Importation of Persimmon, *Diospyros kaki* Thunb., as Fresh Fruit with Calyxes from Japan into the United States

A Pathway-initiated Commodity Risk Analysis

Version 5

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Executive Summary

This document presents results of an analysis of the risks associated with the importation, from Japan into the United States, persimmon, *Diospyros kaki* Thunb., as fresh fruit with calyxes. A search of available sources of information and APHIS, PPQ port interception records identified quarantine pests of *D. kaki* that occur in Japan and that could be introduced into the United States (Continental United States, Alaska, and Hawaii) in consignments of that commodity.

We estimated the *Consequences of Introduction* by assessing five elements that reflect the biology and ecology of the pests: climate/host interaction, host range, dispersal potential, economic impact, and environmental impact, resulting in the calculation of a risk value. We estimated the *Likelihood of Introduction* by considering both the quantity of the commodity to be imported annually and the potential for pest introduction and establishment, resulting in the calculation of a second risk value. We then summed the two values to estimate an overall *Pest Risk Potential*, which estimates the risk in the absence of mitigation.

Quarantine pests considered likely to follow the import pathway are presented in the following table, indicating their risk ratings.

Type	**Taxonomy**	**Pest**	**Pest Risk Potential**
Arthropods	Acari: Tenuipalpidae	*Tenuipalpus zhizhilashviliae* Reck	Medium
	Hemiptera: Pseudococcidae	*Crisicoccus matsumotoi* (Siraiwa)	Medium
		Pseudococcus cryptus Hempel	High
	Lepidoptera: Oecophoridae	*Stathmopoda masinissa* Meyrick	Medium
	Lepidoptera:Pyralidae	*Conogethes punctiferalis* (Guenée)	High
	Lepidoptera:Tortricidae	*Homonopsis illotana* (Kennel)	High
		Lobesia aeolopa Meyrick	High
	Thysanoptera: Phlaeothripidae	*Ponticulothrips diospyrosi* Haga & Okajima	Medium
	Thysanoptera: Thripidae	*Scirtothrips dorsalis* Hood	High
		Thrips coloratus Schmutz	Medium
Fungi		*Adisciso kaki* Yamamoto et al.	Medium
		Colletotrichum horii B. Weir and P. R. Johnst.	Medium
		Cryptosporiopsis kaki (Hara) Weindlmayr	Medium
		Mycosphaerella nawae Hiura and Ikata	Medium
		Pestalotia diospyri Syd. and P. Syd.	High
		Pestalotiopsis acaciae (Thümen) Yokoyama & Kaneko	Medium
		Pestalotiopsis crassiuscula Steyaert	Medium
		Phoma kakivora Hara	Medium
		Phoma loti Cooke	Medium

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1. Introduction

1.1. Background

This document was prepared by the Plant Epidemiology and Risk Analysis Laboratory of the Center for Plant Health Science and Technology, USDA Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), in response to a request to evaluate the risks associated with the importation of commercially produced fresh persimmon (*Diospyros kaki* Thunb) fruit with calyxes, from Japan into the United States (Continental United States, Alaska, and Hawaii).

The International Plant Protection Convention (IPPC) provides guidance for conducting pest risk analyses. The methods used here are consistent with guidelines provided by the IPPC, specifically the International Standard for Phytosanitary Measures (ISPM) on 'Pest Risk Analysis for Quarantine Pests, Including Analysis of Environmental Risks and Living Modified Organisms' (IPPC, 2009: ISPM #11). The use of biological and phytosanitary terms is consistent with the 'Glossary of Phytosanitary Terms and the Compendium of Phytosanitary Terms' (IPPC, 2009: ISPM #5).

Three stages of pest risk analysis are described in international standards: Stage 1, Initiation, Stage 2, Risk Assessment, and Stage 3, Risk Management. This document satisfies the requirements of Stages 1 and 2.

This is a qualitative risk analysis; estimates of risk are expressed in terms of High, Medium, and Low pest risk potentials based on the combined ratings for specified risk elements (PPQ, 2000) related to the probability and consequences of importing this persimmon commodity from Japan. For the purposes of this assessment High, Medium, and Low probabilities will be defined as:

High: More likely to occur than not to occur
Medium: As likely to occur as not to occur
Low: More likely to not occur than to occur

The appropriate risk management strategy for a particular pest depends on the risk posed by that pest. Identification of appropriate sanitary and phytosanitary measures to mitigate the risk, if any, for this pest is undertaken as part of Stage 3 (Risk Management). Other than listing possible mitigation options for the pests of concern, we did not discuss risk management in this document.

1.2. Commodity information

Japanese persimmon (Fig. 1) is native to that region of Asia centered on China (Morton, 1987), although most development of the crop has occurred in Japan, where it is regarded as the national fruit (George & Nissen, 2002). The total growing area devoted to persimmon culture in Japan was estimated at 25,700 ha in 2001 (Itamura et al., 2005). The country's production in 2005 was approximately 230,000 tonnes (FAOSTAT, 2006a). Most production is consumed domestically (George & Nissen, 2002), with only about 0.1% exported. For example, persimmon exports from Japan totaled 242 tonnes in 2004, at an estimated value of $758,000 (FAOSTAT, 2006b). Other major producers are China, Brazil, Korea, and Italy; minor producers include Israel, New Zealand, Australia, Spain, Georgia, Egypt, Chile, and the United States (Gillen, 2003).

The tree was first introduced into the United States from Japan in 1856; later, beginning in 1870, grafted trees of improved cultivars were imported by USDA, and planted in California and other southern states (Morton, 1987). At present, commercial production in the United States is restricted to the San Joaquin Valley of California (Gillen, 2003), which reported a total yield in 2004 of about 12,769 tonnes, exceeding $10.3 million in value (CASS, 2005).

Figure 1. Fruit of Japanese persimmon (*Diospyros kaki* Thunb.)
(source: http://www.antiquemapsandprints.com/BOOKS/AGRICULTURE-FRUIT-1892.htm).

2. Risk Assessment

2.1. Initiating Event: Proposed Action

This risk assessment was developed in response to a request, in October 1988 by the government of Japan, for USDA authorization to permit imports of fresh persimmon fruit from Japan into the United States (Neal, 2001). Entry of this commodity into the United States presents the risk of introduction of exotic plant pests. Title 7, Part 319, Section 56 of the United States Code of Federal Regulations (7 CFR §319.56) provides regulatory authority for the importation of fruits and vegetables from foreign countries into the United States.

2.2. Assessment of the Weed Potential of Persimmon (*Diospyros kaki* Thunb.)

In this step we examine the potential of the commodity to become a weed after it enters the United States (Table 1). If the assessment indicates significant weed potential, then a "pest-initiated" risk assessment is conducted.

Table 1. Assessment of the weed potential of persimmon.

Commodity: Persimmon (*Diospyros kaki* Thunb.) (Ebenaceae)

Phase 1: *Diospyros kaki* is exotic to the United States. The tree is naturalized in Alabama, Arizona, California, Florida, Georgia, Hawaii, Illinois, Indiana, Kansas, Louisiana, Maryland, Michigan, Mississippi, Missouri, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Utah, and Virginia (Morton, 1987; Das et al., 2001). At least 824 ha of commercial persimmon are cultivated in California (CASS, 2005).

Phase 2: Is the species listed in:

No	*Geographical Atlas of World Weeds* (Holm et al., 1979)
No	*World's Worst Weeds* (Holm et al., 1977) or *World Weeds: Natural Histories and Distribution* (Holm et al., 1997)
No	1982 Report of the Technical Committee to Evaluate Noxious Weeds: Exotic Weeds for Federal Noxious Weed Act (Gunn and Ritchie, 1982)
No	*Economically Important Foreign Weeds* (Reed, 1977)
No	Weed Science Society of America list (WSSA, 2006)
Yes	Is there any literature reference indicating weediness (e.g., AGRICOLA, CAB Abstracts, Biological Abstracts, AGRIS; search on "species name" combined with "weed").

Phase 3: Randall (2002) categorized *D. kaki* as an *environmental weed*. However, the species is widespread in the United States where it also is grown as a crop. Since persimmon already is well established in the United States, the importation of fresh fruit from Japan should not increase the plant's weed potential beyond that existing at present. The plant is considered to have little, if any, invasive potential (Gilman & Watson, 1993). A pest-initiated risk assessment therefore is not necessary.

2.3. Previous Risk Assessments, Current Status, and Pest Interceptions

2.3.1. Decision History for *Diospyros kaki* and *Diospyros* sp. from Japan and Korea

1987 – Deny entry from Japan because of the "complex of exotic pests and diseases for which there are no acceptable treatments."
1984 – Deny entry from Japan because of the "complex of insect pests including tortricids and *Dichocrocis punctiferalis*, for which there is no acceptable treatment."
1978 – Deny entry into Hawaii from Japan for lack of treatments available for the complex of insect pests and diseases.
1974 – Deny entry from Korea because of the "[c]omplex of insects in Republic of Korea which attack persimmons."
1967 – Permit entry into Guam from Japan and Korea, subject to inspection and quarantine action if warranted.
1926 – Deny entry from Japan.

2.3.2. Current Status and Pest Interceptions

Currently, persimmon imports from Japan are not authorized by 7 CFR §319.56. Pest interceptions at U.S. ports-of-entry on *Diospyros kaki* from Japan are summarized below (Table 2).

Table 2. Pests intercepted on *Diospyros kaki* from Japan (1984-2005).[1]

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
ACARI				
Tarsonemidae				
Tarsonemus sp.	Fruit	Baggage	Consumption	1
Tarsonemus stammeri Schaarschmidt	Fruit	Stores	Non-entry	1
Tenuipalpidae				
Tenuipalpus zhizhilashviliae Reck	Fruit	Baggage	Consumption	2
		Stores	Non-entry	20
Tetranychidae				
Tetranychus sp.	Fruit	Baggage	Consumption	1
COLEOPTERA				
Bostrichidae				
Mesoxylion sp.	Fruit	Baggage	Consumption	1
Cerambycidae				
Xylotrechus sp.	Stem	Permit cargo	Propagation	1
Curculionidae				
Pseudanchonus sp.	Fruit	Baggage	Consumption	1
COLLEMBOLA				
Collembola, species of	Fruit	Mail	Consumption	1

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
DIPTERA				
Diptera, species of	Fruit	Baggage	Consumption	1
Phoridae				
Phoridae, species of	Fruit	Baggage	Consumption	1
HEMIPTERA				
Homoptera, species of	Fruit	Baggage	Consumption	1
		Mail	Consumption	1
Coccidae				
Coccidae, species of	Fruit	Stores	Non-entry	1
Diaspididae				
Diaspididae, species of	Fruit	Baggage	Consumption	1
Lepidosaphes sp.	Fruit	Mail	Consumption	1
Lepidosaphes conchiformioides Borchsenius	Fruit	Baggage	Consumption	3
		Stores	Non-entry	1
Pseudaonidia sp.	Fruit	Permit cargo	Consumption	1
Pseudaonidia duplex (Cockerell)	Fruit	Baggage	Consumption	2
Pseudaulacaspis sp.	Fruit	Baggage	Consumption	53
		Mail	Consumption	1
		Permit cargo	Consumption	1
	Leaf	Baggage	Consumption	2
	Stem	Baggage	Consumption	1
Pseudischnaspis sp.	Fruit	Stores	Non-entry	6
Eriococcidae				
Asiacornococcus kaki (Kuwana in Kuwana & Muramatsu)	Fruit	Baggage	Consumption	3
		Mail	Consumption	3
Eriococcidae, species of	Fruit	Stores	Consumption	2
Margarodidae				
Margarodidae, species of	Fruit	Baggage	Consumption	1
Pseudococcidae				
Dysmicoccus sp.	Fruit	Baggage	Consumption	2
Maconellicoccus hirsutus (Green)	Fruit	Baggage	Consumption	1
Planococcoides sp.	Fruit	Mail	Consumption	1
Planococcus sp.	Fruit	Baggage	Consumption	28
		Mail	Consumption	8
		Stores	Non-entry	13
	Leaf	Stores	Non-entry	1
	Stem	Baggage	Consumption	1
Planococcus kraunhiae (Kuwana)	Fruit	Baggage	Consumption	74
		Mail	Consumption	9
		Stores	Non-entry	8
		Quarters	Non-entry	1

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
	Leaf	Baggage	Consumption	1
	Stem	Baggage	Consumption	1
Planococcus lilacinus (Cockerell)	Fruit	Baggage	Consumption	1
Planococcus minor (Maskell)	Fruit	Baggage	Consumption	1
Pseudococcidae, species of	Fruit	Baggage	Consumption	205
			Propagation	1
		Mail	Consumption	27
		General cargo	Consumption	3
		Permit cargo	Consumption	3
		Stores	Non-entry	33
		Quarters	Non-entry	1
	Leaf	Baggage	Consumption	3
	Stem	Baggage	Consumption	7
Pseudococcus sp.	Fruit	Baggage	Consumption	6
		Mail	Consumption	2
		Stores	Non-entry	3
Pseudococcus citriculus Green (= *P. cryptus* Hempel)	Fruit	Baggage	Consumption	2
Pseudococcus elisae Borchsenius	Fruit	Baggage	Consumption	1
LEPIDOPTERA				
Lepidoptera, species of	Fruit	Baggage	Consumption	2
Gelechiidae				
Gelechiidae, species of	Fruit	Mail	Consumption	1
Pyralidae				
Crambus sp.	Fruit	Baggage	Consumption	1
Tortricidae				
Olethreutinae, species of	Fruit	Baggage	Consumption	2
		Permit cargo	Consumption	1
Platynota sp.	Fruit	Permit cargo	Consumption	1
Tortricidae, species of	Fruit	Baggage	Consumption	24
		Mail	Consumption	1
		General cargo	Consumption	1
		Permit cargo	Consumption	3
		Stores	Non-entry	6
		Quarters	Non-entry	1
Tortricinae, species of	Fruit	Baggage	Consumption	7
		Mail	Consumption	1
		Permit cargo	Consumption	3
PSOCOPTERA				
Psocoptera, species of	Fruit	Baggage	Consumption	1

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
THYSANOPTERA				
Phlaeothripidae				
Phlaeothripidae, species of	Fruit	Baggage	Consumption	1
Thripidae				
Heliothrips haemorrhoidalis (Bouché)	Fruit	Baggage	Consumption	1
Thripidae, species of	Fruit	Baggage	Consumption	7
		Mail	Consumption	1
		General cargo	Consumption	1
		Stores	Non-entry	1
FUNGI				
Cladosporium sp.	Fruit	Baggage	Consumption	2
		Mail	Consumption	1
Guignardia sp.	Fruit	Baggage	Consumption	1
Pestalotiopsis sp.	Fruit	Baggage	Consumption	2
Phomopsis sp.	Fruit	Baggage	Consumption	1
Phyllactinia guttata (Wallr.) Lév.	Fruit	Baggage	Consumption	1
Phyllosticta sp.	Fruit	Mail	Consumption	1
	Leaf	Permit cargo	Consumption	1
MOLLUSC				
Lehmannia valentiana (Ferussac)	Stem	Permit cargo	Propagation	1

[1]Records from the USDA-APHIS, PPQ Port Information Network (PestID, 2006) database. Last access: August 2006.

2.4. Pest Categorization—Identification of Quarantine Pests and Quarantine Pests Likely to Follow the Pathway

Pests associated with persimmon that also occur in Japan are listed below (Table 3). This list includes information on the presence or absence of these pests in the United States, the affected plant part or parts, the quarantine status of the pest with respect to the United States, an indication of the pest-commodity association, and pertinent references for pest distribution and biology.

Table 3. Pests in Japan associated with persimmon (*Diospyros kaki*).

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
ARTHROPODS					
Acari: Eriophyidae					
Aceria diospyri Keifer (= *Eriophyes diospyri* [Keifer])	JP, US (CA, FL)	F, L	No	Yes	Ashihara et al., 2004; Baker et al., 1996; Davis et al., 1982; Jeppson et al., 1975
Acari: Tarsonemidae					
Polyphagotarsonemus latus (Banks)	JP, US	L	No	No	AFFA, 2004; CABI, 2004
Tarsonemus sp.	JP	F	Yes	Yes	PestID, 2006
Tarsonemus stammeri Schaarschmidt	JP	F	Yes	No[4]	PestID, 2006
Acari: Tenuipalpidae					
Brevipalpus phoenicis (Geijskes)	JP (Ryukyu Is.), US (CA, DC, FL, HI, TX)	F, L	No	Yes	CABI, 2004; Jeppson et al., 1975; Kumar, 1992
Tenuipalpus japonicus Nishio	JP	L	Yes	No	Han, 1970; Nishio, 1956
Tenuipalpus zhizhilashviliae Reck	JP	F, L	Yes	Yes	MAFF, 2005; Umeya & Okada, 2003
Acari: Tetranychidae					
Eotetranychus sexmaculatus (Riley) (= *E. asiaticus* Ehara)	JP, US (AZ, CA, FL)	F, L	No	Yes	Bolland et al., 1998; Jeppson et al., 1975; MAFF, 2005; Umeya & Okada, 2003
Eutetranychus orientalis (Klein)	JP	L	Yes	No	AFFA, 2004; Jeppson et al., 1975
Panonychus citri (McGregor)	JP, US	F, L	No	Yes	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Panonychus ulmi (Koch)	JP, US	L	No	No	AFFA, 2004; Jeppson et al., 1975
Tetranychus sp.	JP	F	Yes	Yes	PestID, 2006
Tetranychus kanzawai Kishida	JP, US	F, L, S	No	Yes	Bolland et al., 1998; MAFF, 2005; Umeya & Okada, 2003
Tetranychus urticae Koch	JP, US	L	No	No	CABI, 2004; Takafuji et al., 1989
Coleoptera: Bostrichidae					
Mesoxylion sp.	JP	F	Yes	No[5]	PestID, 2006
Rhyzopertha dominica (F.) (= *Rhizopertha dominica* F.)	JP, US	Sd	No	No[6]	CABI, 2004; Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Sinoxylon japonicum Lesne	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Coleoptera: Buprestidae					
Agrilus moerens Saunders	JP	S[7]	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987
Agrilus nipponigena Obenberger	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Chrysobothris succedanea Saunders	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Chrysochroa fulgidissima (Schönherr)	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Coleoptera: Cerambycidae					
Apriona japonica Thomson	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Bandar pascoei (Lansberge)	JP	S[8]	Yes	No	Hua, 2002
Cagosima sanguinolenta Thomson	JP	S	Yes	No	Cherepanov, 1991; Japanese Society of Applied Entomology & Zoology, 1987
Chlorophorus japonicus (Chevrolat)	JP	S	Yes	No	Cherepanov, 1990; Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Corymbia dichroa (Blanchard)	JP	S[9]	Yes	No	Hua, 2002
Cyrtoclytus caproides (Bates) (= *Clytus caproides* (Bates))	JP	S	Yes	No	Clausen, 1931; Shiraki, 1952c
Pterolophia rigida (Bates)	JP	S	Yes	No	Hua, 2002; Kawabe, 2006a
Xylotrechus sp.	JP	S	Yes	No	PestID, 2006
Xystrocera globosa (Olivier)	JP, US (HI)	S	Yes	No	Hanks, 1999; Hua, 2002; IIE, 1995
Coleoptera: Chrysomelidae					
Basilepta fulvipes (Motschulsky)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Chrysomela populi L.	JP	L	Yes	No	AFFA, 2004; Kuhn et al., 2004
Luperomorpha funesta (Baly) (= *Phyllotreta funesta* Baly)	JP	L, R	Yes	No	Iba & Inoue, 1977; Shiraki, 1952c
Coleoptera: Curculionidae					
Canoixus japonicus Roelofs	JP	I, L, R[10]	Yes	No	Shiraki, 1952d
Pantomorus cervinus (Boheman)	JP, US	F, L, R	No	Yes	CABI, 2004
Pseudanchonus sp.	JP	F	Yes	Yes	PestID, 2006

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Pseudocneorhinus obesus Roelofs	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Scepticus tigrinus (Roelofs)	JP	L, R	Yes	No	Anonymous, 2005b; Shiraki, 1952d
Coleoptera: Elateridae					
Ectinus sericeus (Candéze) (= *Agriotes sericeus* Candéze)	JP	R	Yes	No	GATA, 2005; Shiraki, 1952c
Melanotus legatus Candéze	JP	R[11]	Yes	No	Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Coleoptera: Rhynchitidae					
Neocoenorrhinus interruptus (Voss)	JP	S	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987; Sawada, 2005
Coleoptera: Scarabaeidae					
Adoretus sinicus Burmeister	JP, US (HI)	L	Yes	No	Gordon, 1988; Hua, 2002; Nishida, 2002
Adoretus tenuimaculatus Waterhouse	JP	C, L	Yes	No[12]	Lee et al., 2002a; Shiraki, 1952d
Anomala albopilosa (Hope)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Anomala cuprea (Hope)	JP	L, R	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Anomala daimiana Harold	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Anomala octiescostata Burmeister	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Anomala puncticollis Harold	JP	L	Yes	No	AFFA, 2004; Hill, 1987
Anomala rufocuprea Motschulsky	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Anomala (= *Mimela*) *splendens* (Gyllenhal)	JP	L	Yes	No	MAFF, 2005; Seliškar, 2002; Umeya & Okada, 2003
Exomala orientalis (Waterhouse) (= *Blitopertha orientalis* [Waterhouse], *Phyllopertha orientalis* Waterhouse)	JP, US	L	No	No	CABI, 2004; CABI/EPPO, 1997a; MAFF, 2005; Shiraki, 1952d; Umeya & Okada, 2003
Gametis jucunda Faldermann	JP	C, I	Yes	No[13]	AFFA, 2004; Lee et al., 2002a
Maladera castanea (Arrow) (= *Autoserica castanea* Waterhouse)	JP, US	L	No	No	MAFF, 2005; Shiraki, 1952d; Umeya & Okada, 2003

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Maladera japonica (Motschulsky)	JP	L	Yes	No	AFFRIC, 2002; Shiraki, 1952d
Maladera orientalis (Motschulsky)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Melolontha frater Arrow	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Melolontha japonica Burmeister	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Mimadoretus mutans (Newman) (= *Popillia mutans* Newman)	JP	I, L	Yes	No	AFFA, 2004; NIAST, 2001a
Poecilophilides rusticola (Burmeister)	JP	I	Yes	No	Hua, 2002; RDB, 2006
Popillia japonica Newman	JP, US	L	Yes	No	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Coleoptera: Scolytidae					
Amasa amputatus (Blandford) (= *Xyleborus amputatus* Blandford)	JP	S[14]	Yes	No	Cognato, 2004i; Hua, 2002
Ambrosiodmus apicalis (Blandford) (= *Xyleborus apicalis* Blandford)	JP	S	Yes	No	Cognato, 2004g; MAFF, 2005; Umeya & Okada, 2003
Ambrosiodmus rubricollis (Eichhoff) (= *Xyleborus rubricollis* [Eichhoff])	JP, US	S	No	No	Cognato, 2004a; Hill, 1987
Cryphalus exiguus Blandford	JP	S	Yes	No	Korea Forest Service, 2004; Krivolutskaya, 2001; Tadauchi & Inoue, 1999
Euwallacea validus (Eichhoff) (= *Xyleborus validus* Eichhoff)	JP, US	S	No	No	Cognato, 2004h; Farrell et al., 2001; Haack, 2001; Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Hypothenemus amakusanus (Murayama)	JP	S[15]	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987
Hypothenemus eruditus Westwood	JP, US (DE, HI)	S	No	No	Choo et al., 1983; Kumar et al., 1979; Lee et al., 1990; Nishida, 2002; Rabaglia & Valenti, 2003; Tadauchi & Inoue, 1999
Scolytoplatypus mikado Blandford	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Scolytus sp.	JP	S[15]	Yes	No	Shiraki, 1952d

Pest	**Geographic Distribution**[1]	**Plant Part Affected**[2]	**Quarantine Pest**[3]	**Likely to Follow Pathway**	**References**
Scolytus japonicus Chapuis	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Xyleborinus attenuatus (Blandford)	JP	S[15]	Yes	No	Cognato, 2004b
Xyleborinus saxeseni (Ratzeburg) (= *Xyleborus saxeseni* [Ratzeburg])	JP, US	S	No	No	Cognato, 2004c; MAFF, 2005; Umeya & Okada, 2003
Xyleborus armiger Schedl	JP	S[14]	Yes	No	Hua, 2002
Xyleborus pfeili (Ratzeburg)	JP, US (MD, OR)	S	No	No	Cognato, 2004d; Mudge et al., 2000
Xylosandrus brevis (Eichhoff)	JP	S	Yes	No	Cognato, 2004e; Kinuura, 1995
Xylosandrus compactus (Eichhoff)	JP, US	S	No	No	CABI, 2004; Japanese Society of Applied Entomology & Zoology, 1987
Xylosandrus crassiusculus (Motschulsky)	JP, US	S	No	No	CABI, 2004; Hopkins & Robbins, 2005
Xylosandrus germanus (Blandford)	JP, US	S	No	No	Cognato, 2004f; MAFF, 2005; Umeya & Okada, 2003
Hemiptera: Aleyrodidae					
Aleurocanthus spiniferus (Quaintance)	JP, US (HI)	L, S	Yes	No	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Aleurothrixus floccosus (Maskell)	JP, US (CA, FL, HI, TX)	L	No	No	CABI, 2004
Aleurotrachelus camelliae (Kuwana)	JP	L[42]	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987
Bemisia argentifolii Bellows & Perring	JP, US	L	No	No	AFFA, 2004; CABI, 2004
Dialeurodes citri (Ashmead)	JP, US	L	No	No	CABI, 2004
Parabemisia myricae (Kuwana) (= *Bemisia myricae* Kuwana)	JP, US (CA, FL, HI)	L	No	No	CABI, 2004; Shiraki, 1952a
Trialeurodes vaporariorum (Westwood)	JP, US	L	No	No	AFFA, 2004; CABI, 2004; Mound & Halsey, 1978
Hemiptera: Aphididae					
Aphis gossypii Glover	JP, US	I, L, S	No	No	CABI, 2004; Swirski et al., 1991
Aphis spiraecola Patch (= *A. citricola* van der Goot)	JP, US	I, L	No	No	CABI, 2004; Korea Forest Service, 2004; Swirski et al., 1991

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Myzus persicae (Sulzer)	JP, US	I, L, S	No	No	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Toxoptera citricida (Kirkaldy)	JP, US (FL, HI)	L	No	No	CABI, 2004; Li et al., 1997
Hemiptera: Cercopidae					
Aphrophora rugosa Matsumura	JP	L, S	Yes	No	Korea Forest Service, 2004; NILGS, 2005
Eoscarta assimilis (Uhler) (= *Paracercopis assimilis* (Uhler))	JP	F	Yes	No[43]	Liang, 2000; Morishita, 2001; Umeya & Okada, 2003
Hemiptera: Cicadellidae					
Bothrogonia japonica Ishihara (= *B. ferruginea* [F.], *Cicadella ferruginea* [F.])	JP	L, S	Yes	No	Ishihara, 1962; Korea Forest Service, 2004; MAFF, 2005; Shiraki, 1952b; Umeya & Okada, 2003
Cicadella viridis (L.)	JP	L, S	Yes	No	MAFF, 2005; Hill, 1987; Shiraki, 1952b
Edwardsiana flavescens (F.)	JP	L, S	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987; NILGS, 2005
Empoasca nipponica Dworakowska	JP	L, S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Empoasca vitis (Göthe) (=*E. flavescens* [F.], *Chlorita flavescens* F.)	JP	L	Yes	No	CABI, 2004; Korea Forest Service, 2004; Ponti et al., 2005; Shiraki, 1952b
Erythroneura mori (Matsumura)	JP	L	Yes	No	Hill, 1987; Obara et al., 2001
Pagaronia guttigera (Uhler)	JP	L, S	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987; NILGS, 2005
Penthimia nitida Lethierry	JP	L[44]	Yes	No	Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Hemiptera: Cicadidae					
Graptopsaltria nigrofuscata (Motschulsky)	JP	F, R, S[45]	Yes	No[46]	Aizu et al., 1984; Shiraki, 1952b
Platypleura kaempferi (F.)	JP	F, R, S	Yes	No[47]	Hill, 1983; MAFF, 2005; Umeya & Okada, 2003
Hemiptera: Cicadellidae					
Bothrogonia japonica Ishihara (= *B. ferruginea* [F.], *Cicadella ferruginea* [F.])	JP	L, S	Yes	No	Ishihara, 1962; Korea Forest Service, 2004; MAFF, 2005; Shiraki, 1952b; Umeya & Okada, 2003

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Cicadella viridis (L.)	JP	L, S	Yes	No	MAFF, 2005; Hill, 1987; Shiraki, 1952b
Edwardsiana flavescens (F.)	JP	L, S	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987; NILGS, 2005
Empoasca nipponica Dworakowska	JP	L, S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Hemiptera: Coccidae					
Ceroplastes ceriferus (F.)	JP, US	L, S	No	No	CABI, 2004
Ceroplastes floridensis Comstock	JP, US	L, S	No	No	Ben-Dov et al., 2005; CABI, 2004
Ceroplastes japonicus Green	JP	S	Yes	No	Ben-Dov et al., 2005; MAFF, 2005
Ceroplastes pseudoceriferus Green	JP	I, L, S	Yes	No	Ali, 1978; Ben-Dov et al., 2005
Ceroplastes rubens Maskell	JP, US (FL, HI)	L, S	No	No	Ben-Dov et al., 2005; CABI, 2004
Coccus hesperidum L.	JP, US	S	No	No	Ben-Dov et al., 2005; MAFF, 2005; Umeya & Okada, 2003
Kilifia acuminata (Signoret)	JP, US	L	No	No	Ben-Dov et al., 2005; Kosztarab, 1997b; Mizell & Brinen, 2005
Milviscutulus mangiferae (Green) (= *Coccus mangiferae* [Fernald])	JP, US (CA, FL, HI, TX)	L	No	No	Avidov & Harpaz, 1969; Ben-Dov et al., 2005
Parthenolecanium corni (Bouché) (= *Lecanium corni* Bouché)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Korea Forest Service, 2004; MAFF, 2005; Umeya & Okada, 2003
Parthenolecanium persicae (F.)	JP, US	L, S	No	No	Ben-Dov et al., 2005; Hill, 1987
Pulvinaria aurantii Cockerell	JP	L, S	Yes	No	Anonymous, 2004a; Ben-Dov et al., 2005
Pulvinaria citricola Kuwana (= *Chloropulvinaria citricola*[48])	JP, US (CA, MD, VA)	S	No	No	Ben-Dov et al., 2005; MAFF, 2005; Umeya & Okada, 2003
Pulvinaria hydrangeae Steinweden	JP, US	L, S	No	No	Ben-Dov et al., 2005; RHS, 2005
Pulvinaria idesiae Kuwana	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Pulvinaria kuwacola Kuwana	JP	L, S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Pulvinaria psidii Maskell	JP, US	L, S	No	No	Ben-Dov et al., 2005; CABI, 2004

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Saissetia citricola (Kuwana)	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Saissetia coffeae (Walker) (= *S. hemisphaerica* Targioni Tozzetti)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Kosztarab, 1997a; Shiraki, 1952a
Saissetia oleae (Olivier)	JP, US	S	No	No	Ben-Dov et al., 2005; Hill, 1987; Kosztarab, 1997a
Takahashia japonica (Cockerell)	JP, US (CA)	L, S	No	No	Ben-Dov et al., 2005; CIAS, 2002; Shiraki, 1952a
Hemiptera: Diaspididae					
Aonidiella aurantii (Maskell)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; CABI, 2004
Aspidiotus destructor Signoret	JP, US (CA, FL, GA, HI)	F, L	No	Yes	Ben-Dov et al., 2005; Briggs, 1921; Korea Forest Service, 2004
Aspidiotus nerii Bouché	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Tomkins et al., 2000
Chrysomphalus aonidum (L.)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; CABI, 2004
Chrysomphalus bifasciculatus Ferris	JP, US	L	No	No	Ben-Dov & German, 2003; Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Diaspidiotus perniciosus (Comstock) (= *Aspidiotus perniciosus* Comstock, *Comstockaspis perniciosa* MacGillivray)	JP, US	F, S	No	Yes	Ben-Dov et al., 2005; Clausen, 1931; MAFF, 2005; Umeya & Okada, 2003
Hemiberlesia lataniae (Signoret)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Tomkins et al., 2000
Hemiberlesia rapax (Comstock)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Tomkins et al., 2000
Howardia biclavis (Comstock)	JP, US	S	No	No	Japanese Society of Applied Entomology & Zoology, 1987; Watson, 2005
Ischnaspis longirostris (Signoret)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Watson, 2005
Lepidosaphes sp.	JP	F	Yes	Yes	PestID, 2006
Lepidosaphes conchiformis (Gmelin) (= *L. conchiformioides* Borchsenius)	JP, US (CA, DC, MD, MO)	F, S	No	Yes	Ben-Dov et al., 2005; MAFF, 2005; Umeya & Okada, 2003
Lepidosaphes cupressi Borchsenius	JP	F, S	Yes	Yes[49]	MAFF, 2005; Umeya & Okada, 2003

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Lepidosaphes kuwacola Kuwana	JP	F, S	Yes	Yes[49]	MAFF, 2005; Umeya & Okada, 2003
Lepidosaphes tubulorum Ferris	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Lepidosaphes ulmi (L.)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; CABI, 2004
Lepidosaphes ussuriensis (Borchsenius)	JP	L, S	Yes	No	Ben-Dov et al., 2005; EPPO, 2003a
Lindingaspis rossi (Maskell) (= *Chrysomphalus rossi* [Maskell])	JP, US (CA, HI, NY)	L, S	No	No	Ben-Dov et al., 2005; Shiraki, 1952a; Watson, 2005
Lopholeucaspis japonica (Cockerell) (= *Leucaspis japonica* [Cockerell])	JP, US	S	No	No	Ben-Dov et al., 2005; MAFF, 2005; Shiraki, 1952a; Umeya & Okada, 2003
Melanaspis sulcata Ferris	JP	L, S[50]	Yes	No	Ben-Dov et al., 2005
Neopinnaspis harperi McKenzie	JP, US (CA, FL, GA, HI)	S	No	No	Ben-Dov et al., 2005; Nishida, 2002; Watson, 2005
Parlatoreopsis chinensis (Marlatt)	JP, US (CA, FL, MO)	S	No	No	Ben-Dov et al., 2005; MAFF, 2005; Umeya & Okada, 2003
Parlatoria pergandii Comstock	JP, US	F, L, S	No	Yes	Shiraki, 1952a; Watson, 2005
Parlatoria proteus (Curtis)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Hua, 2000; Kosztarab, 1996
Parlatoria theae Cockerell	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; Kosztarab, 1996
Pinnaspis buxi (Bouché)	JP, US	L, S	No	No	Ben-Dov et al., 2005; Tenbrink & Hara, 1992; Watson, 2005
Pinnaspis strachani (Cooley)	JP, US	F, L, S	No	Yes	Ben-Dov et al., 2005; CABI, 2004
Pseudaonidia sp.	JP	F	Yes	Yes	PestID, 2006
Pseudaonidia duplex (Cockerell)	JP, US	F, S	No	Yes	MAFF, 2005; PestID, 2006; Umeya & Okada, 2003; Watson, 2005
Pseudaonidia paeoniae (Cockerell)	JP, US	S	No	No	Ben-Dov et al., 2005; MAFF, 2005; Umeya & Okada, 2003
Pseudaonidia trilobitiformis (Green)	JP, US (FL)	F, L, S	No	Yes	Ben-Dov et al., 2005; Hill, 1983
Pseudaulacaspis sp.	JP	F, L, S	Yes	Yes	PestID, 2006
Pseudaulacaspis cockerelli (Cooley)	JP, US	L, S	No	No	Korea Forest Service, 2004; Tadauchi & Inoue, 1999; Watson, 2005

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Pseudaulacaspis pentagona (Targioni Tozzetti) (= *Aulacaspis pentagona* Cockerell, *Diaspis amygdali* Tryon, *Sasakiaspis pentagona* [Targioni Tozzetti])	JP, US	F, S	No	Yes	Ben-Dov et al., 2005; CABI, 2004; Clausen, 1931; Kim et al., 1997; Shiraki, 1952a
Pseudischnaspis sp.	JP	F	Yes	Yes	PestID, 2006
Hemiptera: Flatidae					
Geisha distinctissima (Walker)	JP	L	Yes	No	Hill, 1987; Obara et al., 2001
Hemiptera: Margarodidae					
Drosicha corpulenta (Kuwana) (= *Warajicoccus corpulentus* [Kuwana])	JP	L	Yes	No	Ben-Dov et al., 2005; Shiraki, 1952a; Xu et al., 1999
Icerya purchasi Maskell	JP, US	L, S	No	No	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Icerya seychellarum (Westwood)	JP	L, S	Yes	No	CABI, 2004; Hua, 2000
Kuwania bipora Borchsenius	JP	S[51]	Yes	No	Hua, 2000
Hemiptera: Membracidae					
Machaerotypus sibiricus (Lethierry)	JP	S	Yes	No	Korea Forest Service, 2004; OMNH, 2002; Tadauchi & Inoue, 1999
Hemiptera: Pseudococcidae					
Coccura suwakoensis (Kuwana & Toyoda)	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Crisicoccus azaleae (Tinsley)	JP, US (CA)	F, S	No	Yes	Ben-Dov et al., 2005; MAFF, 2003; Umeya & Okada, 2003
Crisicoccus matsumotoi (Siraiwa)	JP	F, L	Yes	Yes	Ben-Dov et al., 2005; Korea Forest Service, 2004; NIAST, 2001b; Park & Hong, 1992
Crisicoccus seruratus (Kanda)	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Dysmicoccus sp.	JP	F	Yes	Yes	PestID, 2006
Dysmicoccus brevipes (Cockerell)	JP, US (CA, FL, HI, LA)	F, L, S	No	Yes	Ben-Dov et al., 2005; CABI, 2004
Dysmicoccus wistariae (Green)	JP, US	F, S	No	Yes	Ben-Dov et al., 2005; MAFF, 2005; Umeya & Okada, 2003
Maconellicoccus hirsutus (Green)	JP, US (FL, HI, OK)	F, I, L, S	No	Yes	CABI, 2004; CERIS, 2005

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Phenacoccus pergandei Cockerell	JP	I, L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Planococcoides sp.	JP	F	Yes	Yes	PestID, 2006
Planococcus sp.	JP	F, S	Yes	Yes	PestID, 2006
Planococcus citri (Risso) (= *Pseudococcus citri* [Risso])	JP, US	F, I, L	No	Yes	CABI, 2004; Hill, 1987; Izhar, 1999; Shiraki, 1952a
Planococcus kraunhiae (Kuwana) (= *Pseudococcus kraunhiae* Shiraiwa)	JP, US (CA)	F, I, L	No	Yes	Ben-Dov et al., 2005; MAFF, 2005; Shiraki, 1952a; Umeya & Okada, 2003
Planococcus lilacinus (Cockerell)	JP	F	Yes	No[52]	PestID, 2006
Planococcus minor (Maskell)	JP	F	Yes	No[53]	PestID, 2006
Pseudococcus spp.	JP	F	Yes	Yes	Clausen, 1931
Pseudococcus comstocki (Kuwana)	JP, US	F, L, S	No	Yes	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Pseudococcus cryptus Hempel (= *P. citriculus* Green)	JP, US (HI)	F	Yes	Yes	Ben-Dov et al., 2005; George & Nissen, 2002
Pseudococcus elisae Borchsenius	JP	F	Yes	No[53]	PestID, 2006
Pseudococcus longispinus Targioni Tozzetti	JP, US	F, L, S	No	Yes	CABI, 2004
Trionymus pirr Takahashi	JP			No[54]	Shiraki, 1952a
Hemiptera: Ricaniidae					
Euricania ocellus (Walker) (= *E. fascialis* [Walker])	JP	L, S[55]	Yes	No	Korea Forest Service, 2004; Shiraki, 1952a
Orosanga japonicus (Melichar)	JP	L, S	Yes	No	Korea Forest Service, 2004; NILGS, 2005; Tadauchi & Inoue, 1999
Pochazia albomaculata (Uhler)	JP	S	Yes	No	Shiraki, 1952a; Tago, 2001
Pochazia fuscata F.	JP	L, S[55]	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987
Ricania japonica Melichar	JP	L	Yes	No	Dzhashi et al., 1982; Shiraki, 1952a
Ricania speculum (Walker)	JP	L, S	Yes	No	Hill, 1983; Hua, 2000
Heteroptera: Acanthosomatidae					
Acanthosoma denticaudum Jakovlev	JP	F[16]	Yes	No[17]	Korea Forest Service, 2004; Tadauchi & Inoue, 1999

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Heteroptera: Alydidae					
Leptocorisa chinensis (Dallas)	JP	I, L[18]	Yes	No	Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Riptortus clavatus (Thunberg)	JP	F	Yes	No[19]	MAFF, 2005; Umeya & Okada
Heteroptera: Coreidae					
Anacanthocoris striicornis (Scott)	JP	F	Yes	No[20]	Kawabe, 2005d; Korea Forest Service, 2004
Cletus punctiger (Dallas)	JP	Sd	Yes	No[21]	Korea Forest Service, 2004; Numata, 2004
Cletus schmidti Kiritshenko (= *C. rusticus* Stål)	JP	F, L	Yes	No[22]	Ding et al., 2004; Hua, 2000
Homoeocerus dilatatus Horváth	JP	F, Sd[23]	Yes	No[24]	Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Homoeocerus unipunctatus (Thunberg)	JP	F, Sd[23]	Yes	No[25]	Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Paradasynus spinosus Hsiao	JP	F	Yes	No[26]	Anonymous, 2005d; Hua, 2000
Plinachtus bicoloripes Scott	JP	F	Yes	No[27]	Doosan Corp., 2006a; Hua, 2000
Heteroptera: Lygaeidae					
Tropidothorax beloglowi (Jakovlev)	JP	F	Yes	No[28]	Japanese Society of Applied Entomology & Zoology, 1987; Kawabe, 2006b
Tropidothorax cruciger (Motschulsky)	JP	L	Yes	No	Kim et al., 2001; Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Tropidothorax sinensis (Reuter)	JP	F	Yes	No[29]	MAFF, 2005; Umeya & Okada, 2003
Heteroptera: Miridae					
Adelphocoris suturalis (Jakovlev)	JP	I	Yes	No	Hua, 2000; Wheeler, 2001
Apolygus spinolae (Meyer-Dür)	JP	I, L	Yes	No	Umeya & Okada, 2003; Wheeler, 2001
Heteroptera: Pentatomidae					
Dolycoris baccarum (L.)	JP	F, I, L	Yes	No[30]	CABI, 2004; Kim et al., 1997; Panizzi et al., 2000b
Eysarcoris ventralis (Westwood)	JP, US (HI)	S	Yes	No	Imura, 2003; Korea Forest Service, 2004; Nishida, 2002; Tadauchi & Inoue, 1999
Glaucias subpunctatus (Walker)	JP	F	Yes	No[31]	MAFF, 2005; Umeya & Okada, 2003

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Halyomorpha halys (Stål) (= *H. mista* Uhler)	JP, US (NJ, PA)	F	No	No[30]	Hoebeke & Carter, 2003; Kawada & Kitamura, 1983; MAFF, 2005; Mitchell, 2004; Polanin, 2004; Umeya & Okada, 2003
Homalogonia obtusa (Walker)	JP	F	Yes	No[32]	MAFF, 2005; Umeya & Okada, 2003
Lelia decempunctata (Motschulsky)	JP	F	Yes	No[33]	MAFF, 2005; Umeya & Okada
Menida violacea Motschulsky	JP	F	Yes	No[34]	MAFF, 2005; Umeya & Okada
Nezara antennata Scott	JP	F, L	Yes	No[35]	Hill, 1987; Li et al., 2001
Nezara viridula (L.)	JP, US	F	No	No[36]	CABI, 2004; Steven, 2001
Piezodorus hybneri (Gmelin)	JP	Sd	Yes	No[37]	Korea Forest Service, 2004; Panizzi et al., 2000b; Tadauchi & Inoue, 1999
Plautia crossota (Dallas)	JP	F	Yes	No[38]	MAFF, 2005; Umeya & Okada
Plautia stali Scott	JP, US (HI)	F	Yes	No[39]	Kang et al., 2003; Nishida, 2002; Panizzi et al., 2000b
Heteroptera: Plataspidae					
Megacopta punctatissima (Montandon)	JP	Sd	Yes	No[40]	Endo et al., 2002; Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Heteroptera: Rhopalidae					
Rhopalus maculatus (Fieber) (= *Aeschynteles maculatus* Fieber)	JP	Sd	Yes	No[41]	Hua, 2000; Ramos, 2006; Sweet, 2000
Heteroptera: Tingidae					
Stephanitis pyrioides (Scott)	JP, US	L	No	No	Froeschner, 1998; Neal & Schaefer, 2000; Takeno, 1998
Stephanitis takeyai Drake & Maa	JP, US	L	No	No	Froeschner, 1998; MAFF, 2005; Umeya & Okada, 2003
Hymenoptera: Tenthredinidae					
Caliroa cerasi (L.) (= *Eriocampoides limacina* Retzius)	JP, US	L	No	No	CABI, 2004; Clausen, 1931; MAFF, 2005; Umeya & Okada, 2003
Hymenoptera: Vespidae					
Macrovespa mandarina Smith	JP	F[56]	Yes	No[57]	Shiraki, 1952d
Polistes hebraeus F.	JP	I	Yes	No	Bulganin Mitra et al., 2004; Shiraki, 1952d

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Vespa crabro L. (= *Macrovespa crabro crabroniformis* Smith)	JP, US	F[56]	No	No[57]	Muesebeck et al., 1951; Shiraki, 1952d
Vespa japonica de Saussure	JP	F	Yes	No[57]	Chang, 1968; Shiraki, 1952d
Vespa xanthoptera Cameron	JP	I	Yes	No	Kakutani et al., 1989; Shiraki, 1952d
Lepidoptera: Arctiidae					
Aloa lactinea (Cramer) (= *Amsacta lactinea* Cramer)	JP	L	Yes	No	Hua, 2005; Mehra & Sah, 1977
Hyphantria cunea (Drury)	JP, US	L	No	No	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Lemyra imparilis (Butler) (= *Diacrisia imparilis* Butler, *Spilarctia imparilis* Butler, *Spilosoma imparilis* [Butler])	JP	L	Yes	No	Clausen, 1931; Korea Forest Service, 2004; Shiraki, 1952c; Zhang, 1994
Spilarctia sp.	JP	L[58]	Yes	No	Shiraki, 1952c
Spilarctia flammeola Moore (= *Spilosoma flammeolum* [Moore])	JP	L	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987; Kawabe, 2005i; Shiraki, 1952c
Spilarctia infernalis Butler	JP	L[58]	Yes	No	Shiraki, 1952c
Spilarctia subcarnea (Walker)	JP	L	Yes	No	Lin, 2005; Shiraki, 1952c
Spilosoma lubricipeda (L.) (= *Spilarctia lubricipeda* (L.))	JP	L	Yes	No	Shiraki, 1952c; Smolders & van der Velde, 1996; Zhang, 1994
Spilosoma punctaria (Stoll)	JP	L	Yes	No	AFFA, 2004; NILGS, 2005
Lepidoptera: Bombycidae					
Bombyx mandarina (Moore)	JP	L	Yes	No	Korea Forest Service, 2004; Tadauchi & Inoue, 1999; Xia et al., 1995
Lepidoptera: Cossidae					
Cossus jezoensis Matsumura	JP	S	Yes	No	FFPRI, 2003; Japanese Society of Applied Entomology & Zoology, 1987
Holcocerus vicarius Walker	JP	S	Yes	No	NFCF, 2002; Shiraki, 1952b
Zeuzera coffeae Nietner	JP	S	Yes	No	CABI, 2004; Hua, 2005
Zeuzera leuconotum Butler	JP	S	Yes	No	Kawabe, 2005j; Shiraki, 1952b
Zeuzera multistrigata Moore	JP	L, S	Yes	No	MAFF, 2005; Umeya & Okada, 2003

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Lepidoptera: Geometridae					
Alsophila membranaria Christoph	JP	L[59]	Yes	No	Shiraki, 1952c
Ascotis selenaria (Denis & Schiffermüller)	JP	L	Yes	No	Hua, 2005; Kim et al., 1997
Culcula panterinaria (Bremer & Grey)	JP	L	Yes	No	Hill, 1987; Hua, 2005
Ectropis excellens (Butler)	JP	L	Yes	No	Hua, 2005; Kim et al., 1997
Inurois fletcheri Inoue	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Menophra retractaria Moore	JP	L[59]	Yes	No	Robinson et al., 2005
Menophra senilis (Butler)	JP	L[59]	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987
Ophthalmitis albosignaria (Bremer & Grey)	JP	L	Yes	No	Doosan Corp., 2006e; Hua, 2005
Ophthalmodes albosignaria (Bremer & Grey)	JP	L	Yes	No	Hua, 2005; Kawabe, 2006c
Parapercnia giraffata (Guenée) (= *Percnia giraffata* (Guenée))	JP	L	Yes	No	Hill, 1987; Scoble, 1999
Percnia albinigrata Warren	JP	L[59]	Yes	No	Hua, 2005
Lepidoptera: Gracillariidae					
Cuphodes diospyrosella Issiki	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Lepidoptera: Hepialidae					
Endoclita excrescens (Butler) (= *Phassus excrescens* Butler)	JP	F, L, S	Yes	No[60]	CABI, 2004; Kan et al., 2002; Kim et al., 1997; Shiraki, 1952b
Endoclyta sinensis (Moore)	JP	R, S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Palpifer sexnotatus (Moore)	JP	S	Yes	No	Chu & Wang, 1985; Hua, 2005
Phassus signifer Walker	JP	S	Yes	No	Chu & Wang, 1985; Hua, 2005
Lepidoptera: Lasiocampidae					
Gastropacha orientalis Sheljuzhko	JP	L, S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Malacosoma neustria (L.)	JP	L	Yes	No	CABI, 2004; Hua, 2005
Lepidoptera: Lecithoceridae					

Pest	**Geographic Distribution**[1]	**Plant Part Affected**[2]	**Quarantine Pest**[3]	**Likely to Follow Pathway**	**References**
Scythropiodes leucostola (Meyrick) (= *Odites leucostola* (Meyrick))	JP	L	Yes	No	MAFF, 2005; Park & Wu, 1997; Umeya & Okada, 2003
Scythropiodes lividula (Meyrick) (= *Odites lividula* Meyrick)	JP	L	Yes	No	MAFF, 2005; Park & Wu, 1997; Umeya & Okada, 2003
Lepidoptera: Limacodidae					
Cnidocampa flavescens (Walker) (= *Monema flavescens* Walker)	JP	L, S	Yes	No	Clausen, 1931; Hua, 2005; MAFF, 2005; Umeya & Okada, 2003
Microleon longipalpis Butler	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Narosa edoensis Kawada	JP	L[61]	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987
Narosoideus flavidorsalis (Staudinger) (= *Miresa flavidorsalis* Staudinger, *M. inornata* Walker)	JP	L, S	Yes	No	Clausen, 1931; Holloway, 1986; MAFF, 2005; Shiraki, 1952b; Umeya & Okada, 2003
Parasa consocia (Walker) (= *Latoia consocia* Walker)	JP	L	Yes	No	Hill, 1987; MAFF, 2005; Umeya & Okada, 2003
Parasa lepida (Cramer)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Parasa sericea Butler	JP	L[62]	Yes	No	Hua, 2005
Parasa sinica Moore (= *Latoia sinica* [Moore])	JP	L	Yes	No	CABI, 2004; Japanese Society of Applied Entomology & Zoology, 1987; MAFF, 2005; Umeya & Okada, 2003
Phlossa conjuncta (Walker) (= *Iragoides conjuncta* (Walker))	JP	L	Yes	No	Hua, 2005; Robinson et al., 2001; Zhang, 1994
Phrixolepia sericea Butler	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Scopelodes contracta Walker	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Scopelodes venosa Walker	JP	L	Yes	No	Clausen, 1931; Nair, 1975
Lepidoptera: Lycaenidae					
Spindasis takanonis (Matsumura)	JP	L	Yes	No	Hua, 2005; Milligan, 1974
Lepidoptera: Lymantriidae					
Cifuna locuples Walker	JP	L	Yes	No	Gai & Cui, 1997; Hua, 2005

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Euproctis chrysorrhoea (L.)	JP, US	L	No	No	CABI, 2004; Shiraki, 1952c
Euproctis flava (Bremer)	JP	L	Yes	No	Hua, 2005; Robinson et al., 2001
Euproctis pseudoconspersa (Strand) (= *E. conspersa* Butler)	JP	L	Yes	No	CABI, 2004; Hua, 2005; Robinson et al., 2005
Euproctis subflava (Bremer)	JP	L	Yes	No	Ahn et al., 1989; Shiraki, 1952c
Lymantria dispar (L.) (= *L. japonica* [Motschulsky])	JP, US	L, S	Yes	No	Kitagawa & Glucina, 1984; MAFF, 2005; Pintureau, 1981; Umeya & Okada, 2003
Lymantria mathura Moore	JP	I, L	Yes	No	AFFA, 2004; CABI, 2004
Lymantria xylina Swinhoe	JP	L	Yes	No	Hua, 2005; Shen et al., 2003
Orgyia thyellina Butler	JP	F, L, S	Yes	No[63]	MAFF, 2005; Umeya & Okada, 2003
Sphrageidus similis (Fuessly) (= *Euproctis similis* (Fuessly))	JP	L	Yes	No	CABI, 2004; Korea Forest Service, 2004; MAFF, 2005; Umeya & Okada, 2003
Lepidoptera: Lyonetiidae					
Bucculatrix sp.	JP	L[64]	Yes	No	Shiraki, 1952b
Lepidoptera: Noctuidae					
Adris tyrannus (= *A. amurensis* [Staudinger], *Eudocima*) *tyrannus* [Guenée])	JP	F	Yes	No[65]	Heppner & Inoue, 1992; Kitagawa & Glucina, 1984; MAFF, 2005; Shiraki, 1952c; Umeya & Okada, 2003; Zhang, 1994
Artena dotata F.	JP	F	Yes	No[66]	AFFA, 2004; Yoon & Lee, 1974
Blenina senex (Butler)	JP	L	Yes	No	Kawabe, 2005k; Shiraki, 1952c
Catocala sp.	JP	L	Yes	No	Borror et al., 1989; Shiraki, 1952c
Catocala nupta (L.)	JP	L	Yes	No	Hua, 2005; Moya, 2006
Eudocima fullonia (Clerck)	JP, US (HI)	F	Yes	No[65]	CABI, 2004
Helicoverpa armigera (Hübner)	JP	F	Yes	No[60]	CABI, 2004; Kim et al., 1997
Helicoverpa zea (Boddie)	JP, US	F, L	No	No[67]	CABI, 2004; Hill, 1987; Hua, 2005
Hypocala deflorata (F.)	JP, US (HI)	L	Yes	No	Kim et al., 1997; Nishida, 2002; Umeya & Okada, 2003
Hypocala rostrata (F.)	JP	L	Yes	No	Gyotoku, 1971; Thakur et al., 1986

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Hypocala subsatura Guenée	JP	L	Yes	No	Oku & Kobayashi, 1978; Robinson et al., 2001
Hypocala violacea Butler	JP	L	Yes	No	Hua, 2005; Robinson et al., 2001
Macdunnoughia purissima (Butler)	JP	L	Yes	No	Hua, 2005; Kim et al., 1997
Mamestra brassicae (L.)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Oraesia emarginata (F.)	JP	F	Yes	No[65]	MAFF, 2005; Umeya & Okada, 2003
Oraesia excavata (Butler)	JP	F	Yes	No[65]	MAFF, 2005; Umeya & Okada, 2003
Spodoptera litura (F.)	JP	L	Yes	No	Kim et al., 1997; Umeya & Okada, 2003
Thyas juno (Dalman) (= *Lagoptera juno* (Dalman))	JP	F	Yes	No[65]	AFFA, 2004; Zhang, 1994
Triaena intermedia (Warren)	JP	L	Yes	No	Ahn et al., 1989; Umeya & Okada, 2003
Viminia rumicis (L.)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Xylena fumosa (Butler)	JP	L	Yes	No	Kawabe, 2005l; Umeya & Okada, 2003
Lepidoptera: Nymphalidae					
Nymphalis xanthomelas (Esper) (= *Vanessa xanthomeles japonica* Stichel)	JP	L	Yes	No	KCFP, 1999; Savela, 2005; Shiraki, 1952b
Lepidoptera: Oecophoridae					
Protobathra leucosta Meyrick	JP	I, L, S[68]	Yes	No	Shiraki, 1952b
Stathmopoda masinissa Meyrick (= *Kakivoria flavofasciata* Nagano)	JP	F, L, S	Yes	Yes	Clausen, 1931; MAFF, 2005; Umeya & Okada, 2003; Zhang, 1994
Lepidoptera: Psychidae					
Bambalina sp.	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Canephora asiatica Staudinger	JP	L	Yes	No	Nakayama et al., 1973; Shiraki, 1952b
Canephora unicolor Hufnagel	JP	L	Yes	No	Robinson et al., 2001; Shiraki, 1952b
Chalioides kondonis Matsumura	JP	L	Yes	No	HAIN, 2005; Shiraki, 1952b

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Eumeta japonica (Heylaerts) (= *Clania variegata* Snellen, *Cryptothelea japonica* Heylaerts)	JP	F, L	Yes	No[69]	MAFF, 2005; Nishida, 1983; Shiraki, 1952b; Umeya & Okada, 2003
Eumeta minuscula (Butler) (= *Clania minuscula* Butler, *Cryptothelea minuscula* Butler)	JP	F, L	Yes	No[70]	CABI, 2004; MAFF, 2005; Ono, 1937; Shiraki, 1952b; Umeya & Okada, 2003
Eumeta pryeri (Leech) (= *Clania formosicola* Strand)	JP	L	Yes	No	Heppner & Inoue, 1992; Kitagawa & Glucina, 1984; Wu, 1977
Plateumeta aurea Butler	JP	L	Yes	No	Kuwayama, 1953; Shiraki, 1952b
Psyche casta (Pallas)	JP, US	L	No	No	Carter, 1984; CU, 2002; Hill, 1994; VINS, 2005; Zhang, 1994
Psyche niphonica (Hori)	JP	L[71]	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987
Lepidoptera: Pyralidae					
Acrobasis tokiella (Ragonot) (= *Eurhodope tokiella* Ragonot)	JP	L	Yes	No	Anonymous, 2005c; Doosan Corp., 2006f; Shiraki, 1952b
Calguia defiguralis Walker	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Conogethes (= *Dichocrocis*) *punctiferalis* (Guenée)	JP	F	Yes	Yes	CABI, 2004; MAFF, 2005; Shiraki, 1952b; Umeya & Okada, 2003
Crambus sp.	JP	F	Yes	Yes	PestID, 2006
Euzophera batangensis Caradja	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Pleuroptya chlorophanta (Butler) (= *Dichocrocis chlorophanta* Butler)	JP	L	Yes	No	Kuwayama, 1953; Robinson et al., 2005; Shiraki, 1952b
Samaria ardentella Ragonot	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Teliphasa elegans (Butler)	JP	L	Yes	No	Japanese Society of Applied Entomology & Zoology, 1987; NIAST, 2006

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Lepidoptera: Saturniidae					
Saturnia japonica (Moore) (= *Caligula japonica* Moore, *Dictyoploca japonica* Butler)	JP	L	Yes	No	He et al., 1999; Peigler, 1994; Shiraki, 1952c; Umeya & Okada, 2003; Zhang, 1994
Lepidoptera: Sesiidae					
Sannina uroceriformis Walker	JP, US	R, S	No	No	Burns & Honkala, 1990; Clausen, 1931; Hill, 1987
Synanthedon hector (Butler) (= *Conopia hector* Butler)	JP	S	Yes	No	Kang et al., 1991; Robinson et al., 2005; Zhang, 1994
Synanthedon tenuis (Butler)	JP	S	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Lepidoptera: Tortricidae					
Adoxophyes honmai Yasuda	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Adoxophyes orana (Fischer von Röslerstamm)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Archips audax Razowski	JP	L	Yes	No	Meijerman & Ulenberg, 2000; Umeya & Okada, 2003
Archips breviplicanus Walsingham	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Archips fuscocupreanus Walsingham	JP, US	L	No	No	MAFF, 2005; Maier, 2003; Robinson et al., 2005; Umeya & Okada, 2003
Archips ingentanus (Christoph) (= *Cacoecia ingentana* Christoph)	JP	L	Yes	No	Kuwayama, 1953; Robinson et al., 2005; Shiraki, 1952b; Zhang, 1994
Archips nigricaudanus (Walsingham)	JP	L	Yes	No	Aoki, 2005; Robinson et al., 2005
Cacoecia breviplicana Walsingham	JP	L	Yes	No	Kuwayama, 1953; Shiraki, 1952b
Cacoecia circumclusana (Christoph)	JP	L?	Yes	No[72]	Shiraki, 1952b
Cerace guttana Felder	JP	L[73]	Yes	No	Shiraki, 1952b
Choristoneura diversana (Hübner)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Cnephasia stephensiana (Doubleday) (= *C. cinereipalpana* Razowski)	JP	I, L	Yes	No	Meijerman & Ulenberg, 2000; Robinson et al., 2005
Grapholita molesta (Busck)	JP, US	F, S	No	Yes	CABI, 2004; Robinson et al., 2005

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Homona coffearia (Nietner)	JP	F, I, L	Yes	No[74]	CABI, 2004; Meijerman & Ulenberg, 2000; Robinson et al., 2005
Homona magnanima (Diakonoff)	JP	F, L	Yes	No[75]	Kim et al., 1997; MAFF, 2005; Umeya & Okada, 2003
Homonopsis illotana (Kennel)	JP	F	Yes	Yes	MAFF, 2005; Umeya & Okada, 2003
Hoshinoa adumbratana (Walsingham)	JP	L[76]	Yes	No	Hua, 2005
Hoshinoa (= *Choristoneura*) *longicellana* (Walsingham)	JP	I, L	Yes	No	AFFA, 2004; MAFF, 2005; Umeya & Okada, 2003; Zhang, 1994
Lobesia aeolopa Meyrick	JP	F, I, L	Yes	Yes	Robinson et al., 2001, 2005; van der Geest et al., 1991
Pandemis heparana (Denis & Schiffermüller)	JP, US (OR, WA)	L	No	No	LaGasa et al., 2000; MAFF, 2005; ODA, 2005; Umeya & Okada, 2003
Platynota sp.	JP	F	Yes	Yes	PestID, 2006
Ptycholoma lecheana (L.)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Sparganothis matsudai Yasuda	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Sparganothis pilleriana (Denis & Schiffermüller)	JP	L	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Orthoptera: Acrididae					
Atractomorpha sinensis Bolivar (= *A. ambigua* Bolivar)	JP, US (HI)	L	Yes	No	Fullaway & Krauss, 1945; Hua, 2000; Nishida, 2002
Catantops pinguis (Stål)	JP	L	Yes	No	Chiaromonte, 1931; Hua, 2000
Chondracris rosea (De Geer)	JP	L	Yes	No	Hua, 2000; Sun et al., 2006
Orthoptera: Gryllidae					
Truljalia hibinonis (Matsumura) (= *Madasumma hibinonis* Matsumura)	JP	F, S	Yes	No[77]	MAFF, 2005; Shiraki, 1952a; Umeya & Okada, 2003
Orthoptera: Tettigoniidae					
Conocephalus gladiatus (Redtenbacher)	JP	L	Yes	No	Hua, 2000; Shen, 1981
Conocephalus maculatus (Le Guillou)	JP	L[78]	Yes	No	Hua, 2000

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Holochlora japonica Brunner von Watternwyl	JP, US (HI)	L	Yes	No	Kawabe, 2005m; Korea Forest Service, 2004; Nishida, 2002
Mecopoda elongata (L.)	JP	L	Yes	No	Hill, 1983; Korea Forest Service, 2004; Tadauchi & Inoue, 1999
Thysanoptera: Phlaeothripidae					
Haplothrips sp.	JP	I[79]	Yes	No	Miyazaki & Kudo, 1988
Haplothrips chinensis Priesner	JP	I	Yes	No	Miyazaki & Kudo, 1988; Wang, 1997
Ponticulothrips sp.	JP	F, L[80]	Yes	Yes	Miyazaki & Kudo, 1988
Ponticulothrips diospyrosi Haga & Okajima	JP	F, L	Yes	Yes	MAFF, 2005; Umeya & Okada, 2003
Thysanoptera: Thripidae					
Dendrothrips minowai Priesner	JP	L	Yes	No	Miyazaki & Kudo, 1988; Mound & Kibby, 1998
Frankliniella intonsa (Trybom)	JP, US (WA)	F, I	No	Yes	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Frankliniella occidentalis (Pergande)	JP, US	F, I, L	No	Yes	CABI, 2004; Toda & Komazaki, 2002
Heliothrips haemorrhoidalis (Bouché)	JP, US	F, L	No	Yes	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Megalurothrips distalis (Karny)	JP	I, L	Yes	No	CABI, 2004; Miyazaki & Kudo, 1988
Scirtothrips dorsalis Hood	JP, US (FL, HI)	F, I	Yes	Yes	MAFF, 2005; Nishida, 2002; NPB, 2005; Umeya & Okada, 2003
Scolothrips takahashii Priesner	JP	None[81]	Yes	No	Gotoh et al., 2004; Miyazaki & Kudo, 1988
Selenothrips rubrocinctus (Giard)	JP, US (FL, HI)	L	No	No	CABI, 2004; Sanchez-Soto & Nakano, 2002
Thrips coloratus Schmutz	JP	F, I	Yes	Yes	Miyazaki & Kudo, 1988; Mound & Kibby, 1998; Teramoto et al., 2001
Thrips hawaiiensis (Morgan)	JP, US	F, I, L	No	Yes	CABI, 2004; MAFF, 2005; Umeya & Okada, 2003
Thrips setosus Moulton	JP	L	Yes	No	Miyazaki & Kudo, 1988; Murai, 2001
Thrips tabaci Lindeman	JP, US	F	No	Yes	CABI, 2004; Murai, 2004

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
BACTERIA					
Pseudomonas syringae pv. *syringae* van Hall (Pseudomonadales)	JP, US	L, S	No	No	CABI, 2004; Kitagawa & Glucina, 1984
Rhizobium radiobacter (Beijerinck & van Delden) Young et al. (Rhizobiales) (= *Agrobacterium tumefaciens* (Smith & Townsend) Conn)	JP, US	R, S	No	No	CABI, 2004; Kitagawa & Glucina, 1984
Rhizobium rhizogenes (Riker et al.) Young et al. (Rhizobiales)	JP, US	R, S	No	No	CABI, 2004
FUNGI					
Adisciso kaki Yamamoto et al. (Ascomycetes: Amphisphaeriaceae)	JP	C, F, L, S	Yes	Yes	Yamamoto et al., 2012
Alternaria alternata (Fries) Keissler (= *A. tenuis* Nees) (Ascomycetes: Pleosporales)	JP, US	F, L	No	Yes	CABI, 2004; Farr et al., 2005
Armillaria mellea (Vahl) P. Kumm. (Basidiomycetes: Agaricales)	JP, US	R, S	No	No	CABI, 2004; Zakaullah et al., 1987
Armillaria tabescens (Scop.) Dennis, Orton & Hora (= *Clitocybe tabescens* [Scop.] Bres.) (Basidiomycetes: Agaricales)	JP, US	R	No	No	Farr et al., 2005; Weber, 1973
Asterina aspidii (Henn.) Theiss. (Ascomycetes)	JP, US (HI)	L[82]	Yes	No	CTAHR, 2005; Farr et al., 2005
Aureobasidium pullulans (de Bary) Arnaud (Ascomycetes: Dothideales)	JP, US	F, L, S	No	Yes	AFFA, 2004; Farr et al., 2005
Botryosphaeria dothidea (Moug.) Ces. & de Not. (Ascomycetes: Dothideales)	JP, US	S	No	No	Farr et al., 2005; Wellman, 1977

Pest	**Geographic Distribution**[1]	**Plant Part Affected**[2]	**Quarantine Pest**[3]	**Likely to Follow Pathway**	**References**
Botrytis cinerea Pers.: Fr. (= *B. diospyri* Brizi) (Ascomycetes: Helotiales)	JP, US	F, L, S	No	Yes	Borzini, 1936; Farr et al., 2005; Watson, 1971
Calonectria kyotensis Terashita (Ascomycetes: Hypocreales) (= *Cylindrocladium floridanum* Sobers & C.P. Seym.)	JP, US	L, R, S	No	No	Farr et al., 2005; Kirk, 2004g
Capnodium fuliginodes Rehm (= *Capnophaeum fuliginoides* [Rehm] Yamamoto) (Ascomycetes: Capnodiales)	JP	F	Yes	No[83]	AFFA, 2004; Kirk, 2004a
Cercospora fuliginosa Ellis & Kellerman (Ascomycetes: Mycosphaerellales)	JP, US (CA, WI)	L	No	No	AFFA, 2004; Farr et al., 2005
Cercospora kaki Ellis & Everhart (= *Pseudocercospora kaki* Goh & W.H. Hsieh) (Ascomycetes: Mycosphaerellales)	JP, US	C, L	No	Yes	Cook, 1975; Farr et al., 2005
Cercospora kakivora Hara (Ascomycetes: Mycosphaerellales)	JP	L	Yes	No	Hara, 1929; Cook, 1975; Farr et al., 2005
Cladosporium sp. (Ascomycetes: Mycosphaerellales)	JP	F	Yes	Yes	PestID, 2006
Cladosporium cladosporioides (Fresen.) G.A. de Vries (Ascomycetes: Mycosphaerellales)	JP, US	F, L, S	No	Yes	Farr et al., 2005; Ouchi et al., 1976
Cladosporium herbarum (Pers.) Link (Ascomycetes: Mycosphaerellales)	JP, US	F, L, S	No	Yes	Farr et al., 2005; Ouchi et al., 1976

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Colletotrichum horii B. Weir & P.R. Johnst. (= *Gloeosporium kaki* S. Ito) (Ascomycetes: Helotiales)	JP	F, S	Yes	Yes	Weir and Johnston, 2010; Tous & Ferguson, 1996; Kitagawa & Glucina, 1984
Cryptosporiopsis kaki (Hara) Weindlmayr (= *Myxosporium kaki* Hara) (Ascomycetes: Helotiales)	JP	F, S	Yes	Yes	Watson, 1971; Weindlmayr, 1964
Diaporthe eres Nitschke (Ascomycetes: Diaporthales)	JP, US	F, I, L, S	No	Yes	Farr et al., 2005
Diaporthe perniciosa Marchal & É.J. Marchal (= *Phomopsis mali* [Schulzer & Sacc.] Roberge) (Ascomycetes: Diaporthales)	JP, US	F, L, S	No	Yes	Farr et al., 2005; Koganezawa & Sakuma, 1980
Elsinoë diospyri Bitanc. & Jenkins (Ascomycetes: Myriangiales)	JP, US (FL)	F, L	No	Yes	Farr et al., 2005
Fusarium moniliforme Sheldon (Ascomycetes: Hypocreales)	JP, US	F	No	Yes	Akiyama et al., 2000; Farr et al., 2005; Kumar & Rana, 1987
Fusarium oxysporum Schltdl.:Fr. (Ascomycetes: Hypocreales)	JP, US	F, L, R, S	No	Yes	AFFA, 2004; Farr et al., 2005
Fusicladium levieri Magnus (= *F. diospyri* Chona et al., *F. kaki* Hori & Yoshino, *F. diospyrae* Hori and Yosh.) (Ascomycetes: Pleosporales)	JP, US	L	No	No	Farr et al., 2005
Glomerella cingulata (Stonem.) Spauld. & Schrenk (Ascomycetes) (anamorph: *Colletotrichum gloeosporioides* [Penz.] Sacc.)	JP, US	F, I, L, S, Sd	No	Yes	CABI, 2004; Farr et al., 2005

Pest	**Geographic Distribution[1]**	**Plant Part Affected[2]**	**Quaran-tine Pest[3]**	**Likely to Follow Pathway**	**References**
Grifola frondosa (Dickson:Fr.) Gray (Basidiomycetes: Polyporales)	JP, US	R	No	No	Farr et al., 2005; Mizuno & Zhuang, 1995
Guignardia sp. (Ascomycetes: Dothideales)	JP	F	Yes	Yes	PestID, 2006
Helicobasidium mompa Tanaka (Ustilaginomycetes)	JP	R	Yes	No	Farr et al., 2005
Lasiodiplodia theobromae (Pat.) Griffiths & Maubl. (Ascomycetes: Dothideales) (anamorph: *Botryodiplodia theobromae* Pat.)	JP, US	F, I, L, R, S, Sd	No	Yes	CABI, 2004; Cia et al., 2003; Farr et al., 2005
Macrophoma kaki Hori (Ascomycetes: Dothideales)	JP	L	Yes	No	Watson, 1971; Kishi, 1998
Macrophomina phaseolina (Tassi) Goidanich (Ascomycetes)	JP, US	R	No	No	AFFA, 2004; Farr et al., 2005
Microxyphium sp. (Ascomycetes)	JP	L[84]	Yes	No	Kitagawa & Glucina, 1984
Monilinia fructigena Honey (= *Monilia fructigena* Schumach.) (Ascomycetes: Helotiales)	JP	F, I, L, S	Yes	No[85]	CABI, 2004; Kirk, 2004c; Rekhviashvili, 1975
Monilinia laxa (Aderh. & Ruhland) Honey (Ascomycetes: Helotiales)	JP, US	F	No	No[86]	CABI, 2004; Sharma & Kaul, 1989
Monochaetia diospyri Yoshii (Ascomycetes)	JP	L	Yes	No	Farr et al., 2005
Mycosphaerella nawae (Sydow) Hiura & Ikata (Ascomycetes: Mycosphaerellales)	JP	L, C	Yes	Yes	CABI, 2004; Kwon et al., 1998; Kishi, 1998; Berbegal et al., 2010; Farr and Rossman, 2012
Nectria haematococca (Wollenw.) Gerlach (anamorph: *Fusarium solani* [Martius] Sacc.) (Ascomycetes: Hypocreales)	JP, US	R, S	No	No	AFFA, 2004; CABI, 2004; Farr et al., 2005; Takahashi et al., 1999

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Neofusicoccum parvum (Pennycook and Samuels) Crous, Slippers and A.J.L. Phillips (≡ *Fusicoccum parvum* Pennycook & Samuels, Alternate State (Teleomorph): *Botryosphaeria parva* Pennycook & Samuels)	JP, US	F	No	Yes	Farr and Rossman, 2012; Manaaki-Whenua, 2001-2004
Ophiostoma piliferum (Fr.:Fr.) Syd. & P. Syd. (Ascomycetes: Ophiostomatales) (= *Ceratocystis pilifera* [Fr.:Fr.] Moreau, *Ceratostomella pilifera* [Fr.:Fr.] Winter)	JP, US	S	No	No	Farr et al., 2005; Weber, 1973
Pellicularia koleroga Cooke (Basidiomycetes: Ceratobasidiales)	JP, US	L, S	No	No	CMI, 1976; Farr et al., 2005; Wellman, 1977
Penicillium expansum Link (Ascomycetes: Eurotiales)	JP, US	F, L	No	Yes	AFFA, 2004; CABI, 2004; Farr et al., 2005
Pestalotia diospyri Syd. & P. Syd. (=*P. kaki* Ellis & Everhart; *Pestalotiopsis diospyri* [Syd. & P. Syd.] Rib. Souza) (Ascomycetes: Xylariales)	JP	L, F, C	Yes	Yes	Kirk, 2004e; Yasuda et al., 2003; Blanco et al., 2008; Kwon et al., 2004; Lee, 1994; NIAS Genebank, 2012; Kim et al. 1997
Pestalotia longiaristata Maubl. (Ascomycetes: Xylariales)	JP, US (FL)	L	No	No	Farr et al., 2005
Pestalotiopsis sp. (Ascomycetes: Xylariales)	JP	F	Yes	Yes	PestID, 2006
Pestalotiopsis acaciae (Thümen) Yokoyama & Kaneko (Ascomycetes: Xylariales)	JP	C, L	Yes	Yes	Yasuda et al., 2003

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway	References
Pestalotiopsis breviseta (Sacc.) Steyaert (= *Pestalotia breviseta* Sacc.) (Ascomycetes: Xylariales)	JP, US (HI, VA)	F, L	No	Yes	Farr et al., 2005; Kirk, 2004d; Yasuda et al., 2003
Pestalotiopsis crassiuscula Steyaert (Ascomycetes: Xylariales)	JP	C, L	Yes	Yes	Yasuda et al., 2003
Pestalotiopsis foedans (Sacc. & Ellis) Steyaert (Ascomycetes: Xylariales)	JP, US (NJ)	F	No	Yes	Farr et al., 2005; Yasuda et al., 2003
Pestalotiopsis glandicola (Castagne) Steyaert (Ascomycetes: Xylariales)	JP, US (FL)	C, L	No	Yes	Farr et al., 2005; Yasuda et al., 2003
Pestalotiopsis guepinii (Desm.) Steyaert (Ascomycetes: Xylariales)	JP, US (FL)	L	No	No	Farr et al., 2005; Watanabe et al., 1998
Pestalotiopsis longiseta (Spegazzini) Dai & Kobayashi (Ascomycetes: Xylariales)	JP, US	C, L	No	Yes	Dai et al., 1990; Yasuda et al., 2003
Pestalotiopsis theae (Sawada) Steyaert (Ascomycetes: Xylariales)	JP	L	Yes	No	Chang et al., 1999; Farr et al., 2005
Phellinus noxius (Corner) G. Cunn. (Basidiomycetes: Hymenochaetales)	JP	R, S	Yes	No	CABI, 2004; Farr et al., 2005
Phoma kakivora Hara (Ascomycetes: Pleosporales)	JP	C, F, L	Yes	Yes	Cook, 1975; Yamada, 1966
Phoma loti Cooke (Ascomycetes: Pleosporales)	JP	S, F	Yes	Yes	Kishi, 1998; Farr and Rossman, 2012; AFFA, 2004; Saccardo, 1892
Phomopsis sp. (Ascomycetes: Diaporthales)	JP	F, S	Yes	Yes	Kitagawa & Glucina, 1984; PestID, 2006
Phomopsis rojana Gaja (= *P. roiana* L. Gaia) (Ascomycetes: Diaporthales)	JP	S	Yes	No	AFFA, 2004; Kirk, 2004f; Uecker, 1988

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Phyllactinia guttata (Wallr.) Lév. (= *P. suffulta* [Rebent.] Sacc., *P. corylea* [Pers.] P. Karst.) (Ascomycetes: Erysiphales)	JP, US	F, L	No	No[87]	CABI, 2004; Farr et al., 2005; PestID, 2006
Phyllactinia kakicola Sawada (Ascomycetes: Erysiphales)	JP	L	Yes	No	Cook, 1975; Farr and Rossman,2012; Watson, 1971
Phyllosticta sp. (Ascomycetes: Dothideales)	JP	F, L	Yes	Yes	PestID, 2006
Physalospora kaki Hara (Ascomycetes: Xylariales)	JP	L	Yes	No	AFFA, 2004; MAF, 2006
Phytophthora cactorum (Lebert & Cohn) Schröter (Oomycetes: Pythiales)	JP, US	F, L, R, S, Sd	No	Yes	CABI, 2004; Farr et al., 2005
Phytophthora capsici Leonian (Oomycetes: Pythiales)	JP, US	F, L, R, S	No	Yes	CABI, 2004; Farr et al., 2005
Phytophthora citrophthora (R.H. Sm. & E. Sm.) Leonian (Oomycetes: Pythiales)	JP, US	F, L, R, S, Sd	No	Yes	CABI, 2004; Farr et al., 2005
Phytophthora palmivora (E. J. Butler) E. J. Butler (Oomycetes: Pythiales)	JP, US (AZ, CA, FL, HI)	F	No	No[89]	Farr et al., 2005; Michailides, 2003
Podosphaera clandestina (Wallr.) Lév. (= *P. oxyacanthae* [DC.] de Bary) (Ascomycetes: Erysiphales)	JP, US	F, L	No	Yes	Farr et al., 2005
Pseudocercospora diospyri-morrisianae Sawada ex Goh & W.H. Hsieh (Ascomycetes: Mycosphaerellales) (= *Cercospora diospyri-morrisianae* Sawada, *Cylindrosporium kaki* Syd.)	JP	L	Yes	No	Farr and Rossman, 2012;Watson, 1971
Rhizoctonia solani J.G. Kühn (Basidiomycetes: Polyporales)	JP, US	F, L, R, S	No	Yes	Farr et al., 2005

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Rhizopus stolonifer (Ehrenb.) Lind (= *R. nigricans* Ehrenb.) (Zygomycetes: Mucorales)	JP, US	F, I	No	Yes	CABI, 2004; Cia et al., 2003; Farr et al., 2005; Wellman, 1977
Rosellinia necatrix Prillieux (Ascomycetes: Xylariales)	JP, US	R	No	No	CABI, 2004; Sztejnberg & Jabareen, 1985
Schizothyrium pomi (Mont.) v. Arx (Ascomycetes: Microthyriales) (= *Leptothyrium pomi* [Mont. & Fr.] Sacc., *Zygophiala jamaicensis* Mason)	JP, US	F, L	No	Yes	Farr et al., 2005; Nasu & Kunoh, 1987; Wellman, 1977
Sclerotinia sclerotiorum (Lib.) de Bary (Ascomycetes: Helotiales)	JP, US	F, L, R, S	No	Yes	AFFA, 2004; Farr et al., 2005
Scorias communis Yamamoto (Ascomycetes: Capnodiales)	JP	F, L, S[91]	Yes	No[83]	Kitagawa & Glucina, 1984
Septogloeum kaki (Sydow) Hara (Ascomycetes)	JP	L	Yes	No	AFFA, 2004
Tripospermum juglandis (Thüm.) Speg. (Ascomycetes: Capnodiales)	JP	F, L, S[91]	Yes	No[83]	Kitagawa & Glucina, 1984
Verticillium albo-atrum Reinke & Berthier (Ascomycetes: Hypocreales)	JP, US	R, S	No	No	Farr et al., 2005; Weber, 1973
NEMATODES					
Aphelenchoides ritzemabosi (Schwartz) Steiner & Buhrer (Aphelenchoididae)	JP, US	L, S	No	No	CABI, 2004; Handoo & Ellington, 2005; Umeya & Okada, 2003
Coslenchus costatus (de Man) Siddiqi (Tylenchidae)	JP, US (ID, MD, WV)	R	No	No	AFFA, 2004; Geraert, 1991; Handoo & Ellington, 2005
Helicotylenchus dihystera (Cobb) Sher (Hoplolaimidae)	JP, US	R	No	No	CABI, 2004; Japanese Society of Applied Entomology & Zoology, 1987

Pest	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway	References
Meloidogyne hapla Chitwood (Meloidogynidae)	JP, US	R	No	No	Handoo & Ellington, 2005; Knight, 2001
Meloidogyne incognita (Kofoid & White) Chitwood (Meloidogynidae)	JP, US	R	No	No	CABI, 2004; Inomoto et al., 1991
Meloidogyne javanica (Treub) Chitwood (Meloidogynidae)	JP, US	R	No	No	CABI, 2004; Sethi et al., 1988
Pratylenchus spp. (Pratylenchidae)	JP	R	Yes	No	MAFF, 2005; Umeya & Okada, 2003
Pratylenchus crenatus Loof (Pratylenchidae)	JP, US	R	No	No	Handoo & Ellington, 2005; Knight, 2001; Orui & Mizukubo, 1999
Pratylenchus loosi Loof (Pratylenchidae)	JP	R	Yes	No	CABI, 2004
Pratylenchus penetrans (Cobb) Filipjev & Schuurmans Stekhoven (Pratylenchidae)	JP, US	R	No	No	Handoo & Ellington, 2005; Knight, 2001; Orui & Mizukubo, 1999
Pratylenchus thornei Sher & Allen (Pratylenchidae)	JP, US	R	No	No	AFFA, 2004; CABI, 2004; Handoo & Ellington, 2005
Pratylenchus vulnus Allen & Jensen (Pratylenchidae)	JP, US	R	No	No	CABI, 2004; Japanese Society of Applied Entomology & Zoology, 1987
Tylenchulus semipenetrans Cobb (Tylenchulidae)	JP, US	R	No	No	CABI, 2004; Inomoto et al., 1991
Xiphinema americanum Cobb (Xiphinematidae)	JP, US	R	No	No	AFFA, 2004; CABI, 2004
MOLLUSKS					
Lehmannia valentiana (Férussac) (Limacidae)	JP, US	S	No	No	Chichester & Getz, 1973; PestID, 2006

[1]Distribution (specific states are listed only if distribution is limited): AZ = Arizona, CA = California, DC = District of Columbia, DE = Delaware, FL = Florida, GA = Georgia, HI = Hawaii, ID = Idaho, JP = Japan, MD = Maryland, MO = Missouri, NJ = New Jersey, NY = New York, OK = Oklahoma, OR = Oregon, PA = Pennsylvania, TX = Texas, US = United States (widespread), VA = Virginia, WA = Washington, WI = Wisconsin, WV = West Virginia

[2]Plant Parts: C = Calyx or Sepal; F = Fruit; I = Inflorescence; L = Leaf; R = Root; S = Stem; Sd = Seed

[3]Organisms listed at the level of genus, although regarded as quarantine pests because of their uncertain identity, are not considered for further analysis as their identity is not defined clearly enough to ensure that the risk assessment is performed on a distinct organism (IPPC, 2004).

[4]There is no indication that this species occurs anywhere in East Asia. The type locality is in Central Europe (Schaarschmidt, 1959), and the species has been reported from elsewhere in Europe (e.g., Italy; Stoch, 2003), West Asia (e.g., Turkey; Ozman & Cobanoglu, 2001), and South America (e.g., Venezuela; Dominguez-Gil & McPheron, 1992).

[5]Both larvae and adults of Bostrichidae are wood-borers (Ebeling, 1975). Interceptions of this species on fruit (PIN 309) are not indicative of its true host relationships.

[6]Species is a stored-product pest (CABI, 2004), and is not considered likely to accompany consignments of fresh fruit.

[7]Plant part typically attacked by species of *Agrilus* (e.g., Booth et al., 1990).

[8]Plant part typically attacked by species of Cerambycidae (Gressitt, 1951).

[9]Plant part reported to be attacked by species of *Corymbia* (e.g., *C. rubra* [L.]; Barbalat, 1998).

[10]Plant parts typically attacked by species of Entiminae (e.g., Anderson, 2002).

[11]Feeding site typical of species of *Melanotus* (Lee et al., 1999).

[12]Adults are reported to feed externally on the calyces of persimmon fruit (Lee et al., 2002a). At a size of 9.5-11 mm (Kawabe, 2005a), they are not considered likely to remain with the fruit through harvest and post-harvest processing.

[13]Adults feed externally on the calyces of persimmon fruit (Lee et al., 2002a). At a size of 11-16 mm (InsectAcademy, 1999), they are not likely to remain with the fruit through harvest and processing.

[14]Site of attack typical of species of *Xyleborus* (e.g., Nair, 1975).

[15]Site of attack typical of scolytid beetles (Hill, 1987; Metcalf & Metcalf, 1993).

[16]Feeding site of species of *Acanthosoma* (e.g., *A. haemorrhoidale* [L.]; Soerum, 1977).

[17]At a length of 14-18 mm (Kawabe, 2005b), this large, externally feeding insect is not considered likely to remain with fruit through harvesting and processing.

[18]Feeding sites typical of Alydidae; main host of *L. chinensis* appears to be rice (*Oryza* sp.) (Panizzi et al., 2000a).

[19]*Riptortus* spp. reportedly are not usually transported with plants or plant products (CABI, 2004); [19]*Riptortus clavatus*, a moderately large, externally feeding insect (adult length: 14-17 mm; CABI, 2004), is considered unlikely to remain with persimmon fruit through harvest and processing.

[20]Adults (length: 17-21 mm; Kawabe, 2005d) may feed externally on fruit, and are considered unlikely to remain with fruit through harvest and processing.

[21]Pest is largely restricted to hosts within Poaceae (grasses) (Ito, 1989), although it is also recorded on Fabaceae, Polygonaceae, and Cyperaceae (Mitchell, 2000). Persimmon appears to be an incidental host.

[22]Species apparently is restricted to Polygonaceae (Mitchell, 2000; Ding et al., 2004), and is not considered likely to be common on persimmon fruit.

[23]Feeding sites typical of *Homoeocerus* spp. (Mitchell, 2000).

[24]This moderately large, externally feeding insect (adult length: 13-15 mm; Kawabe, 2005c) is not considered likely to remain with fruit through harvest and processing.

[25]This moderately large, externally feeding insect (adult length: 12-15 mm; Kawabe, 2005e) is not considered likely to remain with fruit through harvest and processing.

[26]Attack by this large (adult length: 16-23 mm), externally feeding insect often causes premature fruit drop (Anonymous, 2005d). Pest is considered unlikely to remain with fruit through harvest and processing.

[27]This large (adult length: 14-17 mm; Doosan Corp., 2006a), externally feeding insect is considered unlikely to remain with fruit through harvest and processing.

[28]This moderately large (adult length: 8 mm; Kawabe, 2006b), externally feeding insect is not considered likely to remain with fruit through harvest and processing.

[29]Pest, as a species of Lygaeinae (Lygaeidae of authors; e.g., Sweet, 2000), is an external feeder, and considered unlikely to remain with persimmon fruit through harvest and processing.

[30]Pest damages only developing persimmon fruit (Kim et al., 1997), and is not expected to be present on mature fruit at harvest.
[31]This moderately large (adult length: 14-17 mm; Anonymous, 2005a), externally feeding insect is not considered likely to remain with fruit through harvest and processing.
[32]This active, moderately large (adult length: 12-14 mm; Kawabe, 2005f), externally feeding insect is not considered likely to remain with fruit through harvest and processing.
[33]Pest is a large (adult length: 15-24 mm; Doosan Corp., 2006b), externally feeding insect that is not considered likely to remain with fruit through harvest and processing.
[34]Pest is a moderately large (adult length: 9-10 mm; Doosan Corp., 2006c), externally feeding insect that is not considered likely to remain with fruit through harvest and processing.
[35]This large (adult length: 12-16 mm; Kawabe, 2005g), externally feeding insect is not considered likely to remain with fruit through harvest and processing.
[36]Pest is a large (adult length: 15-18 mm), externally feeding insect (Hill, 1987) that is not considered likely to remain with fruit through harvest and processing.
[37]Species feeds primarily on legumes (Fabaceae), especially soybean (*Glycine max*) (Panizzi et al., 2000b). Persimmon appears to be an incidental host.
[38]Pest is an active, external feeder (Tsutsumi et al., 2003), and is not considered likely to remain with fruit through harvest and processing.
[39]This moderately large (adult length: 11 mm; Kawabe, 2005h), externally feeding insect is not considered likely to remain with fruit through harvest and processing.
[40]Members of this family feed chiefly on Fabaceae (Schaefer et al., 2000). Persimmon appears to be an incidental host.
[41]Species is a common pest of rice (e.g., Sweet, 2000; Ferreira et al., 2001). It is not considered likely to be common on persimmon.
[42]Feeding site typical of *Aleurotrachelus* spp. (e.g., Hill, 1983).
[43]As Cercopidae are active, externally feeding, and moderately large insects (average adult length: ≈13 mm; Borror et al., 1989), individuals of this species are considered unlikely to remain with fruit through harvest and processing.
[44]Feeding site typical of Cicadellidae (Borror et al., 1989).
[45]Roots and stems are plant parts typically attacked by species of Cicadidae (Borror et al., 1989).
[46]Adults are large insects (32-35 mm; Hirai, 2004), and not considered likely to remain with fruit through harvest and processing.
[47]Adults are large (24-38 mm), externally feeding insects (Doosan Corp., 2006d), and not considered likely to remain with fruit through harvest and processing.
[48]Invalid synonym of *Pulvinaria* (Ben-Dov et al., 2005).
[49] Although armored scales may enter on commercial fruit for consumption, they are highly unlikely to become established via this pathway. Please see discussion in section (2.4.1) for a detailed explanation.
[50] Feeding sites typical of species of *Melanaspis* (e.g., Kosztarab, 1996).
[51]Infestation site reported for species of *Kuwania* (e.g. Ben-Dov et al., 2005).
[52]There is no evidence from available sources of information (e.g., Ben-Dov et al., 2005) that *Diospyros kaki* is a true host. The single port interception on persimmon (PIN 309) is an anomaly.
[53]There is no evidence from available sources of information (e.g., Shiraki, 1952a; Tadauchi & Inoue, 1999; Ben-Dov et al., 2005) that this species occurs in Japan. Port interceptions (in baggage; PIN 309) indicating its presence in that country are suspect.
[54]There is no indication that this is a valid species (Y. Ben-Dov, Dept. of Entomology, ARO, Volcani Center, Bet Dagan, Israel, *in litt*., August 25, 2005).
[55]Plant part typically frequented or affected by species of Ricaniidae (Carver et al., 1991; Hill, 1994).
[56]Plant part likely to be attacked by foraging adult Vespidae (Spradbery, 1973).
[57]Large, flight-active, externally feeding insect (Spradbery, 1973) that is not likely to remain with fruit through harvest and post-harvest handling.
[58]Feeding site typical of Arctiidae (Metcalf & Metcalf, 1993).
[59]Feeding site typical of Geometridae (Metcalf & Metcalf, 1993).
[60]Larvae attack developing fruit (Kim et al., 1997), and are considered unlikely to be present on mature fruit at harvest.
[61]Feeding site typical of species of *Narosa* (e.g., Robinson et al., 2001).
[62]Feeding site typical of species of *Parasa* (e.g., Hill, 1983).

[63]Pest is an external feeder, primarily on leaves of hosts (e.g., Yokoyama & Kurosawa, 1933; Sato, 1977), and is not considered likely to be common on persimmon fruit or to remain with fruit through harvest and processing.
[64]Feeding site typical of species of *Bucculatrix* (Robinson et al., 2001).
[65]Fruit is attacked by the adult moth (Zhang, 1994), which is considered unlikely to remain with fruit through harvest and processing.
[66]Fruit is attacked by the adult moth (Yoon & Lee, 1974), which is considered unlikely to remain with fruit through harvest and processing.
[67]This species is confined to the New World (CABI, 2004). Records of its occurrence in Asia (e.g., Hua, 2005) apparently are in error.
[68]Plant parts typically attacked by species of Oecophoridae (Borror et al., 1989).
[69]Pest is an external feeder that lives within a conspicuous structure (length: 35-45 mm) known as a "bag" (Nishida, 1983). It is not considered likely to remain with persimmon fruit through harvest and processing.
[70]Pest is an external feeder, which lives within a conspicuous structure (length: 25-35 mm) known as a "bag" (Nishida, 1983). It is not considered likely to remain with persimmon fruit through harvest and processing.
[71]Feeding site typical of Psychidae (Metcalf & Metcalf, 1993).
[72]No information is available concerning this species. The name appears to be a synonym of *Ptycholoma lecheana circumclusana* (Christoph) (Meijerman & Ulenberg, 2000) (= *Tortrix circumclusana* Christoph; Hua, 2005), which is a leaf-feeder (Kim et al., 1997).
[73]Feeding site typical of Ceracini (Horak & Brown, 1991).
[74]Larvae are reported to feed on developing berries of coffee (van der Geest et al., 1991). If the association with persimmon is similar, the pest would not be expected to occur on mature fruit at harvest.
[75]Larvae may feed externally on persimmon fruit (Meijerman & Ulenberg, 2000), but are not considered likely to remain with fruit through harvest and processing.
[76]*Choristoneura adumbratana* (Walsingham), which is a leaf-feeder (Meijerman & Ulenberg, 2000), probably is a synonym.
[77]Vegetation-inhabiting Gryllidae (e.g., Eneopterinae) may feed externally on fruit (Walker & Masaki, 1989), but are considered unlikely to remain with fruit through harvest and processing.
[78]Feeding site typical of species of *Conocephalus* (Hill, 1994).
[79]Feeding site typical of species of *Haplothrips* (Mound & Kibby, 1998).
[80]Feeding sites typical of *Ponticulothrips* spp. (e.g., *P. diospyrosi*; Haga & Okajima, 1983).
[81]Species is predatory on spider mites (Gotoh et al., 2004).
[82] Removed from the current version.
[83]Species is one of the non-pathogenic sooty mold fungi, which grow superficially in insect honeydew on plant surfaces (Agrios, 1997). It is considered unlikely to remain with fruit through processing.
[84]Plant part typically affected by species of *Microxyphium* (e.g., CMI, 1964).
[85]*Diospyros kaki* appears to be only an experimental host (Rekhviashvili, 1975).
[86]*Diospyros kaki* appears to be only an experimental host (Sharma & Kaul, 1989).
[87]*Phyllactinia* spp. characteristically produce a powdery mildew disease in leaves of hosts (Horst, 2001). Evidence strongly suggests that *P. guttata* is a leaf parasite (e.g., Saccardo, 1882; Braun, 1995). The single port interception on persimmon fruit (PIN 309) is not indicative of the usual symptomatology.
[88]*Phyllactinia* spp. characteristically produce a powdery mildew disease in leaves of hosts (Horst, 2001). Evidence strongly suggests that *P. kakicola* is a leaf parasite (e.g., Petrak, 1939; Cook, 1975; Yao et al., 1990; Huang, 2004). The single port interception on persimmon fruit (Farr et al., 2005) is not indicative of the usual symptomatology.
[89]*Diospyros kaki* appears to be only an experimental host (Nisikado et al., 1941).
[90]*Pseudocercospora* spp. characteristically infect leaves of hosts (Horst, 2001). Evidence strongly suggests that *P. diospyri-morrisianae* is a leaf parasite (e.g., Watson, 1971; Cook, 1975; Shin, 1995). The single port interception on persimmon fruit (Farr et al., 2005) is not indicative of the usual symptomatology.
[91]Plant parts, on which sooty molds, as produced by species of Capnodiales, typically grow (Agrios, 1997; Horst, 2001).

2.4.1. Pests not considered for further mitigation

We did not include *Asiacornococcus kaki* (Kuwana in Kuwana & Muramatsu) in the pest list because we did not find sufficient evidence that it is present in Japan. It is not included in Tadauchi & Inoue's (1999) comprehensive checklist of Japanese insects. Records for this insect in Japan (e.g., Hua, 2000) may be based on a quarantine interception, at the Port of Nagasaki, on plant material from China (Ben-Dov et al., 2005). Although it has been interecepted at U.S. ports-of-entry 11 times on produce carried by passengers from Japan, we cannot be certain that the produce was actually from Japan, and therefore discount the records.

We did not further analyze the armored scales (Hemiptera: Diaspididae) identified in this risk assessment as quarantine pests likely to follow the pathway (*Lepidosaphes cupressi*, and *L. kuwacola*), because armored scales are highly unlikely to establish via this pathway due to their very limited ability to disperse to new host plants (Miller et al., 1985; PERAL, 2007). Only a certain immature form of armored scales, the crawler stage, can self-disperse. Crawlers are highly unlikely to successfully disperse by walking from their natal host since they are not capable of rapid movement over bare soil or rough surfaces. They typically disperse by being blown from plant to plant in the wind. Additionally, their dispersal period is limited to approximately 24 hours, after which they start feeding, become firmly anchored to the host tissue, and lose their legs. Adult females have no wings or legs. Dispersal from fruit discarded into the environment is highly unlikely because of low wind speeds at ground level and low survival rate of crawlers on the ground or on decaying fruit or fruit peels.

2.4.2. Pests considered for further mitigation

Quarantine pests that reasonably can be expected to follow the pathway (i.e., be included in consignments of persimmon fruit) are subjected to steps 5-7 (USDA, 2000) in the following sections of this risk assessment. These pests are listed below (Table 4).

Table 4. Quarantine pests selected for further analysis.

Type	Organism	Taxonomy
Arthropods	*Conogethes punctiferalis*	Lepidoptera: Pyralidae
	Crisicoccus matsumotoi	Hemiptera: Pseudococcidae
	Homonopsis illotana	Lepidoptera: Tortricidae
	Lobesia aeolopa	Lepidoptera: Tortricidae
	Ponticulothrips diospyrosi	Thysanoptera: Phlaeothripidae
	Pseudococcus cryptus	Hemiptera: Pseudococcidae
	Scirtothrips dorsalis	Thysanoptera: Thripidae
	Stathmopoda masinissa	Lepidoptera: Oecophoridae
	Tenuipalpus zhizhilashviliae	Acari: Tenuipalpidae
	Thrips coloratus	Thysanoptera: Thripidae
Fungi	*Adisciso kaki*	Ascomycetes: Xylariales
	Colletotrichum horii	Ascomycetes: Incertae sedis
	Cryptosporiopsis kaki	Ascomycetes: Helotiales
	Mycosphaerella nawae	Ascomycetes: Mycosphaerellales
	Pestalotia diospyri	Ascomycetes: Xylariales
	Pestalotiopsis acaciae	Ascomycetes: Xylariales
	Pestalotiopsis crassiuscula	Ascomycetes: Xylariales
	Phoma kakivora	Ascomycetes: Pleosporales
	Phoma loti	Ascomycetes: Pleosporales

2.5. Consequences of Introduction—Economic/Environmental Importance

Potential consequences of introduction are rated using five risk elements: Climate-Host Interaction, Host Range, Dispersal Potential, Economic Impact, and Environmental Impact. These elements reflect the biology, host ranges and climatic/geographic distributions of the pests. For each risk element, pests are assigned a rating of Low (1 point), Medium (2 points) or High (3 points) (USDA, 2000). A Cumulative Risk Rating is then calculated by summing all risk element values.

Risk values determined for the consequences of introduction for each pest are summarized below (Table 5). As indicated above, risk is considered to be proportional to the degree of uncertainty surrounding a risk element. Because of an occasional lack of information, and thus a high degree of uncertainty, concerning risk elements, some pests have been given risk ratings higher than the available evidence, *prima facie*, might otherwise indicate.

Adisciso kaki	**Risk ratings**
Risk Element #1: Climate-Host Interaction The geographic distribution of *A. kaki* is limited to the Shimane and Chiba Prefectures on Honshu in Japan (Yamamoto et al., 2012), which corresponds to plant hardiness zones 7 and 8 (Magarey et al., 2008). The only host reported is *Diospyros kaki*, although extensive host range testing has not yet been conducted (Yamamoto et al., 2012). *Diospyros kaki* grows in plant hardiness zones from 7 to 11 (National Gardening Association, 2012; Magarey et al., 2008). The pathogen could establish in 4 or more plant hardiness zones, therefore we rated it High	High (3)
Risk Element #2: Host Range Since the only known host is *Diospyros kaki* (Yamamoto et al., 2012), we rated it Low.	Low (1)
Risk Element #3: Dispersal Potential Naturally infected leaves and calyces begin to show symptoms, black lesions expand rapidly, leading to necrosis and finally defoliation (Yamamoto et al., 2012). Immature fruiting structures form on the underside of infected leaves relatively early in the infection cycle and likely complete their development on fallen leaves to produce more ascospores as inoculum to infect new leaves (Yamamoto et al., 2012). We found little information about the ability of the pathogen to disperse, or about how environmental factors might impact dispersal, although it appears that the pathogen can reproduce readily. Overall, we rated this element Medium.	Medium (2)
Risk Element #4: Economic Impact Although no extensive studies of the yield or quality impacts of the pathogen have been conducted, based on the symptoms described we can extrapolate potential impacts on the crop. *Adisciso kaki* would likely both lower yield of persimmon, by causing a severe leaf spot that defoliates the plant, and also the value of fruit, by decreasing its marketable value due to black spotting on fruit (Yamamoto et al., 2012). Therefore, we rated it Medium.	Medium (2)
Risk Element #5: Environmental Impact We found no evidence that *A. kaki* impacts other species, like *Diospyros virginiana* (native to the United States and important in some ecosystems), therefore we rated it Low.	Low (1)

Colletotrichum horii	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Diospyros kaki* is the primary host of this pathogen (Weir and Johnston, 2010), and this host grows in zones 7 to 11 (National Gardening Association, 2012). The pathogen is distributed in China, Japan, Korea and New Zealand (Weir and Johnston, 2010). Zones for Japan and Korea include 5-8, and New Zealand includes 8-10 (Magarey et al., 2008), so the climatic range in the United States it could inhabit if limited to *Diospyros* as a host would be zones 7-11. Thus we rated *C. horii* High.	High (3)
Risk Element #2: Host Range Hosts include *Diospyros kaki* (Weir and Johnston, 2010), *D. glaucifolia*, and *D. kaki* var. *sylvestris* (Xie et al., 2010), all in the plant family Ebenaceae. *Colletotrichum horii*, like some other *Colletotrichum* species may lack host specificity, and therefore may occur on other hosts (Weir and Johnston, 2010). Additional hosts infected only by inoculation in the early literature included the following: pear (*Pyrus* spp.), apple (*Malus* spp.) (Rosaceae), pepper (*Capsicum annuum*; Solanaceae) (Weir and Johnston, 2010), and more recently banana (*Musa acuminate*; Musaceae) and squash (*Cucurbita pepo*; Cucurbitaceae) (Xie et al., 2010). Since we lack evidence of infection of other hosts in nature, we only considered confirmed hosts in *Diospyros.* Therefore we rated the risk associated with host range as Low.	Low (1)
Risk Element #3: Dispersal Potential *Colletotrichum horii* produces abundant masses, which contain millions of infective conidia on twig, leaf, or fruit lesions, which are dispersed by rain splash and wind to infect new plant tissue (Xie et al., 2010). Thus, it has high reproductive potential and inoculum can move readily. It can also be dispersed in symptomless seedlings over long distances (Zhang and Xu, 2003, cited in Zhang, 2008). Given that evidence, we rated it High.	High (3)
Risk Element #4: Economic Impact Anthracnose, the disease caused by *C. horii*, is apparently one of the most important diseases of persimmon in Japan (Kitagawa and Glucina, 1984). The fungus infects shoots, leaves, and twigs, causing defoliation, and infects fruit at all stages of the growing season and after harvest (Xie et al., 2010). We found no evidence that introduction of this pest would result in loss of foreign or domestic markets. *Colletotrichum horii* can lower yield, affect quality of the crop, and increase production costs associated with fungicides needed for control, so we rated it Medium.	Medium (2)
Risk Element #5: Environmental Impact No species of *Diospyros* are on the USFWS Threatened and Endangered Plants list. However, three *Diospyros* species are native to the United States: *D. sandwicensis* (Hawaii), *D. texana* (Texas), and *D. virginiana* (in more than 20 U.S. states), which play roles in some protected ecosystems (USFWS, 2011a, b, c). Since *C. horii* could infect native species over a relatively broad distribution in the United States, we rated the potential environmental impact of its introduction as Medium.	Medium (2)

Conogethes punctiferalis	**Risk ratings**
Risk Element #1: Climate-Host Interaction The geographic distribution of *C. punctiferalis* extends from temperate to tropical Asia and into Australasia (Australia, Papua New Guinea); it has been found as far north as	High (3)

Conogethes punctiferalis	**Risk ratings**
Liaoning Province in China (Plant Hardiness Zones 4-6; Fig. 2) and Honshu, Japan (CABI, 2004). Given this range, it is conservatively estimated that the moth could become established in areas of the United States corresponding to Zones 5-11.	
Risk Element #2: Host Range This species has been recorded on plants in at least 20 families (CABI, 2004). Hosts include *Carica papaya* (Caricaceae), *Gossypium herbaceum* (Malvaceae), *Helianthus annuus* (Asteraceae), *Prunus persica* (Rosaceae), *Zea mays* (Poaceae), *Citrus nobilis* (Rutaceae), *Punica granatum* (Punicaceae), *Vitis vinifera* (Vitaceae), *Zingiber officinale* (Zingiberaceae), *Ricinus communis* (Euphorbiaceae), *Morus alba* (Moraceae), *Psidium guajava* (Myrtaceae), *Macadamia integrifolia* (Proteaceae) (CABI, 2004); *Diospyros kaki* (Ebenaceae) (Umeya & Okada, 2003); *Quercus* spp. (Fagaceae) (Park et al., 1998); *Mangifera indica* (Anacardiaceae) (Nair, 1975); *Dimocarpus longan* (Sapindaceae) (Huang et al., 2000); *Pinus massoniana* (Pinaceae) (Hua, 2005); and *Durio zibethinus* (Bombacaceae) (Brown, 1997).	High (3)
Risk Element #3: Dispersal Potential Females lay an average of 20-30 eggs on the surface of fruits or on the ear silk and tassels of corn (CABI, 2004). Five generations per year have been reported (Wang & Cai, 1997). Demographic studies indicated that, under ideal conditions, populations may increase by a factor of almost 21 times per generation (Bilapate, 1977). Long distance dispersal may be effected via the transport of commercial consignments of fruit. For example, pear fruits from Korea were found to be infested with larvae of *C. punctiferalis* at a Canadian port-of-entry (Lee et al., 2000). This species exhibits high reproductive and dispersal potentials.	High (3)
Risk Element #4: Economic Impact *Conogethes punctiferalis* is one of the most destructive pests of peach in China and of cotton and grain sorghum in Australia, in which latter country infestations of 27% of bolls and 100% of seed heads, respectively, have been reported (Anonymous, 1957). In grains, stems bored by the moth are easily broken down by the wind and farming practices, resulting in decreased yields (CABI, 2004). Yield losses were as high as 42% in castor bean (Kapadia, 1996), 49% in plum (Wang & Cai, 1997), and 50% in grape (Ram et al., 1997). In persimmon, the pest may be present as eggs and larvae on or in fruit at harvest (Tomomatsu et al., 1995). Losses in persimmon crops of almost 2% have been reported, and may continue until harvest (Kim et al., 1997). Annual losses in chestnut crops in parts of Zhejiang Province, China, have been estimated at 120 tonnes at a value of almost $121,000 (Xu et al., 2001). In fruit crops, injury generally occurs when fruit is nearly ripe (Hely et al., 1982). Larval tunneling and attack by secondary organisms of decay may render fruit valueless (Clausen, 1931). As the species is a quarantine pest for countries, such as Canada, Chile, New Zealand, and Peru (EPPO, 2003b; PRF, 2006), its introduction could result in a loss of foreign markets for various U.S. agricultural commodities. Risk is considered to be high.	High (3)
Risk Element #5: Environmental Impact Should it become established in the United States, *C. punctiferalis* would represent a potential threat to plants, such as *Helianthus eggertii*, *H. paradoxus*, and *H. schweinitzii*, *Prunus geniculata*, and *Quercus hinckleyi*, listed as Threatened or Endangered in 50 CFR §17.12. Introduction of the pest likely would result in the initiation of chemical or biological control programs similar to those carried out in other countries (e.g., Choo et al., 1995; Wang et al., 2002). Therefore, we rated this element high.	High (3)

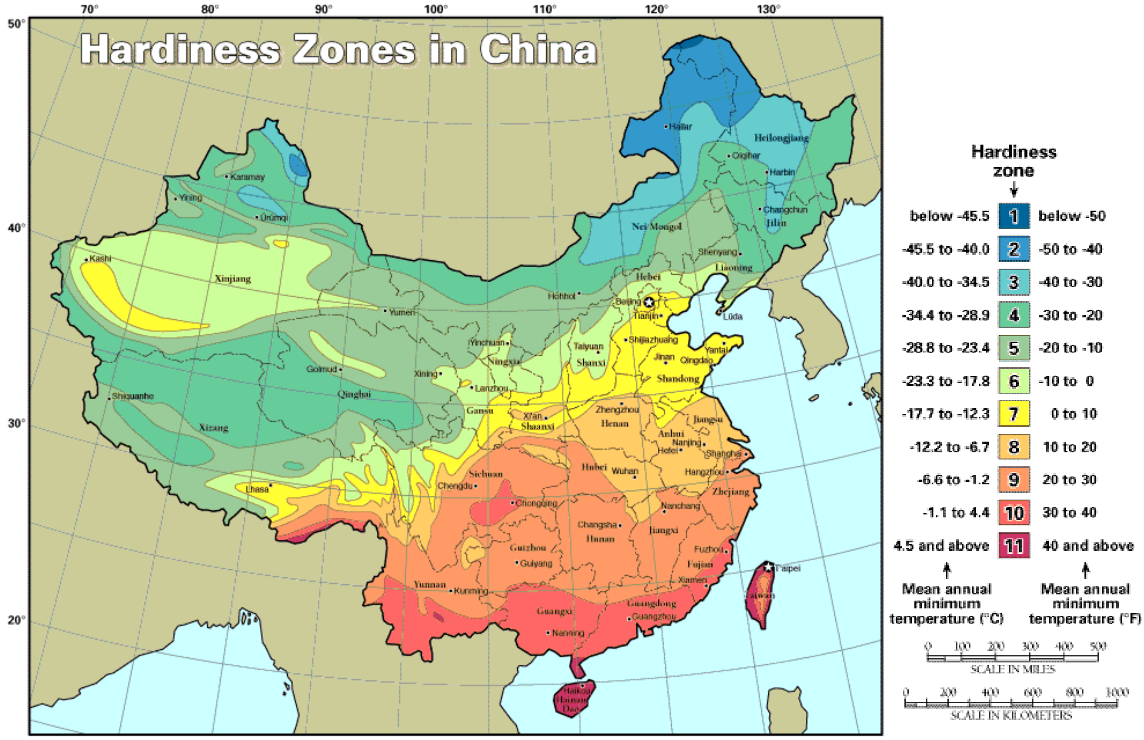

Figure 2. Plant hardiness zones in China (source: http://www.backyardgardener.com/zone/china.html).

Crisicoccus matsumotoi	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Crisicoccus matsumotoi* is restricted to Asia, having been reported from India, Korea, Japan (as far north as Hokkaido, within Plant Hardiness Zones 4-8; Fig. 3), the Philippines, and Sikkim (Ben-Dov et al., 2005). Based on this distribution, it is conservatively estimated that the species could become established in areas of the United States within Zones 6-11.	High (3)
Risk Element #2: Host Range The mealybug has been recorded on hosts in at least nine families, including *Acer* spp. (Aceraceae), *Aster indicus* (Asteraceae), *Codiaeum* sp. (Euphorbiaceae), *Juglans regia* (Juglandaceae), *Malus pumila* and *Pyrus* spp. (Rosaceae), *Citrus* sp. (Rutaceae), *Camellia sinensis* (Theaceae) (Ben-Dov et al., 2005); and *Diospyros kaki* (Ebenaceae) (Korea Forest Service, 2004).	High (3)
Risk Element #3: Dispersal Potential No information is available on the reproductive biology of *C. matsumotoi*. Fecundity in some species of mealybug (Pseudococcidae) may exceed 3000 eggs per female (Kosztarab, 1996); there may be 10 or more generations per year (e.g., Williams, 1996). Scale insects, such as mealybugs, tend to be invasive because they are small in size, often live in concealed habitats, and frequently accompany commodities that are common in international commerce (Miller et al., 2002). If the biology of *C. matsumotoi* is reflective of these traits, dispersal potential of the pest could be high. Risk for this element therefore is estimated to be high.	High (3)
Risk Element #4: Economic Impact	Medium (2)

Crisicoccus matsumotoi	**Risk ratings**
Little information is available concerning the damage potential of *C. matsumotoi*. It is considered a threat to U.S. agriculture by Miller et al. (2002). Park & Hong (1992) reported that the pest was one of three mealybug species attacking pear fruit (*Pyrus* sp.) in Korea, resulting in yield losses as high as 51%. Feeding also causes a loss of vigor in infested trees (CATC, 2004). A want of information may suggest that the pest status of the insect is not sufficiently high in regions, in which it occurs, to warrant a large research effort. However, mealybugs are known to pose serious problems for agriculture when introduced into new areas without their natural enemies (Miller et al., 2002). Because of uncertainty regarding the potential consequences should it be introduced into the United States, risk associated with the economic impact of *C. matsumotoi* is estimated to be medium.	
Risk Element #5: Environmental Impact Because it is known to feed on a related species, *C. matsumotoi* has the potential to attack *Juglans jamaicensis*, listed as Endangered in 50 CFR §17.12. As a potential pest of pome and citrus fruits in the United States, its introduction likely would result in initiation of biological control programs, as has occurred in response to introductions of other pseudococcid species (e.g., Bartlett, 1978b).	High (3)

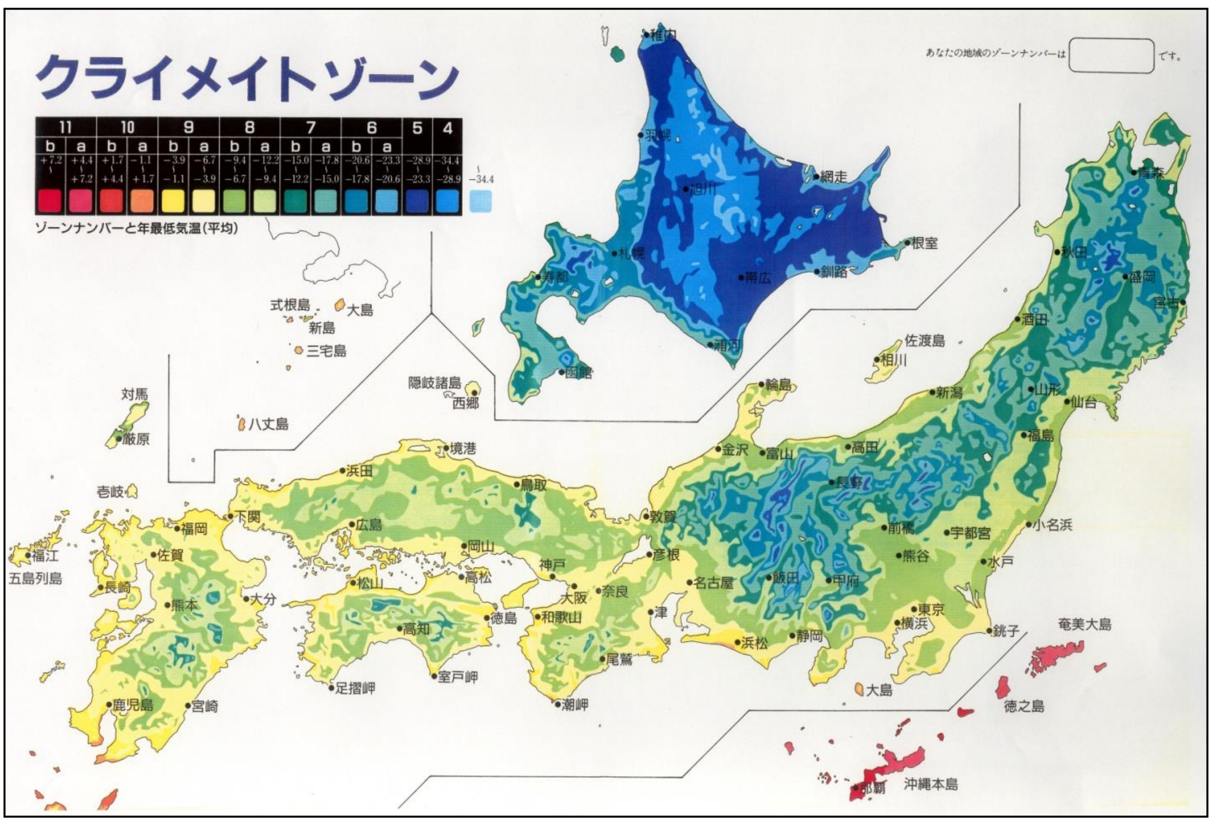

Figure 3. Plant hardiness zones in Japan.

Cryptosporiopsis kaki	**Risk ratings**
Risk Element #1: Climate-Host Interaction	High (3)

Cryptosporiopsis kaki	**Risk ratings**
Available information indicates that *C. kaki* (= *Myxosporium kaki* Hara) occurs only in Japan (Farr & Rossman, 2009). It is estimated that the potential distribution of this fungus, should it be introduced, would correspond to that of persimmon in the United States (Plant Hardiness Zones 7-11; Chia et al., 1989; Gilman & Watson, 1993; Das et al., 2001).	
Risk Element #2: Host Range Available information suggests that *Diospyros kaki* (Ebenaceae) is the only host of this fungus (Farr & Rossman, 2009).	Low (1)
Risk Element #3: Dispersal Potential No information is available on the biology of *C. kaki*. In other species of *Cryptosporiopsis* (e.g., *C. actinidiae* Johnston et al., *C. ericae* Sigler, *C. brunnea* Sigler, *C. rhizophila*), sporulation appears to occur infrequently (Verkley et al., 2003; Sigler et al., 2005; Beever & Parkes, 2007), suggesting a low degree of virulence. If these traits are shared by *C. kaki*, a low reproductive potential may be indicated. The restricted distribution of the species suggests that it is not readily dispersed over long distances. Risk is estimated to be low.	Low (1)
Risk Element #4: Economic Impact No information is available on the economic impact of *C. kaki*. Although the fungus attacks persimmon branches (Weindlmayr, 1964) and fruit (Watson, 1971), presumably reducing yield or quality, species of *Cryptosporiopsis*, as well as other endophytic fungi, are considered to have limited, if any, pathogenic effects (Carroll, 1988). The lack of published research and other information on *C. kaki* suggests that any effects the fungus may have on persimmon crops are not considered economically significant. Risk is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact *Cryptosporiopsis kaki* is unlikely to pose a threat to endangered or threatened native plants in the United States. No species of *Diospyros* is listed in 50 CFR §17.12. Introduction of the fungus probably would not spur the initiation of new chemical control programs, as the broad-spectrum fungicides presently used in U.S. persimmon production (e.g., Baron, 2001) likely would prove adequate for control purposes. Risk of significant environmental consequences resulting from introduction of the fungus is estimated to be low.	Low (1)

Homonopsis illotana	**Risk ratings**
Risk Element #1: Climate-Host Interaction The distribution of *H. illotana* is restricted to East Asia, the species occurring in China as far north as Shaanxi, within Plant Hardiness Zones 5-9 (Fig. 2), Japan (Hokkaido, Honshu), Korea, and the Russian Far East (Meijerman & Ulenberg, 2000; Hua, 2005). It is conservatively estimated that this moth could survive in regions of the United States within Zones 6-11.	High (3)
Risk Element #2: Host Range Hosts include *Abies sachalinensis* (Pinaceae), *Acer* sp. (Aceraceae), *Quercus* spp. (Fagaceae), *Lyonia ovalifolia* (Ericaceae), *Prunus* spp. (Rosaceae), *Polygonum cuspidatum* (Polygonaceae), *Smilax china* (Smilacaceae) (Meijerman & Ulenberg, 2000); *Diospyros kaki* (Ebenaceae) (Umeya & Okada, 2003); and *Salix* sp. (Salicaceae) (Hua, 2005).	High (3)
Risk Element #3: Dispersal Potential	Low (1)

Homonopsis illotana	**Risk ratings**
Little information is available on the biology of *H. illotana*. Adults are found in Japan from mid-May to the end of July (Meijerman & Ulenberg, 2000), indicating one generation per year. The species' restricted distribution may indicate that, overall, its natural powers of dispersal are rather low. Also, a complete lack of U.S. port interception records (PIN 309) suggests that it is not spread widely by human agency. Risk associated with the dispersal potential of *H. illotana* is estimated to be low.	
Risk Element #4: Economic Impact Little information is available concerning the pest status of *H. illotana*. It attacks persimmon fruits (Umeya & Okada, 2003; MAFF, 2005), and damage presumably is caused by larval tunneling, which would result in loss of yield. However, the species is said not to be very important economically (Meijerman & Ulenberg, 2000), and there is no evidence that it is particularly invasive. Risk associated with this element is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact As it is reported to feed on species of *Quercus* and *Prunus*, *H. illotana* has the potential to attack related plants in the United States listed as Endangered or Threatened, such as *Quercus hinckleyi* and *Prunus geniculata*. Its introduction could result in the initiation of biological control programs similar to those that have targeted other tortricid pests in the United States and elsewhere (Clausen, 1978c).	High (3)

Lobesia aeolopa	**Risk ratings**
Risk Element #1: Climate-Host Interaction The geographic distribution of this widespread species extends across four biogeographic regions: the Ethiopian, Palearctic, Oriental (Razowski, 2000), and Australasian (Robinson et al., 2005), from the cold temperate zone to the tropics. Countries, in which it is reported to occur, include: in Africa, Kenya, Madagascar, Uganda, and Zimbabwe; in Asia, China, India, Indonesia, Japan, Korea, Malaysia, Sri Lanka, Taiwan, and Thailand; and in Australasia, New Guinea and Norfolk Island (Zhang, 1994; Smithers, 1998; Hua, 2005; Robinson et al., 2005). In China, the moth occurs as far north as Heilongjiang (Hua, 2005), and in Japan, it is reported from Hokkaido (Suzuki & Komai, 1984), both regions falling within Plant Hardiness Zone 4 (Figs. 2 and 3). It is estimated that it could survive in the United States in Zones 4-11.	High (3)
Risk Element #2: Host Range *Lobesia aeolopa* has been recorded on a wide range of plants in several families. Hosts include *Diospyros kaki* (Ebenaceae), *Hibiscus* sp. (Malvaceae), *Quercus acutissima* (Fagaceae), *Prunus yedoensis* (Rosaceae), *Solidago canadensis* and *Vernonia* sp. (Asteraceae), *Caesalpinia* sp. (Fabaceae), *Actinidia chinensis* (Actinidiaceae), *Citrus* sp. (Rutaceae), *Camellia sinensis* and *Ternstroemia gymnanthera* (Theaceae), *Coffea arabica* (Rubiaceae), *Ilex integerrima* (Aquifoliaceae), *Litchi chinensis* (Sapindaceae), *Mangifera indica* (Anacardiaceae), *Melochia* spp. (Sterculiaceae), *Lantana camara* (Verbenaceae), *Ricinus communis* (Euphorbiaceae), *Lindera* sp. (Lauraceae), *Ulmus parvifolia* (Ulmaceae), *Vitis* spp. (Vitaceae), *Zea mays* (Poaceae) (Robinson et al., 2005); and *Eucalyptus* spp. (Myrtaceae) (Nasu et al., 2004).	High (3)
Risk Element #3: Dispersal Potential No information is available on the reproductive biology of *L. aeolopa*. In the related species, *L. botrana* (Denis & Schiffermüller), fecundity may exceed 300 eggs per female; there may be four generations per year (Avidov & Harpaz, 1969). If reproduction in *L.*	High (3)

Lobesia aeolopa	**Risk ratings**
aeolopa is similar, its biotic potential could be high. The occurrence of the species in remote areas, such as Norfolk Island (Smithers, 1998), demonstrates its capacity to disperse over long distances. Risk associated with the dispersal potential of *L. aeolopa* is estimated to be high.	
Risk Element #4: Economic Impact Little information is available on the economic impact of *L. aeolopa*. It is reported to be a pest of eucalyptus (Nasu et al., 2004) and tea (Sonan, 1939) in Japan, although, in the latter case, damage was said to be slight. Plant reproductive organs, as well as leaves, are attacked. Larvae have been found in fruit of *Leucas cephalotes*, *Lantana camara*, and coffee (van der Geest et al., 1991; Robinson et al., 2001), which would lower yields. As the species is a quarantine pest for South Africa (DEAT, 2005), its introduction could result in a loss of that market for U.S. commodities, such as stone fruits, mango, and corn. Risk associated with the potential economic impact of this pest is estimated to be medium.	Medium (2)
Risk Element #5: Environmental Impact *Lobesia aeolopa* has the potential to attack plants in the United States listed as Endangered or Threatened, and which are close relatives of its known hosts, such as *Hibiscus arnottianus* ssp. *immaculatus*, *H. brackenridgei*, *H. clayi*, and *H. waimeae* ssp. *Hannerae*, *Quercus hinckleyi*, *Prunus geniculata*, *Solidago albopilosa*, *S. houghtonii*, *S. shortii*, and *S. spithamaea*, *Caesalpinia kavaiense*, *Ilex cookii* and *I. sintenisii*, *Lindera melissifolia*, *Ternstroemia luquillensis* and *T. subsessilis*, and *Vernonia proctorii*. As a potential pest of corn, its introduction could result in the initiation of chemical control programs, insecticidal use being common in that crop in the United States (Wright & Van Duyn, 1999). Other management options might include biological control programs, which have proven effective against other tortricid pests in the United States and elsewhere (Clausen, 1978c).	High (3)

Mycosphaerella nawae	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Mycosphaerella nawae* occurs in China (Farr and Rossman, 2012), Japan (Kishi, 1998), Korea (Kwon et al., 1998), and Spain (Berbegal et al., 2010). Those places correspond with U.S. Plant Hardiness zones 6-9 (Magarey et al., 2008), while *D. kaki* grows in zones 7 to 11 (National Gardening Association, 2012; Magarey et al., 2008). Based on those factors, *M. nawae* could establish and survive in at least four plant hardiness zones. We rated it High.	High (3)
Risk Element #2: Host Range The only hosts for *M. nawae* are *D. kaki* and *D. lotus* (Farr and Rossman, 2012), although we found no indication that extensive host range testing has been done. Consequently, we rated it Low.	Low (1)
Risk Element #3: Dispersal Potential *Mycosphaerella nawae* produces large numbers of primary inoculum as ascospores from infected overwintering leaf litter, which can disperse over long distances in air currents, depending upon appropriate temperature and moisture conditions (Vicent et al., 2011). Secondary inoculum (conidia) occurs but is epidemiologically much less important than ascospores. In some growing regions (e.g., Spain) the asexual stage has not been reported (Vicent et al., 2011). Overall, we rated this element High.	High (3)
Risk Element #4: Economic Impact	Medium (2)

Mycosphaerella nawae	**Risk ratings**
Mycosphaerella nawae causes necrotic spots on leaves, chlorosis and early defoliation. Leaf lesions and defoliation caused by infection induce premature fruit maturation and abscission, resulting in serious economic losses (Vicent et al., 2012). Several fungicide applications per season are required to achieve economic control of circular leaf spot caused by *M. nawae* (Vicent et al., 2012). We found no evidence, however, that it would cause trade impacts for the United States. Thus, we rated it Medium.	
Risk Element #5: Environmental Impact *M. nawae* may only infect *D. kaki* and *D. lotus* (Farr and Rossman, 2012). Several native species of *Diospyros* occur in the United States: three species in Hawaii; *D. texana* in Texas; and *D. virginiana*, which is distributed throughout the Eastern United States and can provide food for native species of birds and animals (Nesom, 2006; NRCS, 2012). None of these native species are Federally listed as threatened or endangered plants, but *D. virginiana* is listed in two U.S. states as endangered or threatened. To control *M. nawae*, increased levels of fungicides may be needed (Vicent et al. 2012), increasing environmental exposures to these chemicals. Based on this information, we rated this element Medium.	Medium (2)

Pestalotia diospyri	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Pestalotia diospyri* infects plants in Japan, China, Korea, Spain, Brazil, and Ukraine (Farr and Rossman, 2012), which encompasses a large range of climate zones (Magarey et al., 2008). The fungus can also infect a wide range of hosts in multiple plant families which can allow it to survive and perpetuate itself over a large range of climate zones (Farr and Rossman, 2012). For these reasons we rated this element High.	High (3)
Risk Element #2: Host Range This pathogen infects a wide range of hosts: *Diospyros kaki*, *D. chinensis*, *D. peregrina*, *Euonymus alatus*, *E. japonicas*, *E. sieboldianus*, *Podocarpus macrophyllum*, *Rhus javanica*, and *Smilax china* (Farr and Rossman, 2012). These represent multiple plant families: Ebenaceae, Celastraceae, Podocarpaceae, Anacardiaceae, and Smilacaceae (NRCS, 2012). Consequently, we rated this element High.	High (3)
Risk Element #3: Dispersal Potential *Pestalotia diospyri* produces abundant conidia on infected plant parts and in artificial growing medium (Alves et al., 2011). Relatively high humidity and warm temperatures favor the spread of conidia, mainly by water or wind, and local infections spread easily from plant to plant (Alves et al., 2011). Since it reproduces rapidly and abundantly, but primarily locally, we rated this pathogen Medium.	Medium (2)
Risk Element #4: Economic Impact *Pestalotia diospyri* caused lesions on sepals (calyces), fruit, and leaves, causing defoliation, as well as damaging stem cankers (Alves et al., 2011). Infections therefore can lower value and yields of the persimmon crop. We found no evidence for impacts on foreign or domestic markets. Thus, we rated the pathogen Medium.	Medium (2)
Risk Element #5: Environmental Impact *Pestalotia diospyri* has a relatively broad host range, infecting hosts in multiple plant families (Farr and Rossman, 2012). It is unknown if *P. diospyri* can infect other species of the genera listed above (Farr and Rossman, 2012). If so, four species of *Euonymus*, three species of *Rhus*, and five species of *Smilax* that are listed as threatened or endangered by individual states, and one species of *Rhus* is Federally listed as Endangered (NRCS,	High (3)

Pestalotia diospyri	**Risk ratings**
2012). In addition, *Diospyros virginiana* is listed in two U.S. states as endangered or threatened. We did not find published recommendations to control *P. diospyri*, so we cannot estimate potential impacts which could be associated with additional chemical control measures. Based on the type of damage *P. diospyri* causes and the potential host range, we rated this element High.	

Pestalotiopsis acaciae	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Pestalotiopsis acaciae* has been reported from Australia (Northern Territory and north Queensland, within Plant Hardiness Zone 11 or beyond; Fig. 4), Japan (Tottori Prefecture, within Zones 8-9; Fig. 3), and Portugal (Yuan, 1996; Old et al., 2000; Yasuda et al., 2003; Farr et al., 2005). The potential range of this pest in the United States is Zones 8-11.	High (3)
Risk Element #2: Host Range This fungus has been recorded on *Acacia crassicarpa* and *A. longifolia* (Fabaceae), and *Diospyros kaki* (Ebenaceae) (Old et al., 2000; Yasuda et al., 2003; Farr et al., 2005).	High (3)
Risk Element #3: Dispersal Potential No information is available on the biology of *P. acaciae*. Species of *Pestalotia* or *Pestalotiopsis*, in general, are considered only weak parasites or saprophytes (Horst, 2001). *Pestalotiopsis* spp., in particular, are regarded as opportunistic pathogens that primarily infect plants under stress (e.g., Keith et al., 2006). For example, Wright et al. (1998), investigating a stem blight of blueberry, found that one of the causal agents, *P. guepinii* (Desm.) Steyaert, only infected wounded or stressed plants. If the characteristics of *P. acaciae* are typical of the genus in general, a high level of virulence or invasiveness is not indicated. Whereas some species of *Pestalotiopsis* (e.g., *P. longiseta* [Speg.] Dai & Kobayashi) were common in many persimmon orchards in Japan, *P. acaciae* was isolated only in some orchards (Yasuda et al., 2003), suggesting that local dispersal of the fungus may be limited. However, the widespread distribution of the fungus, with populations established on three continents, suggests that it has the potential to be transported long distances by human agency. Risk is estimated to be medium.	Medium (2)
Risk Element #4: Economic Impact Little information is available concerning the damage potential of this species. Infection produces a ring-spot disease on leaves and calyxes of young fruits of persimmon (Yasuda et al., 2003), presumably reducing fruit quality to some degree. In severe cases, leaves may be shed prematurely. Because *P. acaciae* appears not to be a usual or common pathogen of persimmon in Japan (Yasuda et al., 2003), and affects hosts of apparently no great economic value to the U.S. economy, risk associated with its potential economic impact is judged to be low.	Low (1)
Risk Element #5: Environmental Impact *Pestalotiopsis acaciae* is not expected to pose a threat to endangered or threatened native plants in the United States. No species of *Diospyros* or *Acacia* is listed in 50 CFR §17.12. However, introduction of the fungus into Hawaii could put at risk the native *A. koa*, a tree of considerable economic, ecological, and cultural significance to the state (e.g., Dudley & Yamasaki, 2000), and result in initiation of chemical control programs. Risk of environmental consequences resulting from introduction of the fungus therefore is estimated to be medium.	Medium (2)

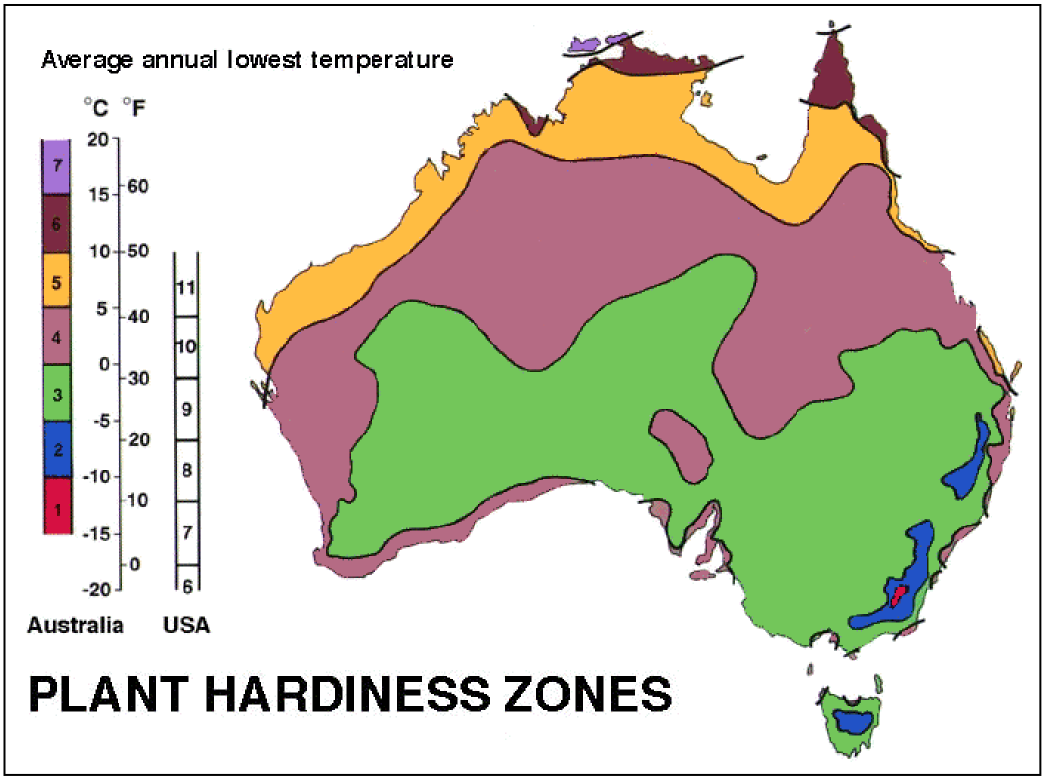

Figure 4. Plant hardiness zones in Australia (source: http://www.anbg.gov.au/hort.research/zones.html).

Pestalotiopsis crassiuscula	Risk ratings
Risk Element #1: Climate-Host Interaction In addition to Japan (Tottori Prefecture, within Plant Hardiness Zones 8-9; Fig. 3), this species has been reported to occur in China and Tanzania (Zones 11 and above; Fig. 5) (Yasuda et al., 2003; Farr et al., 2005). Its estimated potential range in the United States includes regions within Zones 8-11.	High (3)
Risk Element #2: Host Range This fungus has been recorded on *Diospyros kaki* (Ebenaceae), *Eucalyptus globulus* (Myrtaceae), and *Podocarpus macrophyllus* (Podocarpaceae) (Yasuda et al., 2003; Farr et al., 2005).	High (3)
Risk Element #3: Dispersal Potential No information is available on the biology of *P. crassiuscula*. Species of *Pestalotia* or *Pestalotiopsis*, in general, are considered only weak parasites or saprophytes (Horst, 2001). *Pestalotiopsis* spp., in particular, are regarded as opportunistic pathogens that primarily infect plants under stress (e.g., Keith et al., 2006). For example, Wright et al. (1998), investigating a stem blight of blueberry, found that one of the causal agents, *P. guepinii* (Desm.) Steyaert, only infected wounded or stressed plants. If the characteristics of *P. crassiuscula* are typical of the genus in general, a high level of virulence or invasiveness is not indicated. Whereas some species of *Pestalotiopsis* (e.g., *P. longiseta* [Speg.] Dai & Kobayashi) were common in many persimmon orchards in Japan, *P. crassiuscula* was isolated only in some orchards (Yasuda et al., 2003), suggesting that local dispersal of the fungus may be limited. However, the widespread distribution of the fungus, with populations established on at least two continents, suggests that it has the	Medium (2)

Pestalotiopsis crassiuscula	Risk ratings
potential to be transported long distances by human agency. Risk is estimated to be medium.	
Risk Element #4: Economic Impact Little information is available concerning the damage potential of *P. crassiuscula*. Infection produces a ring-spot disease on leaves and calyxes of young fruits of persimmon (Yasuda et al., 2003), presumably reducing fruit quality to some degree. In severe cases, leaves may be shed prematurely. Because the fungus appears not to be a usual or common pathogen of persimmon in Japan (Yasuda et al., 2003), and affects hosts of apparently no great economic value to the U.S. economy, risk associated with its potential economic impact is judged to be low.	Low (1)
Risk Element #5: Environmental Impact *Pestalotiopsis crassiuscula* is not expected to pose a threat to endangered or threatened native plants in the United States. No species of *Diospyros*, *Eucalyptus*, or *Podocarpus* is listed in 50 CFR §17.12. However, introduction of the fungus into areas, such as Florida, could put at risk species of *Eucalyptus* (e.g., *E. amplifolia*, *E. camaldulensis*, and *E. grandis*) with potential to support a commercial wood products industry (e.g., Rockwood, 1997), and result in initiation of chemical control programs. Risk of environmental consequences resulting from introduction of the fungus therefore is estimated to be medium.	Medium (2)

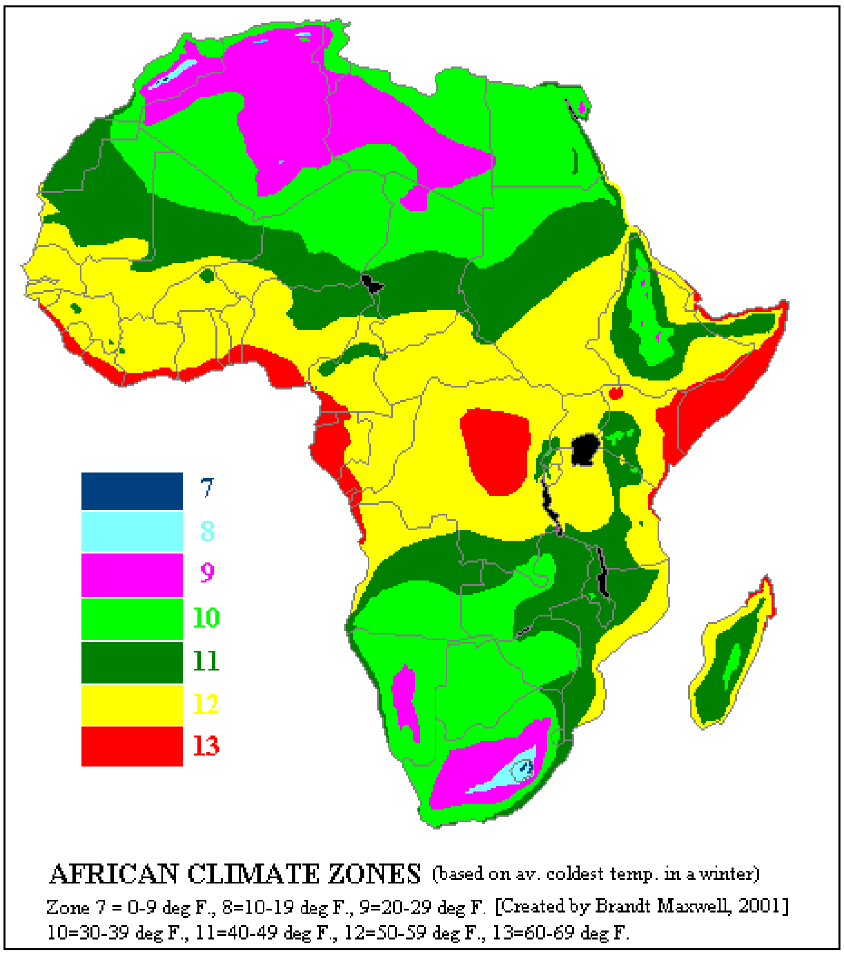

Figure 5. Plant hardiness zones in Africa (source: http://www.backyardgardener.com/zone/africa.html).

Phoma kakivora	Risk ratings
Risk Element #1: Climate-Host Interaction Available information indicates that this species occurs only in Japan (Cook, 1975). It is estimated that the potential distribution of this fungus, should it be introduced, would correspond to that of persimmon in the United States (Plant Hardiness Zones 7-11) (Gilman & Watson, 1993; Das et al., 2001).	High (3)
Risk Element #2: Host Range Available information (and the specific epithet) indicates that *Diospyros kaki* (Ebenaceae) is the only host of this fungus (Yamada, 1966; Cook, 1975).	Low (1)
Risk Element #3: Dispersal Potential No information is available on the biology or ecology of *P. kakivora*. Related species of *Phoma* produce aggressive infections. For example, in *P. lingam* (Tode:Fr.) Desm., epiphytotics may occur under certain favorable conditions (e.g., wet weather); *P. chrysanthemi* Voglino induces a rapid disease of chrysanthemum flowers (Horst, 2001). Infectivity of some commonly phytopathogenic species (e.g., *P. herbarum* Westend., *P. minutispora* Mathur) extends across the kingdom divide to animal hosts (Boerema et al., 2004). If *P. kakivora* exhibits similar characteristics, its reproductive potential could be high. The restricted distribution of the species suggests that it is not readily dispersed over long distances. Risk is estimated to be medium.	Medium (2)
Risk Element #4: Economic Impact Little information is available concerning the economic impact of *P. kakivora*. Infection of fruit produces circular or irregularly-shaped lesions or stains (10-15 mm in diameter) composed of numerous small, black spots (Yamada, 1966), presumably reducing fruit yield and quality. Sepals and leaves also may exhibit the spots. The fungus is a quarantine pest for Korea (PRF, 2006), suggesting that its introduction could result in a potential loss of that market for persimmon fruit from the United States. However, because *P. kakivora* affects only persimmon, a crop of no great economic value to the U.S. economy, risk associated with its potential economic impact is judged to be low.	Low (1)
Risk Element #5: Environmental Impact *Phoma kakivora* is not expected to pose a threat to endangered or threatened native plants in the United States. No species of *Diospyros* is listed in 50 CFR §17.12. Introduction of the fungus probably would not result in initiation of new chemical control programs, as the broad-spectrum fungicides presently used in U.S. persimmon production (e.g., Baron, 2001) likely would prove adequate for control purposes. Risk of significant environmental consequences resulting from introduction of the fungus is estimated to be low.	Low (1)

Phoma loti	**Risk ratings**
Risk Element #1: Climate-Host Interaction Available information indicates that this species occurs only in Japan (Kishi, 1998; Farr and Rossman, 2012). It is estimated that the potential distribution of this fungus, should it be introduced, would correspond to that of persimmon in the United States (Plant Hardiness Zones 7-11) (Gilman & Watson, 1993; Das et al., 2001), therefore we rated this pathogen High for this element.	High (3)
Risk Element #2: Host Range	Low (1)

Phoma loti	**Risk ratings**
Available information indicates that *Diospyros kaki* (Ebenaceae) is the only host of this fungus (Farr and Rossman, 2012), therefore we rated this pathogen Low.	
Risk Element #3: Dispersal Potential No information is available on the biology or ecology of *P. loti*. We examined the biology and epidemiology of other *Phoma* species, including *P. betae* (Leach and MacDonald, 1975), *P. exigua* var. *foveata* (Carnegie, 1975), and *P. lingam* (Travadon et al., 2007) to determine if *P. loti* would reproduce and disperse readily. Based on basic biological and epidemiological information for these other *Phoma* species, conidia are typically rain-splashed and dispersed short distances as the spores become airborne, although long distance spread can occur on infected plant material. For these reasons we rated the pathogen Medium.	Medium (2)
Risk Element #4: Economic Impact No information is available concerning the economic impact of *P. loti*. Fruit and stems of *Diospyros kaki* can be infected (Kishi, 1998), so presumably could reduce fruit yield and quality. However, because *P. loti* affects only persimmon, a crop of little economic value to the U.S. economy, risk associated with its potential economic impact is judged to be low.	Low (1)
Risk Element #5: Environmental Impact It is unknown if *P. loti* is able to infect other species of *Diospyros*, aside from *D. kaki* (Farr and Rossman, 2012). There are several native species of *Diospyros* in the United States, three species in Hawaii, *D. texana* in Texas, and *D. virginiana*, which is distributed throughout the Eastern United States and can provide food for native species of birds and animals (Nesom, 2006; NRCS, 2012). None of these native species are Federally listed as threatened or endangered plants, but *D. virginiana* is listed in two U.S. states as endangered or threatened. However it is not clear how damaging this pathogen would be, since there is little information available about *P. loti*. Based on these potential impacts, we rated this pathogen Medium.	Medium (2)

Ponticulothrips diospyrosi	**Risk ratings**
Risk Element #1: Climate-Host Interaction The geographic distribution of *P. diospyrosi* apparently is restricted to Japan (type locality: Okayama Prefecture) and southern Korea (Haga & Okajima, 1983; Shin et al., 2003). In Japan, the distribution includes Kyushu, Shikoku, and most of Honshu (Suzuki et al., 1995). According to available information, the thrips occurs at least as far north as Fukushima Prefecture (within Plant Hardiness Zones 7-8; Fig. 3) (Kojima et al., 1996). We estimate it could establish permanent populations in areas of the United States within Zones 7-11.	High (3)
Risk Element #2: Host Range The thrips has been recorded on *Diospyros kaki* (Ebenaceae), *Pinus densiflora* (Pinaceae), *Chamaecyparis obtusa* (Cupressaceae), and *Quercus* spp. (Fagaceae) (Miyazaki & Kudo, 1988; Lee et al., 2002b).	High (3)
Risk Element #3: Dispersal Potential Sota (1988) reported average fecundity to range from 160-190 offspring per female; there is one, and occasionally a partial second, generation produced annually. The capacity for increase thus appears to be low. Although spread within a country may be rapid (e.g., Sota, 1988; Shin et al., 2003), the species' restricted, East Asia distribution and a complete lack of U.S. port interception records (PIN 309) suggest that it is not readily	Low (1)

Ponticulothrips diospyrosi	**Risk ratings**
moved internationally in trade or by other, human-aided means. Risk associated with the dispersal potential of *P. diospyrosi* is estimated to be low.	
Risk Element #4: Economic Impact Shin et al. (2003) reported that, in severely infested areas, up to 151 ha of persimmon trees were damaged by the thrips. Damage results from feeding of overwintered females on buds, which results in curling of leaves and formation of horn-like galls, in which eggs are deposited (Sota, 1988). Feeding also produces small (0.5 mm) spots on the surface of fruit, which may coalesce into bands as the fruit grows (Lee et al., 2002b). Shin et al. (2004) found the proportion of damaged persimmon fruit to increase between June and September, from less than 1% to 30%. Insecticidal applications are used to control the thrips in persimmon orchards (Tsuru et al., 1990), which increase costs of fruit production. However, *P. diospyrosi* is known to attack few host plants, and none of great economic value to the U.S. economy. For example, the estimated value of yearly California persimmon production, approximately $10 million (CASS, 2005), is less than 0.005% of total U.S. agricultural output (USCB, 2005b). Risk associated with this species' potential economic impact therefore is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact *Ponticulothrips diospyrosi* poses a potential threat to the native Texas oak, *Quercus hinckleyi*, listed as Threatened in 50 CFR §17.12. As it also represents a potential threat to oriental persimmon in the United States, its establishment in those areas, in which the crop is produced, could lead to the initiation of biological control programs, as has occurred in response to introductions of other thrips species (e.g., Clausen, 1978a, b). Risk attending the potential environmental impact of the thrips is estimated to be high.	High (3)

Pseudococcus cryptus	**Risk Value**
Risk Element #1: Climate-Host Interaction This species exhibits a cold temperate to tropical distribution. It occurs in Kenya, Mauritius, and Zanzibar in Africa; in Asia, from Israel in the west to Japan in the east; in parts of South and Central America, and the Caribbean; and in various island groups of the Pacific, including Hawaii (Ben-Dov *et al*., 2005). In China, the mealybug is found as far north as Liaoning (Plant Hardiness Zones 4-6; Fig. 2) (Hua, 2000). It is conservatively estimated that it could establish permanent populations in the continental United States within Zones 5-11.	High (3)
Risk Element #2: Host Range *Pseudococcus cryptus* has been recorded on plants in more than 40 families (Ben-Dov *et al*., 2005). Hosts include *Mangifera indica* (Anacardiaceae), *Annona muricata* (Annonaceae), *Cocos nucifera* and *Phoenix dactylifera* (Arecaceae), *Ananas sativa* (Bromeliaceae), *Garcinia mangostana* (Clusiaceae), *Persea americana* (Lauraceae), *Glycine max* (Fabaceae), *Punica granatum* (Punicaceae), *Artocarpus* spp. (Moraceae), *Moringa oleifera* (Moringaceae), *Musa* spp. (Musaceae), *Eugenia malaccensis* and *Psidium guajava* (Myrtaceae), *Pandanus* spp. (Pandanaceae), *Passiflora foetida* (Passifloraceae), *Coffea arabica* (Rubiaceae), *Citrus* spp. (Rutaceae), *Litchi chinensis* (Sapindaceae), *Vitis vinifera* (Vitaceae) (Ben-Dov *et al*., 2005); and *Diospyros kaki* (Ebenaceae) (George & Nissen, 2002).	High (3)
Risk Element #3: Dispersal Potential Avidov & Harpaz (1969) and Bartlett (1978b) outlined the reproductive biology of this species. Fecundity ranges from 200-500 eggs per female. There are six to eight	High (3)

generations per year. Mealybugs, in general, are slow-moving insects of limited mobility (e.g., McKenzie, 1967). However, as they frequently accompany commodities that are common in international trade (Miller *et al*., 2002), they are capable of dispersal over considerable distances. For example, *P. cryptus* has been intercepted at U.S. ports on more than 400 occasions, often in cargo (PIN 309). This species exhibits high reproductive and dispersal capacities.	
Risk Element #4: Economic Impact *Pseudococcus cryptus* is considered a major pest of citrus (Hill, 1983). The insect produces copious quantities of honeydew, on which sooty molds develop, sometimes reaching a thickness of 5-8 mm (Avidov & Harpaz, 1969). In heavy infestations, entire trees may be contaminated, and leaves and fruit shed prematurely. Reports from China suggested that the pest “withers entire orange plantations” (Kukhtina, 1970, p. 80). High population densities on coconut palm may cause drying of the inflorescence and button shedding (Moore, 2001). On persimmon, the mealybug settles under the sepal, where it feeds on the fruit; the honeydew produced causes black knots to appear on the fruit (George & Nissen, 2002). The pest is regarded as a major threat to U.S. agriculture (Miller *et al*., 2002). In Israel, both biological and chemical controls have succeeded in maintaining populations generally below economically damaging densities (Avidov & Harpaz, 1969; Blumberg *et al*., 1999), but increase crop production costs. Introduction of this mealybug into the continental United States could result in a loss of foreign markets for various commodities. It is a quarantine pest for Belarus, Argentina, Korea, and Peru (EPPO, 2003b; PRF, 2006). Risk associated with the potential economic impact of this pest is considered high.	High (3)
Risk Element #5: Environmental Impact Because its host range includes a closely related species, *P. cryptus* is considered a potential threat to *Eugenia haematocarpa* and *E. woodburyana*, listed as Endangered in Puerto Rico. As it is a serious pest of citrus and attacks other economically important crops, its introduction into citrus-growing or other regions of the continental United States could spur the initiation of biological control programs. At present, the mealybug is reported to be under at least partial biological control in Israel (Franco *et al*., 2004) and is being considered for biological control in Japan (Arai & Mishiro, 2004). The potential environmental impact of this pest is considered high.	High (3)

Scirtothrips dorsalis	Risk ratings
Risk Element #1: Climate-Host Interaction The distribution of *S. dorsalis* extends from warm temperate zones to the tropics. In Asia, it ranges from Pakistan to Japan and south to Indonesia, into the Hawaiian Islands, and through parts of Melanesia to Australia (CABI/EPPO, 1997b). The thrips recently was detected in Florida in the continental United States (NPB, 2005). Populations also occur in Africa, in Côte d’Ivoire (Bournier, 1999) and South Africa (Gilbert, 1986). In China, the thrips is found as far north as Henan Province (largely within Plant Hardiness Zone 8; Fig. 2) (Hua, 2000). Based on this distribution, it is estimated that *S. dorsalis* could become established in the United States within Zones 8-11.	High (3)
Risk Element #2: Host Range This polyphagous species feeds on a broad range of hosts, including *Solanum melongena* (Solanaceae) (Nair, 1975); *Gossypium hirsutum* (Malvaceae), *Actinidia chinensis* (Actinidiaceae), *Vitis vinifera* (Vitaceae), *Hevea brasiliensis* (Euphorbiaceae), *Allium cepa* (Liliaceae), *Camellia sinensis* (Theaceae), *Citrus* sp. (Rutaceae) (CABI/EPPO, 1997b); *Zea mays* (Poaceae), *Zizyphus mauritiana* (Rhamnaceae), *Passiflora edulis*	High (3)

Scirtothrips dorsalis	Risk ratings
(Passifloraceae), *Fragaria chiloensis* (Rosaceae), *Annona squamosa* (Annonaceae) (Chang, 1991); *Theobroma cacao* (Sterculiaceae), *Mangifera indica* (Anacardiaceae), *Glycine max* (Fabaceae) (Lewis, 1997b); *Diospyros kaki* (Umeya & Okada, 2003); and *Nephelium lappaceum* (Sapindaceae) (Parker & Skinner, 1997).	
Risk Element #3: Dispersal Potential Fecundity ranges from 40-68 eggs per female; a female to male sex ratio of 6:1 has been reported (CABI, 2004). There may be 10-15 generations per year (Li et al., 2004). The potential of *Scirtothrips* spp. for natural spread is said to be limited (CABI/EPPO, 1997b). However, the presence of *S. dorsalis* in Hawaii and Africa, far from its presumed center of origin in Asia (IIE, 1986), suggests that this species can be transported long distances by human agency. This possibility is supported by the record of quarantine interceptions. Since 1985, the thrips has been intercepted at U.S. ports on at least 51 occasions, often in cargo (PIN 309). It also has been intercepted in the Netherlands (CABI/EPPO, 1997b). Risk associated with the dispersal potential of *S. dorsalis* is estimated to be high.	High (3)
Risk Element #4: Economic Impact In tropical Asia, *S. dorsalis* is a serious pest of vegetable crops in Taiwan and Thailand, chili pepper and peanut in India, cotton in India and Pakistan, roses in India, and citrus (particularly *C. unshiu*) in Taiwan and Japan (CABI/EPPO, 1997b). Feeding causes distortion of young leaves and scarring of fruit, resulting in both a lowering of crop quality and yield reduction. For example, in chili pepper, *Capsicum frutescens*, heavy infestation causes premature leaf drop; yield losses of 25-55% have been reported (CABI, 2004). In cashew (*Anacardium occidentale*), infestation was thought to cause premature drop of 15-25% of fruit (Gowda et al., 1979). Insecticidal applications are used routinely for control (CABI, 2004), measures that increase costs of production. The species is a quarantine pest for Mexico, Turkey, Chile, Peru, the European Union, New Zealand, and Canada (EPPO, 2003b; PRF, 2006), suggesting that its introduction into the continental United States could result in a loss of foreign markets for various agricultural commodities. Potential of this pest to cause significant economic harm is considered to be high.	High (3)
Risk Element #5: Environmental Impact Introduction of *S. dorsalis* into the continental United States or Puerto Rico could place at risk listed native plants that are closely related to known hosts (i.e., *Solanum drymophilum*, *Allium munzii*, *Zizyphus celata*). As it is a pest of several economically valuable crops (e.g., soybean, corn, grape, citrus), its introduction also could make it the target of chemical control programs similar to those that have proven successful against it elsewhere (e.g., Reddy et al., 2005). Risk is estimated to be high.	High (3)

Stathmopoda masinissa	Risk ratings
Risk Element #1: Climate-Host Interaction *Stathmopoda masinissa* has been reported from China, Japan, Korea, Sri Lanka, Taiwan, and Thailand (Moriuti & Yasuda, 1983; Kim et al., 1997). In China, it has been found as far north as Hebei and Shanxi (Plant Hardiness Zones 5-7; Fig. 2) (Hua, 2005), and is known to occur in central Honshu in Japan (Naka et al., 2003). It is conservatively estimated that the moth could establish permanent populations in the United States within Zones 6-11.	High (3)
Risk Element #2: Host Range This moth has been recorded on *Diospyros kaki* and *D. lotus* (Ebenaceae) (Xu et al., 1996; Robinson et al., 2005).	Low (1)

Stathmopoda masinissa	Risk ratings
Risk Element #3: Dispersal Potential Average fecundity has been reported to range from 62-77 eggs per female; there are two generations per year (Oda, 1982). Mobility of the species appears to be rather low. For example, the moths are only minimally attracted to light traps (Naka et al., 2003). Also, the species' extremely narrow host range, its restricted distribution in Asia, and a complete lack of interceptions at U.S. ports (PIN 309) suggest that its potential for dispersal, either naturally or by human agency, is not large. Risk associated with this element is judged to be medium.	Medium (2)
Risk Element #4: Economic Impact *Stathmopoda masinissa* has been cited as the most serious pest of persimmon in Japan (Clausen, 1931). Damage is caused by larvae boring into fruit (Naka et al., 2003), at both the developing and harvest stages (Kim et al., 1997). A larva may attack several fruits, thereby compounding the damage (Clausen, 1931). Attack may lead to premature fruit fall (Kawaguchi, 1937). Yield losses of 22-100% have been reported (Tanaka, 1918; Bae, 1997). Control measures include application of insecticides (Naka et al., 2003) and bagging of fruit (Tanaka, 1918; Clausen, 1931), both of which increase production costs. However, as *S. masinissa* is known to attack few hosts, and none of great economic value to the U.S. economy, risk associated with its economic impact is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact This pest is not expected to pose a threat to endangered native plants in the United States. No species of *Diospyros* is listed in 50 CFR §17.12. Its introduction into persimmon-producing areas could spur the initiation of chemical control programs, which are common elsewhere (e.g., Naka et al., 2003). Also, since natural enemies of the moth are known (e.g., Uchida, 1933; Zhao et al., 2004), it could become the target of biological control programs. Risk is estimated to be medium.	Medium (2)

Tenuipalpus zhizhilashviliae	Risk ratings
Risk Element #1: Climate-Host Interaction *Tenuipalpus zhizhilashviliae* is reported to occur in Japan, Taiwan, and the former Soviet Union (e.g. Georgia, within Plant Hardiness Zones 7-9; Fig. 6) (Ghai & Shenhmar, 1984). From this distribution, it is inferred that the species could establish permanent populations in the United States within Zones 7-11.	High (3)
Risk Element #2: Host Range The mite has been recorded on *Diospyros kaki* (Ebenaceae) and *Vitis vinifera* (Vitaceae) (Ghai & Shenhmar, 1984).	High (3)
Risk Element #3: Dispersal Potential No information is available on the reproductive or dispersal potentials of *T. zhizhilashviliae*. Fecundity reported for related species of *Tenuipalpus* ranges from an average of 17 eggs per female in *T. granati* Sayed (Yousef et al., 1979) to 34 eggs per female in *T. heveae* Baker (Pontier et al., 2000). There may be 10 generations per year in some species (e.g., *T. punicae* Pritchard & Baker; Zaher & Yousef, 1972). If the biology of *T. zhizhilashviliae* is similar, its biotic potential could be high. Tenuipalpid mites tend to be slow moving (Jeppson et al., 1975), and thus are likely to have limited inherent powers of dispersal. Movement over long distances is accomplished on plant materials, as evidenced by numerous interceptions at U.S. ports (PIN 309). The disjunct distribution of *T. zhizhilashviliae* in Asia, with a far outlying population in Georgia (Ghai & Shenhmar,	High (3)

Tenuipalpus zhizhilashviliae	Risk ratings
1984), suggests that the species has the potential to be dispersed widely by human agency. Risk is estimated to be high.	
Risk Element #4: Economic Impact No information is available concerning the economic impact of this species. The mite feeds on the fruit of persimmon (Umeya & Okada, 2003; MAFF, 2005), presumably reducing yield or quality to some extent. Feeding by other tenuipalpids produces spotting or other blemishes on fruits (Jeppson et al., 1975). Although recorded on grape (Ghai & Shenhmar, 1984), a lack of published information suggests that its economic impact on that crop is not significant. Jeppson et al. (1975) maintained that most tenuipalpid species are of no economic importance, either because their hosts are economically unimportant or their population densities tend to remain below economically injurious levels. Risk is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact *Tenuipalpus zhizhilashviliae* is not considered likely to put at risk threatened or endangered plants in the United States; no hosts or close relatives of hosts are listed in 50 CFR §17.12. However, as it represents a potential threat to oriental persimmon and grape production, its establishment in those areas, in which the crops are produced, could lead to the initiation of biological and chemical control programs, as have targeted other tenuipalpid pests elsewhere (e.g., Ali et al., 2005). Risk attending the potential environmental impact of the mite is estimated to be medium.	Medium (2)

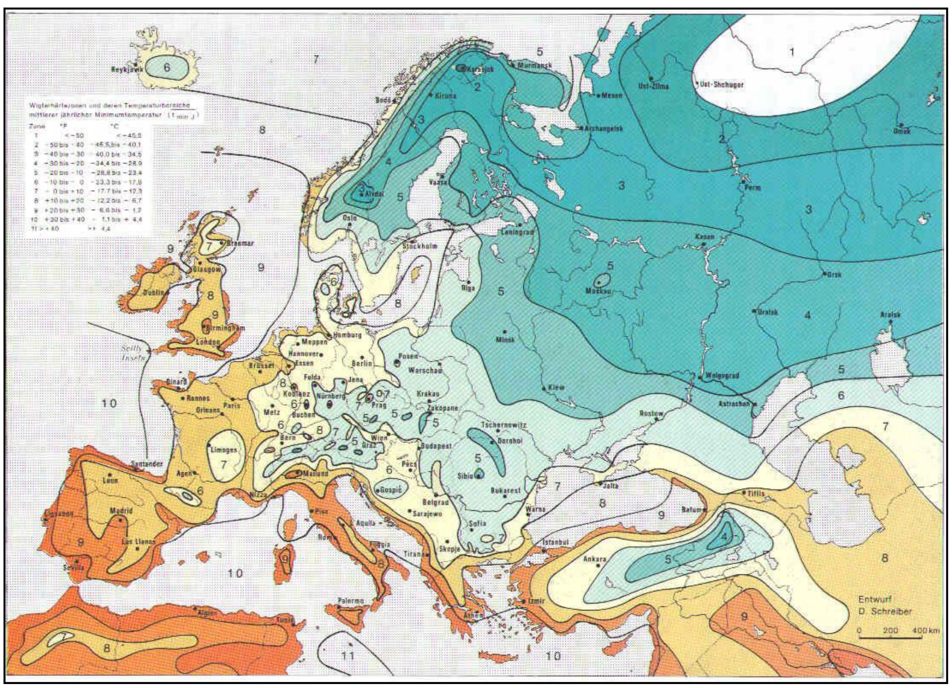

Figure 6. Plant hardiness zones in Europe (source: http://www.backyardgardener.com/zone/europe1zone.html).

Thrips coloratus	**Risk ratings**
Risk Element #1: Climate-Host Interaction	High (3)

Thrips coloratus	**Risk ratings**
The distribution of *T. coloratus* extends from South Asia to Australasia. It is reported to occur in Australia, Brunei, China (as far north as Henan, within Plant Hardiness Zones 7-8; Fig. 2), India, Indonesia, Japan, Korea, Laos, Malaysia, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Taiwan, and Thailand (Mound & Houston, 1987; Wongsiri, 1991; Palmer, 1992; Hua, 2000). It is estimated that this species could survive in regions of the United States corresponding to Zones 7-11.	
Risk Element #2: Host Range This thrips has been recorded on a broad range of plants. Hosts include *Cirsium* sp. (Asteraceae), *Diospyros kaki* (Ebenaceae), *Allium fistulosum* (Liliaceae), *Hibiscus mutabilis* (Malvaceae), *Zea mays* (Poaceae), *Trifolium* sp. (Fabaceae), *Ficus carica* (Moraceae), *Eriobotrya japonica* (Rosaceae), *Citrus* sp. (Rutaceae), *Nicotiana tabacum* (Solanaceae), *Camellia sinensis* (Theaceae), *Vitis vinifera* (Vitaceae) (Miyazaki & Kudo, 1988); *Solidago* sp. (Mound & Masumoto, 2005); *Eucalyptus* sp. (Myrtaceae), *Cucumis sativus* (Cucurbitaceae), *Mangifera indica* (Anacardiaceae) (Hua, 2000); *Litchi chinensis* and *Dimocarpus longan* (Sapindaceae), and *Durio zibethinus* (Bombacaceae) (Wongsiri, 1991).	High (3)
Risk Element #3: Dispersal Potential No information is available on the reproductive or dispersal potentials of this species. Fecundity in related species of *Thrips* ranges from an average of about 80 eggs per female in *T. tabaci* Lindeman (Clausen, 1978b) to 200 or more eggs per female in *T. imaginis* Bagnall (Lewis, 1973). There may be 10 or more generations per year in some species (e.g., *T. tabaci*; Hill, 1987). If the biology of *T. coloratus* is similar, its biotic potential could be high. Although inherently poor fliers, thrips may be dispersed hundreds of kilometers via wind currents (Lewis, 1973). Artificial dispersal also has been implicated in the movement of particular thrips species long distances (Lewis, 1997a), and the rather widespread distribution of *T. coloratus* suggests that human-assisted transport may have played a role in its spread through Asia and the Pacific. The species has been intercepted in baggage and cargo at U.S. ports on at least seven occasions since 1985 (PIN 309). Risk is estimated to be high.	High (3)
Risk Element #4: Economic Impact Little information is available concerning the economic impact of this species. The thrips has been reported to feed on the fruit of citrus (Teramoto et al., 2001) and fig (Imai et al., 2001), and the flowers of other crops (e.g., *Tagetes erecta*; Kulshrestha et al., 1986), presumably reducing yield or quality to some extent. However, it is not usually considered a serious pest (Mound & Kibby, 1998). For example, in Japan, it is regarded as only a minor pest of ornamental plants, fig, and tea (Okada & Kudo, 1982; Imai et al., 2001). As *T. coloratus* is a quarantine pest for New Zealand (PRF, 2006), its introduction could result in a loss of foreign markets for commodities, such as citrus and grape. The weight of evidence suggests that the economic impact of this pest is low.	Low (1)
Risk Element #5: Environmental Impact Because of its association with congeners, *T. coloratus* represents a potential threat to endangered plants in the United States, such as *Cirsium fontinale* var. *fontinale*, *C. fontinale* var. *obispoense*, *C. hydrophilum* var. *hydrophilum*, *C. loncholepis*, *C. vinaceum*, *Allium munzii*, *Hibiscus arnottianus* ssp. *immaculatus*, *H. brackenridgei*, *H. clayi*, *H. waimeae* ssp. *hannerae*, *Trifolium amoenum*, *T. stoloniferum*, *T. trichocalyx*, and *Solidago spithamaea*. As the thrips is a pest of several economically important crops (e.g., corn, citrus, grape), its establishment could lead to the initiation of biological control programs, as has occurred in response to introductions of other thrips species	High (3)

Thrips coloratus	**Risk ratings**
(e.g., Clausen, 1978a, b). Risk attending the potential environmental impact of *T. coloratus* is estimated to be high.	

Table 5. Risk ratings for Consequences of Introduction for pests on persimmon from Japan.

Pest	Risk elements					Cumulative Risk Rating
	Climate/Host Interaction	Host Range	Dispersal Potential	Economic Impact	Environ. Impact	
Adisciso kaki	High (3)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (9)
Colletotrichum horii	High (3)	Low (1)	High (3)	Med (2)	Med (2)	Medium (11)
Conogethes punctiferalis	High (3)	High (3)	High (3)	High (3)	High (3)	High (15)
Crisicoccus matsumotoi	High (3)	High (3)	High (3)	Med (2)	High (3)	High (14)
Cryptosporiopsis kaki	High (3)	Low (1)	Low (1)	Low (1)	Low (1)	Low (7)
Homonopsis illotana	High (3)	High (3)	Low (1)	Low (1)	High (3)	Medium (11)
Lobesia aeolopa	High (3)	High (3)	High (3)	Med (2)	High (3)	High (14)
Mycosphaerella nawae	High (3)	Low (1)	High (3)	Med (2)	Med (2)	Medium (11)
Pestalotia diospyri	High (3)	High (3)	Med (2)	Med (2)	High (3)	High (13)
Pestalotiopsis acacia	High (3)	High (3)	Med (2)	Low (1)	Med (2)	Medium (11)
Pestalotiopsis crassiuscula	High (3)	High (3)	Med (2)	Low (1)	Med (2)	Medium (11)
Phoma kakivora	High (3)	Low (1)	Med (2)	Low (1)	Low (1)	Low (8)
Phoma loti	High (3)	Low (1)	Med (2)	Low (1)	Med (2)	Medium (9)
Ponticulothrips diospyrosi	High (3)	High (3)	Low (1)	Low (1)	High (3)	Medium (11)
Pseudococcus cryptus	High (3)	High (3)	High (3)	High (3)	High (3)	High (15)
Scirtothrips dorsalis	High (3)	High (3)	High (3)	High (3)	High (3)	High (15)
Stathmopoda masinissa	High (3)	Low (1)	Med (2)	Low (1)	Med (2)	Medium (9)
Tenuipalpus zhizhilashviliae	High (3)	High (3)	High (3)	Low (1)	Med (2)	Medium (12)
Thrips coloratus	High (3)	High (3)	High (3)	Low (1)	High (3)	High (13)

2.6. Likelihood of Introduction—Quantity Imported and Pest Opportunity

Likelihood of introduction is a function of both the quantity of the commodity imported annually and pest opportunity, which consists of five criteria that consider the potential for pest survival along the pathway (USDA, 2000). The values determined for the Likelihood of Introduction for each pest are summarized below (Table 8).

2.6.1. Quantity of commodity imported annually

The rating for the quantity imported annually usually is based on the amount reported by the exporting country, and is converted into standard units of 40-foot-long shipping containers. The projected quantity of persimmon fruit to be exported annually by Japan to the United States currently is unknown. However, if it is assumed that fruit production will increase to a level permitting exports to the United States to equal, at a minimum, those presently entering other markets (≈ 240 tonnes; FAOSTAT, 2006b), volume will approximate the capacity of 10 40-foot-long shipping containers. Risk is estimated to be medium.

2.6.2. Survive post-harvest treatment

Specific post-harvest treatments of persimmon fruit in Japan have not been communicated. However, among the arthropod pests of concern, all of those that bore into, and feed within, fruit, such as *Conogethes punctiferalis*, *Homonopsis illotana*, *Lobesia aeolopa*, and *Stathmopoda* *masinissa*, would be expected to have a high probability (> 10 percent; USDA, 2000) of surviving minimal post-harvest treatment, such as washing and culling, especially if infestation of the fruit was not of such great age that damage was obvious, and thus to present a high risk of introduction.

The remaining arthropods, the false spider mite, *Tenuipalpus zhizhilashviliae*, the scale insects, *Crisicoccus matsumotoi*, *Pseudococcus cryptus*, and the thrips, *Ponticulothrips diospyrosi*, *Scirtothrips dorsalis*, and *Thrips coloratus*, are external feeders, and likely would have a lesser probability of surviving post-harvest treatments. However, depending on their stage (egg, larva, adult) or instar, these arthropods might find shelter on persimmon fruit, particularly beneath the calyx, or in packing materials. For example, many scales prefer to settle within tight, protected areas on hosts (Kosztarab, 1996). Their cryptic behavior, small size (most scales are less than 5 mm long; Gullan & Kosztarab, 1997), and water-repellent, waxy coverings could make them difficult to see or dislodge. Also, coccid and diaspidid scales have sessile stages that live firmly appressed to plant surfaces, a posture that contributes further to the difficulty of their removal. Many thrips seek protection in narrow crevices on their hosts, and there is little wandering from these sites (Lewis, 1973). Because of its minute size (length 200-300 μm; Umeya & Okada, 2003), *T. zhizhilashviliae*, might easily evade detection or resist removal, particularly if sheltered by the calyx. Species of *Tenuipalpus*, in general, are reported to be difficult to dislodge from host material (Baker & Tuttle, 1987). The external pests are considered to have a probability of surviving post-harvest treatment of between 0.1 and 10 percent (i.e., in the medium range; USDA, 2000).

In New Zealand, for example, pests from all of the above groups, Lepidoptera, scales, thrips, and mites, have been recorded on persimmon fruit, typically sheltering beneath the calyx (Steven, 2001).

The nine fungi have a high probability of surviving post-harvest treatment, particularly if infection is in its early stages. Most fungi spread, as mycelium, throughout the tissues of the plant organs that they infect (Agrios, 1997). As internal parasites, they would be protected from any post-harvest operations that treat the fruit surface only, and would tend to be invisible to the unaided eye (Moore-Landecker, 1982).

<u>2.6.3. Survive shipment</u>

The Japanese NPPO did not state the conditions under which persimmons will be shipped to the United States, but typical practice for persimmon is to ship at -1 °C (McGregor, 1987).

Fungi. Such temperatures are unlikely to negatively impact the fungi, so we rated them High.

Arthropods. Storing fruit at 0 °C or lower is detrimental to many arthropods (Hoy and Whiting, 1998), but it is not expected to kill all of them.

Prolonged cold storage kills the larvae of *Conogethes punctiferalis* (Lee, et al., 2000). We rated it Low.

Chilling may also affect *Pseudococcus cryptus* because its lower development threshold is 8 °C (Kim, et al., 2008). We assume *Crisicoccus matsumotoi* may be similarly affected. The lower development threshold is about 10 °C for *Ponticulothrips diospyrosi* (Uchiyama and , 1990) and *Scirtothrips dorsalis* (Tatara, 1994), so they also seem likely to be impacted by chilling. The same threshold for *Stathmopoda masinissa* is estimated to be 12.4 °C (Naka et al., 1998). Finally, we found no specific information on temperature limits for *Thrips coloratus*, but a similar species, *Thrips palmi*, had a development threshold of about 7 °C for the most susceptible life stage (McDonald et al., 1999). We rated each of those species as Medium.

We found no specific information for *Lobesia aeolopa*, but a related pest species, *L. botrana*, can survive temperatures below -1 °C (Andreadis, et al., 2005). Therefore, we rated it high.

The distribution of *Homonopsis illotana* from China into Japan, Korea, and Russia (Wang, et al., 2003), indicates considerable potential for cold tolerance. Therefore, we rated it High.

Tenuipalpus zhizhilashviliae seems likely to survive transport on persimmon (DAFF, 2003), so we rated it High.

<u>2.6.4. Not detected at a port-of-entry</u>

As with assessing the risk of persimmon pests surviving post-harvest treatment, estimating the risk that these pests will not be detected at a port-of-entry involves consideration of pest size, mobility, and degree of concealment. Among the arthropods, again depending on the age of infestation, the internal, lepidopterous pests could have a high probability of escaping detection at a port-of-entry, particularly if entry holes are concealed by the calyx. Risk of these pests' evading detection therefore is estimated to be high.

Because the remaining arthropods are external feeders, and therefore potentially visible on the surface of fruit, there might be a somewhat lower, although still significant, likelihood of their escaping detection. As noted above, these pests often have been found sheltering beneath the calyx on persimmon fruits (Steven, 2001). Scale insects are said to be notoriously invasive because of their small size, their tendency to live in concealed habitats, and the fact that they frequently are transported on commodities that are common in international trade (Miller et al., 2002). Small insects, such as thrips, may easily pass unnoticed on fruit and other plant parts unless these are carefully scrutinized (Lewis, 1973). The small size and sluggish activity of tenuipalpid mites, and their habit of living or depositing eggs in secluded places on hosts has tended to shield them from detection (Jeppson et al., 1975). Risk of the external pests not being detected is estimated to be medium.

Latent fungal infections of persimmon fruit, involving internal mycelia (Agrios, 1997), are likely to go undetected. Risk of the fungi escaping detection at a port-of-entry therefore is considered high.

<u>2.6.5. Moved to a habitat suitable for survival</u>

Persimmon fruit from Japan is likely to be sold in every state. However, if it is assumed that demand for the fruit is proportional to the size of the consumer population in potential markets, then imports might be concentrated more in some regions of the United States than in others, and not all of these regions may be conducive to pest survival. Countries in East and Southeast Asia are reported to be large markets for persimmons (Collins, 1997; George & Nissen, 2002). Asian groups, therefore, likely would constitute the major markets for the fruit in the United States, and regions in which these groups are concentrated could become destinations for a majority of persimmon consignments. Twenty-three states are home to substantial Asian populations (> 100,000; USCB, 2005a: Table 23). All 50 states contain areas within Plant Hardiness Zone 4 or above (Fig. 7). Assuming that infestations or infections by all pests will be randomly distributed among consignments, because they have the potential to found populations in a range of states that may comprise as many as 91-100 percent of markets for Japanese persimmon (Table 7), pests with potential to establish within Zones 4-6 and above are estimated to present a high risk of moving to habitat suitable for survival. Habitats considered suitable for the remaining pests (within Zones 7 and above) occur in 15 or fewer states comprising likely markets for persimmon. Risk of these species moving to suitable habitat is estimated to be medium.

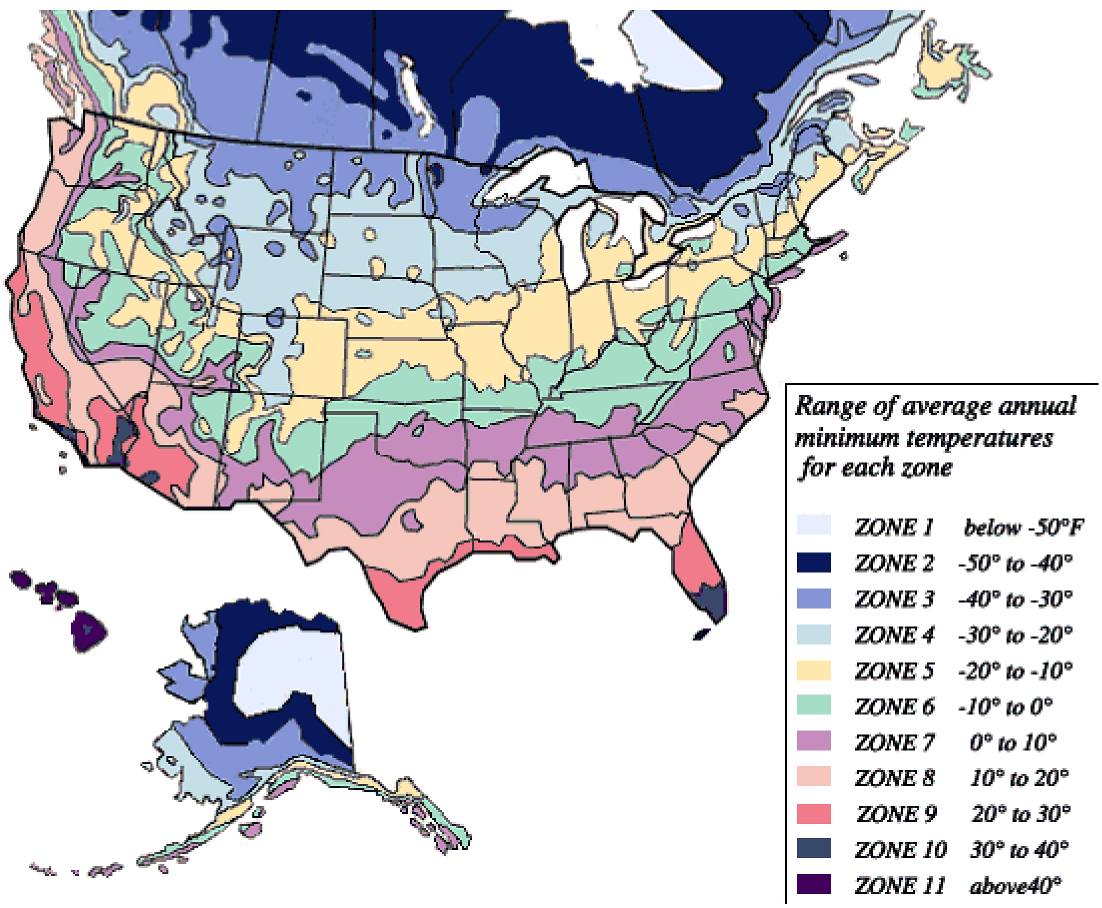

Figure 7. Plant hardiness zones in the United States (source: USDA, 2000).

Table 7. Proportion of likely persimmon markets within potential pest range in the United States.

Pest	**Estimated Potential U.S. Range (Plant Hardiness Zones)[1]**	**Likely Persimmon Markets Within Range[2] (Percentage)**
Adisciso kaki	7-11	58-65
Colletotrichum horii	7-10	58-65
Conogethes punctiferalis	5-11	46-96
Crisicoccus matsumotoi	6-11	54-91
Cryptosporiopsis kaki	7-11	58-65
Homonopsis illotana	6-11	54-91
Lobesia aeolopa	4-11	100
Mycosphaerella nawae	7-11	58-65
Pestalotia diospyri	5-11	46-96
Pestalotiopsis acaciae	8-11	43-59
Pestalotiopsis crassiuscula	8-11	43-59
Phoma kakivora	7-11	58-65
Phoma loti	7-11	58-65
Ponticulothrips diospyrosi	7-11	58-65
Pseudococcus cryptus	5-11	46-96
Scirtothrips dorsalis	8-11	43-59
Stathmopoda masinissa	6-11	54-91
Tenuipalpus zhizhilashviliae	7-11	58-65
Thrips coloratus	7-11	58-65

[1]From Section 5: Consequences of Introduction.
[2]Population data from USCB (2005a).

2.6.6. Come into contact with host material suitable for reproduction

Assessment of the probability that a plant pest will come into contact with host material must take into account not only the availability, in time and space, of its host plants and of the particular plant parts fed upon or used for reproduction, but also the pest’s inherent powers of movement allowing it to find and colonize hosts quickly and the myriad environmental factors that act against its survival.

Even if they succeed in reaching a new region, immigrant organisms are likely to be destroyed quickly by a multitude of physical or biotic agents present in the environment. Data quantifying the number of species actually dispersed from their native ranges, the number arriving at a new site, and the number of these that subsequently perish are almost entirely lacking, but, based on the number of species that have been collected only once far beyond their native range, the local extinction of immigrants soon after their arrival must be enormous (Mack et al., 2000). Other examples serve to illustrate the poor prospects for establishment and the extinction risks faced by small adventive populations. In a study of the success of various groups of invading organisms, Williamson & Fitter (1996) found that no greater than 1 percent of insects introduced into a new region became established. Controlled studies of insects introduced for biological weed control, in which conditions for establishment generally were optimal, showed that small founding populations (at densities likely to be greater than those typically infesting imported commodities, such as fruits and vegetables) tended to become extinct within three years of introduction

(Memmott et al., 1998; Grevstad, 1999). The probability, therefore, that pest organisms entering the United States in consignments of fruits and vegetables will be successful in finding suitable hosts might be assumed a priori to be low.

Depending on cultivar, persimmons mature between early autumn and winter; harvesting of a given cultivar may extend over several weeks (George & Nissen, 2002). Hosts, even if present in an area of pest introduction, might not be in suitable condition (i.e., with new vegetative growth or developing fruit) during much or all of the period, in which the fruit is harvested and shipped.

Also, because persimmons will be imported for consumption only, the fruits would be expected to have only a limited probability of introduction directly into the natural or agricultural environments, in which hosts might be found. APHIS keeps a record of interceptions at U.S. ports of quarantine pests on various commodities (fruits and vegetables, plant propagative material). As only a small percentage of goods passing through the ports is inspected (< 2 percent; NRC, 2002), a reasonable assumption is that at least some of these pests also are present in the many more items that are entering the country without inspection (cf. Work et al., 2005), and are thus presented with opportunities to become established. Yet there is no record of establishment for many of these pests. For example, since 1984, at least 104 specimens of *Conogethes punctiferalis* and more than 550 specimens of *Pseudococcus cryptus* have been intercepted at mainland U.S. ports, on various commodities for consumption (PestID, 2009). During that period, these pests have failed to become established, so far as we know, at least in the continental United States.

Several of the arthropods potentially accompanying persimmon consignments from Japan (i.e., females of the scale insects, *C. matsumotoi*, *E. lagerstroemiae*, *L. cupressi*, and *L. kuwacola*), because they lack wings or other means to achieve flight, have limited powers of natural dispersal (Gullan & Kosztarab, 1997), and thus lack the ability to locate hosts quickly before succumbing to agents of mortality in the environment. For example, evidence suggests that crawlers (first-instar nymphs, the only mobile stage) must colonize suitable host substrate within about 24 hours of hatch in order to survive (Greathead, 1990). Moreover, successful establishment of armored scales in a new environment is contingent on satisfying at least two conditions simultaneously: close proximity of susceptible hosts and presence on the imported fruit or other consumable of crawlers to transfer to new hosts (e.g., Miller, 1985; Blank et al., 1993), circumstances that are highly unlikely to co-occur.

The probability of other pests encountering suitable host material also is considered low. Tenuipalpid mites, as they also are incapable of active or passive flight, have highly limited mobility (Jeppson et al., 1975). Thrips dispersal is associated with extremely high rates of mortality (Lewis, 1973), as the probability of finding suitable hosts is low (Mound & Teulon, 1995). A few of the pests (i.e., *S. masinissa* and the four fungal species) are restricted to persimmon or to that host and one or a few tropical or subtropical genera or species that have limited distributions within the United States (USDA-NRCS, 2006).

Plant material for consumption, such as fresh fruit and vegetables, is considered generally to pose a low risk as a pathway for establishment of fungi, in contrast to propagative material (Palm & Rossman, 2003). For fungi, depending upon their dispersal mechanisms, successful establishment by wind-blown spores is influenced by the quantity of spores produced, the number of spores that become airborne, wind direction and speed, the ability of spores to survive adverse environmental conditions, and the availability of susceptible hosts (Roberts & Boothroyd, 1972). Optimal conditions enabling *Adisciso kaki*, *Cryptosporiopsis kaki*, *Mycosphaerella nawae*, *Pestalotia diospyri*, *Pestalotiopsis acaciae*, *P. crassiuscula*, *Phoma kakivora*, and *P. loti*, to infect hosts are considered unlikely to occur, since the commodity is being imported for consumption and will have low likelihood of contacting susceptible host upon being discarded, although some of the hosts are common in the some areas of the United States.

Females of pyralid and tortricid moths may lay several eggs on an individual fruit (Honda & Matsumoto, 1984; Maher & Thiéry, 2004), and several larvae may be able to complete development in each fruit (e.g., Dustan, 1935; Rothschild & Vickers, 1991). Individual infested persimmon fruit imported into the United States thus would have the potential to give rise to breeding populations of *C. punctiferalis*, *H. illotana*, and *L. aeolopa*. Hosts of these polyphagous and flight-capable species include broadly distributed wild or cultivated plants, such as species of *Prunus, Malus, Quercus, Acer, Vitis, Pinus, Ribes, Rubus, Solidago,* and *Citrus,* and, among row crops, corn, soybean, sorghum, and cotton (USDA-NRCS, 2006), which should be available throughout the potential area of establishment. Risk that these pests will encounter suitable host material is considered medium.

Table 8. Risk rating for Likelihood of Introduction of pests on persimmon, *Diospyros kaki*, from Japan.

Pest	Quantity Imported Annually	Survive Postharvest Treatment	Survive Shipment	Not Detected at Port-of-Entry	Moved to Suitable Habitat	Contact with Host Material	Cumulative Risk Rating[a]
Adisciso kaki	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Colletotrichum horii	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Conogethes punctiferalis	Med (2)	High (3)	Low (1)	High (3)	High (3)	High (3)	High (15)
Crisicoccus matsumotoi	Med (2)	Med (2)	Med (2)	Med (2)	High (3)	Low (1)	Medium (12)
Cryptosporiopsis kaki	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Homonopsis illotana	Med (2)	High (3)	High (3)	High (3)	High (3)	High (3)	High (17)
Lobesia aeolopa	Med (2)	High (3)	High (3)	High (3)	High (3)	High (3)	High (17)
Mycosphaerella nawae	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Pestalotia diospyri	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Pestalotiopsis acaciae	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Pestalotiopsis crassiuscula	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Phoma kakivora	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Phoma loti	Med (2)	High (3)	High (3)	High (3)	Med (2)	Low (1)	Medium (14)
Ponticulothrips diospyrosi	Med (2)	Med (2)	Med (2)	Med (2)	Med (2)	Low (1)	Medium (11)
Pseudococcus cryptus	Med (2)	Med (2)	Med (2)	Med (2)	High (3)	Low (1)	Medium (12)

Pest	Quantity Imported Annually	Survive Postharvest Treatment	Survive Shipment	Not Detected at Port-of-Entry	Moved to Suitable Habitat	Contact with Host Material	Cumulative Risk Rating[a]
Scirtothrips dorsalis	Med (2)	Med (2)	Med (2)	Med (2)	Med (2)	High (3)	Medium (13)
Stathmopoda masinissa	Med (2)	High (3)	Med (2)	High (3)	High (3)	Low (1)	Medium (14)
Tenuipalpus zhizhilashviliae	Med (2)	Med (2)	High (3)	Med (2)	Med (2)	Low (1)	Medium (12)
Thrips coloratus	Med (2)	Med (2)	Med (2)	Med (2)	Med (2)	Low (1)	Medium (11)

[a] Low = 6-9 points, Medium = 10-14 pts, High = 15-18 points

2.7. Conclusion—Pest Risk Potential and Pests Requiring Phytosanitary Measures

The summation of the values for the consequences of introduction and the likelihood of introduction for each pest yields Pest Risk Potential (USDA, 2000) (Table 9). This is an estimate of the unmitigated risk associated with this importation.

Pests with a Pest Risk Potential value of Low do not require mitigation, whereas a value within the Medium range indicates that specific phytosanitary measures may be necessary. The "Guidelines" (USDA, 2000) state that a High Pest Risk Potential means that specific phytosanitary measures are strongly recommended, and that mere port-of-entry inspection is not considered sufficient to provide phytosanitary security. The choice of appropriate phytosanitary measures to mitigate risks is undertaken as part of Risk Management, and is not addressed in this document.

Table 9. Pest Risk Potentials.

Pest	Consequences of Introduction	Likelihood of Introduction	Pest Risk Potential
Adisciso kaki	Medium (9)	Medium (14)	Medium (23)
Colletotrichum horii	Medium (11)	Medium (14)	Medium (25)
Conogethes punctiferalis	High (15)	High (15)	High (30)
Crisicoccus matsumotoi	High (14)	Medium (12)	Medium (26)
Cryptosporiopsis kaki	Low (7)	Medium (14)	Medium (21)
Homonopsis illotana	Medium (11)	High (17)	High (28)
Lobesia aeolopa	High (14)	High (17)	High (31)
Mycosphaerella nawae	Medium (11)	Medium (14)	Medium (25)
Pestalotia diospyri	High (13)	Medium (14)	High (27)
Pestalotiopsis acaciae	Medium (11)	Medium (14)	Medium (25)
Pestalotiopsis crassiuscula	Medium (11)	Medium (14)	Medium (25)
Phoma kakivora	Low (8)	Medium (14)	Medium (22)
Phoma loti	Medium (9)	Medium (14)	Medium (23)
Ponticulothrips diospyrosi	Medium (11)	Medium (11)	Medium (22)
Pseudococcus cryptus	High (15)	Medium (12)	High (27)

Pest	Consequences of Introduction	Likelihood of Introduction	Pest Risk Potential
Scirtothrips dorsalis	High (15)	Medium (13)	High (28)
Stathmopoda masinissa	Medium (9)	Medium (14)	Medium (23)
Tenuipalpus zhizhilashviliae	Medium (12)	Medium (12)	Medium (24)
Thrips coloratus	High (13)	Medium (11)	Medium (24)

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Reviewers: L.M. Ferguson, C. Devorshak, S. Bloem, and Y. Takuechi (Risk Analysts, CPHST, PERAL)

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