vitality of the plants, with the exception of sterile medium of *in vitro* plants. • Annex XI, Part A (1) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union from third countries other than Switzerland of growing medium attached to or associated with plants, intended to sustain the vitality of the plants.
Machinery and vehicles with contaminated soil and/or infected debris of host plants.	Mycelium, pycnidia, chlamydospores and possibly ascomata	• Annex VII (2) of Commission Implementing Regulation (EU) 2019/2072 requires official statement that machinery or vehicles are cleaned and free from soil and plant debris. • Annex XI, Part A (1) of Commission Implementing Regulation (EU) 2019/2072 requires phytosanitary certificate for the introduction into the Union territory of machinery and vehicles from third countries other than Switzerland.

The quantity of fresh produce of main hosts imported into the EU from countries where *L. pseudotheobromae* is present is provided in Table 4 and Appendix C.

Table 4: EU 27 annual imports of fresh produce and wood of main hosts from countries where *Lasiodiplodia pseudotheobromae* is present, 2017–2021 (in 100 kg) Source: Eurostat accessed on 21/10/2022. The pathogen is known to be present in the US only in Puerto Rico. However, trade volumes in Eurostat are available only for the whole of the US (for details of imports of different commodities from the US, see Appendix C)

Commodity	HS code	2016	2017	2018	2019	2020
Fresh or dried avocados	080440	2,188,376	3,201,299	2,844,627	3,325,363	3,895,886
Fresh or dried guavas, mangoes and mangosteens	080450	2,188,720	2,576,451	2,676,531	2,976,886	3,187,970
Citrus fruit, fresh or dried	0805	13,708,870	15,698,345	13,978,973	16,588,213	16,752,751
Fresh persimmons	0810 70	2,057	1,423	10,226	6,710	9,122
Fresh apples	080810	568,810	657,949	422,878	455,074	597,905
Fresh plums	080940	315,828	275,272	208,795	247,633	404,813
Fresh cranberries, bilberries and other fruits of the genus Vaccinium	081040	139,421	180,982	335,275	539,119	614,419
Fresh grapes	080610	3,814,762	4,017,312	4,235,588	4,058,493	4,956,076
Fresh peaches	080930	18,032	33,329	14,640	74,837	85,423
Fresh or dried walnuts, in shell	08023100	432,597	356,725	422,878	405,812	365,742
Fresh or dried pistachios, in shell	080251	707,758	685,618	773,400	828,408	953,389
Maize or corn*	1005	47,566,931	66,498,035	50,517,145	42,130,551	34,470,132
Edible fruit or nut trees, shrubs and bushes, whether or not grafted	060220	23,096	13,315	16,530	15,432	17,545
Citrus trees and shrubs, grafted or not (excl. with bare roots)	062030	0	0	0	0	6

Commodity	HS code	2016	2017	2018	2019	2020
Roses, whether or not grafted	060240	1,129	4,001	690	41	869
Live forest trees	06029041	136	0	0	1	0
Outdoor trees, shrubs and bushes, incl. their roots, with bare roots (excl. cuttings, slips and young plants, and fruit, nut and forest trees)	06029046	604	1,605	870	60	675
Outdoor trees, shrubs and bushes, incl. their roots (excl. with bare roots, cuttings, slips, young plants, conifers, evergreens and fruit, nut and forest trees)	06029046	4,894	9,290	12,151	11,874	24,553
Wood in the rough, whether or not stripped of bark or sapwood, or roughly squared	4403	1,034,923	1,382,175	1,763,478	2,454,524	8,148,014
	Sum	72,716,945	95,593,125	78,234,675	74,119,030	74,485,291

*: This includes 'Maize seeds for sowing' (for import information on maize seeds for sowing, see Appendix C).

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. As on 19 October 2022, there were no records of interceptions of *L. pseudotheobromae* in the TRACES databases. Two interceptions were found in Europhyt (in 1996 and 1998, respectively) for *Diplodia* spp. and *Botryodiplodia* spp. (in the past, both genera were considered as synonymous of the genus *Lasiodiplodia*) on Cactaceae and *Phoenix dactylifera* imported from Peru and Egypt, respectively. However, Cactaceae and *P. dactylifera* are not known to be hosts of the pathogen (see Appendix A). Therefore, it is unlikely that the above-mentioned interceptions refer to *L. pseudotheobromae*.

3.4.2. Establishment

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

Yes, *L. pseudotheobromae* has already established in Spain (see Section 3.2.2). Both the biotic (host availability) and abiotic (climate suitability) factors occurring in the EU suggest that the pathogen could further establish in other parts of the EU territory, similarly to the closely related *L. theobromae*.

Given its biology, the pathogen could potentially be transferred from the pathways of entry to the host plants grown in the EU via splash-dispersed conidia, and contaminated soil and other plant growing media associated with plants for planting, as well as by rain or irrigation water. The frequency of this transfer will depend on the volume and frequency of the imported commodities, their destination (e.g. nurseries, retailers, packinghouses) and its proximity to the hosts grown in the EU territory, as well as on the management of plant debris and fruit waste.

3.4.2.1. EU distribution of main host plants

As noted above and shown in Appendix A, *L. pseudotheobromae* has a very wide host range. In addition, most of its main hosts (see Section 3.1.3) are widely distributed in the EU territory, in commercial production (fields, orchards, greenhouses) and in home gardens. The harvested area of most of the main hosts of *L. pseudotheobromae* cultivated in the EU 27 in recent years is shown in Table 5. Appendix D provides production statistics for individual Member States. In addition, data are available which indicate a pistachio production area in Spain of approximately 60,000 ha (https://www.mapa.gob.es/es/agricultura/temas/producciones-agricolas/frutas-y-hortalizas/Analisis%20realidad%20productiva%20frutos%20de%20cascara.aspx).

Table 5: Harvested area of *Lasiodiplodia pseudotheobromae* main hosts in EU 27, 2017–2021 (1,000 ha). Source EUROSTAT (accessed 19/10/2022) (for individual Member States, see Appendix C) https://ec.europa.eu/eurostat/databrowser/view/APRO_CPSH1__custom_3085921/default/table?lang=en

Crop	2017	2018	2019	2020	2021
Grain maize and corn-cob-mix	8,266.64	8,252.47	8,910.74	9,354.73	9,231.62
Green maize	5,985.90	6,134.91	6,210.36	6,325.30	6,050.71
Grapes	3,133.32	3,135.50	3,155.20	3,145.71	3,101.47
Apples	504.61	506.27	491.08	484.63	496.62
Citrus fruits	502.84	508.99	512.83	519.98	514.65
Peaches	154.06	150.80	144.78	137.07	132.50

3.4.2.2. Climatic conditions affecting establishment

Based on the data available in the literature on the geographic coordinates of the locations from where *L. pseudotheobromae* has been reported, the pathogen is present in non-EU areas with BSh, BSk, Cfa, Cfb, Cfc, Csa, Csb, Csc, Dfb and Dfc Köppen–Geiger climate zones. These climate zones also occur in the EU territory, where susceptible hosts of *L. pseudotheobromae* are also grown (Figure 4). According to the Köppen–Geiger climate classification, the Autonomous Communities of Andalusia and Extremadura in Spain from where the pathogen has been reported belong to the Csa climate zone.

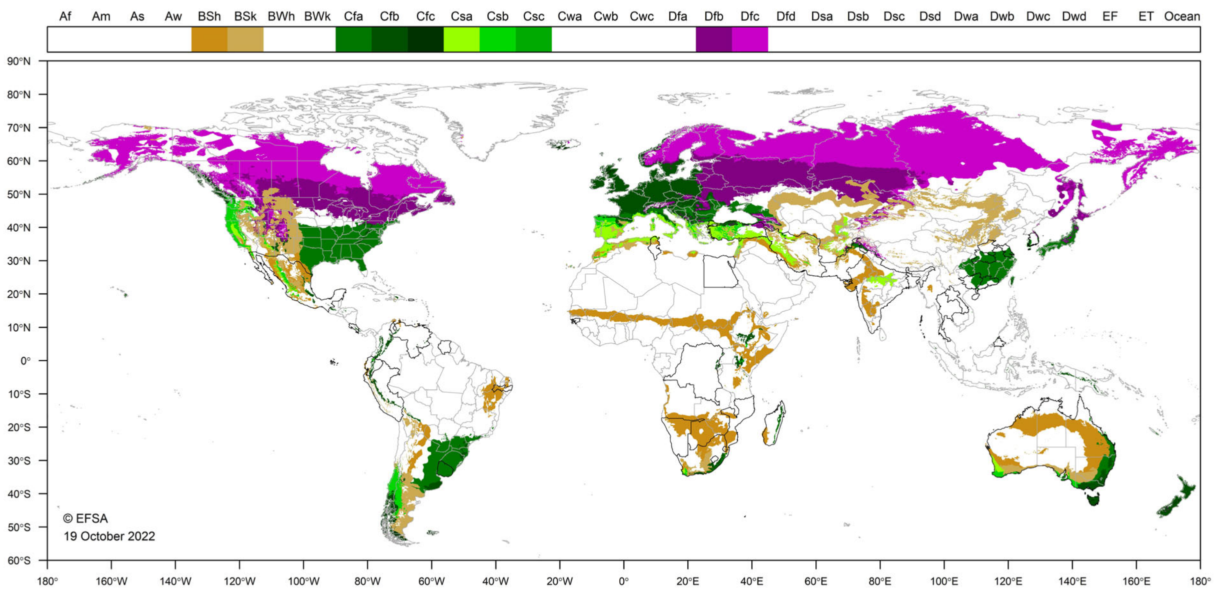

Figure 4: Distribution of 10 Köppen–Geiger climate types, i.e. BSh, BSk, Cfa, Cfb, Cfc, Csa, Csb, Dfb and Dfc that occur in the EU and in third countries where *Lasiodiplodia pseudotheobromae* has been reported. The legend shows the list of Köppen–Geiger climates

3.4.3. Spread

Describe how the pest would be able to spread within the EU territory following establishment?

Lasiodiplodia pseudotheobromae could potentially spread within the EU by both natural and human-assisted means.

Host plants for planting is a main means of spread of the pathogen within the EU territory.

Lasiodiplodia pseudotheobromae could potentially spread via natural and human-assisted means, similarly to other *Lasiodiplodia* species established in the EU (e.g. *L. theobromae*).

Spread by natural means. Conidia of fungi of the family Botryosphaeriaceae can spread over relatively short distances by water splash (rain, irrigation) (Michaelidis and Morgan, 1993; Úrbez-Torres et al., 2010). Wind may increase the dispersal distance of water-splashed conidia, although this has not been studied in the case of *Lasiodiplodia* species. Although it has not been documented, conidia of the pathogen could potentially be dispersed by insects, similarly to other conidia-producing fungi (Magyar et al., 2016). Birds, rodents and other small animals could potentially disperse the pathogen via infected fruits and seeds (nuts). In addition, the pathogen could potentially spread by the wind-disseminated spores (ascospores) of its sexual stage, although the role of those spores in the epidemiology of the diseases caused by *L. pseudotheobromae* is still unknown.

Spread by human-assisted means. The pathogen can spread over long distances via the movement of infected host plants for planting (rootstocks, grafted plants, scions, etc.), including dormant plants, as well as fresh fruits, contaminated soil and agricultural machinery, tools, etc. Although so far it has not been documented, the pathogen could potentially spread via the seeds of its host plants similarly to *L. theobromae* (Rees, 1988; Cilliers et al., 1993; Cardoso et al., 2006; Venkatesagowda et al., 2012; Dugan et al., 2015; Maciel et al., 2015; Ma et al., 2016; Norhayati et al., 2016; Parisi et al., 2018; de Araújo et al., 2019).

3.5. Impacts

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

Yes, the further introduction and/or spread of *Lasiodiplodia pseudotheobromae* into the EU is expected to have yield and quality impacts in parts of the territory where susceptible hosts are grown. Nevertheless, the magnitude of the impacts is not known, especially in cases where other *Lasiodiplodia* species or other fungi of the family Botryosphaeriaceae co-infect the same host.

In the area of its present distribution, *L. pseudotheobromae* is an important pathogen in agriculture and forestry causing root rot, damping-off, leaf spots, twig blight, cankers, stem-end rot, gummosis, branch dieback and pre- and post-harvest fruit rots on a wide range of woody perennial crops and ornamental plants (Sakalidis et al., 2011a,b; Ismail et al., 2012; Marques et al., 2013). These diseases lead to bark and/or xylem discoloration, browning of medullary tissue, a decline in plant growth and drying of leaves on upper branches. In severe cases, they may even lead to plant death (Alves et al., 2004). Since its description, *L. pseudotheobromae* has been reported around the world as being associated with numerous hosts, which highlights its increasing dissemination, distribution and broad host range, similarly to *L. theobromae*.

The pathogen has been reported to be associated with table grape (*Vitis vinifera*) decline (Correia et al., 2013) in Brazil, dieback, cankers and stem-end rot of mango (*Mangifera indica*) in Egypt (Ismail et al., 2012), Western Australia (Sakalidis et al., 2011b), Brazil (Marques et al., 2013) and Peru (Rodríguez-Gálvez et al., 2017), fruit rot of citrus in China (Chen et al., 2021) and of avocado (*Persea americana*) in Nigeria (Onaebi et al., 2019) as well as with branch blight and dieback of avocado in Peru (Rodriguez-Galvez et al., 2021). However, limited quantitative data are available on the impacts caused by *L. pseudotheobromae* on various crops worldwide.

Among the wide range of diseases that impact on table grape production in Brazil, grapevine dieback has become increasingly important (Garrido et al., 2011). The first report of grapevine dieback in Brazil was in 1992 (Ribeiro et al., 1992) and, since then, the intensity of the disease has increased, leading in some cases to high reductions in longevity and productivity of vineyards (Garrido et al., 2011). Eight *Lasiodiplodia* species, including *L. pseudotheobromae,* were identified by Correia et al. (2016) as the causal agents of grapevine dieback of 14 vineyards located in Casa Nova, Juazeiro and Petrolina, Brazil. However, in China, the pathogen has been reported to affect the fruit peduncles and pedicels resulting in cluster and fruit drop, a symptom that differs from those described in other countries (Yan et al., 2013; Dissanayake et al., 2015).

Lasiodiplodia pseudotheobromae can cause gummosis, trunk canker, twig blight and post-harvest fruit rots on citrus resulting in reduction of the crop profitability (Abdollahzadeh et al., 2010; Awan et al., 2016; Sultana et al., 2018; Bautista-Cruz et al., 2019; Valle-De la Paz et al., 2019; Ahmed et al., 2020). According to Xiao et al. (2021), *L. pseudotheobromae* was the second most abundant species of Botryosphaeriaceae isolated from citrus exhibiting symptoms of gummosis, dieback and canker in six out of nine citrus-producing provinces in China. The same study also showed that *L. pseudotheobromae* was the most aggressive species on citrus shoots. Valle-De la Paz et al. (2019) demonstrated that at least three species of the genus *Lasiodiplodia* (i.e. *L. theobromae, L. citricola* and *L. pseudotheobromae*) cause gummosis, dieback of branches and death of Persian lime (*Citrus* *latifolia*) trees in commercial orchards in Morelos State, Mexico. *Lasiodiplodia theobromae* was the prevailing species (28.57%), followed by *L. pseudotheobromae* (16.07%) and *L. citricola* (3.57%). The disease incidence ranged from 49% to 100%, with 78% of the evaluated orchards showing an incidence ranging from 31.8% to 100%. The disease severity ranged from 30% to 100% in more than 71% of the evaluated orchards.

The pathogen has also been reported to cause post-harvest stem-end rot on citrus fruit in Bangladesh (Sultana et al., 2018) and China (Xiao et al., 2021) as well as post-harvest rot of lemon in Cukurova Region of southern Türkiye, the main lemon-producing area which contributes almost to 70% of the total production in Türkiye (Awan et al., 2016).

Among the *Lasiodiplodia* species associated with mango (*Mangifera indica*) diseases worldwide, *L. theobromae, L. pseudotheobromae, L. crassispora, L. egyptiacae, L. hormozganensis, L. mahajangana* and *L. iranensis* have been reported as causing cankers, dieback and stem-end rot on mango in Australia (Sakalidis et al., 2011b), Brazil (Marques et al., 2013), Egypt (Ismail et al., 2012), Iran (Abdollahzadeh et al., 2010), Malaysia (Li et al., 2020) and Thailand (Trakunyingcharoen et al., 2015).

In addition to *L. pseudotheobromae,* four more *Lasiodiplodia* species (i.e. *L. brasiliense, L. caatinguensis, L. iraniensis, L. laeliocattleyae*) were found to be associated with stem cutting dry rot disease of cassava (*Manihot esculenta*) in Brazil resulting in crop yield reduction and decreased product quality (Brito et al., 2020). Machado et al. (2014b) studies showed that *L. pseudotheobromae, L. euphorbicola* and *Neoscytalidium hyalinum* were the causal agents of black root rot of cassava in the states of Maranhão and Paraíba, Brazil.

Naz et al. (2021) identified *L. pseudotheobromae* as the causal agent of severe twig and stem blight of upland cotton (*Gossypium hirsutum*), an important cash crop in Pakistan. The disease incidence ranged from 20% to 40%.

Stem-end rot is an important post-harvest disease of papaya (*Carica papaya*) in Brazil and worldwide. Disease incidence can reach 70%–80%, resulting in reduction in the commercial value of the fruit (Paull et al., 1997; Dantas et al., 2003; Freire et al., 2003; Pereira et al., 2012). In the past, only *L. theobromae* had been reported to cause stem-end rot of papaya. However, surveys conducted in Brazil showed that five species of *Lasiodiplodia*, including *L. pseudotheobromae,* caused stem-end rot of papaya (Netto et al., 2014).

Lasiodiplodia pseudotheobromae affects walnut (*Juglans regia*) in northern China (Henan Province) causing stem and branch cankers, dieback and kernel decay (Li et al., 2015).

Species of the family Botryosphaeriaceae are a significant threat to the production and sustainability of plantations of *Eucalyptus* spp., especially in areas where these species are grown as non-native plants (Smith et al., 1994, 2001; Slippers et al., 2004b, 2009; Mohali et al., 2009; Rodas et al., 2009). At least 23 species of Botryosphaeriaceae have been associated with *Eucalyptus* spp. exhibiting cankers and dieback in commercially grown plantations worldwide (Slippers et al., 2009). Among those species, *L. pseudotheobromae* has been identified on *Eucalyptus* spp. in eastern Australia (Mohali et al., 2005; Alves et al., 2008; Slippers et al., 2009) and Venezuela (Mohali et al., 2005; Alves et al., 2008; Slippers et al., 2009). Pathogenicity studies conducted by Chen et al. (2011) showed that *L. pseudotheobromae* and *L. theobromae* were the most aggressive of all the Botryosphaeriaceae tested on *Eucalyptus* spp.

Lasiodiplodia pseudotheobromae and other fungi of the family Botryosphaeriaceae were reported as the main causal agents of branch dieback, cankers, panicle and shoot blight, and decline of pistachio (*Pistacia vera*) trees in the novel growing regions of this crop across southern Spain [Autonomous Communities of Andalusia (Córdoba, Granada, Málaga and Sevilla provinces) and Extremadura (Badajoz province)] (López-Moral et al., 2020).

Based on the above, it is expected that further introduction and/or spread of *L. pseudotheobromae* in the EU would potentially cause yield and quality losses in parts of the territory where susceptible hosts are grown. However, the magnitude of this impact is not known, especially in cases where the pathogen co-infects the same hosts with other fungi of the family Botryosphaeriaceae. Moreover, it is not known whether the agricultural practices and chemical control measures currently applied in the EU could potentially reduce this impact. Given that the pathogen is a cryptic species of the *L. theobromae* complex (Alves et al., 2008), the reports on impacts of *L. theobromae* in the EU should be carefully revised as some of them might refer to those caused by *L. pseudotheobromae*.

3.6. Available measures and their limitations

Are there measures available to prevent pest entry, establishment, spread or impacts such that the risk becomes mitigated?

Yes. Although not specifically targeted against *L. pseudotheobromae*, existing phytosanitary measures (see Sections 3.3.2 and 3.4.1) mitigate the likelihood of the pathogen's further entry into the EU territory on certain host plants. Potential additional measures are also available to further mitigate the risk of re-entry and spread of the pathogen in the EU (see Section 3.6.1).

3.6.1. Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to some host plants for planting (see Section 3.3.2). Additional potential risk reduction options and supporting measures are shown in Sections 3.6.1.1 and 3.6.1.2.

3.6.1.1. Additional potential risk reduction options

Additional potential risk reduction options are listed in Table 6.

Table 6: 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

Control measure/risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Require pest freedom	Plants, plant products and other objects come from a pest-free country or a pest-free area or a pest-free place of production.	Entry/spread
Growing plants in isolation	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses. Growing nursery plants in isolation may represent an effective control measure.	Entry/Establishment/Spread
Managed growing conditions	Proper field drainage, plant distancing, use of pathogen-free agricultural tools (e.g. pruning scissors, saws and grafting blades), and removal of infected plants and plant debris in the field could potentially mitigate the likelihood of infection at origin as well as the spread of the pathogen.	Entry/Spread/Impact
Crop rotation, associations and density, weed/volunteer control	Crop rotation, associations and density, weed/volunteer control are used to prevent problems related to pests and are usually applied in various combinations to make the habitat less favourable for pests. The measures deal with (1) allocation of crops to field (over time and space) (multi-crop, diversity cropping) and (2) to control weeds and volunteers as hosts of pests/vectors. Although *L. pseudotheobromae* has a wide host range (Appendix A), crop rotation (wherever feasible) may represent an effective means to reduce inoculum sources and potential survival of the pathogen. Although weeds have not been reported as hosts for *L. pseudotheobromae*, their control could potentially make the micro-climatic conditions less favourable (e.g. by reducing moisture) to pathogen infection and spread.	Establishment/Spread/Impact

Control measure/risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Roguing and pruning	Roguing is defined as the removal of infested plants and/or uninfested host plants in a delimited area, whereas pruning is defined as the removal of infested plant parts only without affecting the viability of the plant. *Lasiodiplodia pseudotheobromae* overwinters on infected attached plant organs which can act as inoculum sources. Thus, pruning of the symptomatic plant organs may be important in reducing the sources of inoculum and spread capacity.	Spread/Impact
Biological control and behavioural manipulation	pest control such as: a) Biological control b) Sterile Insect Technique (SIT) c) Mating disruption d) Mass trapping Some microbial antagonists (e.g. endophytes and chitinolytic bacteria) (Membalik et al., 2021) and plant extracts (Asman et al., 2021; Nakasone et al., 2021) have shown *in vitro* promising results against *L. pseudotheobromae*, but none of them has been tested under field conditions.	Impact
Chemical treatments on crops including reproductive material	Several fungicides (e.g. thiophanate-methyl, pyraclostrobin, carbendazim) showed to be effective *in vitro* in inhibiting *L. pseudotheobromae* mycelial growth (Musdalifa et al., 2021), but none of them was tested under field conditions. Despite this, some fungicides (e.g. benomyl, methyl thiophanate, carbendazim, thiabendazole) were found to be effective in the field against other *Lasiodiplodia* spp.	Impact
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage. The treatments addressed in this information sheet are: a) fumigation; b) spraying/dipping pesticides; c) surface disinfectants; d) process additives; e) protective compounds The application of fungicides to plants or plant products after harvest, during process or packaging operations and storage may contribute to mitigate the likelihood of entry or spread of *L. pseudotheobromae*. Similarly, the postharvest application of chlorine dioxide fumigation on fruits is reported to decrease spore germination of some *Lasiodiplodia* species (Sahoo et al., 2021).	Entry/Spread/Impact
Physical treatments on consignments or during processing	This information sheet deals with the following categories of physical treatments: irradiation /ionisation; mechanical cleaning (brushing, washing); sorting and grading, and removal of plant parts (e.g. debarking wood). This information sheet does not address: heat and cold treatment (information sheet 1.14); roguing and pruning (information sheet 1.12). Gamma irradiation of infected mango fruits has been shown to control stem-end rot caused by *Lasiodiplodia* sp. (Singh	Entry/Spread/Impact

Control measure/risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/ spread/impact)
	and Sharma, 2018). However, the efficacy of this method to control *L. pseudotheobromae* is yet to be established.	
Cleaning and disinfection of facilities, tools and machinery	The physical and chemical cleaning and disinfection of facilities, tools, machinery, transport means, facilities and other accessories (e.g. boxes, pots, pallets, palox, supports, hand tools). The measures addressed in this information sheet are washing, sweeping and fumigation. *Lasiodiplodia pseudotheobromae* commonly enters its host plants through wounds created by pruning. Therefore, cleaning and surface sterilisation of pruning tools as well as of equipment and facilities (including premises, storage areas) are good cultural and handling practices employed in the production and marketing of any commodity and may mitigate the likelihood of further entry or spread of *L. pseudotheobromae*.	Entry/Spread
Limits on soil	*Lasiodiplodia pseudotheobromae* survives in the soil and on plant debris lying on the soil surface. Therefore, plants, plant products and other objects (e.g. used farm machinery) should be free from soil to ensure freedom from *L. pseudotheobromae*.	Entry/Spread
Soil treatment	The control of soil organisms by chemical and physical methods listed below: (a) Fumigation; (b) Heating; (c) Solarisation; (d) Flooding; (e) Soil suppression; (f) Augmentative Biological control; (g) Biofumigation Although no specific studies are available on *L. pseudotheobromae*, it is likely that soil and substrate disinfestation with chemical, biological or physical (heat, soil solarisation) means can reduce the persistence and availability of inoculum sources.	Entry/Establishment/ Spread/Impact
Use of non-contaminated water	Chemical and physical treatment of water to eliminate waterborne microorganisms. The measures addressed in this information sheet are: chemical treatments (e.g. chlorine, chlorine dioxide, ozone); physical treatments (e.g. membrane filters, ultraviolet radiation, heat); ecological treatments (e.g. slow sand filtration). Although *L. pseudotheobromae*, could potentially spread via contaminated irrigation water, physical or chemical treatment of irrigation water is likely not to be feasible under field conditions but may be applied in nurseries and greenhouses.	Entry/Spread/Impact
Waste management	Waste management (incineration, production of bioenergy) that takes place in authorised facilities and official restriction on the movement of infected plant material is in force to prevent the pest from escaping. On-site proper management of pruning residues is recommended as an efficient measure.	Entry/Establishment/ Spread
Heat and cold treatments	Controlled temperature treatments aimed to kill or inactivate pests without causing any unacceptable prejudice to the treated material itself. The measures addressed in this information sheet are: autoclaving; steam; hot water; hot air; cold treatment Although no specific studies are available for *L. pseudotheobromae*, hot water treatment at 50–55°C for	Entry/Spread

Control measure/risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
	2–5 min with or without fungicide, may be applied to reduce or eradicate inoculum sources of *Lasiodiplodia* spp. pathogens on plant organs, such as fruits (Brecht, 2020).	
Conditions of transport	Specific requirements for mode and timing of transport of commodities to prevent escape of the pest and/or contamination. a) physical protection of consignment b) timing of transport/trade If plant material, potentially infected or contaminated with *L. pseudotheobromae* (including waste material) must be transported, specific transport conditions (type of packaging/protection, transport means) should be defined to prevent the pathogen from escaping. These may include, albeit not exclusively: physical protection, sorting prior to transport, sealed packaging, etc.	Entry/Spread
Post-entry quarantine and other restrictions of movement in the importing country	This information sheet covers post-entry quarantine (PEQ) of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; Prohibition of import of relevant commodities into the domestic country. 'Relevant commodities' are plants, plant parts and other materials that may carry pests, either as infection, infestation or contamination. Recommended for plant species known to be host of *L. pseudotheobromae*. Nevertheless, this measure does not apply to fruits of host plants.	Establishment/Spread

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 7.

Table 7: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	Summary	Risk element targeted (entry/establishment/spread/impact)
Inspection and trapping	Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5). The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques. The symptoms caused by *L. pseudotheobromae* on host plants are similar to those caused by other *Lasiodiplodia* species or other fungi of the family Botryosphaeriaceae. Moreover, the pathogen may remain quiescent or latent within the host tissues (asymptomatic). Therefore, it is unlikely that *L. pseudotheobromae* could be detected based on visual inspection only.	Entry/Establishment/Spread

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	Summary	Risk element targeted (entry/establishment/ spread/impact)
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols. Diagnostic protocols describe the minimum requirements for reliable diagnosis of regulated pests. Multilocus gene sequencing analysis combined with morphological characteristics of fungal colonies, fruiting bodies and conidia is required for the reliable detection and identification of *L. pseudotheobromae* (see Section 3.1.5)	Entry/Establishment/ Spread
Sampling	According to ISPM 31, it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment. It is noted that the sampling concepts presented in this standard may also apply to other phytosanitary procedures, notably selection of units for testing. For inspection, testing and/or surveillance purposes the sample may be taken according to a statistically based or a non-statistical sampling methodology. Necessary as part of other risk reduction options.	Entry/Establishment/ Spread
Phytosanitary certificate and plant passport	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) a) export certificate (import) b) plant passport (EU internal trade) Recommended for plant species known to be host of *L. pseudotheobromae*, including plant parts (e.g. branches) and seeds for sowing.	Entry/Spread
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by the NPPO in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. Key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent the pursued phytosanitary objective. Traceability aims to provide access to all trustful pieces of information that may help to prove the compliance of consignments with phytosanitary requirements of importing countries. Certified and approved premises reduce the likelihood of the plants and plant products originating in those premises to be infected by *L. pseudotheobromae*.	Entry/Spread
Certification of reproductive material (voluntary/official)	Plants come from within an approved propagation scheme and are certified pest free (level of infestation) following testing; Used to mitigate against pests that are included in a certification scheme. The risk of entry and/or spread of *L. pseudotheobromae* is reduced if host plants for planting, including seeds for sowing, are produced under an approved certification scheme and tested free of the pathogen.	Entry/Spread

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	**Summary**	**Risk element targeted (entry/establishment/ spread/impact)**
Delimitation of Buffer zones	ISPM 5 defines a buffer zone as 'an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimise the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate' (ISPM 5). The objectives for delimiting a buffer zone can be to prevent spread from the outbreak area and to maintain a pest free production place (PFPP), site (PFPS) or area (PFA). Delimitation of a buffer zone around an outbreak area can prevent spread of the pathogen and maintain a pest-free area, site or place of production.	Spread
Surveillance	Surveillance to guarantee that plants and produce originate from a Pest Free Area could be an option. *L. pseudotheobromae* has been reported to be present in the EU. Therefore, surveillance would be an efficient supporting measure to define pest-free areas or pest-free places of production as well as to prevent further spread of the pathogen.	Spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures

- Latently infected (asymptomatic) host plants and plant products cannot be detected by visual inspection.
- The similarity of symptoms caused by *L. pseudotheobromae* and of signs (e.g. pycnidia and conidia) formed by the pathogen with those of other *Lasiodiplodia* species or other fungi of the family Botryosphaeriaceae makes impossible the detection and identification of the pathogen by visual inspection.
- The lack of rapid diagnostic methods based on molecular approaches does not allow proper *in planta* identification of the pathogen at entry. Thorough post-entry laboratory analyses may not be feasible for certain commodities as isolation in pure culture is needed prior to DNA extraction as well as molecular identification based on multigene sequencing.
- The wide host range of the pathogen limits the possibility to develop standard diagnostic protocols for all potential hosts.
- The possibility of sexual recombination in *L. pseudotheobromae* may limit the efficacy of chemical control approaches by favouring the selection of fungicide-resistant populations.

3.7. Uncertainty

There is uncertainty with respect to the geographical distribution of *L. pseudotheobromae* in the EU, as in the past, when molecular tools (particularly multigene phylogenetic analysis) were not available, the pathogen might have been misidentified as *L. theobromae*.

4. Conclusions

Lasiodiplodia pseudotheobromae is known to be present in the EU (Spain) with a restricted distribution. Therefore, *L. pseudotheobromae* satisfies the criteria that are within the remit of EFSA to assess for this species to be regarded as potential Union quarantine pest (Table 8).

Table 8: 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	Key uncertainties
Identity of the pest (Section 3.1)	The identity of *Lasiodiplodia pseudotheobromae* is clearly defined.	None
Absence/ presence of the pest in the EU (Section 3.2)	*Lasiodiplodia pseudotheobromae* is known to be present in Spain, with restricted distribution.	Uncertainty with respect to the geographical distribution of *L. pseudotheobromae* in the EU, as in the past, when molecular tools (particularly multigene phylogenetic analysis) were not available, the pathogen might have been misidentified as *L. theobromae*
Pest potential for entry, establishment and spread in the EU (Section 3.4)	*Lasiodiplodia pseudotheobromae* has already entered the EU and it may be further introduced and spread within the EU territory. The main pathways for the further entry of the pathogen into, and spread within the EU territory are: (i) host plants for planting, including seeds, (ii) fresh fruits of host plants, (iii) bark and wood of host plants and (iv) soil and other plant growing media, originating in infested third countries. *Lasiodiplodia pseudotheobromae* is present in the EU, which indicates that both the biotic (host availability) and abiotic (climate suitability) factors occurring in parts of the EU are favourable for the establishment of the pathogen. *L. pseudotheobromae* could potentially spread within the EU by both natural and human-assisted means.	None
Potential for consequences in the EU (Section 3.5)	The further introduction and/or spread of *Lasiodiplodia pseudotheobromae* into the EU is expected to have yield and quality impacts in parts of the territory where susceptible hosts are grown.	None
Available measures (Section 3.6)	Although not specifically targeted against *L. pseudotheobromae*, existing phytosanitary measures mitigate the likelihood of the pathogen's further introduction and spread in the EU territory. Potential additional measures also exist to further mitigate the risk of further introduction and spread of the pathogen in the EU.	None
Conclusion (Section 4)	*Lasiodiplodia pseudotheobromae* satisfies all the criteria that are within the remit of EFSA to assess for this species to be regarded as potential Union quarantine pest.	None
Aspects of assessment to focus on/scenarios to address in future if appropriate:	The main knowledge gap concerns the present distribution of *L. pseudotheobromae* within the EU territory. Therefore, systematic surveys should be carried out and *L. theobromae* isolates in culture collections should be re-evaluated using appropriate pest identification methods (e.g. multilocus gene sequencing analysis) to define the current geographical distribution of *L. pseudotheobromae* in the EU territory.	

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organisation
FAO	Food and Agriculture Organisation
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

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2021)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2021)
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, 2021)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2021)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2021)
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
Hitchhiker	An organism sheltering or transported accidentally via inanimate pathways including with machinery, shipping containers and vehicles; such organisms are also known as contaminating pests or stowaways (Toy and Newfield, 2010)
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, 2021)
Pathway	Any means that allows the entry or spread of a pest (FAO, 2021)
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, 2021)
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, 2021)
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, 2021)

Appendix A – *Lasiodiplodia pseudotheobromae* host plants/species affected

Source: CABI CPC (CABI, online), Farr and Rossman (2022; https://nt.ars-grin.gov/fungaldatabases/) and other sources.

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Acacia confusa*	Fabaceae	Taiwan acacia	Zhao et al. (2010)
	Acacia mangium	Fabaceae	Brown salwood	CABI CPC
	Acacia mellifera	Fabaceae	Blackthorn	Slippers et al. (2014); Ismail et al. (2012)
	Acer truncatum (syn. *Rhus cotinus*)	Sapindaceae	Purpleblow maple	Qiao et al. (2022)
	Annona crassiflora	Annonaceae	Marolo	Machado et al. (2019)
	Annona muricata	Annonaceae	Prickly custard apple	Tan et al. (2019); Burgess et al. (2019); Machado et al. (2019)
	Annona squamosa	Annonaceae	Cachiman	Machado et al. (2019)
	Annona ×atemoya	Annonaceae	Atemoya	Coutinho et al. (2017)
	Annona ×cherimola-squamosa	Annonaceae	Cherimoya	Machado et al. (2019)
	Bougainvillea spectabilis	Nyctaginaceae	Great bougainvillea	CABI CPC
	Camellia sinensis	Theaceae	Tea	Li et al. (2019)
	Carica papaya	Caricaceae	Papaya	Dissanayake et al. (2016); Netto et al. (2014)
	Celtis sinensis	Cannabaceae	Japanese hackberry	Liang et al. (2020)
	Citrus aurantium	Rutaceae	Bitter orange	Alves et al. (2008); Phillips et al. (2008); Begoude et al. (2010)
	Citrus latifolia	Rutaceae	Tahiti lime	CABI CPC
	Citrus limon			
	Citrus reticulata	Rutaceae	Mandarin	CABI CPC
	Citrus unshiu	Rutaceae	Christmas orange	Chen et al. (2021)
	Cocos nucifera	Arecaceae	Coconut	Netto et al. (2014); Dissanayake et al. (2016)
	Coffea arabica	Rubiaceae	Arabica coffee	CABI CPC
	Cotinus coggygria	Anacardiaceae	European smoketree	Qiao et al. (2022)
	Dimocarpus longan	Sapindaceae	Dragon's eye	Tan et al. (2019); Burgess et al. (2019)
	Diospyros kaki	Ebenaceae	Persimmon	CABI CPC
	Eucalyptus grandis	Myrtaceae	Saligna gum	Dissanayake et al. (2016); Perez et al. (2010)
	Eucalyptus pellita	Myrtaceae	Daintree stringybark	Burgess et al. (2019)
	Eucalyptus ×grandis-urophylla	Myrtaceae	Timor mountain gum	Li et al. (2018); Li et al. (2020)
	Gmelina arborea	Lamiaceae	Indian bulang	Alves et al. (2018); Phillips et al. (2008)
	Gossypium hirsutum	Malvaceae	American upland cotton	Naz et al. (2021)
	Hevea brasiliensis	Euphorbiaceae	Rubber	CABI CPC

Host status	Host name	Plant family	Common name	Reference
	Jatropha curcas	Euphorbiaceae	Barbados nut	
	Juglans regia	Juglandaceae	Walnut	CABI CPC
	Juniperus chinensis	Cupressaceae	Chinese juniper	Trakunyingcharoen et al. (2015)
	Lagerstroemia indica	Lythraceae	Cannonball	Dou et al. (2017)
	Macadamia integrifolia	Proteaceae	Macadamia nut	CABI CPC
	Magnolia candolei	Magnoliaceae	Magnolia	de Silva et al. (2019)
	Malus domestica	Rosaceae	Apple	CABI CPC
	Mangifera indica	Anacardiaceae	Mango	Sakalidis et al. (2011b); Tan et al. (2019); Burgess et al. (2019)
	Mangifera sylvatica	Anacardiaceae	Himalayan mango	Zhao et al. (2010)
	Manihot esculenta	Euphorbiaceae	Cassava	CABI CPC
	Morus alba	Moraceae	Silkworm mulberry	Dou et al. (2017)
	Nephelium lappaceum	Sapindaceae	Rambutan	Serrato-Diaz et al. (2020)
	Nopalea cochenillifera	Cactaceae	Cochineal cactus	Conforto et al. (2019)
	Parkinsonia aculeata	Fabaceae	Jerusalem thorn	Steinrucken et al. (2017)
	Paulownia fortunei	Paulowniaceae	Dragon tree	Zhao et al. (2010)
	Persea americana	Lauraceae	Avocado	Rodriguez-Galvez et al. (2021); Trakunyingcharoen et al. (2015)
	Phyllanthus acidus	Phyllanthaceae	Gooseberry tree	Trakunyingcharoen et al. (2015)
	Pinus sp.	Pinaceae	–	Cruywagen et al. (2017)
	Pistacia vera	Anacardiaceae	Pistache nut	López-Moral et al. (2020)
	Prunus persica	Rosaceae	Peach	Endes et al. (2016)
	Prunus salicina			
	Psidium sp.	Myrtaceae	–	Trakunyingcharoen et al. (2015)
	Rosa sp.	Rosaceae	–	Tan et al. (2019); Alves et al. (2008)
	Sansevieria trifasciata	Asparagaceae	Snake plant	Kee et al. (2019)
	Santalum album	Santalaceae	Indian sandalwood	Burgess et al. (2019)
	Schizolobium parahyba	Fabaceae	Brazilian fern tree	Dissanayake et al. (2016)
	Schizolobium parahyba var. *amazonicum*	Fabaceae	Brazilian fern tree	Dissanayake et al. (2016)
	Selenicereus spp. (syn. *Hylocereus* spp.)	Cactaceae	Moonlight cactus	de Mello et al. (2022)
	Syzygium samarangense	Myrtaceae	Java apple	Trakunyingcharoen et al. (2015)
	Tamarindus indica	Fabaceae	Indian date	Coutinho et al. (2017)
	Tectona grandis	Lamiaceae	Common teak	Doilom et al. (2015); Dissanayake et al. (2016)
	Terminalia catappa	Combretaceae	Barbados almond	Begoude et al. (2010)
	Terminalia sericea	Combretaceae	Assegai wood	Begoude et al. (2010)
	Theobroma cacao	Malvaceae	Cocoa	CABI CPC
	Vaccinium corymbosum	Ericaceae	High-bush blueberry	Burgess et al. (2019); Wang et al. (2016)

Host status	Host name	Plant family	Common name	Reference
	Vachellia karroo	Fabaceae	Karroo thorn	Jami et al. (2015)
	Vitis vinifera	Vitaceae	Grapevine	CABI CPC
	Zea mays	Poaceae	Indian corn	Swamy et al. (2020)
Wild weed hosts	*Adansonia digitata*	Malvaceae	African baobab	Cruywagen et al. (2017); Jami et al. (2017)
	Albizia falcataria	Fabaceae	Moluccan albizia	Zhao et al. (2010)
	Anacardium humile	Anacardiaceae	–	Coutinho et al. (2017)
	Anacardium occidentale	Anacardiaceae	Cashew nut	CABI CPC
	Aquilaria crassna	Thymelaeaceae	Agarwood	Wang et al. (2019)
	Bouea burmanica	Anacardiaceae	–	Trakunyingcharoen et al. (2015)
	Cananga odorata	Annonaceae	Macassar-oil tree	Trakunyingcharoen et al. (2015)
	Cynometra malaccensis	Fabaceae	Plum mango	Gomdola et al. (2020)
	Durio zibethinus	Malvaceae	Durian	Chantarasiri and Boontanom (2021)
	Ficus racemosa	Moraceae	Cluster fig	Trakunyingcharoen et al. (2015)
	Jatropha curcas	Crotonoideae	Barbados nut	Li et al. (2018); Coutinho et al. (2017); Dissanayake et al. (2016)
	Macadamia spp.	Proteaceae	Macadamia nut	CABI CPC
	Malus pumila	Rosaceae	Apple	Xue et al. (2019)
	Morinda officinalis	Rubiaceae	Indian mulberry	CABI CPC
	Ormosia pinnata	Fabaceae	Horse-eye beans	CABI CPC
	Osmanthus fragrans	Oleaceae	Fragrant olive	Trakunyingcharoen et al. (2015)
	Pandanus sp.	Pandanaceae	Pandan	
	Plukenetia volubilis	Euphorbiaceae	Inca nut	Tennakoon et al. (2016); Wang and Song (2021)
	Pteridium aquilinum	Dennstaedtiaceae	Bracken	Dou et al. (2017);
	Pterocarpus angolensis	Fabaceae	African teak	Mehl et al. (2011); Ismail et al. (2012)
	Sclerocarya birrea	Anacardiaceae	Cider tree	Mehl et al. (2017)
	Senegalia mellifera	Fabaceae	Black thorn	Jami et al. (2017)
	Spondias purpurea	Anacardiaceae	Purple mombin	Coutinho et al. (2017)
	Syzygium cordatum	Myrtaceae	Waterbessie	Pillay et al. (2013); Jami et al. (2017)

Appendix B – Distribution of Lasiodiplodia pseudotheobromae

Distribution records based on CABI CPC (CABI, online), Farr and Rossman (2022; https://nt.ars-grin.gov/fungaldatabases/) and literature.

Region	Country	Sub-national (e.g. State)	Status	Reference
North America	Mexico		Present	CABI (online)
	Puerto Rico		Present	CABI (online)
South America	Brazil		Present	CABI (online)
		Pernambuco	Present	CABI (online)
		Sao Paulo	Present	CABI (online)
	Costa Rica		Present	Alves et al. (2008); Zhao et al. (2010)
	Peru		Present	Rodríguez-Gálvez et al. (2017)
	Republic of Ecuador		Present	
	Suriname		Present	Alves et al. (2008); Phillips et al. (2013)
	Uruguay		Present	Perez et al. (2010)
	Venezuela		Present	CABI (online)
EU (27)	Netherlands		Uncertain	Phillips et al. (2013); Alves et al. (2008); Zhao et al. (2010); Chen et al. (2011) NPPO Netherlands: One isolate collected in the 1970s; no other reports; absence not confirmed by surveys
	Spain		Present	López-Moral et al. (2020)
Africa	Congo		Present	Alves et al. (2008)
	Egypt		Present	
	Guinea-Bissau		Present	CABI (online)
	Mozambique		Present	Cruywagen et al. (2017)
	Namibia		Present	Ismail et al. (2012); Slippers et al. (2014)
	Republic of Madagascar		Present	
	South Africa		Present	Cruywagen et al. (2017); Jami et al. (2017)
	Tunisia		Present	Rezgui et al. (2018)
Asia	China		Present	CABI (online)
		Guangdong	Present	CABI (online)
		Guangxi	Present	CABI (online)
		Hainan	Present	CABI (online)
		Henan	Present	CABI (online)
		Hubei	Present	CABI (online)
		Jiangsu	Present	CABI (online)
	India		Present	CABI (online)
	Iran		Present	Abdollahzadeh et al. (2010)
	Laos		Present	Wang et al. (2019)
	Malaysia	Sabah	Present	CABI (online)
			Present	CABI (online)
	Pakistan		Present	CABI (online)
	Republic of Korea		Present	Kwon et al. (2017)
	Thailand		Present	Trakunyingcharoen et al. (2015)
	Türkiye		Present	Endes et al. (2016)
Oceania	Australia		Present	CABI (online)

Appendix C – EU 27 annual imports of fresh produce of hosts from countries where *Lasiodiplodia pseudotheobromae* is present, 2017–2021 (in 100 kg)

Source: Eurostat accessed on 21/10/2022

The pathogen is known to be present in the US only in Puerto Rico

		2016	2017	2018	2019	2020
Fresh or dried avocados	Mexico	445,611.06	463,741.28	767,878.48	716,092.02	750,933.03
	United States	1.19	2,546.86	0.02	4.66	45.38
	Brazil	71,040.5	68,697.61	78,673.73	48,183.83	50,802.49
	Costa Rica	21.56	9.98	428.45	686.4	201.6
	Peru	1,353,466.49	2,009,222.64	1,584,511.63	2,132,092.95	2,661,522.61
	Ecuador	1,052.41	1,264.87	2,314.26	1,763.14	3,368.06
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of	233.4	111.12	71.29		
	Congo				1.48	
	Egypt	5.35	4.58	79.92	363.95	38.44
	Guinea	6				
	Mozambique	559.8	1,294.13	7,134.23	8,014.81	10,737.78
	Namibia					
	Madagascar				0.96	1.11
	South Africa	315,854.56	652,817.98	401,352.79	416,290.22	417,245.48
	Tunisia					
	China	35.28		1.23	0.04	0.12
	India	2.06	0.52	0.06		2.35
	Iran, Islamic Republic of	0				0.03
	Lao People's Democratic Republic					
	Malaysia		47.04			0.04
	Pakistan					0
	Korea, Republic of					
	Thailand	9.76	9.66	9.06	3.39	25.85
	Türkiye	477.05	1,530.93	2,172.09	1,864.65	961.66
	Australia			0.01		0.31
	Sum	2,188,376.47	3,201,299.2	2,844,627.25	3,325,362.5	3,895,886.34

		2016	2017	2018	2019	2020
Fresh or dried guavas, mangoes and mangosteens	Mexico	40,848.36	46,001.68	50,935.79	51,841.89	46,655.37
	United States	45,478.21	54,660.34	82,580.54	82,852.21	51,111.00
	Brazil	1,158,717.06	1,241,860.63	1,437,569.2	1,577,043.99	1,797,178.23
	Costa Rica	19,119.58	18,368.68	12,830.62	14,950.59	23,130.33
	Peru	850,046.15	1,146,171.88	1,012,834.88	1,187,835.17	1,207,152.44
	Ecuador	13,840.91	9,491.23	9,608.87	10,660.02	7,684.59
	Suriname	126.18	164.18	171.7		
	Uruguay					

		2016	2017	2018	2019	2020
	Venezuela, Bolivarian Republic of	2,033.75	2,401.44	1,939.11	282.69	522.3
	Congo					
	Egypt	9,186.69	4,855.57	6,407.46	12,233.16	6,222.90
	Guinea	3,846.36	3,303.14	3,106.88	875.01	445.32
	Mozambique		122.61	126.65	134.13	180.99
	Namibia					
	Madagascar	22.1	15.02	0.66	1.05	20.64
	South Africa	13,015.45	9,739.99	12,116.95	8,656.28	5,777.96
	Tunisia					0.01
	China	51.87	180.81	78.23	104.34	248.77
	India	8,148.87	9,470.36	9,315.51	7,347.61	16,576.61
	Iran, Islamic Republic of	12.12	3	9.1	1.56	19.45
	Lao People's Democratic Republic	620.36	603.14	806.5	525.32	285.98
	Malaysia	197.22	170.64	72.72	44.56	19.01
	Pakistan	15,912.58	21,867.43	29,207.33	16,196.5	19,732.88
	Korea, Republic of					
	Thailand	7,401.8	6,911.89	6,743.91	5,260.84	4,919.06
	Türkiye	0.21	24.09	68.86	38.93	86.48
	Australia	94.18	62.92			0.01
	Sum	2,188,720.01	2,576,450.67	2,676,531.47	2,976,885.85	3,187,970.33

		2016	2017	2018	2019	2020
Citrus fruit, fresh or dried	Mexico	553,818.66	589,021.12	443,743.54	349,648.63	184,528.12
	United States	231,210.47	185,706.99	177,755.45	148,608.92	113,949.21
	Brazil	903,432.95	900,907.24	822,134.46	902,590.26	1,061,352.72
	Costa Rica	921.32	704.93	231.2	461.6	35.2
	Peru	307,974.23	319,766.61	369,251.64	418,362.28	545,984.71
	Ecuador	2,127.19	729.99	1,114.58	127.28	2,312.97
	Suriname	11.27	2.94	0.1		109
	Uruguay	369,933.66	374,356.5	402,778.68	334,468.13	433,248.33
	Venezuela, Bolivarian Republic of	2,216.36	681.07			
	Congo					
	Egypt	2,246,998.88	2,643,272.02	2,206,932.71	2,850,745.77	3,398,718.39
	Guinea					
	Mozambique					
	Namibia		202.8			
	Madagascar	26.42	11.62	7.16	22.16	1.91
	South Africa	5,802,017.61	6,381,124.73	6,196,837.96	7,830,147.6	7,950,282.74
	Tunisia	172,515.76	125,258.3	133,950.15	75,620.02	115,586.91
	China	1,084,857.27	1,024,163.15	1,108,595.22	1,098,689.98	648,410.51
	India	1	449.63	88.51	254.95	22.37

		2016	2017	2018	2019	2020
	Iran, Islamic Republic of	1,218.52	1,208.01	2,174.22	1,882.74	1,910.39
	Lao People's Democratic Republic	2.1			20.23	0.95
	Malaysia	39.02	83.45	7.71		
	Pakistan		2.45	0.59		272
	Korea, Republic of	0.01		21.09	15	
	Thailand	1,283.13	659.74	624.93	194.87	245.31
	Türkiye	2,026,980.05	3,149,386.85	2,102,077.48	2,574,009.13	2,291,682.22
	Australia	1,284.38	644.97	10,645.4	2,343.47	4,097.42
	Sum	13,708,870.26	15,698,345.11	13,978,972.78	16,588,213.02	16,752,751.38

		2016	2017	2018	2019	2020
Fresh persimmons	Mexico					
	United States					
	Brazil	315.72	337.6	974.78	428.63	859.52
	Costa Rica					
	Peru			0.05	787.63	1,860.3
	Ecuador					
	Suriname					
	Uruguay	913.19	872.76	1,392.9	448.5	650.81
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt					
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa	817.79	206.08	7,857.42	4,974.49	5,551
	Tunisia					
	China		5.09		17.4	42.85
	India					
	Iran, Islamic Republic of					
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan			0.52		
	Korea, Republic of		0.05	0.8		
	Thailand		0.07			2.26
	Türkiye	10.29	1.50		52.88	155.23
	Australia					
	Sum	2,056.99	1,423.15	10,226.47	6,709.53	9,121.97

		2016	2017	2018	2019	2020
Fresh apples	Mexico					
	United States	545.82	2,874.22			0.09
	Brazil	249,520.21	242,632.64	139,015.43	92,900.91	154,115.65
	Costa Rica			211.68		211.68
	Peru		214.85		157.38	
	Ecuador					
	Suriname					
	Uruguay	55,103.38	30,072.47	14,164.5	2,310.32	15,521.13
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt	3,234.13	2,299.68		2,501.73	210.89
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa	252,068.96	334,615.9	258,077.03	329,086.35	405,094.64
	Tunisia	152				
	China	1,644.89	15,539.34	780.15	4,778.37	6,152.37
	India				0.45	0.16
	Iran, Islamic Republic of		2,945.28	0.38	676.65	
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan			1.95	0.08	
	Korea, Republic of			4.17		
	Thailand	3.79				3.1
	Türkiye	1,610.74	17,594.86	2,311.21	19,023.31	9,623.89
	Australia	4,926.09	9,159.46	8,311.03	3,638.72	6,971.08
	Sum	568,810.01	657,948.7	422,877.53	455,074.27	597,904.68

		2016	2017	2018	2019	2020
Fresh plums	Mexico		211.68			
	United States			0.29	0.08	0.03
	Brazil	84.84	122.95			
	Costa Rica			319.01		
	Peru	277.7		190.4	36	
	Ecuador					
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					10.89
	Egypt	430.50		0.08	0.71	195.40
	Guinea					
	Mozambique					

		2016	2017	2018	2019	2020
	Namibia					
	Madagascar					
	South Africa	283,934.63	258,257.47	197,059.92	219,211.08	380,386.26
	Tunisia		661.97			
	China		0.10			
	India		0.45			3.76
	Iran, Islamic Republic of	2.94	17.54	14.18	10.22	
	Lao People's Democratic Republic	0.04				
	Malaysia				0.01	
	Pakistan	0.5	1.2	0.61	4.25	16.22
	Korea, Republic of			0.05		
	Thailand	7.33	0.85	0.28	32.98	3.99
	Türkiye	31,089.82	15,990.12	11,194.45	28,141.20	24,191.58
	Australia		7.64	15.28	196.93	5.17
	Sum	315,828.3	275,271.97	208,794.55	247,633.46	404,813.3

		2016	2017	2018	2019	2020
Fresh cranberries, bilberries and other fruits of the genus *Vaccinium*	Mexico	1,012.68	2,037.56	2,228.58	211.38	409.76
	United States	5,842.46	4,891.68	8,219.02	6,685.87	5,766.72
	Brazil		57.60		416.80	
	Costa Rica		165.05			
	Peru	110,384.41	143,419.52	270,539.03	450,502.38	486,117.66
	Ecuador					0.56
	Suriname					
	Uruguay	3,847.86	4,452.52	2,984.56	2,598.80	1,605.67
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt				0.05	16.92
	Guinea					
	Mozambique					
	Namibia				1,389.24	1,089.15
	Madagascar					
	South Africa	18,330.92	25,932.33	51,078.34	77,053.04	117,981.18
	Tunisia					
	China	0.23	5.63	28.90		0.06
	India			0.04	0.70	0.99
	Iran, Islamic Republic of	0.96		1.50	3.00	11.40
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of					
	Thailand	0.51		0.07	0.02	1.22

		2016	2017	2018	2019	2020
	Türkiye		19.11	194.91	257.92	1,417.47
	Australia	0.50	0.57			
	Sum	139,420.53	180,981.57	335,274.95	539,119.2	614,418.76

		2016	2017	2018	2019	2020
Fresh grapes	Mexico	358.96		186.71	184.62	
	United States	8,868.74	4,413.37	1,866.20	1,072.48	4.59
	Brazil	249,279.81	271,987.56	196,465.22	228,091.31	359,340.14
	Costa Rica					
	Peru	438,731.10	747,335.51	759,554.28	782,844.53	1,077,744.59
	Ecuador		345.8	1,807.16	2,266.12	2,907.14
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt	404,801.23	429,994.87	442,798.85	462,889.85	489,796.35
	Guinea					
	Mozambique					
	Namibia	116,952.87	189,844.45	211,463.74	161,540.72	185,257.37
	Madagascar					
	South Africa	1,392,515.89	1,420,569.43	1,397,681.57	1,397,842.25	1,675,463.66
	Tunisia		239.62	40.6	192	
	China	6.00	0.03			6.68
	India	827,467.67	722,802.04	950,910.96	733,563.65	835,020.62
	Iran, Islamic Republic of		2,158.5	366.00	399.80	305.77
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of	2.88	4.32	0.09		22.43
	Thailand	0.14	0.16		0.87	0.43
	Türkiye	375,776.41	227,616.42	272,447.02	287,605.27	330,206.04
	Australia	0.50				
	Sum	3,814,762.2	4,017,312.08	4,235,588.4	4,058,493.47	4,956,075.81

		2016	2017	2018	2019	2020
Fresh peaches	Mexico					
	United States			0.10		0.01
	Brazil	82.05	113.18	7.20	40.40	28.84
	Costa Rica		9.00			
	Peru			136.00	53.76	
	Ecuador					
	Suriname					
	Uruguay					

		2016	2017	2018	2019	2020
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt	1,578.86	515.99	1,360.92	824.36	21.75
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa	5,399.50	6,688.34	6,593.80	6,823.13	8,718.61
	Tunisia	495.72	1,094.61	639.22	1,693.51	2,914.58
	China			3.24		0.00
	India					
	Iran, Islamic Republic of					
	Lao People's Democratic Republic					
	Malaysia				0.77	
	Pakistan					0.04
	Korea, Republic of					
	Thailand					
	Türkiye	10,338.18	24,759.01	5,756.57	65,266.72	73,708.45
	Australia	138.06	149.04	143.38	134.44	30.45
	Sum	18,032.37	33,329.17	14,640.43	74,837.09	85,422.73

		2016	2017	2018	2019	2020
Fresh or dried walnuts, in shell	Mexico					
	United States	383,879.68	323,790.90	396,442.89	371,035.9	334,524.82
	Brazil					
	Costa Rica		0.01			
	Peru					
	Ecuador	192				
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt					
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa	930.25		1,092.5	1,126.07	958.42
	Tunisia				1,532.25	
	China	198.20	708.85	776.63	1,518.23	1,385.26
	India	1.13	0.09		0.1	0
	Iran, Islamic Republic of	0.04	1.27	1.02	0.71	8.96

		2016	2017	2018	2019	2020
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan				0.46	
	Korea, Republic of				0.58	
	Thailand					
	Türkiye	426.6	422.02	463.47	228.11	35.1
	Australia	46,968.6	31,801.8	24,101.3	30,369.2	28,829.42
	Sum	432,596.5	356,724.94	422,877.81	405,811.61	365,741.98

		2016	2017	2018	2019	2020
Fresh or dried pistachios, in shell	Mexico					
	United States	543,547.63	523,093.94	718,669.61	674,398.4	760,986.98
	Brazil					
	Costa Rica					
	Peru					
	Ecuador					
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt		107	199.58		
	Guinea					
	Mozambique					
	Namibia					
	Madagascar			0.02		
	South Africa			390.1	239.35	6.6
	Tunisia		6.01		0.02	0.05
	China	0.39	777.73	400.89	798.23	0.02
	India	0.03	0.01	0.37	1.3	0.34
	Iran, Islamic Republic of	163,614.36	160,472.69	51,644.32	151,918.03	188,088.93
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan	0.08			5.67	
	Korea, Republic of				0.02	
	Thailand	0.05				0.06
	Türkiye	595.35	1,160.66	2,094.93	1,046.79	4,306.44
	Australia					0
	Sum	707,757.89	685,618.04	773,399.82	828,407.81	953,389.42

		2016	2017	2018	2019	2020
Maize or corn	Mexico	1,446.94	427,406.39	2,773.28	1,461.51	2,359.14
	United States	6,638,863.65	17,748,274.58	175,400.69	113,408.35	71,631.09

		2016	2017	2018	2019	2020
	Brazil	40,422,755.38	45,533,847.79	49,693,132.47	41,527,814.75	31,463,321.71
	Costa Rica				3.00	
	Peru	53,088.73	59,114.83	59,498.28	53,086.89	58,104.93
	Ecuador	80.00	312.78	61.57	30.00	30.02
	Suriname					
	Uruguay	56.09	36.10	45.66	5.41	40.70
	Venezuela, Bolivarian Republic of					
	Congo					0.09
	Egypt	242.83	15.00	248.70	11.30	4.25
	Guinea		23.20	8.22	35.00	95.03
	Mozambique	27.64	123.54	6.40		12.16
	Namibia					0.00
	Madagascar	6,607.69	758.61	721.14	444.53	1,213.36
	South Africa	45,595.31	2,563,570.36	508,866.58	318,013.64	2,743,740.64
	Tunisia	0.01		11.74		0.02
	China	49,315.06	13,505.70	1,857.99	536.71	375.87
	India	110.41	9,903.18	663.15	2,040.51	2,412.22
	Iran, Islamic Republic of	13.71	198.98			12.68
	Lao People's Democratic Republic					
	Malaysia				8.05	3.00
	Pakistan					3.86
	Korea, Republic of	0.90	5.19	4.15	25.88	14.95
	Thailand	1,841.34	1,801.98	1,615.47	6,117.68	5,250.64
	Türkiye	327,064.31	118,147.55	72,199.53	107,505.34	121,484.48
	Australia	19,821.10	20,988.74	30.32	1.97	20.88
	Sum	47,566,931.1	66,498,034.5	50,517,145.34	42,130,550.52	34,470,131.72

		2016	2017	2018	2019	2020
Maize seed for sowing	Mexico	1,333.64	1,369.71	1,480.72	1,070.18	1,573.44
	United States	46,241.68	35,856.15	20,771.26	24,027.41	15,731.00
	Brazil	0.64	0.63	0.97	0.78	3.83
	Costa Rica					
	Peru	206.55	516.46	1,164.16	1,732.56	1,975.00
	Ecuador					
	Suriname					
	Uruguay	56.09	36.10	45.66	5.40	40.70
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt	2.83	0.00	1.20	2.23	4.25
	Guinea					
	Mozambique					
	Namibia					

		2016	2017	2018	2019	2020
	Madagascar					
	South Africa	117.42	1,272.89	3.07	2,011.45	27.19
	Tunisia			11.74		0.02
	China	0.12	5.08	0.21	0.05	1.59
	India	0.00	0.21	4.23	1.32	14.67
	Iran, Islamic Republic of		198.98			
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of					
	Thailand	0.39	1.52	0.52	9.25	1.68
	Türkiye	53,460.18	53,616.07	51,208.45	77,671.14	76,834.24
	Australia	0.90	0.38	30.26	0.47	1.32
	Sum	101,420.44	92,874.18	74,722.45	106,532.24	96,208.93

		2016	2017	2018	2019	2020
Edible fruit or nut trees, shrubs and bushes, whether or not grafted	Mexico	2.44	0.42	5.52	0.63	0.54
	United States	18,612.69	7,497.05	6,904.85	11,959.90	14,216.30
	Brazil				0.78	
	Costa Rica					
	Peru			0.28		3.99
	Ecuador	0.15	0.32			7.40
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt	32.73		0.11		
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa	0.13	112.01	30.48	440.81	83.39
	Tunisia	105.00	111.42	144.73	129.40	148.86
	China	552.35	404.63	642.61	305.32	31.81
	India	4.00		0.22		0.03
	Iran, Islamic Republic of			8.17		
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of			163.76		0.10
	Thailand	148.80		0.22	0.36	203.65

		2016	2017	2018	2019	2020
	Türkiye	3,631.03	5,188.93	8,628.70	2,591.56	2,673.67
	Australia	6.50	0.44		2.99	175.72
	Sum	23,095.82	13,315.22	16,529.65	15,431.75	17,545.46

		2016	2017	2018	2019	2020
Outdoor trees, shrubs and bushes, incl. their roots, with bare roots (excl. cuttings, slips and young plants, and fruit, nut and forest trees)	Mexico					
	United States		1,597.53	15.00		0.86
	Brazil					
	Costa Rica					
	Peru					
	Ecuador					
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt	525.00		840.50		561.11
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa					
	Tunisia					
	China	78.90	3.99	0.05		110.43
	India					
	Iran, Islamic Republic of					
	Lao People's Democratic Republic					
	Malaysia					2.13
	Pakistan					
	Korea, Republic of					
	Thailand		0.10	5.37	23.40	
	Türkiye		2.99	9.20	36.85	
	Australia					
	Sum	603.9	1,604.61	870.12	60.25	674.53

		2016	2017	2018	2019	2020
Citrus trees and shrubs, grafted or not (excl. with bare roots)	Mexico					
	United States					0.08
	Brazil					
	Costa Rica					
	Peru					
	Ecuador					
	Suriname					
	Uruguay					

		2016	2017	2018	2019	2020
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt					
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa				0	0
	Tunisia					
	China					6.00
	India					
	Iran, Islamic Republic of					
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of					
	Thailand					
	Türkiye					
	Australia					
	Sum	0	0	0	0	6.08

		2016	2017	2018	2019	2020
Roses, whether or not grafted	Mexico					
	United States	5.15	5.28	1.34	0.61	0.28
	Brazil					
	Costa Rica					
	Peru					
	Ecuador	2.35	3.69	2.48	0.44	
	Suriname	0.99	0.64	0.52	0.33	
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt					
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa	2.22	1,456.9	14.29	7.64	
	Tunisia					
	China	1,019.42	2,510.23	623.75	3.01	623.10
	India	3.52	17.18	17.67	17.8	24.68
	Iran, Islamic Republic of					

		2016	2017	2018	2019	2020
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of	0.79	4.13	29.14	2.28	0.74
	Thailand	0.08	1.80	0.38		4.68
	Türkiye	94.96	0.85		8.85	215.61
	Australia					
	Sum	1,129.48	4,000.7	689.57	40.96	869.09

		2016	2017	2018	2019	2020
Live forest trees	Mexico					
	United States	67.47	0.45	0.05	0.63	0.00
	Brazil	0.01				
	Costa Rica					
	Peru					
	Ecuador					
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt					
	Guinea					
	Mozambique					
	Namibia					
	Madagascar					
	South Africa	0				
	Tunisia					
	China	63.47				
	India	0				
	Iran, Islamic Republic of					
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of					
	Thailand					
	Türkiye	4.73				
	Australia					
	Sum	135.68	0.45	0.05	0.63	0

		2016	2017	2018	2019	2020
Outdoor trees, shrubs and bushes, incl. their roots (excl. with bare roots, cuttings, slips, young plants, conifers, evergreens and fruit, nut and forest trees)	Mexico					
	United States	717.54	331.32	12.39	12.21	27.73
	Brazil					0.01
	Costa Rica	350	467.83	241.6	129.4	120
	Peru					
	Ecuador					
	Suriname					
	Uruguay					
	Venezuela, Bolivarian Republic of					
	Congo					
	Egypt			30.00		
	Guinea					
	Mozambique					
	Namibia					
	Madagascar			0.06		
	South Africa					0.35
	Tunisia					0
	China	2,606.02	3,507.95	2,885.78	1,290.82	2,065.04
	India					0
	Iran, Islamic Republic of					
	Lao People's Democratic Republic					
	Malaysia					
	Pakistan					
	Korea, Republic of	39.22	19.22	0.8		37.83
	Thailand	40.53	224.61	124.01	123.00	71.57
	Türkiye	1,140.89	4,203.11	8,856.50	10,318.57	22,230.44
	Australia		535.5		0.2	
	Sum	4,894.2	9,289.54	12,151.14	11,874.2	24,552.97

		2016	2017	2018	2019	2020
Wood in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood in the form of railway sleepers; wood cut into boards or beams, etc.)	Mexico	4,084.73	6,029.38	7,703.67	7,012.45	4,712.20
	United States	662,928.87	9,35,407.63	546,679.75	491,686.67	614,638.86
	Brazil	1,186.88	62,750.29	786,081.61	1,575,043.54	6,525,272.99
	Costa Rica	1,054.22	1,765.29	5,119.72	2,819.00	3,268.28
	Peru	20.85	26.33	29.71	39.31	268.46
	Ecuador	3,046.15	2,973.93	5,683.21	6,335.12	28,887.73
	Suriname	16,836.48	12,646.55	13,674.27	11,726.75	8,657.67
	Uruguay	132.55	2.40	2,555.14	2,901.72	13.29
	Venezuela, Bolivarian Republic of	560.00		101.09		450.30
	Congo	276,694.78	295,211.44	340,732.45	294,885.50	434,556.17
	Egypt	2,719.30			1,278.35	
	Guinea		203.70			
	Mozambique	242.10		2.75	1.50	449,936.64

		2016	2017	2018	2019	2020
	Namibia	233.80	96.25	211.00	806.22	
	Madagascar	258.78	82.78	69.30	59.87	517.28
	South Africa	28,925.20	38,092.88	30,289.10	27,127.77	26,062.82
	Tunisia	10.14	0.22			15.22
	China	23,079.75	12,979.50	10,474.35	24,651.13	46,064.73
	India	702.74	93.67	670.93	6.38	1.58
	Iran, Islamic Republic of					
	Lao People's Democratic Republic			202.13		
	Malaysia	5,043.04	8,347.47	7,741.71	6,407.28	4,220.68
	Pakistan			14.75	30.73	
	Korea, Republic of		0.00		0.01	
	Thailand	77.03	21.00	104.70	742.61	0.02
	Türkiye	6,986.10	5,289.58	4,402.52	82.41	89.64
	Australia	99.99	154.93	934.60	879.51	379.26
	Sum	1,034,923.48	1,382,175.22	1,763,478.46	2,454,523.83	8,148,013.82

Appendix D – EU 27 and member state cultivation/harvested/production area of *Lasiodiplodia pseudotheobromae* hosts (in 1,000 ha)

Source EUROSTAT (accessed 19/10/2022).

Maize (Grain maize and corn-cob mix)	2017	2018	2019	2020	2021
EU 27	8,266.64	8,252.47	8,910.74	9,354.73	9,237.38
Belgium	49.00	53.99	48.64	51.88	48.20
Bulgaria	398.15	444.62	560.91	581.53	573.02
Czechia	86.00	81.85	74.83	87.23	102.44
Denmark	5.10	6.30	5.40	6.20	6.40
Germany	432.00	410.90	416.00	419.30	430.70
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	132.49	113.45	115.50	116.78	112.82
Spain	333.63	322.37	356.83	343.78	358.27
France	1,435.70	1,426.26	1,506.10	1,691.13	1,547.12
Croatia	247.12	235.35	255.89	288.40	287.98
Italy	645.74	591.21	628.80	602.86	588.60
Cyprus	0.00	0.00	0.00	0.00	0.00
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	9.93	13.39	12.77	20.20	17.87
Luxembourg	0.08	0.09	0.14	0.12	0.07
Hungary	988.82	939.08	1,027.59	981.01	1,054.57
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	12.25	13.76	19.01	19.42	17.20
Austria	209.48	209.90	220.69	212.60	218.20
Poland	562.11	645.41	664.95	946.06	998.47
Portugal	86.52	83.36	77.02	72.99	74.47
Romania	2,405.24	2,443.95	2,681.93	2,680.10	2,554.68
Slovenia	38.29	37.08	38.88	39.83	41.40
Slovakia	187.81	179.03	197.24	191.48	203.16
Finland	0.00	0.00	0.00	0.00	:
Sweden	1.19	1.11	1.62	1.85	1.74

Maize (Green maize)	2017	2018	2019	2020	2021
EU 27	5,985.90	6,134.91	6,210.36	6,325.30	6,050.71
Belgium	171.28	179.74	175.30	181.54	183.10
Bulgaria	29.93	27.24	27.50	30.44	30.11
Czechia	223.21	224.11	232.39	226.16	216.98
Denmark	166.70	179.60	186.40	188.70	173.90
Germany	2,095.90	2,195.90	2,222.70	2,299.70	2,219.60
Estonia	9.18	10.55	13.71	13.60	13.02
Ireland	11.88	17.76	16.62	14.77	14.42
Greece	125.55	129.64	128.07	103.19	103.27
Spain	107.36	107.34	116.46	115.12	118.25
France	1,406.01	1,415.73	1,438.25	1,418.89	1,240.84
Croatia	28.29	25.35	25.41	30.11	25.13
Italy	342.10	355.33	367.42	379.07	375.56
Cyprus	0.17	0.12	0.14	0.11	0.13

Maize (Green maize)	2017	2018	2019	2020	2021
Latvia	22.10	25.50	23.80	22.80	24.90
Lithuania	24.34	28.25	32.94	29.92	29.39
Luxembourg	15.19	15.88	15.78	16.87	17.07
Hungary	69.05	66.40	66.30	62.04	67.54
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	203.51	203.22	186.23	194.65	183.30
Austria	82.19	83.35	85.68	86.86	85.13
Poland	596.01	601.58	599.86	674.31	691.92
Portugal	78.43	74.33	71.94	71.27	71.06
Romania	50.10	47.76	51.81	47.24	51.37
Slovenia	29.19	29.82	30.15	30.63	29.66
Slovakia	81.44	73.11	75.10	67.58	65.85
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	16.80	17.29	20.39	19.72	19.22

Grapes	2017	2018	2019	2020	2021
EU 27	3,133.32	3,135.50	3,155.20	3,145.71	3,101.47
Belgium	0.24	0.30	0.38	0.49	0.56
Bulgaria	34.11	34.11	30.05	28.74	28.53
Czechia	15.81	15.94	16.08	16.14	16.36
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	:	:	:	:	:
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	101.75	100.34	101.85	104.21	72.36
Spain	937.76	939.92	936.89	931.63	929.39
France	750.46	750.62	755.47	759.06	756.52
Croatia	21.90	20.51	19.82	21.45	21.21
Italy	670.09	675.82	697.91	703.90	702.67
Cyprus	5.93	6.67	6.67	6.79	6.22
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	1.26	1.25	1.24	1.24	1.23
Hungary	67.08	66.06	64.92	59.63	59.07
Malta	0.68	0.42	0.42	0.45	0.47
Netherlands	0.16	0.17	0.16	0.17	0.19
Austria	46.33	46.50	46.36	46.16	42.84
Poland	0.67	0.73	0.74	1.00	1.00
Portugal	178.95	179.25	175.65	175.67	175.59
Romania	175.32	172.80	176.34	165.60	163.61
Slovenia	15.86	15.65	15.57	15.29	14.90
Slovakia	8.47	8.01	7.92	7.73	7.75
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.04	0.05	0.05	0.08	0.09

Apples	2017	2018	2019	2020	2021
EU 27	504.61	506.27	491.08	484.63	496.62
Belgium	6.16	5.99	5.79	5.48	5.35

Apples	**2017**	**2018**	**2019**	**2020**	**2021**
Bulgaria	3.97	3.98	4.14	3.56	3.78
Czechia	7.35	7.25	7.32	7.19	7.11
Denmark	1.28	1.42	1.39	1.38	1.40
Germany	33.98	33.98	33.98	33.98	33.98
Estonia	0.48	0.60	0.57	0.62	0.73
Ireland	0.70	0.71	0.71	0.71	0.71
Greece	9.60	10.35	9.82	14.38	13.88
Spain	30.55	29.93	29.64	29.49	29.45
France	50.31	50.54	50.37	50.15	54.69
Croatia	4.84	4.73	4.95	4.36	4.39
Italy	57.26	57.44	55.00	54.91	54.47
Cyprus	0.37	0.37	0.37	0.38	0.40
Latvia	3.30	3.20	3.44	3.50	3.20
Lithuania	9.82	10.13	10.18	10.50	10.17
Luxembourg	0.27	0.27	0.27	0.08	0.10
Hungary	32.17	31.84	30.97	25.97	25.02
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	7.00	6.60	6.42	6.20	5.97
Austria	6.67	6.74	6.59	6.43	6.35
Poland	162.53	166.15	155.62	152.60	161.90
Portugal	13.85	13.61	14.31	14.31	13.92
Romania	55.60	53.94	52.74	52.34	53.82
Slovenia	2.36	2.33	2.27	2.16	2.09
Slovakia	2.18	2.14	2.06	1.80	1.64
Finland	0.63	0.63	0.65	0.67	0.62
Sweden	1.40	1.41	1.52	1.44	1.46

Citrus fruits	**2017**	**2018**	**2019**	**2020**	**2021**
EU 27	502.84	508.99	512.83	519.98	514.65
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.00	0.00	0.00	0.00	0.00
Czechia	0.00	0.00	0.00	0.00	0.00
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.00	0.00	0.00	0.00
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	43.47	46.26	44.23	45.62	39.52
Spain	294.26	297.62	296.48	297.97	300.50
France	4.27	4.39	4.61	4.68	3.16
Croatia	2.06	1.97	2.20	2.10	2.14
Italy	135.36	134.64	140.74	145.10	144.70
Cyprus	2.92	3.05	3.20	3.04	2.95
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
Hungary	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00	0.00

Citrus fruits	2017	2018	2019	2020	2021
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	20.51	21.07	21.37	21.48	21.68
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	0.00	0.00	0.00	0.00	0.00
Slovakia	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00

Peaches	2017	2018	2019	2020	2021
EU 27	154.06	150.80	144.78	137.07	132.50
Belgium	0.00	0.00	0.00	0.00	0.00
Bulgaria	3.73	3.40	3.02	2.70	2.57
Czechia	0.37	0.38	0.34	0.34	0.32
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.11	0.11	0.11	0.11	0.11
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	33.68	34.76	33.61	32.94	29.96
Spain	52.14	49.87	47.94	44.42	43.55
France	4.80	4.69	4.65	4.75	6.03
Croatia	0.71	0.64	0.68	0.61	0.62
Italy	45.49	44.42	41.93	41.04	39.44
Cyprus	0.21	0.21	0.22	0.19	0.23
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
Hungary	5.34	4.93	4.79	3.89	3.86
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.16	0.18	0.18	0.18	0.18
Poland	2.13	2.12	2.15	0.80	1.00
Portugal	2.97	2.84	2.87	2.88	2.86
Romania	1.62	1.64	1.72	1.62	1.27
Slovenia	0.28	0.26	0.25	0.25	0.24
Slovakia	0.32	0.36	0.35	0.31	0.28
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00