Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Importation of various blueberries [*Vaccinium angustifolium* (lowbush blueberry), *V. corymbosum* (highbush blueberry), *V. meridionale* (Andean blueberry), and *V. virgatum* (syn. *V. ashei*, rabbiteye blueberry)] from Colombia into the United States for consumption

A Qualitative, Pathway Initiated Pest Risk Assessment

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Executive Summary

The purpose of this report is to assess the pest risks associated with importing commercially produced fresh fruit of various blueberries, *Vaccinium angustifolium* (lowbush blueberry), *V. corymbosum* (highbush blueberry), *V. meridionale* (Andean blueberry), and *V. virgatum* (syn. *V. ashei*, rabbiteye blueberry)] (Ericaceae), from Colombia into the United States for consumption.

Based on the market access request submitted by Colombia, we considered the pathway to include the following processes and conditions: fresh blueberries will be imported year-round using standard field, harvest, and post-harvest procedures, including culling any rotten or infested fruit. The pest risk ratings depend on the application of all conditions of the pathway as described in this document; blueberries produced under different conditions were not evaluated and may pose a different pest risk.

We used scientific literature, port-of-entry pest interception data, and information from the government of Colombia to develop a list of pests with quarantine significance for the United States. These are pests that occur in Colombia on any host and are associated with the commodity plant species anywhere in the world.

The following organism is a candidate for pest risk management because it has met the threshold for unacceptable consequences of introduction and can follow the commodity import pathway.

Pest type	**Taxonomy**	**Scientific name**	**Likelihood of Introduction**
Arthropod	Diptera: Tephritidae	*Anastrepha fraterculus* Wiedemann	High

The following organism is likely to follow the pathway but was not assessed in this document because it has already been determined to pose an unacceptable risk to the United States. Domestic regulations are in place for this pest:

Pest type	**Taxonomy**	**Scientific name**	**Code of Federal Regulations**
Arthropoda	Diptera: Tephritidae	*Ceratitis capitata* Wiedemann	7 CFR § 301.32-2, 2022

The detailed examination and choice of appropriate phytosanitary measures to mitigate pest risk are addressed in a separate document.

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1. Introduction

1.1. Background

The purpose of this report is to present PPQ's assessment of the pest risk associated with the importation of commercially produced fresh fruit of various blueberry species, specifically *Vaccinium angustifolium* Aiton (lowbush blueberry), *V. corymbosum* L. (highbush blueberry), *V. meridionale* Swartz (Andean blueberry), and *V. virgatum* Aiton (syn. *V. ashei* J. M. Reade, rabbiteye blueberry) (Ericaceae), from Colombia (referred to as the export area) into the United States[1] (referred to as the pest risk analysis or PRA area) for consumption.

This is a qualitative risk assessment. The likelihood of pest introduction is expressed as a qualitative rating rather than using numerical terms. This methodology is consistent with guidelines provided by the International Plant Protection Convention (IPPC) in the International Standard for Phytosanitary Measures (ISPM) No. 11, "Pest Risk Analysis for Quarantine Pests" (IPPC, 2021). The use of biological and phytosanitary terms is consistent with ISPM No. 5, "Glossary of Phytosanitary Terms" (IPPC, 2022).

As defined in ISPM No. 11, this document comprises Stage 1 (Initiation) and Stage 2 (Risk Assessment) of risk analysis. Stage 3 (Risk Management) will be covered in a separate document.

1.2. Initiating event

The importation of fruits and vegetables for consumption into the United States is regulated under Title 7 of the Code of Federal Regulations, Part 319.56-3 (7 CFR §319.56, 2022) and as described in the Agricultural Commodity Import Requirements. Under this regulation, the entry of three species of blueberries from Colombia into the PRA area is currently authorized to all ports (FAVIR, 2022). However, this PRA allows for a market access expansion for a new systems approach for growing blueberry plants in areas with low pest prevalence. For the purpose of this assessment, we will analyze the pest prevalence for all of Colombia. The Instituto Colombiano Agropecuario (ICA), however, requested a new species of blueberry, *Vaccinium meridionale*, to be added to the export market. This commodity risk assessment was initiated in response to a request by ICA to update the federal regulations (Gómez, 2022).

1.3. Potential weediness of the commodity

In some cases, an imported commodity could become invasive in the PRA area. If warranted, we analyze the commodity for weed risk.

A weed risk analysis (WRA) is not required when (a) the commodity is already enterable into the PRA area from other countries, (b) the commodity plant species is widely established or cultivated in the PRA area, or (c) the imported plant part(s) cannot easily propagate on its own or be propagated. We determined that the weed risk of blueberries does not need to be analyzed because *Vaccinium angustifolium*, *V. corymbosum*, and *V. virgatum* are native to the United States and fruit is already permissible to all ports.

[1]The *United States* includes all states, the District of Columbia, Guam, the Northern Mariana Islands, Puerto Rico, the U.S. Virgin Islands, and any other territory or possession of the United States.

Conversely, *Vaccinium meridionale* is not native to the United States, has never been approved for importation into the United States, and the commodity could be propagated; therefore, we performed a weed characterization (PPQ, 2022). Based on the decision tree used in this analysis, the most likely outcome of a PPQ WRA for *V. meridionale* is Moderate Risk of becoming weedy or invasive in the United States. The U.S. areas that are climatically suitable for establishment, however, are probably very limited. *Vaccinium meridionale* is a small shrub that reaches 4 m high and 5 m in diameter, is usually very branched with a rounded crown, and produces small flowers in terminal clusters of 8 to 15. It occurs at high elevations in montane cloud forests in the Andes and Jamaica's Blue Mountains. The Andean blueberry plant is a tetraploid and can produce vigorous hybrids, which has attracted the attention of blueberry enthusiasts. We found no evidence of it being a weed or invasive or of any other noxious traits. We found no evidence of this species growing in the United States. Based on the limited distribution of *V. meridionale*, we would expect it could establish in high elevation areas or habitats similar to its native montane cloud forests. In the United States, these areas may exist in Hawaii, Puerto Rico, and possibly Washington and Oregon. Outside of cultivation, this species would likely not establish easily within the United States (PPQ, 2022).

1.4. Description of the pathway

A pathway is "any means that allows the entry or spread of a pest" (IPPC, 2022). In the context of this document, the pathway is the commodity to be imported. The following description includes those conditions and processes the commodity undergoes from production through importation and distribution that may have an impact on pest risk and therefore were considered in our assessment. Commodities produced under different conditions were not considered.

1.4.1. Description of the commodity

The specific pathway of concern is the importation of fresh blueberry fruits for consumption.

1.4.2. Summary of the production, harvest, post-harvest, shipping, and storage conditions considered

Culling any obviously rotten or infested blueberries during the production, harvesting, and post-harvesting procedures in Colombia was the only mitigation discussed. Additionally, shipping and storage conditions in the export area were not considered during this assessment.

2. Pest List and Pest Categorization

The pest list is a compilation of plant pests of quarantine significance to the United States. This list includes pests that are present in Colombia on any host and are known to be associated with *Vaccinium angustifolium*, *V. corymbosum*, *V. meridionale*, or *V. virgatum*) anywhere in the world. Pests are considered quarantine significant if they (a) are not present in the PRA area, (b) are actionable at U.S. ports of entry, (c) are regulated non-quarantine pests, (d) are under federal official control, or (e) require evaluation for regulatory action. Consistent with ISPM No. 5, pests that meet any of these definitions are considered "quarantine pests" and are candidates for analysis. Species with a reasonable likelihood of following the pathway into the PRA area are analyzed to determine their pest risk potential.

2.1. Pest list

We developed the pest list based on scientific literature, port-of-entry pest interception data, and information provided by the government of Colombia. We listed the pests that are of quarantine significance to the PRA area in Table 1. For each pest, we provided evidence for the pest's presence in Colombia and its association with blueberries. We indicated the plant parts with which the pest is generally associated and, if applicable, provided information about the pest's distribution in the United States. Pests that are likely to remain associated with the harvested commodity in a viable form are indicated by bolded text and are listed separately in Table 2.

Only pests that attack fruit and above ground plant parts were considered for this assessment. Root pests (e.g., nematodes) and wood and stem borers (e.g., Cerambycidae and Bostrichidae) were not considered because they are unlikely to associate with the exported commodity.

Table 1. List of quarantine pests associated with *Vaccinium angustifolium*, *V. corymbosum*, *V. meridionale*, or *V. virgatum* anywhere in the world and present in Colombia on any host

Pest name	Presence in Colombia	Host association	Plant part(s) [2]	Considered further?[3]
INSECT: Coleoptera: Chrysomelidae *Diabrotica speciosa* (Germar)	Silva et al., 2015	Bentancourt and González, 2005	Adults attack all above ground parts (Bentancourt and González, 2005); larvae attack roots (Ávila and Santos, 2010)	No. Cucurbit beetles are conspicuous external feeders that would disperse during harvest. Larvae live underground (Ávila and Santos, 2010).
INSECT: Diptera: Tephritidae *Anastrepha fraterculus* (Wiedemann)	**Canal et al., 2018**	**Vaccaro and Bouvet, 2006**	**Fruit (Vaccaro and Bouvet, 2006)**	**Yes.** **See assessment in section 3.2.1**
INSECT: Diptera: Tephritidae *Ceratitis capitata* (Wiedemann)	**Gasparich et al., 1997**	**Follett et al., 2011**	**Fruit (Alford, 2014; Follett et al., 2011)**	**Yes.** **All *Vaccinium* species are regulated articles for Medfly (§7 CFR § 301.32-2, 2022).**

[2] The plant part(s) listed are those for the plant species under analysis. If the information has been extrapolated, such as from plant part association on other plant species, we note that.

[3] "Yes" indicates simply that the pest has a reasonable likelihood of being associated with the harvested commodity; the level of pest prevalence on the harvested commodity (low, medium, or high) is qualitatively assessed as part of the Likelihood of Introduction assessment (section 3).

Pest name	Presence in Colombia	Host association	Plant part(s) [2]	Considered further?[3]
FUNGUS *Colletotrichum nymphaeae* (Pass.) Aa	Baroncelli et al., 2015	Misawa et al., 2015	Fruit (Misawa et al., 2015), crowns, leaves extrapolated from other plant hosts (Farr and Rossman, 2022)	No. See section 2.2.
FUNGUS *Fusarium oxysporum* Schltdl.: Fr.	Bayona et al., 2011; Carmona et al., 2020; Garibaldi et al., 2011	Liu et al., 2014; Moya-Elizondo et al., 2019	Crowns (Moya-Elizondo et al., 2019); stems (Liu et al., 2014)	No. This pest is actionable for the continental United States (ARM, 2022). It is present in the continental United States (Berg et al., 2017; Hanson, 2006), Hawaii (James et al., 2006; Shiraishi et al., 2012), and Puerto Rico (Garcia et al., 2018). It remains actionable because there are many pathovars some of which may not be in the United States.

2.2. Notes on pests identified in the pest list

Colletotrichum nymphaeae (Pass.) Aa

Colletotrichum nymphaeae is present in the continental United States (Chechi et al., 2019); however, we found no evidence that this pest occurs in Hawaii or Puerto Rico. Regardless, *C. nymphaeae* is highly unlikely to follow the blueberry for consumption pathway for numerous, compounding reasons. First, we only found one report of *C. nymphaeae* in Colombia (Baroncelli et al., 2015), suggesting a low prevalence. Second, this fungus produces conspicuous symptoms on fruit, such as orange-colored spores, fruit lesions, and fruit rot (Chechi et al., 2019; Chen et al., 2016; Misawa et al., 2015; Nasehi et al., 2016; Velho et al., 2014; Yamagishi et al., 2015), which would be noticed at harvest further reducing the likelihood that the fungus would be associated with the commodity. Finally, *Colletotrichum* spp. are dispersed by rain-splash (Ntahimpera et al., 1999; Nicholson and Moraes, 1980), which takes place on a very small scale (McCartney, 1994; Ooka and Kommedahl, 1977). Species in this genus show that most new infections occur within a 25 cm radius of the inoculum source and are greatly influenced by rainfall intensity and ground cover (Madden et al., 1993; Ntahimpera et al., 1999; Smith, 2008). Conditions required for dispersal are unlikely to be met once fruit enters the endangered area. Taken all together, evidence indicates that the likelihood of establishment is very low (negligible). Therefore, the likelihood of introduction of this fungus into the Hawaii or Puerto Rico via commercial blueberry fruit is negligible.

2.3. Pests considered but not included on the pest list

2.3.1. Organisms with non-quarantine status
We found evidence of organisms that are associated with blueberries and are present in the export area; however, they are not of quarantine significance for the PRA area (see Appendix).

Armored scales (Hemiptera: Diaspididae): These insects are highly unlikely to establish via the fruits or vegetables for consumption pathway due to their very limited ability to disperse to new host plants (Miller et al., 1985; PERAL, 2007). Also, diaspidids on fruits and vegetables for consumption are considered non-actionable at U.S. ports of entry (NIS, 2008). For these reasons, armored scales are included in the Appendix rather than Table 1, even if they are not present in the PRA area.

2.4. Pests selected for further analysis or already regulated

We identified one quarantine pests for further analysis (Table 2).

Table 2. Pests selected for further analysis

Pest type	Taxonomy	Species names
Arthropod	Diptera: Tephritidae	*Anastrepha fraterculus* (Wiedemann)

The following pest can follow the commodity pathway. However, it was not assessed because it was previously determined to pose an unacceptable risk to the PRA area and domestic regulations are in place. This pest is a candidate for risk mitigation.

Pest type	Scientific name	Code of Federal Regulation
Arthropod	*Ceratitis capitata* Wiedemann	§7 CFR § 301.32-2, 2022

3. Assessing Pest Risk Potential

3.1. Introduction
Risk is described by the likelihood of introduction, the potential consequences, and the associated uncertainty. For each pest, we determined if an endangered area exists within the United States. The endangered area is defined as the portion of the PRA area where ecological factors favor the pest's establishment and where the pest's presence will likely result in economically important impacts. If a pest causes an unacceptable impact, that means it could adversely affect agricultural production by causing a yield loss of 10 percent or greater, by increasing U.S. production costs, by impacting an environmentally important host, or by impacting international trade. After the endangered area is defined, we assessed the pest's likelihood of introduction into that area via the imported commodity.

The likelihood of introduction is based on the potential entry and establishment of a pest. We qualitatively assessed this using the ratings: Low, Medium, and High. The elements comprising the likelihood of introduction are interdependent; therefore, the model is multiplicative rather than additive. We defined the ratings as follows:

High: This outcome is highly likely to occur because the events required occur frequently.
Medium: This outcome can occur; however, the combination of required events occurs only occasionally.
Low: This outcome is less likely because the exact combination of required events seldom occurs or rarely aligns properly in time and space.

We addressed uncertainty associated with each element as follows:

Negligible: Additional or more reliable evidence is very unlikely to change the rating.
Low: Additional or more reliable evidence probably will not change rating.
Moderate: Additional or more reliable evidence may or may not change rating.
High: Reliable evidence is not available.

3.2. Assessment

3.2.1. *Anastrepha fraterculus* (Diptera: Tephritidae)
Because they have numerous hosts and can cause high levels of damage to fruits, *Anastrepha* species are considered the most serious fruit fly pests in the tropical Americas (Norrbom and Foote, 1989). The South American fruit fly, *Anastrepha fraterculus* (Wiedemann), has over 80 host species (Oroño et al., 2006), including many that are commercially grown in the United States. Fruit flies are highly mobile and people can inadvertently transport larvae great distances in fruit; therefore, they easily spread to new areas including repeated incursions in the United States (CABI, 2022; Dias and Lucky, 2018). *Anastrepha fraterculus* has invaded and is present in the Galapagos Islands (CABI, 2022).

The endangered area for *Anastrepha fraterculus* within the United States
Climatic suitability: *Anastrepha fraterculus* occurs in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Trinidad and Tobago, Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, and Venezuela. The species also has a restricted distribution in Mexico and Argentina, and it may occasionally occur in a very limited portion of the United States (the Rio Grande Valley, Texas) (CABI, 2022; Dias and Lucky, 2018).

Hosts in PRA area: *Anastrepha fraterculus* hosts include **Actinidiaceae**: *Actinidia* spp. (kiwi); **Anacardiaceae**: *Mangifera* spp. (mango), *Spondias* spp. (mombins); **Annonaceae**: *Annona* spp.; **Combretaceae**: *Terminalia* spp. (tropical almond); **Ebenaceae**: *Diospyros* spp. (persimmon); **Ericaceae**: *Vaccinium* spp. (blueberry); **Juglandaceae**: *Juglans* spp. (walnut); **Lauraceae**: *Persea* spp. (avocado); **Moraceae**: *Ficus* spp. (fig); **Myrtaceae**: *Eugenia* spp. (stopper), *Psidium* spp. (guava), *Syzygium* spp.; **Oleaceae**: *Olea* spp. (olive); **Punicaceae**: *Punica* spp. (pomegranate); **Rosaceae**: *Cydonia* spp., *Eriobotrya* spp. (loquat), *Fragaria* spp. (strawberry), *Malus* spp. (apple), *Prunus* spp. (stone fruit), *Pyrus* spp. (pear), *Rubus* spp. (blackberry); **Rutaceae**: *Citrus* spp., *Fortunella* spp. (kumquat); **Sapotaceae**: *Manilkara* spp., *Pouteria* spp.; **Solanaceae**: *Solanum* spp. (tomato); **Vitaceae**: *Vitis* spp. (grape) (Araujo et al., 2019; Oroño et al., 2006; Ovruski et al., 2003; Graciela Putruele, 1996).

Economically important hosts[4]*:* Economically important hosts widely present in the United States include pepper, citrus, fig, mango, apple, black mulberry, plum, peach, blueberry, and grape (NASS, 2022).

Potential consequences on economically important hosts at risk: *Anastrepha* fruit flies can cause unacceptable consequences because they are vastly polyphagous, can travel far distances (including U.S. incursions) alone or assisted by humans, and cause severe economic damage to fruits and vegetables (Dias and Lucky, 2018; Ebeling, 1959; White and Elson-Harris, 1994).

Endangered area: Areas in Plant Hardiness Zones 8-13 where hosts are grown include nearly all southern and coastal states, as well as Hawaii and the territories (Takeuchi et al., 2018).

The likelihood of entry of *Anastrepha fraterculus* into the endangered area via blueberries imported from Colombia

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Pest prevalence on the harvested commodity	High	Low	A 2003 study in seven different blueberry plantations in Argentina sought to determine infestation levels of fruit flies in highbush (*V. corymbosum*) and rabbiteye blueberries (*V. ashei* [*V. virgatum*]). Vaccaro & Bouvet (2006) collected 111.85 kilograms of fruit from 15 blueberry cultivars and incubated it in the laboratory. From those berries, 230 *A. fraterculus* flies emerged. They found every plantation had varying degrees of fruit fly infestations. In Brazil, *A. fraterculus* was able to fully develop in *V. virgatum* (listed as *V. ashei*) fruit (Bisognin et al., 2013). This study did not investigate *V. meridionale*, which is native to Colombia and grows at high altitudes that are likely climatically unsuitable for *Anastrepha* (PPQ, 2022). Fruit flies, however, may oviposit in unprotected, recently harvested berries being transported through lower elevations.

[4] As defined by ISPM No. 5, potential economic importance applies to crops, the environment (ecosystems, habitats, or species), and other specified values such as tourism, recreation, and aesthetics (IPPC, 2022).

Likelihood of surviving post-harvest processing before shipment	High	Low	Other than culling obviously rotten or infested blueberries, we did not consider any post-harvest mitigations. Fruit flies lay their eggs in fruit where the maggots can go unseen until pupation. Therefore, we did not change our risk rating.
Likelihood of surviving transport and storage conditions of the consignment	High	Low	We did not consider transport and storage conditions as pest mitigations; however, agriculture inspectors have intercepted Tephritidae fruit fly larvae inside blueberries four times since 2011 (ARM, 2022). Therefore, we did not change our risk or uncertainty rating.
Overall Likelihood of Entry	High	n/a	n/a

The likelihood of establishment of *Anastrepha fraterculus* into the endangered area via blueberries imported from Colombia

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	High	Low	*Anastrepha fraterculus* is a highly polyphagous species with an expansive host range, and suitable hosts are widely distributed throughout the entire endangered area (see above). Fruit flies move in trade via infested fruit, adults can fly short distances, and winds may carry them a mile or more away. Numerous larvae can infest a single fruit, allowing for individual flies to find a mate easily. Additionally, many *Anastrepha* species, including *A. fraterculus*, have repeatedly invaded the United States (CABI, 2022).
Overall Likelihood of Establishment	High	n/a	n/a

The likelihood of introduction (combined likelihoods of entry and establishment) of *Anastrepha fraterculus* into the endangered area via blueberries imported from Colombia is High

4. Summary

The following pests are considered quarantine significant for the United States. The pests have a reasonable likelihood of following the commodity pathway and would likely cause unacceptable consequences if introduced into the PRA area (Table 3). Thus, the pests are candidates for risk management.

Table 3. Summary of quarantine pests that are candidates for risk management

Pest type	Scientific name	Likelihood of Introduction[a]	Notes
Arthropod	*Anastrepha fraterculus* Wiedemann	High	A study by Bisognin et al. (2013), found *A. fraterculus* prefer native fruits to non-native blueberries. The native *V. meridionale*, however, was not included in the study.
Arthropod	*Ceratitis capitata* Wiedemann	N/A	§7 CFR § 301.32-2, 2022

[a] N/A: The likelihood of introduction was not assessed for Select Agents and Program Pests; federal regulations are in place for these pests because they were previously determined to pose an unacceptable risk to U.S. agriculture or natural resources.

Our assessment of risk is contingent on the application of all components of the pathway as described in section 1.4. The detailed examination and choice of appropriate phytosanitary measures to mitigate pest risk are addressed in a separate document.

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6. Appendix: Pests with non-quarantine status

We found evidence that the organisms listed below are associated with blueberries and are present in Colombia; however, none are of quarantine significance for the United States (ARM, 2022, or as defined by ISPM No. 5). Although we did not intensively evaluate the evidence, we provide references supporting each pest's potential presence in Colombia, presence in United States (if applicable), and association with blueberries. If any of the organisms are **not** present in the United States, we also provide justification for their non-quarantine status. Unless otherwise noted, these organisms are non-actionable at U.S. ports of entry (ARM, 2022).

Organism	In Colombia	In U.S.	Host Association	Notes
MITE: Trombidiformes: Tetranychidae *Bryobia praetiosa* Koch	Beard, 2018	Beard, 2018	Migeon and Dorkeld, 2022	N/A
INSECT: Hemiptera: Aleyrodidae *Tetraleurodes mori* (Quaintance)	Evans, 2008	Evans, 2008	Evans, 2008	N/A
INSECT: Hemiptera: Aphididae *Aphis gossypii* Glover	CABI, 2022	CABI, 2022	Blackman and Eastop, 2000	N/A
INSECT: Hemiptera: Coccidae *Ceroplastes floridensis* Comstock	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Coccidae *Saissetia oleae* (Olivier)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Coreidae *Leptoglossus gonagra* (F.)	Nunez et al., 2008	CABI, 2022	Retamales and Hancock, 2018	N/A
INSECT: Hemiptera: Coreidae *Leptoglossus zonatus* (Dallas)	Nunez et al., 2008	CABI, 2022	Retamales and Hancock, 2018	N/A
INSECT: Hemiptera: Diaspididae[5] *Aspidiotus nerii* Bouche	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Diaspididae *Hemiberlesia cyanophylli* (Signoret)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A

[5] All armored scales (Diaspididae) are non-actionable at U.S. ports of entry on fruits and vegetables for consumption (NIS, 2008). Therefore, we did not need to determine whether they occur in the United States.

Organism	In Colombia	In U.S.	Host Association	Notes
INSECT: Hemiptera: Diaspididae *Hemiberlesia rapax* (Comstock)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Diaspididae *Pseudischnaspis bowreyi* (Cockerell)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Diaspididae *Pseudoparlatoria parlatorioides* (Comstock)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Margarodidae *Icerya purchasi* Maskell	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Pseudococcidae *Pseudococcus maritimus* (Ehrhorn)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Hemiptera: Pseudococcidae *Pseudococcus viburni* (Signoret)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	N/A
INSECT: Thysanoptera: Thripidae *Frankliniella occidentalis* (Pergrande)	CABI, 2022	CABI, 2022	Retamales and Hancock, 2018	N/A
INSECT: Thysanoptera: Thripidae *Scirtothrips dorsalis* Hood	CABI, 2022	CABI, 2022	Retamales and Hancock, 2018	N/A
FUNGUS *Alternaria alternata* (Fr.: Fr.) Keissl.; syn. *A. tenuissima* (Nees & T. Nees: Fr.) Wiltshire	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	N/A
FUNGUS *Armillaria mellea* (Vahl: Fr.) P. Kumm.	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Aspergillus flavus* Link: Fr.	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Munitz et al., 2013	N/A

Organism	In Colombia	In U.S.	Host Association	Notes
FUNGUS *Aspergillus niger* Tiegh.	Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Munitz et al., 2013	N/A
FUNGUS *Asteridiella exilis* (Syd.) Hansf.	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Aureobasidium pullulans* (de Bary) G. Arnaud	Farr and Rossman, 2022	Farr and Rossman, 2022	Xiao and Saito, 2017	N/A
FUNGUS *Berkeleyomyces basicola* (Berk. & Broome) W.J. Nel, Z.W. de Beer, T.A. Duong & M.J. Wingf.; syn. *Thielaviopsis basicola* (Berk. & Broome) Ferraris	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	N/A
FUNGUS *Botryosphaeria dothidea* (Moug.: Fr.) Ces. & De Not.	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	N/A
FUNGUS *Botrytis cinerea* Pers.: Fr.; syn. *Botryotinia fuckeliana* (de Bary) Whetzel	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Calonectria colhounii* var. *colhounii* Peerally; syn. *Calonectria colhounii* Peerally, *Cylindrocladium colhounii* Peerally	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Calonectria kyotensis* Terash.	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Colletotrichum acutatum* J.H. Simmonds	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	N/A
FUNGUS *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc.; syn. *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	N/A

Organism	In Colombia	In U.S.	Host Association	Notes
FUNGUS *Colletotrichum karstii* Y.L. Yang, Z.Y. Liu, K.D. Hyde & L. Cai	Farr and Rossman, 2022	Farr and Rossman, 2022; CABI, 2022	CABI, 2022	N/A
FUNGUS *Corynespora cassiicola* (Berk. & M.A. Curtis) C.T. Wei	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Curvularia lunata* (Wakker) Boedijn; syn. *Cochliobolus lunatus* R.R. Nelson & F.A. Haasis;	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Munitz et al., 2013	N/A
FUNGUS *Curvularia trifolii* (Kauffm.) Boedijn	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Epicoccum nigrum* Link	Farr and Rossman, 2022	Farr and Rossman, 2022	Auda, 2021	N/A
FUNGUS *Exobasidium vaccinii* (Fuckel) Woronin	Buriticá, 1999	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Fusarium acuminatum* Ellis & Everh; syn. *Gibberella acuminata* Wollenw.	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022; CABI 2022	N/A
FUNGUS *Fusarium graminearum* Schwabe; syn. *Gibberella zeae* (Schwein.: Fr.) Petch	CABI, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022	N/A
FUNGUS *Globisporangium splendens* (Hans Braun) Uzuhashi, Tojo & Kakish.	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Lasiodiplodia theobromae* (Pat.) Griffon & Maubl.	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Macrophomina phaseolina* (Tassi) Goid	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Meliola nidulans* (Schwein.) Cooke	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A

Organism	In Colombia	In U.S.	Host Association	Notes
FUNGUS *Meliola niessliana* G. Winter	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Neofusicoccum parvum* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Neofusicoccum ribis* (Slippers, Crous & M.J. Wingf.) Crous, Slippers & A.J.L. Phillips; syn. *Botryosphaeria ribis* Grossenb. & Duggar	Rodas et al., 2009	Rivera-Vargas et al., 2020	Cunnington et al., 2007; Tennakoon et al., 2018	N/A
FUNGUS *Nigrospora oryzae* (Berk. & Broome) Petch.; syn.: *Khuskia oryzae* H.J. Huds	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Paraconiothyrium fuckelii* Sacc.; syn. *Leptosphaeria coniothyrium* (Fuckel) Sacc.	Farr and Rossman, 2022	Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Pucciniastrum minimum* Arthur; syn. *Thekopsora minima* (Arthur) P. Syd. & Syd.	Salazar Yepes and Buriticá Céspedes, 2012	Farr and Rossman, 2022	Salazar Yepes and Buriticá Céspedes, 2012	N/A
FUNGUS *Rhizoctonia solani* J.G. Kühn; syn. *Thanatephorus cucumeris* (A.B. Frank) Donk	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
FUNGUS *Rhizopus stolonifer* (Ehrenb.: Fr.) Vuill.	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Xiao and Saito, 2017	N/A
FUNGUS *Sclerotinia sclerotiorum* (Lib.) de Bary	CABI, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	N/A
FUNGUS *Stemphylium botryosum* Wallr.	Farr and Rossman, 2022	Farr and Rossman, 2022	MGAP-DGSA, 2005	N/A

Organism	In Colombia	In U.S.	Host Association	Notes
FUNGUS *Trichoderma harzianum* Rifai	CABI, 2022	CABI, 2022; Farr and Rossman, 2022	Munitz et al., 2013	N/A
FUNGUS *Verticillium dahliae* Kleb.	CABI, 2022	CABI, 2022; Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	N/A
CHROMISTAN *Phytophthora cinnamomi* Rands	Farr and Rossman, 2022	CABI, 2022; Farr and Rossman, 2022	Farr and Rossman, 2022	N/A
BACTERIUM *Burkholderia andropogonis* (Smith) Gillis et al.; syn. *Pseudomonas andropogonis* (Smith) Stapp	CABI, 2022	Alfieri et al., 1984; CABI, 2022	Kobayashi et al., 1995	N/A
BACTERIUM *Ralstonia solanacearum* biovars 1 and 2 (Smith) Yabuuchi et al.	CABI, 2022	CABI, 2022	CABI, 2022	N/A
BACTERIUM *Rhizobium radiobacter* (Beijerinck & van Delden) Young et al.; syn.: *Agrobacterium tumefaciens* (Smith & Townsend) Conn	CABI, 2022	CABI, 2022	Rebellato Urtizberea, 2011	N/A
BACTERIUM *Rhizobium rhizogenes* (Riker et al.) Young et al.; syn. *Agrobacterium rhizogenes* (Riker et al.) Conn	CABI, 2022	CABI, 2022	CABI, 2022	N/A
BACTERIUM *Pseudomonas syringae* van Hall	Fonseca-Guerra et al., 2021	CABI, 2022	Guerrero and Lobos, 1989	N/A
PHYTOPLASMA '*Candidatus* Phytoplasma asteris'	CABI, 2022	Fránová et al., 2016	Perez-Lopez et al., 2019	N/A
VIRUS *Nepovirus Tomato ringspot virus*	CABI, 2022	CABI, 2022	CABI, 2022	N/A