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

Revising entry requirements for importation of fresh apple fruit (*Malus domestica*) and pear fruit (*Pyrus communis*, *Pyrus pyrifolia*, and *Pyrus* x *bretschneideri*) with peduncles and 2-3 leaves from New Zealand into the United States for consumption

A Qualitative, Pathway Initiated Pest Risk Assessment

Version 1
November 25, 2024

Agency contact
Plant Pest Risk Analysis
Science and Technology
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 apple fruit, with peduncles and 2-3 leaves, *Malus domestica* (Suckow) Borkh., and pear fruit with peduncles and 2-3 leaves, *Pyrus communis* L., *Pyrus pyrifolia* (Burm. f.) Nakai, and *Pyrus* x *bretschneideri* Redh. (Rosaceae) fruit for consumption from New Zealand.

Based on the revised market access request submitted by the New Zealand Ministry of Agriculture and Forestry, we considered the pathway to include the following processes and conditions: fruit with peduncles and 2-3 attached leaves. The pest risk ratings depend on the application of all conditions of the pathway as described in this document; fruit with peduncles, and 2-3 leaves 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 New Zealand to develop a list of pests with quarantine significance for the United States. These are pests that occur in New Zealand 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	Commodity
Arthropod	Lepidoptera: Carposinidae	*Coscinoptycha improbana* Meyrick	Medium	*Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Cnephasia jactatana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Ctenopseustis herana* (Feld. & Rogen.)	Low	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Ctenopseustis obliquana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Planotortrix excessana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Planotortrix octo* Dugdale	Low	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Pyrgotis plagiatana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	Trombidiformes: Tetranychidae	*Bryobia graminum* (Schrank)	High	*Malus*, *Pyrus*
Arthropod	Trombidiformes: Tetranychidae	*Tetranychus lambi* Pritchard & Baker	High	*Malus*

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

Table of Contents

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 fruit of apple (*Malus domestica* (Suckow) Borkh., and pear (*Pyrus communis* L., *Pyrus pyrifolia* (Burm. f.) Nakai, and *Pyrus* x *bretschneideri* Redh.) from New Zealand (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, 2024).

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

Apple (*M. domestica*) and pears (*P. communis* and *P. pyrifolia*) from New Zealand are currently allowed into all U.S. ports. New Zealand has been shipping apple and pear fruit for many years under a preclearance program. New Zealand wishes to modify the existing phytosanitary pre-clearance conditions for shipping apple and pear by adding *P.* x *bretschneideri* fruit, and to allow the exported fruit to have peduncles with 2-3 attached leaves.

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, 2024) and as described in the Agricultural Commodity Import Requirements. Under this regulation, the entry of fruit from New Zealand into the PRA area is authorized into all ports. This commodity risk assessment was initiated in response to a request by the New Zealand Ministry of Agriculture and Forestry to change the federal regulation to allow entry of *Pyrus* x *bretschneideri*, and to include apple, and pear fruit with peduncles and 2-3 leaves.

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 (native) 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 apple and pear fruit does not need to be analyzed because apple and pear are widely grown or naturalized in a number of states (NRCS,

[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.

2024).

1.4. Description of the pathway

A pathway is "any means that allows the entry or spread of a pest" (IPPC, 2024). 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 apple fruit (*M. domestica*) and pear fruit (*P. communis*, and *P. pyrifolia*) and the addition of *P.* x *bretschneideri*; fruit will have peduncles with 2-3 attached leaves.

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

Production, harvesting, and post-harvesting procedures and 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 continental U.S., and offshore states and territories. This list includes pests that are present in New Zealand on any host and are known to be associated with *M. domestica*, *P. communis*, *P. pyrifolia*, or *P.* x *bretschneideri* 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 New Zealand. 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 New Zealand and its association with *M. domestica*, *P. communis*, *P. pyrifolia*, or *P.* x *bretschneideri*. 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. The rationale for including or excluding pests in Table 2 is based on the biological characteristics of the pest. Mobile pests, such as Coleoptera adults, will fly away, or drop away from the commodity during harvest; sessile pests such as scale insects, or those which feed internally, will remain with the commodity during harvest, and may remain with the commodity in the export/import pathway.

Table 1a. List of quarantine pests associated with *Malus domestica*, anywhere in the world and present in New Zealand on any host.

Pest name	Presence in New Zealand	Host association	Plant part(s) [2]	Considered further? [3]
INSECT: Coleoptera: Chrysomelidae *Eucolaspis brunnea* (F.)	Penman, 1984	Penman, 1984	Fruit, leaf (adult), root (larvae) (Miller, 1926)	No. Adults are mobile and feed externally on fruit. Therefore, they would be unlikely to remain with the harvested commodity.
INSECT: Coleoptera: Curculionidae *Phlyctinus callosus* Schönherr	Dymock and Holder, 1996	Annecke and Moran, 1982	Trunk, fruit (external), leaf, (adult), root (larvae) (Annecke and Moran, 1982)	No. Adults are mobile and feed externally on fruit. Therefore, they would be unlikely to remain with the harvested commodity.
INSECT: Lepidoptera: Noctuidae *Graphania mutans* (Walker)	Wearing et al., 2010	Wearing et al., 2010	Leaf, young fruit (Wearing et al., 2010)	No. External feeder on young fruit (Frérot and Foster, 1991). Young fruit would not be harvested for export.
INSECT: Lepidoptera: Noctuidae *Graphania plena* Walker	Wearing et al., 2010	Wearing et al., 2010	Leaf, young fruit (external) (Wearing et al., 2010)	No. Occasional external damage to apples in spring (Wearing et al., 2010).
INSECT: Lepidoptera: Noctuidae *Graphania ustistriga* (Walker)	Wearing et al., 2010	Wearing et al., 2010	Leaf, young fruit (external) (Wearing et al., 2010)	No. Occasional external damage to apples (Wearing et al., 2010).
INSECT: Lepidoptera: Noctuidae *Helicoverpa armigera* (Hübner)	Cameron et al., 1995	Pringle et al., 2015	Blossom, young leaf, young fruit (Pringle et al., 2015)	No. Larvae feed in young fruits which reduces quality, i.e., depending on when the fruit is attacked, the results are a superficial feeding lesion, a visible callous, an indentation, or a hole (Pringle et al., 2015). Larvae are unlikely to be associated with harvested, mature fruit.

[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 New Zealand	Host association	Plant part(s) [2]	Considered further? [3]
INSECT: Lepidoptera: Noctuidae *Helicoverpa punctigera* Wallengren	NZOR, 2024	Zalucki et al., 1986	Leaf, flower, fruit (CABI, 2024)	No. Larvae feed on young tissues growing points, leaves, developing flower buds, flowers and fruits. Most feeding is concentrated on flowers and fruits when present (CABI, 2024). Larvae would not be associated with harvested fruit.
INSECT: Lepidoptera: Noctuidae *Spodoptera litura* (F.)	NZOR, 2024	Thakur et al., 1974	Leaf, shoot, twig (Thakur et al., 1974)	No. Eggs are laid on the underside of the leaves in clusters of 200-300, and covered with hair scales (Hill, 1983); neonate larvae skeletonize leaves, older larvae defoliate leaves leaving only veins (Gupta et al., 2015). These indications of the presence of this species are conspicuous, and they would be removed during processing.
INSECT: Lepidoptera: Oecophoridae *Stathmopoda horticola* Dugdale	Charles, 1998	Scott, 1984 (as *S. skelloni*, a misidentification of *S. horticola* (Dugdale, 1988).	Dying leaf tissue, dead flower sepals at fruit calyx (Scott, 1984)	No. This insect is not associated with the commodity.
INSECT: Lepidoptera: Pyralidae *Cryptoblabes gnidiella* Millière	Carter, 1984	Carter, 1984	Fruit (external) (Plaut, 1971)	No. Larval presence is usually noticed by dense webbing around the stalk (Carter, 1984), and external scarring on fruit (Plaut, 1971). Present in Hawaii (Carter, 1984).
INSECT: Lepidoptera: Tortricidae *Cnephasia jactatana* (Walker)	**Popay, 2008**	**Popay, 2008**	**Leaf (Popay, 2008)**	**Yes**
INSECT: Lepidoptera: Tortricidae *Ctenopseustis herana* (Feld. & Rogen.)	**NZMAF, 2023a**	**NZMAF, 2023a**	**Leaf (Harris, 1994)**	**Yes**

Pest name	Presence in New Zealand	Host association	Plant part(s) [2]	Considered further?[3]
INSECT: Lepidoptera: Tortricidae *Ctenopseustis obliquana* (Walker)	**NZMAF, 2023a**	**NZMAF, 2023a**	**Leaf, fruit (Scott, 1984)**	**Yes**
INSECT: Lepidoptera: Tortricidae *Planotortrix excessana* (Walker)	**NZMAF, 2023a**	**NZMAF, 2023a**	**Leaf, fruit (Scott, 1984)**	**Yes**
INSECT: Lepidoptera: Tortricidae *Planotortrix octo* Dugdale	**NZMAF, 2023a**	**NZMAF, 2023a**	**Leaf (Burnip and Suckling, 2001)**	**Yes**
INSECT: Lepidoptera: Tortricidae *Pyrgotis plagiatana* (Walker)	**NZMAF, 2023a**	**NZMAF, 2023a**	**Leaf (Wearing et al., 2012)**	**Yes**
INSECT: Thysanoptera: Thripidae *Thrips imaginis* Bagnall	Hely et al., 1982	Hely et al., 1982	Flower (Mound and Walker, 1982)	No
INSECT: Thysanoptera: Thripidae *Thrips obscuratus* (J. C. Crawford)	NZMAF, 2023a	NZMAF, 2023a	Flower (Teulon and Penman, 1990)	No
MITE: Tetranychidae: *Bryobia graminum* (Schrank)	**Bolland et al., 1998**	**Bolland et al., 1998**	**Leaf (Bennington and Poole., 2023)**	**Yes**
MITE: Trombidiformes Tetranychidae *Tetranychus lambi* Pritchard & Baker	**Bolland et al., 1998**	**Bolland et al., 1998**	**Leaf (Jeppson et al., 1975)**	**Yes**
MOLLUSK: Gastropoda: Geomitridae *Candidula intersecta* (Poiret)	Barker, 1999	Hitchcox, 2007	Fruit (external) (White-McLean, 2011)	No. This snail damages unripe and fruit forming on the tree. Once damaged, fruit are infected with fungi, bacteria, and yeast which causes them to rot before maturity (CABI, 2024).
FUNGI: *Colletotrichum acerbum* Damm, P.F. Cannon & Crous	Bragança et al., 2016	Bragança et al., 2016	Leaf, fruit (Damm et al., 2012)	No. The symptoms of this species (sunken lesions and bitter rot on fruit) are visible; however, there are asymptomatic infections on leaves (Børve and Stensvand, 2015).
FUNGI: *Gloeocystidiellum sacratum* (G. Cunn.) Stalpers & P.K. Buchanan; syn. *Amylostereum sacratum* (G. Cunn.) Burds.	Farr and Rossman, 2024	Farr and Rossman, 2024	Root, stem (Manaaki Whenua, Landcare Research, 2024)	No. This fungus is not associated with plant part being imported.

Pest name	Presence in New Zealand	Host association	Plant part(s) [2]	Considered further? [3]
VIROID: *Pelamoviroid, Apple hammerhead viroid*	Nabi and Baranwal, 2020	Nabi and Baranwal, 2020	Leaf, systematic (Nabi and Baranwal, 2020)	No. This viroid is mechanically transmitted (Serra et al., 2018). Other methods of transmission are not known, however, fruit for consumption is considered an unlikely pathway for the introduction of this viroid.

Table 1b. List of quarantine pests associated with *Pyrus communis* L., *Pyrus pyrifolia* (Burm. f.) Nakai, or *Pyrus* x *bretschneideri* Redh. (in any country) and present in New Zealand (on any host).

Pest Name	Presence in New Zealand	Host association	Plant part(s) [4]	Considered further? [5]
INSECT: Coleoptera: Curculionidae *Phlyctinus callosus* Schönherr	Dymock and Holder, 1996	Annecke and Moran, 1982	Trunk, fruit (external), leaf, (adult), root (larvae) (Annecke and Moran, 1982)	No. Adults are mobile and feed externally on fruit. Therefore, they would be unlikely to remain with the harvested commodity.
INSECT: Lepidoptera: Carposinidae *Coscinoptycha improbana* Meyrick	**Jamieson et al., 2004**	**Jamieson et al., 2004**	**Fruit (Jamieson et al., 2004)**	**Yes**
INSECT: Lepidoptera: Pyralidae *Cryptoblabes gnidiella* Millière	Plaut, 1971	Plaut, 1971	Fruit (external) (Plaut, 1971)	No. Larval presence is usually noticed by external scarring on fruit (Plaut, 1984). Present in Hawaii (Carter, 1984).
INSECT: Lepidoptera: Tortricidae *Ctenopseustis herana* (Feld. & Rogen.)	**NZMAF, 2023b**	**NZMAF, 2023b**	**Leaf (Harris, 1994)**	**Yes**
INSECT: Lepidoptera: Tortricidae *Ctenopseustis obliquana* (Walker)	**NZMAF, 2023b**	**NZMAF, 2023b**	**Leaf, fruit (Scott, 1984)**	**Yes**
INSECT: Lepidoptera: Tortricidae *Planotortrix excessana* (Walker)	**NZMAF, 2023b**	**NZMAF, 2023b**	**Leaf, fruit Plant parts based on *Malus* (Scott, 1984).**	**Yes**
INSECT: Lepidoptera: Tortricidae *Planotortrix octo* Dugdale	**NZMAF, 2023b**	**NZMAF, 2023b**	**Leaf (Suckling et al., 1994)**	**Yes**

[4] The plant part(s) listed are those for the plant species under analysis. If the information has been extrapolated, such 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 New Zealand	Host association	Plant part(s) [4]	Considered further?[5]
INSECT: Lepidoptera: Tortricidae *Pyrgotis plagiatana* (Walker)	**NZMAF, 2023b**	**NZMAF, 2023b**	**Leaf (Wearing et al., 2012)**	**Yes**
INSECT: Thysanoptera: Thripidae *Thrips imaginis* Bagnall	Mound and Walker, 1982	Kirk, 1987	Flower (Mound and Walker, 1982)	No
INSECT: Thysanoptera: Thripidae *Thrips obscuratus* (Crawford)	NZMAF, 2023b	NZMAF, 2023b	Flower (Teulon and Penman, 1990)	No
MITE: Tetranychidae: *Bryobia graminum* (Schrank)	**Bolland et al., 1998**	**Bolland et al., 1998**	**Leaf (Bennington and Poole., 2023)**	**Yes**
MOLLUSK: Gastropoda: Geomitridae *Candidula intersecta* (Poiret)	Barker, 1999	Hitchcox, 2007	Fruit (external) (White-McLean, 2011)	No
MOLLUSK: Gastropoda: Helicidae *Cornu aspersum* (Müller); syn. *Cantareus aspersus* (Müller)	Barker and Watts, 2002	White-McLean, 2011	Leaf, fruit (external). Plant part based on citrus (Sakovich, 2002).	No
FUNGI: *Colletotrichum pyricola* Damm, P.F. Cannon & Crous	Farr and Rossman, 2024	Farr and Rossman, 2024	Leaf, fruit (Fu et al., 2019)	No. This species causes leaf spots, anthracnose, and fruit rot (Zapata and Opazo, 2017), which are clearly visible. Symptomatic fruit and leaves would be culled during the post-harvest processing. Additionally, pear trees are rarely affected by anthracnose (Damm et al., 2012).
FUNGI: *Gloeocystidiellum sacratum* (G. Cunn.) Stalpers & P.K. Buchanan; syn *Amylostereum sacratum* (G. Cunn.) Burds.	Farr and Rossman, 2024	Farr and Rossman, 2024	Root, stem (Manaaki Whenua, Landcare Research, 2024)	No. This fungus is not associated with the plant part being imported.
FUNGI: *Laetiporus portentosus* (Berk.) Rajchenb.; syn. *Piptoporus portentosus* (Berk.) G. Cunn.	Farr and Rossman, 2024	Farr and Rossman, 2024	Stem (Manaaki Whenua, Landcare Research, 2024)	No. This fungus is not associated with the plant part being imported.

2.2. Pests considered but not included on the pest list

2.2.1. Contaminants

The following quarantine insects are not pests of apple, or pear but have been listed as contaminants in export apple, or pear fruit (NZMAF, 2023a): *Hylastes ater* (Paykull) (Coleoptera: Curculionidae), *Rhypodes serricatus* Usinger (Hemiptera: Lygaeidae) (apple), *Costelytra zealandica* (White) (Coleoptera: Scarabaeidae) (pear), *Nysius huttoni* White

(Hemiptera: Lygaeidae) (apple, and pear).

2.2.2. Organisms with non-quarantine status

We found evidence of organisms that are associated with fruit of *M. domestica*, *P. communis*, *P. pyrifolia*, and *P.* x *bretschneideri* with peduncles, and 2-3 attached leaves, 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.

2.3. Pests selected for further analysis or already regulated

We identified 9 quarantine pests for further analysis (Table 2).

Table 2. Pests selected for further analysis

Pest type	Taxonomy	Species name	Commodity
Arthropod	Lepidoptera: Carposinidae	*Coscinoptycha improbana* Meyrick	*Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Cnephasia jactatana* (Walker)	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Ctenopseustis herana* (Feld. & Rogen.)	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Ctenopseustis obliquana* (Walker)	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Planotortrix excessana* (Walker)	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Planotortrix octo* Dugdale	*Malus*, *Pyrus*
Arthropod	Lepidoptera: Tortricidae	*Pyrgotis plagiatana* (Walker)	*Malus*, *Pyrus*
Arthropod	Trombidiformes: Tetranychidae	*Bryobia graminum* (Schrank)	*Malus*, *Pyrus*
Arthropod	Trombidiformes: Tetranychidae	*Tetranychus lambi* Pritchard & Baker	*Malus*

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 was 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. *Coscinoptycha improbana* Meyrick (Lepidoptera: Carposinidae)
Coscinoptycha improbana, a native to Australia, was first detected in New Zealand in 1999 in mandarins (Froud and Dentener, 2002) and has been found on a number of fruit hosts (Froud and Dentener, 2002).

The endangered area for *Coscinoptycha improbana* within the United States

Climatic suitability:
Coscinoptycha improbana occurs in: **Oceania**: Australia (Queensland, New South Wales, the Australia Capital Territories, Victoria, Tasmania and Norfolk Island); New Caledonia: New Zealand: (Northland) (Froud and Dentener, 2002).

Hosts in PRA area:
Hosts in the PRA area: **Myrtaceae**: *Psidium* sp. (guava); **Rosaceae**: *Eriobotrya japonica* (loquat), *Prunus domestica* (plum), *P. persica* (peach), *Pyrus pyrifolia* (Asian pear); **Rutaceae**: *Citrus limon* (lemon) (Froud and Dentener, 2002; USDA, NASS, 2024; USDA, NRCS, 2024).

Economically important hosts:
All the fruit listed above are grown, commercially or backyard-type settings in the U.S., and have some type of economic importance (USDA, NASS, 2024).

Potential consequences on economically important hosts at risk:
This pest is likely to cause unacceptable consequences because the listed hosts have a wide distribution in the U.S., and have importance as commercial-scale, and backyard plants.

Endangered area:
The current distribution of this insect suggests that it could become established in the United States in Plant Hardiness Zones 6-12 (Takeuchi et al., 2018).

The likelihood of entry of *Coscinoptycha improbana* into the endangered area via *Pyrus communis*, *Pyrus pyrifolia*, or *Pyrus* x *bretschneideri* fruit imported from New Zealand.

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Pest prevalence on the harvested commodity	High	Moderate	Eggs are usually laid on ripening fruit, although they have been observed on fruit stalks (Jamieson et al., 2004), and larvae develop inside the fruit and leave via an exit hole when the fruit falls to the ground (Froud and Dentener, 2002). Additionally, in Northland, suitable hosts are available year-round (Froud and Dentener, 2002) and larvae can be detected year-round (Jamieson et al., 2004).
Likelihood of surviving post-harvest processing before shipment	High	Moderate	Larvae feed internally in host fruit (Jamieson et al., 2004), and as such, may remain undetected during harvest. Post-harvest processing is not considered in this assessment; therefore, the risk rating did not change.
Likelihood of surviving transport and storage conditions of the consignment	High	Moderate	Larvae feed internally in host fruit (Jamieson et al., 2004), and as such, may remain undetected. Additionally, the length of time that larvae are present inside fruit is unknown. Transport and storage conditions were not considered in this assessment, therefore, the risk rating did not change.
Overall Likelihood of Entry	High	n/a	n/a

The likelihood of establishment of *Coscinoptycha improbana* into the endangered area via *Pyrus communis*, *Pyrus pyrifolia*, or *Pyrus* x *bretschneideri* fruit imported from New Zealand.

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	Low	Low	Larvae develop inside the fruit and leave via an exit hole when the fruit falls to the ground (Froud and Dentener, 2002). Upon egress, the larvae pupate directly below the fruit, or travel <0.5 m in search of pupation sites (Jamieson et al., 2004). Therefore, it is unlikely that pupae would complete development, find a mate, extricate themselves from any packaging materials, and buildings, e.g., storage areas, grocery stores, etc., escape to the environment, and find suitable hosts.
Overall Likelihood of Establishment	Low	n/a	n/a

The likelihood of introduction (combined likelihoods of entry and establishment) of *Coscinoptycha improbana* into the endangered area via *Pyrus communis*, *Pyrus pyrifolia*, or *Pyrus* x *bretschneideri* fruit imported from New Zealand is Medium.

3.2.2. *Cnephasia jactatana* (Walker), *Ctenopseustis herana* (Feld. & Rogen.), *Ctenopseustis obliquana* (Walker), *Planotortrix excessana* (Walker), *Planotortrix octo* Dugdale, *Pyrgotis plagiatana* (Walker) (Lepidoptera: Tortricidae)

These species are known as leafrollers and have been grouped together because of the similarities of their life cycle, behavior, and occupation of the same niche, i.e., young larvae spin webbed shelters and feed beneath them on the lower leaf surface; older larvae may web leaves together, roll the edges of leaves over, or web leaves to fruit. The larvae of these species cause similar damage to foliage and fruits, with no way of differentiating between the damage caused by the different species. These insects are key pests of various fruit, and landscape plants, and collectively, they have been reported to attack the foliage, fruit, leaves, shoots, stems, and terminal buds of their host plants (Burnip and Suckling, 2001; Harris, 1994; Jiménez-Pérez et al., 2004; Popay, 2008; Penman, 1984; Walker, 2006; Wearing et al., 2012). The pest status of leafrollers arises because of the cosmetic damage they cause, and restrictions to trade, due to the requirements to meet phytosanitary standards for export fruit (Burnip and Suckling, 2001; Wearing et al. 1991).

The endangered area for *Cnephasia jactatana*, *Ctenopseustis herana*, *Ctenopseustis obliquana*, *Planotortrix excessana*, *Planotortrix octo*, and *Pyrgotis plagiatana* within the PRA area

Climatic suitability:
Cnephasia jactatana, *Ctenopseustis herana*, *Ctenopseustis obliquana*, *Planotortrix excessana*, *Planotortrix octo*, and *Pyrgotis plagiatana* occur in New Zealand (Jiménez-Pérez et al., 2002). Based on these climatic zones in New Zealand, it is estimated that these species could establish in U.S. Plant Hardiness Zones 8-11 (Takeuchi et al., 2018).

Hosts in PRA area: Cnephasia jactatana
Actinidiaceae: *Actinidia chinensis*; **Ebenaceae**: *Diospyros kaki*; **Juglandaceae**: *Juglans regia*; **Leguminosae**: *Trifolium repens*; **Myrtaceae**: *Eucalyptus* sp., *Leptospermum* spp.; **Oleaceae**: *Ligustrum* sp.; **Passifloraceae**: *Passiflora* sp.; **Pinaceae**: *Pinus radiata*; **Polygonaceae**: *Muehlenbeckia complexa*; **Pteridaceae**: *Adiantum hispidulum*; **Rutaceae**: *Citrus aurantium*, *C. sinensis*; **Salicaceae**: *Populus nigra*, *Salix fragilis*; **Sapindaceae**: *Acer pseudoplatanus*; *Camellia* sp.; **Ulmaceae**: *Ulmus glabra*; **Vitaceae**: *Vitus* sp. (Jiménez-Pérez et al., 2002; Plant-SyNZ, 2024; Spiller et al., 1982).

Hosts in PRA area: *Ctenopseustis herana* and *C. obliquana*
Ctenopseustis herana and *C. obliquana* have similar host ranges, therefore, we combined the hosts for both species.
Aceraceae: *Acer nigrum*; **Actinidiaceae**: *Actinidia chinensis*; **Amaranthaceae**: *Amaranthus retroflexus*; **Aquifoliaceae**: *Ilex aquifolium*; **Araliaceae**: *Hedera helix*; **Asteraceae**: *Chrysanthemum* sp., *Dahlia* sp.; **Berberidaceae**: *Berberis darwinii*; **Caprifoliaceae**: *Lonicera japónica*, *Sambucus nigra*; **Cornaceae**: *Aucuba japonica*; **Cupressaceae**: *Thuja plicata*; **Ericaceae**: *Rhododendron* sp.; **Fabaceae**: *Cytisus scoparius*, *Lupinus albus*, *L. arboreus*, **Fagaceae**: *Quercus ilex*; **Grossulariaceae**: *Ribes rubrum*, *R. sanguineum*, *R. uva-crispa*; **Hippocastanaceae**: *Aesculus hippocastanum*; **Hypericaceae**: *Hypericum androsaemum*, *H. perforatum*; **Juglandaceae**: *Juglans regia*; **Lauraceae**: *Persea americana*; **Malvaceae**: *Malva parviflora*; **Myrtaceae**: *Eucalyptus* spp., *Leptospermum* sp.; **Oleaceae**: *Forsythia suspensa*, *Syringa vulgaris*; **Onagraceae**: *Fuschia magellanica*; **Pinaceae**: *Pinus muricata*, *P. nigra*, *P. radiata*, *P. strobus*, *Sequoia sempervirens*; **Pittosporaceae**: *Pittosporum crassifolium*, *P. tenuifolium*; **Ranunculaceae**: *Clematis vitalba*; **Rosaceae:** *Cotoneaster lacteus*, *Eriobotrya japonica*, *Malus baccata*, *M. domestica*, *Photinia glabra*, *Prunus amygdalus*, *P. armeniaca*, *P. avium*, *P. cerasifera*, *P. cerasus*, *P. domestica*, *P. laurocerasus*, *P. persica*, *P. serrulata*, *Pyracantha angustifolia*, *Pyrus communis*, *Rosa* sp., *Rubus idaeus*; **Salicaceae**: *Populus alba*, *P. deltoides*, *P. nigra*, *Salix alba*, *S. babylonica*, *S. fragilis*; **Saxifragaceae**: *Escallonia* sp.; **Scrophulariaceae**: *Hebe speciosa*; **Solanaceae**: *Solanum aviculare*; **Taxodiaceae**: *Cryptomeria japonica*; **Theaceae**: *Camellia japonica*; **Vitaceae**: *Vitis vinifera* (Burnip et al., 1999; Plant-SyNZ, 2024).

Hosts in PRA area: *Ctenopseustis herana*
Asteraceae: *Arctotis stoechadifolia*, *Aster lanceolatus*, *Carduus nutans*, *Cirsium arvense*, *Sonchus oleraceus*; **Brassicaceae**: *Brassica oleracea*; **Caprifoliaceae**: *Weigela florida*; **Cucurbitaceae**: *Cucurbita maxima*; **Cupressaceae**: *Chamaecyparis lawsoniana Thuja* orientalis; **Ericaceae**: *Vaccinium corymbosum*; **Fabaceae**: *Cytisus multiflorus*, *Phaseolus vulgaris*, *Trifolium pratense*, *T. repens*, *Vicia faba*, *Wisteria sinensis*; **Garryaceae**: *Garrya elliptica*; **Hypericaceae***: Hypericum calycinum*; **Lamiaceae**: *Mentha spicata*, *Salvia* sp.; **Magnoliaceae**: *Magnolia stellata*; **Malvaceae**: *Hoheria populnea*; **Moraceae**: *Ficus carica*;

Pinaceae: *Pseudotsuga menziesii*; **Polygonaceae**: *Muehlenbeckia* sp., *Rumex* sp.; **Ranunculaceae**: *Aquilegia vulgaris;* **Rhamnaceae**: *Ceanothus papillosus*; **Rosaceae**: *Chaenomeles speciosa*, *Cydonia oblonga*, *Kerria japónica*, *Rubus occidentalis*; **Scrophulariaceae**: *Antirrhinum majus*, *Veronica* sp.; **Theaceae**: *Camellia sasanqua*; **Verbenaceae**: *Verbena* sp. (Burnip et al., 1999; Plant-SyNZ, 2024).

Hosts in PRA area: *Ctenopseustis obliquana*

Apociaceae: *Vinca major*; **Asteraceae**: *Aster* sp., *Hypochaeris radicata*; **Betulaceae:** *Betula pendula*; **Bignoniaceae:** *Podranea ricasoliana*; *Viburnum* sp.;**Celestraceae:** *Euonymus japonicus*; **Corynocarpaceae:** *Corynocarpus laevigatus*; **Ebenaceae:** *Diospyros khaki*; **Fabaceae**: *Lotus pedunculatus, Lupinus luteus*, *Ulex europaeus*; *Wisteria* sp.; **Fagaceae**: *Quercus suber*; **Geraniaceae:** *Geranium pratense*, *Pelargonium* sp.; **Lauraceae:** *Laurus nobilis*; **Mimosaceae:** *Acacia* spp.; **Oleaceae**: *Ligustrum vulgare*; **Philadelphaceae:** *Deutzia scabra*; **Plantaginaceae:** *Plantago lanceolata*; **Polygonaceae**: *Rumex obtusifolius*; **Rosaceae:** *Duchesnea indica*; **Rutaceae:** *Citrus* grandis, C. *limon*, *C. sinensis*; **Tiliaceae:** *Tilia cordata*; (Burnip et al., 1999; Plant-SyNZ, 2024).

Hosts in PRA area: *Planotortrix excessana* and *Plaonotortrix octo*

Planotortrix excessana and *P. octo* have similar host ranges, therefore, we combined the hosts for both species.

Apociaceae: *Vinca major*; **Aquifoliaceae**: *Ilex aquifolium*; **Araliaceae**: *Hedera helix*; **Asteraceae**: *Achillea millefolium*, *Arctotis stoechadifolia*, *Carduus nutans*, *Chrysanthemum* sp., *Cirsium arvense*, *Cirsium vulgare*, *Dahlia* sp., *Solidago canadensis*, *Sonchus oleraceus*; **Berberidaceae**: *Berberis darwinii*; **Betulaceae**: *Betula pendula*; **Brassicaceae**: *Brassica leracea*; **Caprifoliaceae**: *Weigela florida*; **Corynocarpaceae**: *Corynocarpus laevigatus*; **Cucurbitaceae**: *Cucurbita pepo*; **Cupressaceae**: *Chamaecyparis lawsoniana*, *Thuja plicata*; **Ericaceae**: *Erica lusitanica*, *Rhododendron* sp.; **Fabaceae**: *Cytisus scoparius*, *Lupinus arboreus*, *L. luteus*, *Phaseolus vulgaris*, *Trifolium pratense*, *T. repens*, *Vicia sativa*, *Wisteria sinensis*, *Quercus ilex*; **Geraniaceae**: *Geranium pratense*; **Grossulariaceae**: *Ribes rubrum*, *R. sanguineum*, *R. uva-crispa*; **Hypericaceae**: *Hypericum androsaemum*; **Malvaceae**: *Hoheria populnea*; **Mimosaceae**: *Acacia* spp.; **Myrtaceae**: *Eucalyptus* sp., *Leptospermum* sp.; **Oleaceae**: *Forsythia suspensa*, *Syringa vulgaris*; **Onagraceae**: *Fuchsia magellenica*; **Pinaceae**: *Pinus muricata*, *Pinus nigra*, *P. radiata*, *Pseudotsuga menziesii*; **Pittosporaceae**: *Pittosporum crassifolium*, *P. tenuifolium*; **Plantaginaceae**: *Plantago lanceolata*; **Polygonaceae**: *Muehlenbeckia* sp., *Rumex acetosa*, *R. obtusifolius*; **Ranunculaceae**: *Aquilegia vulgaris*, *Clematis vitalba*; **Rosaceae**: *Chaenomeles speciosa*, *Cotoneaster lacteus*, *Cydonia oblonga*, *Eriobotrya japonica*, *Kerria japonica*, *Malus baccata*, *M. domestica*, *Photinia glabra*, *Prunus amygdalus*, *P. armeniaca*, *P. avium*, *P. cerasifera*, *P. cerasus*, *P. domestica*, *P. laurocerasus*, *P. persica*, *P. serrulata*, *Pyracantha angustifolia*, *Pyrus communis*, *Rosa* sp., *Rubus fruticosus*, *R. idaeus*; **Rutaceae**: *Citrus grandis*, *C. limon*; **Salicaceae**: *Populus alba*, *P. deltoides*, *P. nigra*, *Salix alba*, *S. babylonica*, *S. fragilis*; **Saxifragaceae**: *Escallonia* sp.; **Scrophulariaceae**: *Hebe speciosa*, *Veronica arvensis*; **Solanaceae**: *Capsicum frutescens*, *Physalis peruviana, Lycopersicum esculentum*, *Solanum tuberosum*; **Theaceae**: *Camellia japonica*, *C. sasanqua*; **Tiliaceae**: *Tilia cordata*; **Verbenaceae**: *Verbena* sp.; **Vitaceae**: *Vitis vinifera* (Burnip et al., 1999; Plant-SyNZ, 2024).

Hosts in PRA area: *Planotortrix excessana*

Amaranthaceae: *Amaranthus retroflexus*; **Bignoniaceae**: *Podranea ricasoliana*; **Brassicaceae**: *Capsella bursa-pastoris*; **Caprifoliaceae**: *Viburnum* sp.; **Celestraceae**: *Euonymus japonicus*; **Cornaceae**: *Aucuba japonica*; **Cupressaceae**: *Cupressus* sp.; **Ebenaceae**: *Diospyros khaki*; **Ericaceae**: *Arbutus unedo*; **Fabaceae**: *Laburnum anagyroides*, *Trifolium subterraneum* **Fagaceae**: *Quercus suber*; **Geraniaceae**: *Erodium cicutarium*, *Pelargonium* sp.; **Hippocastanaceae**: *Aesculus hippocastanum*; **Hypericaceae**: *Hypericum perforatum*; **Juglandaceae**: *Juglans regia*; **Lauraceae**: *Laurus nobilis*, *Persea americana*; **Malvaceae**: *Malva parviflora*; **Moraceae**: *Ficus carica*; **Myoporaceae**: *Myoporum laetum*; **Paeoniaceae**: *Paeonia officinalis*; **Passifloraceae**: *Passiflora edulis*, *P. mollissima*; **Pinaceae**: *Cedrus deodara*, *Picea abies*, *Pinus nigra*; **Plantaginaceae**: *Plantago major*; **Plumbaginaceae**: *Plumbago capensis*; **Polygonaceae**: *Polygonum persicaria*, *Rumex crispus*, *R. pulcher*; **Ranunculaceae**: *Clematis paniculata vitalba*; **Rhamnaceae**: *Ceanothus papillosus*; **Rutaceae**: *Citrus sinensis*; **Solanaceae**: *Capsicum frutescens*, *Physalis peruviana* (Burnip et al., 1999; Plant-SyNZ, 2024).

Hosts in PRA area: *Plaonotortrix octo*

Amaranthaceae: *Daucus carota*, *Pastinaca sativa*; **Boraginaceae**: *Myosotis sylvatica*; **Brassicaceae**: *Brassica rapa*; **Cactaceae**: *Opuntia* sp., *Zygocactus* sp.; **Campanulaceae**: *Campanula médium*; **Chenopodiaceae**: *Beta vulgaris*; **Cornaceae**: *Aucuba japónica*; **Cucurbitaceae**: *Cucurbita máxima*; **Cupressaceae**: *Cupressus sempervirens*, *Thuja orientalis*; **Fabaceae**: *Cytisus multiflorus*, *Lupinus albus*, *Pisum sativum*, *Vicia faba*, **Garryaceae**: *Garrya elliptica*; **Hippocastanaceae**: *Aesculus hippocastanum*; **Hypericaceae**: *Hypericum calycinum*; **Iridaceae**: *Iris germánica*; **Juglandaceae**: *Juglans regia*; **Lamiaceae**: *Mentha spicata*; **Lauraceae**: *Laurus nobilis*, *Persea americana*; **Magnoliaceae**: *Magnolia stellata*; **Paeoniaceae**: *Paeonia officinalis*; **Philadelphaceae**: *Deutzia crenata*; **Ranunculaceae**: *Aquilegia vulgaris*; **Rhamnaceae**: *Ceanothus papillosus*; **Rosaceae**: *Rubus occidentalis*; **Scrophulariaceae**: *Antirrhinum majus*; **Solanaceae**: *Solanum nigrum*; **Urticaceae**: *Urtica urens* (Burnip et al., 1999; Plant-SyNZ, 2024).

Hosts in PRA area: Pyrgotis plagiatana

Caprifoliaceae: *Lonicera japonica*; **Leguminosae**: *Clianthus* sp., *Ulex europaeus*; **Pinaceae**: *Larix decidua*, *Pinus radiata, Pseudotsuga menziesii*; **Pittosporaceae**: *Pittosporum tenuifolium*; **Rutaceae**: *Citrus tangelo*; **Salicaceae**: *Salix alba* (Plant-SyNZ, 2024).

Economically important hosts - Cnephasia jactatana[6]*:*

Economically important hosts include: **Actinidiaceae**: *Actinidia chinensis* (kiwi); **Ebenaceae**: *Diospyros kaki* (Japanese persimmon); **Juglandaceae**: *Juglans regia* (English walnut); **Leguminosae**: *Trifolium repens* (white clover); **Myrtaceae**: *Eucalyptus* sp.; **Oleaceae**: *Ligustrum* sp. (privit); **Passifloraceae**: *Passiflora* sp. (passion flower); **Pinaceae**: *Pinus radiata* (Monterey pine); **Rutaceae**: *Citrus aurantium*, *C. x sinensis* (sweet orange); **Salicaceae**: *Populus* spp., *Salix* spp.; **Sapindaceae**: *Acer pseudoplatanus* (sycamore maple); *Camellia* sp.; **Ulmaceae**: *Ulmus glabra* (Scots elm); **Vitaceae**: *Vitus* sp. (grape) (Legner, 2024; USDA, NASS, 2024).

[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, 2021).

Economically important hosts - Ctenopseustis herana, and *C. obliquana*

Ctenopseustis herana, and *C. obliquana* have similar host ranges, therefore, we combined the economically important hosts for both species. These include: **Aceraceae**: *Acer nigrum* (black maple); **Actinidiaceae:** *Actinidia chinensis* (kiwi); **Apociaceae:** *Vinca major* (greater periwinkle); **Aquifoliaceae**: *Ilex aquifolium* (common holly); **Araliaceae**: *Hedera helix* (English ivy); **Asteraceae**: *Aster* sp., *Chrysanthemum* sp., *Dahlia* sp.; **Betulaceae:** *Betula pendula* (silver maple); **Caprifoliaceae:** *Lonicera japonica* (Japanese honeysuckle), *Sambucus nigra* (elder), *Viburnum* sp.; **Celestraceae:** *Euonymus japonicus*; **Cupressaceae**: *Thuja plicata* (western redcedar); **Ebenaceae:** *Diospyros khaki* (Asian persimmon); **Ericaceae**: *Rhododendron* sp.; **Fabaceae**: *Wisteria* sp.; **Fagaceae**: *Quercus ilex* (evergreen oak), *Q. suber* (cork oak); **Geraniaceae:** *Geranium pratense* (meadow geranium), *Pelargonium* sp.; **Grossulariaceae**: *Ribes rubrum* (redcurrant), *R. sanguineum* (red flowering currant), *R. uva-crispa* (European gooseberry); **Hippocastanaceae**: *Aesculus hippocastanum* (horse chestnut); **Juglandaceae**: *Juglans regia* (English walnut); **Lauraceae:** *Laurus nobilis* (bay laurel), *Persea americana* (avocado); **Mimosaceae:** *Acacia* spp.; **Myrtaceae:** *Eucalyptus* spp.; **Oleaceae**: *Forsythia suspensa* (weeping forsythia), *Ligustrum vulgare* (common privet); *Syringa vulgaris* (common lilac); **Onagraceae**: *Fuchsia magellenica* (hardy fuchsia); **Pinaceae**: *Pinus muricata* (Bishop pine), *P. nigra* (black pine), *P. radiata* (Monterey pine), *P. strobus* (eastern white pine), *Sequoia sempervirens* (Coast redwood); **Ranunculaceae**: *Clematis vitalba* (old man's beard); **Rosaceae:** *Cotoneaster lacteus*, *Eriobotrya japonica* (loquat), *Malus baccata* (crabapple), *M. domestica* (apple), *Prunus amygdalus* (almond), *P. armeniaca* (apricot), *P. avium* (sweet cherry), *P. cerasifera* (cherry plum), *P. cerasus* (sour cherry), *P. domestica* (plum), *P. laurocerasus* (cherry laurel), *P. persica* (peach), *P. serrulata* (Japanese flowering cherry), *Pyracantha angustifolia*, *Pyrus communis* (pear), *Rosa* sp., *Rubus idaeus* (red raspberry); **Rutaceae:** *Citrus grandis* (pomelo), *C.* x *limonia* (Rangpur lime), *C.* x *sinensis* (sweet orange); **Salicaceae**: *Populus alba* (white poplar), *P. deltoides* (eastern cottonwood), *P. nigra* (black poplar), *Salix alba* (white willow), *S. babylonica* (weeping willow), *S. fragilis* (crack willow); **Solanaceae**: *Solanum aviculare*; **Taxodiaceae**: *Cryptomeria japonica* (Japanese cedar); **Theaceae**: *Camellia japonica* (Japanese camellia); **Vitaceae**: *Vitis vinifera* (grape) (Legner, 2024, USDA, NASS, 2024).

Economically important hosts - Planotortrix excessana and *P. octo*

Planotortrix excessana and *P. octo* have similar host ranges, therefore, we combined the economically important hosts for both species. These include: **Apociaceae**: *Vinca major* (greater periwinkle); **Aquifoliaceae**: *Ilex aquifolium* (common holy); **Araliaceae**: *Hedera helix* (English ivy); **Asteraceae**: *Chrysanthemum* sp., *Dahlia* sp.; **Betulaceae**: *Betula pendula* (silver birch); **Brassicaceae**: *Brassica oleracea* (cabbage); **Caprifoliaceae**: *Weigela florida*; **Corynocarpaceae**: *Corynocarpus laevigatus* (karaka); **Cucurbitaceae**: *Cucurbita pepo* (pumpkin); **Cupressaceae**: *Chamaecyparis lawsoniana*, *Thuja plicata* (western redcedar); **Ericaceae**: *Erica lusitanica* (Spanish heath), *Rhododendron* sp.; **Fabaceae**: *Cytisus scoparius* (Scotch broom), *Lupinus arboreus* (yellow bush lupine), *L. luteus* (European yellow lupine), *Phaseolus vulgaris* (common bean), *Trifolium pratense* (red clover), *T. repens* (white clover), *Vicia sativa* (common vetch), *Wisteria sinensis* (Chinese wisteria); **Fagaceae**: *Quercus ilex*; **Geraniaceae**: *Geranium pratense* (meadow geranium); **Grossulariaceae**: *Ribes rubrum* (redcurrant), *R. sanguineum* (flowering currant), *R. uva-crispa* (European gooseberry); **Hypericaceae**: *Hypericum androsaemum* (tutsan); **Malvaceae**: *Hoheria populnea*; **Mimosaceae**:

Acacia spp.; **Myrtaceae**: *Eucalyptus* sp., *Leptospermum* sp.(tea tree); **Oleaceae**: *Forsythia suspensa*, *Syringa vulgaris* (common lilac); **Onagraceae**: *Fuchsia magellenica*; **Pinaceae**: *Pinus muricata* (Bishop pine), *Pinus nigra* (black pine), *P. radiata* (Monterey pine), *Pseudotsuga menziesii* (Douglas fir); **Pittosporaceae**: *Pittosporum crassifolium* (karo), *P. tenuifolium* (kohuhu); **Plantaginaceae**: *Plantago lanceolata*; **Polygonaceae**: *Muehlenbeckia* sp., *Rumex acetosa* (sorrel), *R. obtusifolius* (bitter dock); **Ranunculaceae**: *Aquilegia vulgaris* (common columbine), *Clematis vitalba* (old man's beard); **Rosaceae**: *Chaenomeles speciosa* (Chinese quince), *Cotoneaster lacteus*, *Cydonia oblonga* (quince), *Eriobotrya japonica* (loquat), *Kerria japonica* (Japanese kerria), *Malus baccata* (crabapple), *M. domestica* (apple), *Photinia glabra*, *Prunus amygdalus* (almond), *P. armeniaca* (apricot), *P. avium* (sweet cherry), *P. cerasifera* (purple leaf plum), *P. cerasus* (sour cherry), *P. domestica* (plum), *P. laurocerasus* (cherry laurel), *P. persica* (peach), *P. serrulata* (Japanese flowering cherry), *Pyracantha angustifolia*, *Pyrus communis* (pear), *Rosa* sp., *Rubus fruticosus* (blackberry), *R. idaeus* (red raspberry); **Rutaceae**: *Citrus grandis* (pomelo), *C.* x *limon* (lemon); **Salicaceae**: *Populus alba* (white poplar), *P. deltoides* (eastern cottonwood), *P. nigra* (black poplar), *Salix alba* (white willow), *S. babylonica* (weeping willow), *S. fragilis* (crack willow); **Saxifragaceae**: *Escallonia* sp.; **Scrophulariaceae**: *Veronica speciosa*, *Veronica arvensis* (corn speedwell); **Solanaceae**: *Capsicum frutescens* (chili pepper), *Physalis peruviana* (Cape gooseberry), *Lycopersicum esculentum* (tomato), *Solanum tuberosum* (potato); **Theaceae**: *Camellia japonica* (Japanese camellia), *C. sasanqua* (sasanqua camellia); **Tiliaceae**: *Tilia cordata*; **Verbenaceae**: *Verbena* sp.; **Vitaceae**: *Vitis vinifera* (grape) (Legner, 2024; Smith, 2017, USDA, NASS, 2024).

<u>*Economically important hosts – Pyrgotis plagiatana*</u>
Economically important hosts include: **Caprifoliaceae**: *Lonicera japonica* (Japanese honeysuckle); **Pinaceae**: *Larix decidua* (European larch), *Pinus radiata* (Monterey pine), *Pseudotsuga menziesii* (Douglas fir); **Pittosporaceae**: *Pittosporum tenuifolium* (kohuhu); **Rutaceae**: *Citrus* x *tangelo* (tangelo); **Salicaceae**: *Salix alba* (white willow) (Legner, 2024, USDA, NASS, 2024).

<u>*Potential consequences on economically important hosts at risk:*</u> These pest species are likely to cause unacceptable consequences because, collectively, they have been reported to attack the foliage, fruit, leaves, shoots, stems, and terminal buds of their host plants; cause cosmetic damage to fruit which precludes the fruit from meeting the phytosanitary standards for export fruit (Burnip and Suckling, 2001; Wearing et al. 1991).

***<u>Endangered area - Cnephasia jactatana, Ctenopseustis herana, Ctenopseustis obliquana, Planotortrix excessana, Planotortrix octo</u>*, and *<u>Pyrgotis plagiatana</u>*:**
The temperature regimes in New Zealand correspond to U.S. Plant Hardiness Zones 8-11 (Takeuchi et al., 2018).

The likelihood of entry of *Cnephasia jactatana*, *Ctenopseustis herana*, *Ctenopseustis obliquana*, *Planotortrix excessana*, *Planotortrix octo*, and *Pyrgotis plagiatana* into the endangered area via apple and pear fruit imported from New Zealand.

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Pest prevalence on the harvested commodity	High	Low	These species are leafrollers, and the proposed export fruit will have peduncles with 2-3 attached leaves. Leafroller larvae are present in rolled leaves attached to the harvested peduncles and leafroller eggs are laid on leaves or fruit in oval batches of 2-150 (Penman, 1984). Therefore, both larvae and eggs may be associated with the harvested commodity.
Likelihood of surviving post-harvest processing before shipment	Medium	Low	These species are leafrollers, and the rolled leaves attached to the harvested peduncles and fruit would be conspicuous. Additionally, leafroller eggs are laid on leaves or fruit in oval batches of 2-150 (Penman, 1984). The rolled leaves, and egg clusters would be conspicuous during processing procedures. Therefore, we lowered the risk rating one level.
Likelihood of surviving transport and storage conditions of the consignment	Low	Low	Leaves with harvested fruit are a perishing commodity. Should any eggs or larvae be present on leaves with the export fruit they would be unable to complete development and would most likely die due to the diminishing nutritional value of the leaves during storage, shipping, processing, and handling at endpoints, e.g., storage facilities, grocery stores, etc. Therefore, we lowered the risk rating one level.
Overall Likelihood of Entry	Low	n/a	n/a

The likelihood of establishment of *Cnephasia jactatana*, *Ctenopseustis herana*, *Ctenopseustis obliquana*, *Planotortrix excessana*, *Planotortrix octo*, and *Pyrgotis plagiatana* into the endangered area via apple and pear fruit imported from New Zealand.

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	Low	Low	These leafrollers are polyphagous, feeding on approximately 297 plant species in 96 plant families (Burnip et al., 1999; Plant-SyNZ, 2024), many of which occur in Plant Hardiness Zones 8-11 in the United States. Eggs are laid in clusters of 2-150 on the upper surface of host leaves and produce two to six overlapping generations per year depending on latitude and climate (Penman, 1984). Therefore, should any of the leafroller species escape detection upon arrival in U.S. ports-of-entry located in suitable climates, there would be an abundance of host material available for establishing a population depending on season. Additionally, some chemical control programs in the United States may be ineffective, as several leafroller species e.g., *Planotortrix octo* have developed resistance to organophosphate and carbamate insecticides (Lo et al., 1997). However, because the life stage that would likely be associated with the imported commodity would be eggs and larvae, which would have to complete development, find a mate, and establish a population all while avoiding predation. So, while there is a suitable environment throughout much of the PRA area, we rated the likelihood of establishment to be Low given the challenges facing the life stages likely to be associated with the imported commodity.
Overall Likelihood of Establishment	Low	n/a	n/a

The likelihood of introduction (combined likelihoods of entry and establishment) of *Cnephasia jactatana*, *Ctenopseustis herana*, *Ctenopseustis obliquana*, *Planotortrix excessana*, *Planotortrix octo*, and *Pyrgotis plagiatana* into the endangered area via the commodity imported from the New Zealand is Low.

3.2.3. *Bryobia graminum* (Schrank) (Trombidiformes: Tetranychidae)

Bryobia graminum has been recorded on over 30 different host plants (Migeon and

Dorkeld, 2024), herbaceous and fruit plants, including *Prunus dulcis*, *Pyrus communis*, and *Citrus aurantium* (Bolland et al., 1998; Migeon and Dorkeld, 2024). This mite overwinters primarily in the egg stage, although all stages may be found throughout the winter on the lower parts of trunks of apple and pear trees, especially among lichens, or on walls or fences near these trees (Jeppson et al., 1975).

The endangered area for *Bryobia graminum* within the United States

Climatic suitability:
Bryobia graminum occurs in: **Africa**: Egypt, Morocco; **Asia**: Armenia, Azerbaijan, China, Georgia, Israel, Japan, Kazakhstan, Kyrgyzstan, Palestinian Territories, Russian Federation, Tajikistan, Turkmenistan, Uzbekistan; **Europe**: Azerbaijan, Belarus, Belgium, Bulgaria, Estonia, France, Georgia, Germany, Greece, Hungary, Iceland, Italy, Moldova Netherlands, Serbia, Switzerland, Ukraine, United Kingdom, Russian Federation, **Oceania**: Australia, New Zealand, Tasmania; **South America**: Chile (Migeon and Dorkeld, 2024, Ochoa, n.d.).

Hosts in PRA area:
Amaranthaceae: *Amaranthus* sp.; **Amaryllidaceae**: *Allium cepa*; **Apiaceae**: *Daucus carota*; **Araliaceae**: *Hedera colchica*, *Hedera helix*; **Asteraceae**: *Achillea millefolium*, *Artemisia vulgaris*, *Chrysanthemum* sp., *Cichorium intybus*; **Cucurbitaceae**: *Cucumis sativus*; **Fabaceae**: *Medicago sativa*, *Pisum sativum*, *Trifolium alexandrinum*, *T. repens*, *Vicia* sp.; **Lamiaceae**: *Lamium purpureum*, *Mentha longifolia*, *Salvia nemorosa*; **Malvaceae**: *Althaea officinalis*, *Malva sylvestris*; **Pinaceae**: *Pinus strobus*, *Pseudotsuga menziesii*; **Poaceae**: *Alopecurus pratensis*, *Avena sp*., *Bromus sp*., *Cynodon dactylon*, *Elymus repens*, *Holcus* sp., *Hordeum* sp., *Lolium perenne*, *Lolium temulentum*, *Poa* sp., *Triticum* sp.; **Ranunculaceae**: *Ranunculus aconitifolius*, *R.repens*; **Rosaceae**: *Malus domestica*, *Prunus amygdalus*, *Pyrus communis*; **Rutaceae**: *Citrus* x *aurantium* (Migeon and Dorkeld, 2024).

Economically important hosts
Amaranthaceae: *Amaranthus* sp.; **Amaryllidaceae**: *Allium cepa* (onion); **Apiaceae**: *Daucus carota* (wild carrot); **Asteraceae**: *Achillea millefolium* (yarrow), *Artemisia vulgaris* (mugwort), *Chrysanthemum* sp., *Cichorium intybus* (chicory); **Cucurbitaceae**: *Cucumis sativus* (cucumber); **Fabaceae**: *Medicago sativa* (alfalfa), *Pisum sativum* (pea), *Trifolium repens* (white clover), *Vicia* sp.; **Lamiaceae**: *Lamium purpureum* (red dead-nettle), *Mentha longifolia* (horse mint); **Pinaceae**: *Pinus strobus* (white pine), *Pseudotsuga menziesii* (Douglas fir); **Poaceae**: *Avena* sp. (oats), *Hordeum* sp.; **Rosaceae**: *Malus domestica* (apple), *Prunus amygdalus* (almond), *Pyrus communis* (pear); **Rutaceae**: *Citrus* x *aurantium* (bitter orange) ((Legner, 2024; USDA, NASS, 2024; USDA, NRCS, 2024).

Potential consequences on economically important hosts at risk:
This pest does not appear to be much of an economic threat. In Hungary, *B. graminum* overwinters in cracks of the bark of trees and moves to grasses in the spring (Ripka, 1998). In Germany, the spring generations feed on grasses, but generations developing in mid-July to mid-September ascend the trees and feed on the leaves, and occasionally become a pest of apple and pear trees during late summer (Jeppson et al., 1975). In the United Kingdom, *B. graminum*

overwinter as eggs, but all stages may be found throughout the winter on the lower parts of apple tree trunks (Jeppson et al., 1975).

Endangered area:
The current distribution of this mite suggests that it could become established in the United States in Plant Hardiness Zones 2-11 (Takeuchi et al., 2018)

The likelihood of entry of *Bryobia graminum* into the endangered area via *Malus domestica*, *Pyrus communis*, *Pyrus pyrifolia*, or *Pyrus* x *bretschneideri* imported from New Zealand

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Pest prevalence on the harvested commodity	High	Medium	Adult *Bryobia* are about 0.75 mm in length (Anon., 2024). Therefore, small populations of these mites will be inconspicuous. Jeppson et al. (1975) report that spring generations feed on grasses, but generations developing in mid-July to mid-September ascend the trees and feed on the leaves, and occasionally become a pest of apple and pear trees during late summer. It also seems likely that the feeding damage caused by these surviving mites would go unnoticed on leaves, or fruit.
Likelihood of surviving post-harvest processing before shipment	High	Low	Additionally, the New Zealand government has requested that apple exports consist of apple fruit with peduncles, and 2-3 leaves. Production, harvesting, and post-harvesting procedures were not specified as part of the request. Therefore, they were not considered, and the risk rating was not changed.
Likelihood of surviving transport and storage conditions of the consignment	High	Low	Transport and storage conditions were not considered in this assessment. Therefore, the risk rating was not changed.
Overall Likelihood of Entry	High	n/a	n/a

The likelihood of establishment of *Bryobia graminum* into the endangered area via *Malus domestica*, *Pyrus communis*, *Pyrus pyrifolia*, or *Pyrus* x *bretschneideri* imported from New Zealand

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	High	Low	*Bryobia graminum* lives on grasses during most of the year. Summer generations ascend apple and pear trees and feed on leaves (Jeppson et al. 1975). This mite reproduces asexually, and, in conjunction with this, infection by the endosymbiotic bacterium, *Wolbachia*, may induce thelytokous parthenogenesis (Weeks and Breeuwer, 2001). Because this species can survive in a wide range of plant hardiness zones and feed on a wide variety of hosts, it is possible that they could establish and survive over a large portion of the United States, and that a single female mite could start a population should it be introduced into the environment.
Overall Likelihood of Establishment	High	n/a	n/a

The likelihood of introduction (combined likelihoods of entry and establishment) of *Bryobia graminum* into the endangered area via *Malus domestica*, *Pyrus communis*, *Pyrus pyrifolia*, or *Pyrus* x *bretschneideri* imported from New Zealand is High.

3.2.4. *Tetranychus lambi* Pritchard & Baker (Trombidiformes: Tetranychidae)
Tetranychus lambi was described from apple, and strawberry in New Zealand (Pritchard and Baker, 1955) and has a host list of over 60 plants.

The endangered area for *Tetranychus lambi* within the United States

Climatic suitability:
Asia: Iran, Taiwan; **Oceania**: American Samoa, Australia, Cook Islands, Fiji, French Polynesia, New Caledonia, New Zealand, Papua New Guinea, Tasmania, Tonga, Vanuatu, Wallis & Futuna, Western Samoa (Baker, 1975; Bolland et al., 1998; Khalil-Manesh, 1973).

Hosts in PRA area:
Araceae: *Alocasia macrorhiza*, *Colocasia esculenta*, *Xanthosoma sagittifolium*; **Arecaceae**: *Cocos nucifera*; **Asteraceae**: *Senecio cruentus*; **Caricaceae**: *Carica papaya*; **Combretaceae**: *Terminalia catappa*; **Curcurbitaceae**: *Cucurbita maxima*, *C. pepo*; **Euphorbiaceae**: *Manihot esculenta*; **Fabaceae**: *Arachis hypogaea*, *Centrosema plumieri*, *Desmodium intortum*, *D. uncinatum*, *Glycine max*, *Kennedia rubicunda*, *Lotus corniculatus*, *Macroptilium atropurpureum*, *Neonotonia wightii*, *Phaseolus vulgaris*, *Teramnus uncinatus*, *T. volubilis*, *Trifolium pratense, T. repens*, *Vigna angularis*, *V. catiang*; **Fagaceae**: *Quercus alba*; **Goodeniaceae**: *Goodenia ovata*; **Liliaceae**: *Cordyline terminalis*; **Malvaceae**: *Abelmoschus manihot*, *Gossypium hirsutum*; **Moraceae**: *Morus alba*; **Musaceae**: *Musa sapientum*;

Oxalidaceae: *Oxalis latifolia*; **Poaceae**: *Chloris gayana*, *Panicum maximum*, *Sorghum bicolor*, *Zea mays*; **Polygonaceae**: *Homalocladium platycladum*; **Rosaceae**: *Fragaria vesca*, *Malus domestica*, *Prunus persica*; **Rutaceae**: *Poncirus trifoliata*; **Solanaceae**: *Nicotiana tabacum*, *Solanum melongena*, *S. nigrum*, *S. torvum*; **Vitaceae**: *Vitis* sp. (Beard, 2018; Bolland et al., 1998).

Economically important hosts:
Some of the economic hosts are: **Arecaceae**: *Cocos nucifera* (coconut); **Caricaceae**: *Carica papaya* (papaya); **Curcurbitaceae**: *Cucurbita maxima* (squash), *C. pepo* (pumpkin); **Fabaceae**: *Arachis hypogaea* (peanut), *Glycine max*, *Phaseolus vulgaris* (soybean), *Teramnus uncinatus*, *T. volubilis*, *Trifolium pratense* (red clover), *T. repens* (white clover); **Fagaceae**: *Quercus alba* (white oak); **Malvaceae**: *Gossypium hirsutum* (cotton); **Poaceae**: *Sorghum bicolor* (sorghum), *Zea mays* (maize); **Rosaceae**: *Malus domestica* (apple), *Prunus persica* (peach); **Rutaceae**: *Poncirus trifoliata* (trifoliate orange); **Solanaceae**: *Nicotiana tabacum* (tobacco), *Solanum melongena* (eggplant), *S. nigrum* (black nightshade); **Vitaceae**: *Vitis* sp. (grape) (Beard, 2018; Bolland et al., 1998; USDA, NASS, 2024).

Potential consequences on economically important hosts at risk:
Little information is available on the economic importance of this species. It has been recorded from apple in New Zealand (Pritchard and Baker, 1955) and is one of three spider mites that are significant pests of cotton in Australia, causing bronzing and desiccation of the leaves (OGTR, 2016). Crop loss can result from reduced plant vigor due to leaf necrosis, and in severe infestations, defoliation, and premature opening of the buds (Bodnaruk, 1982). In banana, attack is concentrated on leaves, although, in severe outbreaks, mites may move to the fruit (Gold et al., 2002). Feeding produces areas of discoloration on the fruit surface that may later dry out and crack. However, *T. lambi* is regarded only as a minor pest of banana (Morton, 1987).

Endangered area:
Tetranychus lambi is found in parts of Asia, and parts of Oceania. From this distribution, it is estimated that this species could become established in United States in Plant Hardiness Zones 5-11.

The likelihood of entry of *Tetranychus lambi* into the United States via *Malus domestica* fruit imported from New Zealand

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Pest prevalence on the harvested commodity	High	Low	*Tetranychus lambi* is mainly found on leaves (Morton, 1987; OGTR, 2016), however, in heavy infestations, it can infest fruit of its host plants (Gold et al., 2002). Thus, mites may be present on both the harvested leaves and fruit.
Likelihood of surviving post-harvest processing before shipment	High	Low	Post-harvest processing is not considered in this assessment. Therefore, the risk rating was not changed.
Likelihood of surviving transport and storage conditions of the consignment	High	Low	Transport and storage conditions were not considered in this assessment. Therefore, the risk rating was not changed.
Overall Likelihood of Entry	High	n/a	n/a

The likelihood of establishment of *Tetranychus lambi* into the endangered area via *Malus domestica* fruit imported from New Zealand

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	High	Low	*Tetranychus lambi* is found on the leaves of its host plants (Jeppson et al., 1975), and disperses by walking (Wilson, n.d.). There is a lack of fine webbing during infestations by this mite (Pinese and Elder, 2004), thus dispersal by ballooning is uncertain. Females can reproduce sexually and asexually (Bonato and Gutierrez, 1999), which means that a single female has the potential to start a population. Concomitantly, the geographic distribution of *T. lambi* indicates that this species has the potential to establish in the United States in Plant Hardiness Zones 5-11, and there are numerous economic and non-economic host plant species present in these areas. The combination of these factors increases the likelihood that a single female could start a population should it get into the environment.
Overall Likelihood of Establishment	High	n/a	n/a

The likelihood of introduction (combined likelihoods of entry and establishment) of *Tetranychus lambi* into the United States via *Malus domestica* fruit imported from New Zealand 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]	Commodity
Arthropod	*Coscinoptycha improbana* Meyrick	Medium	*Pyrus*
Arthropod	*Cnephasia jactatana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	*Ctenopseustis herana* (Feld. & Rogen.)	Low	*Malus*, *Pyrus*
Arthropod	*Ctenopseustis obliquana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	*Planotortrix excessana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	*Planotortrix octo* Dugdale	Low	*Malus*, *Pyrus*
Arthropod	*Pyrgotis plagiatana* (Walker)	Low	*Malus*, *Pyrus*
Arthropod	*Bryobia graminum* (Schrank)	High	*Malus, Pyrus*
Arthropod	*Tetranychus lambi* Pritchard & Baker	High	*Malus*

[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.

5. Literature Cited

7 CFR § 319.56. 2024. U.S. Code of Federal Regulations, Title 7, Part 319.56 (7 CFR § 319.56 Subpart L). eCFR :: 7 CFR Part 319 Subpart L -- Fruits and Vegetables.

Abuelnaga, H. 2024. New Zealand apple, fuji fragrant pear sand pear modification of market access. Personal communication to G. Cave (Entomologist/Senior Risk Analyst, PPRA), January 3, 2024, from H. Abuelnaga (Senior Regulatory Policy Specialist, Asia, Australia, New Zealand and Oceania, Regulatory Coordination and Compliance, Imports, Regulations, and Manuals, Pest Exclusion and Import Programs, USDA APHIS PPQ).

Ali, S., P. Abbasi, S. Rehman, and W. Ellouze. 2021. First report of moldy core of Minneiska apples from New Zealand caused by *Alternaria arborescens*. Plant Disease 105(9):2719.

Alspach, P. A., and V. G. M. Bus. 1999. Spatial variation of woolly apple aphid (*Eriosoma lanigerum*, Hausmann) in a genetically diverse apple planting. New Zealand Journal of Ecology:39-44.

Amrine, J. W., and T. A. Stasny. 1994. Catalog of the Eriophyoidea (Acarina: Prostigmata) of the World. Indira Publishing House, West Bloomfield.

Andrew, M., T. L. Peever, and B. M. Pryor. 2009. An expanded multilocus phylogeny does not resolve morphological species within the small-spored *Alternaria* species complex. Mycologia 101(1):95-109.

Annecke, D. P., and V. C. Moran. 1982. Insects and Mites of Cultivated Plants in South Africa. Butterworth & Co, Durban.

Anon. 2024. Agriculture Victoria. https://agriculture.vic.gov.au/biosecurity/pest-insects-and-mites/priority-pest-insects-and-mites/bryobia-mite#:~:text=Bryobia%20mites%20are%20smaller%20than,hairs%2C%20appearing%20like%20white%20flecks.

ARM. 2024. Agricultural Risk Management (ARM) System. United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine. https://arm.aphis.edc.usda.gov/.

Baird, R. E., R. D. Gitaitis, and G. A. Herzog. 1997. First report of cotton lint rot by *Pantoea agglomerans* in Georgia. Plant Disease 81(5):551-551.

Baker, E. W., T. Kono, J. W. Amreve, Jr., Delfinado-Baker M., and T. A. Stasny. 1996. Eriophyoid Mites of the United States. Indira Publishing House, West Bloomfield.

Baker, E. W. 1975. Spider mites (Tetranychidae: Acarina) from Southeast Asia and Japan. Cooperative Economic Insect Report 25:911-921.

Baker, E. W., and Y. Suigong. 1988. A catalog of the false spider mites (Tenuipalpidae: Acari) of the United States. International Journal of Acarology 14(3):143-153.

Barker, G. M. 1999. Naturalised terrestrial Stylommatophora (Mollusca: Gastropoda), Canterbury. Fauna of New Zealand, Volume 38. Landcare Reserarch, Lincoln.

Barker, G. M., and C. Watts. 2002. Management of the invasive alien snail *Cantareus aspersus* on conservation land. Doc Science Internal Series 31:1-30. New Zealand Department of Conservation**,** Wellington.

Basavaraju, B., B. Doddabasappa, P. Shashank, and R. Channakeshava. 2010. Seasonal incidence of mite, *Polyphagotarsonemus latus* Banks (Tarsonemidae: Acarina) on potato in southern zone of Karnataka. Current Biotica 4(1):385-390.

Beard, J. J. 2018. Spider mites of Australia (including key exotic southeast Asian pest species). https://keys.lucidcentral.org/keys/v3/spider_mites_australia/index.html.

Bellgard, S. E., C. J. Winks, D. J. Than, and C. C. Aliaga. 2010. Natural enemies of the South American pampas grasses *Cortaderia* spp. in New Zealand, pp. 239-242 *in* Seventeenth Australasian Weeds Conference, New Frontiers in New Zealand: Together we can beat the weeds. September 26-30, Christchurch, New Zealand.

Ben-Dov, Y. 2011-2012. The scale insects (Hemiptera: Coccoidea) of Israel—checklist, host plants, zoogeographical considerations and annotations on species. Israel Journal of Entomology 41-42:21-48.

Bielenin, A., S. N. Jeffers, W. F. Wilcox, and A. L. Jones. 1988. Separation by protein electrophoresis of six species of *Phytophthora* associated with deciduous fruit crops. Phytopathology 78(11):1402-1408.

Blackman, R. L., and V. F. Eastop. Aphids on the World's Trees: An Identification and Information Guide. CAB International, Wallingford.

Bennington, J., and M. Poole. 2023. Spider mite pests of Western Australian plants. https://www.agric.wa.gov.au/plant-biosecurity/spider-mite-pests-western-australian-plants.

Bodnaruk, K. 1982. Life cycle of spider mite. The Australian Cottongrower 3:29.

Bolland, H. R., J. Gutierrez, and C. H. Flechtmann. 1998. World Catalogue of the Spider Mite Family (Acari: Tetranychidae). E. J. Brill, Leiden.

Bonato, O., and J. Gutierrez. 1999. Effect of mating status on the fecundity and longevity of four spider mite species (Acari: Tetranychidae). Experimental & Applied Acarology 23:623-632.

Børve, J., and A. Stensvand. 2015. *Colletotrichum acutatum* on apple in Norway. IOBC-WPRS Bulletin 110:151-157.

Bragança, C. A., U. Damm, R. Baroncelli, N. S. M. Júnior, and P. W. Crous. 2016. Species of the *Colletotrichum acutatum* complex associated with anthracnose diseases of fruit in Brazil. Fungal Biology 120(4):547-561.

Brockerhoff, E. G., M. Knížek, and J. Bain. 2003. Checklist of indigenous and adventive bark and ambrosia beetles (Curculionidae: Scolytinae and Platypodinae) of New Zealand and interceptions of exotic species (1952-2000). New Zealand Entomologist 26:29-44.

Brown, J. W., M. E. Epstein, T. M. Gilligan, S. C. Passoa, and J. A. Powell. 2010. Biology, identification, and history of the light brown apple moth, *Epiphyas postvittana* (Walker) (Lepidoptera: Tortricidae: Archipini) in California: an example of the importance of local faunal surveys to document the establishment of exotic insects. American Entomologist 56(1):34-43.

Brown, M. W., and J. J. Schmitt. 1990. Growth reduction in nonbearing apple trees by woolly apple aphids (Homoptera: Aphididae) on roots. Journal of Economic Entomology 83(4):1526-1530.

Burnip, G., J. Charles, P. Shaw, M. Suckling, W. Thomas, A. Tomkins, J. Walker, and H. Wearing. 1999. Insects and Mites of Pipfruit. The Horticulture and Food Research Institute of New Zealand, Auckland, New Zealand. http://www.hortnet.co.nz/key/pipfruit.htm.

Burnip, G., and D. Suckling. 2001. Leafroller larval and adult phenology at two Canterbury, New Zealand, organic apple orchards. New Zealand Journal of Crop and Horticultural Science 29(1):15-22.

CABI. 2024. Crop Protection Compendium. CAB International. http://www.cabi.org/cpc/.

Cameron, P. J., G. P. Walker, and T. J. B. Herman. 1995. Development of resistance to fenvalerate in *Helicoverpa armigera* (Lepidoptera: Noctuidae) in New Zealand. New Zealand Journal of Crop and Horticultural Science 23(4):429-436.
Carter, D. J. 1984. Pest Lepidoptera of Europe, With Special Reference to the British Isles. Dr. W. Junk Publishers, Dordrecht.
Charles, J. G. 1998. The settlement of fruit crop arthropod pests and their natural enemies in New Zealand: an historical guide to the future. Biocontrol News and Information 19:47N-58N.
Chen, J. 2012. Fungal community survey of *Fraxinus excelior* in New Zealand, Swedish University of Agricultural Sciences, Uppsala.
Collyer, E. 1973. Records of *Brevipalpus* species (Acari: Tenuipalpidae) from New Zealand and the Pacific area. New Zealand Entomologist 5:303-304.
Cooper, J. A. 2005. New Zealand hyphomycete fungi: additional records, new species, and notes on interesting collections. New Zealand Journal of Botany 43(1):323-349.
Cox, J. M. 1987. Pseudococcidae (Insecta: Hemiptera). Fauna of New Zealand, Volume 11. Science Information Publishing Centre, Wellington.
Damm, U., P. F. Cannon, J. H. C. Woudenberg, and P. W. Crous. 2012. The *Colletotrichum acutatum* species complex. Studies in Mycology 73:37-113.
Delgado-Cerrone, L., P. Mondino-Hintz, and S. Alaniz-Ferro. 2016. Botryosphariaceae species associated with stem canker, die-back and fruit rot on apple in Uruguay. European Journal of Plant Pathology 146:637-655.
Denizhan, E., 2018. Eriophyoid mites (Acari: Eriophyoidea) on fruit trees in Yalova, Turkey. Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi 28(3):285-288.
Dugdale, J. S. 1988. Lepidoptera-annotated catalogue, and keys to family-group taxa. Fauna of New Zealand 14.
Dymock, J. J., and P. W. Holder. 1996. Nationwide survey of arthropods and molluscs on cut flowers in New Zealand. New Zealand Journal of Crop and Horticultural Science 24(3): 249-257.
Easterbrook, M. A. 1979. The life-history of the eriophyid mite *Aculus schlechtendali* on apple in south-east England. Annals of Applied Biology 91:287-296.
Farr, D. F., and A. Y. Rossman. 2024. Fungal Databases. United States Department of Agriculture, Agricultural Research Service, U.S. National Fungus Collections. https://fungi.ars.usda.gov/.
Frérot, B. and S. P. Foster. 1991. Sex pheromone evidence for two distinct taxa within *Graphania mutans* (Walker). Journal of Chemical Ecology 17:2077-2093.
Froud, K. J., and P. R. Dentener. 2002. Guava moth in New Zealand - A review of current knowledge, and future directions. HortResearch Internal Report No. 202/350. 16 pp.
Fu, M., P. W. Crous, Q. Bai, P. Zhang, J. Xiang, Y. Guo, F. Zhao, M. Yang, N. Hong, and W. Xu. 2019. *Colletotrichum* species associated with anthracnose of *Pyrus* spp. in China. Persoonia-Molecular Phylogeny and Evolution of Fungi 42(1):1-35.
Gagné, R. J. 1989. The plant-feeding gall midges of North America. Cornell University Press, Ithaca.
García-Morales, M., Denno, B. D., Miller, D. R., Miller, G. L., Ben-Dov, Y., and N. B. Hardy. 2016. ScaleNet: A literature-based model of scale insect biology and systematics. http://scalenet.info.

Gardner, P. C. 1983. Virus and virus-like diseases of roses in New Zealand, Massey University.
GBIF (Global Biodiversity Information Facility). 2024. https://www.gbif.org.
Gold, C. S., B. Pinese, and J. E. Peña. 2002. Pests of banana, pp. 13-56. *in* Peña, J. E., J. L. Sharp, and M. Wysoki (eds.). Tropical Fruit Pests and Pollinators: Biology, Economic Importance, Natural Enemies and Control. CABI Publishing, Wallingford.
Guerber, J. C., B. Liu, J. C. Correll, and P. R. Johnston. 2003. Characterization of diversity in *Colletotrichum acutatum* sensu lato by sequence analysis of two gene introns, mtDNA and intron RFLPs, and mating compatibility. Mycologia 95(5):872-895.
Gupta, M., J. S. Tara, S. Sharma, and A. Bala. 2015. Biology and morphometry of *Spodoptera litura* Fabricus, a Serious defoliator of mango (*Mangifera indica*) in Jammu Region (J&K). Munis Entomology & Zoology 10(1):215-221.
Harris, A. C. 1994. *Ancistrocerus gazella* (Hymenoptera: Vespoidea: Eumenidae): a potentially useful biological control agent for leafrollers *Planotortrix octo*, *P. excessana*, *Ctenopseustis obliquana*, *C. herana*, and *Epiphyas postvittana* (Lepidoptera: Tortricidae) in New Zealand. New Zealand Journal of Crop and Horticultural Science 22(3).
Hely, P. C., G. Pasfield, and J. G. Gellatley. 1982. Insect Pests of Fruit and Vegetables in NSW. Inkata Press, Melbourne.
Henderson, R. C. 2000. The status of *Parlatoria* species (Hemiptera: Coccoidea: Diaspididae) in New Zealand. New Zealand Entomologist 23(1):51-53.
Hill, D. S. 1983. Agricultural Insect Pests of the Tropics and their Control, 2nd edition. Cambridge University Press, London.
Hitchcox, M. 2007. *Candidula intersecta*: Detection of populations of the exotic snail *Candidula intersecta* in Oregon. Oregon State University.
IPPC. 2021. International Standards for Phytosanitary Measures, Publication No. 11: Pest Risk Analysis for Quarantine Pests. Food and Agriculture Organization of the United Nations, Secretariat of the International Plant Protection Convention, Rome, Italy.
IPPC. 2024. International Standards for Phytosanitary Measures, Publication No. 5: Glossary of Phytosanitary Terms. Food and Agriculture Organization of the United Nations, Secretariat of the International Plant Protection Convention, Rome, Italy.
Jamieson, L. E., J. J. Dymock, T. Dawson, K. J. Froud, D. S. Seldon, D. M. Suckling, and A. R. Gibb. 2004. Guava moth in New Zealand-distribution, hosts, life cycle observation and discussion of pest management options. New Zealand Plant Protection 57:13-19.
Jayawardena, R. S., K. D. Hyde, U. Damm, L. Cai, M. Liu, X. H. Li, W. Zhang, W. S. Zhao, and J. Y. Yan. 2016. Notes on currently accepted species of *Colletotrichum*. Mycosphere 7(8):1192-1260.
Jeffers, S., and H. Aldwinckle. 1988. Phytophthora crown rot of apple trees: sources of *Phytophthora cactorum* and *P. cambivora* as primary inoculum. Phytopathology 78(3):328-335.
Jeppson, L. R., H. H. Keifer, and E. W. Baker. 1975. Mites Injurious to Economic Plants. University of California Press, Berkeley.
Jiménez-Pérez, A., Q. Wang, and N. P. Markwick. 2002. Adult activity patterns of Cnephasia jactatana Walker (Lepidoptera Tortricidae). New Zealand Plant Protection 55:374-379.
Jiménez-Pérez, A., Q. Wang, and N. Markwick. 2004. Intrinsic rate of increase in *'Cnephasia' jactatana* Walker (Lepidoptera: Tortricidae), a pest of kiwifruit. New Zealand Entomologist 27(1):109-112.

Kaakeh, W., D. G. Pfeiffer, and R. P. Marini. 1993. Effect of *Aphis spiraecola* and *A. pomi* (Homoptera: Aphididae) on the growth of young apple trees. Crop Protection 12(2):141-147.
Khalil-Manesh, B. 1973. Phytophagus [sic] mite fauna of Iran. Entomologie et Phytopathologie Appliques 35:29-38.
Kirk, W. 1987. A key to the larvae of some common Australian flower thrips (Insecta, Thysanoptera), with a host-plant survey. Australian Journal of Zoology 35(2):173-185.
Kosztarab, M. 1996. Scale Insects of Northeastern North America: Identification, Biology, and Distribution. Virginia Museum of Natural History, Martinsville.
Legner, E. F. 2024. PLANTS OF ECONOMIC &/OR AESTHETIC IMPORTANCE. http://www.faculty.ucr.edu/~legneref/botany/economic.htm.
Lolas, M., J. M. Contreras, R. Méndez, M. Cáceres, and G. A. Díaz. 2016. First report of phytophthora fruit rot in apple caused by *Phytophthora syringae* during cold storage in Maule Region, Chile. Plant Disease 100(7):1507-1507.
Manaaki Whenua, Landcare Research. 2024. Biota of New Zealand. https://biotaNZ.landcareresearch.co.nz.
Manson, D. C. M. 1983. List of new mite/host plant records from New Zealand. New Zealand Entomologist 7(4):401-403.
Lo, P. L., J. T. S. Walker, and D. M. Suckling. 1997. Resistance of *Planotortrix octo* (greenheaded leafroller) to azinphos-methyl in Hawke's Bay, pp 409-413 *in* Proceedings of the 50th New Zealand Plant Protection Conference, Lincoln, New Zealand.
Manson, D. C. M., 1983. List of new mite/host plant records from New Zealand. New Zealand Entomologist 7(4):401-403.
Manson, D. C. M. 1984a. Fauna of New Zealand. Number 4. Eriophyoidea except Eriophyinae (Arachnida: Acari). DSIR, Wellington.
Manson, D. C. M. 1984b. Eriophyinae (Arachnida: Acari: Eriophyoidea). Science Information Publishing Centre, DSIR, Wellington, New Zealand.
Marić, I., I. Međo, and D. Marčić. 2022. The dark-red spider mite, *Tetranychus ludeni* Zacher (Acari: Tetranychidae)–a new pest in Serbian acarofauna. Pesticides and Phytomedicine/Pesticidi i Fitomedicina 37(3):85-93.
Mazzola, M., P. K. Andrews, J. P. Reganold, and C. A. Levesque. 2002. Frequency, virulence, and metalaxyl sensitivity of *Pythium* spp. isolated from apple roots under conventional and organic production systems. Plant Disease 86(6):669-675.
McKenzie, H. L. 1961. Second taxonomic study of California mealybugs, with descriptions of new species (Homoptera: Coccoidea: Pseudococcidae). Hilgardia 31(2):15-52.
Metcalf, R. L., and R. A. Metcalf. 1993. Destructive and Useful Insects: Their Habits and Control. McGraw-Hill, New York.
Migeon, A., and F. Dorkeld. 2024. Spider Mites Web: a comprehensive database for the Tetranychidae. https://www1.montpellier.inrae.fr/CBGP/spmweb.
Miller, D. 1926. The bronze-beetle. Its habits and control as an orchard pest. New Zealand Journal of Agriculture 32(1):9-14.
Miller, D. R., V. L. Blackburn, J. A. Davidson, and W. F. Gimpel, Jr. 1985. Pest risk assessment of armored scales on certain fruit. Report submitted to USDA, Animal and Plant Health Inspection Service, Plant Protection and Quarantine]. United States Department of Agriculture, Agricultural Research Service, Beltsville, MD.

Momen, F. M. and M. Lamlom. 2021. Life history traits and demographic parameters of T*yphlodromus transvaalensis* reared on three eriophyid species (Acari: Phytoseiidae: Eriophyidae). International Journal of Acarology 47(4):346-351.
Morton, J. F. 1987. Banana: *Musa* x *paridasiaca*, pp. 29-46. *in* Fruits of Warm Climates. Julia F. Morton, Miami.
Mound, L. A., and A. K. Walker. 1982. Terebrantia (Insecta: Thysanoptera). Fauna of New Zealand 1. Science Information Division Department of Scientific and Industrial Research, Wellington.
Nakahara, S. 1994. The genus *Thrips* Linnaeus (Thysanoptera: Thripidae) of the New World (Technical Bulletin Number 1822). United States Department of Agriculture, Agricultural Research Service, Beltsville, Maryland.
Nabi, S. U., and V. K. Baranwal. 2020. First report of *Apple hammerhead viroid* infecting apple cultivars in India. Plant Disease 104(11):3086.
NIS (National Identification Service). 2008. Change in action status for armored scales (Hemiptera: Diaspididae) on material for consumption (NIS action policy, March 25, 2008). United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, National Identification Services.
Nouri, M. T., D. P. Lawrence, L. A. Holland, D. A. Doll, C. E. Kallsen, C. M. Culumber, and F. P. Trouillas. 2019. Identification and pathogenicity of fungal species associated with canker diseases of pistachio in California. Plant Disease 103(9):2397-2411.
NRCS (The United States Department of Agriculture, Natural Resources Conservation Service). 2024. The PLANTS Database. https://plants.usda.gov/home.
NZMAF (New Zealand Ministry of Agriculture and Forestry). 2023a. Pest list for New Zealand *Malus domestica* (apple).
NZMAF (New Zealand Ministry of Agriculture and Forestry). 2023b. Pest list for New Zealand *Pyrus communis, Pyrus pyrifolia* & *Pyrus* x *bretschneideri* (pear).
NZOR (New Zealand Organisms Register). data.nzor.org.nz.
Ochoa, R. (Preparer) (n.d.). *Bryobia graminum* (Schrank). Acarological Society of America.
OGTR (Office of the Gene Technology Regulator). 2016. The Biology of *Gossypium hirsutum* L. and *Gossypium barbadense* (cotton). Australian Department of Health, Office of the Gene Technology Regulator. 102 pp.
Paraschivu, M., O. Cotuna, M. Paraschivu, A. Ciobanu, and C. V. Oltenacu. 2021. Infection of *Erwinia amylovora* on different apple varieties and the impact on fruits quality. Scientific Papers. Series B. Horticulture 65(1):211-219.
Pasini, L., D. Prodorutti, S. Pastorelli, and I. Pertot. 2016. Genetic diversity and biocontrol of *Rosellinia necatrix* infecting apple in northern Italy. Plant Disease 100(2):444-452.
Penman, D. R. 1984. Deciduous Tree Fruit Pests, Chapter 2 *in* Scott, R. R., New Zealand Pest and Beneficial Insects. Lincoln University College of Agriculture, Canterbury.
Pennycook, S. R. 1989a. Plant Diseases Recorded in New Zealand, Volume 1. Department of Scientific and Industrial Research, Plant Diseases Division, Auckland.
Pennycook, S. R. 1989b. Plant Diseases Recorded in New Zealand, Volume 2 Department of Scientific and Industrial Research, Plant Diseases Division, Auckland.

PERAL (Plant Epidemiology and Risk Analysis Laboratory). 2007. Phytosanitary risks associated with armored scales in commercial shipments of fruit for consumption to the United States, Revision Original. United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Center for Plant Health Science and Technology, Plant Epidemiology and Risk Analysis Laboratory (PERAL), Raleigh, NC. 24 pp.

Petrini, L. E. 2003. *Rosellinia* and related genera in New Zealand. New Zealand Journal of Botany 41(1):71-138.

Plant-SyNZ. 2024. Plant-SyNZ. https://plant-synz.landcareresearch.co.nz/index.asp.

Plaut, H. N. 1971. Lepidopterous larvae and pupae and their parasites, collected on Pomaceous Fruit trees in Israel. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 44:265-272.

Poole, R. W. and P. Gentili. 1996. Nomina Insecta Nearctica: A Check List of the Insects of North America: Volume 3: Diptera, Lepidoptera, Siphonaptera. Entomological Information Services, Rockville.

Popay, A. 2008. 'Insect pests of crops, pasture and forestry - Apple and kiwifruit pests', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/insect-pests-of-crops-pasture-and-forestry/page-6.

Pringle, K. L., B. N. Barnes, and T. L. Blomefield. 2015. African Bollworm (Apple), text extracted from: Prinsloo, G. L., and V. M. Uys. (eds), Insects of Cultivated Plants and Natural Pastures in Southern Africa. Entomological Society of Southern Africa.

Pritchard, A. E., and E. W. Baker. 1955. A revision of the Spider Mite Family Tetranychidae, Volume 2. Pacific Coast Entomological Society, Memoirs Series, San Francisco.

Richards, A. M. 1960. Scale insect survey on apples 1959–60. New Zealand Journal of Agricultural Research 3(4):693-698.

Ripka, G. 1998. New data to the knowledge on the tetranychid and tenuipalpid fauna in Hungary (Acari: Prostigmata). Acta Phytopathologica et Entomologica Hungarica 33:425-434.

Robertson, G. I. 1973. Occurrence of *Pythium* spp. in New Zealand soils, sands, pumices, and peat, and on roots of container-grown plants. New Zealand Journal of Agricultural Research 16(3):357-365.

Sakovich, N. J. 2002. Integrated management of *Cantareus aspersus* (Müller) (Helicidae) as a pest of citrus in California, pp. 353-360 *in* Barker, G. M. (ed.). Molluscs as Crop Pests. CABI Publishing, Wallingford.

Scott, P., and N. Williams. 2014. Phytophthora diseases in New Zealand forests. NZ Journal of Forestry 59(2):14-21.

Scott, R. R. (ed.). 1984. New Zealand Pest and Beneficial Insects. Lincoln University College of Agriculture, Canterbury.

Serra, P., A. Messmer, D. Sanderson, D. James, and R. Flores. 2018. *Apple hammerhead viroid*-like RNA is a bona fide viroid: autonomous replication and structural features support its inclusion as a new member in the genus *Pelamoviroid*. Virus research 249:8-15.

Sewell, G. W. F. 1981. Effects of *Pythium* species on the growth of apple and their possible causal role in apple replant disease. Annals of Applied Biology 97(1):31-42.

Shen, Y., C. Chao, and H. Liu. 2010. First report of *Neofusicoccum parvum* associated with stem canker and dieback of Asian pear trees in Taiwan. Plant Disease 94(8):1062-1062.

Smith, D. R. 2003. A synopsis of the sawflies (Hymenoptera: Symphyta) of America south of the United States: Tenthredinidae (Nematinae, Heterarthrinae, Tenthredininae). Transactions of the American Entomological Society 129:1-45.
Smith, J. P., Jr. 2017. Economically Important Plants Arranged Systematically. Botanical Studies 48:1-33.
Spiller, D. M., K. A. J. Wise, P. S. Dale, and P. A. Maddison. 1982. A Catalogue (1860-1960) of New Zealand Insects and their Host Plants. Ministry of Agriculture and Fisheries, Auckland. DSIR Bulletin 231. Ministry of Agriculture and Fisheries, Auckland.
Spotts, R. A., and G. G. Grove. 2002. First report of *Phytophthora syringae* causing rot on apples in cold storage in the United States. Plant Disease 86(6):693.
Stevens, N. E. 1933. Two apple black rot fungi in the United States. Mycologia 25(6):536-548.
Suckling, D. M., and E. G. Brockerhoff. 2010. Invasion biology, ecology, and management of the light brown apple moth (Tortricidae). Annual Review of Entomology 55:285-306.
Suckling, D. M., J. F. Brunner, G. M. Burnip, and J. T. S. Walker. 1994. Dispersal of *Epiphyas postvittana* (Walker) and *Planotortrix octo* Dugdale (Lepidoptera: Tortricidae) at a Canterbury, New Zealand orchard. New Zealand Journal of Crop and Horticultural Science 22(3):225-234.
Sutton, T. B., H. S. Alswinckle, A. M. Agnello, and J. F. Walgenbach (eds.). 2014. Compendium of Apple and Pear Diseases and Pests (2nd ed.). APS Press, St. Paul.
Takemoto, S., H. Nakamura, A. Sasaki, and T. Shimane. 2009. *Rosellinia compacta*, a new species similar to the white root rot fungus *Rosellinia necatrix*. Mycologia 101(1):84-94.
Takeuchi, Y., G. Fowler, and A. Joseph. 2018. SAFARIS: Global Plant Hardiness Zone Development. North Carolina State University, Center for Integrated Pest Management; United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Science and Technology, Plant Epidemiology and Risk Analysis Laboratory. https://safaris.cipm.info/safarispestmodel/StartupServlet?phz.
Teulon, D. A. J., and D. R. Penman. 1990. Host records for the New Zealand flower thrips (*Thrips obscuratus* (Crawford) Thysanoptera: Thripidae). New Zealand Entomologist 13:46-51.
Thakur, J. R., P. L. Sharma, and A. K. Bhardwaj. 1974. Occurrence of *Spodoptera litura* (Fabricius) and *Euproctis fraterna* Moore on apple. Indian Journal of Entomology 36(3):226.
Timlin, J. S. 1964. The distribution and relative importance of some armoured scale insects on pip fruit in the Nelson/Marlborough orchards during 1959/60. New Zealand Journal of Agricultural Research 7(4):531-535.
USDA, NASS (United States Department of Agriculture, National Agricultural Statistic Service). https://www.nass.usda.gov/.
USDA, NRCS. 2024. (United States Department of Agriculture, Natural Resources Conservation Service. https://plants.usda.gov/.
Verma, S. C., and C. D. Thapa. 2003. Present status of major insect-pests and diseases of apple in Chamba district and technological interventions by Krishi Vigyan Kendra, Chamba. Acta Horticulturae 696:415-418.
Völksch, B., S. Thon, I. D. Jacobsen, and M. Gube. 2009. Polyphasic study of plant- and clinic-associated *Pantoea agglomerans* strains reveals indistinguishable virulence potential. Infection, Genetics and Evolution 9(6):1381-1391.

Von Dohlen, C. D., and D. A. J. Teulon. 2003. Phylogeny and historical biogeography of New Zealand indigenous Aphidini aphids (Hemiptera, Aphididae): an hypothesis. Annals of the Entomological Society of America 96(2):107-116.
Walker, K. 2006. *Cnephasia jactatana*. https://www.padil.gov.au/pests-and-diseases/pest/136267.
Wang, F., S. Saito, T. J. Michailides, and C.-L. Xiao. 2021. Postharvest use of natamycin to control Alternaria rot on blueberry fruit caused by *Alternaria alternata* and *A. arborescens*. Postharvest Biology and Technology 172:111383.
Waterhouse, G. M., and J. M. Waterson. 1964. C.M.I. Descriptions of Pathogenic Fungi and Bacteria: *Phytophthora syringae* (No. 32). CAB International.
Watson, A. J. 1971. Foreign Bacterial and Fungus Diseases of Food, Forage, and Fiber Crops: An Annotated List (Agriculture Handbook No. 418). United States Department of Agriculture, Agricultural Research Service, Washington, DC.
Wearing, C. H., K. Colhoun, B. Attfield, and R. R. Marshall. 2010. Phenology and management of noctuids attacking apple in Central Otago, New Zealand. New Zealand Entomologist 33:55-67.
Wearing, C. H., W. P. Thomas, J. S. Dugdale, and W. Danthanarayana. 1991. Tortricid pests of pome and stone fruits, Australian and New Zealand species, pp. 453-472 *in* van der Geest, L. P. S., and H. H. Evenhuis, (eds.). World Crop Pests. Elsevier, Amsterdam.
Wearing, C. H., R. R. Marshall, B. A. Attfield, and K. Colhoun. 2012. Ecology and management of the leafroller (Tortricidae) complex over ten years during establishment of an organic pipfruit orchard in Central Otago, New Zealand. Crop Protection 33:82-93.
White-McLean, J. A. 2011. Terrestrial Mollusk Tool. USDA APHIS PPQ S&T Identification Technology Program and the University of Florida. https://idtools.org/mollusk/.
Wood, G. A. 1996. Past and present status of virus and phytoplasma diseases in apple rootstocks in New Zealand. New Zealand Journal of Crop and Horticultural Science 24:133-141.
Wood, G. A. 1997. Viruses and phytoplasma in European pear trees in New Zealand and the role of these pathogens in the compatibility of pear with quince rootstocks. New Zealand Journal of Crop and Horticultural Science 25:333-340.
Wood, S. L, and D. E. Bright. 1992. A Catalog of Scolytidae and Platypodidae (Coleoptera), Part 2: Taxonomic Index. Great Basin Naturalist Memoirs 13:1-1553.
WPFUS. 2024. Widely Prevalent Fungi of the United States. https://www.prevalentfungi.org/.
WPPNUS. 2024. Widely Prevalent Plant-Parasitic Nematodes of the United States. https://www.prevalentnematodes.org/.
WPVUS. 2024. Widely Prevalent Viruses of the United States. https://www.prevalentviruses.org/index.html.
Yeh, Z.-Y., Z.-C. Chen, and J. W. Kimbrough. 2000. *Ganoderma australe* from Florida. Mycotaxon 75:233-240.
Zalucki, M. P., G. Daglish, S. Firempong, and P. Twine. 1986. The biology and ecology of *Heliothis armigera* (Hubner) and *Heliothis punctigera* Wallengren (Lepidoptera, Noctuidae) in Australia: what do we know? Australian Journal of Zoology 34(6):779-814.
Zapata, M., and A. Opazo. 2017. Detección de *Colletotrichum pyricola* asociado a árboles urbanos de *Embothrium coccineum* en Chile. Bosque (Valdivia) 38(1):195-201.

Zenelt, W., K. Krawczyk, and N. Borodynko-Filas. 2021. Biodiversity and scope of endophytic and phytopathogenic bacterial species identified in plant samples investigated in the Plant Disease Clinic laboratory. Journal of Plant Protection Research 61(1):63-82.

Zhang, L., R. French, and W. G. Langenberg. 1993. Molecular cloning and sequencing of the coat protein gene of a Nebraskan isolate of *Tobacco necrosis virus*: the deduced coat protein sequence has only moderate homology with those of strain A and strain D. Archives of Virology 132(3-4):291-305.

6. Appendix: Pests with non-quarantine status

We found evidence that the organisms listed below are associated with apple and pear fruit and are present in New Zealand; however, none are of quarantine significance for the United States (ARM, 2024, 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 New Zealand, presence in United States (if applicable), and association with apple and pear fruit. 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, 2024).

Table A.1. Organisms associated with *Malus domestica*

Organism	**In New Zealand**	**In U.S.**	**Host Association - *Malus***	**Notes**
INSECT: Coleoptera: Curculionidae *Naupactus cervinus* Boheman; syn. *Pantomorus cervinus* (Boheman)	NZMAF, 2023a	CABI, 2024	NZMAF, 2023a	na
INSECT: Diptera: Cecidomyiidae *Dasineura mali* Keiffer	NZMAF, 2023a	Gagne, 1989	NZMAF, 2023a	na
INSECT: Hemiptera: Aphididae *Aphis spiraecola* Patch	Von Dohlen and Teulon, 2003	Kaakeh et al., 1993	Von Dohlen and Teulon, 2003	na
INSECT: Hemiptera: Aphididae *Eriosoma lanigerum* (Hausmann)	NZMAF, 2023a	Brown and Schmitt, 1990	Alspach and Bus, 1999	na
INSECT: Hemiptera: Aphididae *Macrosiphum rosae* L.	CABI, 2024	CABI, 2024	CABI, 2024	na
INSECT: Hemiptera: Aphididae *Myzus persicae* Sulzer	CABI, 2024	CABI, 2024	CABI, 2024	na
INSECT: Hemiptera: Aphididae *Rhopalosiphum insertum* (Walker)	CABI, 2024	CABI, 2024	CABI, 2024	na
INSECT: Hemiptera: Cicadellidae *Edwardsiana crataegi* (Douglas); syn. *Typhlocyba froggatti* Baker	Scott, 1984	CABI, 2024	Scott, 1984	na
INSECT: Hemiptera: Coccidae *Parthenolecanium corni* (Bouché)	García Morales et al., 2016	Garcia-Morales et al., 2016	Garcia-Morales et al., 2016	na
INSECT: Hemiptera: Diaspididae *Aonidiella aurantii* (Maskell)	García Morales et al., 2016	García Morales et al., 2016	Ben-Dov, 2011-2012	na
INSECT: Hemiptera: Diaspididae *Aspidiotus nerii* Bouché	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na
INSECT: Hemiptera: Diaspididae *Diaspidiotus ostreaeformis* (Curtis)	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na
INSECT: Hemiptera: Diaspididae *Comstockaspis perniciosa* (Comstock)	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na
INSECT: Hemiptera: Diaspididae *Hemiberlesia lataniae* (Signoret)	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na

Organism	In New Zealand	In U.S.	Host Association - *Malus*	Notes
INSECT: Hemiptera: Diaspididae *Hemiberlesia rapax* (Comstock)	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na
INSECT: Hemiptera: Diaspididae *Lepidosaphes ulmi* (L.)	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na
INSECT: Hemiptera: Diaspididae *Lindingaspis rossi* (Maskell)	Timlin, 1964	García Morales et al., 2016	Timlin, 1964	na
INSECT: Hemiptera: Diaspididae *Parlatoria desolator* McKenzie	Henderson, 2000	García Morales et al., 2016	Richards, 1960	na
INSECT: Hemiptera: Diaspididae *Parlatoria pittospori* Maskell	Timlin, 1964	Garcia-Morales et al., 2016	Timlin, 1964	na
INSECT: Hemiptera: Margarodidae *Icerya purchasi* Maskell	Garcia-Morales et al., 2016	Kosztarab, 1996	Garcia-Morales et al., 2016	na
INSECT: Hemiptera: Pseudococcidae *Phenacoccus graminicola* Leonardi	Cox, 1987	McKenzie, 1961	Cox, 1987	na
INSECT: Hemiptera: Pseudococcidae *Pseudococcus calceolariae* Maskell	NZMAF, 2023a	CABI, 2024	NZMAF, 2023a	na
INSECT: Hemiptera: Pseudococcidae *Pseudococcus longispinus* (Targioni-Tozzetti)	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na
INSECT: Hemiptera: Pseudococcidae *Pseudococcus viburni* (Signoret)	NZMAF, 2023a	García Morales et al., 2016	NZMAF, 2023a	na
INSECT: Lepidoptera: Noctuidae *Agrotis ipsilon* (Hufnagel)	Wearing et al., 2010	CABI, 2024	Wearing et al., 2010	na
INSECT: Lepidoptera: Noctuidae *Spodoptera frugiperda* J. E. Smith	NZMAF, 2023a	CABI, 2024	NZMAF, 2023a	na
INSECT: Tortricidae *Cydia pomonella* L.	NZMAF, 2023a	CABI, 2024	NZMAF, 2023a	na
INSECT: Lepidoptera: Tortricidae *Epiphyas postvittana* (Walker)	NZMAF, 2023a	Brown et al., 2010	Scott, 1984	na
INSECT: Tortricidae *Grapholita molesta* Busck	NZMAF, 2023a	Metcalf and Metcalf, 1993	NZMAF, 2023a	na
INSECT: Thysanoptera: Thripidae *Frankliniella occidentalis* (Pergande)	NZMAF, 2023a	CABI, 2024	NZMAF, 2023	na
INSECT: Thysanoptera: Thripidae *Heliothrips haemorrhoidalis* (Bouché)	NZMAF, 2023a	CABI, 2024	NZMAF, 2023a	na
INSECT: Thysanoptera: Thripidae *Thrips australis* (Bagnall)	Mound and Walker, 1982	Nakahara, 1994	Mound and Walker, 1982	na
MITE: Trombidiformes: Diptilomiopidae *Diptacus gigantorhynchus* (Nalepa)	Manson, 1984a	Baker et al., 1996	Manson, 1984b	na

Organism	In New Zealand	In U.S.	Host Association - *Malus*	Notes
MITE: Trombidiformes: Eriophyidae *Aculus fockeui* (Nalepa & Trouessart)	CABI, 2024	Baker et al., 1996	Momen and Lamlom, 2021	na
MITE: Trombidiformes: Eriophyidae *Aculus schlechtendali* (Nalepa)	Manson, 1984a	Baker et al., 1996	Easterbrook, 1979	na
MITE: Trombidiformes: Eriophyidae *Calepitrimerus baileyi* Keifer	Manson, 1984a	Baker et al., 1996	Manson, 1984a	na
MITE: Trombidiformes: Eriophyidae *Eriophyes mali* Nalepa	Manson, 1984b	Amrine and Stasny, 1994	Amrine and Stasny, 1994	na
MITE: Trombidiformes: Tenuipalpidae *Brevipalpus obovatus* Donnadieu	Manson, 1983	Baker and Suigong, 1988	Collyer, 1973	na
MITE: Trombidiformes: Tetranychidae *Bryobia praetiosa* Koch	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Bryobia rubrioculus* (Scheuten)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Eotetranychus sexmaculatus* Riley	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Panonychus citri* (McGregor)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Panonychus ulmi* (Koch)	NZMAF, 2023a	Bolland et al., 1998	NZMAF, 2023a	na
MITE: Trombidiformes: Tetranychidae *Tetranychus ludeni* Zacher	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Tetranychus turkestani* (Ugarov and Nikolski)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998; CABI, 2024	na
MITE: Trombidiformes: Tetranychidae *Tetranychus urticae* Koch	NZMAF, 2023a	Bolland et al., 1998	NZMAF, 2023a	na
BACTERIA: *Agrobacterium rhizogenes* (Riker et al.) Conn; syn. *Rhizobium rhizogenes* (Riker el al.) Young et al.	Manaaki Whenua, Landcare Research, 2024	Manaaki Whenua, Landcare Research, 2024	Verma and Thapa, 2003	na
BACTERIA: *Erwinia amylovora* (Burrill) Winslow et al.	Sutton et al., 2014	CABI, 2024	Paraschivu et al., 2021	na
BACTERIA: *Pantoea agglomerans* (Ewing & Fife) Gavini et al.	Völksch et al., 2009	Baird et al., 1997	Zenelt et al., 2021	na

Organism	In New Zealand	In U.S.	Host Association - *Malus*	Notes
BACTERIA: *Pseudomonas syringae* pv. *papulans* (Rose) Dhanvantari	Manaaki Whenua, Landcare Research, 2024	Manaaki Whenua, Landcare Research, 2024	Manaaki Whenua, Landcare Research, 2024	na
BACTERIA: *Pseudomonas syringae* pv. *syringae* van Hall; syn. *P. syringae* van Hall, *P. syringae* subsp. *syringae* van Hall	Sutton et al., 2014	CABI, 2024	CABI, 2024	na
CHROMISTAN: *Phytophthora cactorum* (Lebert & Cohn) J. Schröt.	Pennycook, 1989a	Jeffers and Aldwinckle, 1988	Abuelnaga, 2024	na
CHROMISTAN: *Phytophthora cambivora* (Petri) Buisman	Scott and Williams, 2014	Jeffers and Aldwinckle, 1988	Jeffers and Aldwinckle, 1988	na
CHROMISTAN: *Phytophthora cryptogea* Pethybr. & Laff.	Manaaki Whenua, Landcare Research, 2024	Bielenin et al., 1988	Bielenin et al., 1988	na
CHROMISTAN: *Phytophthora megasperma* var. *megasperma* Drechsler; syn. *Phytophthora megasperma*	Pennycook, 1989a	Farr and Rossman, 2024	Pennycook, 1989a	na
CHROMISTAN: *Phytophthora syringae* (Kleb.) Kleb.	Waterhouse and Waterson, 1964	Spotts and Grove, 2002	Lolas et al., 2016	na
CHROMISTAN: *Pythium acanthicum* Drechsler	Robertson, 1973	Farr and Rossman, 2024	Sewell, 1981	na
CHROMISTAN: *Pythium arrhenomanes* Drechsler	Pennycook, 1989a	CABI, 2024	Pennycook, 1989a	na
CHROMISTAN: *Pythium debaryanum* auct. non Hesse	Robertson, 1973	Mazzola et al., 2002	Pennycook, 1989a	na
CHROMISTAN: *Pythium echinulatum* V.D. Matthews; syn. *Globisporangium echinulatum* (V.D. Matthews) Uzuhashi, Tojo & Kakish	Pennycook, 1989a	Mazzola et al., 2002	Farr and Rossman, 2024	na
CHROMISTAN: *Pythium irregulare* Buisman	Robertson, 1973	Mazzola et al., 2002	Sewell, 1981	na
CHROMISTAN: *Pythium paroecandrum* Drechsler; syn. *Globisporangium paroecandrum* (Drechsler) Uzuhashi, Tojo & Kakish	Pennycook, 1989a	Farr and Rossman, 2024	Pennycook, 1989a	na

Organism	In New Zealand	In U.S.	Host Association - *Malus*	Notes
CHROMISTAN: *Pythium rostratum* E.J. Butler; syn. *Globisporangium rostratum* (E.J. Butler) Uzuhashi, Tojo & Kakish	Pennycook, 1989a	Farr and Rossman, 2024	Pennycook, 1989a	na
CHROMISTAN: *Pythium ultimum* Trow	Robertson, 1973	Mazzola et al., 2002	Sewell, 1981	na
CHROMISTAN: *Pythium vexans* de Bary; syn. *Phytopythium vexans* (de Bary) Abad, de Cock, Bala, Robideau, Lodhi & Lévesque	Pennycook, 1989a	Farr and Rossman, 2024	Pennycook, 1989a	na
FUNGI: *Abortiporus biennis* (Bull.) Singer syn. *Heteroporus biennis* (Bull.: Fr.) Lázaro Ibiza	Sutton et al., 2014	Watson, 1971	Watson, 1971	na
FUNGI: *Alternaria alternata* (Fr.) Keissl.; syn. *Alternaria tenuis* Nees	Watson, 1971	CABI, 2024	Watson, 1971	na
FUNGI: *Alternaria arborescens* E.G. Simmons	Ali et al., 2021	Wang et al., 2021	Ali et al., 2021	na
FUNGI: *Alternaria infectoria* E. G. Simmons; syn. *Lewia infectoria* (Fuckel) M. E. Barr & E. G. Simmons	Bellgard et al., 2010	Farr and Rossman, 2024	Andrew et al., 2009	na
FUNGI: *Armillaria limonea* (G. Stevenson) Boesewinkel	Farr and Rossman, 2024	CABI, 2024	Farr and Rossman, 2024	na
FUNGI: *Armillaria novae-zelandiae* (G. Stevenson) Herink	Farr and Rossman, 2024	CABI, 2024	Farr and Rossman, 2024	na
FUNGI: *Athelia rolfsii* (Curzi) C.C. Tu & Kimbr.	Farr and Rossman, 2024	CABI, 2024	Farr and Rossman, 2024	na
FUNGI: *Botryosphaeria dothidea* (Moug.: Fr.) Ces. & Denot.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Botryosphaeria obtusa* (Schwein.) Shoemaker syn. *Diplodia seriata* De Not.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Botrytis cinerea* Pers.:Fr.	Sutton et al., 2014	WPFUS, 2024	Sutton et al., 2014	na
FUNGI: *Calonectria kyotensis* Terashita; syn. *Cylindrocladium floridanum* Sobers & Seym.	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Chondrostereum purpureum* (Pcrs.:Fr.) Pouzar	Watson, 1971	Watson, 1971	Watson, 1971	na

Organism	In New Zealand	In U.S.	Host Association - *Malus*	Notes
FUNGI: *Clonostachys rosea* (Link) Schroers, Samuels, Seifert & W. Gams; syn. *Bionectria ochroleuca* (Schwein.) Schroers & Samuels, *Clonostachys rosea* f. *rosea* (Link: Fr.) Schroers et. al. (Farr and Rossman, 2024), *Nectria ochroleuca* (Schwein.) Berk.	Chen, 2012	CABI, 2024	Farr and Rossman, 2024	na
FUNGI: *Colletotrichum acutatum* Simmonds ex Simmonds	Guerber et al., 2003	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Colletotrichum alienum* B.S. Weir & P.R. Johnston	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Colletotrichum gloeosporioides* (Penz) Penz & Sacc.; syn. *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Cylindrocarpon candidum* (Link) Wollenw.; syn. *Neonectria coccinea* (Pers.:Fr.) Rossman & Samuels	Cooper, 2005	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Diaporthe actinidiae* N.F. Sommer & Beraha	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Diaporthe eres* Nitschke. syn.: *D. mali* Miura; *Phomopsis cotoneastri* Punith, *Phoma oblonga* Desm., *Phomopsis fukushii* Tanaka & S. Endô	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Diaporthe foeniculina* (Sacc.) Udayanga & Castl.	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Didymella glomerata* (Corda) Qian Chen & L. Cai; syn. *Phoma glomerata* (Corda) Wollenw. & Hochapfel	Abuelnaga, 2024	Nouri et al., 2019	Abuelnaga, 2024	na
FUNGI: *Diplodia mutila* (Fr. : Fr.) Mont	Farr and Rossman, 2024	Stevens, 1933	Farr and Rossman, 2024	na
FUNGI: *Elsinoe piri* (Woron.) Jenkins; syn. *Elsinoe pyri* (Woron.) Jenkins	Sutton et al., 2014	Farr and Rossman, 2024	Sutton et al., 2014	na
FUNGI: *Eutypa lata* (Pers.) Tul. & C. Tul.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Gloeodes pomigena* (Schwein.) Colby	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na

Organism	In New Zealand	In U.S.	Host Association - *Malus*	Notes
FUNGI: *Fusarium equiseti* (Corda) Sacc.	Abuelnaga, 2024	Farr and Rossman, 2024	Abuelnaga, 2024	na
FUNGI: *Fusarium lateritium* Nees: Fr. syn. *Gibberella baccata* (Wallr.) Sacc.	Manaaki Whenua, Landcare Research, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Fusarium tricinctum* (Corda) Sacc.	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Monilia fructicola* (G. Winter) Honey **s**yn. *Sclerotinia fructicola* (G. Winter) Rehm	Pennycook, 1989b	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Monilinia laxa* (Aderh. & Ruhland) Honey	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Nectria cinnabarina* (Tode: Fr.) Fr.	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Neofabraea vagabunda* (Desm.) Rossman; syn. *Neofabraea alba* (E.J.Guthrie) Verkley	Abuelnaga, 2024	Farr and Rossman, 2024	Abuelnaga, 2024	na
FUNGI: *Neofusicoccum luteum* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips; syn. *Fusicoccum luteum* Pennycook & Samuels, *Botryosphaeria lutea* A. J. L. Phillips	Farr and Rossman, 2024	Farr and Rossman, 2024	Delgado-Cerrone et al., 2016	na
FUNGI: *Neofusicoccum parvum* (Pennycook & Samuels) Crous, Slippers & Phillips; syn. *Botryosphaeria parva* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Neonectria ditissima* (Tul. & C. Tul.) Samuels & Rossman; syn. *Nectria galligena* Bres.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Paraconiothyrium fuckelii* (Sacc.) Verkley & Gruyter; syn. *Leptosphaeria coniothyrium* (Fuckel) Sacc.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Pleospora herbarum* (Pers.) Rabenh.	CABI, 2024	WPFUS, 2024	CABI, 2024	na
FUNGI: *Podosphaera pannosa* (Wallr.) de Bary	Abuelnaga, 2024	WPFUS, 2024	Abuelnaga, 2024	na
FUNGI: *Rosellinia necatrix* Berl. Ex Prill.	Petrini, 2003	Farr and Rossman, 2024	Pasini et al., 2016	na

Organism	In New Zealand	In U.S.	Host Association - *Malus*	Notes
FUNGI: *Schizothyrium pomi* (Mont. & Fr.) Arx	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Trametes versicolor* (L.:Fr.) Pilat	Watson, 1971	Watson, 1971	Watson, 1971	na
FUNGI: *Venturia inaequalis* (Cooke) G. Winter	Abuelnaga, 2024	WPPNUS, 2024	Abuelnaga, 2024	na
PHYTOPLASMA: *Apple rubbery wood phytoplasma*	Wood, 1997	CABI, 2024	Wood, 1996	na
VIRUS: *Ilarvirus, Apple mosaic virus*	Gardner, 1983	CABI, 2024	CABI, 2024	na
VIRUS: *Necrovirus, Tobacco necrosis virus*	CABI, 2024	Zhang et al., 1993	CABI, 2024	na
VIRUS: *Trichovirus, Apple chlorotic leaf spot virus*	Manaaki Whenua, Landcare Research, 2024	WPVUS, 2024	Manaaki Whenua, Landcare Research, 2024	na

Table A.2. Organisms associated with *Pyrus* x *bretschneideri*, *P. communis*, or *P. pyrifolia*

Organism	In New Zealand	In U.S.	Host Association - *Pyrus*	Notes
INSECT: Coleoptera: Cerambycidae *Arhopalus ferus* (Mulsant)	NZMAF, 2023b	GBIF, 2024	NZMAF, 2023b	na
INSECT: Coleoptera: Curculionidae *Naupactus cervinus* Boheman syn.; *Pantomorus cervinus* (Boheman)	NZMAF, 2023b	CABI, 2024	NZMAF, 2023b	na
INSECT: Coleoptera: Curculionidae *Xyleborinus saxeseni* (Ratzeburg)	Brockerhoff et al., 2003	Wood and Bright, 1992	CABI, 2024	na
INSECT: Diptera: Cecidomyiidae *Dasineura mali* (Keiffer)	NZMAF, 2023b	Gagne, 1989	NZMAF, 2023b	na
INSECT: Diptera: Cecidomyiidae *Dasineura pyri* (Bouché)	NZMAF, 2023b	CABI, 2024	NZMAF, 2023b	na
INSECT: Hemiptera: Aphididae *Aphis craccivora* Koch	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Aphididae *Aphis gossypii* Glover	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Aphididae *Aphis spiraecola* Patch	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Aphididae *Brachycaudus helichrysi* (Kaltenbach)	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Aphididae *Eriosoma lanigerum* (Hausmann)	NZMAF, 2023b	CABI, 2024	NZMAF, 2023b	na
INSECT: Hemiptera: Aphididae *Macrosiphum rosae* (L.)	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na

Organism	In New Zealand	In U.S.	Host Association - *Pyrus*	Notes
INSECT: Hemiptera: Aphididae *Myzus persicae* (Sulzer)	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Aphididae *Rhopalosiphum insertum* (Walker)	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Aphididae *Rhopalosiphum rufiabdominalis* (Sasaki)	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Aphididae *Aphis aurantii* Boyer de Fonscolombe syn; *Toxoptera aurantii* (Boyer de Fonscolombe)	CABI, 2024	CABI, 2024	Blackman and Eastop, 1994	na
INSECT: Hemiptera: Coccidae *Ceroplastes sinensis* Del Guercio	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Coccidae *Coccus hesperidum* L.	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Coccidae *Parthenolecanium corni* (Bouché)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Coccidae *Saissetia oleae* (Olivier)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Diaspididae *Aonidiella aurantii* (Maskell)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Diaspididae *Aspidiotus nerii* Bouché	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Diaspididae *Aulacaspis rosae* (Bouché)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Diaspididae *Comstockaspis perniciosa* (Comstock)	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na
INSECT: Hemiptera: Diaspididae *Diaspidiotus ostreaeformis* (Curtis)	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na
INSECT: Hemiptera: Diaspididae *Hemiberlesia lataniae* (Signoret)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Diaspididae *Hemiberlesia rapax* (Comstock)	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na
INSECT: Hemiptera: Diaspididae *Lepidosaphes beckii* (Newman)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Diaspididae *Lepidosaphes ulmi* (L.)	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na

Organism	In New Zealand	In U.S.	Host Association - *Pyrus*	Notes
INSECT: Hemiptera: Monophlebidae *Icerya purchasi* Maskell	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na
INSECT: Hemiptera: Pseudococcidae *Planococcus citri* (Risso)	García Morales et al., 2016	García Morales et al., 2016	García Morales et al., 2016	na
INSECT: Hemiptera: Pseudococcidae *Pseudococcus calceolariae* (Maskell)	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na
INSECT: Hemiptera: Pseudococcidae *Pseudococcus longispinus* (Targioni Tozzetti)	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na
INSECT: Hemiptera: Pseudococcidae *Pseudococcus viburni* (Signoret)	NZMAF, 2023b	García Morales et al., 2016	NZMAF, 2023b	na
INSECT: Hymenoptera: Tenthredinidae *Caliroa cerasi* (L.)	Smith, 2003	Smith, 2003	CABI, 2024	na
INSECT: Lepidoptera: Arctiidae *Hyphantria cunea* (Drury)	CABI, 2024	Poole and Gentili, 1996	CABI, 2024	na
INSECT: Lepidoptera: Noctuidae *Agrotis ipsilon* (Hufnagel)	CABI, 2024	CABI, 2024	CABI, 2024	na
INSECT: Lepidoptera: Tortricidae *Cydia pomonella* (L.)	NZMAF, 2023b	CABI, 2024	NZMAF, 2023b	na
INSECT: Lepidoptera: Tortricidae *Epiphyas postvittana* (Walker)	NZMAF, 2023b	Brown et al., 2010	Suckling and Brockerhoff, 2010	na
INSECT: Lepidoptera: Tortricidae *Grapholita molesta* (Busck)	NZMAF, 2023b	Metcalf and Metcalf, 1993	NZMAF, 2023b	na
INSECT: Thysanoptera: Thripidae *Heliothrips haemorrhoidalis* (Bouché)	NZMAF, 2023b	CABI, 2024	NZMAF, 2023b	na
MITE: Trombidiformes: Eriophyidae *Aculus fockeui* (Nalepa & Trouessart)	CABI, 2024	Baker et al., 1996	Momen and Lamlom, 2021	na
MITE: Trombidiformes: Eriophyidae *Aculus schlechtendali* (Nalepa)	CABI, 2024	Baker et al., 1996	CABI, 2024	na
MITE: Trombidiformes: Eriophyidae *Calepitrimerus baileyi* Keifer	Manson, 1984a	Baker et al., 1996	Momen and Lamlom, 2021	na
MITE: Trombidiformes: Eriophyidae *Epitrimerus pyri* (Nalepa)	Manson, 1984a	Baker et al., 1996	Denizhan, 2018	na
MITE: Trombidiformes: Eriophyidae *Eriophyes pyri* (Pagenstecher)	NZMAF, 2023b	Baker et al., 1996	NZMAF, 2023b	na

Organism	In New Zealand	In U.S.	Host Association - *Pyrus*	Notes
MITE: Trombidiformes: Tarsonemidae *Polyphagotarsonemus latus* (Banks)	CABI, 2024	CABI, 2024	Basavaraju et al., 2010	na
MITE: Trombidiformes: Tetranychidae *Bryobia praetiosa* Koch	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Bryobia rubrioculus* (Scheuten)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Panonychus citri* (McGregor)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Panonychus ulmi* (Koch)	NZMAF, 2023b	Bolland et al., 1998	NZMAF, 2023b	na
MITE: Trombidiformes: Tetranychidae *Tetranychus ludeni* Zacher	Bolland et al., 1998	Bolland et al., 1998	Marić et al., 2022	na
MITE: Trombidiformes: Tetranychidae *Tetranychus turkestani* (Ugarov and Nikolski)	Bolland et al., 1998	Bolland et al., 1998	Bolland et al., 1998	na
MITE: Trombidiformes: Tetranychidae *Tetranychus urticae* Koch	NZMAF, 2023b	Bolland et al., 1998	NZMAF, 2023b	na
CHROMISTAN: *Pythium megalacanthum* de Bary	Robertson, 1973	Farr and Rossman, 2024	Farr and Rossman, 2024	na
CHROMISTAN: *Pythium vexans* de Bary; syn. *Phytopythium vexans* (de Bary) Abad, de Cock, Bala, Robideau, Lodhi & Lévesque	Pennycook, 1989a	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Abortiporus biennis* (Bull.) Singer; syn. *Heteroporus biennis* (Bull.: Fr.) Lázaro Ibiza	Sutton et al., 2014	Watson, 1971	Watson, 1971	na
FUNGI: *Botrytis cinerea* Pers.:Fr.	Sutton et al., 2014	WPFUS, 2024	Sutton et al., 2014	na
FUNGI: *Chondrostereum purpureum* (Pcrs.:Fr.) Pouzar	Watson, 1971	Watson, 1971	Watson, 1971	na
FUNGI: *Colletotrichum acutatum* Simmonds ex Simmonds	Guerber et al., 2003	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Colletotrichum gloeosporioides* (Penz) Penz & Sacc.; syn. *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Colletotrichum salicis* (Fuckel) Damm, P.F. Cannon & Crous; syn. *Glomerella miyabeana* (Fukushi) Arx	Jayawardena et al., 2016	Farr and Rossman, 2024	Jayawardena et al., 2016	na

Organism	In New Zealand	In U.S.	Host Association - *Pyrus*	Notes
FUNGI: *Diaporthe eres* Nitschke.; syn.: *D. mali* Miura; *Phomopsis cotoneastri* Punith, *Phoma oblonga* Desm., *Phomopsis fukushii* Tanaka & S. Endô	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Diaporthe foeniculina* (Sacc.) Udayanga & Castl.	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Diaporthe nobilis* Sacc. & Speg.	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Diplocarpon mespili* (Sorauer) B. Sutton	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Elsinoe piri* (Woron.) Jenkins; syn. *Elsinoe pyri* (Woron.) Jenkins	Sutton et al., 2014	Farr and Rossman, 2024	Sutton et al., 2014	na
FUNGI: *Erythricium salmonicolor* (Berk. & Broome) Burds.; syn. *Phanerochaete salmonicolor* (Berk. & Broome) Jülich	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Ganoderma australe* (Fr.: Fr.) Pat.	Farr and Rossman, 2024	Yeh et al., 2000	Farr and Rossman, 2024	na
FUNGI: *Fusarium lateritium* Nees: Fr.; syn. *Gibberella baccata* (Wallr.) Sacc.	Manaaki Whenua, Landcare Research, 2024	Farr and Rossman, 2024	Manaaki Whenua, Landcare Research, 2024	na
FUNGI: *Monilinia laxa* (Aderh. & Ruhland) Honey	Farr and Rossman, 2024	Farr and Rossman, 2024	Abuelnaga, 2024	na
FUNGI: *Nectria cinnabarina* (Tode: Fr.) Fr.	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Neofabraea alba* (E.J.Guthrie) Verkley	Abuelnaga, 2024	Farr and Rossman, 2024	Abuelnaga, 2024	na
FUNGI: *Neofabraea malicorticis* H.S. Jacks.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Neofabraea vagabunda* (Desm.) Rossman; syn. *Neofabraea alba* (E.J. Guthrie) Verkley	Abuelnaga, 2024	Farr and Rossman, 2024	Abuelnaga, 2024	na

Organism	In New Zealand	In U.S.	Host Association - *Pyrus*	Notes
FUNGI: *Neofusicoccum luteum* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips; syn. *Fusicoccum luteum* Pennycook & Samuels; syn. *Botryosphaeria lutea* A.J.L. Phillips	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Neofusicoccum parvum* (Pennycook & Samuels) Crous, Slippers & Phillips; syn. *Botryosphaeria parva* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips	Farr and Rossman, 2024	Farr and Rossman, 2024	Shen et al., 2010	na
FUNGI: *Neonectria ditissima* (Tul. & C. Tul.) Samuels & Rossman; syn. *Nectria galligena* Bres.	Farr and Rossman, 2024	WPFUS, 2024	Abuelnaga, 2024	na
FUNGI: *Penicillium expansum* Link	Farr and Rossman, 2024	WPFUS, 2024	Abuelnaga, 2024	na
FUNGI: *Phlyctema vagabunda* Desm.; syn. *Pezicula alba* E.J. Guthrie	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Pleospora herbarum* (Pers.) Rabenh.	CABI, 2024	WPFUS, 2024	CABI, 2024	na
FUNGI: *Podosphaera leucotricha* (Ellis & Everh.) E.S. Salmon	Farr and Rossman, 2024	WPFUS, 2024	Abuelnaga, 2024	na
FUNGI: *Rhizopus stolonifer* (Ehrenb.: Fr.) Vuill.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
FUNGI: *Rosellinia necatrix* Berl. Ex Prill.	Petrini, 2003	Farr and Rossman, 2024	Farr and Rossman, 2024; Takemoto et al., 2009	na
FUNGI: *Sclerotinia sclerotiorum* (Lib.) de Bary	Farr and Rossman, 2024	CABI, 2024	Farr and Rossman, 2024	na
FUNGI: *Seimatosporium rhododendri* (Schwein.) Piroz. & Shoemaker	Farr and Rossman, 2024	Farr and Rossman, 2024	Farr and Rossman, 2024	na
FUNGI: *Trametes versicolor* (L.:Fr.) Pilat	Watson, 1971	Watson, 1971	Farr and Rossman, 2024	na
FUNGI: *Trichothecium roseum* (Pers.) Link	Farr and Rossman, 2024	CABI, 2024	Farr and Rossman, 2024	na
FUNGI: *Venturia pyrina* Aderh.	Farr and Rossman, 2024	WPFUS, 2024	Abuelnaga, 2024	na

Organism	In New Zealand	In U.S.	Host Association - *Pyrus*	Notes
FUNGI: *Verticillium dahliae* Kleb.	Farr and Rossman, 2024	WPFUS, 2024	Farr and Rossman, 2024	na
PHYTOPLASMA: *Apple rubbery wood phytoplasma*	Wood, 1996	CABI, 2024	CABI, 2024	na
VIRUS: *Ilarvirus, Apple mosaic virus*	Gardner, 1983	CABI, 2024	CABI, 2024	na
VIRUS: *Necrovirus, Tobacco necrosis virus*	CABI, 2024	Zhang et al., 1993	CABI, 2024	na
VIRUS: *Trichovirus, Apple chlorotic leaf spot virus*	Manaaki Whenua, Landcare Research, 2024	WPVUS, 2024	CABI, 2024	na