USDA Animal and Plant Health Inspection Service
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Importation of fig (*Ficus carica*) from Chile into the United States for consumption

A Qualitative, Pathway Initiated Pest Risk Assessment

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Agency contact
Plant Pest Risk Analysis (PPRA)
Science and Technology (ST)
Plant Protection and Quarantine (PPQ)
Animal and Plant Health Inspection Service (APHIS)
United States Department of Agriculture (USDA)
920 Main Campus Drive, Suite 400
Raleigh, NC 27606

Executive Summary

The purpose of this report is to assess the pest risks associated with importing commercially produced fruit of fig, *Ficus carica* (Moraceae), from Chile into the United States for consumption.

Based on the internal request submitted by Plant Protection and Quarantine (PPQ), basic culling was the only harvesting or post-harvesting practice we considered. We did not consider any other standard field, harvest, post-harvest procedures, standard shipping, and storage conditions, and/or phytosanitary measures as part of the pathway. The pest risk ratings depend on the application of all conditions of the pathway as described in this document; fruit 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 Chile to develop a list of pests with quarantine significance for the United States. These are pests that occur in Chile on any host and are associated with the commodity plant species anywhere in the world.

The following organisms are candidates for pest risk management because they have met the threshold for unacceptable consequences of introduction and can follow the commodity import pathway.

Pest type	Taxonomy	Scientific name	Likelihood of Introduction
Mite	Trombidiformes: Eriophyidae	*Aceria ficus* (Cotte)[1]	Medium
Mite	Trombidiformes: Tenuipalpidae	*Brevipalpus chilensis* Baker	Medium

The following organisms are likely to follow the pathway but were not assessed in this document because they have already been determined to pose an unacceptable risk to the United States. Domestic regulations are in place for these pests:

Pest type	Taxonomy	Scientific name	Code of Federal Regulations
Insect	Diptera: Tephritidae	*Ceratitis capitata* (Wiedemann)[2]	7 CFR § 301.32, 2023

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

[1] Endangered area excludes Hawaii for this pest.
[2] Endangered area excludes Hawaii for this pest.

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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 fig (*Ficus carica* Linnaeus) from Chile (referred to as the export area) into the United States[3] (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 Subpart L – Fruits and Vegetables (7 CFR §319.56, 2023) and as described in the Agricultural Commodity Import Requirements. Under this regulation, the entry of fig from Chile into the continental United States is authorized after a methyl bromide treatment (USDA, 2023). This commodity risk assessment was initiated in response to a request by Chile to change the federal regulation to allow entry with a systems approach or irradiation instead of a methyl bromide treatment. Broadening the PRA area to the entire United States is consistent with how PPQ currently conducts risk assessments.

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 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 fig does not need to be analyzed because it is widely established in the United States (NRCS, 2023).

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.

[3]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.

1.4.1. Description of the commodity
The specific pathway of concern is the importation of fresh fruit of fig for consumption.

1.4.2. Summary of the production, harvest, post-harvest, shipping, and storage conditions considered
No production, harvest, post-harvest, shipping, or storage conditions were considered in this PRA except for basic culling.

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 Chile on any host and are known to be associated with *Ficus carica* 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 Chile. 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 Chile and its association with fig. 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.

Table 1. List of quarantine pests associated with *Ficus carica* anywhere in the world and present in Chile on any host

Pest name	**Presence in Chile**	**Fig association**	**Plant part(s)** [4]	**Considered further?** [5]
INSECT Coleoptera: Bostricidae *Micrapate scabrata* (Erichson)	Barriga et al., 1993	Barriga et al., 1993	Dead wood (Barriga et al., 1993)	No Quarantine for Hawaii, Puerto Rico, and U.S. Virgin Islands (ARM, 2023).
INSECT Coleoptera: Cerambycidae *Abyarachryson signaticolle* (Blanchard); syn. *Grammicosum signaticolle* Blanchard	Barriga et al., 1993; Monné and Nearns, 2023	Barriga et al., 1993; Monné and Nearns, 2023	Wood (Barriga et al., 1993; Monné and Hovore, 2005)	No

[4] 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.

[5] "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 Chile**	**Fig association**	**Plant part(s)** [4]	**Considered further?**[5]
INSECT Coleoptera: Cerambycidae *Alcathousites asperipennis* (Fairmaire & Germain); syn. *Leiopus asperipennis* Fairmaire & Germain	Ferrú and Elgueta, 2011; Prado, 1991	Ferrú and Elgueta, 2011; Prado, 1991	Green twigs (Ferrú and Elgueta, 2011), Wood (Monné and Hovore, 2005)	No
INSECT Coleoptera: Cerambycidae *Ceresium unicolor* (Fabricius)	Easter Island (Cerda, 1991; Monné and Nearns, 2023)	Monné and Nearns, 2023	Wood (Gressitt and Davis, 1972)	No Present in Hawaii (Gressitt and Davis, 1972). Quarantine for the continental United States (ARM, 2023).
INSECT Coleoptera: Cerambycidae *Eburia pilosa* (Erichson)	Monné and Chaboo, 2015	Duffy, 1960; Monné and Chaboo, 2015	Wood (Monné and Hovore, 2005)	No
INSECT Coleoptera: Cerambycidae *Eryphus laetus* (Blanchard); syn. *Callideriphus laetus* Blanchard	Barriga et al., 1993	Barriga et al., 1993	Dead wood (Barriga et al., 1993)	No
INSECT Coleoptera: Cerambycidae *Lagocheirus undatus* Voet	Easter Island (Mondaca, 2008)	Mondaca, 2008	Trunk, branches, wood (Mondaca, 2008)	No Present in Hawaii (Gressitt and Davis, 1972; University of Hawaii, 2023) Quarantine for Puerto Rico (ARM, 2023).
INSECT Coleoptera: Cerambycidae *Nathrius brevipennis* (Mulsant)	Barriga et al., 1993	Barriga et al., 1993	Dead wood (Barriga et al., 1993)	No
INSECT Coleoptera: Cerambycidae *Xenocompsa flavonitida* (Fairmaire & Germain)	Barriga et al., 1993	Barriga et al., 1993	Dead wood (Barriga et al., 1993)	No
INSECT Coleoptera: Curculionidae *Phloeotribus willei* Schedl	Ferrú and Elgueta, 2011; Kirkendall, 2018; Koch and Waterhouse, 2000; Prado, 1991	Ferrú and Elgueta, 2011; Kirkendall, 2018; Koch and Waterhouse , 2000; Prado, 1991	Branches (Kirkendall, 2018), Wood (Ferrú and Elgueta, 2011)	No

Pest name	Presence in Chile	Fig association	Plant part(s) [4]	Considered further?[5]
INSECT Coleoptera: Curculionidae *Rhyephenes humeralis* Schoenherr	Prado, 1991	Prado, 1991	Bark, wood (Morrone, 1996)	No
INSECT Diptera: Lonchaeidae *Neosilba pendula* (Bezzi)	Koch and Waterhouse, 2000	Koch and Waterhouse , 2000	Fruit (McAlpine and Steyskal, 1982)	No *Neosilba* species are secondary invaders of fruit (McAlpine and Steyskal, 1982). We found no evidence of *N. pendula* infesting healthy mature fruit for commercial production.
INSECT **Diptera: Tephritidae** ***Ceratitis capitata* (Wiedemann)**	**Curkovic et al., 2023; Prado, 1991**	**Annecke and Moran, 1982; Gençer et al., 2005; Mifsud et al., 2012; Prado, 1991; Segura et al., 2006**	**Fruit (Mifsud et al., 2012; Segura et al., 2006; Wohlfarter et al., 2011)**	**Yes** **This is a domestic quarantine species and is regulated by the U.S. Code of Federal Regulation (7 CFR § 301.32, 2023).** **Present in Hawaii (Liquido et al., 1990).**
INSECT Hemiptera: Aphididae *Greenidea ficicola* Takahashi	EMBL-EBI, 2023	Blackman and Eastop, 2000; Mifsud et al., 2012	Leaves (Liu et al., 2020; Mifsud et al., 2012) Shoots (Liu et al., 2020; Nagamine and Garcia, 2012) Young syconia (Mifsud et al., 2012)	No We did not find evidence that aphids colonize mature fig fruits. Present in the continental United States in California (iNaturalist, 2023), Florida (Halbert, 2004), and Hawaii (Nagamine and Garcia, 2012). Quarantine for Hawaii (ARM, 2023).
INSECT Hemiptera: Coccidae *Ceroplastes sinensis* Del Guercio	García-Morales et al., 2016	Marotta, 1987	Leaves, Stems (Snowball, 1970)	No Quarantine for Hawaii (ARM, 2023).

Pest name	**Presence in Chile**	**Fig association**	**Plant part(s)** [4]	**Considered further?**[5]
INSECT Hemiptera: Pentatomidae *Halyomorpha halys* Stål	Faúndez and Rider, 2017	Bergmann et al., 2016; Zakharchenko et al., 2020	Fruit (Zakharchenko et al., 2020)	No Insects feed externally (Zakharchenko et al., 2020). They are highly mobile and would disperse if disturbed. Present in the continental United States (Bergmann et al., 2016). Quarantine for Hawaii and Puerto Rico (ARM, 2023).
INSECT Hemiptera: Rhizoecidae *Geococcus coffeae* Green	García-Morales et al., 2016	García-Morales et al., 2016	Roots (Capinera, 2008)	No Present in the continental United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands (García-Morales et al., 2016). Quarantine for the continental United States (ARM, 2023).
INSECT Lepidoptera: Erebidae *Achaea janata* (Linnaeus)	Easter Island (Koch and Waterhouse, 2000)	Robinson et al., 2001	Leaves, fruit (Chung et al., 2012; Hill, 1994)	No Adults are active at night, a time which fruit harvest is unlikely. Moths feed externally by piercing fruit (Chung et al., 2012). Adults are winged, highly mobile, and would move off host plant if disturbed. Larvae feed on leaves (Chung et al., 2012). Quarantine for the continental United States (ARM, 2023).
INSECT Thysanoptera: Thripidae *Graphidothrips stuardoi* Moulton; syn. *Pseudodendrothrips stuardoi* (Moulton)	Moulton, 1930; Prado, 1991	Monteiro, 1999; Moulton, 1930; Prado, 1991; Rasool et al., 2021	Flowers, Fruit, (Gonzalez, 1989), Leaves (Gonzalez, 1989; Monteiro, 1999; Rasool et al., 2021)	No Although this species is associated with immature fig fruit (Gonzalez, 1989), we found no evidence of it being associated with mature fruit. Therefore, it is unlikely to be on fig fruit at the time of harvest.

Pest name	Presence in Chile	Fig association	Plant part(s) [4]	Considered further?[5]
MITE Trombidiformes: Eriophyidae *Aceria ficus* (Cotte); syns. *Aceria fici* (Essig); *Eriophyes fici* Essig; *Eriophyes ficus* Cotte	**Gonzalez, 1989; Koch and Waterhouse, 2000; Prado, 1991**	**Abou-Awad et al., 2000; Gençer et al., 2005**	**Branches (Baker, 1938), Buds (Abou-Awad et al., 2000; Baker, 1938; El-Halawany et al., 1990; Gonzalez, 1989), Fruit (Baker, 1938; Gonzalez, 1989), Leaves (Abou-Awad et al., 2000; Akşit and Cakmak, 2022; Baker, 1938; El-Halawany et al., 1990; Gonzalez, 1989)**	**Yes** **Not in ARM** **Present in Hawaii (Nishida, 2002). It was reported in California in the 1930's (Baker, 1938) but there have been no other reports of this species published since then, leaving uncertainty whether the mite is still present in California.**
MITE Trombidiformes: Tetranychidae *Eotetranychus lewisi* (McGregor)	Bolland et al., 1998	Bolland et al., 1998	Leaves [extrapolated from other host plants] (Kaur and Zalom, 2017; Miño et al., 2022; Pérez-Santiago et al., 2007)	No Present in the continental United States and Hawaii (Bolland et al., 1998). No evidence of presence in Puerto Rico.
MITE Trombidiformes: Tetranychidae *Oligonychus mangiferus* (Rahman & Sapra)	Bolland et al., 1998	Bolland et al., 1998	Leaves [extrapolated from other host plants] (Dhooria and Sandhu, 1975; Hussian et al., 2018; Marei et al., 2020)	No Present in Hawaii (Bolland et al., 1998).
MITE Trombidiformes: Tenuipalpidae *Brevipalpus chilensis* Baker	**Koch and Waterhouse, 2000; Prado, 1991**	**Koch and Waterhouse, 2000; Prado, 1991**	**Fruit (CABI, 2023; Castro, 2006), Leaves (CABI, 2023; Gonzalez, 2006)**	**Yes**

Pest name	Presence in Chile	Fig association	Plant part(s) [4]	Considered further? [5]
MOLLUSK Stylommatophora: Helicidae *Cornu aspersum* (O. F. Müller); syn. *Helix aspersa* O. F. Müller	Araya, 2015	Wohlfarter et al., 2011	Whole plant (CABI, 2023) [based on general feeding behavior]	No Wohlfarter et al. (2011) consider this snail "Loosely associated" with fig. Present in the continental United States and Hawaii (CABI, 2023). Quarantine for Alabama, Florida, Guam, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands (ARM, 2023). See notes in Section 2.2.
FUNGI *Flammulina velutipes* (Curtis) Singer; syn. *Collubia velutipes* (Curtis) P. Kumm.	Mujica and Vergara, 1980	Mujica and Vergara, 1980	Mujica and Vergara, 1980	No

2.2. Notes on pests identified in the pest list

Cornu aspersum (O. F. Müller) (Stylommatophora: Helicidae)

Adults and immatures are mobile and feed externally on the plant (CABI, 2023). They are primarily nocturnal feeders (Dekle and Fasulo, 2017) and are unlikely to be associated with the tree during daytime harvest. Further, because their size can measure up to 32 mm (Dekle and Fasulo, 2017), any snails that are on figs are likely to be noticed during harvest and removed.

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 fig 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 two quarantine pests for further analysis (Table 2).

Table 2. Pests selected for further analysis

Pest type	Taxonomy	Species names
Mite	Trombidiformes: Eriophyidae	*Aceria ficus*
Mite	Trombidiformes: Tenuipalpidae	*Brevipalpus chilensis*

The following pests can follow the commodity pathway. However, they were not assessed because they were previously determined to pose an unacceptable risk to the PRA area and domestic regulations are in place. These pests are candidates for risk mitigation.

Pest type	Scientific name	Code of Federal Regulation
Insect	*Ceratitis capitata* (Wiedemann)	7 CFR § 301.32, 2023

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 occur or rarely align 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. *Aceria ficus* (Cotte) (Trombidiformes: Eriophyidae)

The fig bud mite, *Aceria ficus* (Eriophyidae), is a four-legged, elongated mite of *Ficus carica* that measures up to 202 micrometers in length (Baker, 1938). It feeds on leaves, buds, fruit, and ostiolar scales, leaving a rusty discoloration (Baker, 1938). The fig bud mite may enter the

interior of young fruit (Hansen and Davey, 1932). The fig bud mite is associated with and a possible vector of fig mosaic virus (Caglayan et al., 2012; Gençer et al., 2005).

The endangered area for *Aceria ficus* within the United States

Climatic suitability: *Aceria ficus* is present in **Africa:** Egypt (Abou-Awad et al., 2000; El-Halawany et al., 1990); **Asia:** India (Punjab) (Dhooria and Bhullar, 2003), Iran (Arbabi et al., 2002), Iraq (Baghdad) (Al-Neami et al., 2012), Japan (Shimane) (Ishikawa et al., 2012), Saudi Arabia (Qassim Province) (Wang et al., 2014); **Europe:** Italy (Molfetta) (Valenzano et al., 2019), Turkey (Bursa province) (Gençer et al., 2005); **North America:** Hawaii (Nishida, 2002); and **South America:** Chile (regions I [Tarapacá] through VIII [Biobío]) (Gonzalez, 1989). These areas encompass Plant Hardiness Zones 8 to 11 (Takeuchi et al., 2018).

The fig bud mite was reported in California in the 1930's (Baker, 1938), but there have been no other reports of this species in California since then, leaving uncertainty whether the mite is still present there.

Hosts in PRA area: Hosts in the PRA area (NRCS, 2023) include **Moraceae:** *Ficus carica* (fig) (Abou-Awad et al., 2000)

Economically important hosts[6]*:* Fig (NASS, 2019)

Potential consequences on economically important hosts at risk: This pest is likely to cause unacceptable consequences because infestation results in bronzing of fruit (Baker, 1938). Additionally, fig bud mite is associated with and a possible vector of fig mosaic virus (Caglayan et al., 2012; Gençer et al., 2005).

Endangered area: The endangered area encompasses Plant Hardiness Zones 8 through 11 where fig is present. Hawaii is excluded from the endangered area as the mite is already present there.

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

The likelihood of entry of *Aceria ficus* into the endangered area via fig imported from Chile

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Pest prevalence on the harvested commodity	High	Low	*Aceria ficus* occurs on fig fruit and does so at much higher numbers than other mite species found on fig (Abou-Awad et al., 2000). In a study sampling fruit from fig trees in Egypt, an average of 302 fig bud mites were found per 10 fruits in sunny areas and 156 fig bud mites per 10 fruits in shady areas (Abou-Awad et al., 2000). Fig is the primary, and only known host, of the fig bud mite.
Likelihood of surviving post-harvest processing before shipment	High	Low	Culling is the only harvest or post-harvest practice considered for this PRA. Due to the minute size of these mites (up to 0.202 mm long (Baker, 1938)), it is unlikely that culling will result in elimination of these mites on fruit. Only severely infested fruits show bronzing: slightly damaged fig fruits ripen normally (Abou-Awad et al., 2000). This indicates that infested fruits may not always show symptoms and can pass culling. Therefore, we maintained our risk rating at High.
Likelihood of surviving transport and storage conditions of the consignment	High	n/a	Transport and storage conditions were not considered in this assessment; therefore, we maintained a risk rating at High.
Overall Likelihood of Entry	High	n/a	n/a

The likelihood of establishment of *Aceria ficus* into the endangered area via fig imported from Chile

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	Low	Moderate	The host plant, fig, is distributed throughout the southeastern and eastern United States, as well as California (NRCS, 2023). However, fig is the only known host plant of the fig bud mite, which will limit the availability of host plants. Additionally, figs will be imported for consumption, and would only have a limited probability of introduction directly into the natural or agricultural environments, in which hosts of the fig bud mite might be found. Finally, once in the commercial pathway the mite would have limited dispersal abilities which would further limit its ability to locate hosts. Therefore, we chose a risk rating of Low.
Overall Likelihood of Establishment	Low	n/a	n/a

The likelihood of introduction (combined likelihoods of entry and establishment) of *Aceria ficus* into the endangered area via fig imported from Chile is Medium.

3.2.2. *Brevipalpus chilensis* Baker (Trombidiformes: Tenuipalpidae)

The Chilean red mite, *Brevipalpus chilensis* (Acari: Tenuipalpidae) has a variety of hosts (e.g., lemons, figs, kiwi, stone fruit, *Ligustrum* plants), but is primarily known for its damage to some grape varieties. On grape vines, feeding discolors and curls leaves, causes new growth to wilt and die in the spring, and reduces plant yield by up to 30% (Gonzalez R., 1958; Gonzalez, 1983, 1989). Fig is considered a secondary host (Gonzalez R., 1958; Prado, 1991). *Brevipalpus chilensis* overwinters on the stems of its hosts and then migrates to the new shoots and leaves in the spring. All stages develop on the underside of leaves, especially along the midrib (CABI, 2023; Gonzalez, 1989), but they also occur on fruit. Maximal fecundity is reported to be 39 eggs per female (Gonzalez R., 1958). Depending on climate, there may be 3 to 6 generations per year (Jeppson et al., 1975), some of which may be parthenogenetic (Gonzalez R., 1958).

The endangered area for *Brevipalpus chilensis* within the United States

Climatic suitability: *Brevipalpus chilensis* is present in **South America:** Chile (regions III [Atacama] through X [Los Lagos]) (Gonzalez, 1989; Sazo and Montano, 1996). These areas encompass Plant Hardiness Zones 9 to 11 (Takeuchi et al., 2018).

Hosts in PRA area: Hosts in the PRA area (NRCS, 2023) include **Actinidiaceae:** *Actinidia chinensis* (kiwi); **Apiaceae:** *Apium graveolens* (celery); **Chenopodiaceae:** *Dysphania ambrosioides* (Mexican tea); **Convolvulaceae:** *Convolvulus arvensis* (field bindweed); **Moraceae:** *Ficus carica* (edible fig); **Oleaceae:** *Ligustrum sinense* (Chinese privet); **Rosaceae:**

Cydonia oblonga (quince), *Malus domestica* (apple), *Prunus armeniaca* (apricot), *Prunus dulcis* (almond), *Pyrus communis* (pear), *Rubus idaeus* (raspberry); **Rutaceae:** *Citrus* × *limon* (lemon), *C. reticulata* (mandarin), *C.* × *sinensis* (orange); and **Vitaceae:** *Vitis vinifera* (grape) (Gonzalez R., 1958; Gonzalez, 2006; Prado, 1991).

Economically important hosts[7]*:* Almond, apple, apricot, fig, grape, kiwi, lemon, orange, pear, and raspberry (NASS, 2019)

Potential consequences on economically important hosts at risk: This pest is likely to cause unacceptable consequences because feeding by the mite can cause leaf drop, hinder new leaf growth, and dehydrate stems and berries. As noted above, several economically important fruits are hosts of the mite.

Endangered area: The endangered area encompasses Plant Hardiness Zones 9 through 11 where host plants are present.

The likelihood of entry of *Brevipalpus chilensis* into the endangered area via fig imported from Chile

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Pest prevalence on the harvested commodity	Low	Negligible	The national plant protection organization of Chile reports that *B. chilensis* occurs on *F. carica* fruit, but the frequency of infested fruit and the load of mites on them is relatively low (Castro, 2006). From a sample of 500 figs, the average number of mites per fruit was 0.01 (i.e., 5 mites total across all 500 fruit) (Castro, 2006).
Likelihood of surviving post-harvest processing before shipment	Low	Negligible	Culling is the only harvest or post-harvest practice considered for this PRA. Due to the minute size of these mites (under 0.5 mm long (Gonzalez, 2006)), it is unlikely that culling will result in elimination of these mites on fruit. Therefore, we maintained our risk rating at Low.
Likelihood of surviving transport and storage conditions of the consignment	Low	n/a	Transport and storage conditions were not considered in this assessment; therefore, we maintained a risk rating at Low.
Overall Likelihood of Entry	Low	n/a	n/a

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

The likelihood of establishment of *Brevipalpus chilensis* into the endangered area via fig imported from Chile

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	Medium	Low	Suitable hosts, such as Chinese privet, field bindweed, grape, fig, and stone fruit, are widely distributed throughout the United States (NRCS, 2023). However, tenuipalpid mites tend to be slow moving (Jeppson et al., 1975), thus, the Chilean red mite is likely to have limited inherent powers of dispersal and would lack the ability to locate hosts quickly. While fig fruit will be imported for consumption and would only have a limited probability of introduction directly into the natural or agricultural environments, mites feed on several widely distributed hosts which would increase the likelihood of establishment. Therefore, we chose a risk rating of Medium.
Overall Likelihood of Establishment	Medium	n/a	n/a

The likelihood of introduction (combined likelihoods of entry and establishment) of *Brevipalpus chilensis* into the endangered area via fig imported from Chile is Medium.

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[8]	Notes
Mite	*Aceria ficus* (Cotte)[9]	Medium	n/a
Mite	*Brevipalpus chilensis* Baker	Medium	n/a
Insect	*Ceratitis capitata* (Wiedemann)[10]	n/a	7 CFR § 301.32, 2023

[8] 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.

[9] Endangered area excludes Hawaii for this pest.

[10] Endangered area excludes Hawaii for this pest.

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 fig and are present in the United States; however, none are of quarantine significance for the United States (ARM, 2021, 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 Chile, presence in the United States (if applicable), and association with fig. If any of the organisms are **not** present in the United States, we also provided justification for their non-quarantine status. Unless otherwise noted, these organisms are non-actionable at U.S. ports of entry (ARM, 2021).

Organism	In Chile	In U.S.	Fig Association	Notes
INSECT Coleoptera: Nitidulidae *Carpophilus hemipterus* (Linnaeus)	iNaturalist, 2023	iNaturalist, 2023	Akşit and Cakmak, 2022; Gençer et al., 2005	
INSECT Coleoptera: Nitidulidae *Carpophilus* spp.	Prado, 1987	Myers, 2019	Akşit and Cakmak, 2022	Genus is Non-Quarantine (ARM, 2023).
INSECT Diptera: Drosphilidae *Drosophila suzukii* Matsumura	Medina-Muñoz et al., 2015	Drummond et al., 2019	Kenis et al., 2016	
INSECT Hemiptera: Aleyrodidae *Bemisia tabaci* (Gennadius)	Evans, 2008	Evans, 2008	Li et al., 2011; Mifsud et al., 2012	
INSECT Hemiptera: Aleyrodidae *Dialeurodes citri* (Ashmead)	CABI, 2023	CABI, 2023	Akşit and Cakmak, 2022	
INSECT Hemiptera: Aphididae *Aphis fabae* Scopoli	CABI, 2023	CABI, 2023	Blackman and Eastop, 2000	
INSECT Hemiptera: Aphididae *Aphis gossypii* Glover	CABI, 2023	CABI, 2023	Blackman and Eastop, 2000	
INSECT Hemiptera: Aphididae *Aphis spiraecola* Patch	CABI, 2023	CABI, 2023	Blackman and Eastop, 2000	
INSECT Hemiptera: Aphididae *Toxoptera aurantii* (Fonscolombe)	CABI, 2023	CABI, 2023	Blackman and Eastop, 2000	
INSECT Hemiptera: Asterolecaniidae *Pollinia pollini* (Costa)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Coccidae *Coccus hesperidum* (Linnaeus)	García-Morales et al., 2016	García-Morales et al., 2016	Wohlfarter et al., 2011	

Organism	In Chile	In U.S.	Fig Association	Notes
INSECT Hemiptera: Coccidae *Eucalymnatus tessellatus* (Signoret)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Coccidae *Parasaissetia nigra* (Nietner)	García-Morales et al., 2016	García-Morales et al., 2016	Wohlfarter et al., 2011	
INSECT Hemiptera: Coccidae *Parthenolecanium corni* (Bouche)	García-Morales et al., 2016	CABI, 2023	CABI, 2023	
INSECT Hemiptera: Coccidae *Parthenolecanium persicae* (Fabricius)	CABI, 2023	CABI, 2023	CABI, 2023	
INSECT Hemiptera: Coccidae *Saissetia coffeae* (Walker)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Coccidae *Saissetia oleae* (Olivier)	García-Morales et al., 2016	García-Morales et al., 2016	Mifsud et al., 2012	
INSECT Hemiptera: Diaspididae[11] *Aonidiella aurantii* (Maskell)	García-Morales et al., 2016	García-Morales et al., 2016	Annecke and Moran, 1982; Wohlfarter et al., 2011	
INSECT Hemiptera: Diaspididae *Aspidiotus destructor* Signoret	CABI, 2023	CABI, 2023	CABI, 2023	
INSECT Hemiptera: Diaspididae *Aspidiotus nerii* Bouche	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Chrysomphalus aonidum* (Linnaeus)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Chrysomphalus dictyospermi* (Morgan)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Diaspidiotus lenticularis* (Lindinger)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Hemiberlesia cyanophylli* (Signoret); syn. *Abgrallaspis cyanophylli* (Signoret)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	

[11] 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 Chile	In U.S.	Fig Association	Notes
INSECT Hemiptera: Diaspididae *Hemiberlesia lataniae* (Signoret)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Hemiberlesia rapax* (Comstock)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Lepidosaphes beckii* (Newman)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Lepidosaphes conchiformis* (Gmelin); syns. *Lepidosaphes ficus* (Signoret); *Lepidosaphes minima* Newst; *Mytilaspis conchiformis* (Gmelin)	Gonzalez, 1989; Koch and Waterhouse, 2000; Prado, 1991	García-Morales et al., 2016	Gençer et al., 2005; Gonzalez, 1989; Koch and Waterhouse, 2000; Mifsud et al., 2012; Prado, 1991	
INSECT Hemiptera: Diaspididae *Lepidosaphes ulmi* (Linnaeus)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Pinnaspis strachani* (Cooley)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Diaspididae *Pseudaulacaspis pentagona* (Targioni Tozzetti)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Monophlebidae *Icerya purchasi* Maskell	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Pentatomidae *Nezara viridula* (Linnaeus)	Peralta-Castro and Huerta-Fuentes, 2023	CABI, 2023	Wohlfarter et al., 2011	
INSECT Hemiptera: Pseudococcidae *Phenacoccus solenopsis* Tinsley	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	
INSECT Hemiptera: Pseudococcidae *Planococcus citri* (Risso)	García-Morales et al., 2016	García-Morales et al., 2016	García-Morales et al., 2016	

Organism	In Chile	In U.S.	Fig Association	Notes
INSECT Hemiptera: Pseudococcidae *Planococcus ficus* (Signoret)	Gonzalez, 2011	García-Morales et al., 2016	Annecke and Moran, 1982; Gonzalez, 2011; Mifsud et al., 2012; Wohlfarter et al., 2011	
INSECT Hemiptera: Pseudococcidae *Pseudococcus calceolariae* (Maskell)	Gonzalez, 2011	García-Morales et al., 2016	Gonzalez, 2011	
INSECT Hemiptera: Pseudococcidae *Pseudococcus longispinus* (Targioni Tozzetti)	Gonzalez, 2011	García-Morales et al., 2016	Gonzalez, 2011	
INSECT Hemiptera: Pseudococcidae *Pseudococcus maritimus* (Ehrhorn)	García-Morales et al., 2016	Alata Condor, 1973	García-Morales et al., 2016	
INSECT Hemiptera: Pseudococcidae *Pseudococcus viburni* (Signoret)	Gonzalez, 2011	García-Morales et al., 2016	Gonzalez, 2011	
INSECT Lepidoptera: Noctuidae *Helicoverpa zea* (Boddie)	CABI, 2023	CABI, 2023	CABI, 2023	
INSECT Lepidoptera: Nymphalidae: *Marpesia petreus* (Cramer)	Robinson et al., 2023	Robinson et al., 2023	Robinson et al., 2023	
INSECT Lepidoptera: Pyralidae *Cadra cautella* (Walker)	Prado, 1991	Akşit and Cakmak, 2022	CABI, 2023	
INSECT Lepidoptera: Pyralidae *Ectomyelois ceratoniae* Zeller	Zaviezo et al., 2007	Aitken, 1963; Zimmerman, 1958	Akşit and Cakmak, 2022; Mozaffarian et al., 2008	
INSECT Lepidoptera: Pyralidae *Plodia interpunctella* (Hübner)	CABI, 2023	Akşit and Cakmak, 2022	CABI, 2023	
INSECT Thysanoptera: Thripidae *Frankliniella occidentalis* (Pergande)	CABI, 2023	CABI, 2023	Wohlfarter et al., 2011	
INSECT Thysanoptera: Thripidae *Thrips tabaci* Lindeman	CABI, 2023	CABI, 2023	Wohlfarter et al., 2011	

Organism	**In Chile**	**In U.S.**	**Fig Association**	**Notes**
MITE Trombidiformes: Rhyncaphytopidae *Rhyncaphytoptus ficifoliae* Keifer	Koch and Waterhouse, 2000; Peralta A., 1993; Prado, 1991	Gross and Oboyski, 2023	Koch and Waterhouse, 2000; Peralta A., 1993; Prado, 1991	
MITE Trombidiformes: Tenuipalpidae *Brevipalpus phoenicis* (Geijskes)	CABI, 2023	CABI, 2023	CABI, 2023	
MITE Trombidiformes: Tetranychidae *Bryobia praetiosa* Koch	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	
MITE Trombidiformes: Tetranychidae *Panonychus ulmi* (Koch)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998; Gençer et al., 2005	
MITE Trombidiformes: Tetranychidae *Petrobia latens* (Müller)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	
MITE Trombidiformes: Tetranychidae *Tetranychus desertorum* Banks	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	
MITE Trombidiformes: Tetranychidae *Tetranychus ludeni* Zacher	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	
MITE Trombidiformes: Tetranychidae *Tetranychus urticae* Koch	Bolland et al., 1998	Bolland et al., 1998	Akşit and Cakmak, 2022; Gençer et al., 2005	
FUNGUS *Alternaria alternata* (Fr.) Keissi	CABI, 2023; Elfar et al., 2018; Montealegre et al., 2000	CABI, 2023	CABI, 2023; Latinović et al., 2014; Montealegre et al., 2000	
FUNGUS *Aspergillus niger* Tiegh.	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS *Athelia rolfsii* (Curzi) C. C. Tu & Kimbr. syn: *Sclerotium roslfsii* (Sacc.)	CABI, 2023; Farr and Rossman, 2023	CABI, 2023; Farr and Rossman, 2023	CABI, 2023; Farr and Rossman, 2023;	
FUNGUS: *Botrytis cinerea* Pers.	CABI, 2023; Montealegre et al., 2000	CABI, 2023	CABI, 2023; Montealegre et al., 2000	

Organism	**In Chile**	**In U.S.**	**Fig Association**	**Notes**
FUNGUS *Ceratocystis fimbriata* Ellis & Halst	Larenas and Accatino, 1994	CABI, 2023	CABI, 2023	
FUNGUS *Cerotelium fici* (Butler) Arthur	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS *Cladosporium herbarum* (Pers.: FR.) Link	Montealegre et al., 2000	CABI, 2023	Montealegre et al., 2000	
FUNGUS *Cochliobolus lunatus* R.R. Nelson & Haasis syn: *Curvularia lunata* Wakker & Boedjin	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS *Diplodia seriata* De Not.	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS: *Fusarium flocciferum* Corda	Montealegre et al., 2000	No evidence found	Montealegre et al., 2000	Root rot fungus. Not associated with fruit being exported.
FUNGUS *Glomerella cingulata* (Stonem.) Spauld & Schrenk Syn: *Collectotricum gloeosporides* (Penz.) Penz. & Sacc]	CABI, 2023; Perodo and Valenzuala, 1988	CABI, 2023	CABI, 2023	
FUNGUS *Hendersonia toruloidea* Natrass	SAG., 2001	Michailides, 2003; Ogawa and English, 1991; SAG., 2001	Michailides, 2003; Ogawa and English, 1991; SAG., 2001	
FUNGUS *Lasiodiplodia theobromae* (Pat.) Griffiths & Maubl.	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS *Leveillula taurica* (Lév.) G. Arnaud	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS *Nectria haematococca* (Wollenw) Gerlach	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS *Penicillium italicum* Wehmer	CABI, 2023	CABI, 2023	CABI, 2023	
FUNGUS: *Pennillium minioluteum* Dierclox R.P. Syn: *Talaromyces minioluteus* (Dierckx) Samson, Yilmaz, Frisvad & Seifert	Montealegre et al., 2000	Stostic et al., 2020	Montealegre et al., 2000	
CHROMISTAN *Pythium aphanidermatum* (Edson) Fitsp.	CABI, 2023	CABI, 2023	CABI, 2023	

Organism	**In Chile**	**In U.S.**	**Fig Association**	**Notes**
FUNGUS *Rhizopus stolonifer* (Ehrenb.) Lind	CABI, 2023; Franck et al., 2000; Montealegre et al., 2001	CABI, 2023	CABI, 2023; Montealegre et al., 2000	
VIROID *Hostuviroid Hop stunt viroid*	CABI, 2023; Torres et al., 2004	CABI, 2023	CABI, 2023	
VIRUS Fig Mosaic virus	Alfieri et al., 1993; Gonzales, 1989	Alfieri et al., 1993;	Alfieri et al., 1993; Gonzales, 1989	
BACTERIA *Pseudomonas cichorii* (Swingle) Stapp	CABI, 2023	CABI, 2023	CABI, 2023	
BACTERIA *Rhizobium radiobacter* (Beijerink & van Delden) Young	CABI, 2023	CABI, 2023	CABI, 2023	
NEMATODE *Helicotylenchus dihystera* (Cobb) Sher Syn.: *Rotylenchoides* Whitehead *Zimmermannia* Shamsi	CABI, 2023	CABI, 2023	CABI, 2023	
NEMATODE *Meloidogyne arenaria* (Neal) Chitwoodi	Franck et al., 2000; Jimenez, 1984	CABI, 2023; Evans et al., 1993	CABI, 2023; Evans et al., 1993	
NEMATODE: *Pratylenchus coffeae* (Zimmermann) Filipjev & Schuurmans Steckhoven	CABI, 2023	CABI, 2023	CABI, 2023	
NEMATODE *Meloidogyne incognita* (Kofold & White) Chitwoodi	CABI, 2023	CABI, 2023	CABI, 2023	
NEMATODE *Xiphinema americanum* Cobb	CABI, 2023	CABI, 2023	CABI, 2023	
NEMATODE *Xiphinema index* Thorne & Allen	CABI, 2023; Franck et al., 2000; Gonzalez, 1970	CABI, 2023	CABI, 2023	