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Pest categorisation of *Colletotrichum aenigma*, *C. alienum*, *C. perseae*, *C. siamense* and *C. theobromicola*

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Abstract

The EFSA Plant Health Panel performed a pest categorisation of *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*, five clearly defined fungi of the *C. gloeosporioides* complex causing anthracnose. The pathogens are widely distributed in at least three continents. *C. aenigma* and *C. siamense* are reported from Italy and *C. alienum* from Portugal, including the Madeira Islands, with a restricted distribution. *C. perseae* and *C. theobromicola* are not known to be present in the EU. However, there is uncertainty on the status of the pathogens worldwide and in the EU because of the taxonomic re-evaluation of the genus *Colletotrichum* and the lack of specific surveys. The pathogens are not included in Commission Implementing Regulation (EU) 2019/2072 and there are no reports of interceptions in the EU. With the exception of *C. perseae*, which has a very limited number of hosts, the other four *Colletotrichum* species have relatively wide host ranges. Therefore, this pest categorisation focused on those hosts for which there is robust evidence that the pathogens were formally identified by a combination of morphology, pathogenicity and multilocus sequence analysis. Host plants for planting and fresh fruits are the main entry pathways into the EU. Host availability and climate suitability factors occurring in some parts of the EU are favourable for the establishment of the pathogens. No yield losses have been reported so far in the EU but in non-EU areas of their current distribution, the pathogens have a direct impact on cultivated hosts that are also relevant for the EU. Phytosanitary measures are available to prevent the further introduction and spread of *C. aenigma*, *C. alienum* and *C. siamense* into the EU as well as the introduction and spread of *C. perseae* and *C. theobromicola*. *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* satisfy the criteria that are within the remit of EFSA to assess for these species to be regarded as potential Union quarantine pests.

Keywords: anthracnose, *Colletotrichum gloeosporioides*, 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 1E (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

Colletotrichum aenigma, C. alienum, C. perseae, C. siamense and *C. theobromicola* are five 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 assessment of *Persea americana* from Israel.

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 *Colletotrichum aenigma, C. alienum* and *C. siamense*, EFSA has consulted the NPPOs of Italy, Portugal and Spain. The results of this consultation are presented in Section 3.2.2.

2.1.2. Literature search

A literature search on *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* and their synonyms 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 EPPO Global Database, 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 *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola,* 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 *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola,* 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) are 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 identities of *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* are clearly defined.

The genus *Colletotrichum* constitutes a large monophyletic group of ascomycete fungi with more than 200 accepted species classified into at least 14 species complexes and singletons (Damm et al., 2019). The genus includes endophytes, saprobes and plant pathogens, with the latter being responsible for several diseases of many crops worldwide (Cannon et al., 2012; Udayanga et al., 2013). In the past, cultural and morphological characters (colour and growth rate of the colonies, size and shape of conidia and appressoria, presence or absence of setae, etc.) were used to identify *Colletotrichum* at species level (Von Arx, 1957; Sutton, 1980, 1992). However, as these characters vary depending on the culture medium and the environmental conditions (light, temperature, etc.), the identification of *Colletotrichum* species based exclusively on these features is unreliable (Cai et al., 2009; Damm et al., 2012; Liu et al., 2016). Based on literature, identification of *Colletotrichum* at species level is performed using a polyphasic approach that combines cultural and morphological characteristics, pathogenicity tests and multilocus gene sequencing analysis (Cai et al., 2009; Cannon et al., 2012; Weir et al., 2012; Liu et al., 2016). The vast majority of *Colletotrichum* species are now classified into 15 complexes, i.e. *C. acutatum, C. agaves, C. boninense, C. caudatum, C. destructivum, C. dematium, C. dracaenophilum, C. gigasporum, C. gloeosporioides, C. graminicola, C. magnum, C. orbiculare, C. orchidearum, C. spaethianum* and *C. truncatum* (Marin-Felix and Zhang, 2017; Damm et al., 2019; Talhinhas and Baroncelli, 2021). *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* are distinct fungal species belonging to the *C. gloeosporioides* species complex, which consists of 57 closely related species (Weir et al., 2012; Jayawardena et al., 2021; Talhinhas and Baroncelli, 2021).

Colletotrichum aenigma, C. alienum, C. perseae, C. siamense and *C. theobromicola* are fungi of the family Glomerellaceae. The EPPO Global Database (online) provides the following taxonomic identification for each of the above-mentioned *Colletotrichum* species:

1) *Colletotrichum aenigma*

Preferred scientific name: *Colletotrichum aenigma* B.S. Weir & P.R. Johnston.

Order: Phyllachorales.
Family: Glomerellaceae.
Genus: *Colletotrichum*.
Species: *Colletotrichum aenigma*.

Common names: anthracnose.
Synonyms: *Colletotrichum populi* C.M. Tian & Z. Li.

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

2) *Colletotrichum alienum*

Preferred scientific name: *Colletotrichum alienum* B.S. Weir & P.R. Johnston.

Order: Phyllachorales.
Family: Glomerellaceae.
Genus: *Colletotrichum*.
Species: *Colletotrichum alienum*.

Common names: anthracnose.

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

3) *Colletotrichum perseae*

Preferred scientific name: *Colletotrichum perseae* G. Sharma & S. Freeman.

Order: Phyllachorales.
Family: Glomerellaceae.
Genus: *Colletotrichum*.
Species: *Colletotrichum perseae*.

Common names: anthracnose.

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

[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).

4) *Colletotrichum siamense*

Preferred scientific name*: Colletotrichum siamense* Prihastuti, L. Cai & K.D. Hyde.

Order: Phyllachorales.
Family: Glomerellaceae.
Genus: *Colletotrichum*.
Species: *Colletotrichum siamense*.

Common names: anthracnose.
Synonyms: No synonyms for this species are provided by EPPO Global Database or CABI. However, the following synonyms of *C. siamense* are reported by Farr and Rossman (online; https://nt.ars-grin.gov/fungaldatabases/):

- *Colletotrichum communis* G. Sharma, A.K. Pinnaka & B.D. Shenoy
- *Colletotrichum dianesei* N.B. Lima, M.P.S. Câmara & S.J. Michereff
- *Colletotrichum endomangiferae* W.A.S. Vieira, M.P.S. Camara & S.J. Michereff
- *Colletotrichum hymenocallidis* Y.L. Yang, Zuo Y. Liu, K.D. Hyde & L. Cai
- *Colletotrichum jasmini-sambac* Wikee, K.D. Hyde, L. Cai & McKenzie
- *Colletotrichum melanocaulon* V. Doyle, P.V. Oudem & S.A. Rehner

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

5) *Colletotrichum theobromicola*

Preferred scientific name: *Colletotrichum theobromicola* Delacroix.

Order: Phyllachorales.
Family: Glomerellaceae.
Genus: *Colletotrichum*.
Species: *Colletotrichum theobromicola*.

Common names: anthracnose.
Synonyms: No synonyms for this species are provided by EPPO Global Database or CABI. However, the following synonyms are reported by Farr and Rossman (online; https://nt.ars-grin.gov/fungaldatabases/):

- *Colletotrichum fragariae* A.N. Brooks
- *Colletotrichum gloeosporioides* f. *stylosanthis* Munaut
- *Colletotrichum pseudotheobromicola* Chethana, J.Y.Yan, X.H. Li & K.D. Hyde

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

3.1.2. Biology of the pest

Species of the genus *Colletotrichum* show different lifestyles that vary between species complexes, with most species being able to sequentially switch between lifestyles (de Silva et al., 2017a). The lifestyle patterns found in *Colletotrichum* species can be broadly categorised as necrotrophic, hemi-biotrophic, saprotrophic, latent or quiescent, and endophytic. Evidence suggests that the interaction between the host plant and the endophytic *Colletotrichum* species can sometimes switch from mutualistic to antagonistic or pathogenic depending on the physiological condition of the plant, host genotype and environmental conditions (de Silva et al., 2017a). Therefore, *Colletotrichum* species may have different interactions with their hosts and exhibit differences in their life cycles independently whether they belong to the same species complex or not (da Silva et al., 2020). Occurrence of cross-pathogenicity between *Colletotrichum* species from different hosts is also observed (Bragança et al., 2016; Eaton et al., 2021).

Colletotrichum aenigma, C. alienum, C. perseae, C. siamense and *C. theobromicola* have life cycles similar to those of other *Colletotrichum* species (Figure 1). Their life cycles include both asexual and sexual reproductive stages (Cannon et al., 2012; de Silva et al., 2017a). Infection occurs via an appressorium that develops from the germinating conidium on the plant surface, followed by turgor-driven penetration of the cuticle (Deising et al., 2000) and, in some cases, also of the epidermal cells by fungal hyphae (Bailey et al., 1992). Establishment within plant tissues is aided via production by the fungus of host-induced virulence effectors (Kleemann et al., 2012; O'Connell et al., 2012). Subsequently, the pathogens enter a biotrophic phase during which they remain quiescent or latent within the host tissues until environmental conditions and host physiology become conducive for their reactivation and further development (Boufleur et al., 2020). The biotrophic life strategies adopted by *Colletotrichum* species may also contribute to their prominence as symptomless endophytes of living plant tissues (Lu et al., 2004; Joshee et al., 2009; Rojas et al., 2010; Yuan et al., 2011). Following the biotrophic phase, *Colletotrichum* spp. enter a necrotrophic phase that results in death of host plant cells and the appearance of disease symptoms. During their active growth in the plant tissues, the pathogens produce acervuli (asexual fruiting structures) with masses of mucilage-embedded conidia (Figure 1). The mucilaginous matrix is composed of glycoprotein and germination inhibitors that protect conidia against desiccation and toxins produced by the host defence mechanism (Leite and Nicholson, 1992). The conidia are dispersed over relatively short distances by water (rain, irrigation), wind-driven rain (de Silva et al., 2017a). Dispersal is also possible by insects (Gasparoto et al., 2017). They are produced on the infected host tissues throughout the season resulting in polycyclic disease cycles. The sexual stage of many *Colletotrichum* species, including *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*, has been observed in *in vitro* cultures on synthetic media but not under field conditions (Jayawardena et al., 2021).

No information for the potential of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* to survive in soil (with or without plant debris) exists. Nevertheless, in general, *Colletotrichum* species do not survive for long periods in soil (Bergstrom and Nicholson, 1999; Ripoche et al., 2008), although there are notable exceptions (Eastburn and Gubler, 1990; Dillard and Cobb, 1998; Freeman et al., 2002; Feil et al., 2008; Ripoche et al., 2008) and survival structures, such as melanised microsclerotia, have been observed in several species (e.g. *C. truncatum, C. sublineola* and *C. coccodes*) (Dillard and Cobb, 1998; Boyette et al., 2007; Sukno et al., 2008). However, no information exists in the literature on the formation of microsclerotia by *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*.

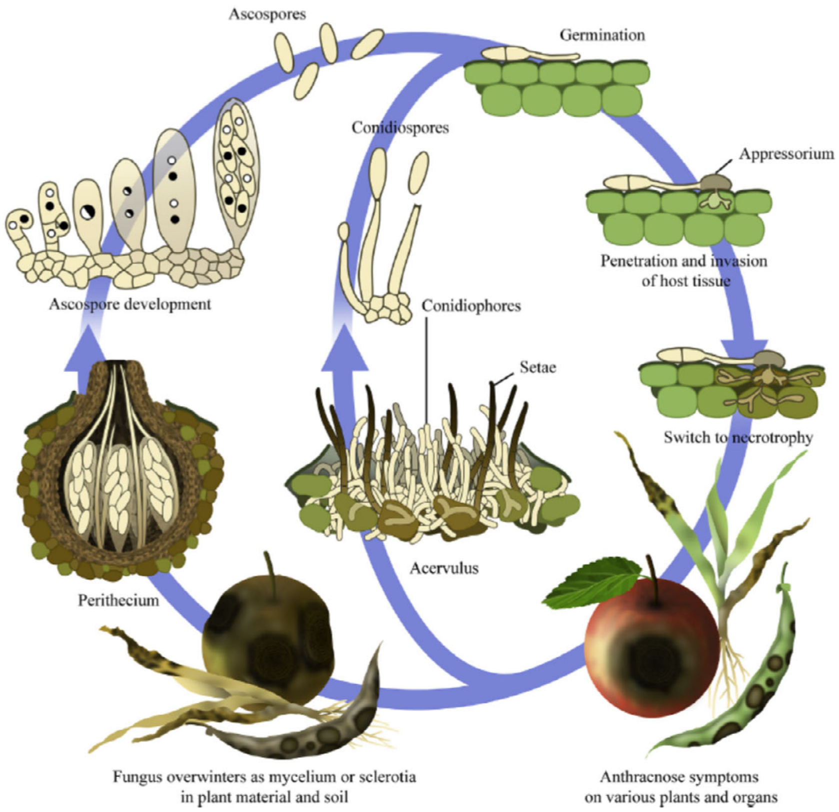

Figure 1: General life cycle of *Colletotrichum* species (from de Silva et al., 2017a)

Although it has not been documented, seeds of host plants are possibly one of the main sources of primary inoculum for the above-mentioned five *Colletotrichum* species, similarly to other *Colletotrichum* species (Cannon et al., 2012).

Like other *Colletotrichum* species, host infection by *C. aenigma, C. alienum, C. perseae, C. siamense* or *C. theobromicola* depends on different factors including humidity, temperature, host physiology and inoculum level (Freeman et al., 1998). In general, warm, wet or humid environmental conditions favour host infection by *Colletotrichum* species. According to Zhang et al. (2020a,b), the optimum temperature for the *in vitro* mycelial growth of *C. aenigma* and *C. siamense* was 28°C. At 36°C, no mycelial growth of *C. aenigma* was observed, whereas *C. siamense* proved to be more tolerant to temperatures higher than 36°C suggesting the potential threat posed by this species to hosts grown in areas with hot and rainy weather.

3.1.3. Host range/Species affected

With the exception of *C. perseae*, which, so far, has been reported to affect a very limited number of hosts, the other four *Colletotrichum* species, i.e. *C. aenigma, C. alienum, C. siamense* and *C. theobromicola,* have relatively wide host ranges (see Appendix A). It should be noted that, in some cases, more than one of the above-mentioned five *Colletotrichum* species were identified to be associated with anthracnose on a single host, whereas in other cases, other species of the *C. gloeosporioides* complex or of other *Colletotrichum* species complexes were also involved (Schena et al., 2014; Liu et al., 2015; Sharma et al., 2017; Yokosawa et al., 2017; Fu et al., 2019; Chen et al., 2020; Zhang et al., 2020a,b). The host range of each of the five *Colletotrichum* species and particularly that of *C. perseae*, which has been identified recently (Sharma et al., 2017), might be wider than that currently reported as, in the past, when molecular tools were not available, *Colletotrichum* species identified as *C. gloeosporioides sensu lato* based on morphology and pathogenicity, might have belonged to one of the above-mentioned species.

Given that *Colletotrichum* species are commonly found on many plant species as pathogens, endophytes and occasionally as saprobes, and that their accurate identification and their discrimination from other closely-related *Colletotrichum* species is only possible by using molecular tools, this Pest categorisation will focus on those hosts for which there is robust evidence in the literature that (i) the pathogens were isolated and identified by both morphology and multilocus gene sequencing analysis, (ii) the Koch's postulates were fulfilled through pathogenicity tests performed on unwounded plant tissues, and (iii) their impacts on crop yield were documented. The reported hosts in the literature of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* that fulfil the above-mentioned criteria are considered by the Panel as main hosts and are listed in Table 2. Appendix B provides an overview on the main hosts which can be infected or co-infected by more than one of the five *Colletotrichum* species.

Table 2: Main hosts of *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*

***Colletotrichum* species**	**Main hosts**	**References**
C. aenigma	*Actinidia arguta*	Wang et al. (2019)
	Aquilaria sinensis	Li et al. (2021a,b)
	Camellia spp. (*C. japonica, C. oleifera, C. sinensis, C. sasanqua)*	Yang et al. (2019), Wang et al. (2020b), Chen et al. (2019)
	Capsicum annuum	Sharma et al. (2022), Diao et al. (2017)
	Diospyros kaki	Andrioli et al. (2021)
	Fragaria × ananassa	Zhang et al. (2020a,b)
	Juglans regia	Wang et al. (2020a,b,c)
	Malus domestica	Lee et al. (2021), Yokosawa et al. (2017), Zhang et al. (2021a,b,c)
	Olea europaea	Schena et al. (2014)
	Persea americana	Sharma et al. (2017)
	Pyrus spp. *(P. pyrifolia, P.* x *bretschneideri, P. communis)*	Fu et al. (2019)
	Prunus avium	Chethana et al. (2019)
	Selenicereus undatus	Meetum et al. (2015)
	Synsepalum dulcificum	Truong et al. (2018)
	Vitis vinifera	Kim et al. (2021)

***Colletotrichum* species**	**Main hosts**	**References**
C. alienum	*Camellia* spp.	Liu et al. (2015)
	Mangifera indica	Ahmad et al. (2021), Tovar-Pedraza et al. (2020)
	Olea europaea	Moreira et al. (2021)
	Persea americana	Sharma et al. (2017)
C. perseae	*Capsicum annum*	Sharma et al. (2022)
	Olea europaea	Moral et al. (2021)
	Persea americana	Sharma et al. (2017), Hofer et al. (2021)
	Vitis vinifera	Yokosawa et al. (2020)
C. siamense	*Allium cepa*	Chowdappa et al. (2015)
	Annona muricata	Costa et al. (2019)
	Annona squamosa	Costa et al. (2019
	Camellia spp.	Liu et al. (2015), Zhao et al. (2021), Peng et al. (2022), Jayawardena et al. (2016)
	Capsicum annum	de Silva et al. (2017b, 2019), de Oliveira et al. (2017), Diao et al. (2017), Sharma and Shenoy (2014), Mongkolporn and Taylor (2018), Suwannarat et al. (2017)
	Carica papaya	Zhang et al. (2021a,b,c)
	Carya illinoinensis	Oh et al. (2021)
	Citrus spp.	Wang et al. (2021)
	Citrus reticulata	Cheng et al. (2013)
	Citrus sinensis	Douanla-Meli and Unger (2017)
	Coffea arabica	Serrato-Diaz et al. (2020)
	Corchorus capsularis	Niu et al. (2016)
	Ctenanthe oppenheimiana	Xu et al. (2020)
	Dioscorea cayennensis	de Souza Junior and Assuncao (2021)
	Fragaria × *ananassa*	Zhang et al. (2020a,b), Wang et al. (2022)
	Gossypium hirsutum	Salunkhe et al. (2020)
	Juglans regia	Wang et al. (2017)
	Malus domestica	Yokosawa et al. (2017)
	Malus niedzwetzkyana	Han et al. (2022)
	Mangifera indica	Giblin et al. (2018), Pardo-De la Hoz et al. (2016)
	Magnolia grandiflora	Zhou et al. (2022)
	Manihot carthaginesis	Oliveira et al. (2018)
	Manihot esculenta	Liu et al. (2019)
	Manihot tomentosa	Oliveira et al. (2018)
	Musa acumitata	Uysal and Kurt (2020)
	Olea europaea	Schena et al. (2014)
	Persea americana	Fuentes-Aragon et al. (2020), Sharma et al. (2017), Hofer et al. (2021)
	Prunus persica	Tan et al. (2022)
	Punica granatum	Xavier et al. (2019)
	Pyrus spp. (*P. pyrifolia, P. bretschneideri, P. communis*)	Fu et al. (2019)
	Ricinus communis	Tang et al. (2021)
	Selenicereus undatus	Meetum et al. (2015)
	Synsepalum dulcificum	Truong et al. (2018)
	Vitis caribaea	Santos et al. (2018)
	Vitis riparia	Santos et al. (2018)

***Colletotrichum* species**	**Main hosts**	**References**
	Zinnia elegans	Li et al. (2021a,b)
	Ziziphus mauritiana	Shu et al. (2021)
C. theobromicola	*Allium fistulosum*	Matos et al. (2017)
	Anacardium occidentale	Veloso et al. (2018)
	Annona spp.	Morita et al. (2015); Costa et al. (2019)
	Anthurium spp.	Chaves et al. (2020)
	Butia odorata	Dorneles et al. (2017)
	Buxus spp.	Singh et al. (2015)
	Campomanesia phaea	Santos et al. (2017)
	Centrosema pubescens	Pakdeeniti et al. (2022)
	Citrus spp.	Wang et al. (2021)
	Coffea arabica	Serrato-Diaz et al. (2020)
	Copernicia prunifera	Araujo et al. (2018)
	Eucalyptus spp.	Rodrigues et al. (2014)
	Gossypium arboretum cv. *indicum*	Kang et al. (2022)
	Malpighia emarginata	Bragança et al. (2014)
	Malus domestica	Alaniz et al. (2015)
	Mangifera indica	Pardo-De la Hoz et al. (2016)
	Manihot esculenta	Oliveira et al. (2018, 2020)
	Manilkara zapota	Martins et al. (2018)
	Olea europaea	Schena et al. (2014), Lima et al. (2020), Moreira et al. (2021)
	Persea americana	Sharma et al. (2017)
	Punica granatum	Xavier et al. (2019)
	Theobroma cacao	Rojas et al. (2010)

3.1.4. Intraspecific diversity

The sexual stage of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* has been observed in *in vitro* cultures but not under field conditions. However, other species of the *C. gloeosporioides* complex form perithecia (sexual fruiting bodies) on their hosts (Dowling et al., 2020). The ability of *Colletotrichum* species to differentiate sexual reproductive stages enhances their genomic plasticity and adaptation to various and/or adverse environmental conditions, including the selection of fungicide-resistant populations. It is generally acknowledged that the risk of fungicide resistance development increases when sexual recombination occurs in the life cycle (FRAC, 2014). With this respect, many isolates of *C. siamense* from commercial peach orchards in South Carolina (USA) were found to be resistant to quinone outside inhibitors (QoI) fungicides and some even dual resistant to QoI and benzimidazole fungicides (Hu et al., 2015).

No information exists in the literature on differences in aggressiveness among isolates of each of the five *Colletotrichum* species, although such differences have been reported for other species of the *C. gloeosporioides* complex (Wang et al., 2021).

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, methods for the detection and identification of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* and their discrimination from other closely related *Colletotrichum* species are available.

Plants infected by *C. aenigma, C. alienum, C. perseae, C. siamense* or *C. theobromicola* show symptoms of anthracnose, which may include dark brown stem and fruit spots, stem cankers, pre- and post-harvest fruit rot, leaf spots and wilt, shoot-tip dieback and defoliation (Rodrigues et al., 2014;

Liu et al., 2015; Diao et al., 2017; Sharma et al., 2017, 2022; de Silva et al., 2017b; Giblin et al., 2018; Chethana et al., 2019; Costa et al., 2019; Chaves et al., 2020; Chen et al., 2020; Chung et al., 2020; Mao et al., 2020; Yokosawa et al., 2020; Andrioli et al., 2021; Carbone et al., 2021; Huang et al., 2021; Luo et al., 2021; Moral et al., 2021; Oo et al., 2021; Han et al., 2022). However, these symptoms are similar to those caused by other *Colletotrichum* species belonging either to the *C. gloeosporioides* complex or to other *Colletotrichum* species complexes. If fruiting structures (acervuli with conidia and/or perithecia with ascospores) are detected on the symptomatic plant tissues using a magnifying lens, they are similar to those of other *Colletotrichum* species. It should be also noted that during the biotrophic phase, the pathogens remain quiescent or latent within the host tissues until environmental conditions and host physiology become conducive for their reactivation and the development of disease symptoms (see Section 3.1.2 Biology of the pest). Based on the above, it is unlikely that *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* could be detected based only on visual inspection of their host plants.

The pathogens can be readily isolated on culture media and description of their cultural and morphological characteristics is available in the literature (Prihastuti et al., 2009; Rojas et al., 2010; Weir et al., 2012; Sharma et al., 2017; Hassan et al., 2018; Fu et al., 2019; Ahmad et al., 2021). However, as some of these characteristics are similar to or overlap with those of other *Colletotrichum* species, and moreover, they vary under changing environmental conditions (Cai et al., 2009; Liu et al., 2016), the pathogens cannot be reliably identified based only on morphology. A polyphasic approach, combining the application of molecular methods, such as multilocus gene sequencing analysis with morphological and pathogenicity data, is currently recognised as being the most reliable method for the identification of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* and their discrimination from other closely related *Colletotrichum* species (Cai et al., 2009; Cannon et al., 2012; Weir et al., 2012). More specifically, *C. aenigma* can be distinguished from other closely related *Colletotrichum* species based on sequence analysis of *tub2* and *gs* genes (Weir et al., 2012); *C. alienum* using *cal* or *gs* genes (Weir et al., 2012); *C. perseae* can be well resolved with sequence analysis of *ApMAT* and *gs* genes (Sharma et al., 2017); *C. siamense* is distinguished by *cal* or *tub2* gene sequence data and *C. theobromicola* by ITS sequences (Weir et al., 2012). Nucleotide sequences of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* are available in GenBank (www.ncbi.nlm.nih.gov/genbank) and could be used as reference material for molecular diagnosis.

No EPPO Standards are available for the detection and identification of *C. aenigma, C. alienum, C. perseae, C. siamense* or *C. theobromicola*.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

The current geographical distribution of *C. aenigma, C. alienum, C. perseae, C. siamense and C. theobromicola* outside the EU is shown in Table 3 and Figures 2–6. The records are based on CABI Crop Protection Compendium (online; accessed on 15/2/2022), Farr and Rossman (online; https://nt.ars-grin.gov/fungaldatabases/; accessed on 15/2/2022) and other sources (published articles until May 2022) as well as on whether the species is included in the EPPO Global Database (online; last accessed on 15/2/2022). Details of the current geographical distribution of each of the above-mentioned pathogens outside the EU are presented in Appendix C.

There is uncertainty with respect to the actual geographical distribution of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* outside the EU, as in the past, when molecular tools (i.e. multigene phylogenetic analysis) were not available, the pathogens might have been misidentified based on morphology and pathogenicity tests only, which cannot reliably identify them.

Table 3: Distribution of *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* outside the EU based on CABI Crop Protection Compendium (online), EPPO Global Database (online), Farr and Rossman (online; https://nt.ars-grin.gov/fungaldatabases/) and other sources

***Colletotrichum* species**	**Distribution**
C. aenigma	Brazil, China, Colombia, Iran, Israel, Japan, Malaysia, Republic of Korea, Thailand, UK, USA
C. alienum	Australia, China, Hawaii, Israel, Mexico, New Zealand, South Africa, Uruguay, USA, Zimbabwe

Colletotrichum species	Distribution
C. perseae	Australia, Chile, Israel, Japan, New Zealand
C. siamense	Argentina, Australia, Bangladesh, Brazil, China, Colombia, Egypt, Ghana, India, Indonesia, Israel, Japan, Kenya, Laos, Malaysia, Malawi, Mexico, New Zealand, Nigeria, Pakistan, Philippines, Puerto Rico, Republic of Korea, South Africa, Sri Lanka, Taiwan, Thailand, Turkey, Uruguay, USA, Vietnam, Zimbabwe
C. theobromicola	Argentina, Angola, Australia, Brazil, China, Colombia, Costa Rica, India, Israel, Japan, Mexico, New Zealand, Panama, Philippines, Puerto Rico, Republic of Korea, Thailand, Uruguay, USA

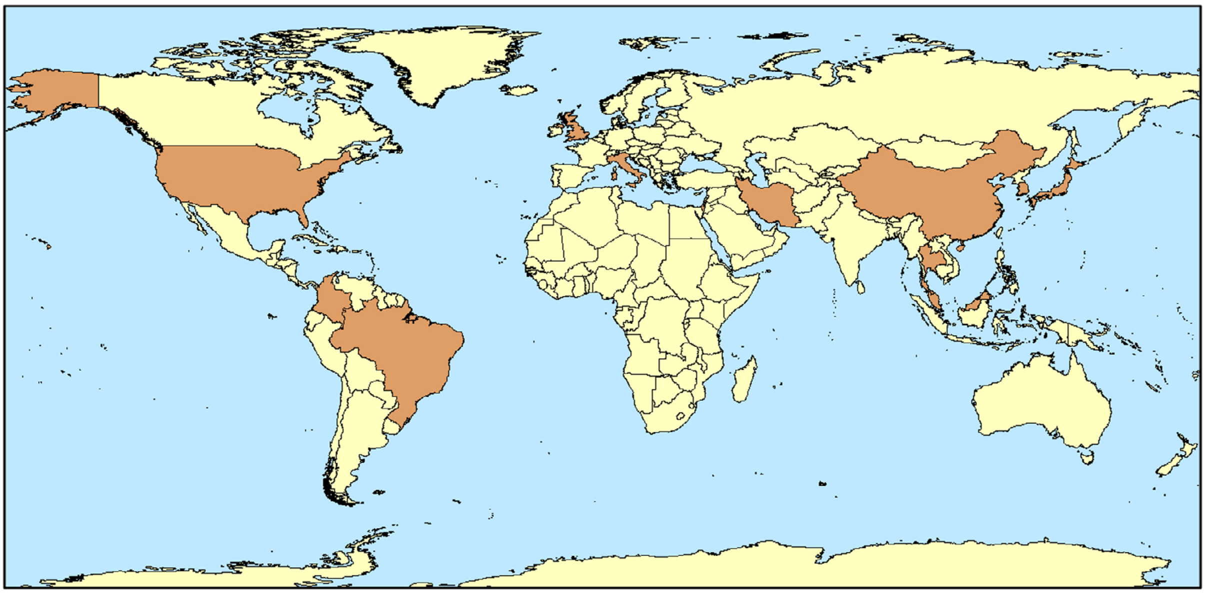

Figure 2: Global distribution of *Colletotrichum aenigma* [Data Source: CABI CPC (online; last accessed on 5 May 2022), Farr and Rossman (online; last accessed on 5 May 2022) and other literature sources]

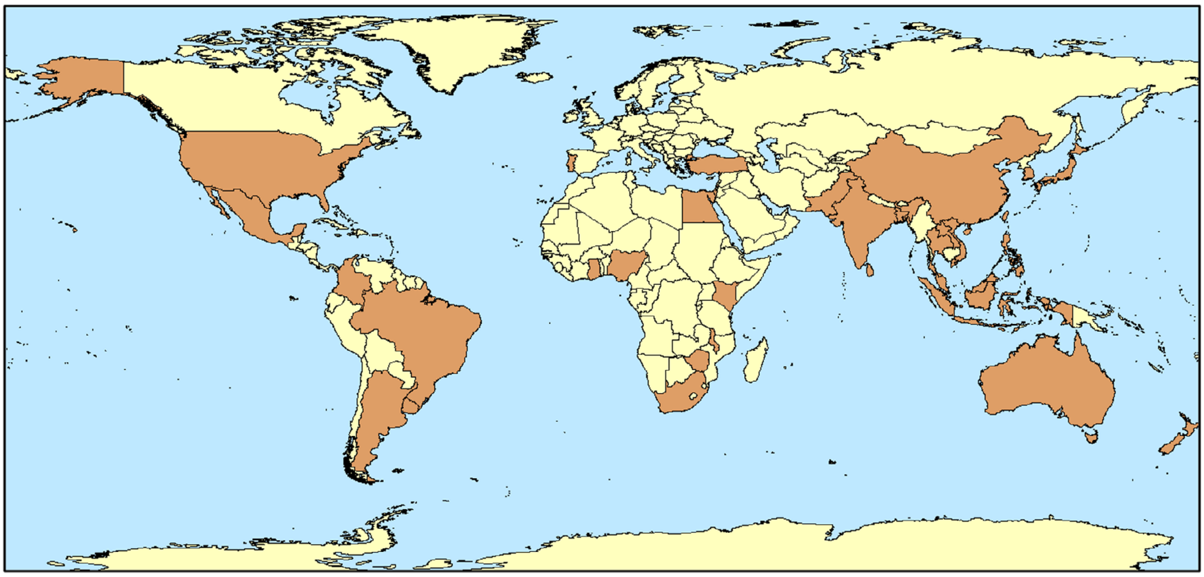

Figure 3: Global distribution of *Colletotrichum alienum* [Data Source: CABI CPC (online; last accessed on 5 May 2022), Farr and Rossman (online; last accessed on 5 May 2022) and other literature sources]

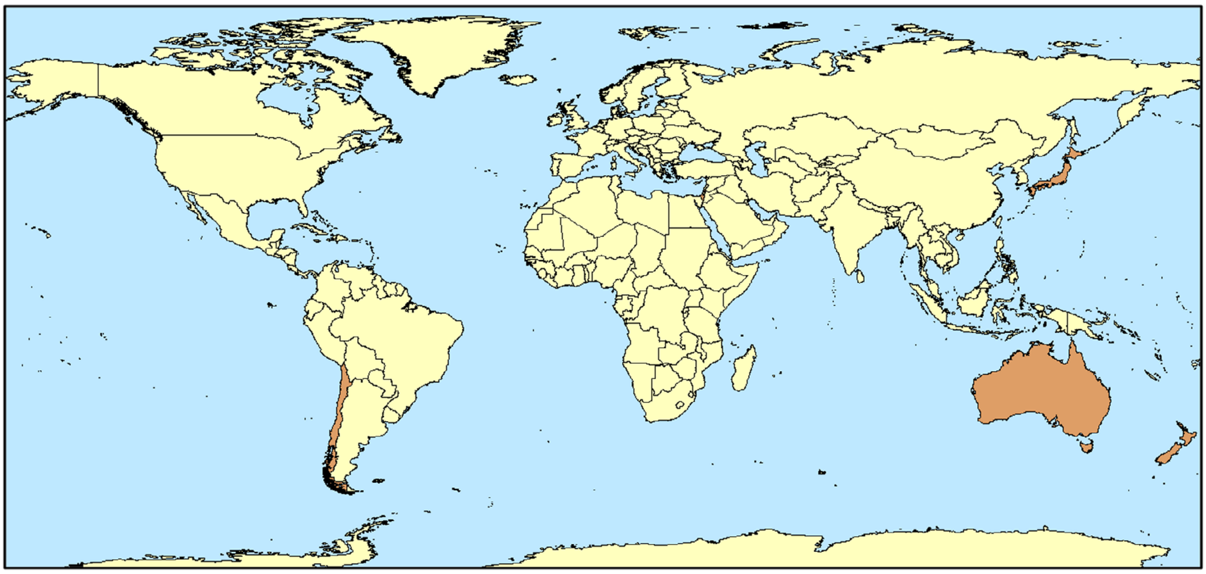

Figure 4: Global distribution of *Colletotrichum perseae* [Data Source: CABI CPC (online; last accessed on 5 May 2022), Farr and Rossman (online; last accessed on 5 May 2022) and other literature sources]

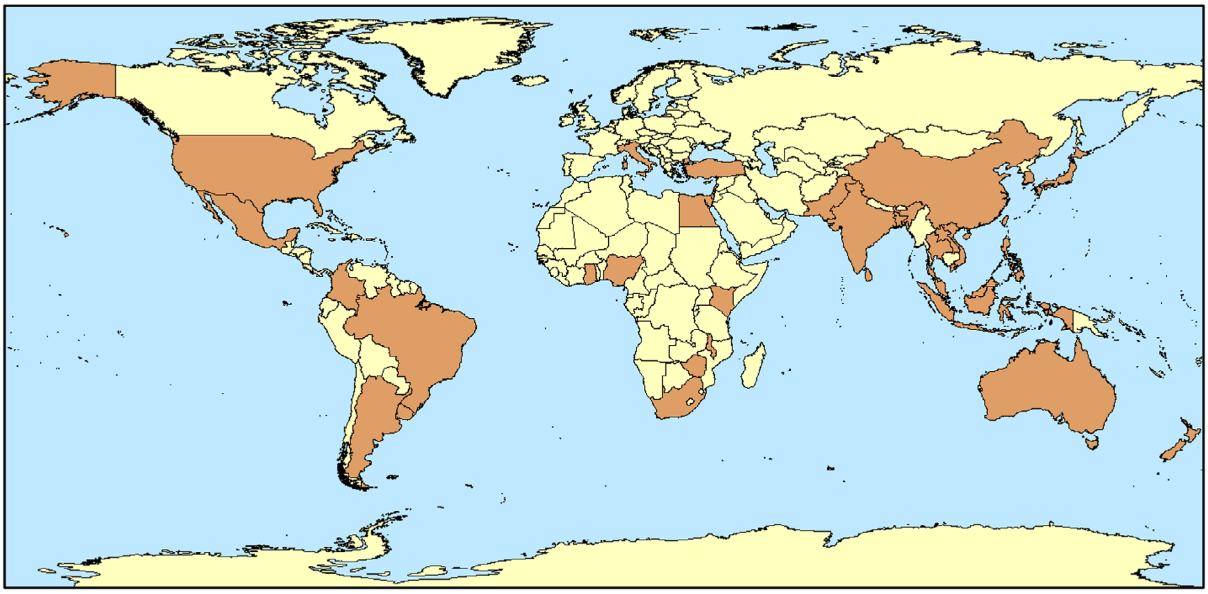

Figure 5: Global distribution of *Colletotrichum siamense* [Data Source: CABI CPC (online; last accessed on 5 May 2022), Farr and Rossman (online; last accessed on 5 May 2022) and other literature sources]

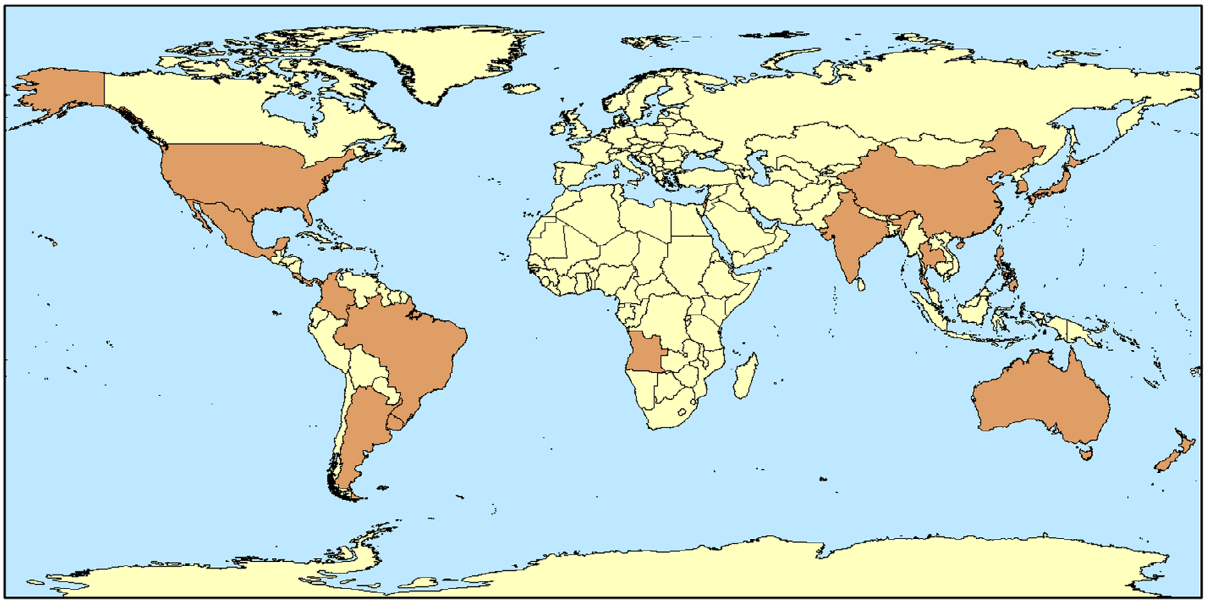

Figure 6: Global distribution of *Colletotrichum theobromicola* [Data Source: CABI CPC (online; last accessed on 5 May 2022), Farr and Rossman (online; last accessed on 5 May 2022) and other literature sources]

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.

Colletotrichum aenigma, C. alienum and *C. siamense* have been reported to be present in the EU, with a restricted distribution. More specifically, *C. aenigma* and *C. siamense* have been reported from Italy and *C. alienum* from Portugal, including Madeira Islands. There are no reports of *C. perseae* and *C. theobromicola* being present in the EU.

According to Schena et al. (2014), *C. aenigma* was isolated from *Citrus sinensis, Pyrus communis* and *Olea europaea* in Italy during the period 1992–2011 and was tested for its pathogenicity on detached olive fruits (cv. Coratina). Results showed that *C. aenigma* was a weak pathogen on green olives, but it induced noticeable rot on olives at the colour changing stage (ripening olives). In Mosca et al. (2014) studies, one isolate of *C. aenigma* from *P. communis* originated in Apulia (Italy) was used as reference material. According to the NPPO of Italy, the only report of *C. aenigma* in Italy is on *Olea europaea*; the NPPO further noted that the fungus is a weak pathogen with sporadic presence.

C. alienum has been reported from Portugal, including Madeira Islands. More specifically, in their studies, Liu et al. (2013) used three reference isolates of *C. alienum* obtained from the Culture Collection of the Westerdijk Fungal Biodiversity Institute (former CBS-KNAW Fungal Biodiversity Centre), the Netherlands. Two isolates were identified on *Leucadendron* spp. (cv. High Gold) in Portugal in 2000 and the third one on *Protea cynaroides* in Madeira Islands in 2001. No other report is available in the literature on the presence of *C. alienum* in Portugal, including Madeira Islands.

Far and Rossman (online; https://nt.ars-grin.gov/fungaldatabases/) reported *C. alienum* as being present in Spain and cited Crous et al. (2013). However, this is an unreliable record as, in none of the primary literature sources (Crous et al., 2013; Liu et al., 2013), *C. alienum* is reported as present in Spain. The NPPO of Spain stated that *C. alienum* is not known to be present in Spain.

In a study on the biodiversity of fungi on *Vitis vinifera* (grapevine), Jayawardena et al. (2018) isolated among other fungi, *C. siamense* from grapevines grown in the Forlì-Cesena Province, Italy. However, the pathogenicity of the fungus on grapevine was not investigated. According to the NPPO of Italy, *C. siamense* has been isolated in 2021 from receptive stigmas of walnut fruit but compared to other *Colletotrichum* species (*C. fioriniae* and *C. nymphaeae*), to date it is not pathogenic on walnut in Italy.

C. perseae and *C. theobromicola* have not been reported from the EU territory.

There is uncertainty with respect to the actual distribution of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* in the EU, as in the past, when molecular tools (i.e. multigene phylogenetic analysis) were not available, the pathogens might have been misidentified based on morphology and pathogenicity tests, which cannot reliably identify them.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

Colletotrichum aenigma, C. alienum, C. perseae, C. siamense and C. theobromicola are not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, an implementing act of Regulation (EU) 2016/2031.

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 4. Some of the hosts which belong to the genera *Acacia, Annona, Diospyros, Jasminum*, *Juglans, Persea, Prunus, Persea* as well as *Ficus carica,* are included in the Commission Implementing Regulation (EU) 2018/2019 on high-risk plants.

Table 4: List of plants, plant products and other objects that are *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense and C. theobromicola* hosts whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI, Commission Implementing Regulation (EU) 2021/419, Annex II and Commission Implementing Regulation (EU) 2021/1936, Annex II, Part 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
8.	Plants for planting of *[...} Malus* Mill., *Prunus* L., *Pyrus* 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 *Pyrus* L. and their hybrids, and *Fragaria* L., 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 2,530 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

Annex II of Commission Implementing Regulation (EU) 2021/419
List of plants, plant products and other objects, originating from third countries, and the corresponding measures for their introduction into the Union territory, as referred to in Article 2

Jasminum polyanthum Franchet, unrooted cuttings of plants for planting	ex 0602 10 90	Israel	(a) Official statement that: (i) the plants are free from . . .*Colletotrichum siamense*;. . .. (iv) the production site has been subject to official inspections for the presence of . . .*Colletotrichum siamense* every three weeks and found free from those pests; (v) immediately prior to export, consignments of the plants have been subjected to an official inspection for the presence of . . ..and to an official inspection for the presence of Colletotrichum siamense including testing of symptomatic plants

Annex II, Part A of Commission Implementing Regulation (EU) 2021/1936
List of plants, plant products and other objects, originating from third countries, and the corresponding measures for their introduction into the Union territory, as referred to in Article 2

Ficus carica L., rooted, dormant, without leaves, 1-year-old plants	ex 0602 20 20 ex 0602 20 80 ex 0602 90 45 ex 0602 90 46	Israel	(a) Official statement that: (i) the plants are free from . . .*Colletotrichum siamense*. . .

for planting with a maximum diameter of 2 cm at the base of the stem, and 1-year-old rooted cuttings without leaves of plants for planting with growing medium and with a maximum diameter of 1 cm at the base of the stem	ex 0602 90 48 ex 0602 90 50 ex 0602 90 70		(iv) immediately prior to export, consignments of the plants have been subjected to an official inspection for the presence of . . . and to an official inspection for the presence of *Colletotrichum siamense* and. . . including random sampling and testing of the plants;
Persea americana Mill., rooted, with leaves, grafted plants for planting with growing medium and with a maximum diameter of 1 cm at the base of the stem	ex 0602 90 41 ex 0602 90 45 ex 0602 90 48 ex 0602 90 50	Israel	(a) Official statement that: (i) the plants are free from . . . *Colletotrichum aenigma*, *Colletotrichum alienum*,. . . *Colletotrichum perseae*, *Colletotrichum siamense*, *Colletotrichum theobromicola*,. . . (iv) immediately prior to export, consignments of the plants have been subjected to an official inspection for the presence of *Colletotrichum aenigma*, *Colletotrichum alienum*,. . . *Colletotrichum perseae*, *Colletotrichum siamense*, *Colletotrichum theobromicola*. . . including random sampling and testing of the plants;
Persea americana Mill., unrooted cuttings of plants for planting with a maximum diameter of 2 cm	ex 0602 10 90	Israel	(a) Official statement that: (i) the plants are free from . . . *Colletotrichum aenigma*, *Colletotrichum alienum*,. . . *Colletotrichum perseae*, *Colletotrichum siamense*, *Colletotrichum theobromicola*,. . . (iv) immediately prior to export, consignments of the plants have been subjected to an official inspection for the presence of *Colletotrichum aenigma*, *Colletotrichum alienum*,. . . *Colletotrichum perseae*, *Colletotrichum siamense*, *Colletotrichum theobromicola*. . . including random sampling and testing of the plants

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. *C. aenigma, C. alienum* and *C. siamense* have already entered the EU and they may further enter via the host plants for planting and the fresh fruit pathways. Similarly, *C. perseae* and *C. theobromicola* could potentially enter the EU territory via the host plants for planting and the fresh fruit pathways.

Comment on plants for planting as a pathway.

Host plants for planting is a main pathway for the entry of the pathogens into the EU territory.

The Panel identified the following main pathways for the entry of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* into the EU territory:

1) host plants for planting, and
2) fresh fruit of host plants,

originating in infested third countries (Table 3).

The pathogens could potentially enter the EU territory on nuts, cut flowers and plant parts of their hosts for ornamental or medicinal purposes. However, these are considered minor pathways for the entry of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* into the EU.

Although seeds are reported as one of the primary sources of inoculum for many *Colletotrichum* species, there is no evidence of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* being transmitted by seeds of their host plants. Therefore, uncertainty exists on seeds of host plants as a pathway for the entry of the above-mentioned five *Colletotrichum* species into the EU.

No information specific for *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* exists in the available literature on their potential to survive in soil, but in general, *Colletotrichum* species appear to be poor competitors in soil (see Section 3.1.2 Biology of the pest). Therefore, uncertainty exists on the soil and other substrates associated or not with host and non-host plants for planting as a pathway of entry of the pathogens into the EU territory.

C. aenigma, C. alienum, C. perseae, C. siamense and *C. theobromicola* are unlikely to enter the EU by natural means (rain, wind-driven rain, insects, etc.) because of the long distance between the infested third countries and the EU Member States. Although there are no quantitative data available, spores of the pathogens may be also 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 entry of the pathogens into the EU territory.

Table 5: Potential pathways for *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* into the EU 27

Pathways	**Life stage**	**Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]**
Description (e.g. host/ intended use/source)		
Host plants for planting other than seeds	Mycelium, acervuli with conidia, perithecia with ascospores	• Annex VI (8) prohibits the introduction of plants for planting of *Malus* Mill., *Prunus L. and Pyrus* L. with leaves, flowers and fruits from certain third countries (Table 4). Among the third countries from where the introduction of the above-mentioned plant material is not prohibited are Turkey and UK, which have been reported to be infested with *C. siamense* and *C. aenigma*, respectively (see Section 3.2.1). • Annex VI (9) prohibits the introduction of plants for planting of *Malus* Mill., *Prunus L., Pyrus* L. and *Fragaria* L., other than seeds, from certain third countries (Table 4). Among the third countries from where the introduction of the above-mentioned plant material is not prohibited are Australia, Egypt, Israel, New Zealand, Turkey, UK and USA, which have been reported to be infested with *C. aenigma* (Israel, UK, USA), *C. alienum* (Australia, Israel, USA), *C. perseae* (Australia, Israel, New Zealand), *C. siamense* (Australia, Egypt, Israel, New Zealand, Turkey, USA) and *C. theobromicola* (Australia, Israel, New Zealand, USA) (see Section 3.2.1). • Annex VII (10 & 11) requires official statement of special requirements for the introduction into the Union from certain third countries of trees and shrubs, intended for planting, other than seeds and plants in tissue culture. These requirements are not specifically targeted against *Colletotrichum*. However, among the third countries from which official statement of special requirements is not required, are (i) Israel, which has been reported to be infested with all the five

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]
		Colletotrichum species, and (ii) Egypt and Turkey which have been reported to be infested with *C. siamense* (see Section 3.2.1). • Annex VII (5) requires official statement of special requirements for the introduction into the Union from third countries other than Switzerland of annual and biennial plants for planting, other than Poaceae and seeds. These requirements are not specifically targeted against *Colletotrichum*.
Host plants other than fruits and seeds	Mycelium, acervuli with conidia, perithecia with ascospores	• Annex VI (10) prohibits the introduction into the Union from third countries other than Switzerland of *Vitis* L. plants, other than fruits. • Annex VI (11) prohibits the introduction into the Union from all third countries of plants of *Citrus L.,* and their hybrids, other than fruits and seeds
Fruits of host plants	Mycelium, acervuli with conidia	• Annex VII (57) requires fruits of *Citrus* L. and their hybrids shall be free from peduncles and leaves and the packaging shall bear an appropriate origin mark. • Annex XI, Part A (5) requires phytosanitary certificate for the introduction into the Union of fruits of *Citrus* L. and their hybrids from third countries other than Switzerland • Annex XI, Part A (5) requires phytosanitary certificate for the introduction into the Union from certain third countries of fruits (fresh or chilled) of *Actinidia* Lindl., *Annona* L., *Carica papaya* L., *Diospyros* L., *Fragaria* L., *Malus* L., *Mangifera* L., *Persea americana* Mill., *Prunus* L., *Pyrus* L. and *Vitis* L. (Table 4). Among the third countries from which a phytosanitary certificate is not required, Turkey has been reported to be infested with *C. siamense* (see Section 3.2.1). • Annex XI, Part A (5) requires phytosanitary certificate for the introduction into the Union from certain third countries of fruits of *Punica granatum* L. (Table 4). Among the third countries from which a phytosanitary certificate is not required, are countries which have been reported to be infested with the pathogens (see Section 3.2.1).
Leaves of host plants	Mycelium, acervuli with conidia, perithecia with ascospores	• Annex XI, Part A (3) requires phytosanitary certificate from third countries other than Switzerland
Parts of host plants, other than fruit and seeds	Mycelium, acervuli with conidia, perithecia with ascospores	• Annex XI, Part A (3) 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, Turkey has been reported to be infested with *C. siamense*. • Annex XI, Part A (3) 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

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation 2019/2072]
		• Annex XI, A (3) 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 have been reported to be infested with the pathogens ((see Section 3.2.1).
Soil associated or not with host and non-host plants for planting	Microsclerotia	• Annex VI (19) 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	Microsclerotia	• Annex VI (20) 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) requires official statement of special requirements 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, with the exception of sterile medium of *in vitro* plants. • Annex XI, Part A (1) 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 which have been operated for agricultural or forestry purposes	Microsclerotia, with high uncertainty because of lack of information	• Annex VII (2) requires official statement that machinery or vehicles are cleaned and free from soil and plant debris. • Annex XI, Part A (1) requires phytosanitary certificate for the introduction into the Union territory of machinery and vehicles from third countries other than Switzerland.

It should be noted that among the host plant genera included in Table 5, *Annona* L., *Diospyros* L., *Juglans* L., *Malus* Mill., *Persea* Mill. and *Prunus* L. are considered high-risk plants [Commission Implementing Regulation (EU) 2018/2019 of 18 December 2018] (see Section 3.3).

The volume of fresh produce of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* main hosts originated in infested third countries and imported into the EU territory during the period 2016–2020 is presented in Table 6. Appendix D provides import statistics for individual third countries.

Table 6: EU 27 annual imports of fresh produce of main hosts from countries where *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* are present, 2016–2020 (in 100 kg) Source: Eurostat accessed on 18/3/2022

Commodity	HS code	2016	2017	2018	2019	2020
Fresh persimmons	0810 70 00	3331.48	3844.34	2205.98	3346.16	6724.66
Fresh strawberries	0810 10 00	42,131.12	48,341.86	44,872.39	35,151.25	84,609.94
Fresh tamarinds, cashew apples, lychees, jackfruit, sapodillo plums, passion fruit, carambola and pitahaya*	0810 90 20	163,404.09	179,632.91	184,705.55	201,001.91	184,088.82
Fresh or dried walnuts, in shell and shelled	0802 31 0802 32	811,100.06	804,843	778,627.4	866,407.4	901,531.72
Fresh apples	0808 10	1,571,609.85	1,811,900.59	2,401,452.66	1,513,510.15	1,688,051.46
Fresh or chilled olives	0709 92	1542.04	1023.52	836.70	2042.29	6381.46
Fresh or dried avocados	0804 40 00	2,063,188.12	2,256,280.11	2,726,949.69	3,008,254.47	3,136,713.56
Fresh pears	0808 30	1,630,892.91	1,358,291.97	1,378,444.99	1,140,281.00	1,320,026.96
Fresh cherries (excl. Sour cherries)	0809 29 00	2556.84	6513.03	6182.85	3435.61	11,509.14
Fresh grapes	0806 10	349,475.09	419,133.7	400,203.5	273,610.8	286,902.3
Fresh or dried guavas, mangoes and mangosteens	0804 50 00	1,407,147.77	1,482,471.03	1,562,860.63	1,845,650.38	1,938,656.55
Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	0901	20,987,474.19	19,595,095.83	20,172,408.67	20,827,757.53	20,131,232.09
Coconuts, Brazil nuts and cashew nuts, fresh or dried, whether or not shelled or peeled	0801	125,274	109,479	121,257.1	119,455.8	111,733.7
Citrus fruit, fresh or dried	0805	14,000,959.74	13,944,079.72	15,893,049.64	13,821,011.24	15,818,866.58
Cocoa beans, whole or broken, raw or roasted	1801 00 00	86,869.22	83,223.42	31,753.83	23,668.46	22,433.73
Vegetable and strawberry plants	0602 90 30	52,806.04	51,745.84	56,746.49	63,535.72	24,547.54

Commodity	HS code	2016	2017	2018	2019	2020
Indoor flowering plants with buds or flowers (excl. cacti)	0602 90 91	8799.73	7811.9	16,582.99	24,858.15	17,842.82
Indoor rooted cuttings and young plants (excl. cacti)	0602 90 70	33,711.04	49,916.36	58,639.58	61,749.60	61,853.04
	Sum	43,299,765.04	42,155,900.84	45,762,558.49	43,748,119.72	45,674,010.54

*: Aggregated data that include also non-hosts.

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. No records of interceptions by EU Members States specific for *C. aenigma, C. alienum, C. perseae, C. siamense* or *C. fructicola* exist in Europhyt (accessed on 6 September 2022). Nevertheless, until May–June 2020, there have been 21 interceptions of unidentified at species level *Colletotrichum*. No records of any of the five *Colletotrichum* species exist in TRACES database since May 2020 (accessed on 15/5/2022). However, there is only one report of *C. acutatum*.

3.4.2. Establishment

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

Yes. *C. aenigma, C. alienum* and *C. siamense* are present in the EU, which indicates that both the biotic (host availability) and abiotic (climate suitability) factors occurring in parts of the EU are also favourable for the establishment of the other two species, i.e. *C. perseae* and *C. theobromicola*.

Given their biology, the five *Colletotrichum* species could potentially be transferred from the pathways of entry to the host plants grown in the EU via splash-dispersed spores, contaminated soil and other plant growth substrates associated with plants for planting, and 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 residues and fruit waste.

Climatic mapping is the principal method for identifying areas that could provide suitable conditions for the establishment of a pest taking key abiotic factors into account (Baker et al., 2000). Availability of hosts is considered in Section 3.4.2.1. Climatic factors are considered in Section 3.4.2.2.

3.4.2.1. EU distribution of main host plants

As noted above and shown in Appendix A, except for *C. perseae*, whose host range is limited so far to pepper, olive, avocado and grapevine, the other four *Colletotrichum* species, i.e. *C. aenigma, C. alienum, C. siamense* and *C. theobromicola* have relatively wide host ranges. In addition, most of the main hosts of the above-mentioned five *Colletotrichum* species (Table 2) 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 each of the above-mentioned *Colletotrichum* species cultivated in the EU 27 in recent years is shown in Table 7. Appendix E provides production statistics for individual Member States.

Table 7: Harvested area of some of the *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* main hosts in EU 27, 2016–2020 (1,000 ha). Source EUROSTAT (accessed 18/03/2022) https://ec.europa.eu/eurostat/databrowser/view/apro_cpsh1/default/table?lang=en

Crop	2016	2017	2018	2019	2020
Strawberries	103.78	103.76	106.42	101.16	83.84
Apples	505.66	504.61	506.27	491.08	483.01
Pears	115.13	113.81	113.54	110.66	107.05

Crop	2016	2017	2018	2019	2020
Cherries	172.45	173.37	175.49	176.30	177.86
Avocados	12.24	12.72	13.22	17.50	19.60
Walnuts	72.61	74.15	80.60	87.62	96.69
Grapes	3,136.15	3,133.32	3,135.50	3,155.20	3,156.22
Olives	5,043.87	5,056.93	5,098.62	5,070.49	5,105.13
Citrus fruits	519.01	502.84	508.99	512.83	519.98

3.4.2.2. Climatic conditions affecting establishment

Of the five *Colletotrichum* species, *C. aenigma* and *C. perseae* have been reported from three continents (i.e. *C. aenigma* from America, Asia and Europe and *C. perseae* from America, Asia and Oceania), *C. theobromicola* from four continents (i.e. Africa, America, Asia and Oceania) and *C. alienum* and *C. siamense* from all the five continents (i.e. Africa, America, Asia, Europe and Oceania).

The global Köppen–Geiger climate zones (Kottek et al., 2006) describe terrestrial climate in terms of average minimum winter temperatures and summer maxima, amount of precipitation and seasonality (rainfall pattern).

Based on the data available in the literature on the exact locations of the infested areas, *C. aenigma* has been reported from areas with BSh, BSk, Cfa, Cfb, Csa, Dfb and Dfc climate zones; *C. alienum* from areas with BSh, BSk, Cfa, Cfb, Cfc, Csa, Csb and Dfc climate zones; *C. perseae* from areas with BSh, Cfa, Cfb, Csa and Dfb climate zones; *C. siamense* from areas with BSh, BSk, Cfa, Cfb, Cfc, Csa, Csb, Csc, Dfb and Dfc climates and *C. theobromicola* from areas with BSh, BSk, Cfa, Cfb, Cfc, Csa, Dfb and Dfc climates. The above-mentioned climate zones, where each of those five *Colletotrichum* species is currently present, are comparable to those occurring in parts of the EU territory where hosts are also grown (Figures 7–11).

Therefore, it can be concluded that the climatic conditions occurring in some parts of the EU territory are favourable for the establishment of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*. However, uncertainty exists on whether the pathogens could potentially establish in EU areas belonging to other than the climate zones shown in Figures 7–11, where hosts are also present.

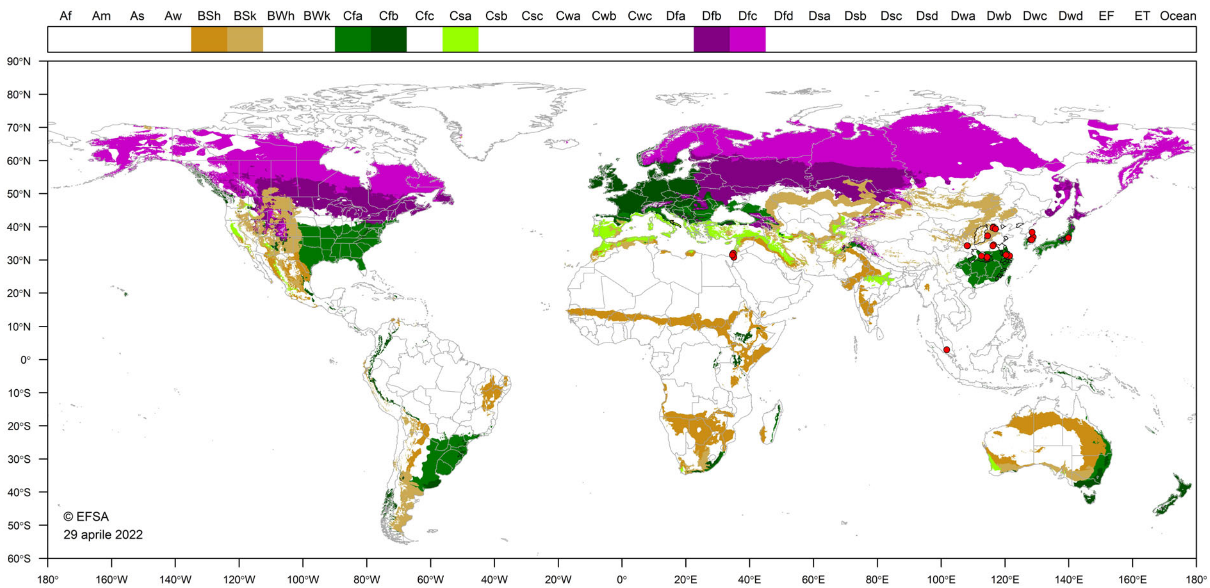

Figure 7: Distribution of seven Köppen–Geiger climate types, i.e. BSh, BSk, Cfa, Cfb, Csa, Dfb and Dfc that occur in the EU and in countries where *Colletotrichum aenigma* has been reported. The legend shows the list of Köppen–Geiger climates. Red dots indicate point locations where *C. aenigma* was reported (Appendix C.1)

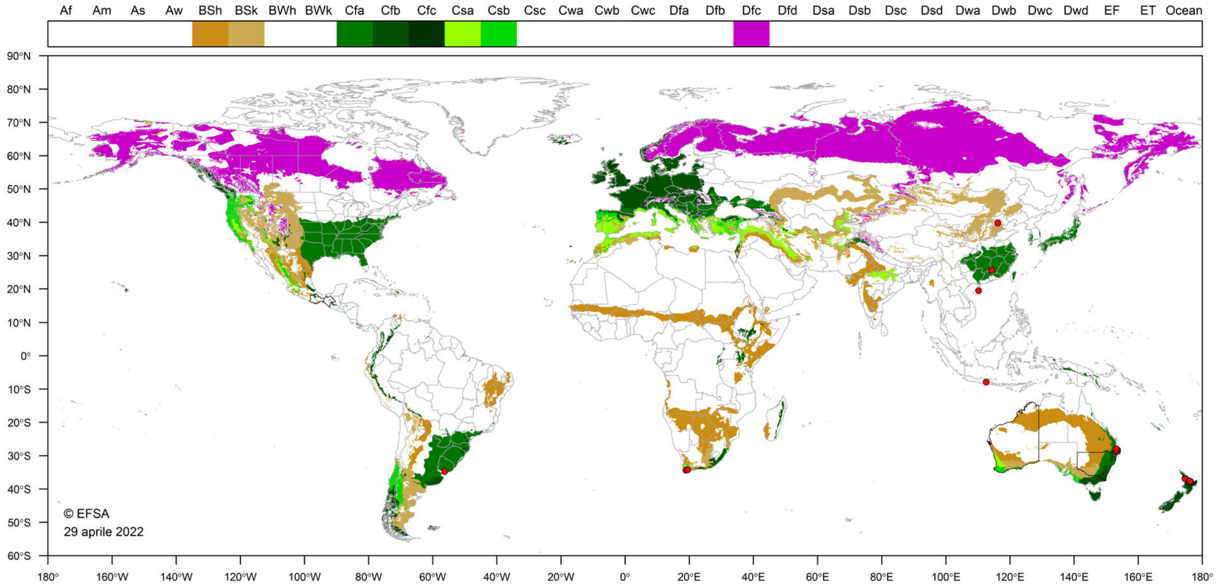

Figure 8: Distribution of eight Köppen–Geiger climate types, i.e. BSh, BSk, Cfa, Cfb, Cfc, Csa, Csb and Dfc that occur in the EU and in countries where *Colletotrichum alienum* has been reported. The legend shows the list of Köppen–Geiger climates. Red dots indicate point locations where *C. alienum* was reported (Appendix C.2)

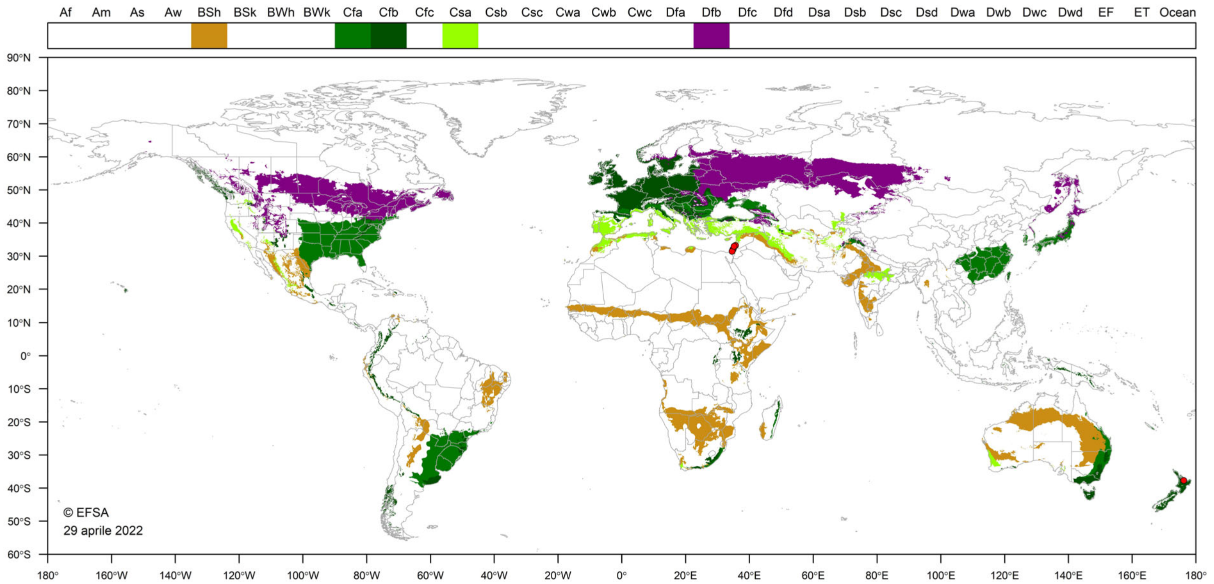

Figure 9: Distribution of five Köppen–Geiger climate types, i.e. BSh, Cfa, Cfb, Csa and Dfb that occur in the EU and in countries where *Colletotrichum perseae* has been reported. The legend shows the list of Köppen–Geiger climates. Red dots indicate point locations where *C. perseae* was reported (Appendix C.3)

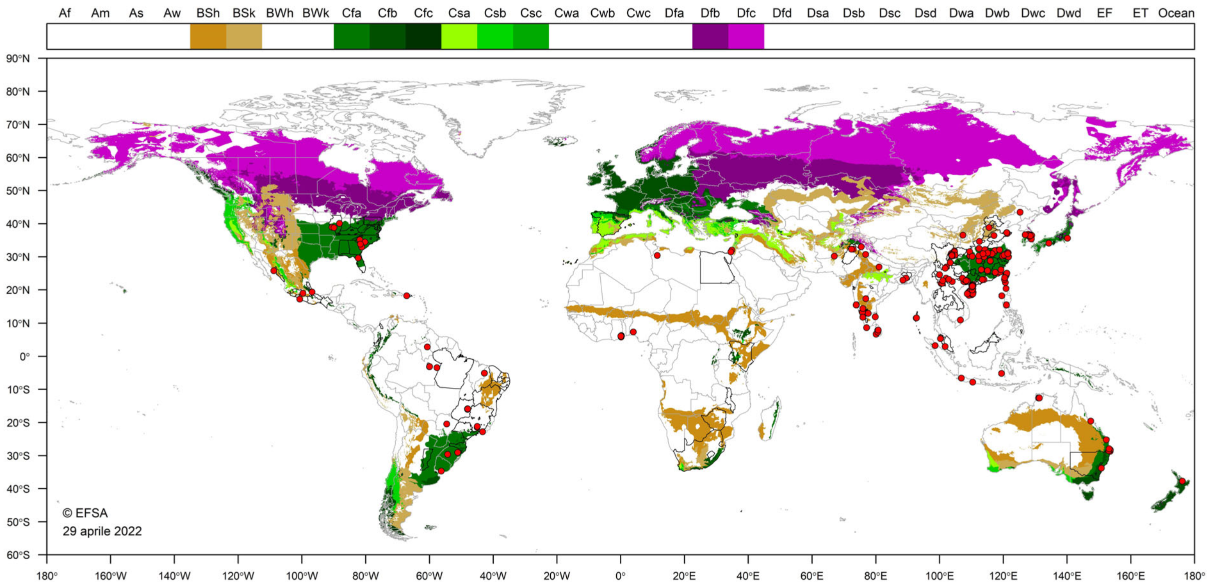

Figure 10: Distribution of 10 Köppen–Geiger climate types, i.e. BSh, BSk, Cfa, Cfb,Cfc, Csa, Csb, Csc, Dfb and Dfc that occur in the EU and in countries where *Colletotrichum siamense* has been reported. The legend shows the list of Köppen–Geiger climates. Red dots indicate point locations where *C. siamense* was reported (Appendix C.4)

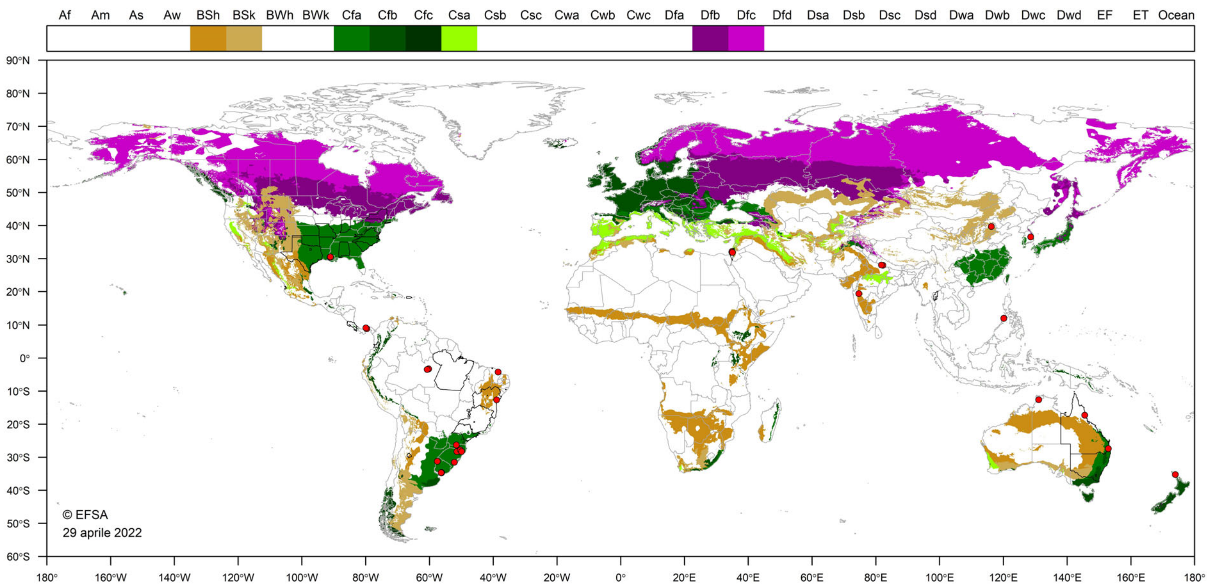

Figure 11: Distribution of eight Köppen–Geiger climate types, i.e. BSh, BSk, Cfa, Cfb, Cfc, Csa, Dfb and Dfc that occur in the EU and in countries where *Colletotrichum theobromicola* has been reported. The legend shows the list of Köppen–Geiger climates. Red dots indicate point locations where *C. theobromicola* was reported (Appendix C.5)

3.4.3. Spread

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

Following establishment, *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* could potentially spread within the EU territory by natural and human-assisted means.

Host plants for planting is one of the main means of spread of the pathogens within the EU territory.

Following their introduction into the EU territory, *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*, similarly to other *Colletotrichum s*pecies, could potentially spread via natural and human-assisted means.

Spread by natural means. *Colletotrichum* species can spread locally mainly by water (rain, irrigation) (Madden et al., 1996; Freeman et al., 2002; Mouen Bedimo et al., 2007; Penet et al., 2014). Wind-driven rain and insects may also contribute to the dispersal of *Colletotrichum* spp. spores (Gasparoto et al., 2017). In some pathosystems (e.g. *C. acutatum sensu stricto* and *C. gloeosporioides sensu stricto* affecting citrus), spread of the pathogens may also occur via wind-disseminated ascospores (Silva-Junior et al., 2014). However, there is uncertainty on the potential of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* to spread via wind-borne ascospores, as the presence of their sexual stage has not been reported so far under field conditions (see Section 3.1.2 Biology of the pest).

Spread by human-assisted means. The pathogens 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 agricultural machinery, tools, irrigation, etc.

Uncertainty exists on the potential of the pathogens to spread via the seeds of their host plants and soil or other plant growth substrates, due to lack of evidence.

3.5. Impacts

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

Yes, the introduction of*,* *C. perseae, C. theobromicola* and the further introduction of *Colletotrichum aenigma, C. alienum* and *C. siamense* in the EU is likely to have yield and quality impacts in some parts of the territory. Nevertheless, the magnitude of the impacts is not known, especially in cases where more than one of the above-mentioned *Colletotrichum* species would co-infect a single host.

Species of the genus *Colletotrichum* are known to infect several economically important cultivated tropical, subtropical and temperate fruit crops, vegetables and ornamentals, causing severe damage and, consequently, resulting in significant losses (Bailey and Jeger, 1992; Lima et al., 2011; Cannon et al., 2012; Anderson et al., 2013; Guarnaccia et al., 2016; de Silva et al., 2017b).

In the areas of their current distribution, *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* are reported to cause anthracnose and pre- and post-harvest fruit rots on their host plants (see Section 3.1.5).

Andrioli et al. (2021) reported that in Brazil, early infection of sweet persimmon fruit by anthracnose caused by *C. aenigma, C. asianum, C. fructicola* and *C. nymphaeae* caused premature fruit drop. Moreover, the disease developed further during fruit ripening and after harvest, leading to post-harvest losses of 50–90%. In China, anthracnose of strawberry caused by *C. aenigma, C. siamense, C. fructicola* and *C. gloeosporioides sensu stricto* was responsible for nearly 50% of seedlings necrosis and > 40% of production losses in nurseries as well as for up to 80% yield losses (Chen et al., 2020). Chung et al. (2020) reported that in Taiwan from 2010 to 2016, *C. siamense* together with *C. karstii, C. fructicola* and *C. boninense* was responsible for a 30–40% loss of strawberry seedlings and of approximately 20% loss of plants after transplanting. In Hubei province, China, an incidence of 45% of strawberry crown rot caused by *C. siamense* was reported by Luo et al. (2021).

C. aenigma was identified to be the causal agent of anthracnose outbreaks in different vineyards in Gimcheon, South Korea (Kim et al., 2021); the most severely affected vineyards showed a disease incidence on grape berries of up to 50% with the infected berries displaying sunken necrotic lesions covered by orange conidial masses. In 2020, a 5% fruit damage caused by *C. aenigma* and *C. perseae* was estimated on pepper crops in two different locations in Southern (Fatsail) and Central Israel (Sde Warburg), respectively (Sharma et al., 2022). At both locations, anthracnose symptoms were observed only on pepper fruits and not on leaves or stems. According to Wang et al. (2020c), *C. aenigma* was the causal agent of a serious anthracnose disease of walnut orchards in Xingtai Hebei, China. Disease symptoms included brown to black circular or irregular sunken lesions on walnut fruits, with an incidence of 31–41% and circular to irregular brown to grey lesions on leaves, with an incidence of 1–2%. Additionally, Wang et al. (2017) identified *C. siamense* as the causal agent of walnut anthracnose in Shandong Province, China, which resulted in 50% yield loss.

Ahmad et al. (2021) reported that in 2019, 30% of mango fruits at different markets of the Fengtai district, Beijing, China, exhibited severe typical symptoms of anthracnose caused by *C. alienum*. Li et al. (2019) identified *C. siamense* as the most dominant among 13 *Colletotrichum* species causing anthracnose on mango crops in the Provinces of Hainan, Yunnan, Sichuan, Guizhou, Guangdong and Fujian of Southern China. The same authors reported that the annual yield loss because of the disease was 30–60% reaching 100% under favourable climatic conditions.

Anthracnose is the most devastating disease of olive in Uruguay (Leoni et al., 2018), particularly in orchards located in areas characterised by frequent high relative humidity and rainfall (around 1,100 mm per year). During the last 10 years, those areas were massively planted with olives for oil production using an intensive rainfed plantation system, which favours anthracnose development. According to Moreira et al. (2021), since 2017, severe anthracnose outbreaks have been observed in those areas leading to high yield losses and decreased olive oil quality (increased acidity and decreased organoleptic properties). *C. alienum* and *C. theobromicola* were identified as the causal agents of those outbreaks together with *C. acutatum sensu stricto, C. nymphaeae* and *C. fioriniae* of the *C. acutatum* complex (Moreira et al., 2021).

Avocado is a high value crop grown in tropical and subtropical areas worldwide. Under the subtropical Mediterranean conditions of Israel, avocado fruit that set during the winter are seriously affected by post-harvest anthracnose which causes significant reduction in their shelf-life and marketability (Freeman et al., 1998). Sharma et al.'s (2017) studies showed that nine *Colletotrichum* species among which *C. aenigma*, *C. alienum*, *C. perseae*, *C. siamense* and *C. theobromicola* were involved in anthracnose disease of avocado in Israel. In Chile, anthracnose has increased during the last decades along with the establishment of new avocado orchards in humid areas. A survey carried out by Bustamante et al. (2020) in four commercial orchards located in the regions of Valparaiso, Metropolitana and O'Higgins (Chile) revealed that *C. perseae* and nine more *Colletotrichum* species belonging to four different *Colletotrichum* species complexes were associated with avocado anthracnose.

Although no quantitative data are available, *C. alienum* has been identified as the most economically important pathogen of Proteaceae in Australia, Europe and South Africa (Crous et al., 2013; Liu et al., 2013).

In India, chilli anthracnose caused by both *C. siamense* and *C. fructicola* was reported to adversely affect the quality of chilli fruits resulting in significant yield losses and reduced marketability (Sharma and Shenoy, 2014). Similarly, Oo et al. (2021) reported that *C. siamense* caused typical anthracnose symptoms on approximately 15–20% of chilli fruits (cv. Manita) growing in Goesan County, Chungcheong province, South Korea. *C. siamense* and *C. truncatum* were identified as the causal agents of severe anthracnose outbreaks in onion crops in southwest India (Chowdappa et al., 2015). Pérez-Mora et al. (2020) showed that in northern Sinaloa, Mexico, *C. siamense* was the only *Colletotrichum* species causing anthracnose symptoms (petal necrosis, fruit lesions) on Mexican lime (*C. aurantifolia*) resulting in high crop losses and unmarketable fruits. *C. siamense* was reported to cause a 50–90% incidence of anthracnose on red-fleshed apples (*Malus niedzwetzkyana*) in commercial orchards in Shandong province, China (Han et al., 2022).

Nine *Colletotrichum* species among which *C. siamense* and *C. theobromicola* were found to be associated with anthracnose of *Annona* spp., the most important disease of annonaceous crops in Brazil, causing yield losses of up to 70% particularly in periods of extended rainfall during the flowering and fruit developmental stages (Costa et al., 2019). It should be noted that *A. squamosa* (sugar apple) and *A. muricata* (soursop) have been arousing great interest in the international market for their fresh and processed fruit as well as for the production of biocomposites of medicinal, allelopathic or pesticide importance (Lemos, 2014). According to Veloso et al. (2018), *C. siamense* was the most dominant among seven *Colletotrichum* species causing anthracnose on cashew in Brazil with more than 40% yield losses.

Citrus anthracnose caused by *Colletotrichum* spp. is a serious disease limiting production globally. Preharvest anthracnose reduces yield, while post-harvest anthracnose affects fruit quality, negatively impacting fruit export and marketability (Phoulivong et al., 2012). During a survey conducted in citrus orchards severely affected by anthracnose in Australia (Victoria, New South Wales, Queensland), Wang et al. (2021) identified six *Colletotrichum* species as the causal agents among which *C. siamense* and *C. theobromicola. C. siamense* was also reported to cause anthracnose of papaya fruit in China with an average disease incidence of 30% and over 60% in some orchards (Zhang et al., 2021a,b,c). According to Pardo-De la Hoz et al. (2016), six *Colletotrichum* species of the *C. gloeosporioides* complex, among which *C. siamense* and *C. theobromicola* and three species of the *C. boninense* complex were associated with up to 60% of yield losses in mango plantations in the state of Tolima, Colombia.

It should be noted that, in cases where anthracnose disease on a single host was reported to be associated with more than one of the five *Colletotrichum* species (i.e. *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola)* or in cases where other species of the *C. gloeosporioides* complex or of other *Colletotrichum* species complexes were also involved, the individual contribution of *C. aenigma, C. alienum, C. perseae, C. siamense* or *C. theobromicola* to the overall impact was not determined (Schena et al., 2014; Liu et al., 2015; Sharma et al., 2017; Yokosawa et al., 2017; Fu et al., 2019; Chen et al., 2020; Zhang et al., 2020a,b).

Based on the above, it is expected that the introduction of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* into the EU territory would potentially cause yield and quality losses in parts of the risk assessment area where susceptible hosts are grown. However, neither the magnitude of this impact is known nor whether the agricultural practices and chemical control measures currently applied in the EU could potentially reduce the impact of the pathogens' introduction. It is worth mentioning that, although *C. aenigma* and *C. siamense* are reported from Italy and *C. alienum* from Portugal, including Madeira Islands, no crop losses have been reported so far.

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 *C. aenigma, C. alienum, C. perseae, C. siamense* or *C. theobromicola*, existing phytosanitary measures (see Sections 3.3.2 and 3.4.1) mitigate the likelihood of the pathogens' entry into the EU territory. Potential additional measures also exist to further mitigate the risk of entry and spread of the pathogens in the EU (see Section 3.6.1).

3.6.1. Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to some hosts of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*, (see Section 3.3.2). Potential additional control measures are listed in Table 8. 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

Potential additional control measures are listed in Table 8.

Table 8: Selected control measures (a full list is available in EFSA PLH Panel et al., 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	The use of transplants raised from pathogen-free propagation material, as well as growing transplants in weed-free areas and away from other crops that are known hosts of the pathogens may represent an effective control measure.	Entry/Spread
Managed growing conditions	Anthracnose disease is generally more severe in tropical and subtropical countries. Hot and humid environmental conditions support the spread of *Colletotrichum* spp. Therefore, proper field drainage, plant distancing, cutting of pruning debris into small pieces for faster decomposition and removal of severely infected plants in the field or in the greenhouse represent effective strategies to manage anthracnose.	Entry/Spread/Impact
Crop rotation, associations and density, weed/volunteer control	Crop rotation (wherever feasible) and control of volunteer plants may also represent effective means to reduce inoculum sources and potential survival of the pathogens on alternative hosts.	Establishment/Spread/ Impact
Roguing and pruning	Infection of host plants by the pathogens usually occurs from conidia formed on infected plants or plant debris which can act as inoculum sources. These propagules are dispersed from the infected plant parts and debris to healthy plants by rain splash, free water or high humidity. To reduce the sources of inoculum, pruning of the infected by the pathogens plant parts is highly recommended.	Spread/Impact
Biological control and behavioural manipulation	Some antagonistic fungi and bacteria have been tested *in vitro* for the biological control of the pathogens, but none of them was effective under field conditions.	Impact
Chemical treatments on crops including reproductive material	Several effective fungicides are available to control anthracnose-causing species of *Colletotrichum*. Copper compounds, triazoles and strobilurins are effective in field treatment as well as when applied on reproductive material. The possibility of selection of fungicide-resistant populations to triazoles and strobilurins must be considered.	Establishment/Spread/ Impact
Chemical treatments on consignments or during processing	Copper compounds, triazoles and strobilurins are effective as post-harvest treatments against *Colletotrichum* species causing anthracnose and post-harvest fruit rot. Calcium chloride is reported to improve the shelf-life and quality of fruits that are known hosts of anthracnose pathogens. The possibility of selection of fungicide-resistant populations should not be ruled out.	Entry/Spread

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/ spread/impact)
Physical treatments on consignments or during processing	Irradiation, mechanical cleaning (brushing, washing), sorting and grading and removal of diseased plant parts could be adopted on consignment or during processing of susceptible host plants or fruit. In the packinghouse, proper sanitation practices (e.g. good drainage systems to channel out wastewater or sewage during on-farm fruit disinfection) should be built and regularly cleaned.	Entry/ Spread
Cleaning and disinfection of facilities, tools and machinery	Cleaning, disinfection and disinfestation (sanitation) 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 contribute to mitigate likelihood of entry or spread of *Colletotrichum* species.	Entry/Spread
Limits on soil	Limits on soil are an efficient measure.	Entry/Spread
Soil treatment	Although no specific studies are available on *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola,* it is likely that the pathogens could potentially survive in infected plant debris in soil, similarly to other *Colletotrichum* species. Therefore, soil and substrate disinfection with chemical or physical (heat, soil solarisation) means represents a suitable option for control.	Entry/Establishment/ Spread/Impact
Use of non-contaminated water	Although *Colletotrichum* species could potentially spread via contaminated irrigation water, physical or chemical treatment of irrigation water is likely not to be feasible.	Spread/Impact
Waste management	Treatment of the waste (deep burial, composting, incineration, chipping, production of bio-energy…) in authorised facilities and official restriction on the movement of waste.	Spread
Heat and cold treatments	Hot water treatment at temperatures of 50–60°C for 5–60 min, depending on the host tolerance, may be applied to reduce the likelihood of infestation of the pathogens in susceptible plants or plant organs. The combination of hot water and calcium chloride may increase the efficacy of the treatment. As *Colletotrichum* spp. are adapted to high temperatures, cold treatment could also mitigate infection of consignments by the pathogens.	Entry/Spread
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 *Colletotrichum* spp. has to be transported (including proper disposal of infested waste material), specific transport conditions (type of packaging/ protection, time of transport, transport means) should be defined to prevent the pathogens from escaping. These may include, albeit not exclusively: physical protection; removal of leaves and peduncles from fruit commodities; sorting prior to transport, sealed packaging, etc.	Entry/Spread

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
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 as hosts of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*.	Establishment/Spread

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 9.

Table 9: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are categorisation measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Supporting measure	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. As the symptoms caused by *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* on their hosts are similar to those of other anthracnose causing *Colletotrichum* species on the same hosts, it is unlikely that the pathogens could be detected at species level based on visual inspection only.	Entry/Establishment/Spread
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. Laboratory testing based on morphological characters and multilocus gene sequencing analysis is required for the detection and reliable identification of the pathogens.	Entry/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.	Entry/Spread

Supporting measure	Summary	Risk element targeted (entry/establishment/spread/impact)
	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	
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 as hosts of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*	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 the pathogens	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 the above-mentioned Colletotrichum species is reduced if host plants for planting, including seeds for sowing, are produced under an approved certification scheme and tested free of these pathogens.	Entry/Spread
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).	Spread

Supporting measure	Summary	Risk element targeted (entry/establishment/ spread/impact)
	In the case of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* delimitation of a buffer zone around an outbreak area can prevent spread of the pathogens and maintain a pest-free area, site or place of production.	
Surveillance	*C. aenigma, C. alienum* and *C. siamense* have been reported to be present in the EU. Surveillance would be an efficient supporting measure to define the actual distribution of each of those pathogens in the affected MSs and prevent its spread.	Spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures

- Latently infected plants and plant products are unlikely to be detected by visual inspection.
- The similarity of symptoms and signs caused by *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* with those of other *Colletotrichum* species makes impossible the detection of the pathogens based on symptoms and signs (e.g. fruiting bodies).
- The lack of rapid diagnostic methods based on serological or molecular approaches does not allow proper *in planta* identification of the pathogens at entry. Thorough post-entry laboratory analyses may not be feasible for certain commodities as isolation in pure culture is needed prior to proceed with DNA extraction and molecular identification based on multigene sequencing.
- The wide host range of some of those *Colletotrichum* species (i.e. *C. siamense*) limits the possibility to develop standard diagnostic protocols for all potential hosts.
- The genome plasticity and the possibility of sexual reproduction leading to genetic recombination in *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* may limit the efficacy of chemical control approaches by favouring the selection of fungicide-resistant populations.

3.7. Uncertainty

Uncertainty on the actual distribution of the five *Colletotrichum* species in the EU, particularly with respect to records where multilocus gene sequencing analysis was not used for the identification of the isolated *Colletotrichum* species.

4. Conclusions

Of the five *Colletotrichum* species, *C. aenigma* and *C. siamense* are reported to be present in Italy and *C. alienum* in Portugal, including Madeira Islands, with a restricted distribution. *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* satisfy the criteria that are within the remit of EFSA to assess for these species to be regarded as potential Union quarantine pests (Table 10).

Table 10: 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 identities of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* are clearly defined	None
Absence/presence of the pest in the EU (Section 3.2)	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.	Uncertainty on the actual distribution of the five *Colletotrichum* species in the EU, particularly with respect to records where multilocus gene sequencing

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
	C. aenigma and *C. siamense* are reported from Italy and *C. alienum* from Portugal, including Madeira Islands, with a restricted distribution. *C. perseae* and *C. theobromicola* have not been reported from the EU territory.	analysis was not used for the identification of the isolated *Colletotrichum* species.
Pest potential for entry, establishment and spread in the EU (Section 3.4)	*C. aenigma, C. alienum* and *C. siamense* have already entered the EU and they may further enter into, become established in, and spread within the EU. Similarly, *C. perseae* and *C. theobromicola* could potentially enter into, become established in, and spread within the EU territory.. The main pathways for the entry/further entry of the pathogens into, and spread within, the EU territory are: (i) host plants for planting, and (ii) fresh fruit of host plants, originating in infested third countries. Spores of the pathogens may be also present as contaminants on other substrates (e.g. non-host plants, and other objects, etc.) imported into the EU, although these are considered minor pathways for the entry of the pathogens into the EU territory. *C. aenigma, C. alienum* and *C. siamense* are present in the EU, which indicates that both the biotic (host availability) and abiotic (climate suitability) factors occurring in parts of the EU are also favourable for the establishment of *C. perseae* and *C. theobromicola,* too. Following establishment, the five *Colletotrichum* species could spread within the EU territory by natural and human-assisted means.	None
Potential for consequences in the EU (Section 3.5)	The introduction and spread of the pathogens in the EU is likely to have yield and quality impacts in some parts of the territory. No associated crop losses have been reported so far from Italy and Portugal where *C. aenigma*, *C. siamense* (Italy) and *C. alienum* (Portugal) occur locally.	None
Available measures (Section 3.6)	Although not specifically targeted against *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola*, existing phytosanitary measures mitigate the likelihood of the pathogens' entry into the EU territory. Potential additional measures also exist to further mitigate the risk of entry into, establishment within, or spread of the pathogens within the EU.	None
Conclusion (Section 4)	*C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* meet all the criteria assessed by EFSA for consideration as Union quarantine pests.	None

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Aspects of assessment to focus on/scenarios to address in future if appropriate:	The main knowledge gap concerns the need to ascertain the present distribution of *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* within the EU territory. Given that all the data available in the literature have been explored, the Panel considers that systematic surveys should be carried out and *Colletotrichum* 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 *C. aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* in the EU territory	

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Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2018)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2018)
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, 2018)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2018)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2018)
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, 2018)
Pathway	Any means that allows the entry or spread of a pest (FAO, 2018)
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, 2018)

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, 2018)
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, 2018)

Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Appendix A – Host plants/species affected by each of the five *Colletotrichum* species

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

A.1. Host plants/species affected by *Colletotrichum aenigma*

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Actinidia arguta*	Actinidiaceae	Hardy kiwi	Wang et al. (2019)
	Aquilaria sinensis	Thymelaeaceae	Agarwood	Li et al. (2021a,b)
	Camellia japonica	Theaceae	Common camellia	Yang et al. (2019)
	Camellia oleifera	Theaceae	Tea oil camellia	Wang et al. (2020b)
	Camellia sinensis	Theaceae	Tea plant; tea tree	Wang et al. (2020b)
	Camelia sasanqua	Theaceae	Sasanqua camellia	Chen et al. (2019)
	Capsicum annuum	Solanaceae	Pepper	Sharma et al. (2022)
	Diospyros kaki	Ebenaceae	Persimmon	Andrioli et al. (2021)
	Fragaria × *ananassa*	Rosaceae	Strawberry	Chen et al. (2020)
	Juglans regia	Juglandaceae	Walnut	Wang et al. (2020c)
	Malus domestica	Rosaceae	Apple	Yokosawa et al. (2017)
	Olea europaea	Oleaceae	Olive	Schena et al. (2014)
	Persea americana	Lauraceae	Avocado	Sharma et al. (2017)
	Populus sp.	Salicaceae	Poplar	Jayawardena et al. (2016)
	Populus nigra var. *italica**	Salicaceae	Black poplar	Li et al. (2012)
	Pyrus pyrifolia	Rosaceae	Nashi pear	Fu et al. (2019)
	Pyrus × *bretschneideri*	Rosaceae	Chinese white pear	Fu et al. (2019)
	Pyrus communis	Rosaceae	European pear	Fu et al. (2019)
	Prunus avium	Rosaceae	Sweet cherry	Chethana et al. (2019)
	Sedum kamtschaticum	Crassulaceae	Stonecrop	Choi et al. (2017)
	Selenicereus undatus	Cactaceae	Dragon fruit; pitahaya	Meetum et al. (2015)
	Synsepalum dulcificum	Sapotaceae	Miracle fruit	Truong et al. (2018)
	Vigna unguiculata	Fabaceae	Cowpea	Alizadeh et al. (2015)
	Vitis vinifera	Vitaceae	Grapevine	Lopez-Zapata et al. (2019), Kim et al. (2021)
Wild weed hosts	–	–	–	–
Artificial/ experimental host	–	–	–	–

*: As *Colletotrichum populi*.

A.2. Host plants/species affected by *Colletotrichum alienum*

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Aquilaria sinensis*	Thymelaeaceae	Agarwood	Liu et al. (2020)
	Camellia spp.	Theaceae	Common camellia; tea oil camellia; tea tree	Liu et al. (2015)
	Diospyros kaki	Ebenaceae	Persimmon	Weir et al. (2012)
	Fragaria × *ananassa*	Rosaceae	Strawberry	Shivas et al. (2016)

Host status	Host name	Plant family	Common name	Reference
	Grevillea sp.	Proteaceae	Spider flowers	Liu et al. (2013), Shivas et al. (2016)
	Leucadendron spp.	Proteaceae	–	Liu et al. (2013)
	Leucospermum spp.	Proteaceae	–	Liu et al. (2013)
	Malus domestica	Rosaceae	Apple	Weir et al. (2012)
	Mangifera indica	Anacardiaceae	Mango	Tovar-Pedraza et al. (2020)
	Nerium oleander	Apocynaceae	Oleander	Shivas et al. (2016)
	Olea europaea	Oleaceae	Olive	Moreira et al. (2021)
	Persea americana	Lauraceae	Avocado	Liu et al. (2013), Sharma et al. (2017)
	Platostoma palustre	Lamiaceae	Chinese mesona	Hsieh et al. (2020)
	Protea cynaroides	Proteaceae	King protea	Liu et al. (2013)
	Serruria sp.	Proteaceae	Spiderhead	Liu et al. (2013)
Wild weed hosts	–	–	–	–
Artificial/ experimental hosts	–	–	–	–

A.3. Host plants/species affected by *Colletotrichum perseae*

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Capsicum annuum*	Solanaceae	Pepper	Sharma et al. (2022)
	Olea europaea	Oleaceae	Olive	Moral et al. (2021)
	Persea americana	Lauraceae	Avocado	Sharma et al. (2017)
	Vitis vinifera	Vitaceae	Grapevine	Yokosawa et al. (2020)
Wild weed hosts	–	–	–	–
Artificial/experimental hosts	–	–	–	–

A.4. Host plants/species affected by *Colletotrichum siamense*

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Acacia confusa*	Mimosaceae	False koa	Liu et al. (2022)
	Alchornea tiliifolia	Euphorbiaceae	–	Liu et al. (2022)
	Allium cepa	Amaryllidaceae	Onion	Chowdappa et al. (2015)
	Alpinia pusilla	Zingiberaceae	–	Liu et al. (2022)
	Amaryllis vittata	Amaryllidaceae	Barbados lily	Liu et al. (2022)
	Amherstia nobilis	Fabaceae	Orchid tree	Liu et al. (2022)
	Annona muricata	Anonnaceae	Soursop	Costa et al. (2019)
	Annona squamosa	Annonaceae	Sugar apple	Costa et al. (2019)
	Arenga caudata	Arecaceae	–	Liu et al. (2022)
	Artabotrys hexapetalus	Annonaceae	Climbing ylang-ylang	Liu et al. (2022)
	Anthurium sp.	Araceae	–	Liu et al. (2022)
	Aspidistra sp.	Asparagaceae	–	Liu et al. (2022)
	Bambusa vulgaris	Poaceae	Common bamboo	Liu et al. (2022)
	Bauhinia purpurea	Fabaceae	Australian orchid tree	Liu et al. (2022)

Host status	Host name	Plant family	Common name	Reference
	Calliandra haematocephala	Mimosaceae	Red powder puff	Liu et al. (2022)
	Camellia chrysantha	Theaceae	Camellia	Zhao et al. (2021)
	Camellia japonica	Theaceae	Common camellia	Peng et al. (2022)
	Camellia oleifera	Theaceae	Tea oil camellia	Liu et al. (2015)
	Camellia sinensis	Theaceae	Tea plant	Jayawardena et al. (2016)
	Capsicum annuum	Solanaceae	Pepper	Sharma and Shenoy (2014)
	Capsicum frutescens	Solanaceae	Bird's eye chilli	Noor and Zakaria (2018)
	Carica papaya	Caricaceae	Papaya	Zhang et al. (2021a,b,c)
	Carya illinoinensis	Juglandaceae	Pecan	Oh et al. (2021)
	Castanea henryi	Fagaceae	Henry's chestnut	Liu et al. (2022)
	Celtis sinensis	Cannabaceae	Japanese hackberry	Liu et al. (2022)
	Cenchrus purpureus	Poaceae	Elephant grass	Hyde et al. (2018)
	Cenostigma tocantinum	Leguminosae	–	Ferreira e Ferreira et al. (2020)
	Cercis chinensis	Fabaceae	Chinese redbud	Ji et al. (2019)
	Chamaerops humilis	Arecaceae	Mediterranean palm	Liu et al. (2022)
	Chrysalidocarpus lutescens	Palmae	Madagascar palm	Liu et al. (2022)
	Cinnamomum burmannii	Lauraceae	Batavia cinnamon	Liu et al. (2022)
	Cinnamomum camphora	Lauraceae	Camphor	Liu et al. (2022)
	Cinnamomum kotoense	Lauraceae	–	Zhou et al. (2016)
	Citrus spp.	Rutaceae	Citrus	Wang et al. (2021)
	Citrus reticulata	Rutaceae	Mandarin	Cheng et al. (2013)
	Citrus sinensis var. brasiliensis	Rutaceae	–	Liu et al. (2022)
	Clerodendrum wallichii	Lamiaceae	Swaddling flower	Liu et al. (2022)
	Clinacanthus nutans	Acanthaceae	Sabah snake grass	Liu et al. (2022)
	Coffea arabica	Rubiaceae	Coffee	Prihastuti et al. (2009)
	Corchorus capsularis	Malvaceae	White jute	Niu et al. (2016)
	Cornus hongkongensis	Cornaceae	Dogwood	Wang et al. (2021)
	Crinum asiaticum	Amaryllidaceae	Crinum lily	Liu et al. (2022)
	Cymbidium ensifolium	Orchidaceae	Oriental cymbidium	Liu et al. (2022)
	Cymbidium hybrid	Orchidaceae	–	Liu et al. (2022)
	Cymbopogon citratus	Poaceae	Lemon grass	Hyde et al. (2018)
	Dichotomanthus tristaniaecarpa	*Rosaceae*	–	Liu et al. *(2022)*
	Dionaea muscipula	Droseraceae	Venus flytrap	Shivas et al. (2016)
	Dioscorea cayennensis	Dioscoreaceae	Yam	De Souza Jr and Assuncao (2021)
	Diospyros kaki	Ebenaceae	Persimmon	Chang et al. (2018)
	Dracaena angustifolia	Asparagaceae	–	Liu et al. (2022)
	Dracaena cambodiana	Asparagaceae	–	Liu et al. (2022)

Host status	Host name	Plant family	Common name	Reference
	Dracaena fragrans	Asparagaceae	Cornstalk dracaena	Liu et al. (2022)
	Dypsis lutescens	Arecaceae	Areca palm	Chou et al. (2019)
	Elettaria cardamomum	Zingiberaceae	Cardamom	Chethana et al. (2016)
	Ensete superbum	Musaceae	Cliff banana	Kumar et al. (2017)
	Eriobotrya japonica	Rosaceae	Loquat	Shivas et al. (2016)
	Erythrina crista-galli	Fabaceae	Cockspur coral tree	Li et al. (2021)
	Erythrina variegata	Fabaceae	Indian coral tree	Guterres et al. (2020)
	Erythrophloeum fordii	Leguminosae	–	Liu et al. (2022)
	Euonymus japonicus	Celastraceae	Evergreen spindle	Wu et al. (2020)
	Excentrodendron hsienmu	Malvaceae	–	Liu et al. (2022)
	Excoecaria cochinchinensis	Euphorbiaceae	–	Liu et al. (2022)
	Ficus carica	Moraceae	Fig	Shivas et al. (2016)
	Ficus elastica	Moraceae	Rubber tree	Jayawardena et al. (2016)
	Fragaria × *ananassa*	Rosaceae	Strawberry	Weir et al. (2012)
	Gossypium hirsutum	Malvaceae	Cotton	Salunkhe et al. (2020)
	Heliconia rostrata	Musaceae	False bird of paradise	Chaves et al. (2020)
	Hevea sp.	Euphorbiaceae	–	Liu et al. (2022)
	Hibiscus tiliaceus	Malvaceae	Coastal hibiscus	Rocha et al. (2021)
	Homalomena occulta	Araceae	–	Liu et al. (2022)
	Hymenocallis spp.	Amaryllidaceae	Spider lily	Weir et al. (2012)
	Ilex cornuta	Aquifoliaceae	Chinese holly	Liu et al. (2022)
	Iris tectorum	Iridaceae	Iris	Liu et al. (2017)
	Jasminum mesnyi	Oleaceae	Chinese jasmine	Liu et al. (2022)
	Jasminum sambac	Oleaceae	Arabian jasmine	Liu et al. (2022)
	Jatropha integerrima	Euphorbiaceae	Spicy jatropha	Liu et al. (2022)
	Juglans regia	Juglandaceae	walnut	Wang et al. (2017)
	Lagerstroemia speciosa	Lythraceae	Pride of India	Liu et al. (2022)
	Licania tomentosa	Chrysobalanaceae		Lisboa et al. (2018)
	Liriodendron chinese × *tulipifera*	Magnoliaceae	Tulip poplar	Zhu et al. (2019)
	Litsea honghoensis	Lauraceae	–	Liu et al. (2022)
	Litchi chinensis	Sapindaceae	litchi	Ling et al. (2019)
	Macadamia integrifolia	Proteaceae	Macadamia	Prassanath et al. (2020)
	Machilus ichangensis	Lauraceae	–	Cheng et al. (2019)
	Machilus pauhoi	Lauraceae	–	Liu et al. (2022)
	Maesa indica	Primulaceae	–	Liu et al. (2022)
	Magnolia × *alba*	Magnoliaceae	White sandalwood	Liu et al. (2022)
	Magnolia grandiflora	Magnoliaceae	Magnolia	Zhou et al. (2022)
	Malus domestica	Rosaceae	Apple	Weir et al. (2012)
	Malus niedzwetzkyana	Rosaceae	Red-fleshed apple	Han et al. (2022)
	Mandevilla sp.	Apocynaceae	Rock trumpet	Watanabe et al. (2016)
	Mangifera indica	Anacardiaceae	Mango	Giblin et al. (2018)

Host status	Host name	Plant family	Common name	Reference
	Manihot esculenta	Euphorbiaceae	Cassava	Liu et al. (2019)
	Mentha sp.	Lamiaceae	Mint	James et al. (2014)
	Monstera deliciosa	Araceae	Split-leaf philodendron	Liu et al. (2022)
	Murraya sp.	Rutaceae	–	Liu et al. (2015)
	Musa acuminata	Musaceae	Banana	Uysal and Kurt (2020)
	Musa paradisiaca	Musaceae	–	Liu et al. (2022)
	Nelumbo nucifera	Nelumbonaceae	Lotus	Chen and Kirschner (2018)
	Ocinum basilicum	Lamiaceae	Basil	Ismail et al. (2021)
	Olea europaea	Oleaceae	Olive	Schena et al. (2014)
	Ophiopogon japonicus	Asparagaceae	Dwarf lilyturf	Liu et al. (2022)
	Opuntia cochenillifera	Cactaceae		Conforto et al. (2017)
	Orchid	Orchidaceae	–	Liu et al. (2022)
	Paramongaia weberbaueri	Amaryllidaceae	–	Liu et al. (2022)
	Parthenocissus tricuspidata	Vitaceae	Ivy	Schena et al. (2014)
	Peperomia sp.	Piperaceae	–	Liu et al. (2022)
	Persea americana	Lauraceae	Avocado	Liu et al. (2022)
	Philodendron selloum	Araceae	Lacy tree philodendron	Liu et al. (2022)
	Piper nigrum	Piperaceae	Black pepper	James et al. (2014)
	Pistacia vera	Anacardiaceae	Pistachio	Weir et al. (2012)
	Platostoma palustre	Lamiaceae	Chinese mesona	Hsieh et al. (2020)
	Plukenetia volubilis	Euphorbiaceae	Mountain peanut	Wang et al. (2020a)
	Plumeria alba	Apocynaceae	–	Ismail et al. (2021)
	Pongamia pinnata	Leguminosae	Indian beech	Liu et al. (2022)
	Protea cynaroides	Proteaceae	King protea	Liu et al. (2013)
	Prunus persica	Rosaceae	Peach	Tan et al. (2022)
	Psidium guajava	Myrtaceae	Common guava	Rodriguez-Palafox et al. (2021), Liu et al. (2022)
	Pterocarpus sp.	Fabaceae	–	Liu et al. (2022)
	Punica granatum	Lythraceae	Pomegranate	Xavier et al. (2019)
	Pyrus communis	Rosaceae	Pear	Fu et al. (2019)
	Pyrus pyrifolia	Rosaceae	Nashi pear	Fu et al. (2019)
	Renanthera coccinea	Orchidaceae	–	Liu et al. (2022)
	Rhaphiolepis indica	Rosaceae	Indian hawthorn	Liu et al. (2022)
	Ricinus communis	Euphorbiaceae	Castor bean	Tang et al. (2021)
	Rosa chinensis	Rosaceae	Rose	Feng et al. (2019)
	Rubus reflexus	Rosaceae	–	Liu et al. (2022)
	Saccharum spp.	Poaceae	–	Cavalcanti Marins et al. (2022)
	Salix matsudana	Salicaceae	Chinese willow	Zhang et al. (2021a,b,c)
	Salvia rosmarinus	Lamiaceae	Rosemary	James et al. (2014)
	Saraca indica	Fabaceae	Asoka tree	Jayawardena et al. (2016)
	Sarcandra glabra	Chloranthaceae	Herba sarcandrae	Ye et al. (2016)
	Saururus chinensis	Saururaceae	Lizard's tail	Liu et al. (2022)
	Schefflera heptaphylla	Araliaceae	–	Liu et al. (2022)

Host status	Host name	Plant family	Common name	Reference
	Schima noronhae	Theaceae	–	Liu et al. (2022)
	Selenicereus spp.	Cactaceae	Dragon fruit	Zhao et al. (2018)
	Smilax ocreata	Smilacaceae	–	Liu et al. (2022)
	Solanum betaceum	Solanaceae	Tamarillo	Pardo-De la Hoz et al. (2016)
	Sophora tonkinensis	Fabaceae	–	Song et al. (2021)
	Sphagneticola trilobata	Asteraceae	Singapore daisy	Liu et al. (2022)
	Spondias purpura	Anacardiaceae	Jocote	Carvalho et al. (2019)
	Syngonium auritum	Araceae	–	Liu et al. (2022)
	Tetrastigma obovatum	Vitaceae	–	Liu et al. (2022)
	Theobroma cacao	Malvaceae	Cacao tree	Serrato-Diaz et al. (2020)
	Uvaria chamae	Annonaceae	–	Liu et al. (2022)
	Vaccinium spp.	Ericaceae	Cranberry	Jayawardena et al. (2016)
	Vernicia montana	Euphorbiaceae	Mu oil tree	Yang et al. (2021)
	Vitis caribaea x *Riparia do Traviü*	Vitaceae	Caribbean grape	Santos et al. (2018)
	Vitis riparia	Vitaceae	Riverbank grape	Santos et al. (2018)
	Vitis vinifera	Vitaceae	Grapevine	Weir et al. (2012)
	Washingtonia robusta	Arecaceae	Mexican fan palm	Liu et al. (2022)
	Zinnia elegans	Asteraceae	Zinnia	Li et al. (2021a,b)
	Ziziphus mauritiana	Rhamnaceae	Indian jujube	Shu et al. (2021)
Wild weed hosts	*Commelina* sp.	Commelinaceae	Dayflower	Weir et al. (2012)
	Cycas debaoensis	Cycadaceae		Han et al. (2021)
	Dichotomanthus tristaniaecarpa	Rosaceae		Liu et al. (2022)
	Kadsura coccinea	Schisandraceae		Wang et al. (2017)
	Mallotus oppositifolius	Euphorbiaceae	Partridge tea	Liu et al. (2018)
	Solanum rostratum	Solanaceae	Beaked nightshade	Liu et al. (2022)
	Sterculia spp.	Malvaceae	–	Zhang et al. (2020a,b)
	Uraria picta	Fabaceae	–	Srivastava et al. (2017)

A.5. Host plants/species affected by *Colletotrichum theobromicola*

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Anacardium occidentale**	Anacardiaceae	Cashew	Veloso et al. (2018)
	Allium fistulosum	Amaryllidaceae	Welsh onion	Matos et al. (2017)
	*Annona cherimola**	Annonaceae	Cherimoya	Villanueva-Arce et al. (2008)
	Annona diversifolia	Annonaceae	Soursop	Weir et al. (2012)
	Annona muricata	Annonaceae	Soursop	Costa et al. (2019)
	Annona squamosa	Annonaceae	Sugar apple	Costa et al. (2019)
	Anthurium spp.	Araceae	Anthurium	Chaves et al. (2020)
	Butia odorata	Arecaceae	Jelly palm	Dorneles et al. (2018)
	Buxus spp.	Buxaceae	Boxwood	Hawk et al. (2018)
	Campomanesia phaea	Myrtaceae	Cambuci	Santos et al. (2017)
	Centrosema pubescens	Fabaceae	Butterfly pea	Pakdeeniti et al. (2022)
	Citrus spp.	Rutaceae	Citrus	Wang et al. (2021)

Host status	Host name	Plant family	Common name	Reference
	Coffea arabica	Rubiaceae	Coffee	James et al. (2014)
	Copernicia prunifera	Arecaceae	Carnaubeira palm	Araujo et al. (2018)
	Cyclamen persicum	Primulaceae	Persian cyclamen	Liu et al. (2011)
	Eucalyptus spp.	Myrtaceae	Eucalyptus	Rodrigues et al. (2014)
	Feijoa sellowiana	Myrtaceae	Feijoa	Weir et al. (2012)
	Fragaria × *ananassa*	Rosaceae	Strawberry	Weir et al. (2012)
	Gossypium arboretum cv. *indicum***	Malvaceae	Cotton	Kang et al. (2022)
	Limonium spp.	Plumbaginaceae	Sea lavender	Weir et al. (2012)
	Malpighia emarginata	Malpighiaceae	Acerola cherry	Braganca et al. (2014)
	Malus domestica	Rosaceae	Apple	Munir et al. (2016)
	Mangifera indica	Anacardiaceae	Mango	Pardo-De la Hoz et al. (2016)
	Manihot esculenta	Euphorbiaceae	Cassava	Oliveira et al. (2018)
	Manilkara zapota	Sapotaceae	Sapodilla	Martins et al. (2018)
	Olea europaea	Oleaceae	Olive	Lima et al. (2020)
	Persea americana	Lauraceae	Avocado	Sharma et al. (2017)
	*Prunus avium***	Rosaceae	Sweet cherry	Chethana et al. (2019)
	Punica granatum	Lythraceae	Pomegranate	Xavier et al. (2019)
	Quercus spp.	Fagaceae	Oak	Weir et al. (2012)
	*Senna obtusifolia**	Fabaceae	Chinese senna	Howard and Albregts (1973)
	Stylosanthes spp.	Fabaceae	Pencilflower	Weir et al. (2012)
	Theobroma cacao	Malvaceae	Cacao tree	Rojas et al. (2010)
Wild weed hosts	*Aeschynomene falcata*	Fabaceae	–	Shivas et al. (2016)
	Fragaria vesca	Rosaceae	Wild strawberry	Weir et al. (2012)
	*Hopea odorata**	Dipterocarpaceae	–	Rashid et al. (2021)
	*Potentilla canadensis**	Rosaceae	–	Grand (1985)

*: As *Colletotrichum fragariae*.
**: As *Colletotrichum pseudotheobromicola*.

Appendix B – Aggregate table of main hosts of the five *Colletotrichum* species

HOST NAME	*C. aenigma*	*C. alienum*	*C. perseae*	*C. siamense*	*C. theobromicola*
Actinidia arguta	•				
Allium cepa				•	
Allium fistulosum					•
Anacardium occidentale					•
Annona spp.				•	•
Anthurium spp.					•
Aquilaria sinensis	•				
Butia odorata					•
Buxus spp.					•
Camellia spp.	•	•		•	
Capsicum annuum	•		•	•	
Campomanesia phaea					•
Centrosema pubescens					•
Carica papaya				•	
Carya illinoinensis				•	
Citrus spp.				•	•
Citrus sinensis				•	
Citrus reticulata				•	
Coffea arabica				•	•
Copernicia prunifera					•
Corchorus capsularis				•	
Ctenanthe oppenheimiana				•	
Dioscorea cayennensis				•	
Diospyros kaki	•				
Eucalyptus spp.					•
Fragaria × *ananassa*	•			•	
Gossypium arboretum cv. *indicum*					•
Juglans regia	•				
Malpighia emarginata					•
Malus domestica	•			•	•
Malus niedzwetzkyana				•	
Mangifera indica		•		•	•
Manihot carthaginesis				•	
Manihot esculenta					•
Manihot tomentosa				•	
Manikara zapota					•
Olea europaea	•		•	•	•
Persea americana	•	•	•	•	•
Protea spp.		•			
Prunus avium	•				•
Prunus persica				•	
Punica granatum				•	•
Pyrus x *bretschneideri*	•			•	
Pyrus pyrifolia	•			•	
Pyrus communis	•			•	
Selenicereus undatus	•			•	

HOST NAME	*C. aenigma*	*C. alienum*	*C. perseae*	*C. siamense*	*C. theobromicola*
Synsepalum dulcificum	•			•	
Theobroma cacao					•
Vitis caribaea × *Riparia do Traviü*				•	
Vitis riparia				•	
Vitis vinifera	•		•		
Zinnia elegans				•	
Ziziphus mauritiana				•	

Appendix C – Distribution of the five *Colletotrichum* species

C.1. Distribution of *Colletotrichum aenigma*

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

Region	Country	Subnational (e.g. State)	Status	Reference
North America	USA*	N/A	Present	Jayawardena et al. (2016)
South America	Brazil	Rio Grande do Sul (Farroupilha)	Present	Andrioli et al. (2021)
	Colombia	La Union, Valle del Cauca	Present	López-Zapata et al. (2019), Guevara-Suarez et al. (2022)
EU (27)	Italy	Apulia	Present	Schena et al. (2014)
Other Europe	UK	N/A	Present	Baroncelli et al. (2015)
Asia	China	• Beijing (Shi Jingshan)** • Changzhou • Dandong (Liaoning) • Dangshan (Anhui) • Fangshan (Beijing) • Hainan province • Hangzhou (Zhejiang) • Hongshan (Wuhan, Hubei) • Huangpi (Hubei) • Hubei • Jiangsu • Jinhua (Zhejiang) • Liaoning • Nanjing • Neiqiu (Xingtai, Hebei) • Ningbo (Zhejiang) • Ningde (Fujian) • Putian (Fujian) • Qingdao • Qinhuangdao (Hebei) • Quanzhou (Fujian) • Shanghai (Campus of East China Normal University) • Shanxi • Shaoxing (Zhejiang) • Tianjin • Wugong • Wuhan (Hubei) • Wuxi (Jiangsu) • Xiayi (Henan) • Yancheng (Jiangsu) • Yangling • Yangliuqing (Tianjin) • Zhangzhou (Fujian) • Zhongxiang (Hubei)	Present	Chen et al. (2019), Chethana et al. (2019), Diao et al. (2017), Fu et al. (2019), Han et al. (2016); Li et al. (2021a,b), Wang et al. (2015, 2019); Yan et al. (2015), Yang et al. (2019); Zhang et al. (2020a,b)
	Iran	• Langrood • Rasht • Guilan	Present	Alizadeh et al. (2015)

Region	Country	Subnational (e.g. State)	Status	Reference
		• Mazandaran • Golestan		
	Israel	• Beit Haemek • Bet Dagan (Central District) • Kfar Aza • Besor (Aza Farm) • Fatsail • Central Israel (ARO orchard; Sde Warburg)	Present	Chen et al. (2020), Diao et al. (2017), Fuentes-Aragón et al. (2018), Liu et al. (2015); Sharma et al. (2017, 2022), Vieira et al. (2014), Weir et al. (2012)
	Japan	• Tokyo • Kanagawa • Kagoshima • Nagano • Tochigi	Present	Chen et al. (2020), Costa et al. (2019), Liu et al. (2015), Sharma et al. (2017), Yokosawa et al. (2017), Vieira et al. (2014), Weir et al. (2012)
	Malaysia	• Jalan Asam Jaws (Universiti Putra Malaysia) • Serdang (Selangor)	Present	Zakaria (2021)
	Republic of Korea	• Bonghwa • Gimcheon • Gosung (Kangwon) • Gunwi (Gyeongbuk)	Present	Choi et al. (2017), Kim et al. (2021), Lee et al. (2021)
	Thailand	• Nakhon Pathom • Pathum Thani • Samut Sakhon	Present	Meetum et al. (2015)

*: Reported by Jayawardena et al. (2016) but no ref is cited.
**: As *Colletotrichum populi*.

C.2. Distribution of *Colletotrichum alienum*

Distribution records based on Farr and Rossman (online; https://nt.ars-grin.gov/fungaldatabases/) and other sources.

Region	Country	Subnational (e.g. State)	Status	References
North America	USA	• California	Present	Crous et al. (2013)
	Hawaii	N/A	Present	Crous et al. (2013)
	Mexico	• Chiapas • Oaxaca	Present	Tovar-Pedraza et al. (2020)
South America	Uruguay	• Departments of Colonia, Canelones, Montevideo, Maldonado, Rocha and Treinta y Tres	Present	Moreira et al. (2021)
EU (27)	Portugal	• Madeira Islands_Florialis Estate	Present	Liu et al. (2013)
Africa	South Africa	• Western Cape Province • Caledon • Betty's Bay	Present	Liu et al. (2013)
	Zimbabwe	N/A	Present	Crous et al. (2013)

Region	Country	Subnational (e.g. State)	Status	References
Asia	China	• Fengtai (Beijing) • Huangzhuling Forest Farm (Hainan) • Jiangxi Province (Ganzhou National Forest Park)	Present	Ahmad et al. (2021)
	Israel	• Kfar Yuval Orchard (North Israel)	Present	Sharma et al. (2017)
Oceania	Australia	• Bangalow • Cudgen • Duranbah • Green Pigeon • Mt Tamborine • New South Wales • Western Australia	Present	Costa et al. (2019), Crous et al. (2013), Mo et al. (2018), Schena et al. (2014), Shivas et al. (2016), Weir et al. (2012)
	New Zealand	• Auckland (Oratia, Kumeu research orchard) • Bay of Plenty (Katikati, Te Puke, Te Puna) • Tauranga • Waikato (Hamilton)	Present	Alaniz et al. (2019), Diao et al. (2017), Liu et al. (2015), Vieira et al. (2014), Weir et al. (2012)

C.3. Distribution of *Colletotrichum perseae*

Distribution records based on Farr and Rossman (online; https://nt.ars-grin.gov/fungaldatabases/) and other sources.

Region	Country	Sub-national (e.g. State)	Status	References
Asia	Israel	• Sde Warburg • Bet Dagan • Mikveh	Present	Sharma et al. (2017, 2022)
	Japan	• Nagano • Obuse • Suzuka • Takayama	Present	Yokosawa et al. (2020)
South America	Chile	• Valparaiso • Metropolitana • Libertador Gral (Bernardo Ohiggins)	Present	Bustamante et al. (2020)
Oceania	Australia	N/A	Present	Moral et al. (2021)
	New Zealand	Tauranga (Bay of Plenty)	Present	Hofer et al. (2021)

C.4. Distribution of *Colletotrichum siamense*

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

Region	Country	Subnational (e.g. State)	Status	References
North America	Mexico	• Chiapas • Cocula • Colima • Guerrero • Michoacan • Nayarit • Oaxaca	Present	Pérez-Mora et al. (2020)

Region	Country	Subnational (e.g. State)	Status	References
		• Xipotepec (Puebla) • Alome (Sinaloa) • El Fuerte (Sinaloa) • Juan Jose Rios (Sinaloa) • Tecpan • Veracruz		
	USA	• Adams (Pennsylvania) • Aiken (South Carolina) • Alabama • Berks (Pennsylvania) • Bourbon (Kentucky) • Brussels (Illinois) • Chesnee (South Carolina) • Clinton (Kentucky) • Cumberlar (Kentucky) • Edwardsville (Illinois) • Fairfax (South Carolina) • Fayetta (Kentucky) • Florida • Frederick (Maryland) • Georgia • Graves (Kentucky) • Harlan (Kentucky) • Johnston (North Carolina) • Kent (Delaware) • Lancaster (Pennsylvania) • Licking (Ohio) • Lyon (Kentucky) • McBee (South Carolina) • Marshall (Kentucky) • Montgomery (Kentucky) • Ridge Spring (South Carolina) • Saluda (South Carolina) • Urbana (Illinois) • Virginia • Wilkes (North Carolina) • Woodford (Kentucky)	Present	Weir et al. (2012)
South America	Argentina	• La Plata (Buenos Aires) • Santa Fe	Present	Larran et al. (2015), Fernandez et al. (2018)
	Brazil	• Alagoas • Aguai (Sao Paolo) • Atalaia • Bahia • Bauru (Sao Paolo) • Belem (Para) • Boa Esperanca (Minas Gerais) • Boa Vista (Roraima) • Bonito (Pernambuco) • Campinas (Sao Paolo) • Campo Grande (Mato Grosso) • Ceara • Concorde (Sao Paolo) • Conselheiro Lafaiete (Minas Gerais) • Curvelo (Minas Gerais)	Present	Costa et al. (2019), Fantinel et al. (2017), Lima et al. (2013), Oliveira et al. (2018), Santos et al. (2018), Soares et al. (2020)

Region	Country	Subnational (e.g. State)	Status	References
		• Flores da Cunha (Rio Grande Do Sul) • Formiga (Minas Gerais) • Gama (Distrito Federal) • Goias • Gurupi (Tocantins) • Lavras (Minas Gerais) • Manaus (Amazonas) • Palmital do Cervo (Minas Gerais) • Paraiba • Patos de Minas (Minas Gerais) • Piracicaba (Sao Paolo) • Piraju (Sao Paolo) • Riacho Fundo • Rio Largo • São Pedro do Sul (Rio Grande do Sul) • Santa Catarina • Sao Caetano do Sul (Sao Paolo) • Teresina (Pernambuco) • Perdoes (Minas Gerais) • UFPI-Teresina (Piaui) • Recanto de Emas (Distrito Federal) • Ribeirao Vermelho (Minas Gerais) • Samambaia (Distrito Federal) • Sao Joao del Rei (Minas Gerais) • Sao Joao do Miriti (Rio de Janeiro) • Sao Sebastiao de Paraiso (Minas Gerais) • Taguatinga (Distrito Federal) • Tres Coracoes (Minas Gerais) • Vicosa (Minas Gerais)		
	Colombia	• Caldas • Sucre • Tolima • La Union (Valle del Cauca)	Present	Pardo-De la Hoz et al. (2016)
	Uruguay	• Rincon del Colorado (Canelones)	Present	Carbone et al. (2021)
Central America	Puerto Rico	• Adjuntas • Ciales • Utuado • Mayaguez	Present	Serrato-Diaz et al. (2020)
EU (27)	Italy*	Forlì-Cesena	Present	Jayawardena et al. (2018)
Africa	Egypt	N/A	Present	Douanla-Meli and Unger (2017)
	Ghana	• Akuse (Eastern Region)	Present	Douanla-Meli and Unger (2017)

Region	Country	Subnational (e.g. State)	Status	References
		• Asutuare (Greater Accra Region) • Dodowa (Greater Accra Region) • Juapong (Volta Region) • Kpong (Eastern Region) • Somanya (Eastern Region)		
	Kenya	N/A	Present	Silva et al. (2012)
	Nigeria	N/A	Present	Silva et al. (2012)
	Malawi	• Ibadan	Present	Weir et al. (2012)
	South Africa	N/A	Present	Weir et al. (2012)
	Zimbabwe	N/A	Present	Liu et al. (2013)
Asia	Bangladesh	• Dhaka • Rajshahi district • Tangail	Present	Azad et al. (2020)
	China	• Anhui • Fujian • Guangdong • Guangxi • Hainan • Henan • Hubei • Hunan • Jiangxi • Sichuan • Yunnan • Zhejiang • Zhuang • Wuhan	Present	Weir et al. (2012), Xu et al. (2015)
	India	• Andaman & Nicobar Islands • Karnataka • Kerala • Maharashtra • Punjab	Present	Sharma and Shenoy (2014)
	Indonesia	• Gowa	Present	Radiastuti et al. (2019), Sukarno et al. (2021), Zhafarina et al. (2021)
		• Indonesian Medicinal and Aromatic Crops Research Institute_Bogor • Jeneponto • Massakar • Sibolangit_Deli Serdang_North Sumatra • Yogyakarta		
	Israel	• Bet Dagan • Kfar Aza	Present	Sharma et al. (2017)
	Japan	• Chiba • Awa Prefecture • Nagano • Nara • Sagamihar	Present	Yokosawa et al. (2017)

Region	Country	Subnational (e.g. State)	Status	References
	Laos	• N/A	Present	Phoulivong et al. (2012)
	Malaysia	• Sungai Kapar (Pos Dipang) • Agricultural Farm (Universiti Putra Malaysia, Selangor) • Bakti Permai (Universiti Sains Malaysia) • Jalan Asam Jaws (Universiti Putra Malaysia Serdang Selangor) • Organic Edible Garden Unit (Serdang, Selangor) • Penang Island • Peninsular Malaysia	Present	de Silva et al. (2019)
	Pakistan	• Punjab • Bhalwal • Khurshab • Quetta • Sargodha	Present	Abid et al. (2019)
	Philippines	• Davao del Norte • Mayapyap Sur (Cabanatuan, Nueva Ecija)	Present	Reyes et al. (2021)
	South Korea	• Andong (Gyeongsangbuk do) • Cheongdo (Gun North) Gyeongsang • Gimcheon • Goesan (Chungcheong) • Gyeongbuk • Miryang • Mungyeong • Sangju (Gyeongbuk) • Uiseong • Yesan	Present	Hassan et al. (2018), Oo et al. (2021)
	Sri Lanka	• Bulanawewa (Galewela, Matale) • Kananwila (Horana) • Kandy • Peradeniya • Sigiriya (Matale District)	Present	de Silva et al. (2019)
	Taiwan	• Dahu Township (Miaoli) • Fangshan (Pingtung) • Gongguan Township (Miaoli) • Guantian (Taian) • Miaoli • Shitan Township (Miaoli) • Taichung City (National Museum of Natural Science) • Taoyuan City (Guanyin) • Yunlin county	Present	Wu et al. (2020)

Region	Country	Subnational (e.g. State)	Status	References
	Thailand	• Mae Taeng (Mae Lod Village, Chiang Mai) • Mae Taeng (Pha Daeng Village, Chiang Mai) • Chainat (Nakhon Ratchasima) • Chiang Mai • Kanchanaburi • Loei • Nakhon Pathom • Pathum Thani • Ratchaburi • Roi Et • Samut Sakhon	Present	Weir et al. (2012), de Silva et al. (2019)
	Turkey	• Hatay	Present	Uysal and Kurt (2020)
	Vietnam*	• Cu Chi District (Trung An Ward) * • Ho Chi Minh City (Cu Chi, Binh My Ward)	Present	Weir et al. (2012)
Oceania	Australia	• Ayr • Bangalow • Bees Creek • Bundaberg (Queensland) • Childers (Queensland) • Cudgen • Duranbah • Green Pigeon • Middle Point • Mt Tamborine • Murwillumbah (New South Wales) • Muswellbrook (New South Wales) • Orchard (New South Wales) • Wales (New South Wales)	Present	Weir et al. (2012), Wang et al. (2021)
	New Zealand	• Tauranga	Present	Hofer et al. (2021)

*: As *C. jasmine-sambac*.

C.5. Distribution of *Colletotrichum theobromicola*

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

Region	Country	Sub-national (e.g. State)	Status	References
North America	USA	• Alabama • Baton Rouge (Louisiana) • Dover (Florida) • East Baton Rouge Parish (Louisiana) • Lake Alfred (Florida) • Indiana • Louisiana • Mississippi • Missouri	Present	Weir et al. (2012), Hawk et al. (2018)

Region	Country	Sub-national (e.g. State)	Status	References
		• New York • North Carolina • Oklahoma • Perry (Kentucky) • Puerto Rico • South Carolina • Tarrant (Texas) • Virginia		
	Mexico	• Michoacán* • State of Mexico* • Compostela (Nayarit) • San Blas (Nayarit) • Venustiano Carranza (Puebla)	Present	Cristobal-Martinez et al. (2016)
Central America	Panama	• Chiriqui (San Vicente) • Chiriqui (Escobal)	Present	Weir et al. (2012), Solís et al. (2022)
Caribbean	Puerto Rico	• Adjuntas • Ciales • Utuado	Present	Serrato-Diaz et al. (2020)
South America	Argentina	• Capital (La Rioja)	Present	Lima et al. (2020)
	Brazil	• Atalaia (Alagoas) • Nossa Senhora de Fatima (Iranduba, Amazonas) • Parana do Supia (Manacapuru, Amazonas) • Bela Cruz (Ceara) • Embrapa Agroindustria Tropical (Pacajus, Ceara) • Brasilia (Federal District) • Cachoeira • Cristalina (Goias) • Campo Alegre (Goias) • Lages (Santa Catarina) • Sao Gotardo (Minas Gerais) • Sao Paolo • Palm Agricultural Center of Federal University of Pelotas (Capao do Leao, Rio Grande Do Sul) • Palmas (Parana) • Para • Piracicaba (Sao Paolo) • Nazare (Reconcavo Region in Bahia) • Sao Felix (Reconcavo Region in Bahia) • Sao Jose do Rio Pardo (Sao Paolo) • Sao Jose do Norte (Rio Grande Do Sul) • Sao Jorge (Rio Grande Do Sul) • Sao Joaquim (Santa Catarina) • Irece (Reconcavo Region in Bahia) • Palm Agricultural Center of Federal University of Pelotas_Capao do Leao • Sao Jorge • Sao Jose do Norte • Lages • Sao Joaquim • Sao Jose do Rio Pardo • Piracicaba • Nazare • Cachoeira • Sao Felix	Present	Matos et al. (2017), Stadnik et al. (2019)

Region	Country	Sub-national (e.g. State)	Status	References
	Colombia	• Tolima • Valle del Cauca	Present	Pardo-De la Hoz et al. (2016)
	Costa Rica	• Parrita • San Carlos • Guácimo	Present	Ruiz-Campos et al. (2022)
	Uruguay	• Progreso (Canelones) • Juanicó (Canelones) • Melilla (Montevideo) • Salto • Canelones (las Brujias) • Departments of Colonia, Maldonado, Rocha and Treinta y Tres	Present	Alaniz et al. (2015), Moreira et al. (2021)
Africa	Angola	N/A	Present	Silva et al. (2012)
Asia	China	• Fangshang (Bejiing)	Present	Solís et al. (2022)
	India	• Rahuri (Maharashtra)	Present	Sharma et al. (2017)
	Israel	• Hod Hasharon • Kfar Rut • Bet Dagan	Present	Sharma et al. (2017), Solís et al. (2022)
	Japan	• Chichijima island	Present	Morita et al. (2015)
	Philippines	• Depangal (Coron) • Nagbaril (Coron) • Bintuan (Coron)	Present	Dela Cueva Fe et al. (2021)
	Republic of Korea	• Hahoe Village (Andong, Gyeongbuk)	Present	Kang et al. (2022)
	Thailand	• Chiang Mai • Lamphum	Present	Pakdeeniti et al. (2022)
Oceania	Australia	• Atherton Tablelands (Queensland) • Bees Creek • Melville Island • New South Wales • Samford	Present	Weir et al. (2012), Wang et al. (2021)
	New Zealand	• Kerikeri	Present	Weir et al. (2012)

*: As *C. fragariae*.

Appendix D – EU 27 annual imports of fresh produce of hosts from countries where *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* are present, 2016–2020 (in 100 kg)

Source: Eurostat accessed on 18/3/2022.

		2016	2017	2018	2019	2020
Fresh persimmons	United Kingdom	875.83	297.06	703.77	2,188.73	3,067.48
	Thailand	:	:	0.07	:	:
	Japan	:	0.27	0.76	0.27	0.02
	Brazil	33.63	315.72	337.60	974.78	428.63
	South Korea	:	:	0.05	0.80	:
	Israel	2,404.45	3,231.29	1,158.64	181.58	3,211.13
	China	17.57	:	5.09	:	17.40
	Sum	3,331.48	3,844.34	2,205.98	3,346.16	6,724.66
		2016	**2017**	**2018**	**2019**	**2020**
Fresh strawberries	United Kingdom	10,860.25	13,845.53	6,788.52	16,708.13	25,121.30
	Japan	0.97	1.38	0.36	0.33	0.09
	South Korea	0.12	:	:	:	:
	USA	2,881.84	1,572.86	354.26	10.12	3.11
	Israel	4.28	5.10	:	:	:
	China	1,500.00	1,250.00	:	:	:
	South Africa	20.46	64.44	176.31	25.35	124.80
	Argentina	:	:	:	19.20	:
	Colombia	:	:	:	0.57	:
	Mexico	49.87	34.38	41.34	80.00	6.66
	Kenya		0.70	0.64	0.01	
	Turkey	26,813.33	31,567.47	37,510.96	18,307.54	59,353.98
	Sum	42,131.12	48,341.86	44,872.39	35,151.25	84,609.94
		2016	**2017**	**2018**	**2019**	**2020**
Fresh or dried walnuts, shelled and in shell	United Kingdom	15,274.36	13,547.81	15,560.94	18,851.19	22,022.85
	Thailand	:	:	:	:	0.01
	Japan	0.01	:	:	0	:
	Brazil	:	15.75	0.05	:	0.12
	South Korea	:	:	:	:	0.58
	USA	793,088.61	774,219.27	732,846.81	828,789.85	831,274.57
	Israel	218.03	7.55	7.32	8.920	2.32
	Iran	18.99	8.37	85.24	102.01	10.38
	China	2,500.06	17,044.27	30,127.04	18,655.46	48,220.89
	Sum	811,100.06	804,843	778,627.4	866,407.4	901,531.7
		2016	**2017**	**2018**	**2019**	**2020**
Fresh apples	United Kingdom	208,071.14	340,412.05	555,318.23	214,996.32	310,964.24
	Thailand	:	3.79	:	:	:
	Japan	7.61	0.53	0.95	:	19.25
	Brazil	154,768.58	249,520.21	242,632.64	139,015.43	92,900.91
	South Korea	:	:	:	4.17	:
	USA	0.05	545.82	2,874.22	:	:

		2016	2017	2018	2019	2020
	Israel	2,225.55	1,037.58	936.63	1,813.20	755.03
	Iran	:	:	2,945.28	0.38	676.65
	China	13,188.53	1,644.89	15,539.34	780.15	4,778.37
	South Africa	298,162.64	252,068.96	334,615.90	258,077.03	329,086.35
	Argentina	120,597.09	148,910.00	222,092.84	144,581.51	163,000.90
	Australia	1,048.66	4,926.09	9,159.46	8,311.03	3,638.72
	Colombia	785.39	1,376.06	745.60	1,397.11	1,065.38
	Taiwan	:	:	:	2.97	:
	Bangladesh	:	2.64	2.18	0.63	4.05
	Nigeria	:	0.76	:	:	:
	Pakistan	:	:	:	1.95	0.08
	India	0.01	:	:	:	0.45
	Turkey	240.22	1,610.74	17,594.86	2,311.21	19,023.31
	Viet Nam	:	:	0.20	:	:
	Sri Lanka	:	:	:	0.15	:
	New Zealand	751,627.60	754,736.56	966,920.91	728,052.41	759,371.40
	Panama					436.80
	Uruguay	20,879.17	55,103.38	30,072.47	14,164.50	2,310.32
	Sum	1,571,602	1,811,900	2,401,452	1,513,510	1,688,032
		2016	**2017**	**2018**	**2019**	**2020**
Fresh or chilled olives	United Kingdom	1,375.44	1,004.14	769.35	1,339.85	4,669.79
	Thailand	0.08	0.71	0.59	0.48	0.03
	USA	0.95	0.61	0.00	:	0.19
	Israel	3.44	0.14	:	0.22	0.00
	Iran	:	:	:	2.01	:
	China	:	0.08	:	:	:
	Australia	:	:	0.02	:	0.00
	South Africa	:	:	0.02	0.31	0.01
	Argentina	:	:	:	0.61	:
	Australia	:	:	0.02	:	0.00
	Kenya	:	:	:	0.11	:
	Bangladesh	11.80	15.44	23.98	12.89	18.93
	India	:	:	:	0.10	5.05
	Turkey	150.33	2.30	42.74	685.71	1,687.46
	Sum	1,542.04	1,023.42	836.72	2,042.29	6,381.46
		2016	**2017**	**2018**	**2019**	**2020**
Fresh or dried avocados	United Kingdom	89,364.19	100,238.31	104,652.29	117,434.53	125,600.43
	Thailand	3.68	9.76	9.66	9.06	3.39
	Brazil	44,357.36	71,040.50	68,697.61	78,673.73	48,183.83
	USA	8,819.53	1.19	2,546.86	0.02	4.66
	Israel	301,123.91	424,267.97	370,378.23	437,318.01	345,664.24
	China	193.97	35.28	:	1.23	0.04
	South Africa	419,768.89	315,854.56	652,817.98	401,352.79	416,290.22
	New Zealand	0.85	0.61	:	:	0.03
	Australia	:	:	:	0.01	:
	Mexico	503,687.52	445,611.06	463,741.28	767,878.48	716,092.02
	Israel	301,123.91	424,267.97	370,378.23	437,318.01	345,664.24

		2016	2017	2018	2019	2020
	Zimbabwe	13,030.06	20,378.85	36,539.24	32,020.52	38,872.63
	Argentina	950.00	:	:	:	:
	Colombia	152,115.55	210,139.60	251,050.33	387,367.23	663,148.97
	Mexico	503,687.52	445,611.06	463,741.28	767,878.48	716,092.02
	Kenya	228,426.16	243,947.31	404,593.87	346,231.90	435,308.72
	Nigeria	1.06	3.15	3.18	0.51	:
	India	0.04	2.06	0.52	0.06	:
	Turkey	213.41	477.05	1,530.93	2,172.09	1,864.65
	Zimbabwe	13,030.06	20,378.85	36,539.24	32,020.52	38,872.63
	Viet Nam	1.00	:	:	0.05	:
	Sri Lanka	7.03	4.88	5.63	2.00	11.95
	Angola	:	:	3.85	:	3.54
	Panama	:	:	:	474.24	:
	Sum	2,579,906	2,722,270	3,227,230.2	3,808,153	3,891,678
		2016	**2017**	**2018**	**2019**	**2020**
Fresh pears	United Kingdom	36,698.28	32,267.61	16,605.43	10,203.21	16,864.50
	Japan	2.50	0.02	0.45	:	:
	Brazil	208.68	:	251.27	926.88	:
	South Korea	789.33	1,036.40	666.02	819.04	628.26
	USA	214.47	454.76	471.49	12.54	:
	Israel	:	664.59	:	569.20	219.49
	Iran	:	:	32.40	:	7.50
	China	102,076.61	98,191.53	116,993.12	82,741.84	99,293.92
	South Africa	865,862.63	759,193.32	655,428.91	590,939.08	583,331.56
	Argentina	611,166.07	434,480.03	519,079.90	390,070.38	505,997.93
	Australia	:	:	1,224.72	:	:
	Nigeria	:	:	1.00	:	0.36
	Turkey	13,874.34	32,003.71	67,690.28	63,998.83	113,683.44
	Sum	1,630,892.9	1,358,292	1,378,445	1,140,281	1,320,027
		2016	**2017**	**2018**	**2019**	**2020**
Fresh cherries (excl. Sour cherries)	United Kingdom	2,100.45	2,245.25	4,635.62	2,497.09	11,131.10
	Japan	:	:	:	0.02	:
	Brazil	:	:	:	15.45	:
	USA	453.30	4,267.78	1,541.48	923.05	216.04
	Israel	3.09	:	:	:	:
	Iran	:	0.00	5.75	:	162.00
	Sum	2,556.84	6,513.03	6,182.85	3,435.61	11,509.14
		2016	**2017**	**2018**	**2019**	**2020**
Fresh grapes	United Kingdom	140,433.00	153,809.85	115,241.01	74,593.85	56,236.27
	Thailand	0.37	0.14	0.16	:	0.87
	Japan	4.84	1.19	1.17	1.15	20.67
	Brazil	194,152.79	249,279.81	271,987.56	196,465.22	228,091.31
	South Korea	:	2.88	4.32	0.09	:
	USA	1,714.93	8,868.74	4,413.37	1,866.20	1,072.48
	Israel	13,169.16	7,165.09	6,397.33	318.24	1,080.90
	Iran	:	:	2,158.50	366.00	399.80

		2016	2017	2018	2019	2020
	China	0.00	6.00	0.03	:	:
	Australia	2.95	0.50	:	:	:
	Sum	349,478.04	419,134.2	400,203.45	273,610.8	286,902.3
		2016	**2017**	**2018**	**2019**	**2020**
Fresh or dried guavas, mangoes and mangosteens	South Africa	8,550.13	13,015.45	9,739.99	12,116.95	8,656.28
	New Zealand	0.01	0.08	0.09	0.07	0.10
	Australia	25.72	94.18	62.92	:	:
	Mexico	35,095.07	40,848.36	46,001.68	50,935.79	51,841.89
	Israel	143,726.08	140,551.30	108,353.48	121,875.16	98,143.59
	China	38.95	51.87	180.81	78.23	104.34
	USA	78,874.11	45,478.21	54,660.34	82,580.54	82,852.21
	Argentina	14.40	:	:	:	:
	Colombia	2,321.38	2,553.75	3,139.67	6,833.02	4,131.75
	Kenya	232.06	4.08	65.09	10.30	66.53
	Thailand	6,460.81	7,401.80	6,911.89	6,743.92	5,260.84
	Taiwan	:	:	3.48	17.34	0.92
	Bangladesh	438.53	256.66	331.27	310.73	323.91
	Malawi	:	:	:	:	648.00
	Nigeria	0.78	0.10	1.13	1.95	0.03
	Pakistan	17,149.78	15,912.58	21,867.43	29,207.33	16,196.50
	India	5,989.34	8,148.87	9,470.36	9,315.51	7,347.61
	Turkey	0.12	0.21	24.09	68.86	38.93
	Japan	0.66	:	:	:	0.01
	Viet Nam	794.89	950.37	1,346.64	1,546.69	965.31
	Indonesia	1,981.20	2,004.36	2,926.64	2,386.27	1,406.94
	Sri Lanka	1,254.27	1,003.35	765.31	813.83	423.16
	Angola	:	:	486.65	658.15	351.50
	Brazil	1,025,325.4	1,158,717.1	1,241,860.6	1,437,569.2	1,577,043.9
	Panama	:	0.18	0.70	:	:
	Sum	1,328,273.7	1,436,993	1,508,200.3	1,763,070	1,855,804
		2016	**2017**	**2018**	**2019**	**2020**
Citrus fruit, fresh or dried	South Korea	12.70	0.01	:	21.09	15.00
	South Africa	5,278,830.95	5,802,017.61	6,381,124.73	6,196,837.96	7,830,147.60
	Argentina	2,412,706.76	1,913,772.23	2,242,298.89	1,585,087.09	1,403,348.80
	Australia	3,279.84	1,284.38	644.97	10,645.40	2,343.47
	Colombia	44,825.37	79,400.99	123,887.46	136,914.85	172,197.70
	Mexico	570,402.80	553,818.66	589,021.12	443,743.54	349,648.63
	Kenya	:	:	8.80	:	34.56
	Thailand	426.42	1,283.13	659.74	624.93	194.87
	Taiwan	157.49	:	:	:	0.01
	Bangladesh	227.61	229.58	159.67	322.42	1,183.66
	Nigeria	:	:	0.03	0.10	200.00
	Pakistan	:	:	2.45	0.59	:
	India	246.80	1.00	449.63	88.51	254.95
	Turkey	2,569,671.58	2,026,980.05	3,149,386.85	2,102,077.48	2,574,009.13
	Japan	352.58	417.44	270.73	319.24	162.50
	Brazil	864,863.09	903,432.95	900,907.24	822,134.46	902,590.26
	USA	301,229.06	231,210.47	185,706.99	177,755.45	148,608.92
	Israel	799,118.49	969,403.62	824,601.66	812,738.57	878,713.18

		2016	2017	2018	2019	2020
	Zimbabwe	297,550.62	328,595.48	397,906.49	348,303.06	391,868.70
	Viet Nam	28,649.46	46,738.17	70,934.07	73,964.35	63,730.02
	Indonesia	566.73	555.70	779.35	836.73	864.54
	China	827,840.57	1,084,857.27	1,024,163.15	1,108,595.22	1,098,689.98
	Sri Lanka	0.82	80.98	135.62	0.20	60.10
	Sum	14,000,959.7	13,944,079.7	15,893,049.6	13,821,011.2	15,818,866.6
		2016	**2017**	**2018**	**2019**	**2020**
Fresh tamarinds, cashew apples, lychees, jackfruit, sapodillo plums, passion fruit, carambola and pitahaya	South Africa	39,656.26	45,282.45	30,643.15	27,215.68	19,903.15
	Australia	:	:	:	:	12.50
	Colombia	69,743.63	72,656.37	83,639.84	89,847.31	90,741.20
	Mexico	543.90	212.78	1,295.08	669.87	2,331.91
	Kenya	714.44	221.45	603.11	481.00	697.14
	Thailand	9,774.93	10,279.68	12,461.38	14,900.21	10,138.75
	Taiwan	11.92	:	10.59	25.97	8.97
	Bangladesh	140.15	222.55	291.61	206.12	382.00
	Nigeria	:	:	:	1.91	3.09
	Pakistan	2.22	3.34	8.17	:	:
	India	324.19	621.75	1,095.12	1,168.69	754.33
	Turkey	:	:	8.61	18.92	23.40
	Japan	:	:	0.07	0.02	:
	Brazil	49.36	147.37	368.88	966.63	1,220.26
	USA	3.97	3.00	0.07		0.02
	Israel	2,943.37	2,919.30	1,061.09	1,125.92	594.86
	Zimbabwe	3,880.59	3,622.61	3,725.92	4,324.34	4,886.79
	Viet Nam	33,078.82	38,428.61	44,070.83	52,846.33	45,652.67
	Indonesia	103.20	333.37	297.72	246.67	441.64
	China	314.75	287.38	1,112.11	1,014.77	823.41
	Sri Lanka	347.84	392.81	104.84	104.62	85.24
	Angola	0.20		98.60	205.72	435.93
	Iran	6.25	:	1.75	0.50	3.88
	Sum	161,639.99	175,634.8	180,897.75	195,371.2	179,141.18
		2016	**2017**	**2018**	**2019**	**2020**
Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	South Korea	26.96	42.26	2,135.94	13.79	35.16
	South Africa	2,867.11	915.21	279.46	314.60	131.21
	Argentina	45.24	2.23	32.16	12.80	3.74
	Australia	444.13	437.59	494.10	543.81	228.46
	Colombia	1,758,248.35	1,684,213.76	1,569,515.05	1,656,882.11	1,541,733.58
	Mexico	235,341.78	217,362.60	272,525.32	329,751.67	363,292.19
	Kenya	240,945.59	215,953.40	206,693.36	241,045.70	221,434.83
	Thailand	3,072.97	1,049.26	13,173.87	6,502.86	2,591.27
	Taiwan	3.01	1.22	9.80	35.34	2.30
	Bangladesh	:	:	:	0.00	0.03
	Malawi	3,353.26	1,921.31	2,425.91	1,591.15	4,794.93
	Nigeria	687.64	878.40	749.61	6.27	175.92
	Pakistan	0.00	:	:	:	:
	India	1,386,868.49	1,456,990.52	1,548,969.71	1,367,326.79	1,083,355.51
	Turkey	3,826.13	3,473.77	3,986.39	4,187.14	6,527.21
	Japan	28.78	127.93	63.32	113.01	384.22
	Brazil	8,884,451.03	8,059,774.02	8,340,175.81	9,322,630.20	9,326,189.77

		2016	2017	2018	2019	2020
	USA	19,453.40	36,377.42	32,323.21	44,134.86	82,825.73
	Israel	428.35	341.94	222.41	197.59	244.48
	Zimbabwe	3,826.96	316.30	567.38	1,817.41	675.95
	Viet Nam	7,061,355.60	6,350,171.59	7,155,297.73	6,730,345.99	6,420,701.22
	Indonesia	940,766.27	1,155,325.36	575,414.13	769,517.70	773,805.47
	China	:	0.01	:	:	:
	Sri Lanka	406,073.82	359,543.82	393,659.33	288,971.81	199,635.62
	New Zealand	0.24	5.33	6.48	6.56	13.83
	Angola	2,970.62	4,348.14	4,225.81	7,120.66	12,574.44
	Panama	9,404.34	7,648.87	3,451.12	3,463.82	4,206.02
	Uruguay	0.00	:	0.55	:	0.00
	Sum	20,964,490	19,557,222	20,126,398	20,776,534	20,045,563
		2016	**2017**	**2018**	**2019**	**2020**
Coconuts, Brazil nuts and cashew nuts, fresh or dried, whether or not shelled or peeled	New Zealand	26.96	42.26	2,135.94	13.79	35.16
	Argentina	2,867.11	915.21	279.46	314.60	131.21
	Australia	45.24	2.23	32.16	12.80	3.74
	Colombia	444.13	437.59	494.10	543.81	228.46
	Thailand	1,758,248.35	1,684,213.76	1,569,515.05	1,656,882.11	1,541,733.58
	Brazil	235,341.78	217,362.60	272,525.32	329,751.67	363,292.19
	USA	240,945.59	215,953.40	206,693.36	241,045.70	221,434.83
	Israel	3,072.97	1,049.26	13,173.87	6,502.86	2,591.27
	Panama	3.01	1.22	9.80	35.34	2.30
	Mexico	:	:	:	0.00	0.03
	Sum	125,274	109,479	121,257.1	119,455.8	111,733.7
		2016	**2017**	**2018**	**2019**	**2020**
Cocoa beans, whole or broken, raw or roasted	New Zealand	:	0.15	0.06	0.20	:
	Australia	0.30	0.65	125.20	:	0.05
	Colombia	71,129.12	71,178.89	20,815.98	12,962.68	12,353.08
	Thailand	4.80	0.32	5.00	:	0.22
	Japan	2,027.95	18.72	1.00	0.02	0.18
	Brazil	1,966.17	2,492.11	2,330.62	3,166.30	2,690.30
	USA	1,038.76	2,040.19	500.84	199.11	453.78
	Israel	:	:	0.06	3.29	6.60
	Panama	4,998.44	5,041.40	5,110.17	3,953.48	5,902.14
	Mexico	5,703.68	2,450.99	2,864.90	3,383.38	1,027.38
	Sum	86,869.22	83,223.42	31,753.83	23,668.46	22,433.73
		2016	**2017**	**2018**	**2019**	**2020**
Vegetable and strawberry plants	Australia	:	:	4.05	:	:
	Brazil	0.16	1.01	393.78	:	0.85
	China	0.02		180.00	0.92	2.28
	Israel	213.07	9.27	34.04	17.44	17.61
	Iran	:	:	:	:	7.15
	Japan	:	:	:	1.03	0.28
	Mexico	0.20	:	:	:	1.23
	New Zealand	0.16	0.01	:	1.35	0.31
	Thailand	:	:	0.08	:	:
	South Africa	5.89	58.73	2.00	17.88	5.94
	United Kingdom	47,542.28	46,794.49	51,438.19	59,693.77	22,252.55

		2016	2017	2018	2019	2020
	USA	4,848.40	4,711.58	4,447.01	3,506.85	1,794.38
	Chile	5.60	13.96	4.05	1.72	0.67
	India	0.03	2.40	0.03	2.05	2.08
	Turkey	189.82	154.19	243.06	292.47	462.21
	Viet Nam	0.41	0.20	0.20	0.24	:
	Sum	52,806.04	51,745.84	56,746.49	63,535.72	24,547.54
		2016	**2017**	**2018**	**2019**	**2020**
Indoor flowering plants with buds or flowers (excl. cacti)	Australia	:	:	0.01	2.39	:
	China	2.38	0.22	7.10	835.87	91.43
	Israel	20.03	44.45	0.80	:	:
	Japan	:	0.12	:	:	4.06
	South Korea	:	:	:	:	0.02
	Thailand	33.64	43.34	44.54	30.72	15.35
	South Africa	:	0.01	:	:	:
	United Kingdom	8,640.36	6,843.20	10,090.13	9,548.07	5,541.82
	USA	23.87	2.94	25.72	61.07	23.56
	Egypt	:	397.71	:	:	:
	Indonesia	:	0.02	:	:	0.17
	Laos	2.90	9.40	:	:	:
	Sri Lanka	1.07	0.48	16.81	:	0.61
	Turkey	30.70	441.28	6,244.99	13,343.48	11,649.26
	Taiwan	44.42	27.98	152.89	1,036.55	485.84
	Philippines	:	:	:	:	0.70
	Viet Nam	:	0.75	:	:	:
	Costa Rica	0.36	:	:	:	30.00
	Sum	8,799.73	7,811.9	16,582.99	24,858.15	17,842.82
		2016	**2017**	**2018**	**2019**	**2020**
Indoor rooted cuttings and young plants (excl. cacti)	Australia	128.71	347.76	354.52	369.02	384.96
	Brazil	21.51	165.09	656.62	247.66	54.81
	China	2,752.64	9,997.46	13,466.13	14,163.88	19,018.51
	Colombia	85.70	21.77	241.38	484.53	211.31
	Israel	5,296.44	4,669.39	4,532.24	4,572.86	4,385.72
	Iran	:	1.44	:	:	:
	Japan	2.61	1.11	11.20	13.28	12.09
	South Korea	0.33	2.64	18.06	0.32	6.81
	Mexico	1.28	0.30	:	:	:
	Malaysia	162.98	130.92	208.38	692.96	481.63
	New Zealand	27.20	117.07	396.42	79.56	0.89
	Thailand	5,088.95	5,155.52	5,186.67	5,025.07	5,508.39
	Uruguay	:	:	0.12	:	:
	South Africa	1,350.18	3,955.46	3,726.06	3,245.41	2,856.00
	Zimbabwe	:	43.61	2.28	97.28	:
	United Kingdom	84.26	98.89	314.16	1,674.00	807.85
	USA	206.43	169.98	201.85	398.31	114.98
	Chile	2.90	224.23	447.94	499.94	273.69
	Egypt	18.06	35.42	84.34	51.13	33.11
	Ghana	28.14	:	338.65	880.13	1,087.52

		2016	2017	2018	2019	2020
	Indonesia	59.17	353.38	901.69	985.39	888.74
	India	457.56	672.09	4,428.20	4,581.08	4,284.74
	Sri Lanka	401.65	1,033.74	1,445.74	1,403.22	1,119.29
	Malawi	:	:	:	:	0.64
	Nigeria	:	:	0.53	1.43	1.10
	Turkey	1,416.01	1,710.10	2,039.26	2,570.49	1,728.18
	Taiwan	808.70	878.53	815.69	842.29	480.22
	Philippines	10.69	20.21	17.61	113.19	114.45
	Viet Nam	234.78	1,831.48	2,166.63	2,159.08	2,520.12
	Costa Rica	15,064.16	18,278.77	16,637.21	16,598.09	15,477.29
	Sum	33,711.04	49,916.36	58,639.58	61,749.60	61,853.04

Appendix E – EU 27 and member state cultivation/harvested/production area of *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense* and *C. theobromicola* hosts (in 1,000 ha)

Strawberries	**2016**	**2017**	**2018**	**2019**	**2020**
EU 27	103.78	103.76	106.42	101.16	83.84
Belgium	1.90	1.98	1.97	1.97	1.60
Bulgaria	0.68	0.66	0.73	0.71	0.74
Czechia	0.71	0.69	0.71	0.68	0.46
Denmark	1.17	1.16	1.15	1.11	1.07
Germany	14.30	14.16	14.00	13.20	12.86
Estonia	0.44	0.53	0.62	0.63	0.66
Ireland	0.19	0.19	0.19	0.18	0.18
Greece	1.49	1.47	1.47	1.61	1.72
Spain	6.87	6.82	7.03	7.26	7.35
France	3.34	3.37	3.35	3.35	3.33
Croatia	0.37	0.37	0.25	0.25	0.30
Italy	4.88	4.86	4.72	4.74	4.62
Cyprus	0.04	0.06	0.05	0.05	0.05
Latvia	0.50	0.50	0.50	0.49	0.50
Lithuania	0.78	0.84	0.83	0.88	0.94
Luxembourg	0.01	0.01	0.01	0.01	0.01
Hungary	0.79	0.79	0.73	0.73	0.88
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	1.72	1.69	1.62	1.64	1.52
Austria	1.14	1.14	1.21	1.19	1.18
Poland	50.78	49.84	49.18	49.90	32.90
Portugal	0.39	0.31	0.32	0.55	0.81
Romania	2.72	3.25	3.27	3.30	3.29
Slovenia	0.11	0.11	0.12	0.11	0.14
Slovakia	0.17	0.12	0.17	0.27	0.21
Finland	6.30	6.89	10.16	4.40	4.44
Sweden	2.01	1.97	2.07	1.96	2.08

Pears	**2016**	**2017**	**2018**	**2019**	**2020**
EU 27	115.13	113.81	113.54	110.66	107.05
Belgium	9.69	10.02	10.15	10.37	10.66
Bulgaria	0.41	0.45	0.57	0.70	0.50
Czechia	0.74	0.71	0.75	0.80	0.83
Denmark	0.30	0.30	0.29	0.30	0.30
Germany	1.93	2.14	2.14	2.14	2.14
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	4.08	4.07	4.41	4.34	5.42
Spain	22.55	21.89	21.33	20.62	20.22
France	5.30	5.25	5.24	5.25	5.38
Croatia	0.93	0.71	0.80	0.86	0.73
Italy	32.29	31.73	31.34	28.71	26.60
Cyprus	0.07	0.07	0.06	0.06	0.06
Latvia	0.20	0.20	0.20	0.20	0.20
Lithuania	0.80	0.82	0.82	0.82	0.85
Luxembourg	0.02	0.02	0.02	0.02	0.01

Pears	**2016**	**2017**	**2018**	**2019**	**2020**
Hungary	2.87	2.90	2.84	2.81	2.62
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	9.40	9.70	10.00	10.09	10.00
Austria	0.46	0.46	0.49	0.50	0.54
Poland	7.49	7.26	7.30	7.22	5.10
Portugal	11.99	11.54	11.21	11.33	11.33
Romania	3.15	3.12	3.10	3.08	3.09
Slovenia	0.20	0.20	0.21	0.21	0.23
Slovakia	0.11	0.11	0.12	0.11	0.10
Finland	0.04	0.04	0.05	0.04	0.05
Sweden	0.12	0.12	0.11	0.10	0.11
Cherries	**2016**	**2017**	**2018**	**2019**	**2020**
EU 27	172.45	173.37	175.49	176.30	177.86
Belgium	1.32	1.40	1.14	1.14	1.12
Bulgaria	9.60	10.06	11.23	12.16	11.73
Czechia	2.19	2.11	2.07	2.16	2.15
Denmark	0.79	0.66	0.56	0.53	0.61
Germany	7.14	7.96	7.94	7.94	7.89
Estonia	0.00	0.01	0.00	0.00	0.01
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	15.57	15.83	16.21	16.24	20.70
Spain	26.95	27.59	27.50	27.60	27.91
France	8.14	8.01	8.13	8.03	7.96
Croatia	3.43	3.53	2.94	2.85	3.12
Italy	29.97	29.27	29.16	29.21	29.01
Cyprus	0.21	0.23	0.22	0.23	0.23
Latvia	0.10	0.10	0.10	0.12	0.10
Lithuania	0.72	0.73	0.76	0.77	0.77
Luxembourg	0.00	0.00	0.00	0.00	0.00
Hungary	15.49	15.65	15.88	15.93	16.62
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.82	0.81	0.79	0.78	0.79
Austria	0.24	0.25	0.30	0.30	0.30
Poland	36.81	36.44	36.91	37.29	34.00
Portugal	6.43	6.30	6.14	6.50	6.49
Romania	6.13	6.02	7.06	6.09	5.94
Slovenia	0.18	0.19	0.20	0.21	0.21
Slovakia	0.17	0.19	0.21	0.20	0.16
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.04	0.03	0.03	0.03	0.04
Avocados	**2016**	**2017**	**2018**	**2019**	**2020**
EU 27	12.24	12.72	13.22	17.50	19.60
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

Avocados	**2016**	**2017**	**2018**	**2019**	**2020**
Greece	0.48	0.60	0.72	1.08	1.10
Spain	11.44	11.81	12.16	14.10	15.85
France	0.23	0.23	0.24	0.24	0.24
Croatia	0.00	0.00	0.00	0.00	0.00
Italy	0.00	0.00	0.00	0.00	0.00
Cyprus	0.09	0.08	0.10	0.10	0.10
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
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	0.00	0.00	0.00	1.98	2.31
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
Walnuts	**2016**	**2017**	**2018**	**2019**	**2020**
EU 27	72.61	74.15	80.60	87.62	96.69
Belgium	0.05	0.05	0.08	0.10	0.10
Bulgaria	6.28	5.05	6.18	6.36	7.10
Czechia	0.18	0.19	0.17	0.13	0.16
Denmark	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.29	0.29	0.29	0.29
Estonia	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.00
Greece	12.04	13.19	15.27	14.82	20.27
Spain	9.63	10.37	11.00	11.44	12.29
France	21.36	21.63	22.17	25.88	24.99
Croatia	5.40	5.55	6.70	7.21	8.11
Italy	4.54	4.35	4.50	4.67	4.93
Cyprus	0.21	0.19	0.18	0.21	0.21
Latvia	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.01	0.01	0.01	0.01	0.01
Hungary	4.85	5.08	5.40	6.00	6.40
Malta	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00
Austria	0.14	0.14	0.17	0.17	0.18
Poland	2.47	2.38	2.31	2.27	2.70
Portugal	3.32	3.54	3.85	5.37	5.40
Romania	1.67	1.60	1.59	1.62	1.91
Slovenia	0.27	0.34	0.38	0.44	0.47
Slovakia	0.19	0.21	0.36	0.63	1.17
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	0.00	0.00	0.00

Grapes	2016	2017	2018	2019	2020
EU 27	3,136.15	3,133.32	3,135.50	3,155.20	3,156.22
Belgium	0.24	0.24	0.30	0.38	0.49
Bulgaria	36.55	34.11	34.11	30.05	28.74
Czechia	15.80	15.81	15.94	16.08	16.14
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	98.09	101.75	100.34	101.85	104.21
Spain	935.11	937.76	939.92	936.89	931.63
France	751.69	750.46	750.62	755.47	759.06
Croatia	23.40	21.90	20.51	19.82	21.45
Italy	673.76	670.09	675.82	697.91	703.90
Cyprus	6.07	5.93	6.67	6.67	6.79
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	1.26	1.25	1.24	1.24
Hungary	68.12	67.08	66.06	64.92	59.63
Malta	0.68	0.68	0.42	0.42	0.45
Netherlands	0.14	0.16	0.17	0.16	0.17
Austria	46.49	46.33	46.50	46.36	46.16
Poland	0.62	0.67	0.73	0.74	0.90
Portugal	179.17	178.95	179.25	175.65	175.67
Romania	174.17	175.32	172.80	176.34	175.59
Slovenia	15.84	15.86	15.65	15.57	15.29
Slovakia	8.71	8.47	8.01	7.92	7.73
Finland	0.00	0.00	0.00	0.00	0.00
Sweden	0.05	0.04	0.05	0.05	0.08

Olives	2016	2017	2018	2019	2020
EU 27	5,043.87	5,056.93	5,098.62	5,070.49	5,105.13
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	969.07	940.52	963.12	903.08	906.02
Spain	2,521.69	2,554.83	2,579.00	2,601.90	2,623.72
France	17.38	17.38	17.40	17.72	17.62
Croatia	18.18	18.68	18.70	18.61	20.28
Italy	1,144.95	1,149.47	1,142.12	1,139.47	1,145.52
Cyprus	10.61	10.83	10.76	11.06	11.11
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

Olives	2016	2017	2018	2019	2020
Poland	0.00	0.00	0.00	0.00	0.00
Portugal	360.81	363.97	366.23	377.28	379.44
Romania	0.00	0.00	0.00	0.00	0.00
Slovenia	1.17	1.24	1.30	1.37	1.42
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